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INDEX TO VOL. XIX.

The asterisk (*) indicates that the subject is illustrated.

GENERAL INDEX.

INDEX TO QUERIES AND REPLIES.

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 375. JULY 2, 1908. PUBLISHED WEEKLY.

A Useful Model Engine and Boiler.

By ISAAC T. ASTLEY.

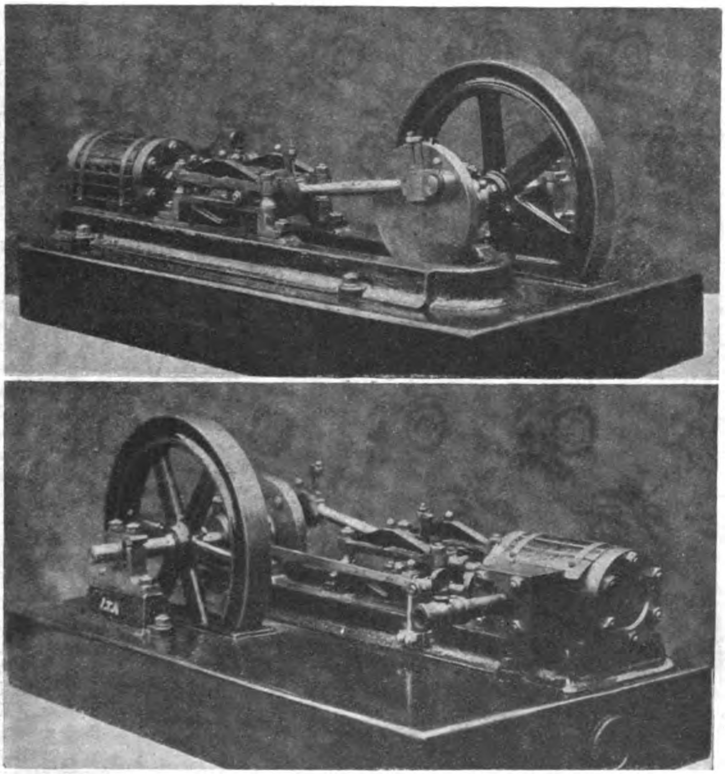


FIG. 1.—MR. I. T. ASTLEY'S MODEL HORIZONTAL ENGINE.

THE model engine and boiler-feed arrangement illustrated herewith I have designed and made in my spare time. The horizontal engine (Fig. 1) I have recently completed, having built it for high pressure and high speed. It works very silently and easily, and runs till it hums. It is very heavy and has a massive appearance. With a 2-in. pulley on the end of crankshaft and a faceplate pulley on a 2½-in. centre lathe, it will bore a cylinder 1½ ins. by 3 ins. comfortably, self-acting, with a small ratchet arrangement. The crankshaft, crank-disc, carriages, crosshead, gudgeon, connecting-rod, straps, gibs, cotters, eccentric block, rod, guide, valve spindle, piston and piston-rod, nuts, bolts, studs are all steel. The piston rings, slide-valve, crosshead, crank-pin and crankshaft bearings, and bar slippers are brass. The crosshead is turned with a small bead on the neck, bored taper for the piston-rod, and fitted with a flat cotter, the other faces having a small boss faced on them. The connecting-rod brasses were bored and faced in their straps. The gibs and cotters are fixed with a screw adjustment on the gibs. The crank-shaft brasses were also bored and faced in the carriages. The bolts which hold the top slide-bars are turned with heads fitting into a recess in the bottom bar, and fit with small feathers. The slide-bars, cylinders, and carriage fit on fillets and in toggles cast on the bed. The steam chest is one casting cored out, with two fillets for the valve to work in. The cylinder is lagged with pieces of teak, varnished, cut to fit, and then dowelled all together and driven on tight and secured to the bed with two small brass belts. The cylinder is $1\frac{1}{2}$-in. bore by 3-in. stroke. The ports are drilled and the centre cut out, making them the same as if cored. Steam ports, 3-16ths in. by 9-16ths in.; exhaust port, $\frac{1}{4}$ in. by 9-16ths in.; piston-rod, $\frac{3}{8}$ in. diameter; crank-pin, 7-16ths in. diameter; valve spindle, $\frac{1}{4}$ in. diameter; flywheel, $8\frac{5}{8}$ ins. diameter, 1 3-16ths in. face, and very heavy. In the whole of the fitting I used file and scraper, and bedded to a surface-plate. The engine base is 22 ins. by $11\frac{1}{2}$ ins. The bed and flywheel are painted two bronze-greens and small yellow lines. The flywheel is 6 ins. diameter and rather heavy. The slide-valve is worked by a trail crank, which fits into a square hole in the other crank so that it cannot misplace itself. Both engines have brass bushes in the connecting-rods and brass rings on the pistons.

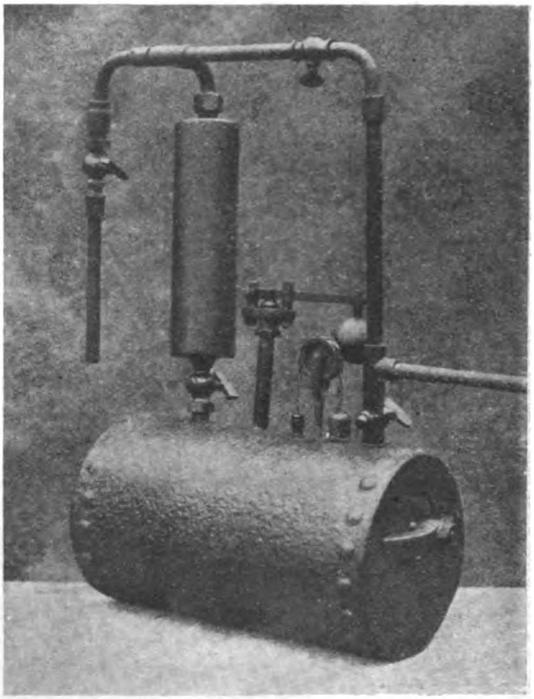


FIG. 2.—MODEL BOILER, WITH FEED ARRANGEMENT.

The boiler is of the cylinder type, and has had some outside weather, as will be seen. It is a full $\frac{1}{4}$ in. thick, and is 14 ins. by 7 ins.; the ends riveted to internal ring $\frac{7}{8}$ in. square, and a riveted seam the whole of its length (on the far side of photograph). I have fitted it with a water float and safety valve (which I have reckoned to blow at 60 lbs.), and a feed arrangement (Fig. 2).

No doubt there are other MODEL ENGINEER readers, like myself, who have not got vertical boilers and gas burners, and who have to use the kitchen fire. The model boiler-feed arrangement will suit them, for the boiler can be fed whether the engine is connected and working, or not. To use it, say the face end of pipe, see left-hand side is connected to crank and the three taps closed. First open the steam tap on the right, then close it and open the tap on the suction pipe; it will then nearly fill the vessel. Then close that tap

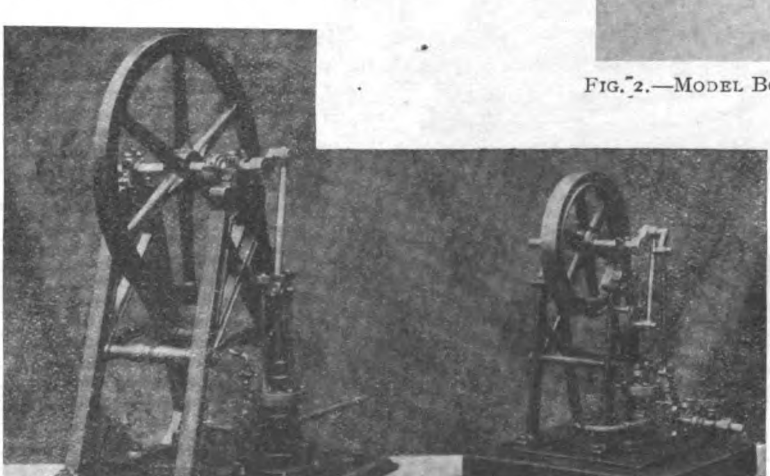


FIG. 3.—TWO MODEL VERTICAL STEAM ENGINES, CONSTRUCTED BY MR. I. T. ASTLEY.

The two vertical engines (Fig. 3) are previous ventures at model making, and, as will be seen, had not the work or time spent on them as the former. The largest is $1\frac{1}{4}$-in. bore by $2\frac{1}{2}$-in. stroke. The flywheel is nearly 12 ins. diameter, but is very light. Height over all, $18\frac{1}{2}$ ins. The base is cast iron relieved under side for the head of bolts. The small one is $1\frac{1}{8}$-in. bore by $1\frac{7}{8}$-in. stroke.

and open steam tap again, and immediately open tap on the boiler. The steam will then blow the contents of vessel into the boiler. Repeat these operations until there is sufficient water in the boiler. I may add that the pipe at bottom of vessel reaches to nearly the bottom of boiler. The barrel is of brass tubing 2 ins. diameter by 9 ins. long.

A Model Fowler Type Traction Engine.

By H. GREENLY.

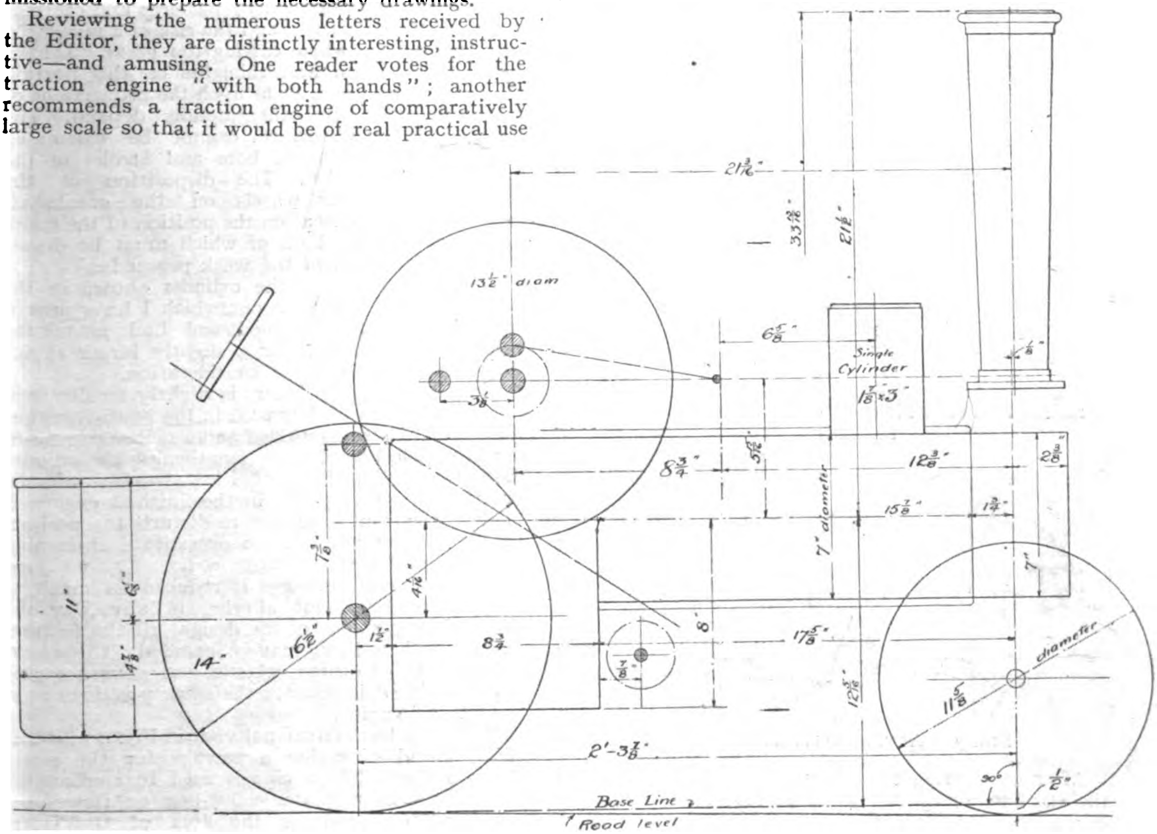
I.—GENERAL CONSIDERATIONS.

A FEW months ago a note was inserted in the Editor's page asking readers of THE MODEL ENGINEER to record their wishes with regard to the publishing of a design for a model traction engine. There appeared to be no doubt in the minds of our readers as to the popularity of this type of model, and as a result I have been commissioned to prepare the necessary drawings.

Reviewing the numerous letters received by the Editor, they are distinctly interesting, instructive—and amusing. One reader votes for the traction engine "with both hands"; another recommends a traction engine of comparatively large scale so that it would be of real practical use when constructed, suggesting that a large model traction engine could be adapted to rolling a lawn or even harnessed to a mower. The advantages of a model traction engine over the railway locomotive were also very freely discussed. When built even a large model traction engine does not require much space in which to run it. There is no costly track to lay down, no earthworks, and no tunnels. By fitting rubber-tyred wheels, the engine could be run at a fair speed on the roads in the same way as the one described in THE MODEL ENGINEER some time ago.

The only difficulty which arises out of these letters is the question of size. For the most part a large engine is required, as mentioned above, and, to satisfy the majority, the present designs have been commenced. But the claims of the minority will not be forgotten, and following the procedure adopted in the case of the model undertype engines which have been described in this journal, the design for the larger model will be followed by an engine of smaller proportions altogether.

In suggesting the scale of model, owing perhaps to the original paragraph containing a reference



LEADING DIMENSIONS OF MODEL FOWLER TYPE TRACTION ENGINE. (*Drawing ⅛th full size of finished model.*)

to a 1½-in. scale railway locomotive, the same scale has been put forward by several readers as the most suitable for the proposed model traction engine. Although traction engines vary in size considerably, especially since the advent of the smaller types known as "road tractors," I consider that a 1½-in. scale traction engine, like a 1-in. scale working model locomotive, would be neither fish, fowl, nor good roast beef. It is an "in-between" size of model—too large to work with a methylated spirit fire, and a little on the small side for carrying a passenger and burning coal; just in the same way that a ¾-in. or 1-in. scale locomotive is too large to be let run loose on the track, and a comparatively unsatisfactory machine for hauling a passenger continuously.

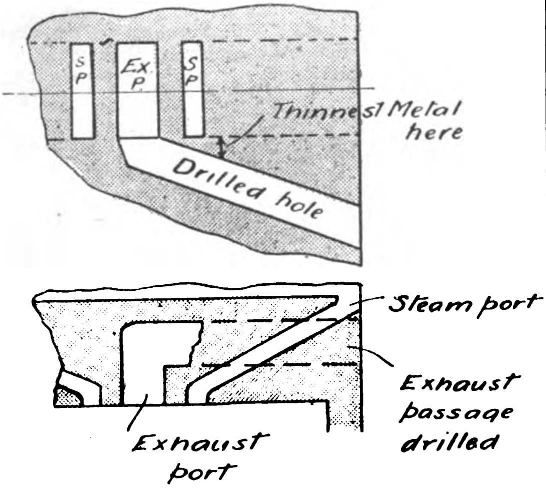


Fig. 2.—Showing Method of Forming Exhaust Passage.

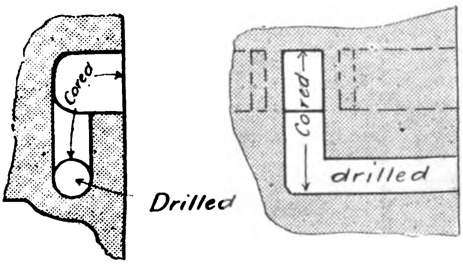


Fig. 3.—Alternative Method.

After considering all things, I have adopted as the standard design a very close model of a small engine with 5-ft. 6-in. wheels, and have chosen as a prototype one of the excellent engines built by Messrs. John Fowler & Co., Ltd., of Leeds. The scale will be as nearly as possible 3 ins. to the foot, which will provide a cylinder 1⅞-in. bore by 3-in. stroke and a boiler 7 ins. diameter. The firebox will be 8 ¾ins. long, and is therefore of sufficient size to burn coal quite satisfactorily. The boiler may be made of copper or steel. This is an important point, as below a certain size (*i.e.*, where ⅛-in. or 5-32nds-in. thickness of plate may be used) steel cannot be used with any degree of success to the appearance and satisfactory working of the model as a whole.

The engine which is to form the prototype is a modern four-shaft engine with differential gear, and as far as possible those features will be introduced into the model. The use of differential gear in the model is not imperative. The old method of withdrawing the pin from one wheel and thus freeing it from the axle may be adopted when turning a very sharp corner, or the driving may be done by one wheel only, the other being permanently free on the axle. These and other matters involving the gearing may, however, be considered in dealing with the transmission arrangements.

After having decided upon the general proportions of the model, which, it may be mentioned, are accurately to scale, the construction of the cylinder is the most important feature. A traction engine cylinder is usually an excellent specimen of the founder's art, and involves rather intricate coring, which cannot very well be copied in even a large scale working model; patterns and castings would be too expensive, and the risk of a misplaced core spoiling the whole casting too great. I have therefore bestowed first thoughts on this portion of the model (see Fig. 4), as upon the proportions of the cylinder many other details depend. The required heating surface cannot be calculated until the dimensions of bore and stroke of the cylinder are settled. The disposition of the eccentrics and gear wheels on the crankshaft depends to some extent on the position of the crank and valve spindle, both of which must be drawn out before the rest of the work proceeds.

The arrangement of the cylinder shown in the accompanying drawing is one which I have proved successful, having designed and had made the cylinder and top gear for a slightly larger engine than the one now under consideration.

The bore of the cylinder is slightly smaller than a scale reduction of that used in the prototype, but the stroke has been retained and a reasonable width of piston (⅝ in.) obtained by lengthening the cylinder casting slightly. The addition, which will be practically imperceptible in the finished engine, is made at the front so as not to disturb the position of the motion plate or to necessitate shortening the crosshead and connecting-rod.

The coring of passages is reduced as much as possible, and without altering in any way the external proportions of the design, all the features present in the original may be included; the safety-valve, cylinder drains, whistle, and governor gear may be placed in exactly the same positions as in the original engine.

Reference to the sectional view in Fig. 4 will show that instead of coring a passage for the steam through the saddle a pipe is used to connect the boiler and the regulator valve-box on top of the cylinder. This reduces the area of the steam jointing to a minimum and dispenses with a core, the passages for the steam through the casting to the valve box and the safety valve being very easily drilled out of the solid casting. The pipe is covered by the lagging plate, which, by the way, is present in the prototype, and is therefore not an "impossible" feature.

An oval-flanged connection is used for the cylinder and a union screwing on to a flanged spigot piece, which is in turn screwed to the boiler barrel being employed at the other end. A union

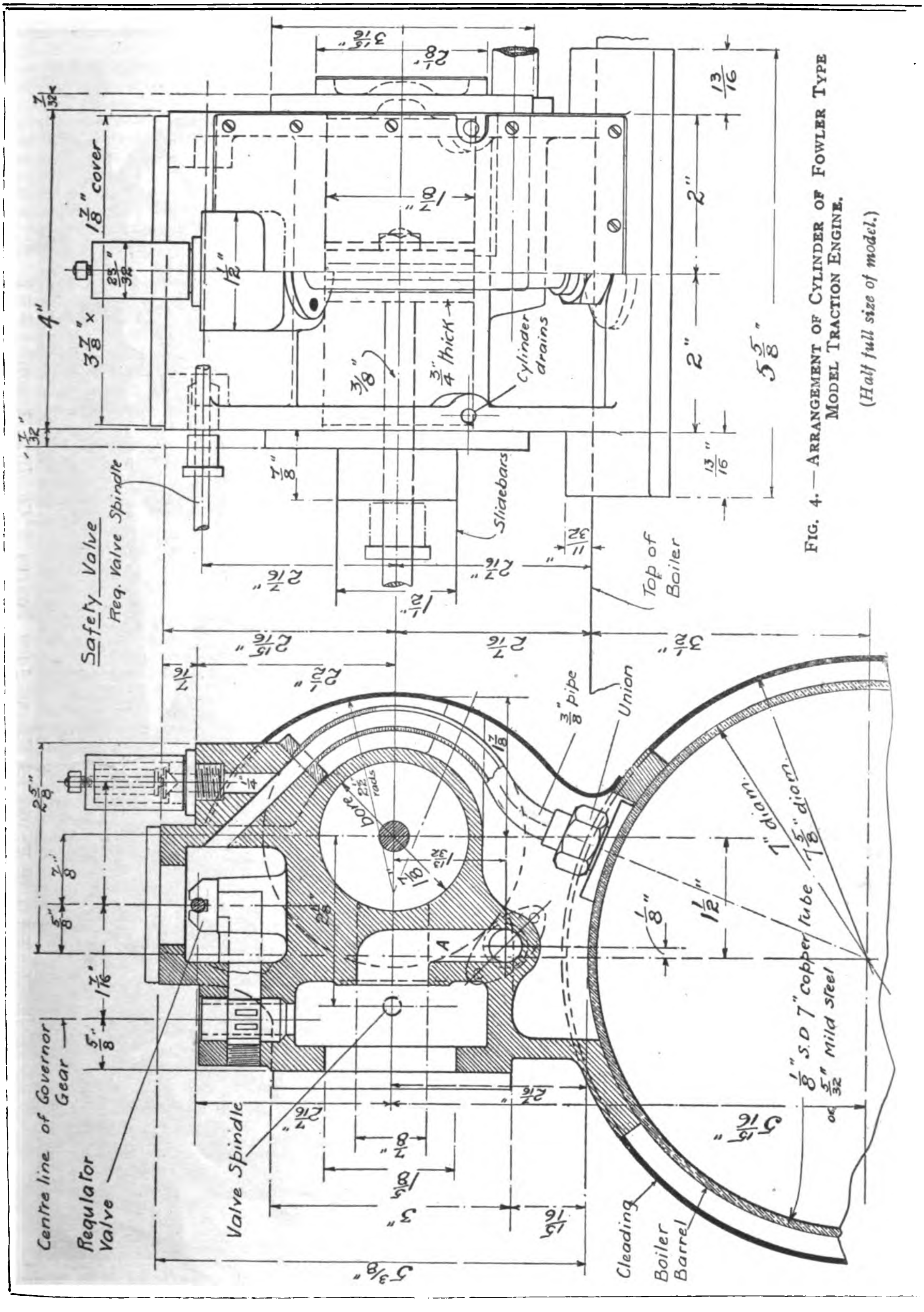
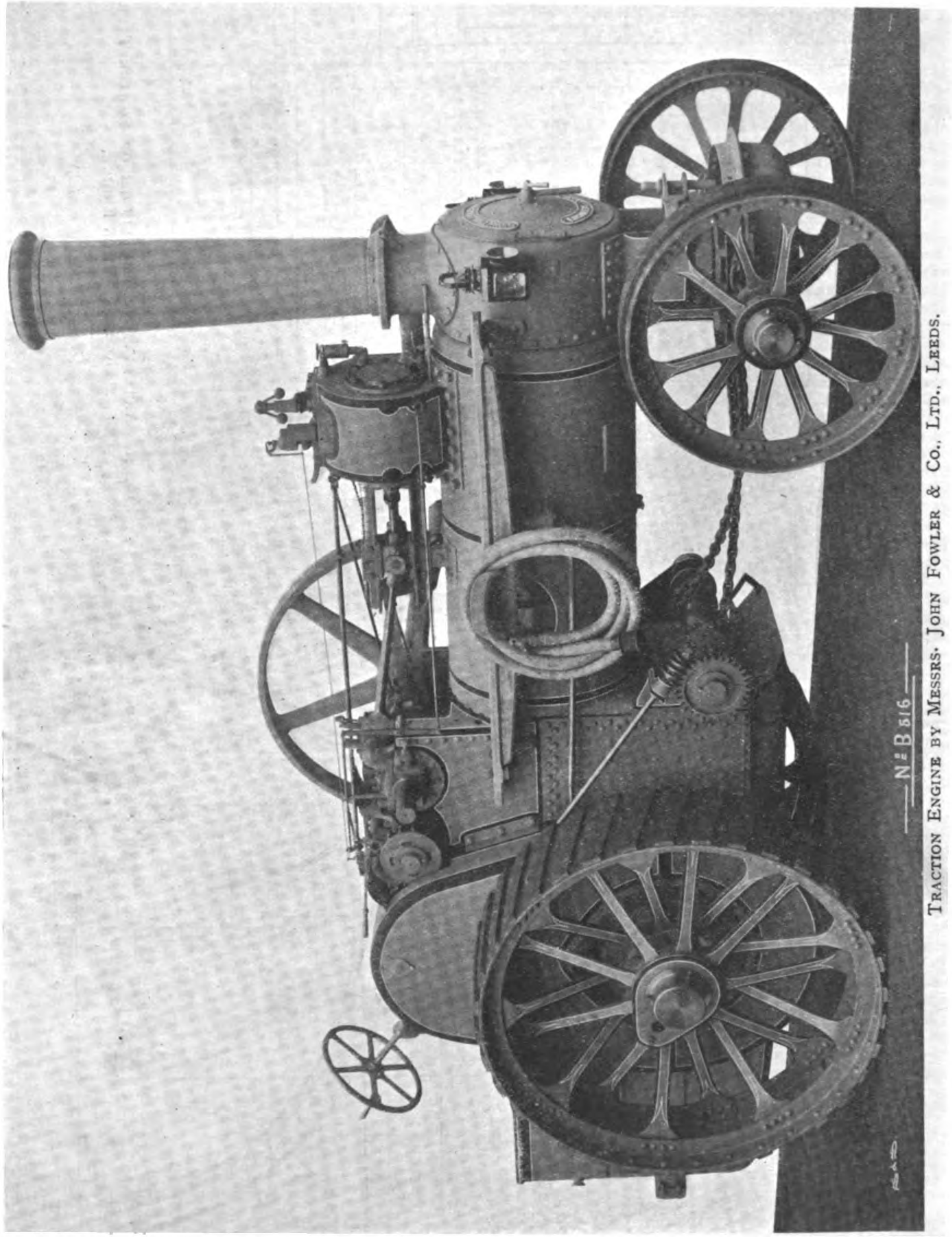


FIG. 4.—ARRANGEMENT OF CYLINDER OF FOWLER TYPE MODEL TRACTION ENGINE.

(*Half full size of model.*)



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TRACTION ENGINE BY MESSRS. JOHN FOWLER & CO., LTD., LEEDS.

is not absolutely necessary, as a flanged connection might be adopted for securing the pipe to the boiler, and the cylinder threaded over the pipe after it has been fixed to the barrel.

The regulator valve-box is large, to provide an ample reservoir for the steam, and also to lighten the casting. The valve face sticks up in the centre and may be milled through the top opening. The passage may be drilled and chipped square on the face without difficulty. The horizontal passage is drilled from the outside of the casting, the hole being plugged and covered from view by the governor bracket casting.

Crossing this hole vertically we get the throttle valve liner, this connecting with the main valve chest. The steam ports may be cored in the ordinary manner. The coring of exhaust port, however, is a matter open to discussion. As all know, the exhaust of a traction engine is generally arranged to come out diagonally below the cylinder cover at the front end of the cylinder, a pipe leading straight to the base of the chimney. This means that the exhaust passage must dip down under the front steam port to the front of the casting. It would be possible to core the exhaust port down from the valve face and to drill diagonally from the front end of the casting, as shown in the sketch, Fig. 2. This would, however, be a somewhat risky proceeding. With the slightest displacement of the steam port core, the drill might make an unintentional passage from the steam to exhaust sides which would be disastrous to the success of the cylinder. The vertical passage marked A in the section, Fig. 4, may be cored with the exhaust port, when the risk of spoiling the casting in this way will be very remote (see Fig. 3). The moulder may, however, veto this suggestion and prefer to core the whole of the exhaust passages; but this, so far as I can see, increases the pattern-maker's and moulder's portion of the work considerably. I therefore make a final suggestion that the port be cored down from the face, and the vertical passage A (Fig. 4) drilled from the underside of the cylinder to meet this core, the horizontal passage being drilled as sketched in Fig. 3. This, as far as I remember, was the procedure adopted in casting and machining the larger cylinder mentioned above.

(*To be continued.*)

"The Model Engineer" Model Motor Boat Regatta.

WE are glad to be able to state that the arrangements for this novel event, to take place at Wembley Park, on Saturday, July 25th, are progressing very satisfactorily, and we now give below the particulars of the various events and the rules under which they will be conducted.

The management will be in the hands of the following gentlemen, who have kindly consented to act as the Regatta Committee, and the various judges, starters, and other officials will be selected from among their number.

REGATTA COMMITTEE.

Mr. G. F. Young (Clapham Steam and Sailing Club).
Mr. G. Arthur Smith (ditto).
Mr. R. Martin Weaver (ditto).
Mr. W. J. E. Pike (Victoria Model Steamer Club).
Mr. Thomas Dysart (ditto).
Mr. W. L. Blaney (ditto).
Mr. W. Poole (ditto).
Mr. A. M. H. Solomon (Society of Model Engineers).
Mr. H. G. Riddle (ditto).
Mr. L. M. G. Ferreira (ditto).
Mr. W. C. Runciman (The Model Engineer).
Mr. Percival Marshall (ditto).

PROGRAMME OF EVENTS.

(1) Open Race for model steam, petrol, and electric boats over, 4 ft. in length. Three Prizes for fastest times. 1st Prize, value £2 2s.; 2nd Prize, value £1 1s.; 3rd Prize, value 10s. 6d.

(2) Open Race for model steam, petrol, and electric boats, 4 ft. or under in length. Three prizes for fastest times. 1st Prize, value £2 2s.; 2nd Prize, value £1 1s.; 3rd Prize, value 10s. 6d.

(3) Inter-Club Race, for the Wembley Park Challenge Cup. Open to any recognised model yacht or steamer club. Each club to enter a team of four boats—two being over 4 ft. in length, and two being 4 ft. or under in length. The Cup to go to the club making the best aggregate time with its four boats, and to be held by them till the next Regatta. If won twice in succession, or three times in all, to become the absolute property of the winning club.

RACING RULES.

(1) Boats over 4 ft. in length are termed Class I boats. Boats 4 ft. and under in length are termed Class II boats. All boats to be measured on load water-line when at rest. Competitors belonging to any club to furnish a club certificate of measurement. Boats belonging to non-club competitors will be measured by the Racing Committee prior to being run. Fractions of inches to count as inches.

(2) All boats in Class I will compete on level terms, and will be required to make one trip over a measured course not exceeding 250 yards in length.

(3) All boats in Class II will be handicapped, and will be required to make one trip over a measured course not exceeding 125 yards in length. The handicapping will be on a basis of 2 miles per hour per foot of length. Thus a standard time will be set for each boat (*e.g.*, for a 3-ft. boat this will be 6 miles per hour; for a 3-ft. 6-in. boat, 7 miles per hour), and the boat covering the course in the time nearest to its own stated time to be adjudged the winner. Should two or more boats beat their respective standard times, the race to be re-run.

(4) All boats to be started from rest. No pushing-off allowed. The engine or motor to be kept running for at least 15 seconds before starting. No boat to be considered to have completed the course until she has passed between the two flags denoting

the winning line. Three mechanical failures to stay the course will disqualify.

(5) No sail or wind device to be used. Should any boat be disabled through collision or by the fouling of propellers, the course to be re-run.

(6) Each boat to carry a distinctive number in a prominent position. These numbers will be provided.

(7) An owner may enter any number of boats for the open events, and if desirous, may enter any boat in a higher class than that in which its measurement places it. In such case, the boat shall run under the conditions applying to the higher class.

(8) Racing to start at 4 o'clock. All competitors to report themselves to the Committee immediately on arrival. Any competitor failing to report his arrival by 4 o'clock to be disqualified.

EXHIBITION OF BOATS.

An exhibition of model boats of all kinds will be held in one of the buildings in the Park. These will be divided into two classes: (1) Sailing Section, (2) Power Section, and 1st and 2nd Prizes, value £2 2s. and £1 1s., will be offered in each section, to be awarded by the judges to the best models in point of design and workmanship. All models for exhibition (except those running on the lake) to be placed on view not later than 5 p.m.

ENTRY FORMS.

An entry form for the above events will be found in the advertisement pages of this issue. Intending competitors are requested to fill up and send in their form *as early as possible*, to facilitate the preparation of the official programme.

Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "WORKSHOP" on the envelope.]

A Ball-bearing Emery Grinder.

By C. CHEVERTON.

One of the most useful devices of the model-maker's workshop is a serviceable emery grinder. Hours of weary filing, which seem to take all the

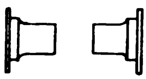


FIG. 1.

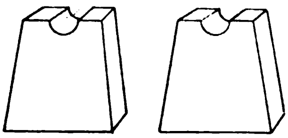


FIG. 2.

pleasure from our work, will cease upon its introduction.

I have always been among those whose ambitions to possess a lathe, good tools, and other things so dear to the mechanically inclined remain unachieved; never mind, it may not always be thus. After all, those who can produce models under such unfavourable circumstances must really be better pleased as they survey the result of patient labour.

This little tool can be made with very little trouble, the emery wheels being the most expensive

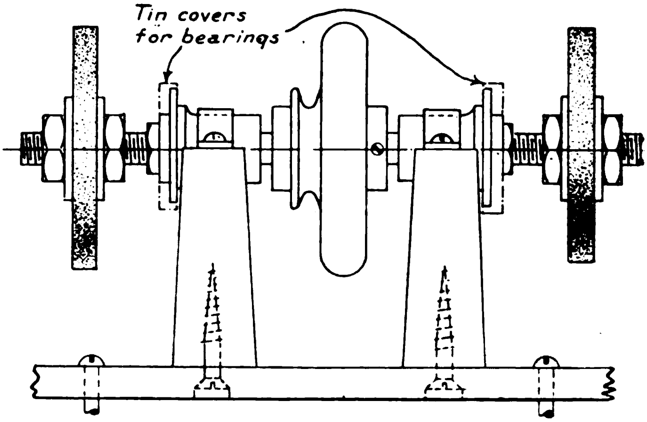


FIG. 3.

item to consider. I might say here that this machine has been in use for nearly six years in the shop at which I was apprenticed, and still does its work well.

In the first place an old cycle hub—from any

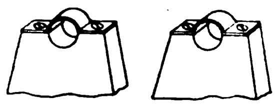


FIG. 4.

prehistoric wreck you may come across, and there are plenty in our ponds and streams—will be required. Cut this in half, as Fig. 1. The spindle may be discarded, as it is too short for our purpose. Then cut two wooden blocks as standards (Fig. 2) cutting a groove in the tops to receive the bearings

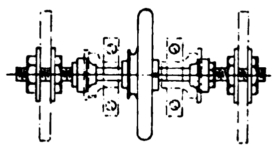


FIG. 5.

which are held in place by bent iron clips (Fig. 4). A spindle is then made about 12 ins. long, threaded to take the cones about 4 ins. from each end; the thread will also take the nuts that secure the emery wheels. An old sewing-machine wheel and a few washers will complete our grinder.

Mount the wheel on the centre of the spindle, using the pin to fasten it, and assemble the bearings as illustrated (Figs. 3 and 5).

To keep dust from the bearings screw over them a tin wing or guard.

This emery grinder may be run on an old sewing-machine table, or, if you are so fortunate as to possess a lathe, from its flywheel.

The Making of Ship's Model Fittings.

By "X. Y. Z."

It is intended to show by these articles how the amateur model maker may construct the small deck fittings which are to be seen on the models in exhibitions, shipping offices, etc. While it is almost impossible in an article to describe every fitting there is on a ship, I shall endeavour to instruct carefully and with all the detail I can, so that any model engineer (who, as a class, are very ingenious) will be able to make any fitting he fancies. I shall also illustrate and describe the various tools used. The majority of these can be made by the amateur himself, and the making of some of them calls for some skill, and should prove interesting. However, I wish to impress on the budding model maker the necessity for plenty of patience and no "bodging." The tools required will be, principally, a lathe with self-centreing chuck, two or three files, dividers, small mouth blowpipe, vice, and emery; the other tools required can be added from time to time as we construct the different fittings. The best lathe is an ordinary single lathe, and hand T-rest. A back-gear lathe will do, of course; but a hand-turning tool is the only one that will be of any use.

First of all, we will make a bollard (Fig. 1). There are generally about ten to sixteen of these on an ordinary cargo steamer. The scale used throughout this article will be the one generally used on the models, viz., ¼ in. equals 1 ft. Having carefully studied the sketch, the first thing to do is to make the bollard bottoms. Take a piece of sheet brass, 16 gauge, and cut off a strip with either the shears or hacksaw about the width, and then cut off into lengths. File one edge and square the end; now take the dividers and set them to the correct width and "scribe" a line to file to. The same applies, of course, to the length. Now set the dividers and draw a centre line, set the dividers again to ¼ in., and draw a line across to give the position of bollard top; now centre-punch where the lines cross. Put a 16 gauge drill in the chuck and place the brass on a piece of wood (to prevent the drill from rushing through and damaging both drill and fingers), and drill the two large holes. If pinholes are required for fixing, carefully set out 3-32nds in. from the edge and centre-punch lightly; care must be taken to see that the edge is uninjured by expansion of the metal. The pinholes should on no account exceed 22 gauge. Having now made the bottom of the bollard, we have to polish, first, the edges. This is best done with an emery stick, procurable at most watchmakers' shops, or, if desired, these can be made by the model maker himself, and are, in use, the best. Get some of Oakey's blue twilled emery cloth and tear into strips; make a piece of wood, say 10 ins. long and 1 in. wide and about ¼ in. thick, and glue a strip on each side. Having done this, place some heavy flat object on the top until dry, when it is ready for use. F.F. and O emery will be the best. To polish the flat surface put a piece of wood in vice and drive two pins through the large holes; you will then be able to file and polish in comfort.

The next operation is turning the tops. First make a tool (out of an old file) to the shape of top, as in Fig. 2, then take a piece of 5-16ths-in. brass rod, put it into chuck, and set the dividers to the length without pin. You will now require, if not already in workshop, three turning tools. These I show you in Figs. 3, 4, and 5; they are made from ¼-in. tool steel, which can be bought at almost any ironmonger's. Take up tool 3, called a "ripper," and roughly shape; afterwards push bollard tool firmly into the work until it is the finished shape. Then turn a small pin to fit the hole already drilled in the bollard bottom, and cut slightly under to ensure a good fit between top and bottom. Rivet to bottom and level off with file, and the bollard is complete.

The next article to construct is a fairlead. (Fig 6).

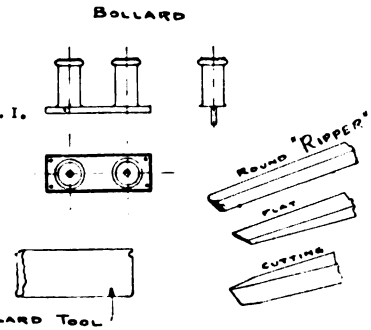


Fig. 1. Fig. 2. Fig 3. Fig. 4. Fig. 5.

with three rollers. Take a piece of 16-gauge sheet brass and cut a strip the width and then to the length for the bottom. Now cut another strip slightly longer, but the same width, to form the top. Measure from each end of the top a ¼ in., and nearly cut through with a square file, as shown, and bend.

Before going any further the model maker will require a knowledge of hard soldering. As this is, to an amateur, rather a mysterious sort of work, I will explain the method of procedure. If the instructions here given are carefully followed, the operator will have no difficulty in carrying the work to a successful issue. He should, however, first make himself master of the use of the blowpipe and practice upon pieces of brass or copper before attempting any fine work. The operator should provide himself with a clean piece of slate, say about 3 ins. square, and a small bottle filled with water, and having a cork with a small groove cut in it from end to end. The bottle is used to apply moisture a drop at a time, whilst a large piece of rock borax is rubbed upon the slate. By this means a thick, creamy paste of borax is obtained upon the slate, which will be used as presently directed. The parts to be united or soldered must now be scraped clean wherever the solder is expected to adhere, and, with a camel-hair brush dipped in the paste, brush over the parts to be soldered. Now place a piece of solder on the joints to be united and place on a piece of flat pumice (made flat by rubbing on a flagstone). A gentle blast of the blowpipe will at first dry the borax, and the flame must then be increased (holding the blowpipe some distance from the flame in order to give a broad jet), and in a few moments, if the jet is favourable, the solder will "run," as it is termed, into every crevice, when the blowpipe must be instantly withdrawn. A very little practice will make the operator expert in this interesting art, and it will be advisable for him to practice upon articles of little value until he has not only acquired the use of the blowpipe, but also the proper kind of flame to make the solder run freely. After an article has been hard soldered it is allowed to cool, or may be at once placed in a weak solution of sulphuric acid (a few drops to an ounce of water), which, after a few moments, will dissolve the borax flux which remains after the soldering is complete. The article should now be rinsed in water and dried. Having carefully read how to solder, solder the corners you have nearly cut through, and then file the bottoms of these flat. Now cut a piece of ⅛-in. rod into four pieces, as shown in Fig. 7, place at each end and hard-solder. Now take a piece of round brass and *soft*-solder the fairlead on it, (as shown in Fig. 8) it can then be filed into the required shape with ease. Take your dividers and "scribe" a line down centre and also across the ends to give the distance for the rollers; centre-punch, and then drill a 20-gauge hole right through; then from the hole draw a circle a little larger than the diameter of the roller. Cut or file out the piece between the circles, and round each of the ends to the lines of circle. Next find the position of centre roller, which is determined from the holes already made. This having been done and the frame of fairlead polished, hold in the gas to unsolder from the piece of brass by which it has been held.

We have next to turn the pulleys. Take a piece of 5-32nds-in. brass rod and turn to shape of pulleys, drill a 20-gauge hole through centre, afterwards fitting into position and riveting up, care being taken to leave the pins a little above the top to imitate the studs or bolts. These may be cupped by means of a punch shown in Fig. 9, which can be made in a few moments by turning a small recess in a piece of steel and afterwards tempering. This considerably enhances the appearance of the job.

Having described the making of a roller fairlead, I will now describe how to make what is called the plain or "horn fairlead." Take a piece of 3-16ths-in. sheet brass and file to the shape in Fig. 9*a*; make a small mandrel of either brass or steel, and tap the lugs over, as in finished sketch. Afterwards finish by polishing and putting in the required pinholes. The roller fairleads can also be made this way, but are not so good a job.

The next job is to make the hawse pipe (Fig. 10). You will require a short piece of ⅝-in. rod. Chuck and bore a hole, say 7-16ths in., leaving a narrow edge, which should be nicely rounded, as shown in section, and then cut off about 3-32nds-in. thick with a parting tool. It is then made red-hot and plunged into water or pickle to anneal it. Now take it in a pair of pliers and open vice to size and squeeze to an oval shape. It will perhaps kink or buckle in this process, so lay it on the lathe bed and tap flat with a piece of wood; it should then be filed perfectly flat on back. To do this get a piece of soft wood, and, using the end grain, lay wood on top of pipe and give it a sharp blow; it will then be found that it is firmly embedded in the wood, and can be filed with ease; next add pinholes to fancy, and it is complete. The same rules apply to the mooring pipes (Fig. 11), except that you use ⅜-in. rod and bore a 7-32nds-in. hole. The operator having by now got into the way of using his hand-tools, we will make the sidelights (Fig. 12). These are made in several sizes, but for the purpose of illustration we will make a 9-in. light. This is a lathe job throughout. Put a piece of 5-16ths-in. rod in the chuck and drill a 3-16ths-in. hole right through; having drilled the hole, we have to make a cutter after the style of Fig. 13. This is slightly larger than the bore, say about ¼ in. Using another tool for a rest, make the edge of hole on a taper about size of cutter; then push the flat cutter firmly up hole until it has reached the mark across the cutter. This will, of course, leave a shoulder inside; set the dividers the same length as the mark on cutter, and leaving a small flange of about 1-16th-in., slightly cut; now turn down the outside fairly thin, still leaving this short of the total length as before, and then cut off. The next thing to be done is to put a piece of rod in chuck and turn a mandrel to fit the large hole

FIG. 6.

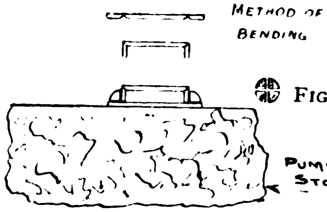


FIG. 7.

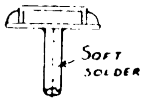


FIG. 8.

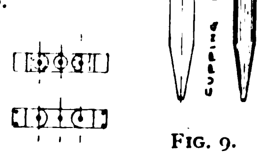


FIG. 9.

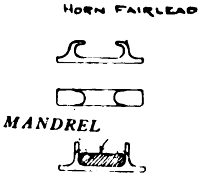


FIG. 9*a*.

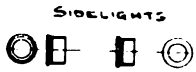


FIG. 12.

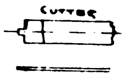


FIG. 13.

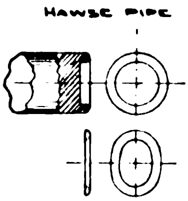


FIG. 10.

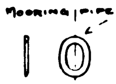


FIG. 11.

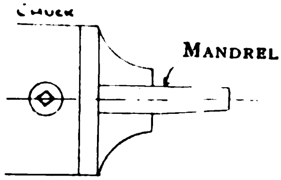


FIG. 14.

(Fig. 14). Press the light "firmly" on to mandrel with the flat tool and face up either flat or bevel, as required. The lights in the deckhouses are finished flat, and in the hull they are bevel faced. The flat ones can be considerably improved by putting two small marks in face, as shown in sketch. To finish these off in a proper manner you should take a piece of celluloid (an old watch-case will do), and cut some small glasses to fit, and colour green at back, and the sidelights are ready for fitting into model.

(To be continued.)

An Electric Wind Vane.

By C. E. S.

WHO does not take an interest in forecasting the weather—and, incidentally, in the direction of the wind? The apparatus to be described was devised on account of the writer having to spend a good deal of his time out-of-doors, and of his living in a house from which no weather-cock was visible.

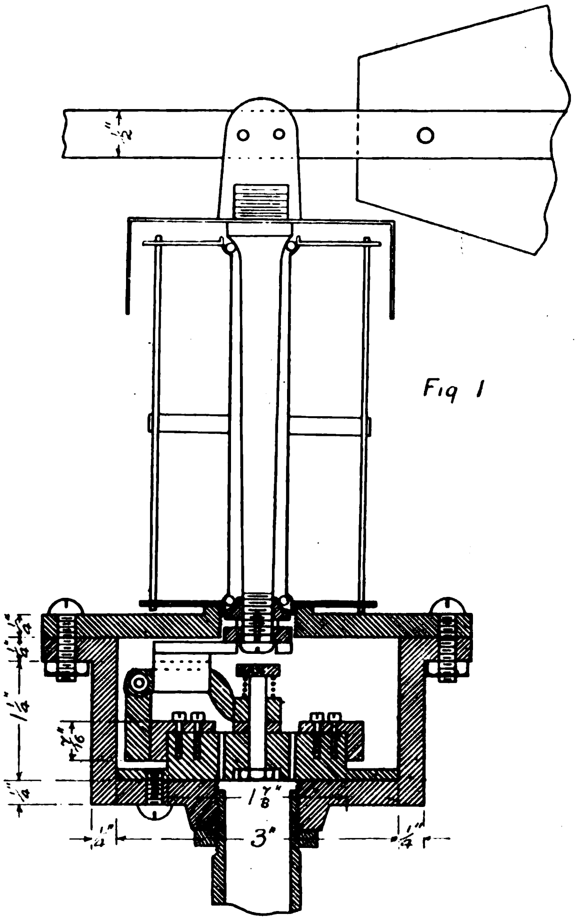
It consists of a vane, on ball bearings, standing on the top of an iron box, which is attached to a standard of gas tubing. The box contains an eight-part commutator, which is actuated by the spindle of the vane, and from which wires pass, through the standard, to any suitable position in the house, where they are joined to the terminals of an indicator. The latter, on touching a push, shows from which of the eight main points the wind is blowing. The battery consists of three No. 2 Leclanché cells.

Fig. 1 shows the general arrangement of the vane and commutator. The vane, Fig. 2, is made to the dimensions shown, from two pieces of ½-in. by 3-32nds-in. bar iron, between which the sheet iron point and "feathers" are fastened by two rivets each. Two small strips of sheet lead are held by the rivets at the point, sufficient to make that end rather heavier than the other, when the vane is balanced at its centre. If exactly balanced at this stage, it will be found, after two or three coats of paint, that the point will be too light. The balancing is necessary to prevent the vane having a tendency to cock one end if the standard is not quite perpendicular.

The bearings consist of a right-hand rat-trap bicycle pedal, which can be bought second-hand for a shilling. To the end which originally screwed into the crank, and which is uppermost, is fitted a brass cap, which is shown in Fig. 3. This is slotted to admit the stem of the vane, to which it is attached by two rivets. A tinplate raincap, shaped like the lid of a cocoa tin, with a hole in the centre, is held between the brass cap and the spindle. Fig. 1 shows it in position.

Examine the spindle of the pedal, and notice whether it projects through the nut which adjusts the bearings. If it does so to the extent of not less than 1-16th in., it will save trouble; if not, the adjusting nut must be turned thinner until it projects that amount. Take out the spindle and file a second flat on the small end, opposite the existing one, extending about ⅛ in. Drill a hole about ⅜ in. deep up the spindle, and tap it ⅛ in. This is shown in Fig. 4.

Three castings will be wanted. One of brass for the commutator, and two of iron for the containing box and its cover. The dimensions of the latter can be seen in Fig. 1. Notice that there is a boss at the bottom of the box, into which the standard will be screwed; also that there is a thin boss on the top of the cover to be threaded to receive that part of the pedal on to which the dust cap was originally screwed. This boss need be only about 1-16th in. thick, its purpose being to allow the pedal to screw home, which without it would be impossible, owing



General Arrangement of Electric Wind Vane.

to the sides of the pedal projecting slightly beyond the end. Have both bosses cast solid.

The cover must be turned on the whole of its lower surface. It is then reversed in the chuck and the boss faced, drilled, and threaded to fit the dust cap screw of the pedal. The thread was 36 per inch in the pedal which the writer used. The box must be faced on its upper surface, and rough turned inside. Reverse the chucking for drilling and screwing the boss, which is faced for a nut to bed upon. Screw it 14 per inch to fit ½-in. gas tubing. Fix the cover to the box by six 3-16ths-in. stove screws and nuts (see Figs. 1 and 5), drilling passing holes through both at once. Mark cover and box clearly so that the correct holes may be brought together again. The joint is made water-tight by a washer of thin asbestos millboard covered on both sides with red lead and oil, and not extending inside beyond the joint face. Give all the parts exposed to the weather two or three coats of paint. The commutator is shown in Figs. 1 and 6, in section and plan. The segments, arm, contact piece, and screws are all of brass, and the whole is mounted on vulcanite. The dimensions of the casting for the segments can be found from the figures, allowance

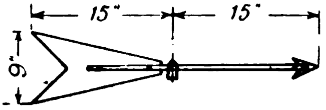


Fig 2

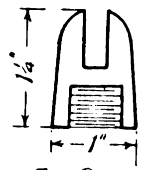


Fig 3


Fig 4

being made for turning all over. After turning to size, if the lathe has a division plate, mark out the division lines, while still in the chuck. Then turn the vulcanite base to fit it nicely. The latter

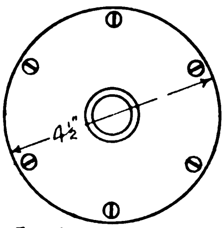


Fig 5

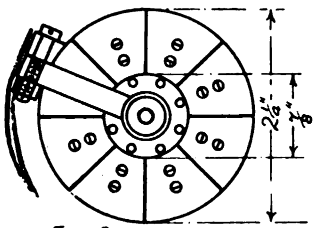


Fig 6

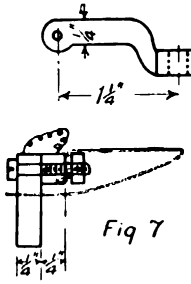


Fig 7

can be made from one piece ½-in. thick, or, more economically, from two pieces ⅜-in. and ⅛ in. thick, joined together by two recessed screws. Fit the sixteen screws holding the segments to the base, which are 3-32nds in. in diameter, and are quickly made from 3-16ths-in. brass wire. Drill brass and vulcanite together, to ensure alignment, and afterwards enlarge those in the brass and tap those in the vulcanite. Do not use wood screws, as these often jamb and break in vulcanite. Number brass and vulcanite 1 to 8. Saw the segments apart and clean their edges on a smooth file. No insulating material is needed between them; for the rubbing surfaces being perpendicular, any brass dust formed will fall to the bottom. Notch the inner sides of each segment, opposite the screw, with a rat-tail file, to allow the wires which pass up through the holes shown in the vulcanite to lie snugly against the segments. Otherwise they might foul the arm which carries the contact piece.

This arm is shown in Fig. 7, in side and end elevations. Make it from two pieces of brass. After turning the boss, file the other piece to shape and silver solder the two together. Figs. 1, 6, and 7 show the brass contact piece and the screw holding it in position. Drill a passing hole in the contact piece and a tapping hole in the arm, and fit a lock-nut. The wire spring, which keeps the contact piece up to the segments, is curved as shown to clear the containing box. It is bent into a ring and pinched in position by the lock-nut, and to prevent any chance of it shifting, the fixed end is bent at right angles and enters a small hole in the arm. To ensure good electrical connection between the arm and contact piece, the two are joined by a short length of thin copper wire.

The brass spindle about which the arm turns is shown in Fig. 8. It is fitted with a nut top and bottom—the latter to clamp it to the vulcanite base; and the former to act as a fixed point for a small coiled sping, shown in Fig. 1, which keeps the boss of the arm firmly pressed upon the flange of the spindle. To prevent this spring cutting into the brass, two thin washers, not shown, are placed for it to bear upon. They can be made from softened clock spring.

The commutator is fixed to the containing box by three 3-16ths-in. stove screws, one of which is shewn in Fig. 1, the vulcanite being tapped to receive them; they must not touch any segments.

The claw which moves the commutator arm is shown in Fig. 9—(1) plan from above; (2) plan from below; (3) side elevation, and (4) end elevation. B is vulcanite, to which are riveted the brass pieces A and C. Copper wire makes excellent rivets, which should be countersunk at each end.

The piece A is rigidly attached to the lower end of the vane spindle (see Fig. 4), and has an oval hole for it to fit into. A hole is turned in the vulcanite B to allow an ⅛-in. screw, with a large thin head, to fix A to the spindle, and not project beyond the surface of B. The piece C has a slot filed to fit

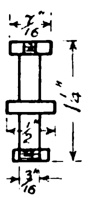
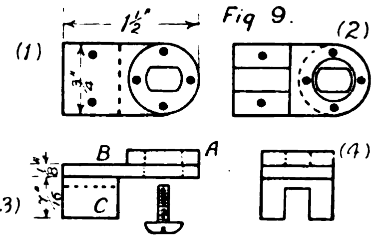


Fig 8



easily over the commutator arm. In making the claw the points to notice are that A must be deep enough to allow B to just clear the cover of the containing box, and that C must engage with the commutator arm without fouling the segment screws. No part of the electric circuit must touch the containing box.

The height of the standard will depend upon circumstances. The writer's is 15 ft. high, to clear some chimney stacks, the upper part being ½-in. iron gas tubing and the lower half ¾-in., joined by a reduction socket. The method of fixing will depend upon whether it is placed outside an attic window or directly on the roof.

A terminal box is placed as close as convenient to where the wires enter the house, so that, if from wear or any other reason, it is necessary to examine the commutator, the aerial portion can be taken down and disconnected, without cutting the wires. Having settled the height and position of the standard, find out the length of wire required to pass from the commutator through the standard to the terminal box; allow about 1 ft. extra, and cut off nine lengths. A suitable wire for use throughout from commutator to indicator is No. 22, such as is used in electric bell circuits. One wire is soldered to the bottom of the spindle (Fig. 8), and the other eight pass to the segments, being pinched under the inner screw in each case. The wires being attached, make them into a cable by winding linen tape over them to prevent them being chafed when drawn through the standard.

With an electric bell and battery identify the free ends of the wire, and mark them 1 to 8 and B (battery) for the common wire.

(To be continued).

Model Rolling-Stock Notes.

By Henry Greenly.

(Continued from page 612, Vol. XVIII.)

L.N.W.R. Timber Trucks.

After the open coal or goods wagon has been modelled, perhaps the most interesting type of wagon the amateur can build is the single-bolster timber truck. These wagons look exceedingly well when loaded up with miniature logs, and having a short wheel-base, they will pass a relatively sharp curve with ease. Of course, two wagons are necessary to complete the model, and, if time permits, three wagons, as shown in the photograph (Fig. 1), may be made, so that extra long logs can be accommodated.

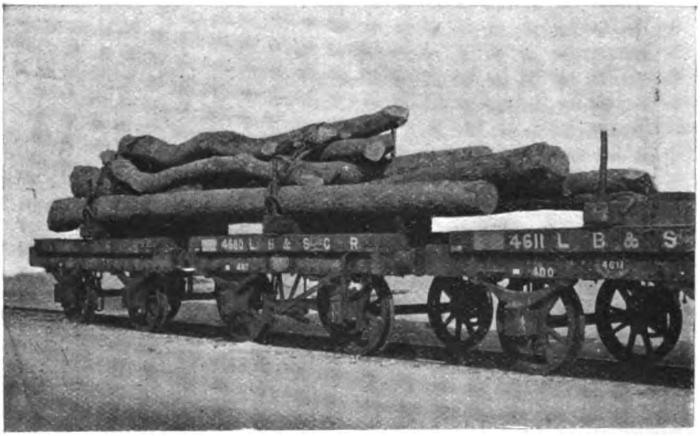


Fig. 1.—L.B. & S.C.R. Timber Trucks loaded with Logs.

General observation, as well as a comparison of the photograph of the L.B. & S.C.R. trucks and the L.N.W.R. vehicles illustrated in the other drawings, will show that the main features of the construction of timber trucks are fairly standard with all railway companies. These types of wagons are for most part owned exclusively by the Companies, and do not come under the notice of the Railway Clearing House Wagon Committee, and are not covered by the specifications issued by this body. In trifling details, therefore, each Company's design will betray the standard practices of the Company in the matter of wagon stock.

Convenience in measuring the actual vehicles has enabled me to include herewith, as a basis, a design for a model of the L.N.W.R. Company's single-bolster wagons. The drawings are reproduced to half full size and full size for a 3½-in. gauge, and show both the spring- and dumb-buffered types of wagon.

In the L.B.S.C.R. photograph (Fig. 1) it will be noticed that the wagons are separate entities, a spring-buffered wagon being placed between two "dumb" wagons, the one in the right-hand side of the picture being used solely as a "distance-piece" under the overhanging logs, and not to carry any part of the load. The extra truck is known, on the G.W.R., at least, as a "match" truck.

In the case of the L.N.W.R. vehicles the two trucks are coupled by a special link-and-pin coupling, a curved block of wood on each truck acting as a central buffer. The Great Central Railway, I have observed since making the accompanying drawings, do the same thing. The outside ends have the ordinary spring buffers, which may be of the self-contained type preferably.

There are, however, a large number of wagons now running on the L.N.W.R. with dumb buffers at the extreme ends; but these will no doubt be converted before the time-limit set by the Railway Clearing House for the extinction of the dumb-buffered wagons on all our railways has expired.

The vehicles shown in the photographs are all provided with the ordinary grease axle-boxes; other details of the North-Western trucks, however, conform to the standards shown in the drawings of the 10-ton ordinary goods wagon described in the last article. The general arrangement drawing shows one truck and the detail at the right-hand end shows the difference between the dumb buffer and spring-buffered wagons.

In both cases the sole-bar or side frame timbers of the wagons are flitched with an iron plate. In the spring-buffered vehicle this flitch is an angle-iron and supports the floor and side coping of the wagon (see section, Fig. 7). This, of course, makes the depth of the coping different, and the official particulars I have in my possession state that these timber trucks are, under the new painting scheme, to be lettered "L.N.W.R" with 6-in. letters. This will be possible with the dumb-buffered trucks, but I presume that slightly smaller letters will have to be used—as indicated in the drawing (Fig. 4)—when the other type go in for repainting. The chief feature of the timber wagon is the pivoted bolster in the centre of each truck. To this bolster the logs are chained tightly, so that to all intents and purposes a pair of trucks become a bogie wagon in which the logs and bolster are the body and the trucks are the bogies, which swivel to conform to any curvature of the railway.

There are several methods of building model trucks. In small $1\frac{3}{4}$-in., 2-in., and $2\frac{1}{2}$-in. gauge model wagons the greater portion, if not all, of the under-frame timbers may be dispensed with. This method of construction I will deal with in describing the modelling of ordinary open wagons. In larger models, to prevent the warping and twisting of the wood, and ultimately causing the model to fall to pieces, the "plank of wood for a baseplate and four strips for the sides" method should be avoided, and the timbers framed up in the more or less orthodox way. Diagram Fig. 10 indicates the arrangement of under-frames I would recommend for a $3\frac{1}{4}$-in., $3\frac{1}{2}$-in., or $4\frac{3}{4}$-in. gauge model. Some of the timbers used in the original are purposely omitted as unnecessary. The section (Fig. 7) is arranged exactly the same as in the actual spring-buffered truck, with angle-iron flitchplate and half-round edging on the top of the coping. This iron flitch and capping may be dispensed with, as shown in Fig. 9; the wooden parts, however

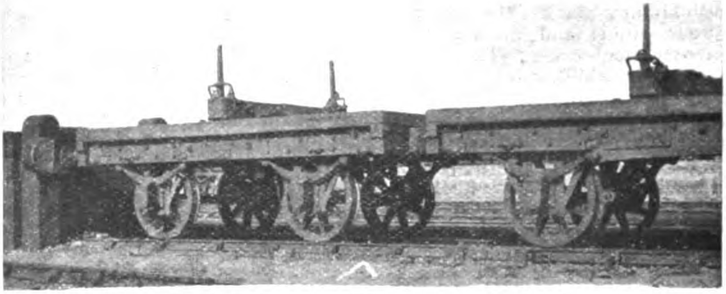


Fig. 2.—L.N.W.R. Spring-buffered Timber Trucks.

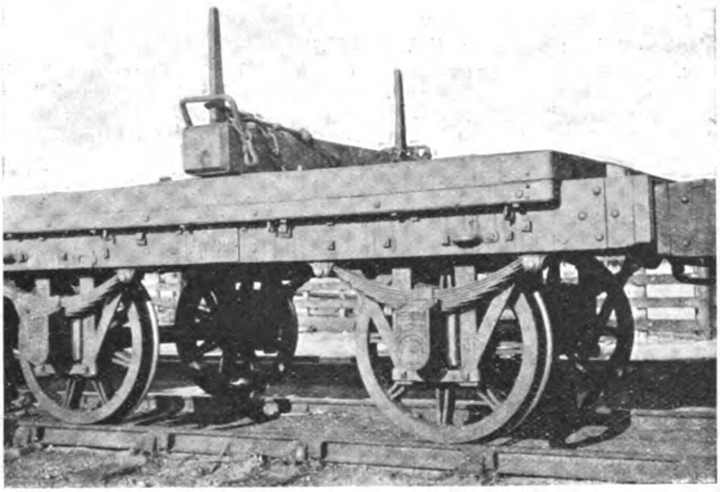


Fig. 3.—View of Dumb-buffer, L.N.W.R. Timber Truck. (*Note higher coping.*)

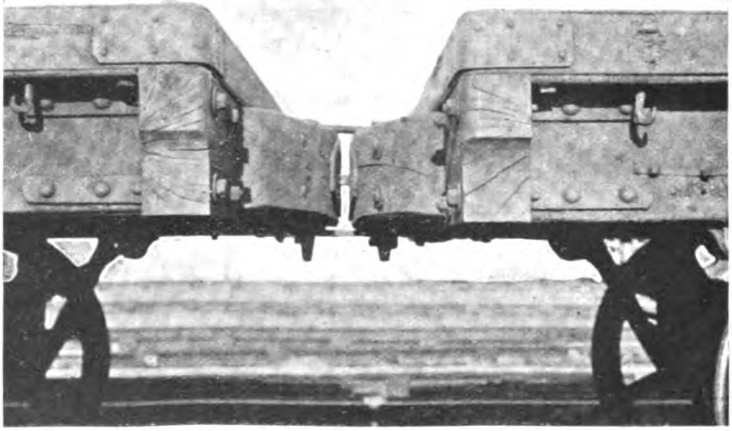


Fig. 11.—Coupling of L.N.W.R. Timber Trucks.

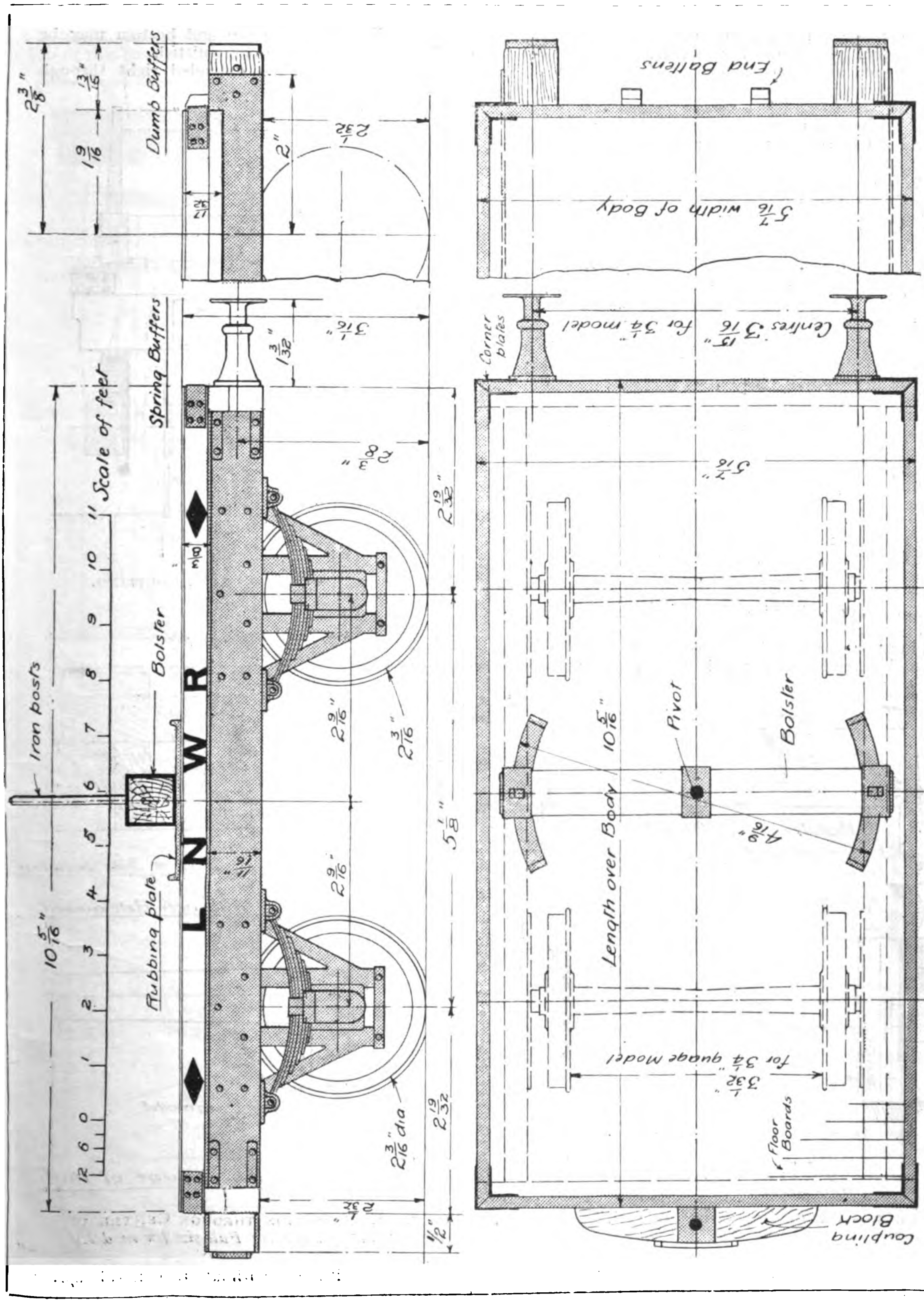


FIG. 4.—GENERAL ARRANGEMENT OF L.N.W.R. TIMBER TRUCKS. (*Scale: Half size for 3½-in. gauge model.*)

must be made so much larger to preserve the scale of the wagon. The under-frames (Fig. 10) are therefore designed and dimensioned to suit this method of construction.

In the actual truck a heavy beam runs across the wagon under the bolster, and, as far as I could see from an examination of the wagons illustrated in the photographs, Fig. 7 is an accurate representation of the arrangement of the joints. In the model this centre beam may be included, as shown in Fig. 9. On either side of this beam, the top of which is flush with the floor, boards which are about 4 ins. wide (or say ¼ in. wide in the 3¼-in. gauge model) run transversely across the truck, as shown in Figs. 4 and 8. In a model of 3¼-in. gauge separate pieces of wood for the flooring are not really necessary, and two boards 5 1-16th ins. long and full ⅛ in. thick, of just sufficient width to fit the space between the main cross-beam in the centre and the end copings of the wagon, may be fastened to the under-frames. The grain should run longitudinally, as it will be necessary to fasten the side coping to this flooring, and nailing or screwing into end grain is not good practice.

The W-irons, wheels, and buffers are standard, and, as most readers of THE MODEL ENGINEER know, excellent castings and parts can be obtained from firms laying themselves out for this class of model work.

The central coupling is quite clear from the drawings and photographs. The blocks of wood in the model may be screwed to the headstock. In models intended more particularly for actual use

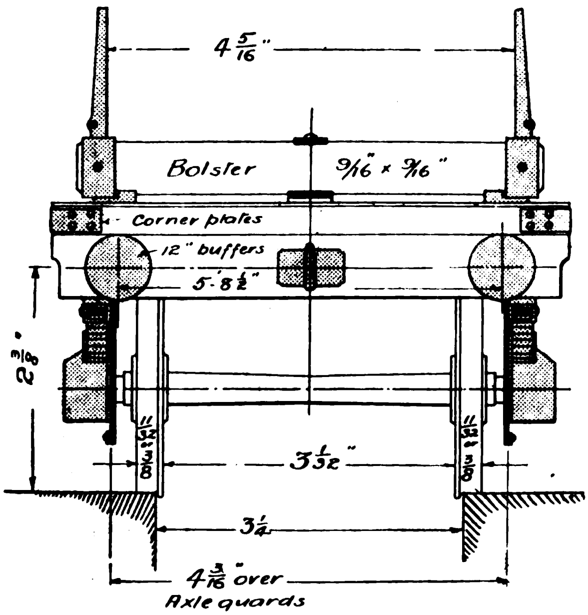


FIG. 5.—BUFFER END VIEW OF L.N.W.R. TIMBER TRUCK.

than for the showcase the washer- and rubbing-plates may be dispensed with, and, instead of the three coupling links, one top and bottom may be employed and the centre one omitted.

The drawbars may be extended right through

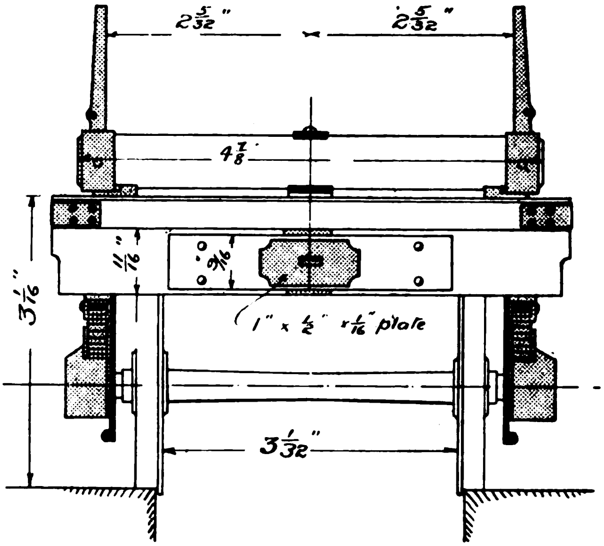


FIG. 6.—END VIEW, SHOWING CENTRE COUPLING.

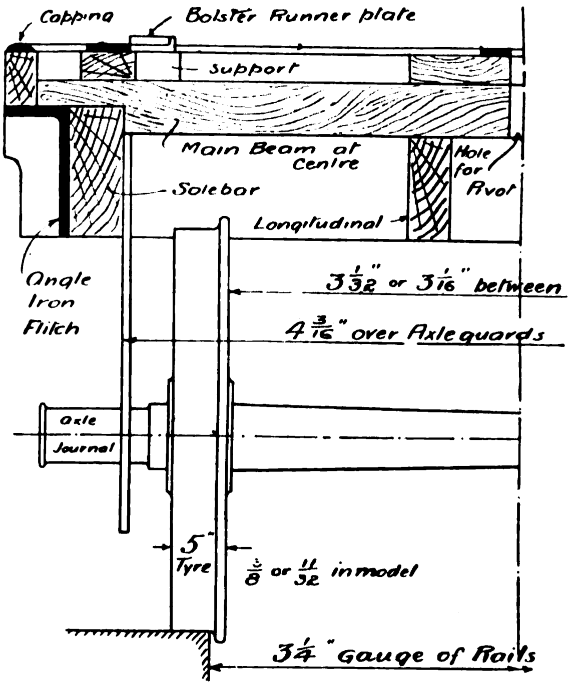


FIG. 7.—HALF-SECTION THROUGH CENTRE OF TIMBER TRUCK. (*Scale: Full size for model.*)

the wagon, with or without a central spring coupling.

As shown in the photograph (Fig. 3) the ends of the bolster are ferruled with iron plates. Through the top of this ferrule a hole is drilled for the iron posts, which, on the L.N.W.R. trucks, are of rectangular section tapering towards the top, and on some other railways round posts. A shackle fits through

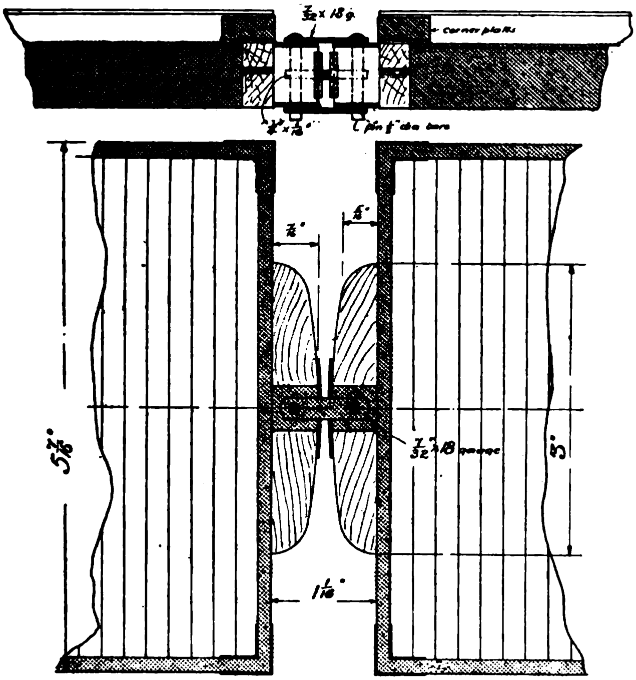


FIG. 8.

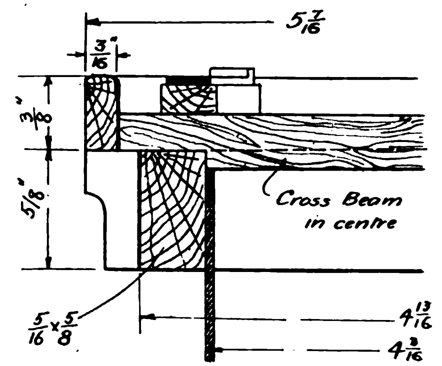


FIG. 9.

FIG. 9.—SECTION AT CENTRE OF MODEL L.N.W.R. TIMBER TRUCK.

FIG. 8.—PLAN SHOWING COUPLING.

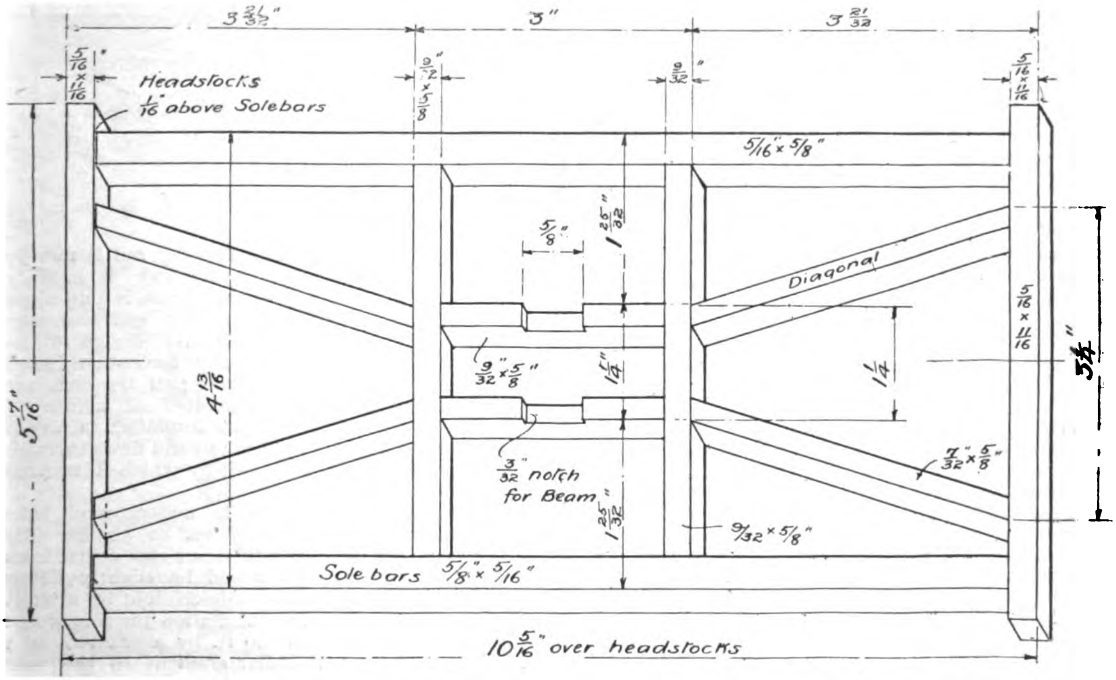


FIG. 10.—PLAN OF UNDER-FRAME. (*Half size for 1-16th-in. scale model.*)

the bolster directly under the post, and has attached to it a length of chain and a hook, with a screw coupling for tightening down the load intervening. The shackle, which is shown in the detail photograph (Fig. 3), should be bent up out of 1-16th-in. brass or steel wire, the ends being bossed out to take a pin of the same diameter.

In small model wagons the use of iron ferrules, straps, rubbing-plates, etc., bands round the ends of dumb buffers, and corner-plates is not really necessary; the required effect can be produced by black paint. The use of gimp-pins, to imitate rivets and bolts, will, however, enhance the appearance of the model considerably. Care should be taken to drill all holes before driving the pins and screws used in the construction of the model, otherwise the small parts may split in the operation of fitting together.

The use of glue should as far as possible be avoided in the construction of model wagons, and reliance made on paint joints and screws and spikes as fastenings.

(*To be continued.*)

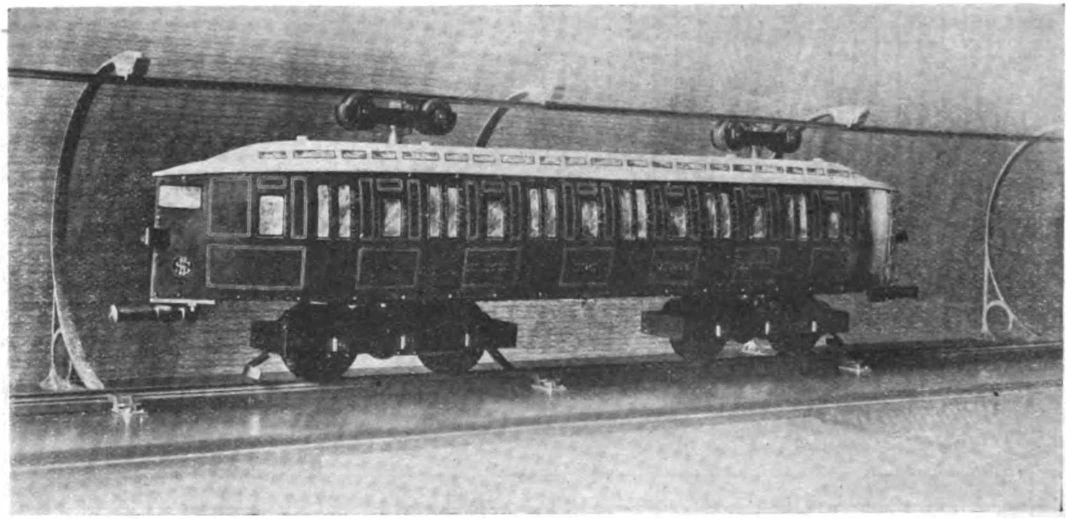
Silvering Brass or Copper.

By C. J. T.

THE following is a process for silvering brass or copper. Take ½ oz. nitrate of silver and dissolve in about 2 ozs. of water. Then add ½ lb. of cream of tartar, with ¾ lb. of common salt. Stir and mix well together, adding water until it attains the consistency of a thick paste. The articles to be silvered should be well cleaned. Then rub the silvering mixture on until the work attains the appearance of silver, which will be in a minute or so. Then rub a little whiting over it, wash out in clean water, and dry in sawdust. Great care should be taken to avoid any mixture of whiting with unused silvering mixture. After drying, lacquer with colourless lacquer.

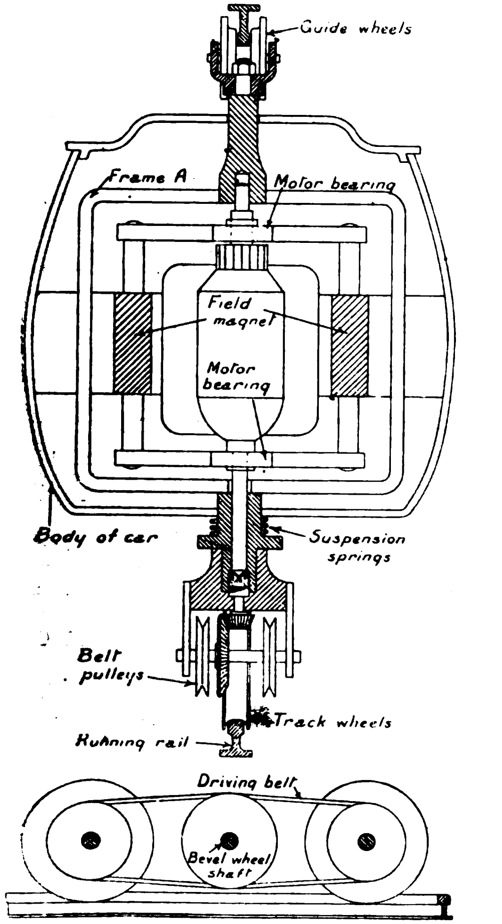
The Kearney High-speed Railway Model.

A DEMONSTRATION was given on June 15th, at 51, Aldwych, London, W.C., by means of an electrically-driven model of Mr. E. W. C. Kearney's proposed mono-rail system of working railways by means of high-speed trains or cars. According to the prospectus of the Company (The Kearney High Speed Railway Company, Ltd.), which is being promoted to work the invention, it is—" the result of some six years' experiment following upon an exhaustive research into the numerous systems of railway which have been introduced for the purpose of reducing the cost or increasing the speed, as compared with the ordinary twin-rail road." There are two rails, between which the cars run. The bottom one is the running rail and supports the car. The top rail is merely a guide. According to the inventor, it is only on curves that any appreciable stress is put upon the top rail, and that the safety and economy of the system depend on the correct design of the guide-wheels. Presumably, any convenient kind of motive power might be used; if the cars are propelled by electricity generated at a central power station, the rails are insulated. Current is then collected from the top rail and flows through the motors to the bottom rail by which it returns to the power station.

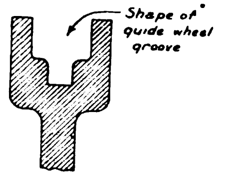


MR. E. W. C. KEARNEY'S HIGH-SPEED RAILWAY MODEL.

In applying the system to underground tube railways, Mr. Kearney proposes to abolish lifts altogether and build the tube on the switchback principle. The stations would be slightly below ground level, the passengers descending by a short flight of stairs. Leaving the station the line would dip to a depth of about 90 ft. by a gradient of 1 in 7, and rise by a similar gradient to the next station, after running the local distance on the level between the two gradients. It is anticipated that the force due to acceleration will counterbalance the effect of the gradient when the car is descending, and the opposing forces of gravity and retardation will counterbalance each other when it is ascending, so that passengers will not be conscious of the inclination of the line, but only experience a slight movement at starting and stopping, the effect



Diagrammatic Section of the Kearney Coach.



Diagrammatic Details of Mr. Kearney's Model.

of the gradients being intended to enable the cars to quickly attain a high speed and be retarded with economy of power. At the stations the cars are to run between a pair of platforms and be fitted with side doors. Passengers will enter the car at one side and leave by the other, so that loading and unloading is expedited The system is supposed to do away with the necessity for cuttings and tunnels on main lines, the railway following the contour of the country.

The model used at the demonstration is shown in the accompanying illustration. It is constructed entirely for the purpose of showing the working of the system. The body is made of sheet metal, and is to a scale of 1-16th the size proposed for the actual cars. Length over the ends is 40 ins.; width, 7½ ins.; height, 7 ins.; weight of car, complete, about 60 lbs., each motor weighing 11 lbs. Two motors are fitted—one to drive each set of wheels. They are of ironclad Lahmeyer pattern, designed and made by Mr. A. H. Avery, of Tunbridge Wells, 1-10th n.h.-p. each. The armatures (2½ ins. diameter by 1½ ins. length of core) are of toothed-drum pattern, with twelve coils and twelve-section commutators. Each drives its gear independently of the other. The drive is through a hardened steel bevel wheel and pinion having a reduction of 8 to 1. On the bevel wheel shaft are two V pulleys, which drive the track wheels by round leather belts 3-16ths in. diameter. One pulley drives the leading wheel and the other the trailing wheel, the pulleys being arranged to speed up in the proportion of about 4 to 3. Those on the bevel wheel shaft are 2 ins. diameter, and those on the track wheel shaft 1½ ins. diameter. Track wheels are 3⅜ ins. diameter over all, and about 3 ins. diameter at bottom of groove.

No working drawings were available, but the diagram sketch, which is not to scale, will give an idea of the method of driving and principle of suspension of the car body. Each set of guide and track wheels is carried by a rectangular frame, so that the vertical distance between the centres of these wheels is rigidly maintained. Thus the frame carrying the guide-wheels at the top and track wheels at the bottom fits in the rails and cannot fall out sideways, being retained in position by the flanges of the wheels. The frame carrying the guide-wheels and that carrying the track wheels are each made to swivel, so that the wheels can follow curves in the track. The armature of the motor is vertical, and drives the bevel pinion by a squared socket fitting so that the end-thrust does not come upon the pinion. The field-magnet is bolted to the car body, which is free to rise and fall independently of the frame A, and is supported by a coil spring concentric with the pivot upon which the wheel truck swivels. By this construction the car is carried by two frames, each provided with top and bottom wheels fitting between the rails, and is free to move vertically by the action of the suspension springs. A spring shoe collector is fitted to each of the top trucks. They are insulated from the framework and rub against the top rail. They are connected electrically, so that each conveys current to both motors. When the car is running, the one which is trailing makes better contact than that which is leading; it is therefore advisable to have the two. The guide wheels are 1½ ins. outside diameter and 1 in. diameter at the bottom of the groove, which is of similar shape to that shown in the sketch. Normally, the rail runs in the lower part.

The model track was 106 ft. in length, with gradients at the ends rising at a maximum inclination of 1 in 3. The rails were carried in circular supports, the distance between the running surfaces of the top and bottom rails being 11 ins.; inside diameter of the supporting rings, 12½ ins.; distance between each ring and the next 19 ins. The field coils of the two motors were connected in series and in shunt to the brushes. The armatures were connected in series with each other. Continuous current at a pressure of 200 volts was obtained from the street mains, the motors taking 2½ to 3½ amps., occasionally rising to 5 amps., at the gradients. The maximum speed was stated to be 23 miles per hour. In the illustration the near halves of the supports are cut away to show the car, but they could be made to support the track from one side only, as shown.

The running rails are of brass, flat-bottom pattern, bonded with copper wire at the joints. The track and supports are to scale size, and evidently not stiff enough to properly stand the weight of the model and effects of varying temperature, as considerable trouble was experienced in running the car owing to distortion of the track. The inventor is Mr. E. W. C. Kearney, 17, Old Queen Street, Westminster.

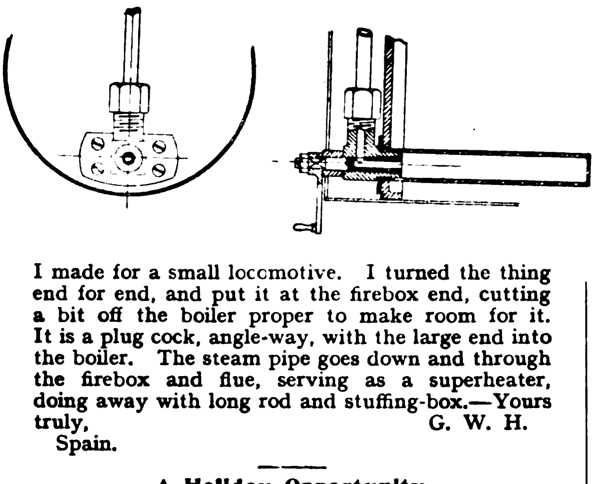
Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender MUST *invariably be attached though not necessarily for publication.]*

Regulator for a Small Locomotive

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I enclose rough sketch of a regulator



I made for a small locomotive. I turned the thing end for end, and put it at the firebox end, cutting a bit off the boiler proper to make room for it. It is a plug cock, angle-way, with the large end into the boiler. The steam pipe goes down and through the firebox and flue, serving as a superheater, doing away with long rod and stuffing-box.—Yours truly, G. W. H.

Spain.

A Holiday Opportunity.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Since taking your interesting paper about two years ago, I have often wondered if there are any experienced readers of THE MODEL ENGINEER who would care to come into the country for a holiday and at the same time give an amateur a little help in workshop practice.

This leads me to write and say that if there are any such, and they will communicate with me through the Editor, I should be only too pleased to entertain them.

I have a well-equipped workshop, with large and small screw-cutting lathes, drilling machine, etc., but badly want a little practical help, particularly in turning. Anyone with knowledge of motor work would be doubly useful, as I have motor cycle and car, but being in the country have to depend entirely on my own resources and THE MODEL ENGINEER.

I think a pleasant change could be arranged through the summer with more than one reader, as this is the healthiest as well as the prettiest village in the West of England, and close to several interesting places and within cycling distance of the Coast. I have also a roomy house and grounds. Will any interested readers write me through the Editor?—Yours truly, "COUNTRY AMATEUR."

Hot Water Supply.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—*Re* A. A. Cumming's criticism on "Plumber's" reply to W. G.'s query on hot water supply. I beg to point out that "Plumber" is right and Mr. Cumming is wrong. In the first place, Mr. Cumming puts the cold supply, or rather shows it, entering the bottom of boiler, which is the very worst place it could be. I myself have had to clean boilers of that description every three months, and have often found 1 to 1½ ins. of scale at the bottom. As regards flowpipe from boiler to cylinder, it does not matter where it enters same, as long as it is above the return pipe, which should be kept as low down as possible. I am sure if W. G. follows "Plumber's" directions he will get it to work satisfactorily, unless the draw-off taps are a long distance from cylinder; then he would require a secondary circulation. Both pipes should rise from boiler to cylinder.—Yours truly, "HOT WATER."

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.]*

London.

THE Society's Annual All-day Excursion will take place on Thursday, July 23rd, when a visit will be made to Bedford to inspect the well-known engineering works of Messrs. W. H. Allen, Son & Co., Ltd. The party will travel by the 10.6 a.m. train from St. Pancras, arriving at Bedford shortly after 11 o'clock. As the works are very extensive and the processes to be seen in operation are of a very varied and interesting character, the inspection will be a lengthy one, interrupted from 1 till 2 for luncheon, which will be served at the Grafton Hotel near the works. As much as remains of the day will be spent in excursions on or about the picturesque river Ouse which runs through the town, and the members of the party will please themselves as to where they take tea, meeting again later for the return to London by the 7.58 train, reaching St. Pancras at 9.4 p.m. The price of the tickets at the special fare quoted by the Company is 5s. 1d., and the luncheon 2s. As the number of the party is limited, early notification should be given the Secretary of intention to be present, enclosing at the same time the price of the rail ticket. The last day for joining the excursion is Saturday, July 18th.—HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green, S.E.

For the Bookshelf.

[Any book reviewed under this heading may be obtained from THE MODEL ENGINEER *Book Department, 26–29, Poppin's Court, Fleet Street, London, E.C., by remitting the published price and the cost of postage.]*

VARIABLE GEARS IN THEORY AND PRACTICE. By "Logos." London: W. A. Standring, 19, and 21, Wilson Street, E.C. Price 2s.; postage, 3d. extra.

One of the most interesting developments in the construction of the modern safety bicycle has been the application of variable-speed gears to enable the rider to increase his power at the expense of his speed when hill-climbing, and *vice versâ* when on the level or on favourable gradients. This has been a favourite subject with inventors, and a number of highly successful gears have been placed on the market from time to time. The author has made an exhaustive study of the various devices put forward from the earliest days of cycle-building to the present time, and presents in these pages an excellent account of all the most noteworthy gears. The descriptions are very clearly written, and are in most cases illustrated by diagrams and sectional drawings. For the cycle mechanic, as well as for the rider who takes an interest in cycle construction, the book possesses a special interest and is well worth reading.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[18,964] **Arc Lamps and Resistances.** R. D. F. (Fareham) writes: Will you please tell me the best way to make a resistance board or coil to use with an arc light for lantern purposes on a 100-volt alternating current? In the Chapel I shall use the electric meter is 30 amps., and another hall is 10 amps. If I can obtain this information from any book you publish, please send it. If not, please fill in replies to following questions. Which pattern is best (portability preferred)? Kind and gauge of wire required? Length altogether required? Can connection be made at ordinary 16 c.-p. bracket? Will arc or Kamm's Nernst * 3-burner give most light? Relative candle-power of each? Diameter of carbons for lamp? Any special kind recommended?

The type of resistance most suitable for working arc lamps on alternating current circuits is what is termed a "choking coil," which is somewhat different in principle to the simple resistance used for direct currents. You do not state what size arc lamp you intend using, but we strongly recommend you to obtain a suitable choking coil from the maker of the arc lamp you purpose using. As a rule, choking coils are supplied with arc lamps and, in any case, the makers of the lamp are able to supply exactly what is wanted in order to run the lamp successfully and economically from the supply mains. To answer all your questions fully would be equivalent to working out a complete design for both lamp and choking coil, and this, we much regret, we are unable to do through our Query columns. One point we can reply to definitely is that you cannot connect your arc lamp on to the existing wiring intended only for small 16 c.-p. lamps. You will have to have larger cable or leads run in from the meter to the place where you are taking your current from. From the cutting you send we should say the lamp illustrated is of a very small power and presumably is run from a continuous current circuit, as no dimensions, however, are given, it is not possible to say what candle-power such a lamp would give.

[19,848] **Failure of Model Locomotive.** H. D. B. (London) writes: I have made a model tank engine, 2—4—0 type, coupled wheelbase, 3½-in. driving wheels, 2 ins. diameter, gauge 2 ins., weight about 6 lbs. (empty), cylinder 7-16ths-in. bore, ¾-in. stroke, which I bought of Messrs. Bassett-Lowke. The boiler is 6½ ins. long, 2½ ins. in diameter, three 3-16ths-in. water tubes enclosed in flue, the same as in the simple model locomotive of 1902, fired by spirit lamp, two wicks, ⅜ in. diameter, which will raise steam in about eight minutes and run the engine at a high speed when lifted off the rails, but when put on the rails she will only move about 18 ins.—then stop. The engine runs easily and the lamp is well ventilated. Do you think the boiler ought to have more tubes? The thickness of shell is 3-64ths in., and the steam pipe runs through the fire. The diameter is 3-16ths in. The exhaust also leaves the chimney with a sharp puff, and draws fire fairly well. I have no pressure gauge, so cannot tell what pressure there is.

We do not think that the boiler is at fault. The very fact that it quickly raises steam shows that its evaporative powers are sufficient for the purpose. You say the engine runs easily; it should not do so, although, of course, the parts should be fitted properly and in alignment. The piston should be packed tightly, so that when the engine is cold the driving wheels are inclined not to revolve. The connections should be absolutely tight, the valves properly set and faced, and the glands well packed. The exhaust nozzle should not be too large, especially if the engine is without a superheater. Don't attempt to run the engine until you have a good head of steam.

[18,963] **Voltmeter and Ammeter Readings on Charging Circuits.** N. G. D. D. (Cambridge) writes: I should be very much obliged if you would answer the following query. If a shunt wound dynamo is charging a battery of accumulators (consisting in this case of four cells) and V is a voltmeter, how does the reading of the voltmeter depend? On the voltage of the dynamo on open circuit, or on the voltage of the battery of accumulators on open circuit—*i.e.*, on the back E.M.F. of the battery? If A is an ammeter I suppose it will read—

$$\frac{V_1 - V_2}{R} \text{ amps.}$$

Where V_2 = voltage of dynamo on open circuit.
V_1 = back E.M.F. of battery.
R = total resistance of circuit.

Is this correct? At first I thought that the voltage would be the difference between the E.M.F.'s of dynamo and battery, but that certainly is not the case, as I have found by experiment.

You do not enclose any diagram with your enquiry. If the voltmeter is connected across the terminals of the cells being charged whilst they are being supplied with current from your dynamo, the voltmeter will read the voltage of supply; that is, the voltage of the dynamo which is charging the cells. We cannot answer your enquiry *re* ammeter without the aid of a sketch showing your connections. It also depends upon whether the ammeter takes the full current or is of the other type of instrument which only shunts a portion of the current which is proportional to the total current flowing in the outer circuit. All ammeters simply register the current flowing in one direction or the other. If two opposing E.M.F.'s are coupled together, current will flow in the direction of the higher E.M.F. to the lower. If the difference between the E.M.F.'s is very slight, the result will be a very slight current in that direction. We do not think we can explain this matter any more fully unless we know more clearly what your difficulty is. Your equation is stated correctly.

[19,748] **Steam Ports for Triple Expansion Engine.** J. B. (Hartlepool) writes: Could you oblige me by giving me the size of ports for triple-expansion engine, cylinders 1¼ ins. by 1½ ins. by 2½ ins., with a common stroke of 2 ins.; and what pressure of steam would be required and horse-power obtained? Please say if these size cylinders are in fair proportion.

We cannot state exactly what pressure is best, as we do not know anything about the valve setting or whether the engine is to work condensing or non-condensing. However, the total ratio of expansion with 100 per cent. cut-off is 1 to 4, and to obtain a terminal pressure of, say 5 lbs. above the atmosphere (5 lbs. on the gauge), at least 80 lbs. pressure must be employed in the H.-P. steam chest. As the valves will no doubt be arranged to cut-off at about three-quarter stroke, the expansion ratio will be greater, and we would not reckon on a boiler pressure of less than 120 to 130 lbs. The ports should be as follows: H.-P. steam, ⅛ in. by ½ in.; exhaust, ¼ in. by ½ in.; intermediate steam, ⅛ in. by ¾ in.; exhaust, ¼ in. by ¾ in.; L.-P. steam, 1⅛ ins. by ⅛ in.; exhaust, 1⅛ ins. by ¼ in.; port bars, ⅛ in. or 5-32nds in. wide.

[19,853] **Electric Lighting for House.** C. C. M. (Barmouth) writes: I should be much obliged if you could answer these questions for me and send the answers as soon as possible. I want to light the house up with electric light. (1) What number of lights would a 30-volt 8-amp. dynamo light, say 10-volt lamps? (2) What power would be required to run the dynamo, using a water motor? The pressure on the main is about 50 to 60 lbs. (3) I want at least thirty-five lamps. My rooms are about 10 ft. by 20 ft., also 10 by 12 ft. What candle-power should the lamps be? (4) I want to have a storage battery, so that I can run the lights for a short time without the dynamo, say ten hours. (5) How many accumulators should be required, and how long should they take to charge? (6) Would using water be cheaper than a gas or oil engine? Gas is 5s. per thousand. (7) How much wire would be required and what size? How should I arrange the fuse and switchboards; how many would I want? (8) How much room would dynamo and water motor, also batteries and switch and fuseboards take up? My cellar is 15 ft. square. (9) Please tell me what kind of holders and lamps are best, what price they are, including shades (glass shades)? I want a low-speed dynamo, not 3,000, about 1,500 r.p.m. Could you estimate the total cost of installation for me? What price are the ammeters and voltmeters?

(1) Would give a total of approximately 60 c.-p. (2) A water motor capable of developing fully 1 b.h.-p. (3) The total candle-power may be divided up amongst any number of lamps, as convenience dictates. (4 and 5) To get an equivalent output to that which dynamo would give running for say five hours, you will require an accumulator capable of giving 1,200 watts output. Assuming a voltage of 30 is required, you would need fifteen cells each capable of discharging at the rate of 8 amps. Coupled in series, therefore, each cell would have to contain about 2 sq. ft. of positive plate surface. (6) We should say gas would be cheaper. (7) Please refer to "Private House Electric Lighting," 1s. 3d. post free. (8) The plant would take about 40 sq. ft. of floor space. (9) We advise you to get a quotation from any of our electrical advertisers. Messrs. Whitneys, 117, City Road, London, E.C., or Messrs. Thompson and Co., 28, Deptford Bridge, Greenwich, London, S.E., would quote you on application.

[19,679] **Silver Soldering.** J. D. (Guernsey) writes: I am making a small vertical boiler, 4 ins. diameter by 9 ins., 1-16th-in. shell, brass, double-riveted; 3-32nds-in. tube plates, cast brass; seven 9-16ths-in. tubes. Shall be glad if you will enlighten me on the following points:—(1) The method of silver-soldering tubes into tube plates. Will a No. 2 Aetna lamp be suitable? (2) I intend sweating collars to inside of shell for fittings; how can these be kept in place whilst silver-soldering the tubes? (3) Will ordinary soft solder stand on the fire side of bottom tube plate?

You will find some useful notes on silver-soldering in our issue for April 23rd, 1903. You should also refer to various articles which have appeared on small boiler construction from time to time. We enclose list of back numbers which you can refer to. Further, you should read the article entitled "Wrinkles in Model-making," which appeared in our February 6th issue of this year, in which you will find some very useful hints on silver soldering. We should not advise soft solder for your boiler.

[19,529] **Model Steamer Machinery.** H. P. (Torquay) writes: Would a boiler such as that described by Mr. Barton Mott in the issue of The Model Engineer dated August 29th, 1907, but using 3-in. drums instead of 4-in., and other parts reduced in proportion, be suitable as a marine boiler to drive a 3-ft. model of an ocean liner, 6-in. beam? If so, can it be fired by a Swedish blowlamp? If it cannot, what would you advise? What size engine, what size propeller, what diameter steam pipe? Referring to page 18 of Handbook No. 13, would the flue tubes be merely soft soldered in? What pressure would this boiler stand?

Yes, such a boiler would prove successful. We think that a beam of 6 ins. is rather too much for a 3-ft. model of a liner; but, of course, from the *working* model point of view it is no disadvantage. Why not make it 3 ft. 4 ins. long? We should advise a small benzoline or petrol blowlamp. Use a 2½-in. diameter propeller about 3-in. pitch. Steam pipe, 5-32nds or 3-16ths in. diam. copper tube. To which boiler in "Model Steamer Machinery" do you refer—Fig. 8 or Fig. 9? In both cases the tubes may be soft soldered in, but in Fig. 9 especially they would be better silver soldered or brazed.

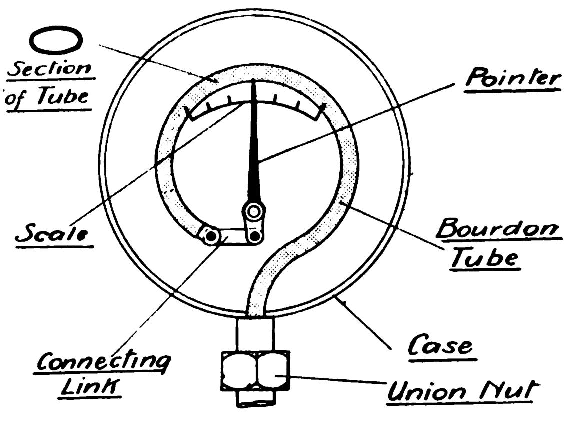
[19,429] **Model Boiler.** H. T. (Northumberland) writes: Please tell me what size and kind of boiler I could use for a horizontal slide-valve engine, ¾-in. bore, 1½-in. stroke? What power would engine be, and what necessary fittings would you suggest?

Any good type of boiler, having at least 100 sq. ins. of heating surface, will drive your model. We cannot advise more definitely as you do not give us any idea as to what type would be acceptable. The engine will develop at 50 lbs. pressure and 500 r.p.m. about 1-25th i.h.-p., and drive a 10-watt dynamo. This is presuming it is well made. You would do well to refer to our sixpenny handbook, "Model Boiler Making," and we may recommend for oil-firing the type of boiler illustrated on page 32. You may work to drawing Fig. 9A, making the shell 5 ins. diameter by 10 ins. high, and employing fifteen tubes ¼ in. diameter. You require a safety valve, stop valve, water gauge, pressure gauge, and blow-off taps.

[19,503] **Steam Dynamo Plant.** S. P. (Haslemere) writes: Having received valuable advice from you before, I again seek your assistance and should be much obliged if you would answer me the following questions:—(1) Would a vertical steel solid-drawn boiler, 5 ins. diameter, 6 ins. between tube plates, 3-32nds in. thick (or less), with twelve ½-in. tubes, and fired by a single 3-in. Primus oil burner, be powerful enough to drive a ¾-in. by 1½-in. horizontal engine at 500 revolutions and 60 lbs. pressure? (2) How long would water in same last without use of pump? (3) Would this engine and boiler be powerful enough to drive a 5-volt 1-amp. dynamo, speed 3,000 revolutions? (4) What part of horse-power would engine be? (5) What is the slowest possible speed I could run engine when driving dynamo at 3,000 r.p.m.?

(1) We do not advise the use of steel. You would do better to use copper, which should be less difficult to obtain. The boiler should be 8 ins. high. The generator you propose would evaporate about ½ cub. inch per minute without priming, and would run the engine at 60 lbs. and 200 r.p.m. (2) The water, reckoning on a 1-in. variation, would require replenishing every 20 minutes theoretically, or, say, every 15 minutes in practice. We should advise a pump running continuously. (3) We recommend a boiler at least 6 ins. by 9 ins. with about the same number of tubes. The larger generator will give much greater satisfaction. (4) Reckon the engine at 1-25th i.h.-p. at 60 lbs. and 500 r.p.m., and with 50 per cent. loss in mechanical efficiency and another 50 per cent. in the dynamo you may expect to get under best conditions about 7½ watts. (5) Run the engine at 500 revs. and with a 1 to 6 drive; say, a 9-in. driving wheel on the engine, and a 1½-in. pulley on the dynamo.

[19,585] **Steam Gauge.** C. M. D. (Highbury, N.) writes: I am a beginner in running model engines and purchased in January last a 2½-in. gauge locomotive, low-pressure, at £5 5s. 6d. The last few times of using I have noticed that the steam gauge returns to zero (or nearly so) only some ten minutes or so after the engine



Query 19585

is finished with, and all water emptied from the boiler. The working pressure is from 10 to 20 lbs., the maximum pressure for the boiler being 35 lbs. Could you please inform me whether my steam gauge is working correctly, and briefly explain to me the inner mechanism and principle of the working parts of a steam pressure gauge and syphon? I notice "Model Railways," page 20 at footnote, says—"A syphon is used to prevent the hot steam getting to the mechanism of the gauge." How, then, does the gauge work, and how does the syphon "prevent" the steam getting to the interior of the gauge?

We should say that the mechanism is jambing slightly, and at the lower pressures the "spring" of the tube is insufficient to return the pointer to zero immediately. Generally, where the pointer does not return to zero, it is loose on the pivot, and may be put in the correct position and knocked on tightly. They are fitted in the same way as watch and clock hands. The Bourdon pressure gauge consists of a flat or oval tube which, of course, has a larger outside surface than inside. It is elastic and when fluid pressure is exerted inside the tube, it tends to unroll, and pulls a pointer over a graduated scale. Perhaps in your case the tube is kinked slightly. There is no remedy for this. You will find a description of the syphon arrangement in a recent query. See issue of December 5th, 1907 last, page 557, Query No. 17,890.

[19,763] **Charging Accumulators and their Construction; Small Power Electric Motor.** D. N. B. (Windsor) writes: (1) I am thinking of using a battery of twelve cells to charge a 4-volt 30 amp.-hour accumulator. I am going to use four of the batteries at a time for about 15 minutes, then switch them off and four more in, and so on, till I have used the last four for 15 minutes; then start all over again till the accumulator is charged. Can you advise me which type of cell would be most suitable for this method of charging—agglomerate block, sack Leclanché, carporous Leclanché, or ordinary Leclanché? (2) Could you give me the name and address of any electrical firm who could supply me with a small motor to drive a 4-in. ventilating fan taking 4 volts 1 amp.? I have tried many small motors, but find they take 3 or 4 amps., and therefore are not suitable for running from a small accumulator of about 6 amp.-hours capacity. (3) How many pint Leclanché cells should I require for a small telephone, the wires extending from second storey to the ground floor? (4) Is there such a thing as a "dry" accumulator; if so, could you tell me how to make one? (5) Would it be possible for me to drive a water motor with a pressure of 14 lbs., the water coming in through ½-in. pipe? (6) I broke the lug off one of the positive plates of a 20 amp.-hour accumulator, and since I could not burn another lug on, I took the paste out of about nine squares in one corner of the plate and poured molten lead in, thereby being able to burn a fresh lug on. Do you think this method will answer? (7) I am thinking of making an accumulator having, instead of plates, square boxes made from sheet lead filled with litharge, each side being 2 ins. square and well perforated. This method, I thought, would do away with pasting plates, which at times is very annoying. Do you think it would work all right?

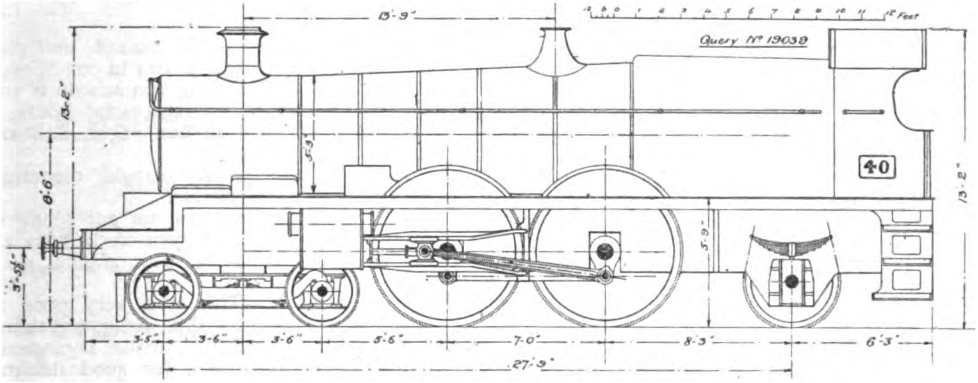
(1) Leclanché cells of any type are not suitable for charging work. However, for charging at a very slow rate you should use sack Leclanchés, working on the method you suggest. (2) There is not a motor of this size on the market as far as we know, but Messrs. Thompson & Co., 28, Deptford Bridge, Greenwich, London, S.E., would make you one specially on receipt of particulars. (3) About three Leclanchés in series would probably be sufficient. (4) No; possibly you mean an accumulator with a jelly electrolyte, some particulars of which were given in Vol. VIII of this journal. (5) Yes, but the power would be extremely small. (6) Yes. (7) This method will work well enough, but the disadvantage is that the surface of the plates is not as large as in other types of accumulators, hence the discharge rate is limited. Besides this, it is more difficult to thoroughly form the plates.

[19,713] **Model Boilers.** D. M. G. (Strood) writes: I have a boiler made like the locomotive boiler rebuilt by Mr. Greenly and described in the issue of September 12th (1907), pages 250–1, but with all tubes brazed. I want to know—(1) Safe working pressure (boiler 14 ins. long by 4 ins. inside diameter, 1-16th-in. copper shell, seam brazed, ends of ⅛-in. copper plate brazed in). (2) Are longitudinal stays needed; if so—size, number, and pitch? (3) Taking S.D. tube as 100, the average strength of well-brazed tubes. (4) How can I stick asbestos millboard to tinplate or sheet iron to stand heat?

(1) Neglecting that, if not stayed, the ends will bulge, the working pressure may be 80 to 90 lbs. per sq. in. (2) Yes, at least one 3-16ths in. diameter copper or bronze stay. Screw, forty thread per inch. (3) Unknown and variable. Allow same factor as double riveting, viz., 75 per cent. (4) Rivet it on.

[19,039] **G.W.R. "North Star" Locomotive, 4—4—2 Type.** W. R. writes: I am desirous of building a ½-in. scale express locomotive of the G.W.R. "Star" class, type 4—4—2, and should esteem it a favour if you would insert at your convenience a scale drawing of this engine and tender, in your valuable paper. I should also be grateful for information on the following points:—(1) Bore and stroke of cylinders. (2) Dimensions of Smithies' type boiler.

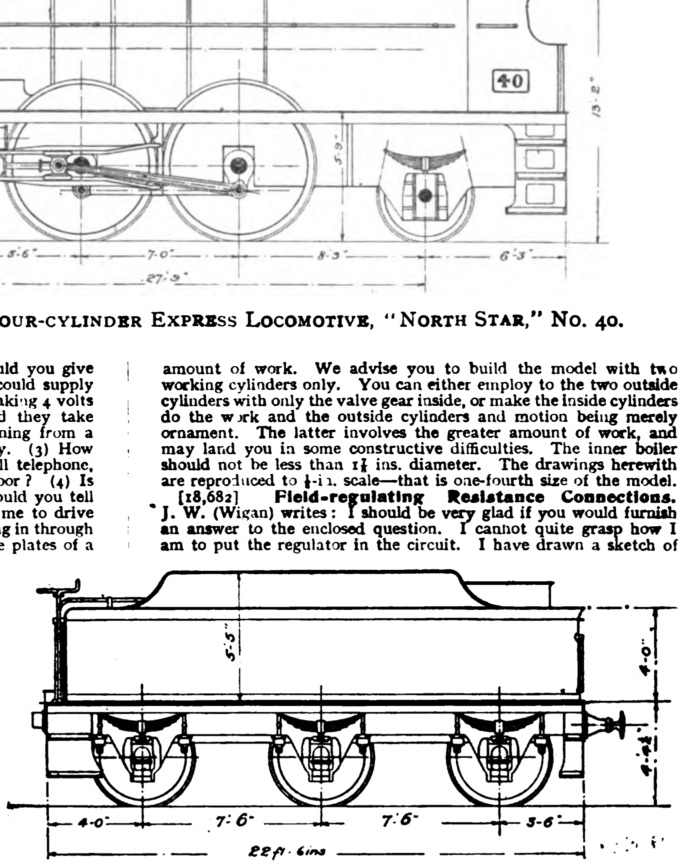
Your choice of a prototype will entail a comparatively large amount of work. We advise you to build the model with two working cylinders only. You can either employ to the two outside cylinders with only the valve gear inside, or make the inside cylinders do the work and the outside cylinders and motion being merely ornament. The latter involves the greater amount of work, and may land you in some constructive difficulties. The inner boiler should not be less than 1¼ ins. diameter. The drawings herewith are reproduced to ⅛-in. scale—that is one-fourth size of the model.



OUTLINE OF G.W.R. 4—4—2 TYPE FOUR-CYLINDER EXPRESS LOCOMOTIVE, "NORTH STAR," NO. 40.

[18,682] **Field-regulating Resistance Connections.** J. W. (Wigan) writes: I should be very glad if you would furnish an answer to the enclosed question. I cannot quite grasp how I am to put the regulator in the circuit. I have drawn a sketch of the switchboard, but I have omitted, as you see, the connections to the regulator. Would you please complete the sketch by putting in connections?

In reply to your enquiry, we give a sketch of connections for switchboard (not reproduced). The regulating resistance is connected in series with the shunt circuit of the field-magnets, and is employed to regulate the terminal voltage of the machine. In addition to this regulating resistance, it is usual to have a high resistance fitted, which is used to cut down the current flowing in the field winding to a very small figure previous to totally breaking the shunt circuit, but as your engine is probably quite a small one such a switch would be unnecessary.



G.W.R. TENDER FOR "NORTH STAR" LOCOMOTIVE.

[17,950] **Hard Lead Alloy or Type Metal.** A. H. (Carlisle) writes: I wish to make castings in lead. Is there any method of hardening this metal? I would like to make it very hard, without being too brittle. Is there any harder metal as cheap which can be melted as easily as lead?

We can only suggest that you add a small percentage of antimony to your lead. About 25 per cent. would make a considerable difference in its hardness.

The Editor's Page.

WE publish elsewhere in this issue full particulars of the events and regulations for our Model Motor Boat Regatta and also an entry form for competitors. We hope those who intend entering a boat will fill up the form and send it to us as early as possible, so that we may get the official programme for the day into the printer's hands. We learn that some of the intending competitors have been enterprising enough to set out to design and build new fast boats especially for this event, and we shall look forward with confidence to seeing all previous records go by the board, given favourable weather conditions.

* * *

Among the various letters received in support of the Regatta Scheme we have pleasure in giving prominence to the following from Mr. Geo. F. Young, the Hon. Secretary of the Clapham Steam and Sailing Club:—" I was extremely pleased to see from this week's MODEL ENGINEER that the idea of a Model Steam Boat Regatta at Wembley Park is being taken up. I can assure you that the members of our club and also members of the Victoria Park Model Steam Boat Club, some of whom, I might say, I have met and discussed the subject with, are entering into the spirit of the thing very thoroughly, and I hope that when you have all the conditions settled the other model steam boat clubs of England, and also individual owners, will enter into competition with as much zeal. I feel sure that the owners of model steamers will be very thankful to you for giving them this opportunity of meeting in friendly competition. It is the first opportunity that has been given, as although you hold a Speed Competition every year, it cannot be equal to an event where the boats meet each other and contest their superiority. Such being the case, I hope that your endeavours will meet with the success they justly merit."

Answers to Correspondents.

A. E. S. (Tunbridge Wells).—See our issue for April 7th, 1904; also *The Electrical Review* for Feb. 10th, 1905.

E. G. (Leeds).—Hot-air engines are made by Messrs. A. E. & H. Robinson, Ltd., Gt. Bridgewater Street, Salford, and W. H. Bailey & Co., Ltd., Salford. You might also get particulars of the Lowne vacuum engine, made by Messrs. Hardy & Padmore, Ltd., Worcester.

"A READER."—Your enquiry for complete scale plan for model yachts is having our attention, and we will endeavour to publish something suitable at an early date.

A. F. R. (Streatham).—A diagram of switchboard connections was given in our first issue in January, 1908, to which please refer.

B. J. J. (Dublin).—Why not use a gas or oil engine instead of a hot-air engine? You will have difficulty in obtaining a suitable one, as large engines of the latter type only give comparatively small power.

P. B. A. (Carron).—Your design would not prove practicable. You will find excellent drawings for a model centrifugal in our issue of Sept. 13, 1906, Vol. XV, page 256.

J. O. (Bermondsey).—We cannot undertake to design a boat for you to run in our Speed Competition. The best thing you can do is to study the particulars of the successful boats, which we have published in our pages, and try and build something better.

G. T. R. (Hanley).—We should recommend a Stuart Turner gas engine.

L. H. (Dublin).—We have not got plans of this sized craft in hand. If you work from a larger model, proportionately, you should get good results.

A. D. (Liverpool).—This is a very poor design, and not worth your while doing anything with it. See handbook, "Small Dynamos and Motors," 7d. post free, for good designs and particulars of windings.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 376. — JULY 9, 1908. PUBLISHED WEEKLY

A Triple Expansion Condensing Marine Engine and Two Serviceable Machine Tools.

By W. B.

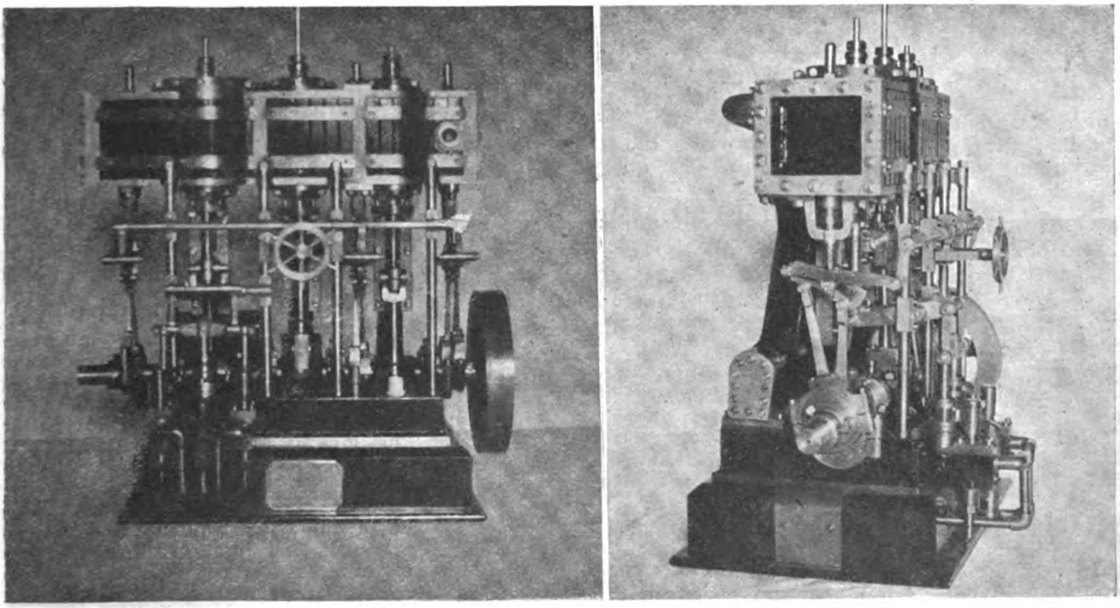


FIG. 1.—MODEL TRIPLE EXPANSION CONDENSING MARINE ENGINE.
(*Presented by the builder to the Technical Department of the Maidstone Museum.*)

A $3\frac{1}{8}$-IN. CENTRE COMBINATION LATHE.

SOME years since I enquired of a Broadheath works if they could manufacture a similar lathe to the one they were then producing, of less than 6-in. centres. Their reply was: "No; a lathe of this design could not be made." This induced me to make a reduced set of drawings from what I knew of the larger lathe. Then I made the patterns; Messrs. Martin, of West Ham, cast from them; and eventually the lathe was built. It is self-acting in all cuts, and screw-cutting; it has a taper attachment, and will presently have a turret arrangement. The cast-steel spindle is hollow. The right-hand foot-gear drives a small drill, as shown. A vice is fitted to the bench. The whole is contained in a cabinet, round the inside of which is a rack for apparatus,

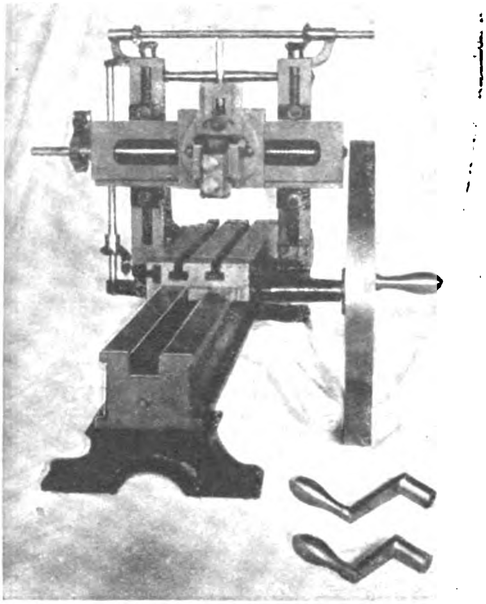


FIG. 2.—A SMALL PLANER.

tools, etc.; and a drawer is fitted under the centre of the bench. The top of cabinet opens in two leaves, the stays of which are shown. The whole

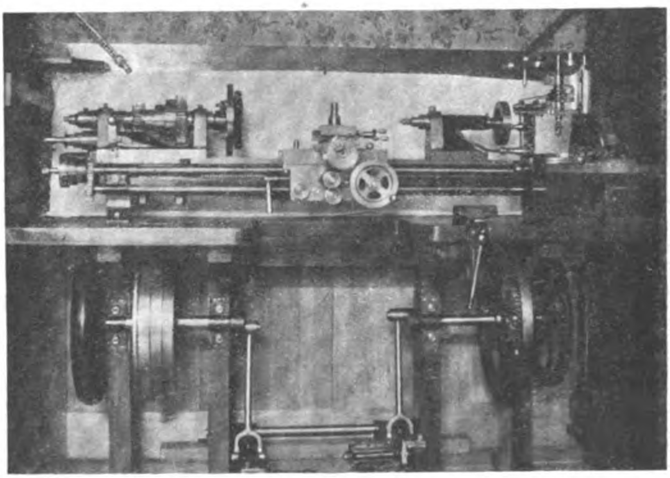


FIG. 3.—A 3½-IN. CENTRE COMBINATION LATHE.

forms a neat workshop—complete. I still hold the drawings and patterns of the lathe.

A SMALL PLANER.

In the second illustration may be seen a small planing machine, which will take work up to 6 ins. by 3 ins. by 3 ins. There is an attachment which screws against the saddle and geared with winch drive for milling. A screw-feed is applied to the table when milling. The tool was designed and made in order to make use of a small planed lathe bed, 24 ins. long, I had by me. It is a strong little machine, and there are cross-stops.

TRIPLE-EXPANSION CONDENSING MARINE ENGINE.

Following are the principal dimensions of this model engine (shown in the two views at Fig. 1): H.-P. cylinder, 1½ ins. diameter; I.P., 2¼ ins. diameter; L.-P. cylinder, 3½ ins. diameter; stroke, 4 ins. The model is about 20 ins. square; the pumping gear is in front; pump of gun-metal. I had the pleasure of presenting it to the Technical Department of the Museum at Maidstone, and I have no doubt opportunity would be granted by the head master for anyone to see it at convenient times.

A Model Whaler.

By A. E. CHURCHILL.

THE following is a description of a model "whaler" I built during my spare time. As can be seen from the photograph, it resembles a "whaler," the boiler and machinery being placed aft. The hull, which I dug out of a piece of pine, has the following dimensions:—Length, 2 ft. 6 ins.; breadth, 6 ins.; depth (forward), 7 ins., (aft), 6¼ ins.; draught (forward), 3¾ ins., (aft), 4 ins.

The decks were originally of wood, but owing to heat were always splitting or causing trouble in some way. This difficulty has been overcome by making them of thin sheet iron, painted, and then lined, to imitate planking.

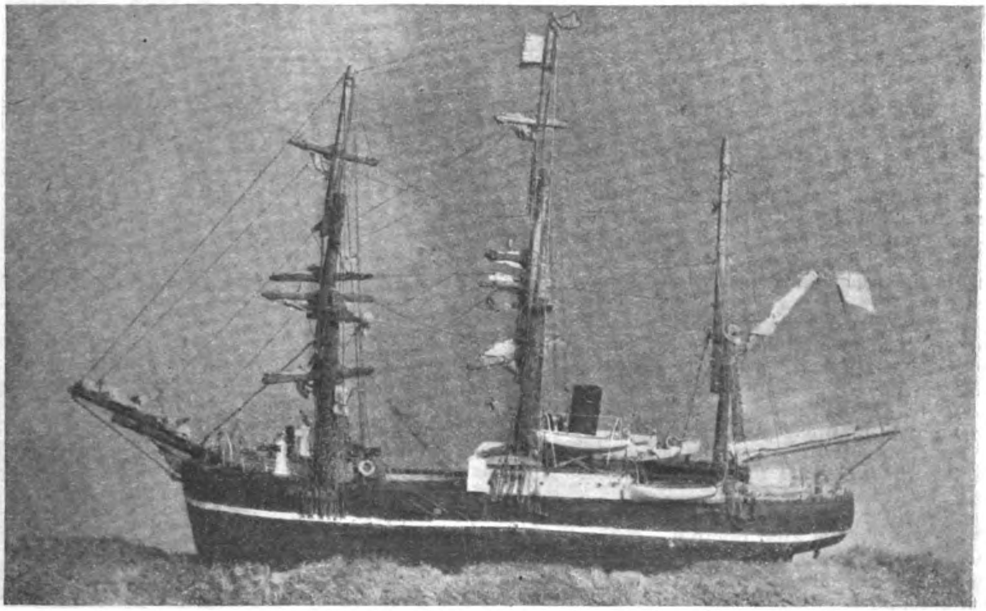
The engine is of the direct action slide-valve type, ⅜-in. bore, ⅜-in. stroke, and drives a three-bladed 2½-in. propeller. The boiler is made of galvanised iron, double seamed and riveted, and is fitted with two gauge cocks, water inlet, whistle, and safety valve. Firing is effected by an ordinary spirit burner. This is the second engine and boiler put in, the previous engine having had an oscillating cylinder. Although an excellent little machine, it was found to be far too small for the purpose.

The present model is barque rigged, carrying in all eighteen sails. These take quite half-an-hour to set and twice as long to furl again if the job is to be done properly. As she is not of much account as a sailer, this trouble is not often encountered. She steams well, although rather slow, but as whalers and sealing steamers are slow boats, this only adds to realism. In the prototype I believe steam is used as an aid to the sails or when it is impossible to sail, but in this case it is very much the other way about.

The fittings include three lifeboats and one steam launch (dummy) on davits, two gigs and two surf boats—eight boats in all; two steering wheels, one in the wheel-house (aft), and the other on the bridge, where there is also a compass, engine-room telegraph, bell, lifebuoys, etc. Two ventilators are placed in front of the funnel. On the fore deck are the port and starboard lighthouses, windlass, two pairs of bollards, and two anchors. There is about 3 ft. of chain attached to each anchor. The "crow's-nest" on the mainmast was cut out of a small cotton reel. The hull is painted black with a white line, and decks are of teak colour, upper works white, and funnel red and black.

I hope this account of a first attempt at model shipbuilding may interest some readers of THE MODEL ENGINEER.

THE ironclad *Peder Skram* was launched from the Royal dockyard, Copenhagen, on May 2nd. She is a sister ship to the *Herluf Trolle*, launched in 1899, and the *Olfert Fischer*, launched in 1903. The principal dimensions of the new ship are as follows:—Length, 84 metres; breadth, 15·7 metres; depth, 4·9 metres; and her displacement is 3,650 tons. There are two vertical triple-expansion engines, six boilers, and two propellers; the engines will indicate 4,600 h.-p., and the speed is to be 15½ knots. She will have two high masts for wireless telegraphy, and electricity is extensively used on board for a number of mechanical purposes. Wood has been used as little as possible, and the furniture, for instance, will be made of zinc. The cost of the ship will be about £300,000. The armament comprises a 24-centimetre gun in each of the two revolving protected turrets, one fore and one aft, and four 15-centimetre guns, besides lighter anti-torpedo guns, and four submarine appliances for firing torpedoes.



A MODEL WHALER.

An Electric Wind Vane.—II.

By C. E. S.

(*Continued from page* 13.)

THE indicator is shown in the photograph, and also diagrammatically in horizontal section, in Fig. 10. Fig. 11 shows some of the working parts from behind.

It is similar in construction to an eight-hole electric bell indicator, except that the holes, and hence the mechanism, are arranged in a circle. Each hole has behind it a tinplate flag, painted half white and half black, and when not in use the black is shown. Each flag is soldered to a bent-wire arm, which is itself soldered to a soft iron armature, and the whole can turn about a post screwed into vulcanite base. Each arm is placed at an angle of 45 degs. with its hole, and is actuated by a two-pole electro-magnet.

First make the base from vulcanite ¼ in. thick. It is 6¼ ins. in diameter, with a 3½-in. hole in the centre (see Fig. 11). (The piece cut from the centre can be used to make the lower part of the commutator base, already described.) The iron part of the electro-magnets is shown in Fig. 12. The yoke, made from ½-in. by 3-32nds-in. iron, is bent at right angles to form a foot, which is attached to the vulcanite by two ⅛-in. iron screws, the vulcanite being tapped to receive them. The iron for yokes and cores should be annealed.

The bobbins are shown clearly in Figs. 10 and 11, and they can be made from pear or any close-grained wood. They are wound on a mandrel in the lathe with No. 28 s.c.c. wire, and eight layers can be got on, leaving 3 or 4 ins. at each end for connections. Half a pound of wire will be more than sufficient for all the bobbins. After winding, give them a coat of thin shellac varnish.

The armature (shown in Fig. 13) is made of annealed iron about 1-16th in. thick, and has soldered to it a thin brass tube, made out of wire in the lathe. To solder the tube and wire to the armature, cut a slight groove in a piece of wood for the tube to lie in, bring the armature and wire into position, and the two joints can be made in a moment. The wires are bent once at right angles before soldering, the other ends being left for the present.

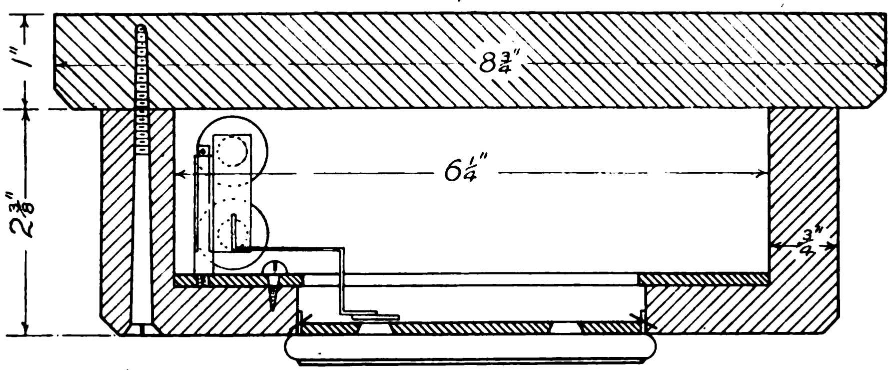
The post supporting the armature is shown in Fig. 13. It has a shoulder below, and a hole to receive a wire pin above, to keep the armature in place. It is screwed ⅛ in. for attaching to the vulcanite. Number each magnet and armature. Drill and tap the holes in the vulcanite for the magnets, numbering the vulcanite to correspond, and then fix the armature posts.

From a clockmaker procure the case of an old French clock, the kind referred to being that with a brass cylindrical case about 2 ins. deep and about 3⅜ ins. in diameter; they are quite common and cost very little. The parts wanted are the glass and its retaining ring, which are shown in Fig. 10. Turn a dial-plate of brass about ⅛ in. thick to fit nicely behind the glass, and drill eight ⅛-in. holes in it, countersinking them on the side next to the glass (see Figs. 10 and 14). Then have the eight points of the compass engraved opposite the holes, and polish the front face and lacquer it.

For the indicator case two pieces of well-seasoned wood are needed. Sycamore is suitable, and looks well if treated with an oak stain and varnished. The front of the case is fastened to the back by three screws, the heads of which should be polished and lacquered. The hole in front will be turned to fit the retaining wing of the glass, and the latter is fixed into the case by two small nails, seen in Fig. 10, which also keep the dial-plate in position.

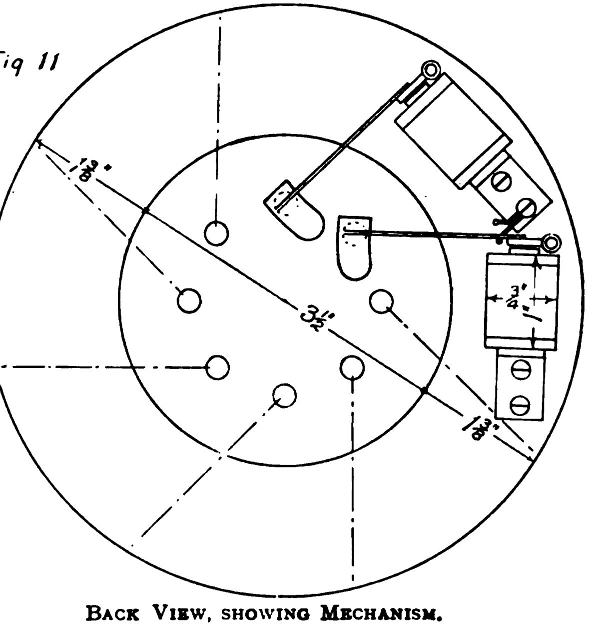
A small push, similar to those used for electric bells, is screwed to the front of the case immediately below the glass. It is shown in the photograph, and needs no description beyond stating that it looks well made of brass and that its base can be made of vulcanite. It cannot exceed 1 in. in diam. as it would then cover one of the screws holding the two parts of the case together; the terminals prevent a screw being placed at the top.

Fig 10



Horizontal Section through Indicator.

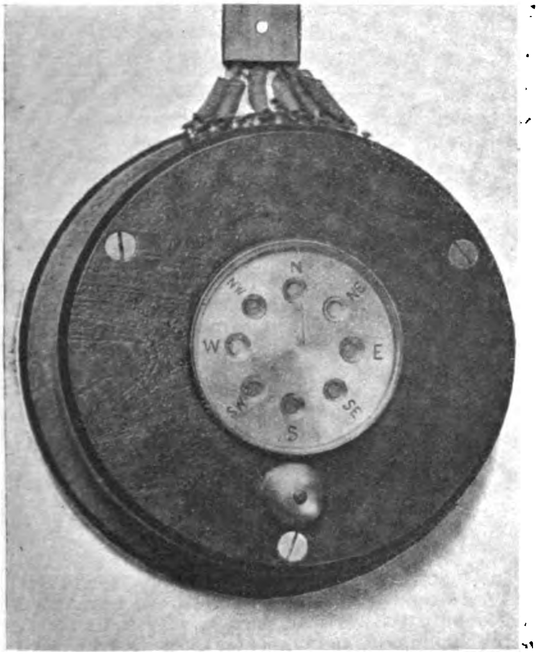
Fig 11



Back View, showing Mechanism.

The vulcanite ring, on which the magnets are mounted, is fastened to the case by three screws, one being shown in Fig. 10. Bend the wire arms of the armatures to shape and solder on the flags, which are painted half white and half black, the latter being the round end. The screws fixing the magnets have each a second duty to perform. Those furthest from their bobbins hold little wire forks which limit the movement of the armature arms. One of these is shown in plan in Fig. 11, the two ends being up at right angles to the plane of the paper. It is made of brass wire, and a little experimenting will show the shape to give it.

The screws next to their bobbins hold springs which act upon the armature arms. They are made of steel piano wire, and one is shown in Fig. 15. It is like a hairpin about 1½ ins. high, with a small ring on one leg, so that it stands nearly vertically to the surface on which it is clamped. If the indicator were without springs, gravity would cause some of the armatures to lie close to their magnets; others would be too heavy for their magnets to attract, and one or two would work satisfactorily. Hence some of the arms will be placed inside the springs and will be pulled by them, and others will be outside and will be pushed. When the indicator is in its proper position each flag should show black, but a slight pull of the armature should make the white appear. In Fig. 11 both are showing white.



Photograph of Wind Vane Electric Indicator.

Eighteen small brass terminals are needed—nine with nuts and nine without. They are not worth making, as they can be bought for a penny each and a halfpenny for the nuts, which is less than the cost of the rod from which to turn them.

Drill a small hole up the screwed stem of nine (see Fig. 16), and into each solder about 1 ft. of copper wire. No. 22 cotton-covered is suitable for all connections in the indicator. Connect the two coils of each magnet by twisting together and soldering two beginning or two finishing ends, thus getting N. and S. poles.

To connect the various parts of the indicator, attach two 18-in. lengths of wire to the push, grooving the case inside to allow them to pass under the vulcanite ring and so to the back. Make nine holes through the top of the case, about ½ in. from the base, and spaced ¾-in. centre to centre, and screw in the terminals. Calling the terminal on the left No. 1, connect it with one wire (it is immaterial which) of the magnet which shows N;

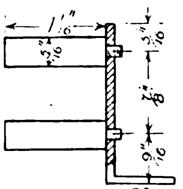


Fig 12.

Magnet Cores.

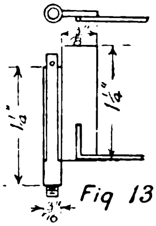
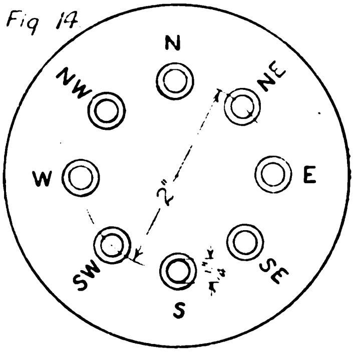


Fig 13

The Armature.

No. 2 with that showing N.E., and so on to No. 8 with that showing N.W. No. 9 is connected with one of the push wires. Make a ring about 3 ins. in diameter of fairly thick uncovered copper wire, and connect with it the second wire of each magnet

Fig 14.



Brass Dial-plate.

and the remaining wire from the push. Clean all wires before soldering the joints, and, if killed spirit is used, be careful to rub an oily rag over the joint as soon as the solder has set.

Test the indicator with a battery, one wire going to the common terminal, and the other to each of the remaining eight in succession. On touching the push, the hole in circuit should show white with a sharp click. Two Leclanché cells should work it well on short-circuit, and if any

Piano Wire Spring.

Fig 15

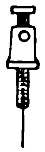


Fig 16

Brass Terminal.

hole does not act quickly, adjust the armature spring until it does so.

The nine wires from the indicator are No. 22 bell wire, and they are less unsightly if laid in the wooden casing used for running wire in house lighting (see photograph). They pass to the terminal-box, where they join those from the commutator. The battery can be placed in any convenient position, the common wire from the indicator being cut and the two ends joined to it.

The terminal box is shown in plan, with the lid removed, in Fig. 17. It is square in section and contains a strip of vulcanite into which nine terminals are screwed, the nuts of which serve to connect the wires from the indicator. Nine holes are bored through each side at a suitable level to admit the wires.

It only remains to connect the wires from the commutator in the right order, making the final adjustment by slightly rotating the standard until the points read correctly. This is most easily

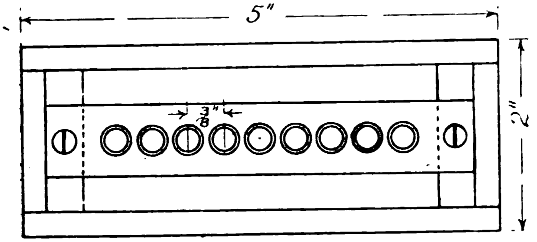


Fig 17.

PLAN OF TERMINAL BOX.

effected by using a battery and bell at the terminal-box, *i.e.*, not making use of the lower part of the circuit. Let the wires from the standard be enclosed in rubber tubing until they enter the house.

A simpler indicator could be made by placing a small electric lamp behind each hole. The writer did not employ this method because the uncertain life of small lamps would probably necessitate fairly frequent renewals, and, further, more current would be used.

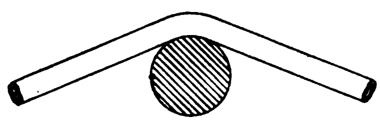
Workshop Notes and Notions.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.]*

A Simple Method of Lengthening a Piece of Pipe or Tubing.

By ALEC CAMERON.

Heat the piece of pipe in the middle on one side only; when to a good heat, bend it a little round a piece of bar, taking care to keep the hot side

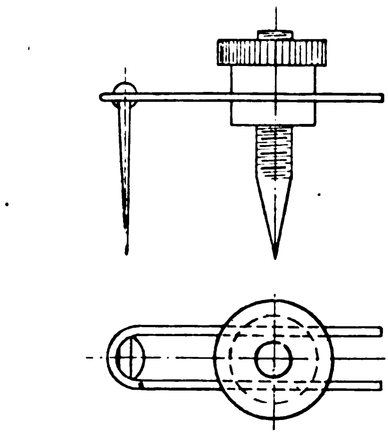


of the pipe on the outside of the bend. Then allow to get perfectly cold. When cold, heat the inner side of the bend and bend straight; if the pipe is still too short, repeat process, but in another part of the pipe.

A Washer-Cutter.

By A. LINTON.

This little device is by no means a perfect washer cutter, but I have for some time repaired the taps and ball valves in our house with it, using leather or hard indiarubber for the washers. I made it in a few minutes from an old terminal of a porous



pot, a piece of iron wire, and a broken keyhole saw. I soft-soldered the knife to the wire. This wire might, with advantage, be replaced by a sheet of brass with a slit in it for the terminal screw to pass through, as the wire is apt to bend in the process of cutting a washer. The disadvantage of this tool over a bought one is that you cannot cut washers with a diameter smaller than that of the terminal. I find it best to hold the cutter perfectly still and to turn the leather round, as by this method one gets a less jerky cut.

Chaser Making.

By H. BROWN.

The following wrinkles may be of use to readers of THE MODEL ENGINEER. They have been tried and found to answer their purpose very well indeed.

The buying of chasers being a very expensive

FIG. 1.

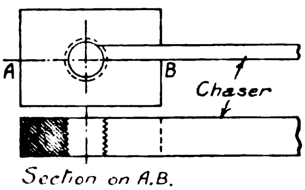
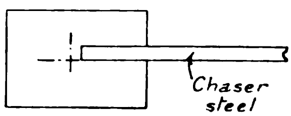


FIG. 2.



item, the following will appeal to those who use them, whether frequently or only at odd times.

Take a piece of iron or mild steel about 1 in. by

1½ ins., and of thickness equal to width of tool steel of which the chaser is to be made. Cut a slot in this, as in Fig. 1, and insert the chaser steel, making it a tight fit. Now drill a tapping hole to suit a tap of same pitch as required for chaser, the centre of hole being in line with the bottom of chaser teeth. This will give the relief and cutting edge. This hole now only needs tapping, and if there is a full thread, the chaser can be taken out and hardened in the usual way. The block can be used again for similar pitch chasers by placing the steel in the slot and allowing it to project slightly into the hole and screwing the tap through; then knock steel a little further into hole and tap again, and so on until a full tooth is given to chaser.

Slotting a Keyway in Eccentrics.

By H. Brown.

The eccentrics in this case were double and bored ¼ in., and a 1-16th-in. keyway was required through them.

The tool consists of a piece of mild steel ¼ in. diameter and 2 ins. long; a ⅛-in. diameter hole is

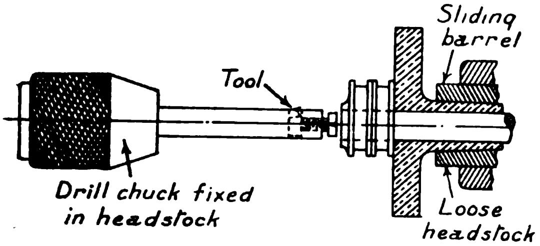
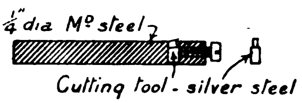


Fig. 1.

drilled right through about ¼ in. from one end for cutting tool, which is a piece of silver steel ⅛ in. diameter and ¼ in. long, with cutting edge filed to shape and hardened. This is placed in the hole with its cutting edge slightly projecting, and is fixed with a ⅛-in. setscrew in the end (Fig. 2). To

Fig. 2



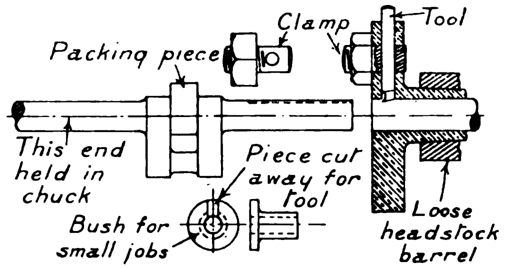
use the tool, it is held in a drill chuck, which is fixed in headstock (Fig. 1). The eccentrics are held against a small drilling table fixed in loose headstock. The eccentrics are forced along tool by loose headstock screw and a cut is thus taken right through. The tool is then set to take another small cut, and the eccentrics again forced along. Five cuts completed the job, which is very neat and much better than could be obtained by chipping or filing through so small a hole.

Cutting Keyway in Crankshaft.

By H. Brown.

To do this the small drilling table used in former job was again used. It has a ¼-in. diameter hole drilled through its centre, and a ⅛-in. hole is drilled right through from edge to this hole. This ⅛-in. hole is for cutting tool, which is ⅛ in. diameter silver steel, with properly shaped cutting edge

This tool is clamped in place, as shown. The tool is operated almost the same as in the slotting job; the work is fixed in chuck and the drilling table, with tool clamped in it, is held in loose headstock.

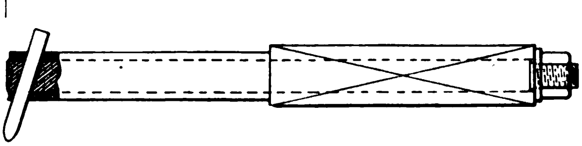


The tool is forced along the job by tailstock screw. A keyway 1-16th in. wide and 1 in. long was cut in a ¼ in. diameter crankshaft. Small drills and reamers can be fluted, and, should these be less than ¼ in. diameter, small bushes are placed in central hole in drilling table.

A Boring Tool for the Lathe.

By C. J. T.

The boring tool of which I give a rough sketch will be found invaluable to lathe users who find it difficult to get ordinary lathe tools forged, and just as serviceable. Get a piece of ⅝-in. square iron or steel and bore a ⅜-in. hole right through it; then get a piece of ⅜-in. round steel to fit the hole, and screw it one end to take a nut. Then drill a 3-16ths-in. hole through the end and file the hole square to take 3-16ths-in. square steel for cutters. The hole in bar for cutters is drilled on an angle, so as to be able to get to the bottom of the work. To tighten or release cutter, loosen or tighten nut at the end; The ⅝-in. square bar should be turned down to



about ½ in. for half its length. The sketch above will explain.

A Tip for Working Celluloid.

By C. W. Cheverton.

When desiring to alter the form of a celluloid

article, for instance, in the fitting of mudguards to the stays of a cycle, the following plan will answer well. Select a length of iron rod, the thickness and shape of which is decided by the effect required, and heat it until too hot to touch, only allow a few inches to handle. If this is then wiped with an oily rag and applied with a sawing motion to the celluloid, the latter will speedily take the form of the hot iron. Care must be taken not to use overheated tools.

Browning Gun Barrels.

By A. H. W. N.

I have pleasure in sending you full method adopted for "browning" rifles (which is the same as done by gunmakers) by armourer-sergeants in the Army. The rifles have to be "browned" every year regularly. The method is, as regards the chemicals, kept more or less of a secret, and my experience has been that every armourer-sergeant has a slightly varying formula for the proportions, as there is good, bad, and indifferent browning. It is entirely an application, and is usually termed "pickling."

The best method (which I fully describe) is the one adopted, and is a very messy, tedious affair, sufficiently so to prevent most amateurs ever attempting it again. The shorter methods are nearly as efficient, but naturally will not last quite as long.

The "blueing" of small arms is quite a different process, and consists of a process of tempering. All rifles, etc., are sent from the Government factory "blued"; but this blueing will only last a certain time — thereafter they all have to undergo browning.

I trust that the following may be found useful to your readers, who may try one of the methods; but "success is only to be gained by repeated failures," and they will be advised, unless really wishful to experiment in this line, to send the barrels to G. Lewis, Birmingham, or any other well-known firm, who will do it in as few days as they charge shillings.

The best method is:—

(1) Rub the barrels with three or four emery cloths, finishing with No. 000, to a glass polish. Rub off all grease with a rag; then plug the ends of the barrels carefully with corks, making watertight. The metal must not again be touched with the hands or come into contact with any grease till after the final oiling. Now mix unslaked lime in water to a thickish cream; cover the metal with it, and leave to dry. Instead of covering with the lime, the metal may be boiled in a trough for some time in soda water, or treated by any method which will thoroughly remove all grease.

Mix ½ oz. tincture steel,
½ oz. spirits of wine,
½ oz. nitric acid,
1½ drs. corrosive sublimate,
3½ drs. sulphate copper,
1½ pints soft water,

and keep in a glass-stoppered bottle. Fix a small sponge the size of a walnut in a piece of split wood. and pour out enough of the liquid into a saucer to thoroughly dampen the sponge. Brush off the lime from the barrels, or hold in front of fire to evaporate the soda water, and, when dry, brush down with a file card or scratch brush. Dip the sponge in the liquid, and give even strokes up and down, completely covering the metal. Place metal in front of fire, or in some dry place at a temperature of from 60° to 80° F., and leave for twelve hours. Now rub up and down with a piece of scratch card, with light, but sharp strokes. Then pour boiling water out of a kettle over the barrel, letting the water run down it and covering every part. Now scratch-brush again, and leave to drain and cool. Then give another application of the mixture with the sponge, and leave in a warm place, as before, for six hours. Then scratch-brush. Give another application of the liquid, stand for six hours, scratch-brush, scald, and then scratch-brush again. Give a fourth coating of the mixture, stand for six hours, and scratch-brush; give a fifth coating of the mixture, stand for six hours, scratch-brush, scald, and scratch again. In most cases this will be enough (for the barrels and for the applier); but, if not, give a sixth coating, dry, scratch, scald, and scratch again. Then finally oil over.

Second Method.—Make the mixture same as above, but leave out corrosive sublimate. Then proceed as before, the only difference being that the barrels must be boiled in water twenty minutes instead of pouring boiling water over them. This method gives a very dark-brown colour, as seen on rifles more than gun barrels.

N.B.—The first is the most satisfactory and lasting method, and that done by gunmakers and adopted in the Army.

Third Method.—Dissolve—

2 parts crystallised chloride iron,
2 parts chloride of antimony,
1 part gallic acid,
in 4 parts water.

Apply the solution with a sponge, and leave to dry in the air before applying the next coat, three or four coats being usually required. When of sufficient depth of colour, wash with water, dry, and rub over with linseed oil. The chloride of antimony should be as little acid as possible.

Fourth Method.—Remove all grease with potash water. Dissolve 1 oz. blue vitriol in 4 ozs. water, and then add 1 oz. nitric acid and 1 pint water. Warm the mixture slightly and apply with a sponge. Leave for twelve hours in a warm place; then brush lightly with a wire brush and apply another coat. Leave for twelve hours; brush and apply a third coat. Brush with a stiff hairbrush, and varnish.

Fifth Method.—Mix chloride of antimony with olive oil to consistency of cream. Warm the barrels and apply mixture. Leave on till browning is of the required shade. A few drops of nitric acid may be added to the mixture, which will hasten the process.

Hints to Bellfitters.

By F. Cooper.

When wiring with twin wire do not connect on to the battery until last thing. Should the ends of the wires come in contact, the battery would soon run down. When economy of wire is desired, and a gas or water pipe connection is pretty handy at each end, it is possible to make the pipe serve as one conductor, using only a single wire as the other. Solder a wire to the pipe at each end, and lead them to the battery, bell, or push as the case may be. There being a large area of metal in the pipe, the resistance is no more than that of a wire, assuming good metallic contact at the joints.

The Making of Ship's Model Fittings.

By "X Y Z."

(*Continued from page* 11.)

THE next fitting we will undertake is what is called the deckplate (Fig. 16). Take a piece of 18-gauge sheet brass and cut a piece ⅝ in. by ⅜ in., and file square and polish edges and flat. Now set out and drill four pinholes; next turn a small mooring pipe, but without the pinholes, and place on the top of plate; put a small piece of soft solder in centre of flange, heat gently until the solder runs, allow it to cool, and then drill a hole as large as possible and file the hole to size of mooring pipe,

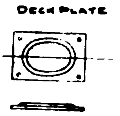


FIG. 16.

FIG. 17.

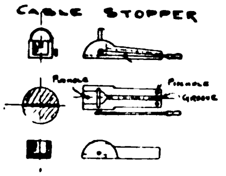


FIG. 18.

and the deckplate is complete. A glance at the sketch will clearly explain the whole of the job.

Having had a hard-soldering job before, we will now proceed to make what is called a "cable stopper" (Fig. 17). This, I may say, is generally made from a casting, but we will manage to make one without castings if the methods explained are carefully carried out. Take a piece of ⅜-in. or ½-in. rod and cut down centre; then take a piece of 3-16ths-in. sheet, 3-16ths-in. wide and ½ in. long, and hard-solder, as shown in Fig. 18. It is now the shape casting would be. Now cut a small groove down centre, as shown, with a hack-saw or warding file, and file a piece out of back, as shown, afterwards fitting a piece of 18-gauge sheet into the part you have filed out, and soft-solder in. Now drill a hole on each side 18-gauge to take the top loop. Make as shown and press into position. Next turn a piece of brass to shape shown to construct the handle, and hard-solder a piece of 18-gauge wire on to it, as sketch; drill a hole into side, fix handle, and the chain stopper is complete. Add pinholes, of course, to suit your requirements.

We will next make what seems to me to present a lot of difficulties to amateurs—that is, a ventilator (Fig 19). By carefully following the instructions you should be able to make one in half-an-hour. These are made in several sizes, according to the amount of air required in the holds, etc.; this applies to the heights as well. For the purpose of illustrating the method of construction we will make an 18-in. one. That will be ⅜ in. diameter of tube. The first thing will be to make a wood pattern, as shown in Fig. 20, afterwards getting the number required cast; the very small ones can be more satisfactorily turned from the solid rod. The general rule for the size of these tops is double the diameter of the tube. For instance, a ¼-in. tube will require a ½-in. top, a 5-16ths-in. tube a ⅝-in. top, and ⅜ a ¾-in., etc. The tops, being cast, chuck and turn to shape shown in sketch. (Fig 21)

To form the small bead, a tool should be made as shown in Fig. 22. To make this tool take a piece of ¼-in. steel and file or forge flat on both sides; next drill a hole the size you require the bead, afterwards filing slightly more than half the hole away, and hardening and tempering. Turn the cowl as near as possible a uniform thickness all over, and for the inside make a suitable tool. Leave untouched the pin by which it has been held in chuck. Now file a flat on one side, as shown in Fig. 24, take a piece of ⅜-in. tube and file the same angle as shown, and hold cowl in vice with the pin by which it has been held

FIG. 19.

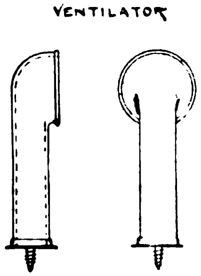
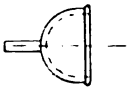


FIG. 20.



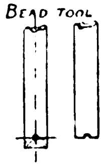


FIG. 22.

FIG. 24.

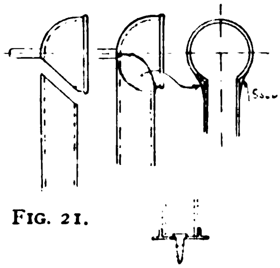


FIG. 21.

in chuck. The soldering iron should now be heated, and we also require some "spirits" made by adding strips of zinc to hydrochloric acid until it is "killed." Now put some spirits on to joint, and holding the tube in left hand tack tube to cowl with soldering iron, taking care that it is fair in centre of tube. Release from vice and fill the joint with plenty of soft solder to form a nice curve. This is rather a "tricky" job, as, if it is made too hot, the top is apt to drop off. A little practice will soon make the operator perfect. Use plenty of spirits to ensure a good flow of solder. The top being fastened, put a drill in chuck the same size as the bore of tube. Holding vent in a pair of strong pliers or hand-vice by the small pin on back, drill carefully into the cowl. Now cut the pin off and put vent (holding by the tube) into chuck, and file or carve with penknife the solder into shape, afterwards carefully emery-papering and buffing. Take parting tool and cut off the desired length. If these are intended to be fixed to a wood deck, turn a small disc to fit tube, with a small hole in centre to fit a small brass wood screw—(these are sold about a penny a dozen, and should be about ½ in. long), solder carefully into bottom with the blowpipe. As a finish, turn an angle-ring to fit outside of tube; this can be left loose or fixed, as desired. This completes the ventilator and, if the instructions have been followed, should prove to be a good job.

The next fitting is a bench one—wash or bulwark doors (Fig. 25). The making of these will, I think, introduce to the average amateur an interesting tool, namely, a punch to stamp out the small hinges (Fig. 26). First of all we cut a strip of 22-gauge sheet ⅜ in. wide, long enough to make the required number, if possible. There are generally from twelve to sixteen; then cut into pieces ⅜ in. long, making them ⅜ in. by ⅜ in.; then square up and embed it in a piece of wood, as previously described in connection with mooring pipes, file both sides, and polish.

The next operation is to make the hinges (Fig. 27).

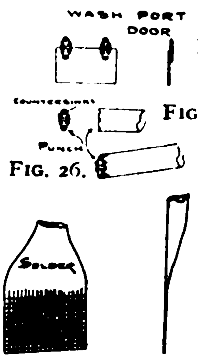


FIG. 25.

FIG. 27.

FIG. 26.

FIG. 28.

To make the punch, take a piece of ¼-in. tool steel and file to shape as shown in Fig. 27. The small dots in illustration are small countersinks, and the mark across is a groove that is to imitate the hinges and rivet-heads respectively. Polish the face and edges and harden and temper. We now require a cake of lead. (These can be cast by the model maker himself, and should not be less than ⅜ in. thick.) Knock together a small box (a cigar-box will do, but it is spoiled after using). Having got the lead and punch ready, take a piece of 22- or 24-gauge sheet and place on the lead, and with two or three blows punch the number of hinges you require. To get these out of the lead tap the back of the lead, and they will fall out. If the rivet heads, etc., are not well pronounced, soften the hinges by placing on the pumice and heating with the blowpipe, afterwards plunging into water. Place them on the vice or lathe bed and, putting punch on top, give a sharp blow. We now have to trim the edges and file the backs flat by knocking several of them into a piece of soft wood. These then require to be soldered to doors. Hold them in the position with a pair of tweezers (cost, 4d. to 6d.), and place a small piece of solder at the back and blow with the blowpipe until the solder melts and runs neatly all round. The way to make the small pieces of solder is to flatten the solder thin with a hammer, and then cut as shown (Fig. 28). This applies to hard solder as well, only the hard solder is generally thin when purchased and simply requires cutting. Put pinholes where shown, and they are complete.

(To be continued.)

Models and Machinery at the Franco-British Exhibition.

By "ATLAS."

THE "White City," as it is popularly termed, is likely to be visited by many readers of this journal during the present summer, for, apart from the attractions of a more general and a lighter character, there is much to interest and to instruct the engineering enthusiast. While not professing completeness as a guide to the various technical exhibits, these notes may be of service to those who visit Shepherd's Bush, as a record of the impressions of an engineer with an eye for models, as well as with an appreciation of the novel and the interesting among the machines of larger growth. Those who have not the good fortune to get to the Exhibition, may at least be glad to come as closely into touch with the things worth seeing as photographs and printers' ink will permit.

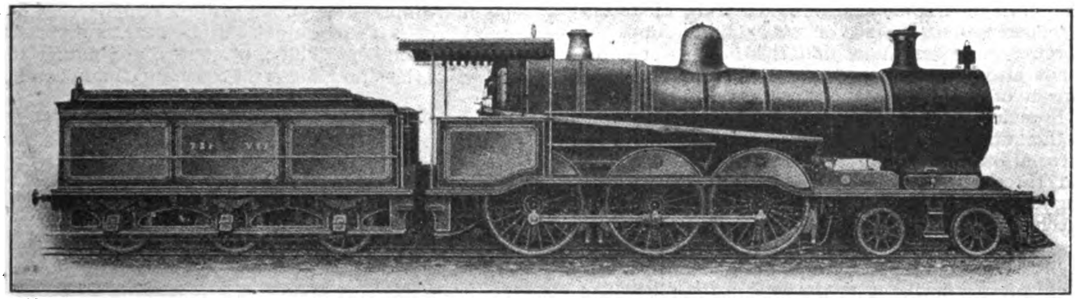
The main portion of the Exhibition is best reached by means of the Wood Lane entrance, but there is a long series of galleries extending from Uxbridge Road Station to Wood Lane which should on no account be missed by the model engineer, and it is from this end that the present pilgrimage is commenced. Indeed, the visitor will not have journeyed very far from the Uxbridge Road entrance before he meets a familiar name—that of Messrs. A. G. Thornton, Ltd., of Manchester, who are showing an excellent assortment of their high-class drawing instruments and materials. Two novelties which will be appreciated by the practical draughtsman are an adjustable spring bow pencil and a self-filling drawing pen. In the former, the leg of the compass carrying the pencil has a screw adjustment at its upper end, so that once the pencil is placed in place, the leg can be instantly adjusted to compensate for any wear of the lead, without it being necessary to disturb the latter in its holder. The self-filling drawing pen has a swivelling arm fitted by means of which the ink is raised from the saucer or bottle and placed between the nibs of the pen. This arm is operated by a simple movement of the finger tip, and the filling of the pen is rendered a perfectly cleanly and very rapid operation. A number of other interesting instruments are to be seen on this stand, which is well worth careful inspection.

Proceeding onwards, a group of highly finished American models will be seen in the next hall. These are the work of Mr. W. A. M. Scott, of 41, Jasmine Grove, Anerley, S.E., and are operated on the penny-in-the-slot principle. A model of a beam paddle engine, as used in many American river steamers, is one of the most interesting of these to English eyes, as it shows a type of engine not met with in this country. The enormous size of the single cylinder used in this design, and the details of the valve gear, are well worth noting. A little further on is a model of the steamer *City of Worcester*, showing the engine beam projecting from the centre of the upper deck, and the funnels two abreast, a feature also peculiar to American practice. Another well-finished model shows an electric lighting plant, consisting of a Corliss horizontal long stroke steam engine driving a small dynamo. The power is transmitted by means of a particularly neat little overhead countershaft, with a friction clutch for putting the dynamo in and out of gear. The flat belts, too, look very well. A vertical type fire engine, a pair of vertical Corliss pumping engines, and a ¾-in. scale American locomotive complete Mr. Scott's models in this section, but a number of other examples are to be found elsewhere in the Exhibition. We fancy we have met some of them before at the St. Louis Exposition of 1904. Some working models in this section are also shown by Messrs. B. Jackson & Co., but these are not marked by any features of special interest.

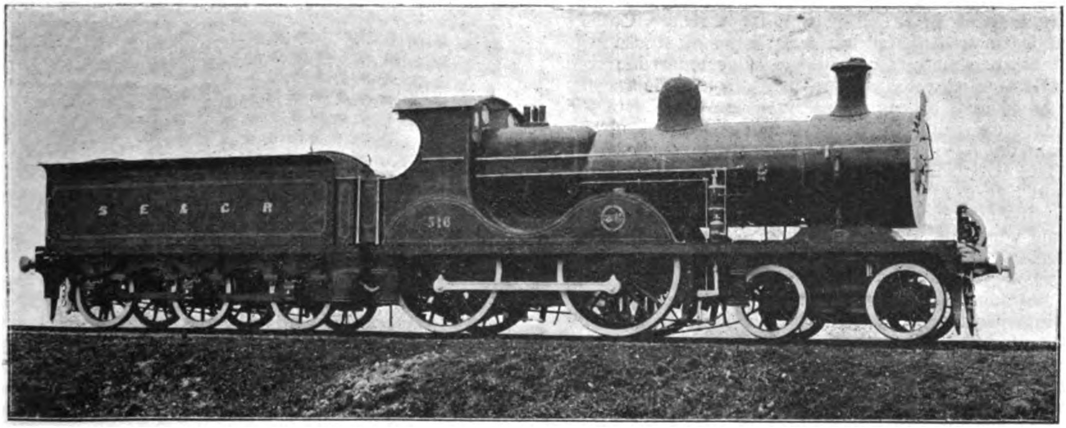
In the next room may be seen a scale model of the well-known mustard works of Messrs. Colman, of Norwich. While this is not notable for anything in the way of finished or intricate work, it is interesting as an example of the lay-out of a large factory, and is worth looking at. Another example of industrial modelling which will, perhaps, possess more novelty for English people, is the sectional model of champagne cellars to be seen in a large glass case in the succeeding French section. This gives one an excellent idea of the importance of the wine industry in the country of our cross-Channel neighbours, where many such establishments are in existence. An ingenious type of ladder elevator will be noticed in this model for raising both baskets and barrels from floor to floor. A very pretty landscape model of the vineyards of the Château Livran is shown close by, and the miniature motor-car placed in the centre of the main *allée* in this model gives quite an up-to-date touch to the charming scene here depicted.

One of the rooms in this section is devoted to aeronautics, and though in a very unfinished stage at the time of our visit, contained two items of considerable interest. One of these is a model of a dirigible balloon exhibited by the Société Française de Ballons Dirigeables. All the details are shown nicely to scale and the power transmission arrangements and the steering mechanism may be conveniently studied. The motive power is provided by a four-cylinder petrol motor which, through a speed-reducing gear, drives a vertical shaft running up to the framing immediately below the body of the cigar-shaped balloon. Here, through bevel gearing, the power is transferred to a horizontal shaft running to a two-bladed propeller at the stern, where the speed is again reduced by a pair of gear wheels. The other noteworthy exhibit in the same room is a full-size Antoinette motor as used by M. Delagrange for his aeroplane which created the world's record in April last. This is an eight-cylinder motor driving a propeller shaft carrying two 2-bladed propellers.

In the next room are some instructive examples



EXPRESS PASSENGER LOCOMOTIVE, "ABBAS HILMY," FOR THE EGYPTIAN STATE RAILWAYS.

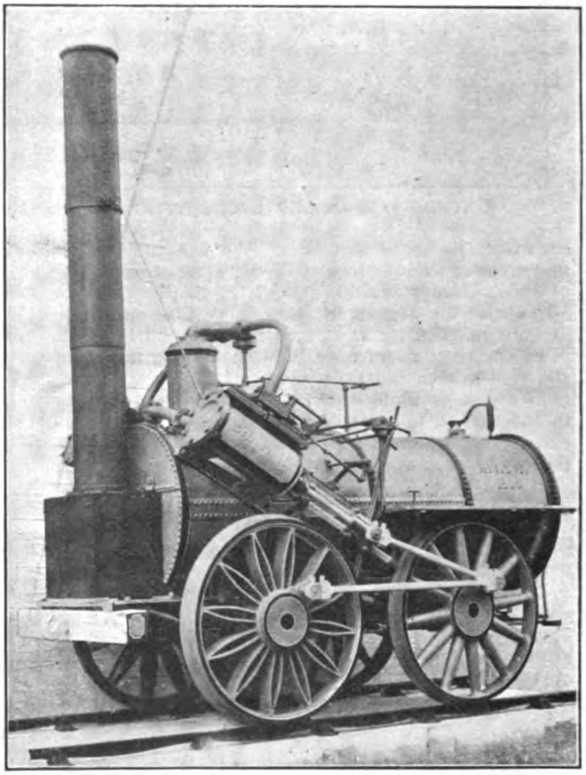


S.E. & C. RLY. BOGIE EXPRESS LOCOMOTIVE.

of work executed by students in French Technical Schools. These are very creditable as a whole, but we observe in some instances that the exercises given are more ingenious than useful. This is particularly noticeable in the examples of metal fitting, such things as trick dovetail joints, and the fitting of triangles, crosses, and stars into corresponding recesses, being numerous. These may be good exercises in the careful use of the file, but they have no practical application. It would be better to employ the student in doing work which had some real utility when completed, or which at least embodied some instructive feature of design or construction. Some of the other groups of exercises, however, show that this important point is not altogether overlooked. Before leaving this portion of the Exhibition there are two examples of French model making which may be inspected on the stand of the Ans. Ets. Albaret, of Liancourt. These are a model road roller and a portable engine and threshing machine. The former has a very English look about its general design, but the wheels are rather heavier in construction, and the motion work of the engine is concealed by a bright casing. The bright chimney and boiler lagging, too, make the model look a little less like the real thing than it would otherwise do. The portable engine model loses effect for the same reason.

Just inside the main entrance at Wood Lane will be found the British Science Section, and the electrical student may well devote some little time to the inspection of its contents. From the historical point of view there are a number of most interesting exhibits, such, for instance, as the earliest incandescent lamp invented by Sir Joseph Swan, and the companion items which illustrate the subsequent stages of filament development. The original Wheatstone Bridge, the original Daniell Battery, and early types of electrical apparatus used by Wheatstone, Clerk Maxwell, and Faraday may be seen in the collection from King's College Laboratory. In striking contrast with these, the Science Section also contains a collection of Marconi wireless telegraphy apparatus. From Wheatstone to Marconi is a long step, and a comparison of the apparatus devised by these two distinguished inventors is very impressive.

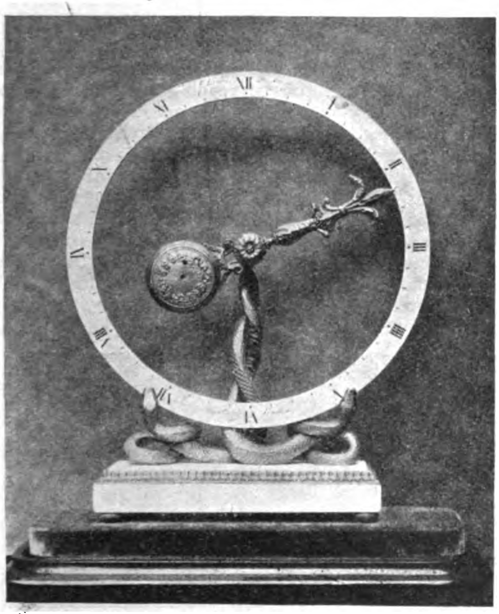
The British Applied Arts Section is devoted mainly to exhibits of jewellers and goldsmiths, and watch and clockmakers; but in the latter sphere some very fine work is on view, particularly at the stand of Messrs. Chas. Frodsham & Co., whose name has long been an honoured one in the world of horology. Here may be seen some very interesting mystery clocks, the mechanism of which will afford the visitor considerable room for speculation. One such clock, for instance, consists of a dial in the form of a horizontal dish of water, with the hours marked out on the rim. In the water swims a little tortoise, who is intelligent enough always to locate himself opposite the exact time of day. This is a copy of a clock originally built for Louis XIV. Another clock, devised specially as an exhibit for the present occasion, consists of a simple hand pivoted on a glass dial bearing the hour figures. The hand may be moved to any position, but promptly returns of its own accord to the correct time. The makers have been kind enough to furnish us with the accompanying photographs of this clever piece of work and a little explanation of the secret. The works are in the round box at the end of the hand. When the clock is not going, the hand is so perfectly poised that it will remain wherever it is placed. When the works are started, they carry a little weight round the inside of the box; the point of the hand follows the position of the weight and so travels all round the circle pointing to the time. Another interesting clock is that invented about 1810 by Sir William Congreve, in which a little steel ball makes an apparently never-ending journey up and down a series of grooves on an oscillating brass plate. The popular impression among visitors seems to be that this clock is a successful solution of the perpetual motion problem. These, of course, are merely the curios of the stand, Messrs. Frodsham's main exhibit



THE "INVICTA" OF 1830.

being an excellent display of the highest class of chronometers and clocks of the usual kind.

The Machinery Hall will no doubt be the Mecca of most of our readers, and here they will find much to interest them and to admire. The railway section, while not large, contains some excellent model exhibits, notably, a model railway by Messrs. Bassett-Lowke & Co., shown on the stand of the L. & N.W.Rly. The track of this model is 40 ft. long, and the gauge is only 2 ins. It is built to a scale of 1-30th full size, and comprises a section of railway with up and down main lines, a junction, and a station—all modelled exactly on L. & N.W.R. practice. Two complete trains are included, one being an accurate replica of one of the L. & N.W.R. "crack" expresses drawn by a model of the famous "Experiment" class of six-coupled bogie engines. The other, a goods train, is made up of representative wagon stock of the railway, comprising open wagons, coal trucks, hopper wagons, cattle trucks, boiler trolleys, and brake vans, beautifully modelled from the actual vehicles.



A Novel Clock, by Messrs. Chas. Frodsham and Co.

The model railway is shown at work from time to time each day. The locomotives are driven and controlled electrically, the mechanism being arranged in such a manner that the attendant at the signal-box has full control of the train. He can start and stop it, regulate the speed and reverse the locomotives without touching them or moving from his post. Collisions are impossible on this small railway as the engine will on no account run past a signal at "danger," and two trains cannot be made to run in opposite directions on the same line of rails. The signals are interlocked with each other and with the points and, therefore, conflicting signals cannot be given. This, combined with the electric control, absolutely prevents all ordinary collisions.

A similar model railway, built for the International Exhibition held at Dublin last year, ran daily for six months without a failure. Another one is being made at Northampton for the Scottish National Exhibition at Edinburgh this summer. The railway will not be quite so elaborate as the one at the Franco-British Exhibition, but will have the same main features and be provided with electrically controlled trains. The accompanying photograph of a part of the model shows its realistic appearance very well. One has difficulty in looking at the picture of the railway, in deciding whether it is a photograph of the model or of the actual thing.

On the same stand may also be seen a model of the coach "Experience" which ran on the Liverpool and Manchester Railway in 1838, now a part of the L. & N.W. system. This model shows very clearly how the designers of the early railway vehicles followed the lines of the road coaches in the formation of the body. Other North-Western models worth inspecting are the "Diamond Jubilee" and the "Empress" locomotives, and the large scale model of the King's saloon, which formed part of this Company's exhibit when they were awarded the Grand Prix at the St. Louis Exposition of 1904.

The only British railway to show a full-size locomotive is the S.E. & C.Rly., and they are to be congratulated on the handsome design and magnificent finish of their "E" bogie express engine, No. 516. This is of the four-coupled type, with 6-ft. 6-in. wheels, cylinders 19½ ins. by 26 ins., and 180 lbs. boiler pressure. The total weight of the engine and tender is 91 tons 7 cwts. It is a splendid example of modern British practice, and we are sure it will make a deep impression on the minds of our Continental friends who have the privilege of seeing it. When put into service, it will be used for Royal trains. The working drawings of this engine are also shown.

A most interesting contrast to this modern giant is exhibited a few yards away. It is the new "Invicta" built by George Stephenson's firm. This was the first engine to run on a public railway between Canterbury and Whitstable, which was

A Model Railway, by Messrs. Bassett-Lowke & Co.

opened on May 3rd. 1830. The "Invicta" was No. 12 on the books of Messrs. George Stephenson and Co., and weighs between 5 and 6 tons. The cylinders are 10 × 18 ins. This engine is usually on view in the Dane John Gardens at Canterbury. Through the courtesy of Mr. Harry S. Wainright, the Chief Mechanical Engineer of the S.E. & C.Rly., we are enabled to reproduce photographs of these two important exhibits.

The S.E. & C.Rly. also show a 50-ft. bogie tri-composite carriage with guard's van.

A model of a specially interesting nature is that shown by the North British Locomotive Company, Ltd. This represents the express passenger locomotive "Abbas Hilmy" of the 4—6—0 type, with six-wheel tender, built by this Company for the Egyptian State Railways. The prototype shown in our photograph has a Walschaerts valve gear, 6-ft. 3-in. driving wheels, and cylinders 19 × 26 ins. It is noteworthy by reason of the employment of a patent feed-heater and spark arrester, designed by Mr. F. H. Trevithick, M.Inst.C.E. By this device the feed-water is raised to boiling point by circulating amongst the tubes of a surplus exhaust steam heater which directly communicates with the cylinder, and is further raised to an average temperature of 260° by circulating amongst heated tubes placed in the smokebox, and through which the furnace gases pass on their way to the chimney. The emission of sparks is prevented by drawing the gases through a wire netting sieve which retains the ashes and deposits them in a box. The use of the feed-heating device in actual practice has enabled an economy in fuel consumption of over 22 per cent. to be obtained. The model was made in the railway workshops in Cairo, and is exhibited with the smokebox door open so that the feed-heater arrangements may be clearly seen.

(*To be continued.*)

It is reported that the building of a large new power station in Lapland, North Sweden, is likely to be taken in hand during the forthcoming summer. It is a question of the Norr and Söderfors Falls, the survey of which has been going on for some considerable time. It is proposed to build the power station close to the Brännland railway station, and at a distance of barely ten miles from the sea. The power available is estimated at 81,000 horse-power.

A Mercury Jet Interrupter.

By John Pike.

Some months ago I was asked for details of a mercury jet break; but having at the time no practical knowledge of this class of instrument, I had to decline. I have, however, now made a few experiments and completed, so far, a break which I think many coil makers would do well to try their hands at, the cost being trifling and the accessory itself a pleasing addition to one's outfit.

In a mercury jet interrupter a centrifugal pump, driven by an electric motor, ejects a stream of mercury which in its course makes contact with copper tongues or plates placed at intervals round the circumference of the circle travelled. The speed of the motor can and should be controlled, and the number of contacts increased or varied, as, if the break is used with high voltage currents, then the speed must be great and the interruptions more frequent.

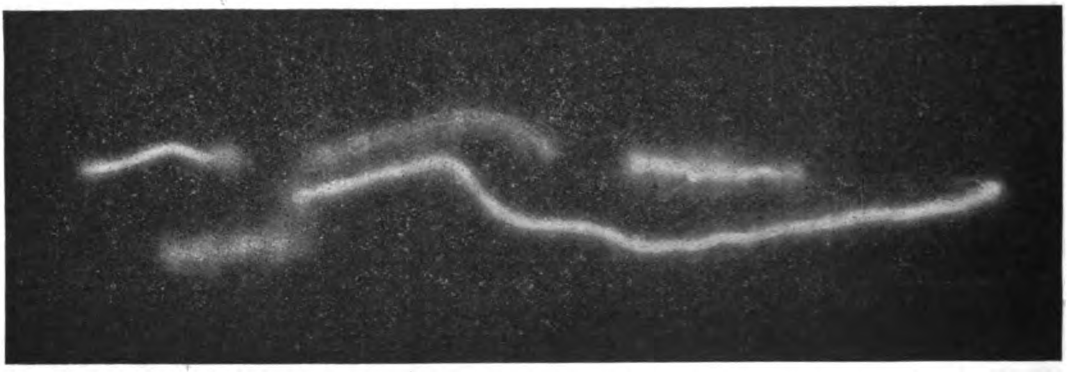


Fig. 1.—Photograph of Spark.

At present, unfortunately, I can only command eight cells, *i.e.*, 16 volts, 4 volts being required for the motor, thus I have only been able to use 12 volts in the primary circuit, and my experience is so far limited. I can readily imagine that with 20 volts, say, this simple break would prove very effective indeed.

It will be seen that this break may be used with batteries, it runs and works easily, and requires little or no attention, and it gives a heavy discharge, within certain limits heavier and thicker sparks than with other mercury breaks I have. It will be remembered, however, that the advantage of a high-voltage current is that the maximum of magnetism is achieved more quickly; with 12 volts about three times as much time is taken as with 100 volts: the results must, of course, not be compared.

Two photographs are appended. In one is shown the finished break, and in the second the pump. The latter works in a vessel which may be of metal (iron) or glass. It is provided with a tightly fitting cover by and through which it is securely clamped to the baseboard.

A suitable jar, strong and flat in the bottom, is to be had 5½ ins. high outside and about 3 ins. or more diameter at the top—a jam jar in fact. The lid should be about 4 ins. square and ¼ in. thick, and on the lower face should have a groove or channel about ¼ in. deep to make a neat fit in top of jar. Iron bolts with butterfly nuts may be bought which will suit the purpose; they should be fully 6 ins. long. All four bolts serve as conductors, two conveying the current for the motor and two are in circuit with the condenser and primary.

The cover is completed by drilling suitable holes for the bolts and one in the centre is to be bushed with a piece of stout brass tube a good fit on the spindle, the tube is soldered to a brass plate for screwing to the cover. The jar should be chosen with straight sides, or at any rate straight to the top, *i.e.*, with no neck. All the fittings practically lie within a circle, which will probably not be more than 3 ins. diameter.

brass tube (four pieces of equal length) may be used. The photo (Fig. 3) shows exactly what is meant, washers on either side being used. This makes a very secure fitting. The centre hole in the bottom plate is tapped, and a finely pointed screw inserted. One end of the spindle rests on this point, and the screw is secured tightly with a bolt on the upper side.

The cylinder presented the most difficulty. It would be better turned, but I made trial (with good results) with something handy, in the shape of one of those small tin receptacles made for holding sample enamels. One of these penny tins cleaned up will answer very well, and can be replaced later by something better. The lid is discarded, a hole drilled accurately in the centre

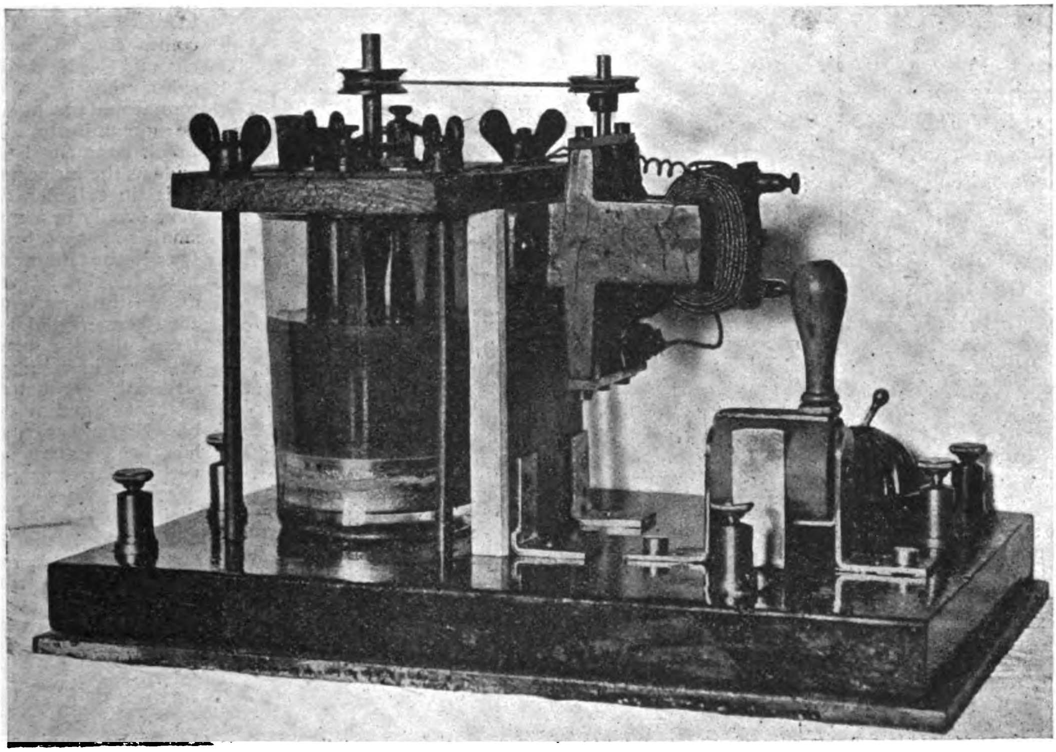


FIG. 2.—MR. JOHN PIKE'S MERCURY JET INTERRUPTER.

Assuming the jar to be of the height mentioned, the spindle on which the small drum revolves should be about 5½ ins. long. A piece of ¼-in. or 5-16ths-in. mild-steel rod is cut, the ends trued, centred, and countersunk; it requires then to be put in the lathe and one end for ½ in. turned down to, say, a little more than ⅛ in. On this ½ in. we put a thread and fix on it a well-fitting nut.

The spindle is supported on a bracket, which will depend about 3¾ ins. from the lid. Firstly, a piece of thick sheet brass (1-12th in.) is cut 2½ ins. by 2½ ins., holes drilled at the centre and at each corner, squarely, these holes tapped, and rods screwed in, as shown in the photograph. To keep the bottom plate the proper distance from the lid,

of the bottom to fit the end of spindle, and the tin box or cylinder secured there tightly with a nut. If this be done neatly, it will revolve with almost perfect accuracy inside the four arms of the bracket. Before fixing into position, the box must have a small hole drilled at the top on one side 1-16th in. diameter, and in the bottom near the outer edge other holes must be made to allow entry of the mercury. Three holes drilled and extended with a small round file will answer the purpose. This arrangement is revolved by means of the pulley on the top end of spindle, as shown, and the work necessary should of course be done before finally screwing up the bracket, etc.

This practically completes the central fitting or pump, and if we were to put a sufficiency of mercury in the jar to cover the lower part of the cylinder, and then revolve the latter rapidly, we should see the mercury by centrifugal force ejected through the hole in the upper edge put there for the purpose.

The next operation is to provide and fix copper tongues or plates for the jet to strike against as

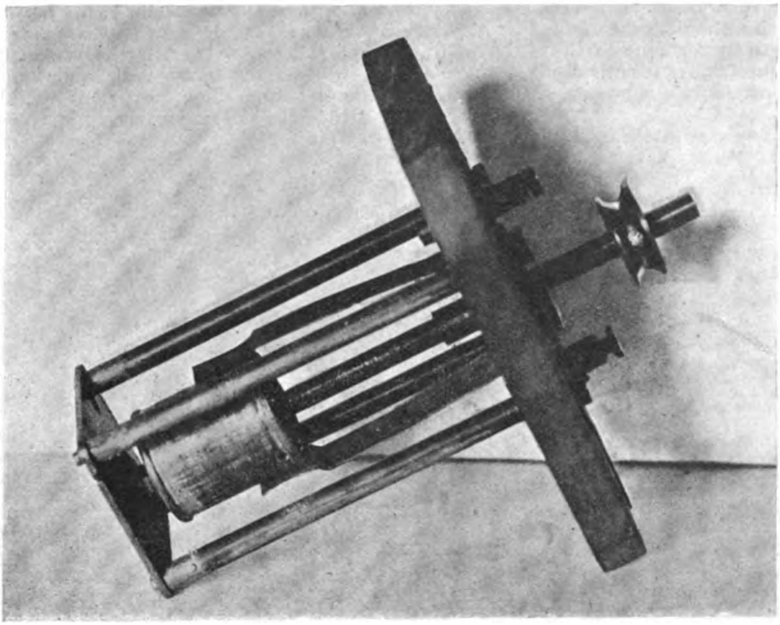


FIG. 3.—THE PUMP FOR INTERRUPTER.

the spindle revolves. In the "break" illustrated the jet makes contact twice with each revolution; if high voltage current of, say, 20 or 30 volts were used we might fix three or four contacts, and in the best apparatus these are made adjustable so that less or more surface may be exposed to the jet. In its simplest form the contact may take the shape of a long-handled spade cut out of sheet copper, the handles being secured to the lid by bolts or battery terminals, while the spade, slightly curved, approaches closely the cylinder. The distance should not exceed $\frac{1}{8}$ in., and the contact should be well above the level of the mercury. The total surface of contact may be $\frac{1}{2}$ in. square. On the top of cover these contacts are joined by means of stout copper wire, and are ultimately connected to one of the bolts already referred to. Similarly the bracket—the lower end of which is covered with mercury—is connected to another of the bolts. This in all essentials completes the break.

A thick and heavy baseboard is provided, and should be fitted with a switch for the motor and a commutator. The motor, one of Thompson's, may be fixed as shown in Fig. 2, or placed on the baseboard. In the latter event two extra pulleys on the edge of lid would have to be fitted to carry the belt over and down to the pulley of the motor. A much smaller motor will drive this break, but one of Thompson's is better, worked with two cells (accumulator) and preferably with a resistance in circuit. With two *fixed* contacts the only control we have is in regulating the speed of the motor.

The circular groove in the lower side of the lid should have a little packing, such as a flat rubber ring; this ensures the jar being nearly air-tight. Also in the lid I find it convenient to have a hole—with a cork—so that more mercury may be added or more alcohol. The jar is to be nearly filled with "*absolute* alcohol."

The cylinder should certainly be turned out of solid iron, and the hole through which the mercury is ejected becomes then a narrow channel with straight sides, the jet, therefore, would presumably be more uniform. The bracket must be as wide as the jar permits. This tin cylinder runs very evenly in a much smaller space, but I found the four rods much too close. Sparks came intermittently, then ceased, and I inferred that the jet was sufficient in volume to strike the contact and bracket simultaneously. No further trouble has been experienced with the larger bracket.

An electro-motor designed to stand on its base does not look well in any other position. The best place, to avoid friction, etc., is no doubt above the jar with the armature shaft coupled on to the spindle of centrifugal pump.

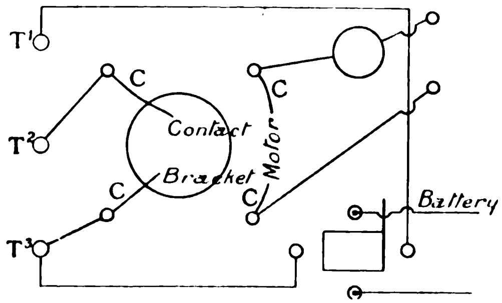


FIG. 4.—DIAGRAM OF CONNECTIONS.

It would be easy, I think, to design two or more other methods of construction; certainly I never expected a simple tin cylinder would give such satisfactory results. Anything likely to "churn up" the mercury unduly should be avoided. With the plain cylinder I do not notice much agitation of the contents of the jar.

The wiring is shown in the figure, and is adapted for coils described in previous articles. T_1 and T_2 are connected to the primary of coil T_2 and to T_3 the condenser.

Since writing the above, I have had an iron cylinder or cup made for permanent use, but before going to this expense the amateur will do well to try the simple tin, which, as regards size and shape, may serve as a model.

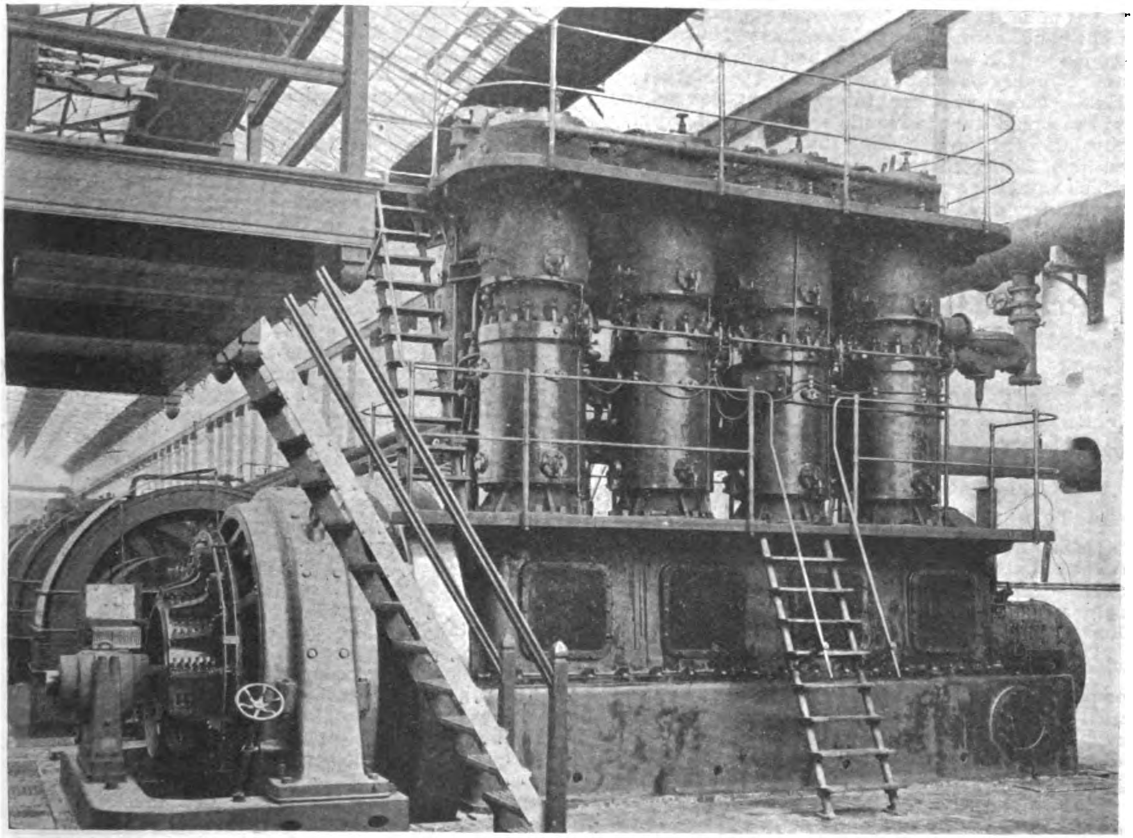
The spark illustrated shows pretty well the heavy discharge between the secondary terminals. The spark was allowed to flash across the sensitive film of the photographic plate enclosed in a light tight envelope.

The Latest in Engineering.

The Largest Vertical Gas Engine in the World.

An event of more than usual importance took place on the 6th ult. at the works of the Castner-Kellner Alkali Company, Ltd., Runcorn, when a 1,000 b.h.-p. gas engine was started up by Mr. Percy Allen, engineer to the Company. type have been in operation for some considerable time in connection with the electrolytic process of the above firm.

Some idea of the 1,000 b.h.-p. engine may be gained from the accompanying illustration. It



A 1,000-H.-P. Vertical Westinghouse Gas Engine.

The engine, which is of the latest standard vertical type, was supplied by the British Westinghouse Company, and is connected to a direct-current generator supplied by the same makers. It forms an extension to the existing installation at Runcorn, where four 750 b.h.-p. engines of the same will be noticed that the cylinders, in pairs, are placed over four cranks, by which arrangement the makers claim that they can give the most even turning moment of any gas engine on the market. No water-cooling is used for the pistons, valves, or other moving parts, thus avoiding any danger of breakage of pistons, which is often the source of trouble in connection with large horizontal engines. Forced lubrication is used throughout, the oil pumps being in duplicate, and these can be examined and the oil sieves changed whilst the engine is in operation. All valves are positively operated by means of straight push rods actuated directly from the camshaft. These are also arranged with adjustable screws, so that any play or wear can be taken up on these valves, whilst the engine is in operation.

The installation of this engine may be said to mark an epoch in the gas engine industry, as it is the largest vertical gas engine yet manufactured and put into successful operation.

In addition to the five Westinghouse engines of this type now installed at the Castner-Kellner works, three of 750 b.h.-p. capacity have been supplied to Messrs. Pilkington Bros., St. Helens, for their glass works, one of 750 b.h.-p. to the Hollins Mill Company, Marple, which has been working for some considerable time operating their cotton mill, and visitors to the Franco-British Exhibition will have noticed one of these large engines in the right-hand corner of the Machinery Hall. This engine runs in conjunction with a Parsons' turbine, and supplies electric current to the Machinery Hall. Those who are interested in gas engine work should take advantage of the opportunity thus afforded for inspecting this example of a type entirely British, both in design and manufacture, which is taking a premier position in the gas engine world of to-day.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.]*

Automatic Railway Couplings.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In regard to the subject of automatic railway couplings there seems to be a general lack of knowledge as to what really constitutes an up-to-date automatic coupler as understood to-day in North America.

The United States Safety Appliance Law says, " It shall be unlawful of any common carrier to haul or permit to be hauled or use on its lines any car used in moving inter-State traffic not equipped with couplers coupling automatically by impact, and which can be coupled without the necessity of men going between the ends of the cars."

Now, it is not very difficult to devise a coupler which merely conforms to the letter of the above law—that is, a device " coupling automatically by impact," but it is quite another matter to develop a coupler which possesses the many advantages which some of the best M.C.B. couplers can claim.

The qualifications of a vertical plane automatic coupler, as determined by the most perfect makes of the Master Car Builders' standard type used in North America, are as follows :—

1. Couples automatically by impact on a tangent or ordinary curve.
2. Transmits buffing shocks, thus obviating the necessity for buffers.
3. Remains coupled when buffing or curving.
4. Has no appreciable slack, or lost motion between buffing and hauling contact faces.
5. Can be uncoupled from side of car.
6. When once unlocked will continually thus remain until cars are drawn apart, when the lock automatically resets itself.
7. Can be retained in unlocked position to facilitate switching operations, so that cars coming in contact will not become coupled unless so desired.
8. Having a knuckle opening device operated from side of car, so that when two cars approach with both knuckles closed, one of them can be opened without the necessity of going between the cars.
9. So constructed that should knuckle pivot pin break or fall out, the knuckle will not pull out, but will be held in place by the locking parts.

All makes of M.C.B. couplers possess some of the foregoing qualifications, but there are few that can claim them all. It will be readily seen that to produce a coupler having so many points of advantage is no light task, but a matter for considerable and long-continued thought, ingenuity, and experiment.

In reviewing what has recently appeared in the engineering press regarding the development of the automatic coupler in the United Kingdom, it is noticeable that there seems to be amongst British engineers a tendency to adhere to, and experiment along the lines of, horizontal plane couplers. This is probably due to the belief of many that the horizontal plane coupler—represented in Europe by the hook and link devices, and in America by the link and pin couplings—is the right principle, but merely needs improving and developing. Hence the various additions to, and modifications of hooks and links which appear at intervals.

In North America the link and pin coupler was experimented with from 1860 to 1890, a period of thirty years, as can be ascertained by consulting the patent records of the *Scientific American.* When the question came up for final decision by the Master Car Builders' Association, many kinds of couplers were submitted of both the vertical and horizontal plane types. The advocates of the horizontal (link and pin) types were strongly in evidence, but the vertical plane triumphed, and of these the Janney coupler was decided to be the best, its contour, line and general dimensions being adopted as the standard of the Association. No doubt there was a general feeling against any form of link and pin coupler on account of the years of trouble incidental to its use, such as damage to cars, and the expense of broken and lost links and pins, apart altogether from the fearful loss of life of and injury to employees. Also the vertical plane was looked upon as being a tried and trustworthy system, the Miller coupler having been in successful use for many years on passenger cars. This coupler is described and illustrated on page 451 of issue for May 10th, 1906.

Now, in the United Kingdom for some years, and especially since the universal adoption of the M.C.B. coupler in North America, there has been a growing feeling that the link and hook coupling does not meet all the conditions of an ideal coupler. But instead of taking up the matter where the American engineers have brought it, the British inventors have started right in at the beginning, and are now going over the ground which was covered by American inventors and proved impracticable ten years ago.

Fundamentally the horizontal plane coupler is all wrong. If it is not wrong, then why are the car ends, the buffers, the air and steam heat couplings all vertical plane devices, and why should an exception be made in the case of the most important of all couplings? There must be a good reason for this preponderance of vertical plane coupling and contacting devices on the end of a car!

The writer does not remember having seen any mention of British vertical plane couplers in the engineering press, but the horizontal plane coupler comes in for a good deal of attention. In THE MODEL ENGINEER for August 10th and 17th, 1905, three of these couplings are described and illustrated. The "A.B.C." coupling (page 134) can be coupled on impact, and can be uncoupled from side of car, provided there is enough slack to allow the shackle to be lifted over the hook. But the long and comparatively light shackle is very liable to become bent or broken in the minor collisions to which freight cars are subjected, and further, the slack of this coupling is almost as great as with links and hooks. Mr. William Downing's device (page 151) is not by any means automatic, being operated entirely by hand, also his is a slack coupling and difficult to uncouple if the links are in tension. The photograph of the Rushforth-Sowden arrangement on page 152 does not clearly show whether it couples on impact or is hand operated. At the best it is a slack coupling, and as in the Downing device, there is no attempt to provide a substitute for the death-dealing side buffers.

After reviewing the efforts of railway engineers to evolve something practical, though along unpractical lines, it is distinctly cheering to turn to the model engineers and to find that they at any rate are on the right road in adopting vertical plane devices. Reference in particular is made to two couplers described by their makers in this journal.

In criticising in a friendly way the coupler by Mr. S. A. H. Noel (May 17th, 1906, page 467) it is noticed that while his coupler certainly operates by impact, there is no way provided for uncoupling except by going in between the buffers and pushing the hooks apart by hand, nor is there any means of preventing cars from becoming coupled when not so desired in switching operations. Again, due to the reversed inclined faces of the hooks, it would be very difficult to uncouple cars without a good deal of slack, which is a very undesirable feature in any coupling.

The coupler described by Mr. F. A. Schulz on page 595 of issue for December 21st, 1905, is, however, a much farther advance, being a modification of the Miller coupler, and readily uncoupled from side of car. But, being a slack coupling, it must be used in connection with some auxiliary devices to keep the hauling contact faces together at all times. Miller remedied this defect by using a complicated and expensive system of levers, springs and plungers so arranged that the hooks were in contact in buffing as well as in hauling. Many of these equipments are still to be seen on older passenger cars, and are a distinct contrast to the simplicity of the buffing and draft appliances necessary with the M.C.B. coupler.—Yours truly,

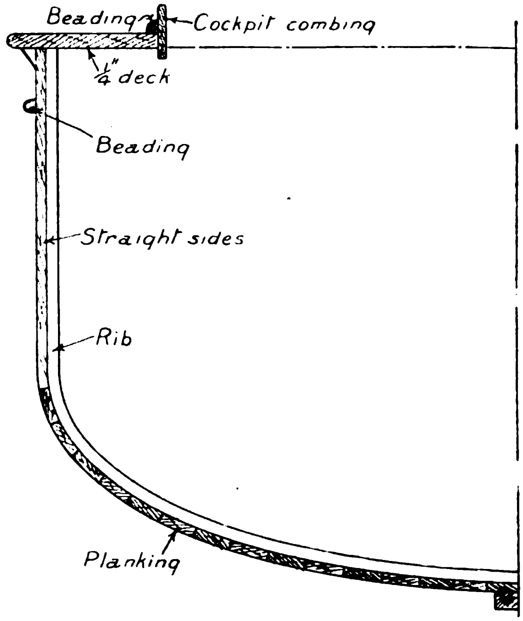
ARTHUR WILFRED LINE.

Sierra Madre, Cal., U.S.A.

A Model Steam Launch.

To the Editor of *The Model Engineer*.

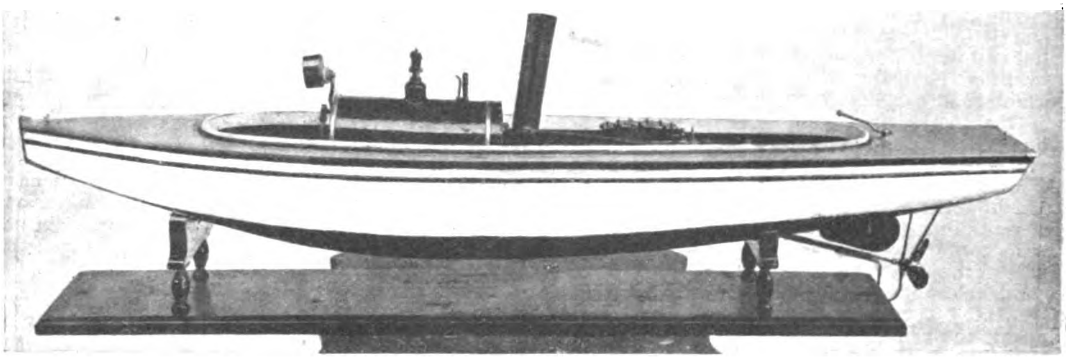
DEAR SIR,—Having been a reader of THE MODEL ENGINEER for some considerable time, and having derived a considerable amount of knowledge and pastime from same, and seeing that you invite correspondence on model work done by readers of your valuable paper, I send you a few particulars of my model steam launch, *Elsie*. The dimensions are as follows:—Length over all, 4 ft. 5 ins.; beam, 10 ins.; draught, 3½ ins.; and load water-line, 4 ft.



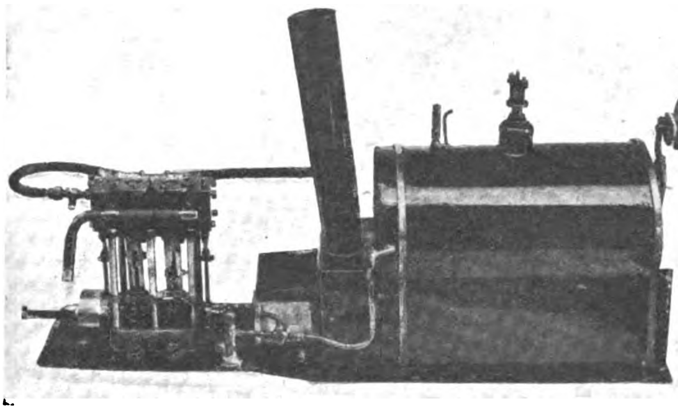
MIDSHIP SECTION OF LAUNCH HULL.

You will see by the photographs that she is of the "Sharpie" type. The draught may seem a lot, but the boiler, engine, and lamp weigh 17 lbs. No doubt this type of boat is fairly easy to build if you can get the right timber to make the ribs up. I had some trouble with those. I tried every kind I had by me, and at last I got a bit of kerosene case, which bent well, and I made the ribs of it. The hull is built up. The sides are ¼-in. Queensland maple, a strong and easily bent timber. The bottom is planked with ⅝-in. by ¼-in. cedar, running full length and riveted to ribs, and after giving a good coat of marine glue, was sand-papered down smooth, and given four coats of paint, which made her water-tight everywhere. I have not put any turtle-deck on her, as I do not think it requires it, unless to protect the lamp from the wind.

The boiler is taken from a design sent to THE MODEL ENGINEER by a reader. The barrel is oval, being 8 ins. by 5½ ins. by 3½ ins. water space, with ten ¼-in. water tubes running into a ½-in. downcomer, and are brazed into the downcomer. The ends are single-riveted, rivets being ⅜ in. apart, and are made from brass escutcheon pins. The barrel is lap-jointed and riveted, and the whole is sweated together with soft solder, and the ends have two ¼-in. copper rod stays. The fittings are—water gauge, pressure gauge, whistle, and blower, the latter added since photographs were taken.



A READER'S STEAM LAUNCH, "ELSIE."



BOILER AND ENGINE FOR THE "ELSIE."

The engine is a twin-cylinder type, 1-in. bore by ⅞-in. stroke, by Stuart Turner. I may state that Stuart castings are splendid for making up. The engine runs well with 10 lbs. steam, but has been tested to 60 lbs. I have a pump to pump the condensed steam back to boiler, but do not use it, as I can get a 150-yd. run with one filling. The lamp is a Primus burner, fed by a flexible tube from tank at back of engine and works all right.

I am having trouble with the propeller just now, and I am experimenting. I have made four so far, and am not satisfied yet. The longest run I can give her is 100 ft., which is the length of our swimming baths, which was done in 35 secs. with a 3-in. propeller. I tried her recently with a 5-in. one, but something went wrong with the lamps—as they usually do when wanted to do their best—and when I was about to change propellers I had the luck to find one of the stay bolts breaking, which prevented me from any further trials that day

I may say there is no list whatever in my boat the great beam, I think, prevents this from taking place. I have not built her for speedy work, but just merely for a fairly fast and snug little launch.

I forgot to mention that steam was taken from the dome down into the firebox, and then up the funnel and out about half-way up to the engine, which works well.

I may say, however, that I have not finished with experimenting with my boat, and hope and am sure of greater speed next trial, and should there be any further development which I think would be of interest to other readers, I shall let you know.—I am, yours truly,

"ONE OF THE GROUP."

Liverpool and District Electrical Association.

ON Saturday, June 27th, a party of members and friends paid a visit to the Pacific Steam Navigation Company's s.s. *Crita*, in the Alexandra Dock, Bootle. The visitors were received by the officer on watch, when a complete survey was made of the steamer and its equipment, and a detailed inspection was made of the engine-room plant, under the guidance of the steamer's electrician. Every information and assistance was most willingly given by the ship's people, and a most interesting time was spent.

NEXT MEETING.—The next meeting of the Liverpool and District Electrical Association—which will be the Annual General Meeting—will be held at the Common Hall, Hackins Hey, Dale Street, at 8 p.m., Tuesday, July 21st, when the business of the Association for the past year will be considered and also the re-election of the officers and council.—SAMUEL FRITH, Hon. Secretary and Treasurer, 77, St. John's Road, Bootle, Liverpool.

The Glasgow Model Steamer Club.

THE above held their first review of model steamboats on Springburn Park Lake, on Saturday afternoon, June 20th, with a large number of spectators present. The following steamboats attended: Mr. R. U. Baird's *Iris*, Mr. Thos. Allen's *Mona*, Mr. Samuel Russell's *Veda*, Mr. Wm. McKay's electric launch *Mystery*, Mr. A. C. Gaffikin's *Rocket*.

The same Club also held their race for the Commodore's colours on the Alexandra Model Yacht Lake, on Saturday evening, June 27th, in fine weather, with a large attendance, Mr. Samuel Russell's *Veda* winning the prize, running two lengths of the lake in fine style. The following steam boats attended—Mr. R. M. Baird's *Iris*, Mr. J. Hughes's *Scotia*, Mr. A. C. Gaffikin's *Rocket*; starter, Mr. Thos. Allen. Next meet: Springburn Park Lake, Saturday, July 11th, at 4.30 p.m.—A. C. GAFFIKIN, Hon. Secretary, 725, Hawthorn Street, Springburn, Glasgow.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[19,772] **Electric Motors for Boats.** W. J. R. (Weymouth) writes: Would you be good enough to advise what is the best motor to use for a twin-screw boat about 4 ft. 6 ins. long by about 7½" ins. wide. At present I have two small 2-volt Kapp motors, wound for 8 volts and driven by two 4-volt accumulators in series, and the motors run in parallel; but these do not give sufficient power to drive her fast enough, although they work very well. I might say the motors work independently of one another. What I want to get or make is a powerful motor taking minimum current, say not more than ¾ to 1 amp., or less, at 8 volts. Of course, I should use two of these for boat—one for each screw. The beam of boat across motors is about 5 to 6 ins. I trust this will be clear enough for you to judge what is wanted.

The one fact to bear in mind in such cases as this is that it is not the motor upon which the power depends, but upon the source of supply of current for the motor. It is a common fault to endeavour to get more power by using a larger motor, whereas the proper course to adopt would be to increase the battery power. Make the accumulator as large as the available space and carrying capacity of the vessel will allow, and you will find that you will get very much better results. You say: "At present I have two small 2-volt Kapp motors, wound for 8 volts and driven by two 4-volt accumulators." We do not know exactly what you mean by this, but presume your motors are about 10-watt size. Such motors, if supplied with ample current, should be equal to driving your boat. For best forms of arranging and means of driving, etc., you cannot do better than read up the contributions on craft of this kind which have appeared from time to time in this journal.

[19,820] **Model Boiler.** H. V. C. (Stoney Stratford) writes: Would you kindly answer me the following question? I have a horizontal engine, 1-in. bore, 2-in. stroke. What size and what sort of boiler would you recommend to drive a 10-watt dynamo, and also a 30-watt dynamo?

You could use a boiler about 11½ ins. diameter, 24 ins. high, firebox 11 ins. high, containing twelve 1-in. tubes; thickness of metal, 11-64ths in. Type of boiler, vertical multitubular, steel.

[19,670] **Preserving Permanent Way.** C. C. (Caergog) writes: I am laying down an iron permanent way for ¼-in. scale locomotive. Would you kindly let me know what is the best coating I can use to prevent rust?

You will find a good coating of paint or shellac varnish about as satisfactory as anything. If you use tar, it is a nuisance in the hot weather. The new "Tessted" steel rails, recently put on the market, are very useful, inasmuch as it is claimed for them that they will not rust in the most exposed positions.

[19,937] **Electrical Engraving.** J. M. (Consett) writes: Is it possible to drive an engraving machine taking 4 volts off a small dynamo that will give up to 8 volts? I want to connect it direct to dynamo.

You could no doubt drive your machine from the 8-volt dynamo. If you found it worked too vigorously, you should reduce the speed of dynamo and thus reduce the supply voltage. In our June 4th, 1908, issue, we give an article on an electric engraving machine from which you will get useful information.

[19,941] **Demagnetising Tools, Watches, &c.** G. A. Y. (Newbury) writes: Would you kindly tell me how I can get magnetism out of tools, as I have some watch tools magnetised and it makes it very awkward to use them with watches.

The usual procedure is to suspend the tool to be demagnetised by a length of string, then spin the tool round in front of a powerful magnet and whilst it is spinning gradually withdraw it from the range of the magnet. Repeat this process several times and you will find that the residual magnetism in the tools gradually disappears altogether.

[19,948] **Driving Belts for Small Car.** A. B. R. (Homerton) writes: (1) Would you be good enough to give me your opinion *re* a *flat* belt drive for a 6 h.-p. twin cylinder motor bike and side car (rigid)? (2) Would it be beneficial to cover one or both pulleys with leather? If only one, presume the smaller (engine) pulley. (3) If leather, should be fixed to pulley with hot shellac or screws, or both? (4) If raw-hide or tanned belt should be used, and what width, also single or double ply? (5) What would be most suitable gear to use: cylinders are 3-in. bore by 3½-in. stroke, "Antoine" 6 h.-p. motor? (6) When the flat belt was tried a few years back, what were the chief objections?

(1 and 2) You could try the effect of covering the smaller pulley with leather, preferably fixing by rivets as well as some form of adhesive material. There are various makes of belts on the market and there is really not much to choose between them. With regard to gear to employ, we think the makers of the machine would be in the best position to advise you on this point. The objection to flat belts in the old days was due to their slipping propensities.

[19,951] **Coil Conversion; Cutting Holes in Wimshurst Plates.** H. M. (Aston Manor) writes: I should be greatly obliged if you would answer the following queries. (1) I have an old De Dion Bouton non-trembler coil in round black case. Can I use this for a shocking coil, or would it be possible to make it into a small spark coil? I have your sixpenny book, but it does not say anything about this kind of coil. (2) How can I cut a hole in centre of glass plate for Wimshurst machine? (3) Would cycle frame built of cycle tube screwed with fine gas thread be alright? I mean tubes screwed in instead of brazed, finished with a running joint under seat pillar.

(1) If you can dismantle the coil and get hold of the primary winding ends and also the secondary ends, there is nothing to prevent you fitting an ordinary trembler break as used on ordinary induction coils. (2) *Re* cutting hole for Wimshurst machine, a glazier would do this for you very quickly or you can grind it out by using a copper tube, weighted, the size of the hole to be cut, and rotating this and using fine emery powder and turpentine to gradually grind away the hole. (3) *Re* cycle frame, we should not recommend simply screwed tubes, they require to be brazed also.

[19,135] **Cracked Valve Seat of Small Oil Engine.** A. H. I. (Ashingdon) writes: *Re* my oil engine query, I thank you for your advice. I have gone carefully over every part and have had same to pieces and cleaned well, and engine acts just the same as before, so had the engine to pieces again and carefully inspected every part, and I find a small crack across the top of seat of exhaust valve, and take it for granted that is the cause of trouble, as I have tried two different kinds of oil and the engine runs for a time and then stops, as it seems to be choked with smoke and will not run even light. Am I right in assuming that as soon as the ignition chamber gets hot it expands the crack mentioned and will cause the same trouble as a valve sticking up? Also would it answer to re-bore chamber where valve is cracked, say, ⅜ to ½ in. larger and re-bush same, and would it be best to screw same and screw bush in or force it in with jack, as I think it would be much cheaper and quicker than a new front? Thanking you for your kind attention to my previous query.

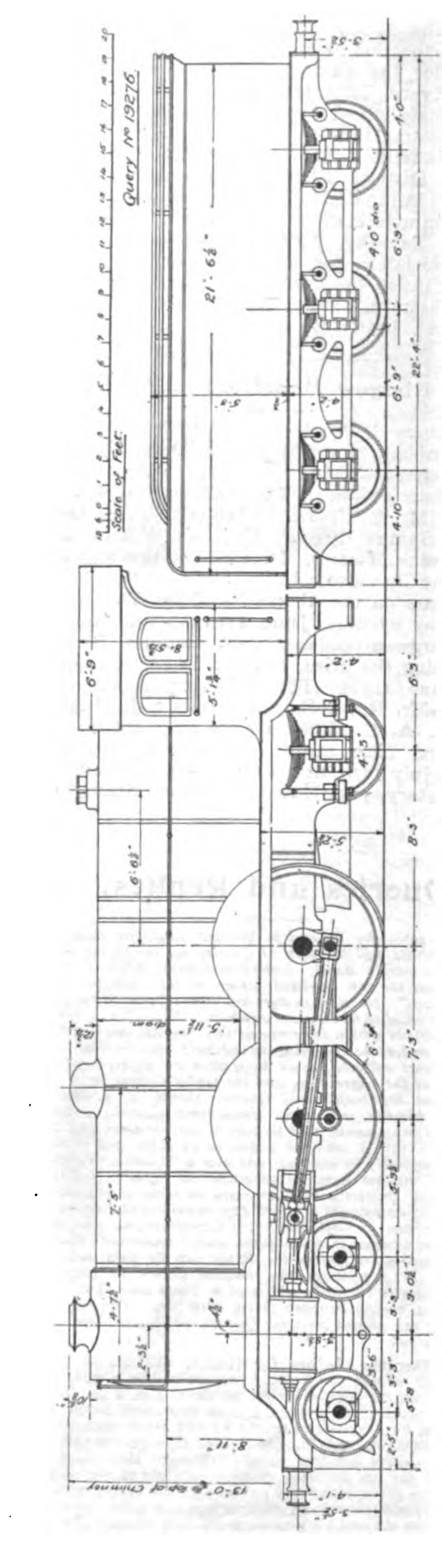
It is quite possible that the crack you have discovered is the cause of the trouble with your engine, and we think your best plan will be to re-bush the seating of the valve. This, to be carried out properly, would necessitate cutting away a certain amount of metal so that when the new bush is fitted the clearance spaces in the cylinder and around the valve will be the same as before. If you are quite certain that you can carry the job out satisfactorily at the first try you could screw in your bush; on the other hand, we should feel inclined to advise making it just a good driving fit and then, if required, inserting a steadying pin through one side to prevent the bush turning, should it ever wish to do so. We think you should be able to carry the job out satisfactorily and shall be glad to hear from you as to the results you obtain.

[19,276] **N.B.R. "Aberdonian," "Atlantic," Type Locomotive.** R.W.S. (West Kensington) writes: I shall be much obliged if you will send me a dimensioned scale drawing of a new "Atlantic" type locomotive "Aberdonian," No. 868, of the North British Railway. Front elevation of engine, also side elevation of engine and tender.

We include an outline drawing of the N.B.R. "Atlantics" to a scale of ¼ in. to the foot. The width over the footplates at the cylinders is 8 ft. 9 ins. and at the driving wheels 8 ft. 3 ins. Width over splashers, 7 ft. 6½ ins. Width over cab 7 ft. 8 ins. The following are the numbers and names of these engines:—

No. 868, Aberdonian.	No. 875, Midlothian.
„ 869, Dundonian.	„ 876, Waverley.
„ 870, Bon-Accord.	„ 877, Liddlesdale.
„ 871, Thane of Fife.	„ 878, Hazeldean.
„ 872, Auld Reekie.	„ 879, Abbotsford.
„ 873, St. Mungo.	„ 880, Tweeddale.
„ 874, Dunedin.	„ 881, Borderer.

Total length over buffers, 63 ft. 0½ in. Total weight in working order, 119 tons 16 cwt.



N.B.R. "ABERDONIAN" "ATLANTIC" TYPE LOCOMOTIVE.

[19,034] **Model Steamer achinery.** A. V. G. writes: Would you give me some information on the following. I am building a model liner, 6 ft. long, 8-in. beam, 10 ins. deep. Could you tell me what number of THE MODEL ENGINEER has the drawings or fittings of a model liner? What size compound engine would drive the liner at a good speed? What size boiler should I require to drive the engine? Do you think Fig. 15A in fifth edition of "Model Boiler Making," if made bigger, would suit the engine? How much larger should I have to make it? What size blowlamp would be suitable for the boiler?

You will find some excellent illustrations of model ocean liner fittings in our issues of July 27th, 1905, and January 25th, 1906. We would advise a compound engine, ¾ by ⅞ by 1 1-16ths by ⅞, working at 100 lbs. per sq. in. pressure. The design for boiler, Fig. 15A (page 46 of "Model Boiler Making") will do well, if you make the shell 2 ins. long and put another two rows of water tubes in the furnace. We cannot answer the last query in so many words. The burner should consume about half pint of spirit per hour.

[18,958] **400-watt Ironclad Dynamo.** D. M. S. (Horsham) writes: I have a casting of a dynamo, and should like to know the size and amount of wire for armature and field-magnets to give an output of 50 volts and 12 or 20 amps. The armature is cogged drum, stampings 3½ ins. by 4 ins. long, sixteen slots.

Your machine will not generate more than about 400 watts; the windings—to give 50 volts and 8 amps.—would be—on armature, 2 lbs. No. 18 S.W.G.; and on field-magnets, 11¾ lbs. No. 22 S.W.G.

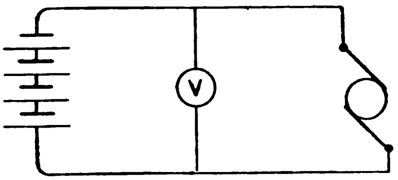
[19,729] **Water Motor and Dynamo.** S. P. (Douglas) writes: I have a 400-watt dynamo, shunt-wound, 100 volts 4 amps., armature wound in 32 slots, 16-segment commutator, with 2 lbs. of 22-gauge wire. The poles are wound with 8½ lbs. of 25-gauge wire. The bobbins on which it is wound are 4 ins. by 2¾ ins. by 3 ins. deep; the wire is 1 in. deep outside of that size. The armature is 4 ins. long by 4 ins. diameter. I would like to know if it could be altered or rewound in any way so as to give only 100 volts 1½ amps., so as ½ h.-p. would drive it. If so would you let me have particulars as to doing same. If it is impossible to get the 100 volts., smaller would do, but would like to have the 100. For the water motor, I have 35–40 lbs. pressure with a ⅜-in. jet of water, and I would like to know if I can get ½ h.-p. from it with a pelton wheel. If so, could you please let me have the following sizes: What diameter of wheel outside of cups? What size of cups, width, etc.? Where to get cups? Number of cups required?

All you have to do to enable a smaller power to drive the dynamo is to take less current from the machine when it is running at its normal speed. As an instance: supposing the machine required 1 h.-p. to drive it when lighting, say, 10 lamps, the same machine when lighting only 5 lamps would only require ½ h.-p. to drive it. Therefore, you will see there is no need to alter the windings in any way provided the voltage of the machine remains constant and the same as hitherto. *Re* water motor at 40 lbs. pressure and a ⅜-in. jet, you should get close upon ½ h.-p. with a pelton wheel. The consumption of water would be approximately 3½ cub. ft. per minute. We should use a wheel of about 15 ins. diameter, and constructed on similar lines and with similar proportions to the ¼ h.-p. motor described in December 15th issue, Vol. V.

[19,806] **Converting to Spark Ignition.** I. W. (Bridgnorth) writes: Will you kindly give me your advice again? (1) I want to convert my gas engine from tube to electric ignition. It is ¾ h.-p., and water-cooled. I do not know where I can put the sparking plug, or the wipe and break contact arrangement. I enclose sketch (not reproduced). (2) I have fitted up a burglar-alarm bell to my safe. It will ring the bell when either of the two wires get cut. I want the best kind of battery to work it. What do you advise? It must be continuous, because the current has to hold armature to bell, until one wire is cut, and then the circuit is an ordinary one. I want a battery that will want the least attention.

(1) It will be rather a difficult job to fit the electric ignition, as the space at the back end is probably limited. In the ordinary way a small flange would be bolted on to the back end of the cylinder carrying the sparking plug. If you could arrange to take the air and gas inlet arrangement to one side of the back end, you could use the hole where the inlet pipe is at present, for the ignition plug and flange. Or another way, provided there is room, would be to drill a hole alongside the gas inlet pipe and fix plug by screwing directly into the back end of cylinder. (2) You cannot do better than use Leclanché cells for this job, provided a very small current is required.

[19073] **Voltage when Charging Cells.** N. D. G. D. (Cambridge) writes: *Re* Query No. 18,963. I am afraid I did not express myself quite clearly. What I want is an expression for the voltage indicated by the voltmeter V during charging in terms of the back pressure of the cells at the particular instant in question and the E.M.F. of the dynamo on open circuit. If you could give me an expression for this voltage showing how it is arrived at, I should



be most grateful. I regret I omitted to send the sketch with my first enquiry.

The expression you require is $V = \frac{E}{\omega} - e$; where V is the voltage indicated by the voltmeter, E the voltage between dynamo terminals on open circuit, ω the internal resistance of dynamo, and e the back E.M.F. of cells.

[19,385] **Model Locomotive Failure.** J. W. R. (Glamorgan) writes: I have just finished a ½-in. scale locomotive (L. & S.W.R., 580 class), but I cannot get it to steam satisfactorily. The slide-valves are faced and set correctly, the motion works freely, I have tried various positions of the blast pipe, but with no success. The boiler is a Smithies' type, 9½ ins. by 2 ins., with three water tubes (½ in.) brazed in; flame superheater as advised in "The Model Locomotive." I have tried spirit lamps of various kinds, four wicks round, six wicks round, one tray 3½ by ¾ by ½-in., and two ditto, but cannot get enough steam to move her along; but if lifted clear of the ground the wheels will spin at a good rate for about half a minute or so but is too weak to pull her own weight without the tender. I should like to try a Primus burner, but I cannot get it in the firebox, which is 1⅜ ins. wide. Can you please advise me in this as it is the second lot of cylinders and the third boiler I have made?

We are unable to diagnose the complaint exactly, but two things are most likely at fault. (1) Piston packing. You say that the engine has no power. (2) Minute leaks in the boiler and steam pipes. A model locomotive should be packed so tightly that when first tried the wheels will not revolve when the engine is pushed along by hand without steam. A Primus burner is quite unnecessary. Do you get a good head of steam before you start the engine? This is an important point. Moreover, does the engine puff in a hearty manner? If neither of these conditions obtain, then look to boiler and pipe joints and to the pistons and valves.

[19,634] **Lead Castings.** W. J. W. (Avoca, co. Wicklow) writes: I have been attempting to make some castings of signal spectacles and brackets in lead, but cannot get them right, and should be obliged for your advice. The moulds I use are double and made of plaster. The impression of the pattern in the mould is quite clean, but the molten metal, when poured in, makes a spluttering noise, and does not run so as to fill up all the space in the mould, and consequently gives a very imperfect casting. Can you please say where the defect is? Does the metal cool too quickly? Would heating the mould improve matters? Should I add any other metal or substance to the lead?

Heating the mould would certainly improve matters, for in a thin casting the lead always has a tendency to cool before it reaches the end farthest from the source of supply. We presume your air-vents are all in order. You might also try the effect of a larger header when pouring the lead; the effect would be to force the metal to the other end of the mould much more rapidly, and thus overcome the difficulty due to cooling. We think you will be able to get over the difficulty if you make one or two more attempts.

[19,710] **Making Cylinder-Head Joint on Petrol Motor.** E. J. S. (Bromyard) writes: I have a motor bike air-cooled petrol engine, where the cylinder-head is a separate casting from the cylinder barrel; this means an additional joint to make gas-tight The copper asbestos washer supplied does not make a good joint. leakage results, causing great loss of power. Asbestos string soaked in boiled oil, and asbestos string and fish glue have been recommended in place of the asbestos washer, but in practice I find that, though the head may be just the right distance from the crank chamber at night, owing to a certain thickness of either packing, by the morning the packing has consolidated more, and the valve stems, which before just nicely cleared the tappet rods, now practically touch, and when hot, do not allow the valves to close properly. This becomes such a nuisance, as it is a work of some time to take the engine down and put her back, that I wonder whether there is not a way of cementing or rusting the two together. The cylinder has a spigot turned at the top, and the head a channel. Can you suggest a cement or method of rusting the two together permanently, making a gas-tight joint to stand the heat and some 300 lbs. per sq. in. pressure.

The trouble you mention can only be remedied by making the two faces, namely, that of the head and that of the cylinder, perfectly true, metal to metal. When that is done, a very slight amount of packing will ensure a perfectly tight joint under all conditions. Personally we have found that coppered asbestos rings, fairly thin, give very good results, but as we said, it is essential that the joint be almost perfect even without any packing whatever. You might try a piece of thin copper wire as packing if the other material fails. We do not advise rusting or cementing the joint together.

[19,754] **Model "Dunalastair" Locomotive.** G. D. (Finchley) writes: Having just started taking in your paper, which I think is very instructive, and having obtained a partly finished model ¾-in. scale Caledonian locomotive ("Dunalastair"), which is minus the crank and eccentrics, I am now anxious to try and finish it, if you will kindly advise me on the following items. I have sketched a rough drawing out of a two-throw crank and eccentrics which advance 100 degs. of the crank-pin. Is this allowing too much, eccentrics 3-16ths in. out of centre? The cylinders are 1 1-16th-in. bore by 1½-in. stroke. Is my drawing correctly marked and centred for turning crank and eccentric sheaves from a solid piece, providing the advance is correct? Do you strike the radius of link from the centre of crank? The size of reversing link to use—would four times the travel of valve be right?

You are advised to obtain "The Model Locomotive: Its Design and Construction," by Henry Greenly, price 6s. 5d. post free, and on page 159 (Fig. 183) you will find a full-size drawing of the valve gear of this model. Do not follow the eccentric setting given in the articles in Vol. IV, as this does not allow—(it has since been proved)—enough valve travel, and owing to the angularity of rods increasing the lead, the actual lap and lead is excessive and the cut-off too early. The eccentric throw should be 7-32nds in., not 3-16ths in., and the angle of advance about 1-16th in. The length of the link should be 1¼ ins. to 1½ ins. Your cylinders are rather large. We would not recommend larger than 15-16ths in. by 1½ ins. for this engine. The valve should have 1-16th-in. lap.

[19,648] **The Care of Accumulators.** H. E. H. (Leicester) writes: Would you kindly advise me on the following? I have a 4-volt accumulator which has been standing for about eighteen months. There is now a white deposit all over plates. What is this? What is the best method of removing the same? What method to adopt to put cell into proper working order? What would be the cost of having same done by any of your advertisers? The top is fastened on with a black substance. What is this? How to take top off and how to fasten same on again?

The plates have probably become sulphated, and the best remedy is to thoroughly scrape them when they are dry and then give them a good spell of charging and discharging at a fairly slow rate. An inspection of the cells would be required before we could say definitely what should be done, but any of our advertisers, such as Messrs. T. W. Thompson & Co., 28, Deptford Bridge, Greenwich, S.E., or Messrs. Whitney, 117, City Road, London, E.C., would quote you a price on application for putting the cells in good condition again if that were possible. If you would read the query replies which have been constantly appearing during the past few years you would find full information on the treatment of small accumulators and also information relating to their construction.

The Editor's Page.

We hope those who intend entering boats for our Model Regatta will kindly send in their entrance-forms without delay. An entry-form is necessary, whether the boat is to be run on the lake or only placed on exhibition, as we wish to know what space to provide, and also to publish in the official programme a complete list of boats on view.

* * *

The visit to the works of Messrs. Drummond Bros., Ltd., on Saturday, the 11th inst., which has been arranged by Mr. H. W. Greenfield, will no doubt be very interesting to those of our readers who are able to go, and Mr. Arthur Drummond is hoping to see quite a large party. In the notice in our issue of June 18th we incorrectly implied that this was an official visit of the Society of Model Engineers. This, however, is not the case, the visit having been privately arranged by Mr. Greenfield, with the permission of Messrs. Drummond Bros., Ltd.

* * *

With reference to our recent remarks on the subject of perpetual motion, we have received the following interesting note from "Pat" (Cardiff):—"I daresay I am safe in stating that there are few with a scientific inclination who have escaped a more or less severe attack of the perpetual motion fever, and perhaps also very many of these, if they would only admit it, are not quite convinced by the apparently unanswerable arguments used to oppose it, and no doubt, from a purely mechanical view, it is impossible. I confess to be one who was badly struck, and I also confess that I am not yet convinced of its impossibility, and for the following reasons: It is Nature's law—a law, too, which makes a state of rest impossible, and if we could adopt Nature's methods, its accomplishment by us should be possible. All the attempts I ever heard of were of a purely mechanical nature, which must fail; but what about enlisting the services of chemistry to bring about mechanical effects, as Nature does? All matter is indestructible and always undergoing change, new substances forming from the parts given off by the disintegration of others, so that if we could only discover a simple circuit of elements, such that the renewal of any one just requires those parts supplied by the decomposition of the others, perpetual motion would be assured. The flow of water in rivers is the simplest illustration I can think of, and this requires only one chemical agent—the heat of the sun. Of course, the heat has to be accounted for, and this, when better known, like all other mysteries, may be simple enough."

"Pat's" idea of the chain of chemical elements converting themselves one into the other and back again to the original element is a very pretty conception. But it does not embody the idea of perpetual motion, as generally accepted by the inventor. For an example of perpetual motion, as provided by Nature, "Pat" need look no further than to the rise and fall of the tide, but the inventor's idea of the problem is to construct a machine or combination of machines which, once started, will go on working, giving out useful power without fresh power being put into it. For the reasons we have already given, this is quite impossible.

* * *

Some little while ago we had occasion to comment on the lack of a Society of Model Engineers in Manchester. Mr. Basil H. Reynolds, whom we know to be a very capable and enthusiastic reader of "ours," writes to say that he will be pleased to assist in the formation of a local society, and would like any other interested Manchester readers to communicate with him. His address is 35, Torbay Road, Chorlton-cum-Hardy, Manchester. Now then, Manchester, wake up!

Answers to Correspondents.

W. W. N. (Pudsley).—(1) We doubt whether the Fuller cells will charge the three accumulators in succession, especially as you do not mention the amp.-hour capacity of the accumulators. (2) The most satisfactory way would be to make a trial and see exactly for yourself what the cells will do.

D. W. W. (Morpeth).—The accumulator should either be charged now and then, say once every ten days when not in use, to keep it in good condition, or it should be completely dismantled by fully discharging and drying the plates after they are taken out of the cell. If you refer to recent query columns, you will find this matter has been explained on several occasions.

Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

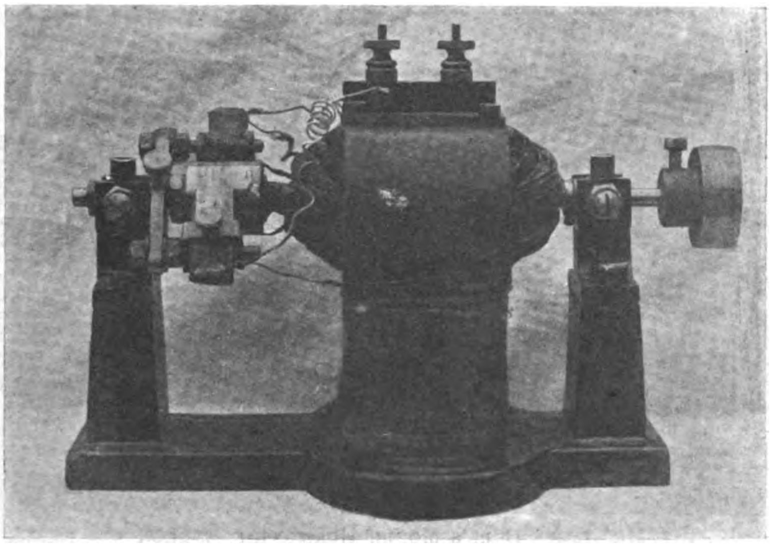
THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 377. JULY 16, 1908. PUBLISHED WEEKLY.

A Small Overtype Dynamo.

By E. WILSON.



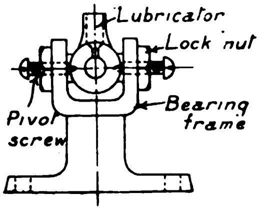
MR. E. WILSON'S OVERTYPE DYNAMO.

THE accompanying photograph represents a a small dynamo I have recently constructed in my spare time.

I commenced the actual work of fitting the field-magnets to the baseplate, taking particular care to make good joints. The magnets were annealed in the kitchen fire before being fitted, this not only making them better quality from an electrical point of view, but also giving ease in filing. The bearings, as will be seen from the sketch, are rather different from the usual form, the bearing frame and bearing proper being cast separately, the one in cast iron and the other in gun-metal. The object is to facilitate the fitting up of same.

The shaft was turned from a piece of ½ in. diam. cast steel—length, 9 ins.; diameter at bearings, ¼ in.; diameter at centre, ⅜ in. The armature stampings, together with a thick brass disc at either end (filed to same shape as stampings) were next assembled and held by a tight-fitting nut, backing them up against a shoulder turned on the spindle. The principal dimensions of armature are as follows: Diameter, 2 ins.; length, 2¼ ins.; number of slots, eight. Before winding the armature, the commutator was made. This was turned from a solid piece of brass rod 1 in. diameter, bored out to fit tightly on a boxwood core, also held by a nut. The sections were insulated from one another by strips of mica glued in place.

The bearings were bored out very slightly smaller than the finished diameter of shaft, and afterwards ground in by means of fine emery powder, the bearing being slowly turned in the lathe. Silk and shellac varnish were used for the armature insulation, and brown paper soaked in paste for the field-magnets. Heedless of the information given in



ARRANGEMENT OF DYNAMO BEARING.

THE MODEL ENGINEER Handbook, I commenced winding the armature (in four sections, connected to a four-part commutator) before the insulation was thoroughly dry, with the result that I much regretted having done so, for not only did one coil leak, but all four. However, by more closely following instructions, I succeeded in my next attempt. The gauge of wire used was No. 24 D.C.C.—about 8 ozs. for armature and 2 lbs. for field-magnets, connected in shunt. All coils are shellaced.

The brush rocker is of the usual type, the gauze brushes being pressed on the commutator by means of springs.

The armature is protected by a brass plate screwed across the poles of the field-magnets. On this plate is mounted the terminal board. The whole of the ironwork, except screws and nuts, is painted a glossy black, which gives it a rather neat appearance, whilst most of the brass work is left bright.

In testing the machine, I ran it up to a speed of about 2,000 r.p.m. from the lathe, and after manipulating the brushes for a time it started generating, this fact being evident by the curious hum of the machine and slight sparking at the brushes. I tried a 20-volt lamp in the circuit, and it lighted up brilliantly. Up to the present I have not tested its ampereage, but I believe the machine should be capable of supplying 3 to 4 amps. When tried as a motor, on a 20-volt circuit, it ran at a tremendous speed, taking about 1½ amps. (no load).

Design for Small Power Horizontal Engine and Boiler.

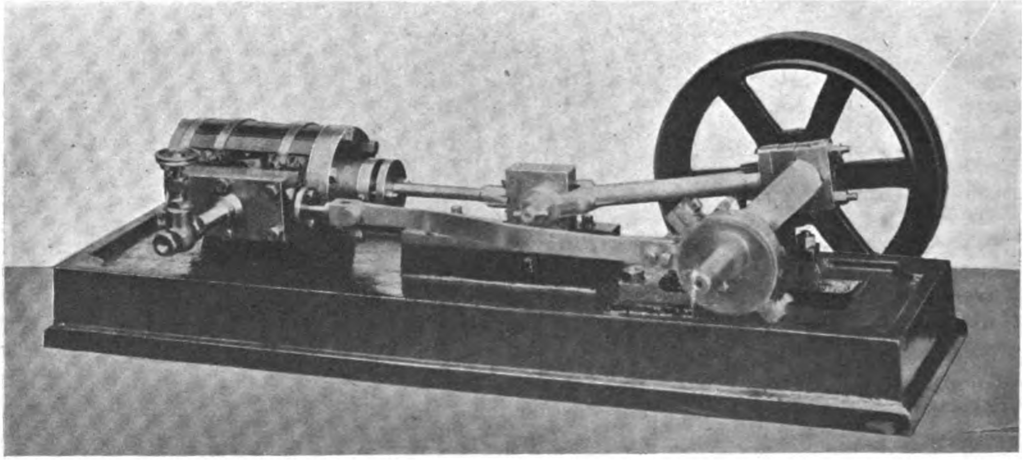
By JAMES BURR.

FOLLOWING is a description of a small horizontal engine of 1½-in. bore and 2½-in. stroke constructed by me, and a small horizontal type Lancashire boiler, 14 ins. long by 8 ins. diameter, with two 2-in. diameter tubes running the whole length of boiler.

The engine was designed with a view of obtaining the most power in the least available space and ease of construction, together with a good appearance. The cylinder is 3½ ins. long over all, fitted with C.I. piston and eccentrical rings as per sketch (Fig. 6). The steam chest is bolted to the cylinder with six 3-16ths in. by 1-in. setscrews, and is made with loose cover for ease of making adjustment of valve. The valve is designed to give cut-off at half stroke over steam ports, ⅛ in. wide and 9-16ths in. long. The stroke of eccentric is, therefore, large, being actually ⅝-in. travel. The stop valve is of 5-16ths in. outside diameter brass pipe size.

The piston-rod is 5-16ths in. diameter fitted to crosshead with a loose tee-piece and two 3-16ths in. setscrews and fastened with a strong cotter. The crosshead is designed so that when the brass begins to wear it is to be taken out and replaced by another of a good fit.

The connecting-rod is 6 ins. long, fitting to crosshead with a jaw, and the other end with the usual



MR. JAMES BURR'S MODEL HORIZONTAL ENGINE.

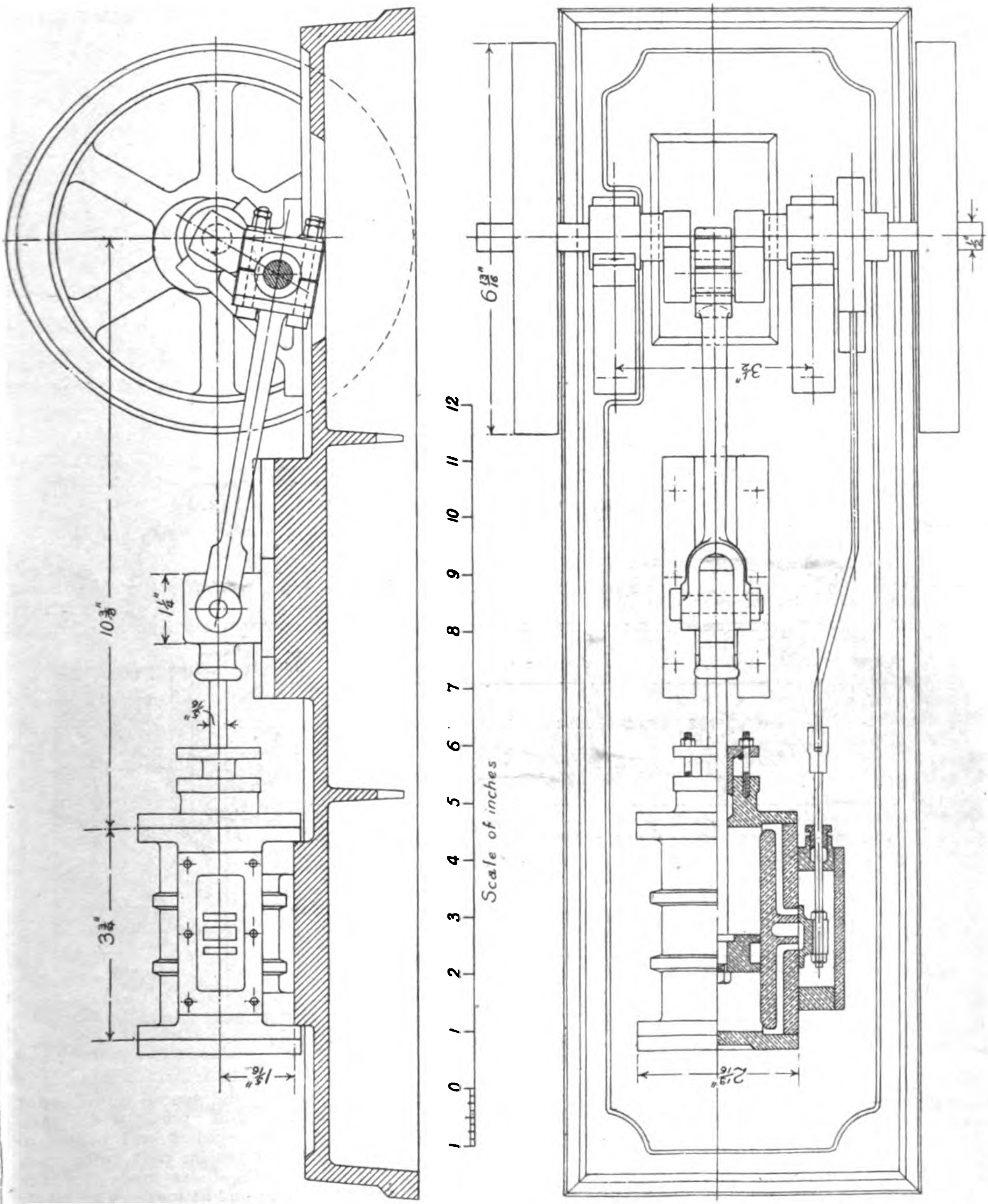


Fig. 1.

Fig. 2.

Part Sectional Plan and Elevation of Mr. James Burr's Horizontal Engine.

adjustable brasses, of ⅜ in. diameter near jaw and tapering straight to 7-16ths in. diameter.

The bearings are solid and of a very rigid design, of a suitable bore to suit the ½-in. diameter crankshaft, which is of the whole type with bearings on each side. There are two flywheels, one not being shown in photograph, 7 ins. diameter by ¾ in. wide on face—one fitted on to a pulley for a ¾-in. belt, and the other one fitted for a ¼ in. diameter rope drive.

The whole of the patterns for the above were made by myself, and all the castings, excepting the bed, being moulded in a wooden box and taken to the foundry to be cast.

The boiler is made from a piece of Mannesman weldless steel tube, 8 ins. diameter and about 7-64ths in. thick. I cut it from a long length in the lathe so as to ensure perfectly flat ends. The end plates were then turned from ½-in. thick plates, and a groove cut all round 3-16ths in. deep and the same width as the thickness of the tube. Nine 5-16ths in. holes were then drilled in plate at a centre of 6¾ ins. diameter and spaced equidistant around circle. The two 2-in. tubes were then turned at ends and holes bored in end plates to exactly fit the tubes; 5-16ths in. rods were then made and screwed and the holes made for the necessary boiler mountings and fittings. The whole boiler was then fitted together as shown in the drawings, the end plates being hammered to tube and the small tubes caulked into place to stand about 200 lbs. pressure.

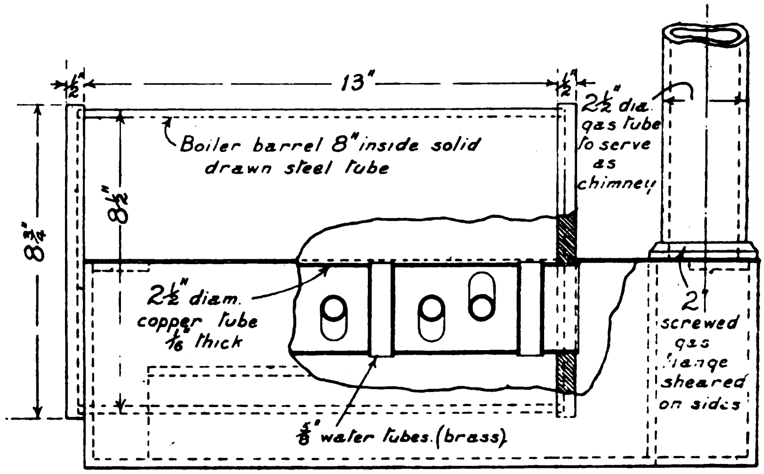


FIG. 3.—PART SECTIONAL ELEVATION OF MODEL LANCASHIRE BOILER.

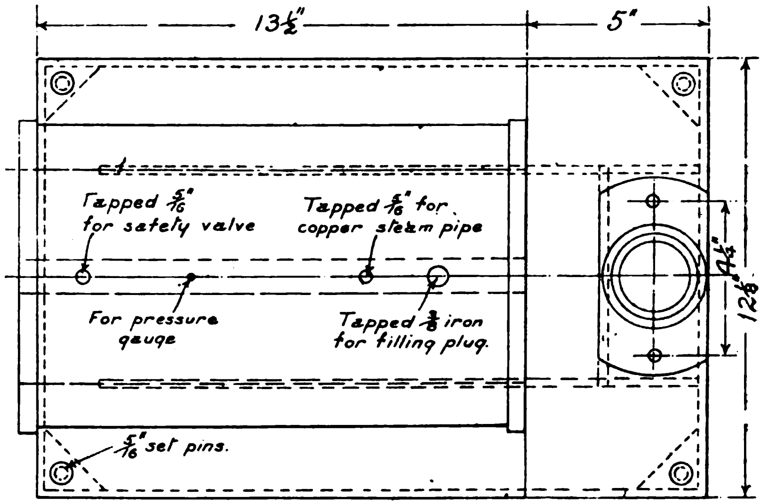


FIG. 4.—PLAN OF MODEL LANCASHIRE BOILER.

The boiler is now mounted in its proper place on a C.I. setting, the flues being arranged the same as in a real Lancashire boiler. The heating arrangements at present are two small Bunsen burners,

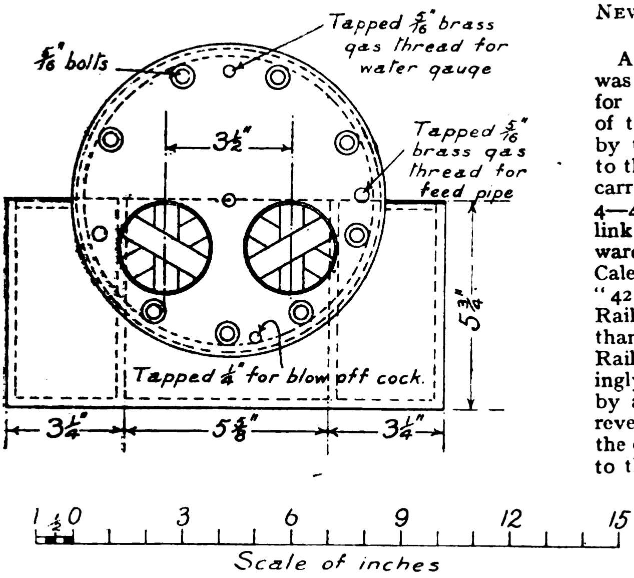
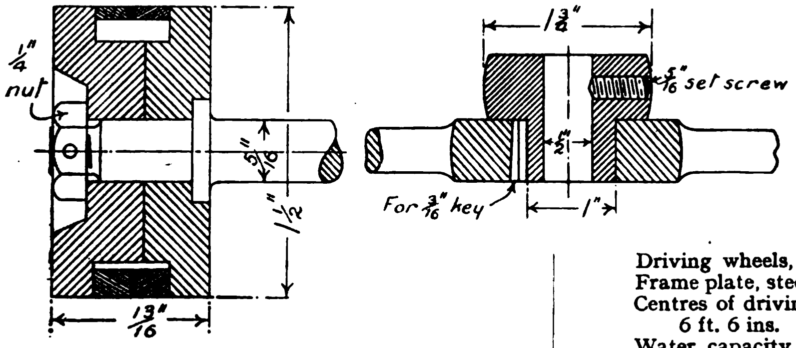


Fig. 5.—End Elevation of Boiler and Setting.

but later on I propose to make a special tank with two blowlamps with pressure. The present heating arrangements keep the engine going with 45 lbs. pressure with engine running at just 200 r.p.m.



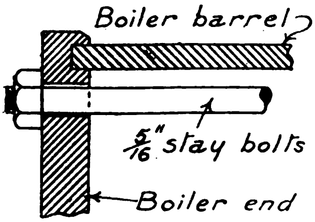


Fig. 6.

Details of Piston and Boiler Construction.

The engine itself will run with just 4½ lbs. pressure, but with 45 lbs. will easily drive Drummond's 3½-in. S.S. lathe, with back-gear, and a light cut direct.

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

New Express Locomotives for the Highland Railway.

A new series of express passenger locomotives was recently introduced on the Highland Railway for working the heavy mail and passenger traffic of that line. The engines, which have been built by the North British Locomotive Company, Ltd., to the design of Mr. Peter Drummond, locomotive carriage and wagon superintendent, are of the 4—4—0 type, with inside cylinders and Stephenson link motion. They resemble very closely in outward appearance the "140" Class engines of the Caledonian Railway and also the 4—4—0 type "425" Class of the London & South-Western Railway. The boilers are larger and higher pitched than hitherto has been the case on the Highland Railway for this type of engine, and the correspondingly greater total heating surface is accompanied by a higher steam pressure. The valve gears are reversed by steam and water cataract mechanism, the operating cylinders of which are coupled directly to the reversing shaft and controlled by the driver from the footplate by means of a small handle and gearing. A tablet catching device is attached to the left-hand side of the cab, for use in conjunction with single-line working.

The large end of the connecting-rod is of the marine type, and the slide bars, which are made of cast-iron, are supported by and fixed to a frame cross stay independently of the cylinders.

The leading dimensions are as follows :—

Inside cylinders, 18¼ ins. diameter by 26 ins. stroke.
Boiler (second ring), 5 ft. 3 ins. outside diameter.
Number of tubes, 266; 2 ins. diameter.
Heating surface: Firebox, 132 sq. ft.; tubes, 1,516·2 sq. ft.; total, 1,648·2 sq. ft.
Working pressure, 180 lbs. per sq. in.
Bogie wheels, 3 ft. 6 ins. diameter.
Driving wheels, 6 ft. diameter.
Frame plate, steel, 1 in. thick.
Centres of driving wheels, 9 ft.; bogie wheels, 6 ft. 6 ins.
Water capacity of tank, 3,185 gallons.
Fuel space of tank, 260·5 cub. ft.
Tender wheels, 4 ft. diameter.
Wheelbase: Engine, 22 ft. 3 ins.; tender, 13 ft.
Total wheelbase, engine and tender, 44 ft. 1½ ins.
Weight of engine (in working order), 49 tons 8 cwts.; tender, 33 tons 8 cwt. 2 qrs.

A Modern American Locomotive for Mixed Traffic.

The locomotive illustrated on page 54 is one of an order of several recently built by the Baldwin Locomotive Works, Philadelphia, for the Mobile and Ohio Railroad. It is of the 4—6—0 or ten wheeled type, and the proportions have been selected with a view to rendering the engine suitable alike for goods or passenger traffic. The tractive force is 29,630 lbs., and as the weight on driving wheels is about 135,650 lbs., the factor of adhesion is 4–58. The boiler is built for a pressure of 200 lbs. per sq. in., but in service the safety valves are set at 175 lbs. The firebox is long and narrow and is placed above the frames, the foundation-ring being carried by two sliding supports on each side. The frames are dropped down between the main and rear driving wheels in order to give room for a sufficiently deep throat. The grate is of the usual rocking type, with drop-plate in front. The backplate of the boiler is sloped, and the barrel is built with three rings, the middle one of which is tapered. The dome is placed on the third ring, and the safety valves and whistle are separately mounted over the firebox. The cylinders are single-expansion and are equipped with balanced slide-valves, which are driven by Stephenson link motion. In this case the rocking shafts are placed between the first and second pairs of driving wheels, and are connected directly to the link blocks. The valve rods, which are of necessity long, are supported in the guide-yoke to prevent springing. The valves are set with a maximum travel of 5½ ins. and a lead in full gear of 1-16th in. The inside lap zero. The frames and running gear of this engine are in accordance with the usual American practice. To facilitate curving, the engine has a swing bolster and the main driving wheels have plain tyres without flanges. Grease lubrication is provided on the driving journals and crank-pins. The locomotive embodies in its construction features which have long proved satisfactory by trial in actual service.

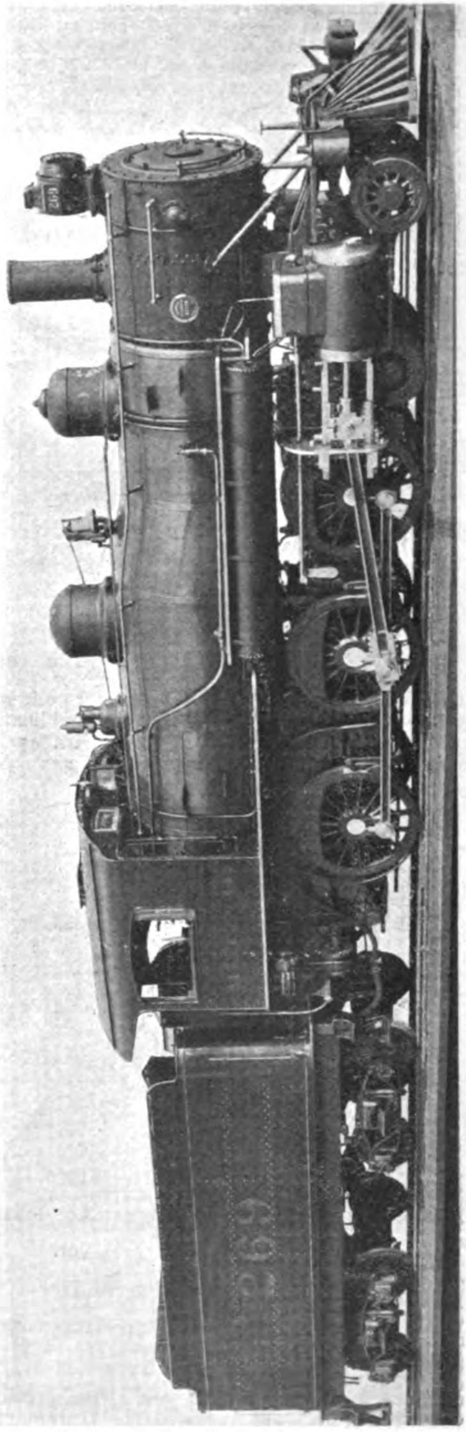
The principal dimensions are as follows:—

Cylinders: Diameter, 21 ins.; piston stroke, 28 ins.
Wheels—diameter: Bogie, 2 ft. 6 ins.; coupled, 5 ft. 2 ins.
Wheelbase: Rigid, 14 ft. 10 ins.; total, 25 ft. 10 ins.
Boiler: Diameter, 5 ft. 6 ins.; length, 15 ft.
Heating surface: Tubes, 2,819 sq. ft.; firebox, 194 sq. ft.: total, 3,013 sq. ft.
Grate area, 34·3 sq. ft.
Working pressure, 175 lbs.
Weight on coupled wheels, 60 tons.
Weight of engine (in working order), 81 tons.

The tender is of the eight-wheeled double-bogie pattern, with capacities for 7,000 gallons of water and 15 tons of coal. Its weight (in working order) is about 70 tons, so that engine and tender (in working order) weigh about 150 tons.

A Correspondent on Four-cylinder Locomotives.

A correspondent refers, in a letter to the writer, to the subject of four-cylinder simple locomotives, and asks where the advantage of the latter comes in after proper deductions have been made for the much greater expense of building and maintaining them, and adds: "It puzzles me to understand why the locomotive superintendent of one railway who has to provide against traffic conditions on the whole less arduous than those obtaining on another line where two-cylinder locomotives only are used, should design very large and unwieldy



A New American Mixed Traffic Locomotive.

engines with the four-cylinder complication, seeing that quite as good results are being obtained with the much lighter and less costly locomotive employed in the other case. If the position were reversed, I could then better understand why it is so."

As a matter of fact, the two railways referred to by the correspondent in question are the London and South-Western and the London & North-Western, whereon, although in the main the conditions vary considerably, there must be a lot of very similar work to be performed. However, we must not consider these matters " on the whole," as mentioned by the correspondent. Locomotives of advanced types, such as the 4—6—o's of the L. & S.W.R., are not intended for the purpose of taking turns with the lighter four-coupled designs on any traffic that may come along. They have their specified purpose, in that they are provided to deal with the heaviest train services on such unusually difficult stretches of line as that from Salisbury to Exeter and beyond, and they have only been introduced after the fact has been established, as the result of long experience, that it is impracticable to load the required adhesion weight on two axles only. The introduction of the third coupled axle at once makes it profitable to considerably augment the cylinder capacity, and as, under the conditions of British railways it is difficult and inconvenient to carry two very large cylinders, the plan of breaking up the total piston area into four instead of two units is very naturally resorted to. The same thing is done in other types of engines, and especially in the pétrol engine, and with the larger number of pistons, each of comparatively small area, the impulses are smoother and there is a corresponding advantage, viz., that of reducing the stress in the axles and other parts of the construction, while if three cylinders are employed, a more even turning movement may be secured by arranging the cranks at 120 degs. apart. Splendid work is, of course, being done every day on the L. & N.W. Railway with 4—6—o type locomotives having two relatively large simple cylinders, and the construction is beyond question less complicated and therefore cheaper to maintain, than in the other case quoted; but there is no comparison between the two designs when it comes to drawbar pull, and although the L.N.W.R. engine might show very well on the West of Salibury division of the L.S.W.R., it is not the class of engine Mr. Drummond considers necessary for the conditions to be met on that particular section, and he has therefore designed a much more powerful one, splitting up the cylinder capacity into four units for the reason given above. So long as requirements can be met by utilising normal cylinder diameters, it is needless to depart from the customary plan of using only two cylinders in simple locomotives, but once that point is passed, a division of the capacity and mechanism becomes advisable.

We understand that an order has been placed with Sir Raylton Dixon & Co., Ltd., of Middlesbrough, by Messrs. Parbury, Henty & Co., of London, the agents for the Colonial Sugar Refining Co., of Sydney, Australia, for a steamer on the builder's latest improved cantilever principle to carry 7,300 tons cargo, the top-side tanks being specially adapted for the carriage of molasses in bulk. The engines of 2,500 i.h.p. will be built by the North-Eastern Marine Engineering Co., Ltd., of Sunderland.

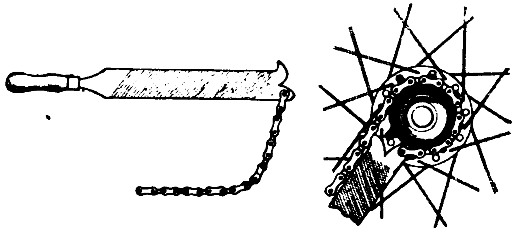
Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked " WORKSHOP *" on the envelope.]*

A Useful Wrench.

By C. W. Cheverton.

A great difficulty is often experienced in removing the cog from the wheel of a cycle, constant riding having screwed it on to its utmost limit. This contrivance seldom fails to remove such an one.

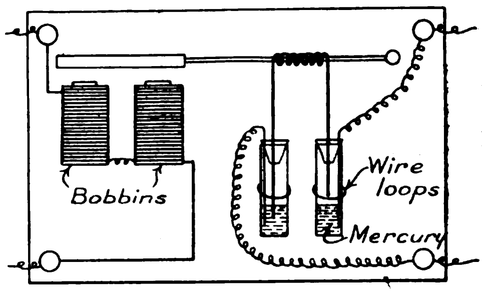


Procure an old flat file and split the end, as illustrated. While red hot spread the two ends open, after which drill a small hole, as shown, and attach about a foot of old cycle chain. When placed round the cog and hitched on to the projecting tooth of the file, this wrench cannot slip, a steady pull generally loosening the refractory cog.

A Simple Relay.

By " Wireless."

A short while ago I was in need of a relay, but as my pocket-money is limited, I resorted to the following device. I took the coils, cores and armature from an old bell and set them on a larger board with supports at the back to make it stand up perpendicular. I next wound some thick copper wire over the end of the bell hammer, as Fig. 1, leaving one end ¼ in. longer than the other. Directly



below these two ends I fixed two glass tubes of ½-in. internal diameter, by passing wire loops round the tubes and through the back. These tubes had corks in the top and sufficient mercury in the bottom to cover the longer end of the copper wire.

For the second set of connections, wires are passed through the corks into the mercury. I think the illustration will make all clear. The armature, being drawn towards the magnets, plunges the shorter copper wire into the mercury, thus completing the second circuit.

Notes on Calipers and Micrometers.

By George Gentry.

In conjunction with these notes the reader is referred to a very interesting series of articles which were published in The Model Engineer Vol. XIII, Nos. 228, 229, and 230, wherein the construction and method of reading slide calipers is dealt with very thoroughly by "A. W. M.," under the title of "Slide and Micrometer Calipers," and it is not intended in these notes to do more than show an up-to-date example of one of these. The reader is referred particularly to the end of this series for a very excellent description of the principle of the micrometer as used to-day, and it is the writer's intention to enlarge upon same.

Calipers generally may be divided into three groups, viz.:—(1) Those of the simple form for outside and inside measurements, together with spring calipers and those with other fine adjustments and locking devices, also so-called "hermaphrodite" calipers and plain dividers. These, it will be noted, have to be referred to a rule to set to size. (2) Registering calipers and slide gauges. The latter are sometimes known as bar micrometers when fitted with a micrometer adjustment, which register their own measurements by a sliding index on a scale. (3) Micrometers generally.

Dealing with simple calipers first. It would be an insult to the intelligence of the average reader to describe in any sense the construction of a simple pair of calipers. Every engineer apprentice is conversant with the methods, and the writer believes that this is generally a stock job of quite a new hand to provide himself with a pair of calipers of more or less ornate design—usually the latter. The main point in constructing such is to be particularly careful that the joints are made thoroughly parallel, and that the rivet is a nice fit and is square with the joint. Beyond this there is nothing in the construction of a simple pair of calipers.

Of recent years several American firms have turned their attention to improving ordinary workshop calipers, and notably among these the L. S. Starrett Company, of Athol, Mass., U.S.A., have made rapid strides, and have produced several ingenious devices. Referring to Fig. 1, which is an elevation and section of the joint and adjusting device of a pair of calipers in which *a* and *b* are the stumps of the legs, it will be seen by looking at the section that the leg *b* is in one with a tapered washer and screwed stud, and that the leg *a* is free to revolve upon the internal boss of a false leg *a'*. This latter is bored out to the same taper as the fixed washer upon the leg *b*, and normally rides upon it. Upon the outer end of the screwed stud is shown a milled nut *c*, which, when screwed up against the face of the projecting part of the false leg *a'*, causes it to seize tightly upon the adjacent portion of the leg *b*, and so lock *a'* to *b*. When the nut is out to its full extent—which is limited by an internal screwed knob *c'* on the end of the stud—sufficient pressure is put upon the joint by means

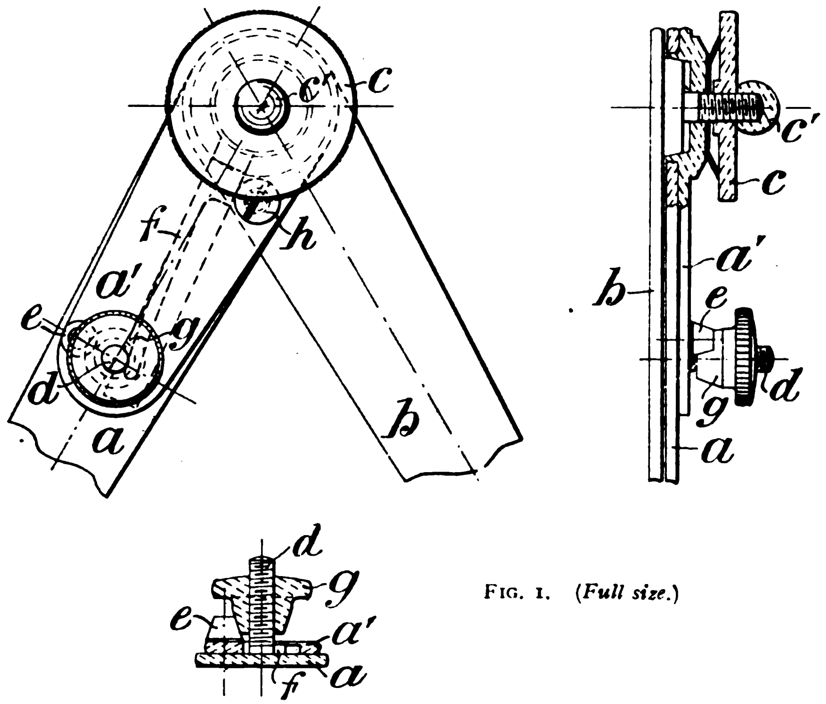


Fig. 1. (*Full size.*)

of a light steel spring shown between *c* and *a'*, to cause the joint to hold together. The reason for making leg *a* separate from the locking device is to permit of finely adjusting it relatively to *b*, which is done by the following method:—Upon *a* is fixed a screwed stud *d* which passes through a hole in *a'*, having plenty of clearance to allow of *a* moving relatively to *a'*. Upon the side of this opening on *a'* is fixed a small steel cone *e*, against which ordinarily the stud *d* impinges, by reason of a strong finger spring let into the underside of *a'* and shown dotted at *f*. The action of this spring practically makes *a* solid with *a'*, while a set screw with flat head *h* screwed into *a* keeps the two pieces in close proximity. If now it is intended to close the caliper leg slightly to finely adjust the points, by screwing down the cone-shaped milled nut *g* until it comes in contact with the cone *e*, the forcing action brought about against the spring will cause *a* to move relatively to *a'*, and by unscrewing *g* the spring takes up the action and opens the leg out again. This constitutes the fine adjustment on the best class of caliper made by the Starrett Company. It will be seen that the advantage of this device does away entirely with the old method of tapping the caliper legs on a bar to

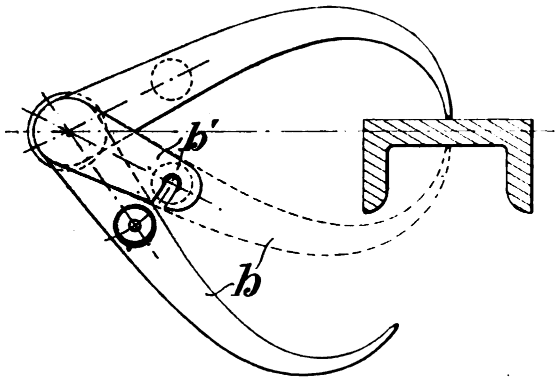


FIG. 2. (*Half full size.*)

close them slightly, or on the butt of the joint on a flat surface to open them again. In conjunction with these calipers a further device remarkable for its extreme simplicity is added, which Fig. 2 shows

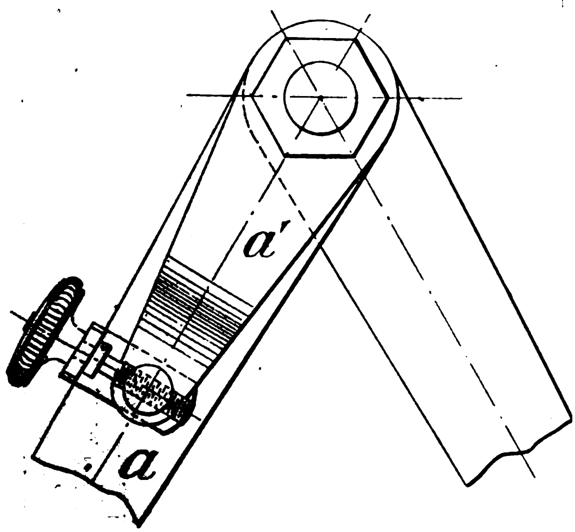


FIG. 3. (*Full size.*)

so clearly that scarcely any description is necessary. The leg corresponding to *b* in Fig. 1 has a false leg *b'*, which is attached directly to the locking device, leaving the main leg *b* free to open out. *b* is normally locked to *b'* by a stud passing into a slot in the latter with a tapered nut, similar to the one shown on the fine adjustment device, which beds itself into a countersunk opening at the end of the slot. Having taken the measurement of the web of a channel or casting similar to that shown in Fig. 2—from which it will be seen, ordinary calipers cannot be withdrawn—by unscrewing the nut and allowing the point to clear the groove the leg *b* can be opened and the caliper removed, after which by replacing it and locking as before, the measurement can be read off. Fig. 3 shows a type of fine adjustment which is a somewhat older device, and is generally added to the form of caliper

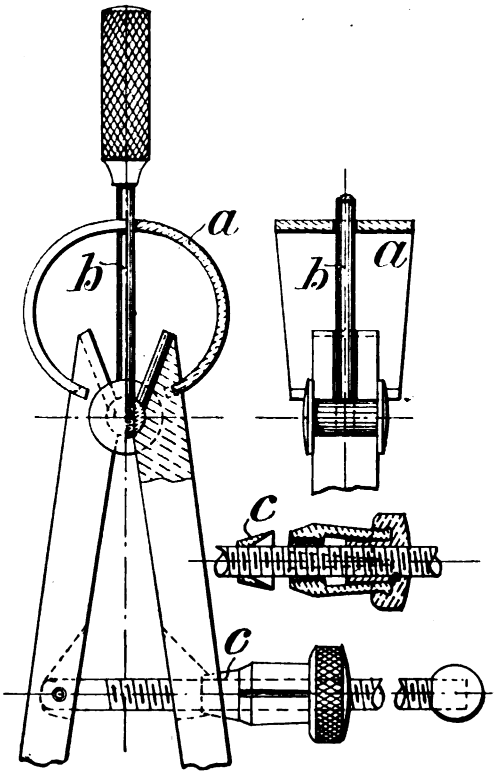


FIG. 5. (*Full size.*)

shown, viz., such as have no locking attachment. Here the false leg *a'* carries upon its end an internally threaded stud which travels upon a similar traversing screw controlled by the milled head, which with its bearing is part of the leg *a*. The hexagon washer shown on the joint is provided to allow of tightening up the joint when, through wear, it works loosely. This latter joint is similar to the locking joint shown in Fig. 1.

In the matter of spring calipers Fig. 5 shows an up-to-date method of applying a separate spring to actuate the legs. In this case the illustration is taken from a pair of "Fay" patent spring dividers. The legs are made separate from the joint entirely, the latter being made by a reel-shaped pin—shown in the section—which fits into semi-circular grooves cut in the inner sides of the ends of the legs and upon which they are free to rotate relatively to each other, being limited in their movements outwards by their projecting ends coming in contact. They are controlled in this same direction by the bow-shaped spring *a*, the ends of which fit into grooves upon the outside of the legs above the joint. When the legs are wide open, the tension on this spring is then sufficiently strong to prevent its coming out of its place. It will be seen that by the controlling action of the nut on the adjusting screw below that the legs can be drawn together or allowed to part, being kept taut by the action of this spring. The advantage of this form of joint is such that, being made up in separate parts, should the spring fly, through rapid change of temperature or other cause, it can be replaced without discarding the other parts of the tool. The vertical pin *b*, together with the knurled handle at the top, are provided for actuating the dividers more conveniently. A further ingenious attachment to this form of tool, is the quick-action spring nut shown in section in the same figure. Here the tension, in any position, brought about by the spring causes the taper collar *c* to clench the nose of the split nut and so to lock the threaded portion on to the adjusting screw. If the calipers or dividers are at a small dimension, and are wanted to be set nearer their full extent, by releasing the tension on the spring, by gripping the legs together in the hand, the nut can be split, drawn over as many threads as necessary, and allowed to spring out, take up the tension, and lock the nut on that point, after which the fine adjustment can be made in the ordinary way. The small internally threaded knob, shown on the end of screw, is to act as a stop to prevent the nut leaving the thread entirely.

(*To be continued.*)

Model Rolling-Stock Notes.

By Henry Greenly.

(*Continued from page* 18.)

Private Owners' Open Wagons.

In the Railway Clearing House specifications of privately owned wagons, the very latest of which are before me as I write, the construction of standard 8-, 10-, and 12-ton wagons is dealt under one heading, and except in axle and spring details, there are very little points of difference. In the matter of size an 8-ton may be as capacious as a 10-ton wagon, or a 10-ton as large as a 12-ton, according to the goods to be carried. It is common knowledge that coke has more bulk per unit of weight than coal, and coke wagons—to carry a given weight—are therefore made with higher sides than coal wagons.

In the first article (page 501, May 28th issue) it was noted that measurement of actual private owners' trucks showed the height of the sides of a 10-ton truck body to vary between 3 ft. 5 ins. and 3 ft. 10 ins.

Drawing Fig. 1 of the R.C.H. specifications, which is descriptive of 8-, 10-, and 12-ton wagons, shows the height of the sides measured above the level of the solebars at 4 ft. 10¾ ins. (4 ft. 7½ ins. depth inside), and taking this as the standard for the largest size, it involves only a simple arithmetical problem to find what should be the height of an 8- or 10-ton wagon, as, all other dimensions being the same, the capacity will vary as the depth of the body measured inside from the level of the flooring, which is 2½ ins. thick.

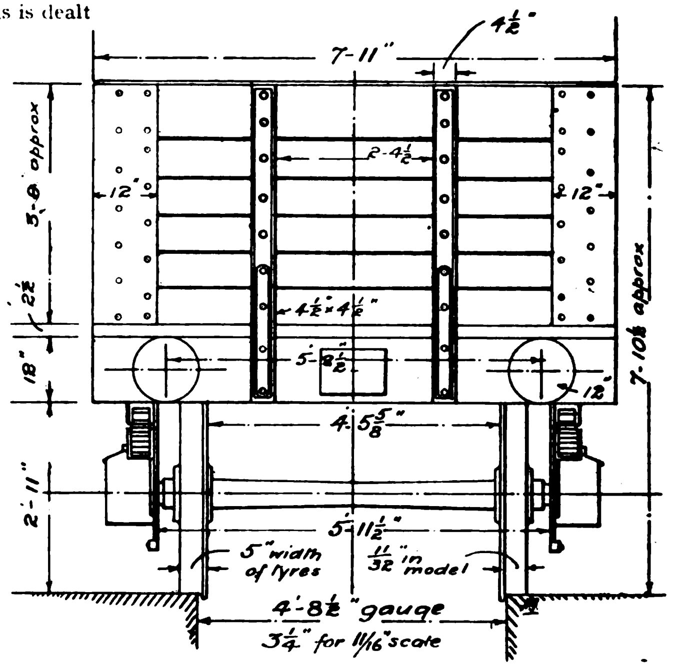


Fig. 2.—End View of 10-ton Standard Private Owners' Open Railway Wagon.

For instance, if the 12-ton wagon is 4 ft. 7 ins. high inside, then the 10-ton should be $\frac{10}{12}$ of 4 ft. 7½ ins. $= \frac{10}{12} \times 55 = 45\frac{3}{4}$ ins. = 3 ft. 9¾ ins.; and the 8-ton wagon $\frac{8}{12}$ of 55 ins. $= 36\frac{2}{3}$ ins. Of course, the engineers do not bother about the odd fractions; truck construction is more or less a strong, rough class of work, and the sides being built up of standard widths of plank—7 ins. or 9 ins.,* as the case may be

* These are nominal sizes only. On the R.C.H. drawings a 7-in. board is dimensioned 6⅞ ins. wide.

—the actual capacity may vary a little, according to the width and number of planks the engineer finds it most convenient to use. This being the case, the sides of a 10-ton truck may be made up of five 7-in. boards and one 9 ins. or 11 ins. wide at the top (as shown in the accompanying drawings), making the total height 44 or 46 ins., instead of the theoretical 45¾ ins. The 8-ton wagon would be made up of five 7-in. boards, giving a height of 35 ins., which is a sufficiently close approximation to the 36¾ ins. required by the rule of proportionate capacity. In some instances (see photo, Fig. 7, page 61) I have noted the use of four 7-in. boards and one 9-in., giving a nominal height of 37 ins., and an actual height of 36½ ins.

We find also trucks with high or low bodies to suit the special requirements of owners. Of these I hope to provide particulars in the next article, and include several photographs herewith. Referring to the low-sided truck, as built by the Great Western Railway Company for carrying, say, any heavy iron goods of small bulk, the photograph (Fig. 6) really shows two low-sided trucks, with bodies respectively 21 ins. and 12 ins. high. General observation, however, will soon enable one to discover many odd types of trucks, which, if the general proportions of wagons are known, can be easily modelled accurately to scale by taking one or two dimensions. Supposing, for example, a model of the low-sided G.W.R. wagon shown in Fig. 6 is required; all that is required to be known in addition to the standard particulars is the height of the body and arrangement of corner-plates and other ironwork fixed to the body, the lettering, and the end battens which support the body (if such are used). If time permits, the length of the body and wheelbase may be checked and compared with the standard dimensions, as I did in the case of the G. W. R. wagon photographed, and found that they agreed exactly, viz., length, 15 ft.; wheelbase, 9 ft.; overhang at each end, 3 ft.

In building a model goods train the aim, I think, should be to obtain the greatest diversity of vehicles, and therefore unless there is any special reason to the contrary, no two vehicles should be made exactly alike, except in the matter of wheels, axle-guards, and other fittings, which are more or less universal in design. If this is done, a most pleasing effect will be obtained.

But to return to our subject. The drawings included herewith are intended to represent a 10-ton standard wagon, with wooden body and underframe. Standard wagons are also made with steel under-frames and wooden bodies, and all in iron or steel, the specifications of the R.C.H. covering the design of these types of vehicles.

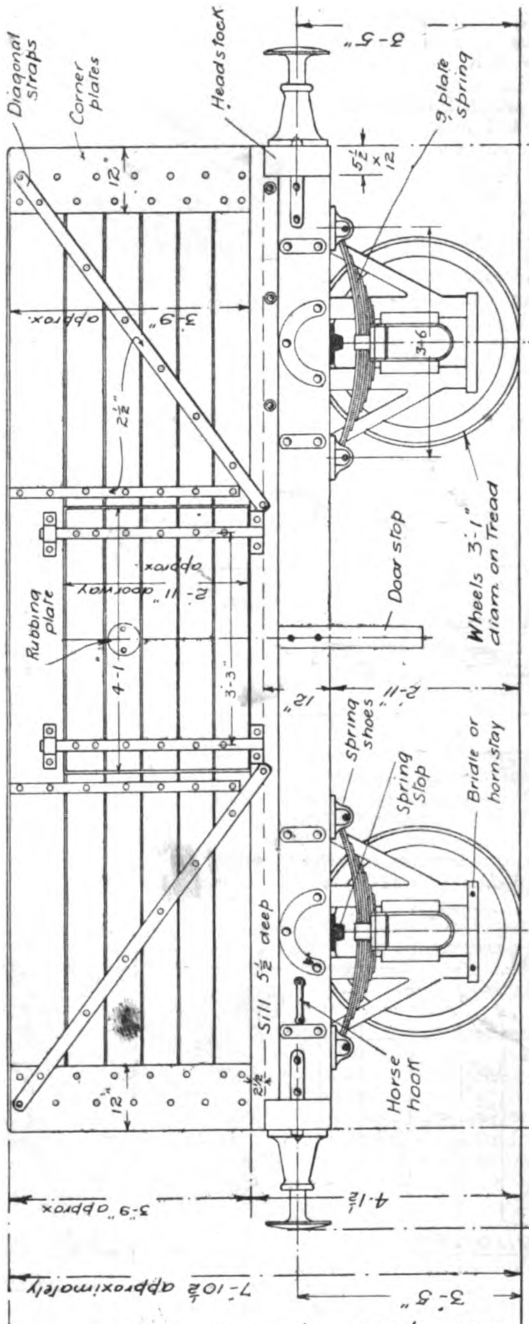


Fig. 1.—Elevation of Private Owners' Railway Wagon, with Wood Underframe and 10-ton Body.

(Half size for 11-16ths-in. scale 3½-in gauge model.)

For Plan, Fig 3.] [see page 62.

Many of the railway companies, notably the Midland, adhere very closely to the R.C.H. standards, and may be built up from the accompanying drawings and simply coloured and lettered with the particular railway company's initials. In building a model G.N.R. wagon, however, it must be noted that this Company have a 9-ton truck, and the L.N.W.R. Company make a speciality of a 7-ton truck—all of which I intend to describe in detail in later articles. This is another instance of the companies not doing what they advise others to do.

Another interesting point in the construction of goods trucks which should be observed by the makers of models is the arrangement of doors. Wagons are built with side doors only, others with trap doors in the bottom in addition. We may also observe a combination of side and end doors which is common to most coal wagons. There are also special arrangements of side doors, as shown

Fig. 6.—G.W.R. Low-sided Open Goods Wagon.

in the photograph (Fig. 8) of the "Haunchwood" 10-ton coal truck, and which will be described in detail later on.

With further reference to the use of washer-plates for the bolts which hold the W-irons or axle-guards to the solebars of private owners' wagons, the specifications require these only where a steel or iron flitchplate is not used to strengthen and protect the solebar, the dimensions of which must be 5 ins. by 12 ins. without the plate, against 4½ ins. by 12 ins. with it.

Another variable detail is the bearing springs. These arrangements may be adopted as follows:—

Five plates (4-in. by ⅝-in.)—for 8-, 10-, and 12-ton wagons.

Nine plates (4-in. by ½-in.)—for 8- and 10-ton wagons only.

Ten plates (4-in. by 1½-in.)—for 12-ton wagons only.

The model maker may therefore take his choice, and will no doubt adopt, where real laminated springs are to be used, as in models of ⅝-in. scale and over, the least possible number allowed.

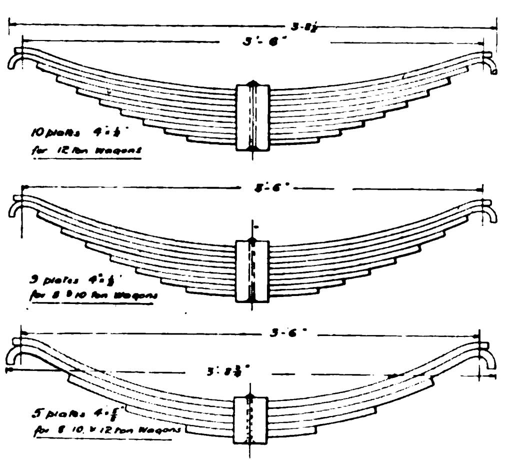


Fig. 5.—Bearing Springs for Private Owners' Wagons. (*Full size for 11-16ths-in. scale model.*)

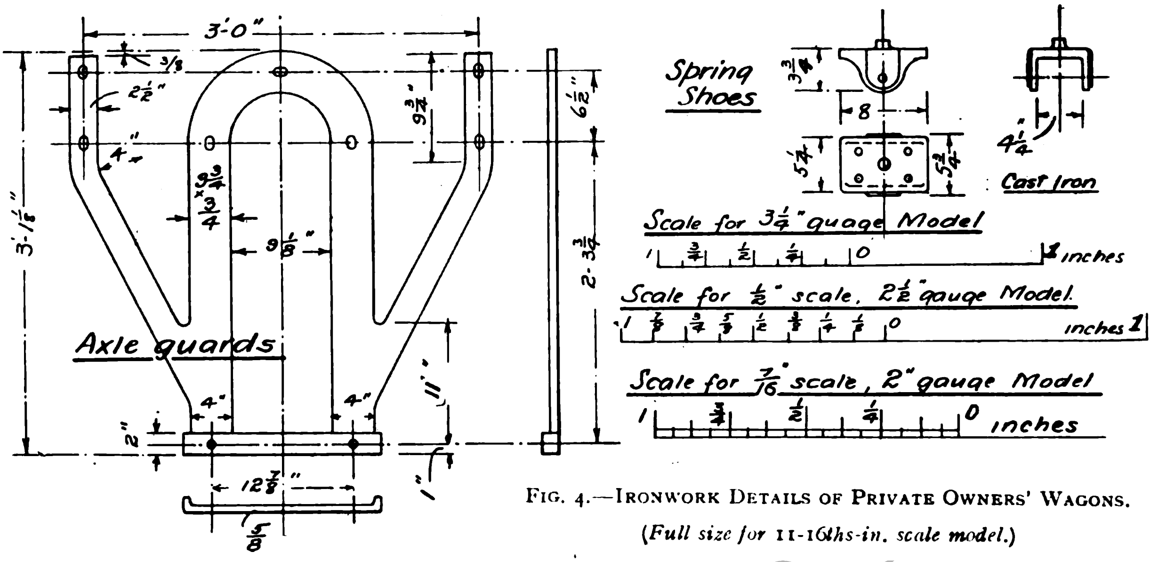


Fig. 4.—Ironwork Details of Private Owners' Wagons.

(*Full size for 11-16ths-in. scale model.*)

Where dummy springs are used and a spiral spring is artfully concealed in the buckle, then the best policy will be to employ the spring with greatest number of plates. The lengths of the springs for the 8- to 12-ton open wagons are standard, viz., 3 ft. 8½ ins. or 3 ft. 8¾ ins. over all, and 3 ft. 6 ins. over bearing points. They rest on the top of the axle-boxes and take a bearing in castings or stampings called spring shoes. To prevent accidents, should the vehicles be overloaded, spring stops which are either made of cast iron or pressed steel —or wood, in the case of older wagons—are fixed to the under-sides of the solebar just over the spring buckle.

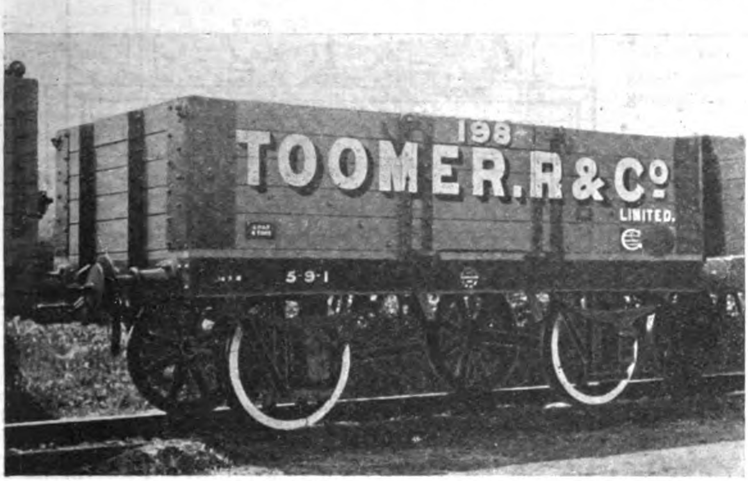


FIG. 7.—PRIVATE OWNERS' WAGON, WITH STANDARD 8-TON BODY.
(Steel under-frame; height of body inside, 3 ft. 0½ in.)

FIG. 8.—HIGH-SIDED 10-TON PRIVATE WAGON, WITH TOP FLAP OVER DOOR.
(Note extra large capacity: Height of side, 3 ft. 11 ins.; length of body, 15 ft. 11 ins.)

(To be continued.)

The Insulation of Spark Coils and other Electrical Apparatus.

By "ZODIAC."

OWING to the exceedingly high voltage to which the insulation of spark coils, Tesla coils, etc., is subjected, careful insulation is absolutely essential, and nothing can be more disheartening to the amateur than the laborious unwinding of a spark coil that has proved a failure owing to defective or wrongly applied insulation. In this article it is proposed to deal with the various insulation materials and point out their properties and the care that must be taken to avoid spoiling their insulating qualities. Quite recently the writer had an 8-in. coil submitted to him by a reader, in which the defect was clearly due to the paraffin wax having been overheated and ruined during the winding; while a Wimshurst machine with ebonite plates failed, due to the employment of a black varnish in which lead driers had been employed.

Insulation Resistance and Dielectric Strength.—All insulators are in reality very poor conductors, that is to say their specific resistance is enormous as compared with that of, say, copper or silver. For instance, the specific resistance of shellac is several billion times as great as that of silver. But specific resistance must not be confused with dielectric strength. For example, air has a very high specific resistance indeed, but not very much dielectric strength, being easily broken down by a spark. On the other hand, glass has a large dielectric strength, but not nearly as high a specific resistance as air. The *specific resistance* determines the amount of current (negligibly small, of course, in the case of a good insulator) that can flow through the insulator and thus leak away, while the *dielectric strength* is the ability of the material to stand the mechanical and electrical stresses due to the voltages to which it is subjected. Then we have *surface leakage*, owing to which the current leaks over the surface of the insulator without passing through the material. Paraffin wax has a larger surface insulation than glass, but not so high a specific resistance as good crystal glass. Hence the reason for coating Leyden jars, etc., with paraffin wax or with shellac varnish. Placing the materials in the order of their specific resistances, we get: dry air, crystal glass, paraffin wax, ebonite, shellac, gutta percha, and mica. As regards dielectric strength, however, as seen from Fig. 1, mica easily stands first, while air is the worst of all. Hence the importance in spark coil construction of filling in the spaces between the windings with wax and excluding air as far as possible.

Sparking Distance in Air.—Different experimenters give varying results for the dielectric strength of air due probably to variations as regards shape of electrodes, etc. The American Institute tests, using sharp needle points and sine wave alternating current, are given below :—

Spark Length in mm.	Disruptive Voltage.
5·7	5,000
25·4 (= 1·0 in., ...	20,000
62·2	40,000
180 (= 7·1 in.)	80,000
301	120,000
380 (=15 ins.)	150,000

A. Siemens, using a point and plane with alternating current, obtained the values 10,000 volts for 5·78 mm. (·228 in.) and 25,000 volts for 22 mm. (·866 in.).

Sir W. Preece states that a voltage of 300 to 400 volts is necessary to start a spark in air at all, however short the spark gap may be. Once a spark has passed, it is easier for a second to follow ; the first spark probably produces chemical dissociations in its path which do not instantly pass away. The arrangement of the coil electrodes so that the spark gap cannot be increased (as recently advised by a writer in THE MODEL ENGINEER) beyond the limit of the coil's capacity, is a very great safeguard against breakdown. A perfect vacuum has infinite dielectric strength, no spark can cross it. Increase of air pressure also raises the resistance to the passage of a spark. Cailletet compressed dry air to 40 or 50 atmospheres (about 700 lbs. per sq. in.), and was unable to spark across a 0·05 cm. gap (0·0196 in., or approximately 1-64th in.) although using a very powerful induction coil.

A Wimshurst machine, when enclosed and worked in compressed air at even low pressures of 15 to 20 lbs. per square inch, will give nearly double the length of spark that it will yield when worked in the open, the sparking balls being of course brought outside the case.

Fig. 1 shows the dielectric strength of various materials, the voltages being the maximum values. From this curve it is evident that mica easily stands first, while paraffined paper (*i.e.*, paraffin waxed) comes very near to it.

Steinmetz gives the following disruptive or dielectric strengths for various materials at a thickness of 0·05 m.m. :—

Material.	Disruptive Strength in Max. Volts per Mm.	Remarks.
Air	1,670	
Mica ..	320,000	
Vulcanised fibre ..	5,200	(red) slightly damp
Dry wood fibre ..	13,000	
Paraffined paper ..	33,900	
Melted paraffin ..	8,100	65° C.
Boiled linseed oil	8,000	21° C.
Turpentine oil ..	6,400	

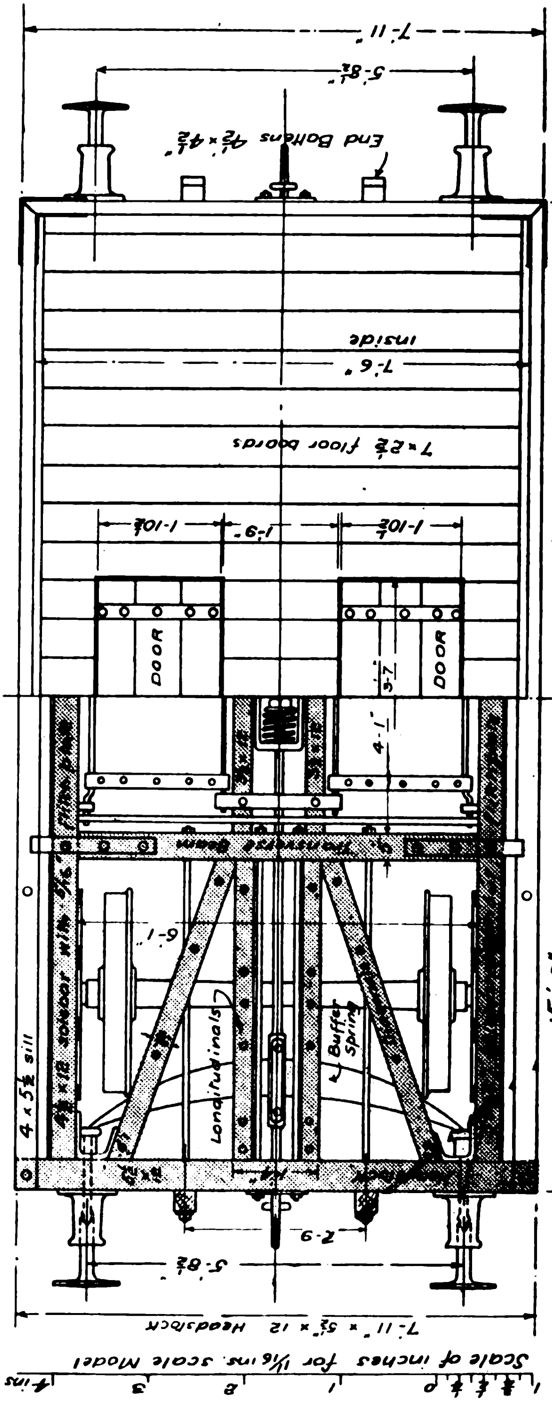


FIG. 3.—PLAN OF 8-, 10-, AND 12-TON PRIVATE OWNERS' WAGONS, WITH WOODEN BODY AND UNDER-FRAME
[For description see page 58.]

Copal varnish ..	3,000	
Ebonite (1 mm. thick)	53,000	(T. Gray's result)

The striking distance depends upon the maximum potential, and is therefore approximately the same for an alternating voltage (R.M.S. or effective or virtual value, see article on "Model Alternators," in THE MODEL ENGINEER, 1905) as it is for a continuous voltage 1·41 times as great. This is, however, not strictly true in the case of solid insulation, due to the fact that an alternating current heats up the insulation. White glass, for instance, 0·3 mm. thick, will resist 20,000 to 25,000 volts D.C. pressure, and is only pierced when subjected to an oscillating condenser discharge. Professor Elihu Thomson found that oil is not so good an insulator for low as for high frequencies, hence the success of oil as an insulator for Telsa coils. With 100 cycles one-third the thickness of air was found to withstand the voltage, while with 50,000 to 100,000 cycles from 1-20th to 1-60th was a sufficient barrier.

Thickness of Dielectric.—The breakdown strength

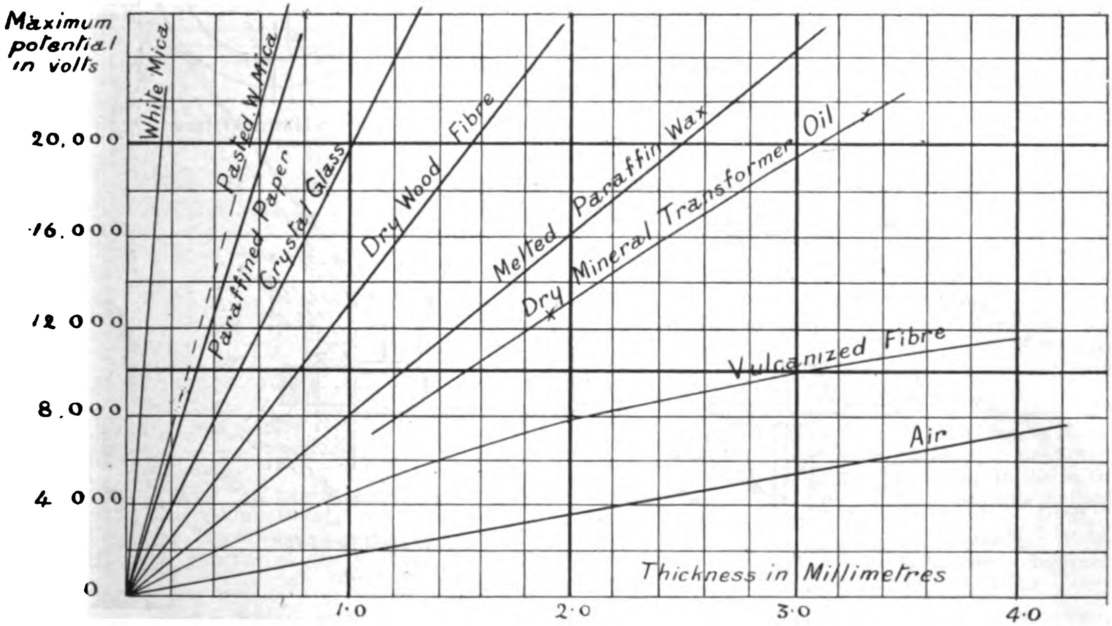


FIG. 1.—DISRUPTIVE STRENGTH OF VARIOUS INSULATING MATERIALS.

per unit of thickness is generally (but not always) greater as the thickness of insulation is decreased. An infinitely small thickness of some insulators may thus have a very high disruptive strength per mm. The disruptive strength of melted paraffin, paraffined paper, dry air for thicknesses exceeding 10 mm., and mica for thicknesses exceeding about ·75 mm., obeys a straight line law, *i.e.*, the disruptive strength varies directly as the thickness.

It is therefore evident that a coil wound in, say, 40 sections, will be much better insulated than one wound in 20 sections with double the insulation between each section.

Specific Inductive Capacity.—For a given condenser (with fixed size of plates and distance apart), the capacity is dependent upon the nature of the dielectric between the plates, *i.e.*, proportional to the specific inductive capacity of the dielectric. It will be presently shown that this inductive capacity has a very important bearing on the insulation question. The specific inductive capacity of the various insulators is given below:—

Dry air	1
Glass	6 to 10
Solid paraffin wax ..	2·29 to 1·97
Paraffin oil	1·92
Shellac	2·95 to 3·15
Ebonite	2·21 to 3·15
Mica	5 to 6·64
Sulphur	3·97
Petroleum oil	2·03 to 2·07
Turpentine (commercial)	2·16 to 2·23
Resin	2·55
Gutta percha	3·84
Pitch	1·8
Ozokerit oil	2·16

From the above the advantage of glass as a condenser dielectric is obvious, and also the advantage of thoroughly excluding air by soaking a spark coil condenser in melted paraffin as recommended in Hare's book on coil construction, its capacity being by this means nearly doubled. Immersion in oil would, of course, have a similar effect.

(To be continued.)

THE earliest known hot-water heating is curiously traced to Greenland, says *Science and Art of Mining*, where the strangely forgotten colony of Norwegians had increased to 190 villages in the 14th century. A German author in 1516 mentions heating and cooking by water in pipes from a hot spring, the ruins of the colony being located in 1722.

Design for a Model Motor Fire Engine.

By FRANK FINCH.

(*Continued from page 308, Vol. XVIII*)

STEERING GEAR.

HAVING dealt with the wheels in the last article, it is as well now to describe in detail the parts which are required for the steering gear and front axle, seeing they are so closely associated with each other. A full-size drawing of each separate limb is given, and the construction of the gear is so simple that it should not prove a difficult task to fit the respective limbs. The front axle is a steel forging with bifurcated ends (Fig. 12). Into either end is fitted respectively a right gun-metal casting as shown in Fig. 13,

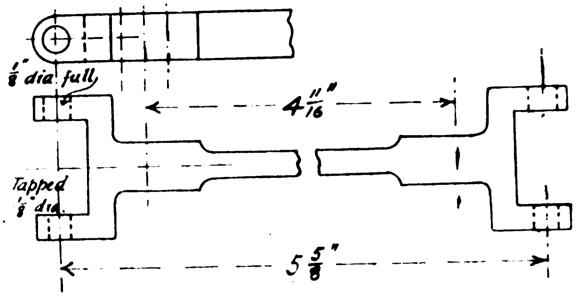


FIG. 12.—FRONT AXLE

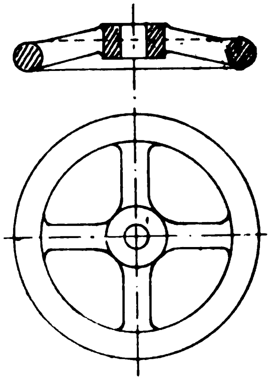
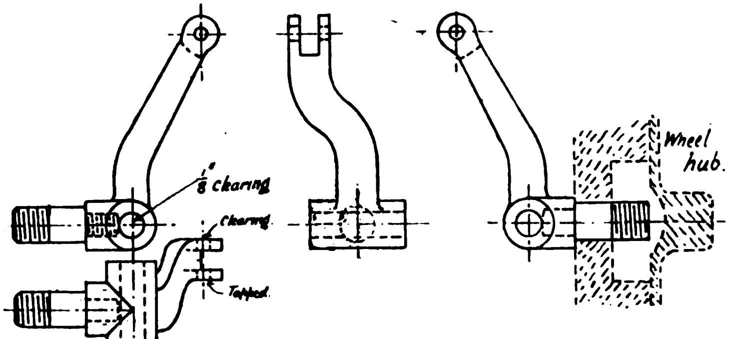


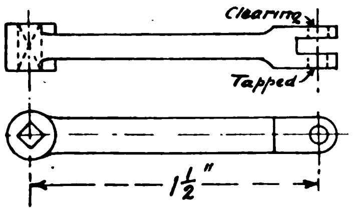
FIG. 18.—HAND WHEEL.



One left hand thus. *One right hand thus.*

FIG. 13.—GUN-METAL CASTING. (*Full size.*)

FIG. 15. (*Full size.*)



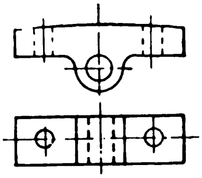


FIG. 17. GUN-METAL BEARING FOR STEERING ROD. (*Full size.*)

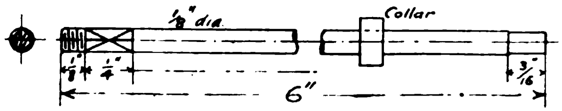


FIG. 14. (*Full size.*)

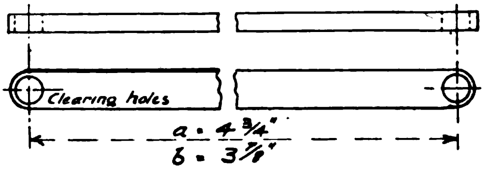
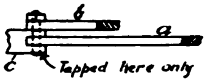


FIG. 16.—MAIN STEERING ROD.

DETAILS OF PARTS FOR MODEL MOTOR FIRE ENGINE.

and at *c* in Fig. 19; into the main bars a steel stud is screwed, upon which the front wheels revolve. The end of the arm in both cases is bifurcated, the lower lip being tapped for a small screw, whilst the upper lip has a hole to clear the screw. The rod for connecting the right and left arms and thereby actuating the opposite wheel is a plain steel bar as shown in Fig. 14, and at *a* in Fig. 19. Each end is inserted into the end of the curved arm and kept in position by a setscrew which fits loosely through the top lip and connecting-rod, and screws into the lower lip of arm. The fitting *d* is shown in detail at Fig. 15, and as will be seen, has one end bifurcated, and at the opposite end a boss with a square hole, in order to securely hold the steering rod. Connection is made between *d*, *c* and *a* by a plain strip *b* (Fig. 14), having a clearing hole in each end. The main steering rod (Fig. 16) is held by two gun-metal bearings shown in detail (Fig. 17). The position of the steering angle is retained by a small screw in the upper bearing, as shown in the coloured general arrangement drawing (see issue for January 4th, 1908). The hand-wheel (Fig. 18) to be fixed to the top of steering rod needs no description. It may be possible to secure a suitable wheel from the "scrap" box. A perspective sketch (not to scale) is given in Fig. 20 in order to make the arrangement more easily understood.



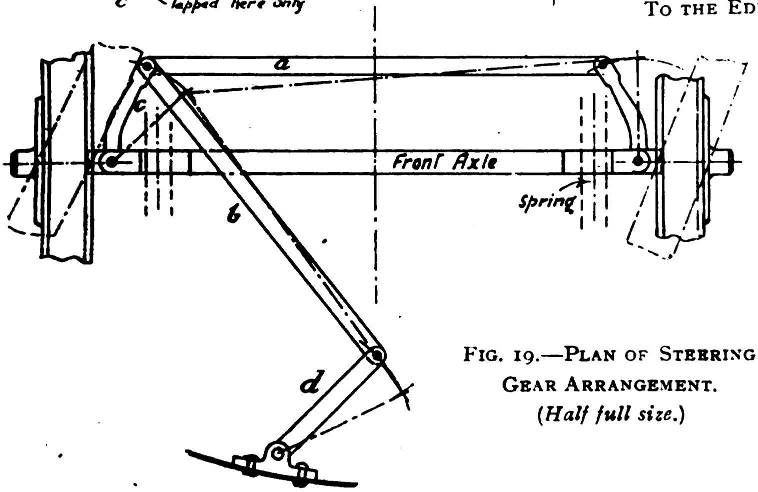


Fig. 19.—Plan of Steering Gear Arrangement. (*Half full size.*)

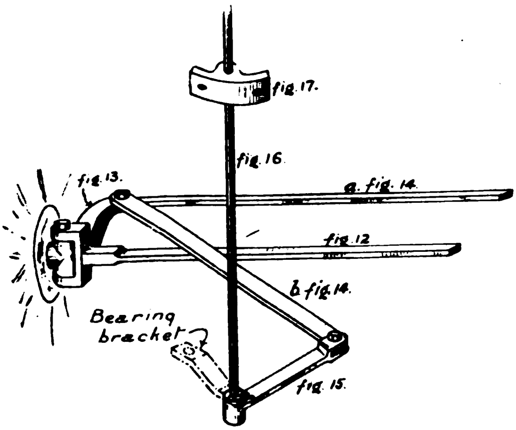


Fig. 20.—Perspective Sketch of Portion of Steering Gear. (*Not to scale.*)

(*To be continued.*)

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.*]

Model Screw Propellers.

To the Editor of *The Model Engineer.*

Dear Sir,—I was glad to see Mr. Arkell's expression of opinion anent above in your June 4th issue, and heartily re-echo his wish that more readers would open their hearts on the subject of screw propulsion.

But "there's the rub," and my case. How can they contribute their quota to progress if they follow the hit-and-miss methods advocated in twisting sheet-metal blades?

If inverse dies of hardwood are carefully swept up beforehand to likely data for the bending of the blades in the first case for a new propeller, and subsequently altered to the acquired likelier data for increased speed, then I grant that a sheet-metal screw would be the better job, as a job, owing to the metal being thinner than it could be cast, but this method is not so direct or interesting.

Simply bending by guesswork may be tricky sport, but it is not educative to the individual, nor does it add to the collective sum of our scanty knowledge of basic principles.

After two or twenty misses one hit may be judged to have been attained, but how is one to be sure that finality in efficiency has been reached, or profit by his labours leading up to it, if he has no data to go upon.

He cannot be confident he has got the most efficient screw for that individual boat, and may be afraid to alter further without a guide in direction in case he cannot go back on his tracks.

The nearer one gets to efficiency the less alteration is required, and therein lies the fascination, likewise the instruction and experience to be gained, by making cast screws according to the methods shown. They would furnish the experimental experiences and data whereby one could progress in every subsequent effort, and, not only that, but what is very important from a collectively scientific standpoint is that they would enable the student to report progress, and how it was gained, for the benefit of fellow-readers. I am convinced that The Model Engineer and its steamer builders could become a power in this connection.

The costly tank experiments conducted in the foremost shipbuilding yards have justified themselves by the data gained, but naturally (from a commercial standpoint) each keeps its own stages of advance secret. Of course, the value of model experiments is somewhat discounted by the failure of water to act to scale, but an approximate scale of dimensional difference is slowly being established.

In answer to Mr. Arkell, as to radial dissipation of power, I may say that my blade prevents this in a marked degree, and this conservation of energy sternward is brought about (as it was intended it should be) by the long continued *radial* leading edge ending in a comparatively small rounding-off into radius of propeller.

As for comparing the thrust with built-up screws—apart from what I have already said—I should like to; only, like the "feller" in Mark Twain's master-piece, "I ain't got no frog." the smallest pattern I have of this type up to present stage of experiments being 7 ins. diameter. I intend shortly, however, beginning experiments in a far more satisfactory manner.

My plan is to pit twin screws against one another, each screw being of alternatively progressive design, elaborate data being taken from each performance all the while. These will be fitted to a small boat and driven by foot power (a *positively* constant power at *any* speed) on an even keel without rudder. The better screw will then describe its own engineering curve of efficiency *on* the water, not in it, as the boat will be built on the hydroplane principle, to differential scale from a small model I have been experimenting with under sail.

Just here, Sir, will you allow me to express my profound admiration for the masterly articles of Mr. Blaney on this subject. I look to them to give a great fillip to endeavour and discovery in a comparatively new direction. What a tremendous lot has to be found out yet about the action of *screw* propellers, water, and the forms of vessels.

In spite of what has been said to the contrary, I think it possible, given time and collective experience, to reduce the seeming vagaries of the screw propeller to formulæ; but it is my humble opinion that the increasing knowledge that would lead to this, will, long before it is reached, lead to its abandonment in favour of some other mode, combined with form of ship, that will convey more of the power generated by motors to propulsion.

It is with this object in view that I intend experimenting to obtain the maximum speed with screws. Then I shall apply a new medium of power conveyance to the same boat, which, I think, will beat its screw record. Anything I find out worthy of note in the course of screw trials I shall be glad, with our good Editor's permission, to communicate to the readers of The Model Engineer.

Just as I write my copy has come to hand containing the "Practical Letter" from Mr. Murphy, and he will see that his criticisms are covered by what I have already said. I was simply fascinated however, by the latter part of his letter, and I am convinced from what he says and what I already know, that he is on the right track towards the elucidation of the mysteries surrounding the action of *screw* propellers, and I trust he will develop his discovery with all speed.

It is a recondite subject, and when engineers begin to discuss it—

They argue right,
They argue left,
They argue round about;

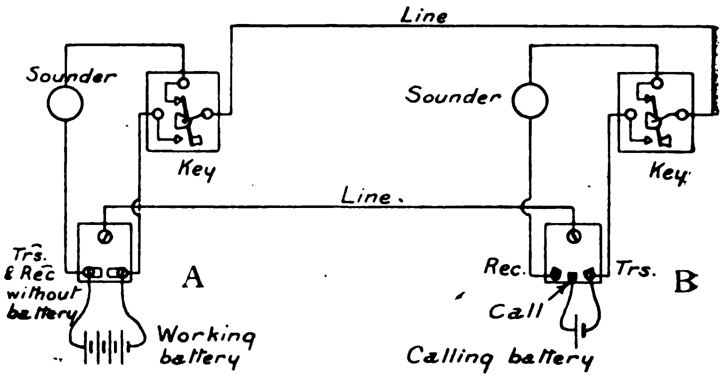
but they never seem to argue "forrard." Let us *go* "forrard."—Yours truly,

T. D. Garscadden

Telegraph Connections.

To the Editor of *The Model Engineer*.

Dear Sir,—As most readers will know, a battery is required at each station on a telegraph installation. One of these batteries can be dispensed with by using three wires between the two stations, but this is not always convenient. In a telegraph installation I have recently made and fitted, it was desirable that one of the stations should have no battery, owing to space required, fumes, etc., and also it was inconvenient to use three wires between the two stations. The diagram of connections shows how I arranged this. As it is impossible to dispense with a battery altogether, I placed a small pocket-lamp battery in a small polished case, which only occupies a space of 3¾ ins. by 3 ins. by 1 in. This battery is of no use for working, as it would soon become exhausted; but the object being for "calling" purposes, there is a switch at both stations. At station A, the station which supplies all the current for working purposes, the switch has two positions—"Send" and "Receive." The "Send" contact is also "Receive without Battery," and the switch arm must be left on this contact when not working. At station B, the switch has three contacts—"Receive," "Call," and "Send," and the switch arm being left on "Receive" when not working.



Telegraph Connections.

When station A wishes to call B, he calls in the usual manner, it being unnecessary for him to move his switch, as it is already on "Send," using the working battery for this. He then places his switch to "Receive." Station B will then put his switch to "Send" and acknowledge, and communication will be carried on in the usual "Switch" system of working.

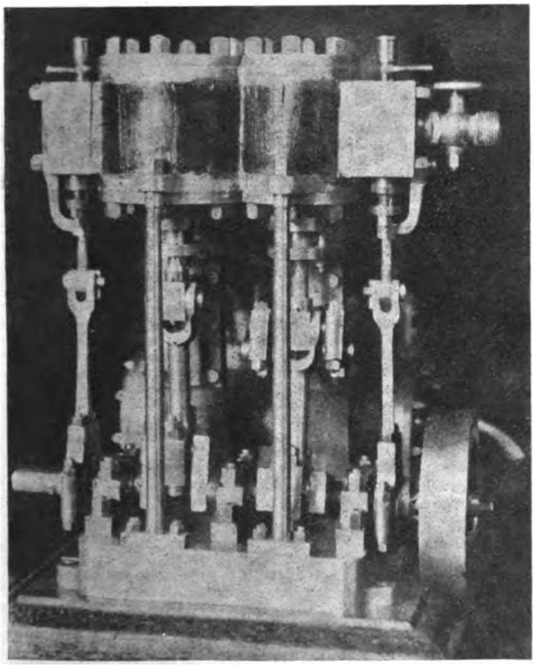
When station B wishes to call A, he places his switch on "Call," and calls, using the calling battery, replacing switch to "Receive" for acknowledgement. When the call has been acknowledged, communication is carried on by means of the "Send" and "Receive" contacts, no notice then being taken of the "Calling" contact.

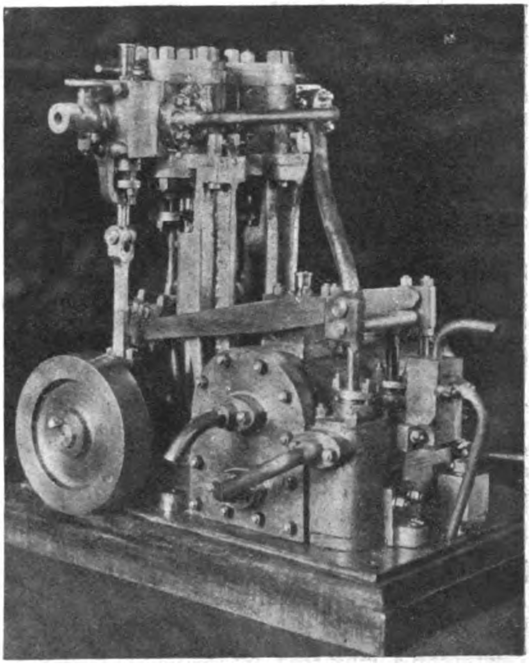
No doubt at first sight there seems to be many disadvantages to this arrangement, but when the "system" has been got hold of, it is surprising how simple it is to manipulate. Hoping this will be of some use to the readers of THE MODEL ENGINEER, —I remain, yours truly, A. H. JOHNSON.

A Compound Surface Condensing Engine.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Here is my third attempt at model-making: a compound surface condensing engine. Bore of cylinders—H.-P. $\frac{7}{8}$ in., L.-P., $1\frac{1}{4}$ ins.; stroke, 1 in. The condenser has twenty tubes of 3-16ths-in. brass piping, 3 ins. long. The circulating pump, air pump, and feed pump have a common stroke of $\frac{3}{8}$ in., and all three work off the H.-P. crosshead, and I might add that they work splendidly. The circulating pump puts a bucket of water through the condenser in a very few minutes. The hot-well has a small auxiliary overflow. The engine has been working several hours at 60 lbs. pressure at a very high speed, so much so that a hum was all that was heard, and a blurr all that was seen of it. Every part is made very strong with plenty of metal for wear, and looks much better in reality than appears from the photographs. I made my own patterns and all nuts and bolts.—Yours truly, T. LEIGH.





TWO VIEWS OF A COMPOUND SURFACE CONDENSING ENGINE.

Electric Light Plant.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—*Re* Mr. Wood's small electric light plant. I have read with much interest Mr. H. Wood's description of the above in your recent issue, but feel I should like to call his attention to the disastrous effect of filling his boiler as he states, viz., "The boiler can be filled with water very rapidly by this pipe in the following manner: I let the steam out of the boiler when I have ceased running and close all outlets. When the boiler has cooled, the resulting vacuum draws in sufficient water for the next run."

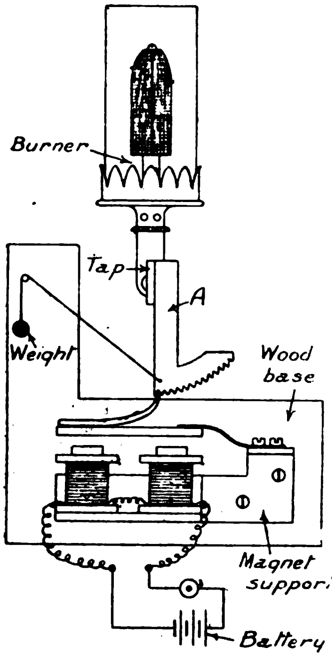
This may be a very quick and simple method of filling his boiler, but it is very injurious to it; of course, it greatly depends upon how much water is left in when he cools down, and in the single-flue boiler there is not so much harm in the contraction of the plates. But in a multitubular boiler this violent cooling down and subsequent contraction of plates and tubes would cause the latter to "blow," and, in fact, would be fatal to any boiler. At any rate, I should be sorry to subject any boiler of mine to such severe treatment.—Yours faithfully, ERNEST G. NORTON.

Cambridge.

Apparatus for Turning Off Gas.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Enclosed is a design for an apparatus for turning off the gas I am about to make. It is taken from a design and description by T. A. C. Treston, published in THE MODEL ENGINEER October 18th, 1906, the chief difference being the lever A, which is curved and has a number of nitches, as shown. This allows one to regulate the gas, which is very necessary with an incandescent burner. The working can be seen from the drawing (not to scale). My gas fixture is very awkward, as the tap is just below the burner, so I have to arrange magnets under tap to be out of the way. The magnets are ordinary bell magnets, lever A



An Electrically-operated Gas Burner.

made from zinc or brass, weight attached by thin string passes first over hook then to lever which draws it to horizontal position when released by magnet. Hoping you can find space for this in your valuable and interesting paper,—Yours truly,

J. B.

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of The Model Engineer *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.]*

London.

On Saturday, June 27th, the annual social outing of the members and their friends was held, in the shape of a launch trip down the Thames. Enjoyable as these outings have always been the present one quite eclipsed all previous records, the weather being perfect, the river scenery at its best, and the locks not so crowded as to cause tedious delays. The route from Reading to Windsor embraces 30 miles of the most picturesque portions of the river, including Henley, where preparations for the next week's regatta were nearly completed, and several of the rival crews were seen at practice; Marlow, Quarry, and Clievedon Woods. The party left Paddington at 1.45, the train running to Reading without a stop in 43 minutes, the launch *Empress of India* leaving at 3, and Windsor being reached at 9.45. An excellent impromptu concert was given on board, and that indispensable adjunct, the refreshment department, was, as always, managed in first-class style. On reaching Windsor Station for the return to town, the thanks of all present were returned to the Committee for the most enjoyable trip yet held, and the wish expressed that another trip over the same route might be made next year.

The annual all-day excursion will be made on Thursday, July 23rd, to Bedford, to inspect the works of Messrs. W. H. Allen, Son & Co., Ltd., leaving St. Pancras by the 10·6 a.m. train. Price of tickets, including luncheon, 7s. 1d. Last day for joining party, July 18th.

The next indoor meeting will be held at the Cripplegate Institute on Wednesday, August 26th, and will be made a special locomotive night, prizes being awarded to those models running most successfully.—Herbert G. Riddle, Secretary, 37, Minard Road, Hither Green, S.E.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* The Model Engineer, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[20,042] **Large-headed Electric Fan.** W. C. (Southport) writes: I wish to make an electric fan motor, and shall be obliged if you can give me advice. The usual small 8-in. or 9-in. fans, running at a high rate of speed, are objectionable in several respects. They give a too narrow and too concentrated current of air, and the result of sitting for any length of time in this is frequently a crick in the neck, or sometimes something more serious. I should prefer, therefore, to use a larger fan, say 18 ins. or 20 ins., geared down from the motor, and run at a considerably lower speed than is usual for the small fans. Could you advise me on the following points—(1) Type and size of motor. (2) Best kind of battery, with size and number of cells. Economy is desirable. (3) Kind of gearing. I have thought of a simple pulley drive, as it would simplify experiments on different speeds, and would also enable the fan to be mounted on standards well above the motor, so that the latter would not interfere with the supply of air to the back of the fan. (4) Design of fan blades. I propose to use a four-bladed fan.

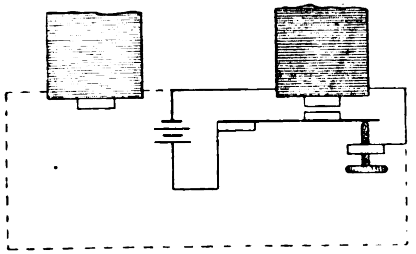
(1) We should advise a motor of about ⅛ h.-p. You will find full details of motor to give this output in our handbooks, "Small Dynamos and Motors" and "Small Electric Motors." (2) You would need about 100—150 watts to drive it. Thus, a battery giving, say 50 volts 3 amps. would be required. For a 20-hour run the battery must have a capacity of 70 amp.-hours. (3) A gut or leather band would probably be best to use for the purpose. Be careful to have it sufficiently tight. (4) We do not think you can improve upon the ordinary propeller type of blade.

[19,622] **Buckled Accumulator Plates.** F. W. N. (Ilford) writes: Can you oblige me with replies to the following brief questions? How can I straighten buckled positive accumulator plates, which have been bent considerably? I enclose portion

of one which shows that when bent back to its position the grid breaks, although the negatives from the same cell bend quite easily. Does the charging, etc., make the positive lead of such a brittle nature? Is the sulphuric acid at 2d. per lb. suitable for accumulators, or must the pure acid—at 5d. in their list—be used?

Once the plates are buckled it is always a risky job to attempt to straighten them again; especially is this the case with pasted plates. If they are badly bent, the only thing you can do is to replace them with new ones, if they crack when straightening. We should prefer to use the pure acid.

[20,073] **Two Induction Coils with One Trembler.** W. D. (Holloway) writes: I have made a double induction coil for a two-cylinder motor cycle from instructions given in THE MODEL ENGINEER handbook, and should be obliged if you will inform me how to work the two coils with one trembler.



QUERY Nº 20073

Connect a trembler to one coil in the ordinary way, trembler and battery being in series with the primary coil. Then connect the primary of second coil also in series with the trembler and battery, thus putting the two primary coils in parallel. The above diagram will make connections clear.

[19,627] **Replenishing Leclanche Cells.** R. H. (Edmonton) writes: In recharging Leclanché cells, is it advisable to put fresh water in, or should more sal-ammoniac be added to the old water?

As a rule the water has to be replenished from time to time, especially in some situations where it evaporates rather quickly. So long as there are a few crystals of sal-ammoniac in the jar no more need be added, but only the water kept up to its usual level. We prefer a solution which is not quite saturated, but by using a saturated solution you can always tell when the solution is getting weak by the disappearance of the few extra crystals, which will not dissolve when you have a saturated solution.

[19,609] **Working Tesla Coil from Wimshurst Machine; High-frequency Apparatus.** H. T. (Hampstead) writes: Would you kindly oblige by answering the following queries? I cannot find the desired information in any text-book on the subject. (1) Could a Tesla coil, such as that described in your issue of March 26th, be worked from a Wimshurst machine; and, if so, how much larger would the coil have to be to work from a 3½-in. spark Wimshurst, and what length spark might be expected? (2) Does such a coil give results similar to a D'Arsonval high-frequency apparatus? (3) What is the function of the small spark-gap described in the article in question? Is not the discharge from the ordinary Rhumkorff coil sufficiently intermittent without it? (4) Does the efficiency of the Tesla coil increase with the size of the condenser, or must the correct size be found by experiment? (5) In the coil described is not the distance between the primary and secondary coils excessive, and could not the length of the primary be increased with much advantage?

(1) Such a Tesla as you mention could be worked from a Wimshurst machine, but unless the machine has very large plates and generates very rapidly, the sparks will be far apart and the effects obtained from the Tesla will be far less striking than they are with a rapidly working coil. The jar will not discharge until fully charged and raised to the right potential difference, and unless the output is very considerable, the charging takes some time. We would not advise you to use a larger Tesla coil than the one in question. (2) The secondary discharge is similar to the current from a D'Arsonval high-frequency apparatus in that both are very high frequency, but the voltage is usually higher and the current smaller from the Tesla secondary. (3) We would recommend you to read the first chapters of Mr. Howgrave-Graham's book on "Wireless Telegraphy." A thorough understanding of the action of the Tesla coil is essential, and you would do well to know the principles involved before constructing one. The small gap is most certainly necessary, and provides for the sudden discharge of the Leyden jar through the Tesla primary, in which natural electrical vibrations are set up. These may be so rapid as a million or more per second. (4) There is a wide latitude as to size of condenser, but the very best size should be found by experiment, if you desire to exercise any very unusual care in the matter. You could try one, two, or three jars, but need not trouble about finer adjustment of size, as no refinement of this sort is necessary. (5) We think that, considering the coil is so small and cannot give a very powerful secondary discharge, the secondary might advantageously be a little larger in diameter and the primary might be longer. The primary is so easy to re-wind and alter that you can easily make trials for finding out the best dimensions.

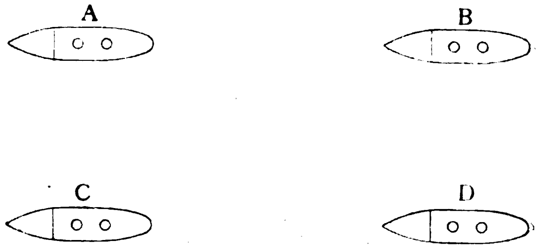
[19,849] **Scale Drawings in "Small Dynamos and Motors."** T. G. (Dover) writes: In your handbook, No. 10, page 24, it states that: "The smaller diagrams on pages 16 and 18 are to half the scale." I do not understand to which diagrams these refer. I have made a drawing of field-magnets in Fig. 11, to be of wrought iron, from the scale on page 23 to give 60 watts, and the sizes over all are—4 ins. high by 2½ ins. by 2½ ins. (without bobbins). Is this the correct size to give 60 watts, or should it be 8 ins. by 5 ins. by 5 ins.? Will this same pattern do to give 6 volts 10 amps.? Please give windings for same and any necessary alteration from the sketch in handbook.

What is meant by saying that drawings are to half scale is—that they are half the scale size when working from the scale given on page 23; therefore, the over-all sizes of your machine will be—8 ins. by 5 ins. by 5 ins. The windings for 6 volts 10 amps. would be the same weight of wire respectively, but using No. 17 for armature and No. 20 for field-magnets.

[19,596] **Pasting Accumulator Grids.** L. G. W. (London) writes: Please inform me how I could form negative plates for an accumulator. I have tried the method advised in your book on "Small Accumulators" (precipitated lead process), but I have not been successful. I should like to try some other process.

We are aware that considerable force is necessary to force the crystals into the lead grids, but once this is done you should have no further difficulty with the plates. However, if you still have trouble with this process, the only thing you can do is to use litharge and sulphuric acid to make a paste, and then paste the negative grids in the same manner as the positive. In this case, of course, the plates will have to be formed by repeated charging and discharging until the plates attain a fair capacity.

[19,903] **Tuning: Wireless Telegraphy.** M. J. D. (Liskeard, Cornwall) writes: Many thanks for reply to previous questions, and now I should be obliged if you would kindly give me some information on the following:—Suppose A, B, C and D to be ships fitted with wireless telegraph apparatus. A is speaking to B and C to D at the same time. If the waves circulate all round, B would receive the message from C as well as from A, and the operator would not know which was A's message and which was C's—in fact, it would produce confusion, as the letters would come in the wrong places to produce a word. I know this cannot be the case, but should like to know how it is prevented. A friend of mine said he heard that the instruments were tuned for this, but I do not see how that can be.



QUERY Nº 19903

Your friend was quite correct in saying that the interference is prevented by "tuning." The difficulty is to tune so sharply as to prevent the receiver from responding to powerful waves rather near when it is desired to receive other waves from a distance. In some systems tuning has been brought to great perfection. The transmitting and receiving aerials and circuits possess a very definite natural period of oscillation, and if they are carefully adjusted the latter will not easily respond to any frequency of wave but that which is the same as it would give itself if used for transmission. The action resembles that of a pair of tuning forks, one of which responds to the other only when their natural pitch is identical.

[19,935] **A Simple Revolution Indicator.** F. B. (Barnsby) writes: I am asking a bit of a problem. I am making a model winding engine, 2 ins. by 1 in.; my drum is 1½ ins. diam. I should like to know how to gear indicator up off the crank-pin. What I want to know is, while the pointer on the indicator is going round once I want the engine drum to go round 40 times. I should like to know how to connect up, diameter and number of teeth in gear wheels, and number of wheels and how to fix. I am anxious to become a winding engineer at a colliery. My father has been one twenty-five years, but he won't tell how to get on; so I seek your advice on the subject. I am learning to be a fitter

at present but I cannot think of anything else but winding. What would be the first thing to do to get to my ambition? What is the wage for a start? What experience has one to have? What sort of a job is it, and what risk is there?

All you require to do is to fix up two toothed wheels, one on the engine shaft having a diameter of exactly 1-40th of the one driving the indicator pointer, thus the indicator will revolve once to every 40 revolutions of the engine. Instead of obtaining this reduction in one step, you could introduce a series of wheels which would give you the same reduction. As regards how to become a winding engineer, we can only suggest that you make personal enquiries of any of the managers or foremen at any likely colliery. We may say, however, there is not much in the job you are anxious to obtain, and you would probably find fitting and bench work, etc., much more remunerative. We advise you strongly to be advised by a man who has had practical experience of the work, such as you say your father has. As far as we know, the hours are very long and the pay very short.

[20,082] **Gas Engine Ignition.** E. Y. (Tavistock) writes: Will you please reply to the following queries? (1) Would dry batteries be as suitable as accumulators for stationary gas engine work? (2) If so, how many must I have and what size? (3) How long would they last? I have an accumulator at present, but as I only work engine now about once a fortnight, I find that voltage has got low, as it is an old cycle one. I thought that dry batteries, if suitable, would be cheaper, and not require charging.

(1) Dry batteries would probably be more suitable than an accumulator in your case. (2) The number of cells required depends upon the resistance of your coil and the current required. The voltage of any dry cell is about 1·5 volts, and the internal resistance varies with the size of cell—the larger the cell the lower its resistance. (3) This depends wholly on the quality of the cell you buy. There are many inferior makes on the market which would only give you an hour or two's work. But dry cells can be had of capacities up to about 50 ampere-hours. You could obtain particulars of capacities and prices from the makers.

[20,081] **Charging from Dry Cells.** N. C. (East Ham) writes: Would you please inform me if I can charge an accumulator of 2 amp.-hour capacity from B.C.C. dry cells? If I connected up four cells, each two in parallel, making a total capacity of about 96 amp.-hours at 3 volts (insert resistance to bring voltage down to 2½ to suit accumulator), would they be sufficient to charge the accumulator thirty-eight or forty times?

Yes, the E.C.C. cells will serve for charging your accumulators. For a 2 amp.-hour accumulator the charging current should not greatly exceed 1-5th amp. So put a resistance in circuit sufficient to pass a current of 1-5th amp. The current strength is all you need trouble about—the volts will take care of themselves. The four cells arranged as you suggest would charge the accumulator between thirty and forty times.

[20,080] **Winding of Dynamo.** R. B. (Ashton-under-Lyne) writes: I have a small dynamo, which, when it came into my hands, had one limb of the field-magnet casting broken off near the base. I have had the broken part set up in its place and fastened by two screws from underneath the base, so that it now shows only a very slight crack. The armature is a drum, 2½ ins. long by 1½ ins. diameter with four slots ¼ in. wide by ¼ in. deep. The fields are wound with 17½ ozs. of wire, of which the enclosed is a sample. (Please state what gauge.) I should like to know what quantity and gauge of wire to put on armature to balance fields, and give highest possible output. Could I get 30 watts at 10 volts 3 amps. out of it?

If the broken ends of your magnet casting make good contact the fracture will not considerably lower the efficiency of the machine. A small air-gap, however, between the ends would have a most detrimental effect. The sample of wire you send is No. 22. Wind the armature with 4½ ozs. No. 20. The machine should give nearly 40 watts at 10 volts 4 amps.

[20,083] **Wimshurst Machine.** W. T. A. (Cwmbran) writes: I should be grateful to you for a little advice on Wimshurst machines. I want to construct a twelve-plate machine suitable for radiography and wireless telegraphy experiments. I have looked up six volumes of The Model Engineer, but do not quite see what I want. In the issue of March 7th, 1907, is illustrated a machine made by Mr. A. Dean. I like the look of that machine, and though its construction is evidently expensive, it is much cheaper than building a useless machine. I hope I am not asking too much, but can you give me the design of the machine illustrated? Or, failing that particular machine, can you supply me with particulars of a suitable machine?

We regret we cannot furnish any further particulars of the machine you refer to. Our handbook, "The Wimshurst Machine: How to Make and Use It," price 7d. post free, would probably give you the information you require. We would also refer you to the issue of The Model Engineer for Nov. 17th, 1904, which contains details of a machine suited to your requirements.

[20,070] **Drop in Volts.** F. H. W. (Colwyn Bay) writes: How is it that when a voltmeter is connected in series with a 220-volt lamp, on a 220-volt circuit, it shows 215 volts—that is, only a drop of 5 volts? If this is correct, it points out that a resistance is of no use to cut the voltage down, which, of course, is absurd. The voltmeter is correct—have just had it tested.

No matter what you have connected between your 220-volt mains, the drop in volts is the same, viz., 220 volts. Now the drop in any one part of the circuit between the leads depends upon the proportion that the resistance of that part bears to the resistance of the whole circuit. It does not follow because a lamp is marked for 220 volts that the drop of voltage on the lamp must always be 220. That is only the case when the lamp is connected *alone* across the mains, and so receives its full current. When you connect a voltmeter in series with your lamp you have put in a resistance about forty-three times as great as that of the lamp. So the ratio of the drop in volts in the lamp to the drop in volts in the voltmeter will be the same as the ratio of 1 to 43, and there being 220 volts drop in all, it follows that drop in lamp will be 5 volts and drop in voltmeter 215 volts.

[20,041] **Accumulator Charging.** F. H. W. (Stourbridge) writes: We have a piano driven by electricity, supplied from a 12-volt 90 amp.-hour accumulator. As it is very inconvenient to carry and also expensive to charge, I should like to get a small dynamo and charge it myself. What size would I require, and how should I connect wires, etc.? Would a turbo-dynamo charge it; if so, would a 20-volt 4-amp. be too large, and how long would it have to remain on charge? Could I charge it with bichromate cells—if so, how many?

We do not advise bichromate cells for charging your accumulator, as this type of cell polarises after about an hour's use, and your accumulator should be charged for upwards of ten hours with 9 amps. at about 16 volts. You could use bichromates, however, by charging for about an hour at a time, allowing an interval between the charges. Try about ten large cells. Yes, a turbo-dynamo would do, but 20-volt 4-amp. size would not be large enough. You would want a machine of about 150 watts, say 15 volts 10 amps. The positive terminal of dynamo must be connected to positive terminal of the accumulator.

[19,673] **Lathe Headstock.** B. J. B. (Brighton) writes: I have a 3-in. centre lathe and on account of the bad design of mandrel it is impossible to do any faceplate work. I thought of making a new mandrel and should be glad if you could give me a rough sketch of same that would be more rigid. My present one is as shown in Fig. 1. As you will see by rough sketch, I have to press pulley wheel and mandrel together to fit tight in bearing and then screw up setscrew on pulley wheel. I should be much obliged if you can help me with above. I might mention that the thickness of lathe head makes it impossible to have a split bearing.

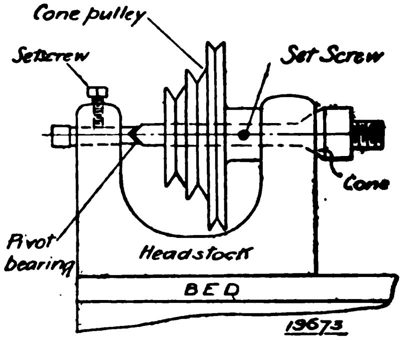
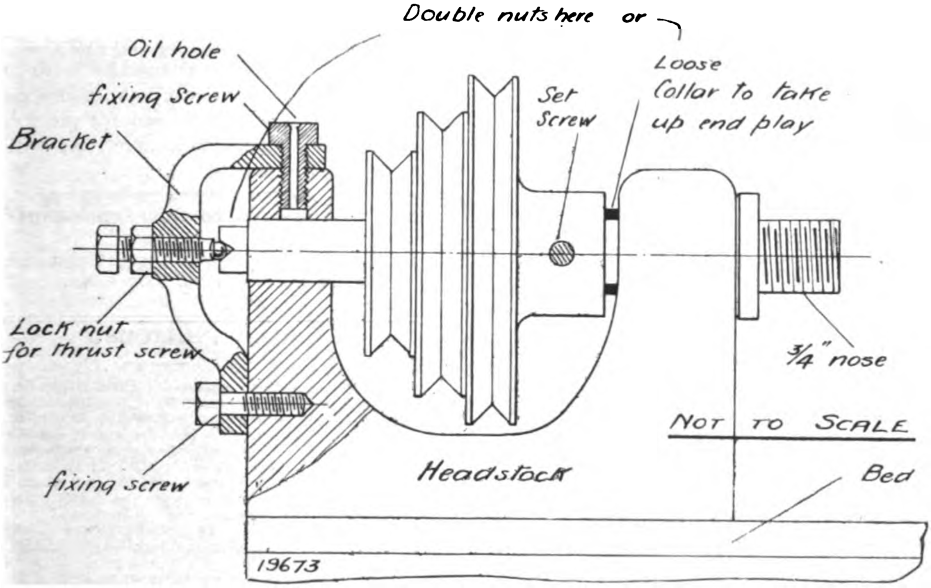


FIG. 1.—THE OLD HEADSTOCK.

You do not send quite sufficient information and drawings to enable us to re-design the headstock properly and in a way calculated to reduce the amount of work involved to the least possible We presume, however, that there are no lugs on the rear portion of the head to which a thrust bracket could be fixed in the usua manner, *i.e.*, horizontally. We suggest that you bore out the rear portion of the casting and make a new mandrel to fit the hole and the front cone. The end play can be adjusted by the cone pulley, and if this does not present a sufficiently good wearing face as it is, we recommend that a steel washer or collar be arranged to intervene. The actual adjustment may be made by loosening the setscrew on the cone pulley or by cutting a thread on the mandrel and screwing the collar to suit. The boss of the cone pulley would act as a locknut. Other approved methods are also possible. Double nuts behind the back limb can, of course, be used to take up end play instead of the collar on the front limb of the headstock. The thrust bracket may be placed vertically as shown, the hole in the top (for the present setscrew) being used for the uppermost fixing screw. This screw may be drilled to form an oil passage to the mandrel. A ball may be introduced to save hardening the point of the thrust screw, as indicated on the drawing. You must make certain that the two holes in the headstock are truly in line and that the coning is quite accurate.

[20,044] **Motor and Propeller for Boat.** W. F. H. (St. Columb) writes: I have a light boat, 15 ft. 6 ins. long and 4 ft. wide overall; 15 ft. by 3 ft. 7 ins. on the L.W.L. What speed ought a 1½ h.-p. Ixion two-stroke motor to drive this? Do you know this make of motor, and is it to be relied upon? The boat draws about 9½ to 10 ins. of water at the stern to the bottom of keel. What diameter propeller should I have, and what pitch?

A motor of 1½ h.-p. seems rather small for the size of your boat. We doubt whether you would get more than about 3 miles an hour. We have not had personal experience of the particular motor you name. The makers would no doubt supply particulars as to its capabilities in speed, etc., and you could ask them for references in regard to its reliability. You do not show us the shape of a midship section of your boat, and as the size of propeller is partly dependent upon this, we cannot give you definite advice on that point. If you will refer to our issue of April 2nd, 1903, you will find an excellent article on the design of propellers, and by its help you could probably work out the best size for your boat yourself.



For description] FIG. 2.—PROPOSED ALTERATION TO LATHE HEADSTOCK. [*see page* 70.

[20,043] **Testing Ignition Coils.** W. H. S. (Leytonstone) writes: Will you please let me know how I may test the working order of both trembler and non-trembler coils? I have an accumulator, but no motor cycle now. So the test would be made apart from the motor cycle wirings.

For the trembler coil, connect the primary (inside) winding in series with the accumulator, so as to give it the current for which it was designed. If the coil is in order, you should be able to obtain a spark in air of at least ¼ in. from the secondary winding. For the non-trembler coil, put a make-and-break device in series with its primary winding and the accumulator. You could use the trembler of the other coil for this. This should give a similar length of spark.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

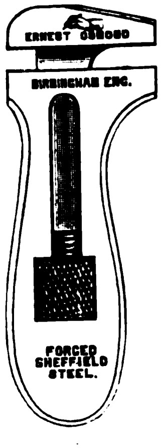
* *Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

Ignition Accumulators.

We have received from the Accumulator Industries, Ltd., 1, White Street, Moorfields, London, E.C., a well got-up list illustrating and describing their specialities in accumulators, in both celluloid cases and lead-lined teak boxes. The positive plates are of the improved Planté type, the whole plate being formed out of solid lead, the advantage of no paste being used being apparent to any one who has had anything to do with accumulators. The negative plates are of porous lead and of special form, contained in an undercut grid. The lugs of the plates pass through special grease cups so that corrosion and creeping are absolutely prevented. Further, patent non-splash vent holes are provided. Particulars of the capacity of these cells are given in tabular form on page 6, which is a handy reference for those about to purchase. Further on, their patent discharge indicator for accumulators is listed, from which may be judged in what condition the accumulator is. It indicates the approximate state of the discharge of the cell. General instructions for charging and working are also given at the end of the list.

A Miniature Wrench.

Messrs. Ernest Osmond, Winchester Works, Birmingham, have recently placed on the market an interesting and useful tool in the form of a miniature wrench, which we illustrate herewith. Such a tool has undoubtedly been needed since engineering began, and seeing that in it are embodied good design and the best British workmanship, together with first-class material, it should command a very wide sale. The illustration represents the tool to full scale exactly, and it will be seen that it can be carried without inconvenience in the waistcoat pocket. Another useful device of which we have received particulars is Osmond's Motor Cable Terminal. It is an extremely simple device, and possesses many important features, one being that it can be instantly attached to or detached from the wire, thus avoiding the necessity of slacking out nuts when removing the sparking plug or the accumulators, which, in the latter case, is often an extremely difficult matter owing to the nuts having become corroded, etc. On the leaflet describing this prices and further particulars are given, which may be obtained by interested readers on application to the above address. Another device by the same firm consists of a lamp lock, which is made to fit the lamp and bracket, and, it is claimed, effectually prevents the lamp becoming unduly loose or leaving the bracket altogether.



The Editor's Page.

WE are often asked by our readers for advice in connection with the patenting and placing on the market of inventions. One of the most usual forms of inquiry is from someone who has got what he considers to be a good idea, but has not sufficient means to take out a patent, or if the idea be patented, has not the necessary capital to work it, and we are asked to suggest the best means of turning the invention to account. We may say right away that the first step to take is to secure a patent for which the services of a reliable patent agent should be engaged. If the inventor has not the necessary means for progressing thus far, he should endeavour to find someone amongst his friends or acquaintances who will advance the money to secure protection, in return for a share in the invention. To arrange this the inventor is confronted with the necessity for disclosing his secret, for no one is likely to advance money without some definite knowledge of the idea it is required to finance. Among friends this is perhaps not a great drawback, but with people who are mere acquaintances the risk is greater. It has, however, to be faced, unless the inventor is prepared to make the necessary personal sacrifice to raise the money by other means. Then the invention, once protected, comes the perhaps more difficult task of getting some person or firm in the particular line of business to which it relates to take it up. A commercial sample, or a satisfactory model, now becomes almost a necessity, before any firm can be persuaded to even look at the idea at all, and this involves further capital outlay. The sample or model ready, it by no means follows that even with a really good idea, well worked out, a purchaser will be easily found. Many firms to whom the article might be expected to appeal may not be prepared to take up anything new, and there are often many reasons other than sheer thick-headedness which prevent a firm from proposing business. The only course open for the inventor is to keep pegging away at likely firms until one or other can be induced to interest themselves in his ideas. When such a firm is found, the inventor must be moderate in his views as to terms, for the step from the production of the working model to the placing of the article on the market in quantity is a big one, and involves considerable expenditure of time and money on the part of the manufacturers, for which, if the article does not prove a big success, they may never see an adequate return. All these points are intended to convey the moral that the way of the inventor is hard, and that success is not to be had without considerable sacrifice, and considerable effort, however brilliant the invention may be. We do not wish for a moment to dissuade our readers from inventing. On the contrary we are always glad to see and to encourage originality of thought, but we think the few words we have said may well be taken to heart by those whom they may concern, and no inventor must regard his difficulties as over when he has got his ideas into successful working shape. His real troubles are only then beginning. One of the best books we know for anyone of an inventive turn of mind is "The Autobiography of Sir Henry Bessemer." Bessemer was an exceptional example of the combination of the mechanical genius with the shrewd man of business, and the life story of his world-famous inventions in connection with steel-manufacture and other branches of applied science shows very clearly the need for pluck and perseverance, in addition to a more than ordinary share of skill and ingenuity.

Answers to Correspondents.

T. H. S. (Canada).—We suggest you refer to "The World's Locomotives," by Chas. S. Lake, price 11s. 9d. post free.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

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All correspondence relating to advertisements and deposits to be addressed to The Advertisement Manager, "The Model Engineer," 26-29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

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EDITED BY PERCIVAL MARSHALL, A.I.Mech.E.

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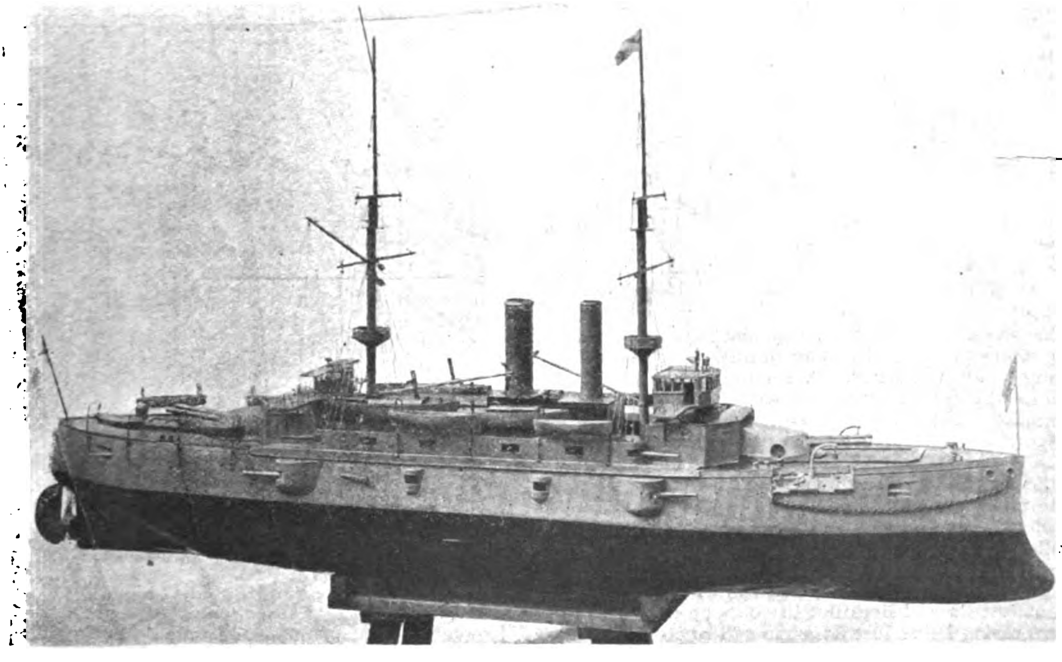
A Model First-Class Battleship—H.M.S. "London."

By Alan H. Miller.



Mr. Alan H. Miller's Model of H.M.S. "London."

I AM sending you two photographs which I have taken of my model battleship. I hope these and also the following description may interest your readers. I began to build her ten years ago, taking as my model H.M.S. *Magnificent*. When finished, she had four fighting tops, funnels abreast, also ventilators, and the 6-in. guns on the main deck could only fire ahead and astern respectively. Then, in order to make her more up-to-date, I started on a scheme of reconstruction, having H.M.S. *London* as my model, and as such she appears in the photographs. There are now only two fighting tops, the funnels are in line fore and aft, there are no ventilators on the upper deck, and the 6-in. main deck guns are in sponsons, to fire right ahead or astern. As H.M.S. *Magnificent*, she was painted black, with white upper works and buff funnels and masts. She is now grey down to the water-line.

The only plans I could procure were in the *Engineer*—deck plan and midship section. From these I made drawings of the lines to the best of my ability. I then made a half model in wood, quarter the length of the finished ship, and made whatever alterations I thought necessary. This half model was then taken apart and the lines set out and redrawn full size. She is built on the bread-and-butter plan of 1-in. pine boards. The length on the water-line is 6 ft. 1 in. and beam 14 ins. The draught is 5 ins. forward and 6 ins. aft, while the freeboard is 5½ ins. forward and 4 ins. aft. The stem is of brass and the keel ⅜-in. square brass, each dovetailed into a gun-metal casting forming the ram. Each board was carefully planed, and then all screwed together and the outside shaped up. I then took the boards apart and cut out the inside, and finally screwed them together again with a good mixture of white lead and paint between each board. There are three bulkheads fitted across the ship, of oak ¾ in. thick, and these stiffen her very considerably. There is one at each end of the boiler and one behind the engine.

The boiler is of the locomotive type, 6 ins. diameter and 15 ins. long over-all, with seventeen ½-in. brass tubes. It is fitted with steam dome and the usual fittings. The firebox is 4½ ins. long and is not supplied with any water tubes. For firing I use a "La Française" benzoline lamp with two burners, and keep steam well with it. In the bows under the capstan is one of Whitney's hand pumps, with a rubber suction pipe which I put over the side to take water from the lake. The first engine I used had two 1-in. by 1½-in. cylinders, but it was second-hand and was not a success. So I got a new one of Whitney's, 1½-in. bore 1½-in. stroke, single cylinder and balanced crank. This gives every satisfaction and drives the ship well. I may say that I have not aimed at speed in this model, but rather in making one which would look something like the prototype.

The shaft is steel, ⅜ in. diameter, and 16 ins. long, while the propeller is an ordinary three-blade casting 5 ins. diameter. A small handle will be seen in the photograph almost underneath the mainmast. This is the starting lever, and there is a corresponding one for the other side. To get at the lamp and pump, I can lift up the long hatch on the forecastle, on which is fixed the barbette with its two guns. The upper deck will lift off complete with masts, guns, boats, and charthouses to allow of access to the boiler and engine. The forward funnel is over the safety valve and lifts off independently, while the after funnel is for the exhaust steam and does not lift off, the hole in its square casing being just large enough to clear.

The lower masts, fighting tops, and funnels are of brass tube, while the top masts and yards are of beech. The total height of the masts is 2 ft. 4½ ins. There are four launches carried on chocks on the boat deck, and eight boats on davits. The boom for lifting the boats is of ¼-in. round steel and has a double hinge, so that it will raise, lower, or slew to either side. The forward charthouse has glass windows all round, and on the top, compass, steering wheel and engine-room telegraph. The two barbettes are each mounted on a circular brass plate, which fits into a mahogany base fixed to the deck. The barbettes are free to rotate and move through an angle of about 220 degs.

Each gun has its own carriage, running in V-slides. The guns themselves are made of best hard brass tube, 5-16ths in. bore, ¾ in. diameter, and 7 ins. long. The ends were plugged, trunnions fitted, and the guns then turned down to shape. They were all tested and fired before being put into the ship. The 6-in. guns are similarly made of brass tube, 5-32nds in. bore, ½ in. diameter, and 3½ ins. long. They turn through an angle of 90 degs., and like the 12-in. guns will elevate or depress.

END VIEW OF H.M.S. "LONDON.

They were also fired and tested. I made twelve of these, but have taken out four of them. There are twelve model 12-pounder guns, but these are dummies, being merely taper pins turned down to shape and drilled up about ½ in.

My great difficulty is to find a suitable place where I can sail her. I have taken her several times to Peckham Rye pond, and two years ago took her all the way to Keston Lakes, near Hayes Common. It was well worth the trouble, but the transport problem was an expensive one. If I make any more model ships, I shall try my hand at a *Dreadnought* or an *Inflexible*, if they are not out of date by the time I feel disposed to begin.

Engineering Drawing for Beginners.

By H. Muncaster, A.M.I.M.E.

(*Continued from page* 464, *Vol. XVIII.*)

THE beginner may usefully give some attention to the geometry of valve gearing, which will be of service when designing the details of steam engines. It is therefore deemed advisable at this stage to give a few simple instructions for setting out the parts of valve motions for actuating the ordinary form of slide-valve.

The usual form of slide-valve is shown in section (Fig. 110). V is the valve, *s s* the steam ports, *e* the exhaust port of the cylinder, and *b b* the bars between the ports. The valve is shown in the middle of its stroke, all the ports being closed. If the space P were filled with steam, it is evident that none could enter the ports until the valve was moved to a distance equal to more than the distance *a*, which

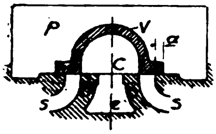


Fig. 110.

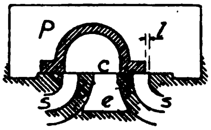


Fig. 111.

is the amount the valve overlaps the edge of the port; this amount is called the lap of the valve, and is the same at each side of the valve. The valve is hollow, having a cavity *c*, generally of such dimensions that it extends to the outer edges of the bars, so that a movement of the valve of a given amount gives an opening to one of the ports equal to this amount; in other words, there is no *internal* lap to the valve; occasionally, there is a small lap allowed for, and, on rare occasions, a negative lap, where both of the steam ports would have a slight opening into the cavity when the valve is in the middle of the stroke.

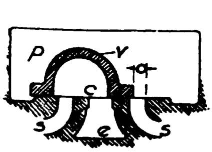


Fig. 112.

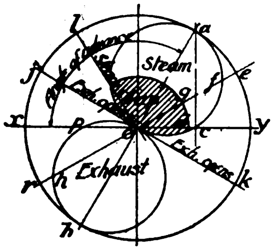


Fig. 113.

The valve is arranged in such a manner that when the piston is at the beginning of its stroke, *i.e.*, when the crank is on the dead centre, a small amount of opening is given to the steam port to ensure the full pressure of the steam (assumed to be in the valve-chest) being behind the piston at the commencement. The amount of opening *l* is called the *lead* of the valve. The valve has at this point moved from its centre position a distance $=a+l=$the lap added to the lead (see Fig. 111).

The valve may not open the full width of the port, the travel of the valve giving only a partial opening, say ⅞ of the port area, as shown at *o* (Fig. 112), the total travel of the valve being $=2(a+o)=$lap added to the steam opening, the sum being multiplied by two, as this amount of travel takes place at each side of the valve centre.

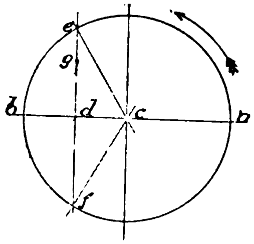


Fig. 114.

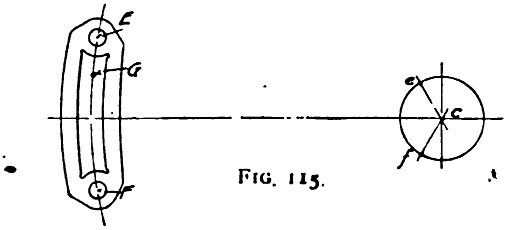


Fig. 115.

A very useful diagram for tracing the movement of a valve actuated by a simple eccentric is shown in Fig. 113.

Let *a x b y* be a circle whose diameter *x y* equals the travel of the valve. From the centre *o* set off *o d* equal to the lap and *d c* equal to the lead of the valve; draw through *c* the perpendicular *a c*, intersecting the circle at *a*; through *a* and *o* draw the straight line *a o b*; describe a circle on *o a* as diameter; similarly on *o b*; from *o*, with radius

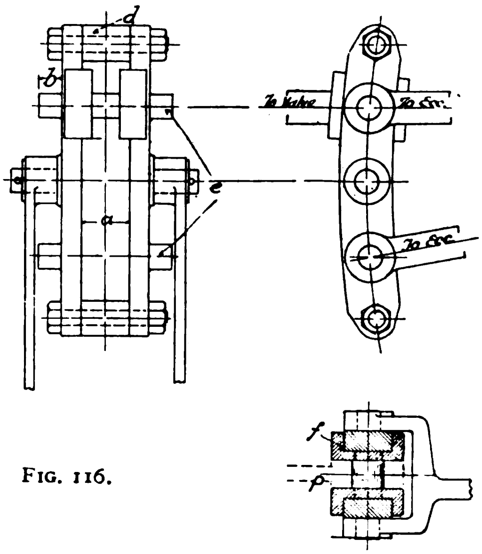


Fig. 116.

o d and centre *o*, draw the part of a circle that falls *within* the circle *a c o*. The crank will be in the direction of *x*, and the angle of advance will be equal to *a o x*. At the beginning of the stroke we have, then, the valve moved to *c*; but, on account of the lap of the valve being equal to *d o*,

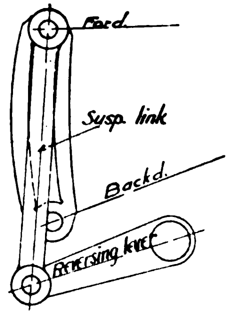


FIG. 117.

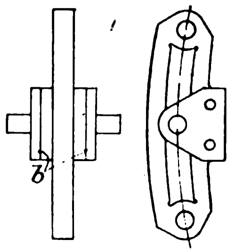


FIG. 118.

we have only an opening into the steam port equal to *c d*; while, if there be no lap on the exhaust, we have an opening into the exhaust port equal to *o p* (which, is according to the construction, equal to *o c*). We therefore, along the line *x y*, have an indication of the conditions existing in the distribution of the steam by the valve when

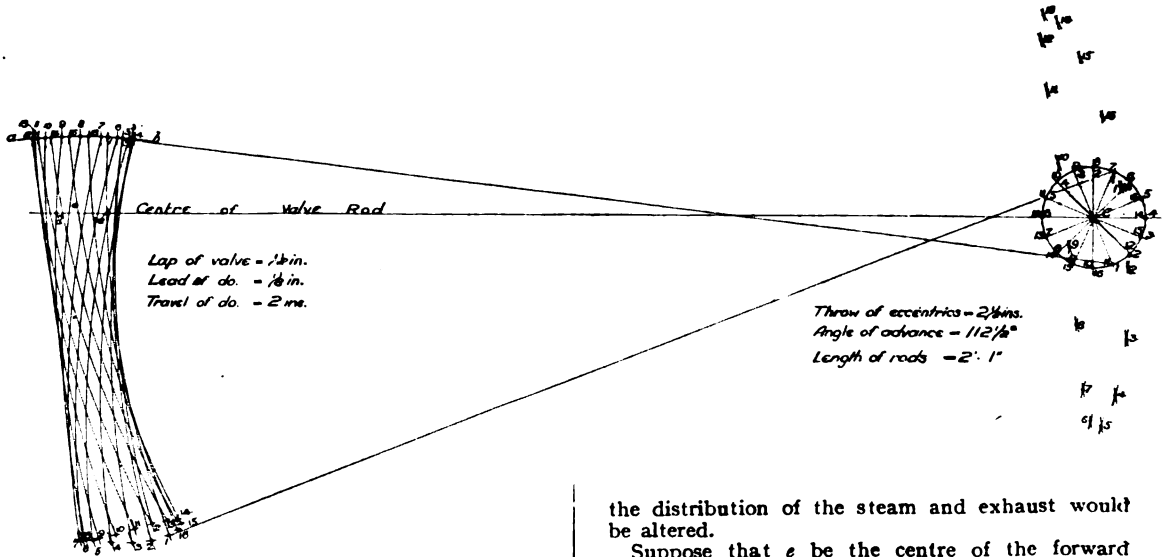


FIG. 119.

the crank is at *x*. Suppose we require to know the conditions when the crank has moved on through an angular distance equal to *r o x*, but in the direction of *a*, which is clockwise. Draw the line *r o e*; then *g f* will equal the steam opening, and *o h* the exhaust opening. Instead of considering *x* as the starting point of the crank, imagine it to be at *y* and moving towards *a*. We can then measure the conditions at any angle of the crank by simply putting a scale across the centre *o* and taking the distances between the circumferences of the smaller circles. When the crank travels an angular distance equal to *a o y*, the valve would have its greatest opening; the angle *l o y* shows the steam closed by the lap of the valve. At the angle *j o y* the diagram shows the exhaust opening for the return stroke and closing on the opposite side for compression; *j k* will be at right angles to *a b*. Having made the half revolution, the same operation may be repeated for the return stroke.

Now, if the valve be actuated by a simple eccentric connected by a rod, the throw of the eccentric will be equal to the travel of the valve, and the position of the eccentric in relation to the crank determined as follows.

Let *c* (Fig. 114) be the centre of the crankshaft and *a b* a circle of a diameter equal to the throw of the eccentric, the crank being on the line *a c* in the direction of *a*. Set off *c d* equal to the lap and lead of the valve; from *d* erect the perpendicular *d e f*: if the crank has to move in the direction shown by the arrow, *e* will be the centre of the eccentric; if the crank be required to travel in the contrary direction, the centre of the eccentric will be denoted by *f*. If we could move the eccentric along the line *e f*, the throw of the eccentric would become smaller as it approached *d*. The lead of the valve, however, would remain constant, although the distribution of the steam and exhaust would be altered.

Suppose that *e* be the centre of the forward eccentric and *f* the centre of the backward eccentric, and that these eccentrics are joined by means of rods of *infinite length* to a link E F, the link being connected at any intermediate point G to the valve rod. On the line *e f* set off *g* so that $\frac{eg}{ef} = \frac{EG}{EF}$; the movement of the valve would be the same as if it were actuated by an eccentric having its centre at *g*. The condition of having rods of infinite length is, of course, an impossible one, and we have to consider a given limited length of rod, which makes a considerable difference in the movement of the valve.

Let E F be the link (Fig. 115) and *e* and *f* be the centre of the eccentrics on the crankshaft *c*. We can connect either end of the link to either eccentric.

Suppose we connect E to the eccentric of which *e* is the centre and F to *f* the proportion, $\frac{EG}{EF}$ remaining as in the last figure, the movement at G would be in excess to that given by an eccentric having its centre at *g*. On the other hand, if we connect E to *f* and F to *e*, the movement at G would be less.

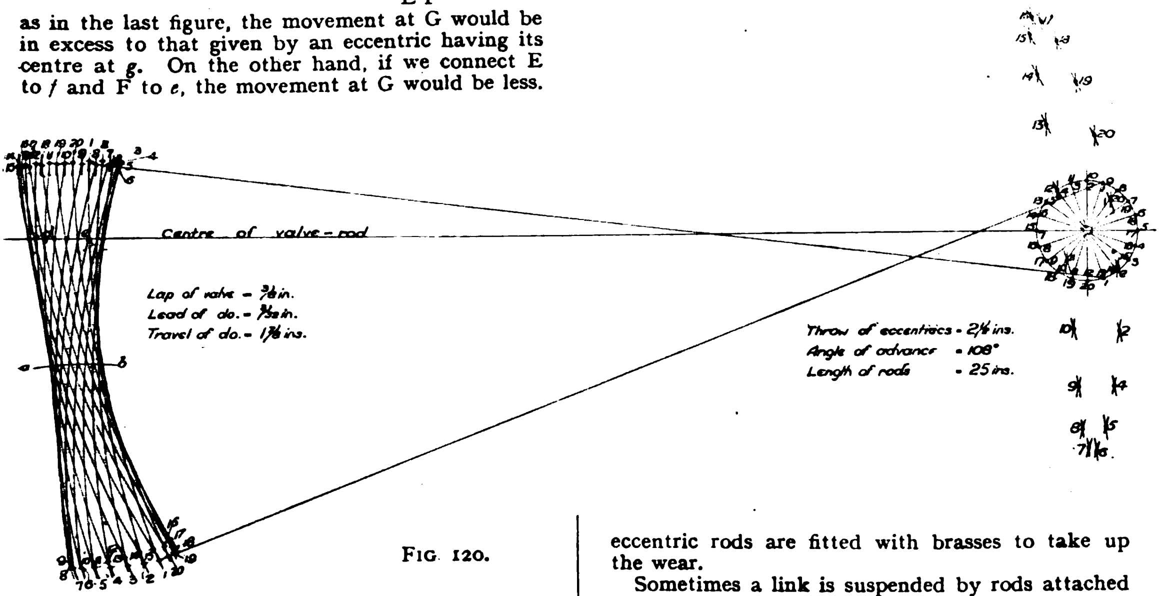


FIG. 120.

We have therefore to consider crossed rods and open rods. In the case of a locomotive the rods are generally so connected that the link is at the lowest position when in forward gear; in which case E will be connected to *e*.

In the form of link shown the valve rod will always be connected somewhere between E and F, even when in full forward or backward gear; the throw of the eccentrics must therefore be *increased* to give the full travel of the valve and the *angle of advance* adjusted to suit.

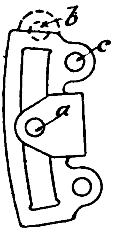


FIG. 122.

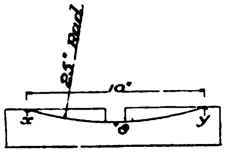


FIG. 121.

In the form shown in Fig. 116 the link can be brought into position where the valve rod and eccentric are in line, the throw of the eccentric will be practically the same as if no link-work existed. This type of link is generally used on marine engines, but on account of the extra room required is not quite suitable for locomotives.

In designing these links it is necessary to make the dimension *a* slightly in excess of the dimension *b*, as the pins *e* are forged solid with the side of the link to allow them to be got into the jaws of the eccentric rods; the pin *p* is slipped into the dies, and the latter pushed into place before the distance-piece *d* is fixed. Frequently, the jaws of the eccentric rods are fitted with brasses to take up the wear.

Sometimes a link is suspended by rods attached to the same pin as the forward eccentric rod, as shown in Fig. 117. This is an excellent method, the end of the link being kept in an arc of a circle of a radius equal to the length of the rods. The effect of this is that in forward gear the die is nearly in the same position as regards the link, and a very small amount of movement takes place along the slot of the link.

Another method of suspending the link is shown in Fig. 118. There the point of suspension coincides with the middle of the link. A bracket *b*, to which the pin is forged solid, is halved to each side of the link. The short radius and the curved shape of the link has the effect of reducing the amount of movement of the die in the slot of the link, provided the parts are correctly proportioned. This mode of suspension has the further advantage of improving the motion when in backward gear.

In setting out reversing gear the writer begins by dividing up a circle representing the path of the centre of the eccentric into a given number of equal parts, beginning at the position of each of the eccentrics when the crank is on a dead centre. Fig. 119 shows an example of setting out in this manner. In this case the advance of the eccentric is equal to a right angle plus 1-16th of 360° = 112½°; the position of the gear may then be decided at sixteen different positions. Taking the length of the rod on the trammels from each of the points given in the circle, an arc should be drawn across *a b*, the path of the suspension link. (We are assuming that the link is suspended from the top end.) Each arc should be numbered to correspond with the point in the circle.

(*To be continued.*)

Notes on Calipers and Micrometers.

By George Gentry.

(*Continued from page* 58.)

THE addition of registering devices to calipers, by means of which the set size of the measuring points is recorded upon a scale, is of Continental origin, and in the writer's opinion forms a very useful combination. Fig. 6 is an example of the best form of this kind of caliper, and it will here be noted that the scale is divided upon a quadrant arm attached to the leg *a*. The index pointer is actuated

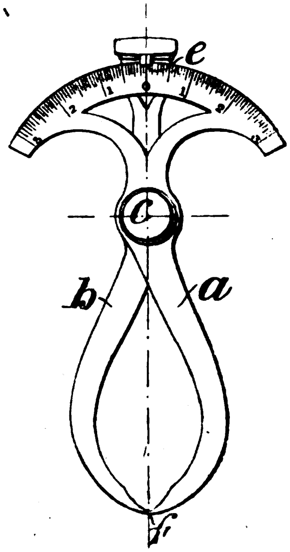


Fig. 6. (*Half full size.*)

by the leg *b*, and, as will be seen, records its reading upon either side of the zero mark to give both external and internal readings. For the latter, it is necessary to spring the legs one over the other, and they are of such a form that comparatively small internal dimensions can be taken by this means. Now it may occur to the reader that the construction of such as these is quite a simple matter. Offhand it appears that the quadrant scale is merely a dividing out into a number of equal divisions marked inches, the proportion of which to the measurement made by the legs of the instrument being the relationship between the radius *c e* to the radius *c f*. As a matter of fact this is only correct when the caliper stands at zero, for it must be remembered that the measurement made by the points is along the cord of the circle described by the radius *c f*; therefore the measurements shown upon the scale above are in proportion to the cords of the arc through which the index moves to record that size, consequently the length of the succeeding divisions continually increases measured along the arc, which fact can clearly be seen by referring to Fig. 6. It would perhaps be as well to describe why this is. Referring to Fig. 7, which is a diagram showing a portion of the quadrant scale, as an arc, the point marked 0 being zero, if we move the index through the distance 1 the cord 1·0 has a length in proportion to the varying radii of the calipers. Now if we take a cord of double this length, which reaches to point 2 upon the arc described, it may seem at first that the arc 2·0 should be exactly double the arc 1·0, but if this were so, by joining up 2 and 1 with a cord, it will be seen that if the arc 2·0 is double that of 1·0, the cord 2·1 is equal to the cord 1·0, but the cord 1·0 is half the cord 2·0, therefore the cord 2·1 is also half of the cord 2·0, and the two cords 2·1 and 1·0 are together equal to the cord 2·0. In other words, two sides of a triangle are equal to the third side, which we all know to be hopelessly wrong. Therefore, the cord 2·1 must be longer than the cord 1·0, and the corresponding arc 2·1 must be that much greater than the arc 1·0, but the calipers in passing through the spaces described will only be making twice the measurement. From this it will be seen that the graduation of a pair of calipers of this class is a

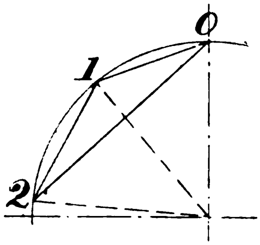


Fig. 7.

matter involving the use of very accurate geometrical dividing devices.

The writer has for some years used a pair of these calipers, and with the exception of some slight alteration to the points to make them accurate for both inside and outside readings, has never had any trouble whatever, and believes he has saved a good deal of time by their use. It is usual for the manufacturers to finish off the points of calipers rounded, the idea of this being to allow for the extreme wear to which they are generally subjected, but in the case of registering calipers, an element of inaccuracy creeps in, in proportion to the size of the point, which renders it absolutely necessary to have as sharp measuring points as are consistent with strength. A peculiarity about the registering calipers mentioned above is that the manufacturers always make them with these rounded points, and if the possessor of such wishes them to answer all purposes for inside and outside measurement, he will have to correct this. A glance at Fig. 8 will demonstrate why this is. Let *c* be the centre of the caliper joint and the arc 1·0·1′ represent the divided scale, the points (very much enlarged) being closed to zero, as shown at *a*, and after being opened through the angle *a c b*, record the diameter of the circle shown within the points to be 0·1′. Now if the point *b* be carried past the point *a* into position *b′* equal to its original angle *a c b*, but in the opposite direction, it now records a distance 0·1, equal to 0·1′, but it will be clearly seen that it is now measuring a very much larger circle than the original diameter, which is shown upon the other side between the points. This is entirely due to the continual altering of the radial length *a c*, in the first case to a much shorter length *d c*, and in the second to a slightly longer length *e c*, because in the first case the least distance between the measuring points lies upon a line connecting the centres of the circles, of which the points are made up, and being comparatively remote from each other, this line lies well within the circle traversed by the arms

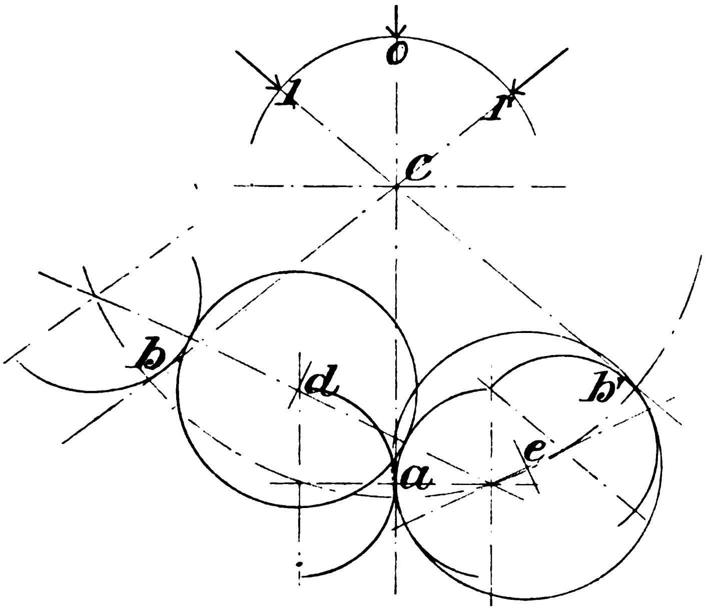


Fig. 8.

themselves in opening. On the other hand, in measuring the internal opening, a line drawn through these two centres lies very nearly upon the circle described by the points when in that position. From this it will clearly be seen that the points of

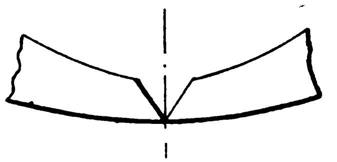


Fig. 9.

the form shown in Fig. 9, in which the measuring point approaches as nearly to a knife edge as it is possible to get, are the only things consistent with accuracy, and it will therefore be necessary, in view of their limited area, to see that they are thoroughly hardened to resist wear.

Calipers of this description can be obtained in London at ordinary ironmongers at as low a price as 3s., and any reader who cares to invest in these, can take it for granted that the scale is accurately set out, and it only remains for him to exercise painstaking judgment in setting the points to be of the form described above. He will have to adopt the following routine. Having thoroughly annealed the points, file them to the shape shown in Fig. 9, taking care to remove no more metal than is absolutely necessary; now close the calipers, give them a slight tap to be sure that they are well together, and examine the points to see that one is not longer than the other. If found to be so, by opening the calipers wide and placing the longer leg in the jaw of the vice, being careful to use lead clamps, a smart blow upon the point with a small lead mallet, or better still, a hardwood drift, will usually set it sufficiently to correct any error of this sort. Having closed the points again, the first thing to see is that the index is upon zero of the inch scale. If it is not so, by gripping the leg carrying the index pointer between the jaws of the vice, the pointer can be set over by using a wood drift placed upon the side of the index frame, and giving it a tap with a light hammer in the necessary direction. This does not in any way affect the set of the points. Now it is necessary to use a standard gauge, which should be as near the maximum reading of the scale as possible: in the case of Fig. 6, say a 2-in. or 2½-in. male gauge. By carefully setting the points to this gauge any inaccuracy in the radial length of the measuring arms now becomes apparent, in that if the legs are too long the index will record under the size, and if too short, the contrary will be the case. Care must be taken in lengthening or shortening the legs, which can be done by means of the wooden drift, as described before, that when closed they are both of the same length and the measuring edges shut together exactly. This operation is almost sure to take the index off the zero again, which will have to be corrected before testing the legs again on the standard gauge. Usually three or four operations of this sort are sufficient to determine the right length of the legs. Having adjusted the caliper to within these limits, it is only necessary to harden the points. A very good condition, but one involving a lot of work, is to remove the fixed index pointer on the metre scale and replace it by one adjustable, slightly lateral, as it will often be found that both indexes are not on their respective zeros simultaneously. An illustration of this form of caliper will be given in the following article.

(*To be continued.*)

Official trials of the De Forest wireless apparatus for telephonic purposes have recently been made in the presence of the officials of the dockyard and of delegates of the Italian Ministry of Marine and War Office, says the *Mechanical World*. For this purpose the *Partenope*, of the Royal Navy, with Mr. De Forest and the delegates of the War Office on board, put to sea in a direction towards Genoa. The apparatus installed in the *Partenope*, in a special covered cabin, allowed communication with that in the *Eridano*, which remained at anchor in the dockyard, and in which the electrical engineer in charge and the technical officials of the Ministry of Marine were stationed. At a distance of 20 miles (the greatest distance tried) telephonic communication was regularly maintained.

An Alcester Enthusiast.

By H. G.

THE taste for mechanics with which I suppose the majority of the readers of this journal are imbued cannot very well be explained by the ordinary laws of heredity and environment. No one would expect to find in a quiet Warwickshire town an amateur engineer of no mean skill, whose leisure moments right from his school-days have been devoted to the practice of model making and mechanical pursuits in general. However, this was my pleasure, and I recently spent an enjoyable week-end reviewing his many achievements.

Mr. T. W. Averill, who is responsible for the various models, etc., illustrated in this article, has almost from the time he can remember been interested in engineering. Of his first model I cannot submit any tangible record. It will suffice to say that Mr. Averill has lost count. One of the early ones is shown in the picture, Fig. 1, herewith. This

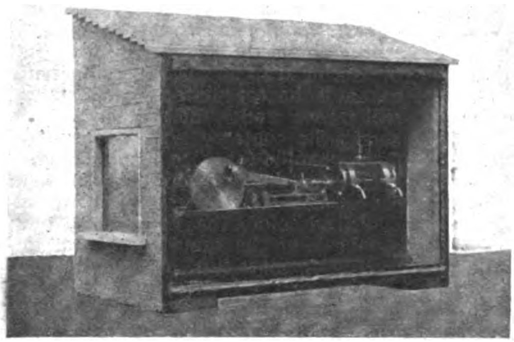


FIG. 1.—ONE OF MR. AVERILL'S EARLY MODELS.

model is now preserved against rust by being encased in an air-tight glass-fronted box, which is made to represent an engine-house, as shown in the photograph.

This model is a horizontal engine of the ordinary mill type, with four guide bars and an overhung disc crank. The cylinder is 1½ ins. diameter by 3 ins. stroke, and the engine is fitted with governor gear, the bevel wheel frame and pinion of which once formed part of an egg whisk.

Another model of note is the 2¼-in. bore by 2-in. stroke twin-cylinder high-pressure launch engine, which was built to run an 18-ft. boat. This engine is not the only one of its kind Mr. Averill has made. He has had three launches running on the neighbouring River Avon, each of which contained machinery made by the owner. The engine shown in the photograph is double-acting, non-compound, and is made of gun-metal and bronze throughout, to prevent rusting during periods of disuse. It is built on round columns, and has link motion reversing gear, the weigh-bar shaft being situated just above the tops of the columns in front of the cylinders. This allows the handle and rack to be placed sufficiently high up to be convenient when the engine is fixed in the boat. The lubricators are of ample size and at the back of the cylinders the exhaust pipes are connected to a cylindrical container, which at one and the same time acts as a "silencer" for the exhaust and a feed-water heater. The drain cocks are coupled together so that they work from the handle attached to the uppermost plug. The waste water is conducted to the bilges by copper pipes having flanged connections. No lower guides are used for the valve spindles, the top of the steam chests being provided with dummy glands to keep the valve spindles in true alignment. This is a good feature, as it enables longer eccentric rods to be used and link motion, which will provide a better distribution of steam.

Mr. Averill's work has taken various phases. The cycles of activity are in his case fairly numerous.

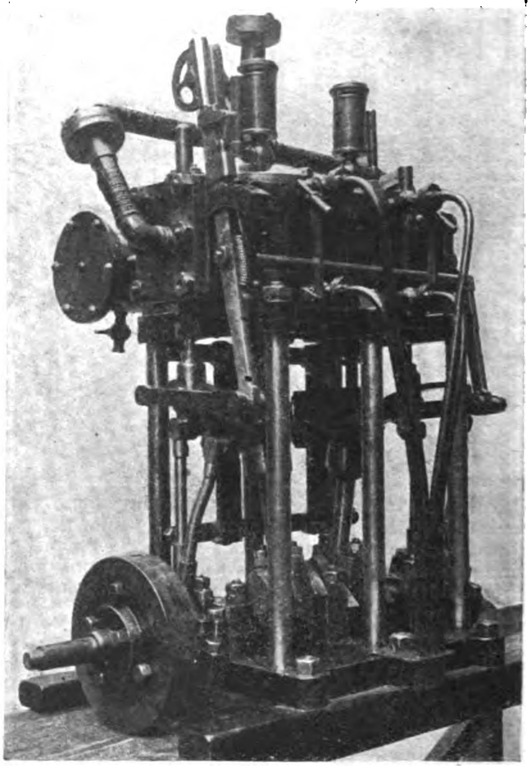


FIG. 2.—A 2-IN. BY 2-IN. TWIN HIGH-PRESSURE LAUNCH ENGINE, MADE BY MR. AVERILL, OF ALCESTER.

We have the early stationary-engine period, followed by a devotion to making and running steam launches. The repeal of the "red flag" law of road traction encouraged Mr. Averill to take up motoring, and not content with following up the sport in the ordinary way, he must try his hand at car building.

The experiments in automobile building commenced in 1901 by Mr. Averill rebuilding a "Beeston" quad, an account of which will be found in the pages of our esteemed contemporary *The Autocar* for February 8th, 1902. The desire for more power, which inevitably attacks the motorist, resulted ultimately in the well-made car shown in the accompanying photograph. This car the writer saw on his visit to Alcester and, although it has been supplanted by a more modern 12 h.-p. "Heron," it is still a sound machine, capable of hauling two passengers at speeds up to 30 miles an hour on the level.

It is a belt-driven car and has a 4½ h.-p. de Dion motor. The drive is taken from a 7-in. wood pulley to a cast-iron wheel of the same size on a countershaft at the other end of the car by 3½-in. two-ply Dicks' belting, which has never given any trouble from slipping. The change speed gear is a Dupont, which Mr. Averill strengthened to take the 4½ h.-p. The top speed is direct.

The combined radiator and water tank holds four gallons of water and has forty-eight plain vertical tubes of copper set in zig-zag order, 10 ins. long and ⅜ in. diameter, running from the bottom portion of the tank to the top, the circulation being effected by the natural convection currents. An automatic air valve, which tends to give the correct mixture at the varying speeds, is fitted to the carburettor and allows the engine to be run on the direct drive from 5 or 6 miles per hour to 30 miles per hour.

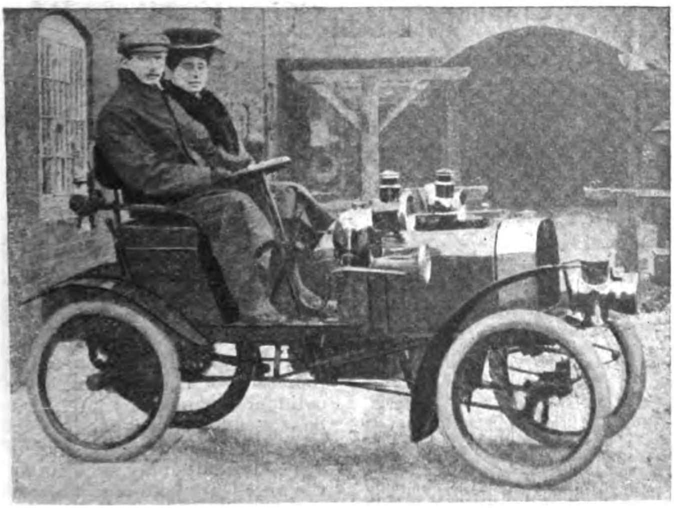


FIG. 3.—MR. T. W. AVERILL'S HOME-MADE BELT-DRIVEN 4½ H.-P. MOTOR CAR.

The brake is interlocked with the sparking gear, so that the first portion of the movement of the foot pedal pushes the sparking right back to slow, and then actuates the drum brakes on the countershaft.

Ignition is by wipe-contact, and a separate brush is used for the return current to earth. This is a good idea, and has been acted on by more than one of the writer's friends with beneficial results. Undue resistance often occurs in the low voltage earth return current where it is left to find its own path. The weight of the car complete is about 5 cwt., and the petrol consumption about 30 to 40 miles per gallon.

During the last two or three years Mr. Averill has taken to model locomotive construction and, in addition to the little clockwork engine and railway which he made and installed in a top room of the house for the benefit of any youthful visitors, he has three locomotives, viz., a ½-in. scale N.E.R. "Atlantic," a 3¼-in. gauge model Midland compound locomotive, and the latest ¾-in. scale G.N.R. "Atlantic," No. 251 type, with which the writer was able to make some remarkable hauling tests, which will be detailed in the article to follow this.

FIG. 4.—MODEL N.E.R. "ATLANTIC" LOCOMOTIVE, NO. 649.
(½-in. scale, 2½-in. gauge.)

The Midland locomotive has, perhaps, no feature of particular note, except that it has several little additions in the way of steam brakes, Stephenson's link motion reversing gear actuated by screw gear in cab, and other fittings. It was built from the drawings which appeared in the issue of THE MODEL ENGINEER for September 10th, 1903. The drain cocks are coupled up to work from the cab, and instead of the usual spirit lamp it is fitted with a Primus burner (2½-in. size, No. 4). While this burner steams the engine perfectly, it has the drawback of making the frames and outside boiler shell rather hot, and blistering the paint overmuch. This is, of course, unavoidable in an engine like the Midland. The boiler is comparatively small in diameter and does not allow of double casing the outer shell, as can be done in models of more modern prototypes.

The feature of the testing stand upon which the locomotive is photographed is the small hand-wheel which is attached to the spindle of the main rollers. This renders it unnecessary to have to put the fingers in the spokes of the wheel to give the engine an initial start and to clear the waterlogged cylinders.

The clockwork locomotive shown in Figs. 6 and 7 is built to run on the standard No. 0 (1¼-in.) gauge tin rails, and is modelled on the lines of the well-known 4—4—2 type L.N.W.R. "Precursor" tanks. The clockwork is a piece of standard motion with the usual reversing gear and speed governors. The excellent proportions of the model tend to show that there is not much reason for the hideous clockwork locomotives which are sometimes

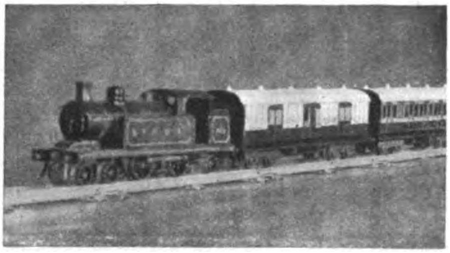


Fig. 6.—No. 0 Gauge Model Clockwork Train, headed by L.N.W.R. "Precursor" Tank Locomotive.

put forward as representing various famous prototypes when we go buying clockwork locomotives for the younger generation at Christmas - time. It is handling of these proportions which make or mar a model, and although Mr. Averill does not claim anything in the way of workmanship for this toy, the photograph shows that it looks like an engine.

The line on which this model runs takes the form of an elongated oval with a loop line, and is laid on a large table. The railway includes, beside the station, a lattice girder bridge, which could not be photographed owing to difficulties of lighting—and a tunnel, the mouth of which is discernible in Fig. 7.

The station is built mostly of wood and cardboard, and is embellished by a central building with the usual awning and sundry miniature advertisements, to which the new "M. E." sign will now, no doubt, be added.

The N.E.R. locomotive is more or less of a curio, in that the outside cylinders and motion are purely ornamental and are added only to give the model its desired character. The *raison d'être* of the model was the possession of a pair of double-acting oscillating cylinders. These were subsequently altered to slide-valve cylinders suitable for use in a locomotive, and formed the basis of the locomotive shown in the accompanying illustration.

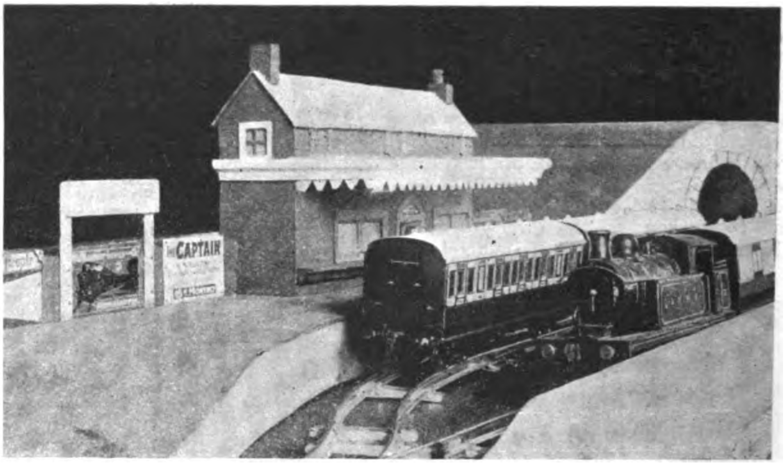


Fig. 7.—The Station :i Mr. Averill's 1½-in. Gauge Model Clockwork Railway.

To all intents and purposes the mechanical arrangements of the engine are more like those of the L. & Y. Rly. 4—4—2 type express locomotives, the first pair of coupled wheels being the drivers, and the cylinders being inside the frames, than to the engine it is supposed to represent. The use of inside cylinders enables the firebox to be extended over the axle of the rear coupled wheels, and in some measure may account for the excellent steaming power of the engine. The tender side frames were made up of standard ½-in. scale model N.E.R. locomotive castings, with dummy springs, horns, and axle-boxes cast on solid, and to further reduce the labour an extra casting (making three in all) was procured and cut up to make the outside frames for the trailing wheel of the engine.

Brakes are fitted to both the engine and tender, and the former are useful in controlling the

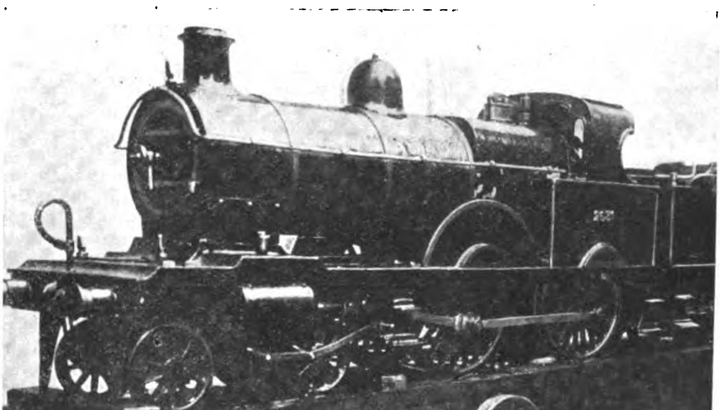


Fig. 5.—Mr. Averill's 3½-in. Gauge Midland Locomotive on the Testing Stand.

speed of the engine when it is run on the testing stand. This engine, as well as the M.R., are seldom run on the track (for want of a track), and the N.E.R. is fitted with a Bunsen gas burner, which is connected to the house supply by a rubber tube, and the disagreeable fumes and trouble, to say nothing of the expense, of the usual spirit lamp, is avoided.

(*To be continued.*)

How It Is Done.

[*For insertion under this heading, the Editor invites readers to submit practical articles describing actual workshop practice. Accepted contributions will be paid for on publication, if desired, according to merit.*]

Turning a Crankshaft.

By W. Muncaster.

Most model makers find great difficulties in the turning of a crankshaft, but with proper appliances it will be found to be quite an ordinary job, providing, of course, that a fair amount of care is exercised. On commencing operations, the first thing necessary is a pair of dogs or jigs, which are placed on the ends of the crankshaft, and on which the centres of the crank-pins should be marked out and centred.

Fig. 1 shows design of dogs necessary for use in turning a single throw crank, made to suit a small vertical or horizontal engine of 1½-in. stroke. The dogs should be made from mild steel, 1¾-in. by ⅞-in. by ⅜-in., and as nearly parallel as possible. Taking the diameter of the shaft to be 5-16ths in., drill a hole in each dog to suit the same, keeping the holes equidistant from each side. These dogs should be fitted on the shaft approximately parallel to the centres of crankshaft and pin, the shaft first being turned to 5-16ths in. diameter ½ in. from each end, on its own centres, and tightened with the setscrews S and S′ to keep them in position as shown in Fig. 2, taking care that the dogs are also parallel to each other. Mark off from the centres already in crankshaft the distance of required throw, viz. ¾ in., and divide this from the parallel sides of the dogs with a pair of odd legs or jennies; or, better still, place the whole job on a surface plate and carry the centre line across with a scribing block. The position of false centres will be shown where the lines cross each other. The dogs should now be removed and the centres drilled with a Slocomb centre bit. On replacing these dogs, in the same position, the crankshaft can be put between the centres of the lathe, the dog at one end acting as a carrier.

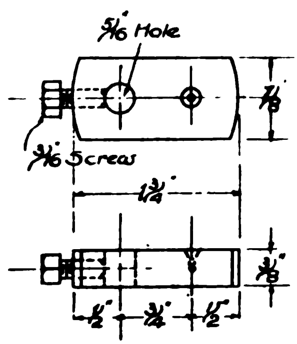


Fig. 1.

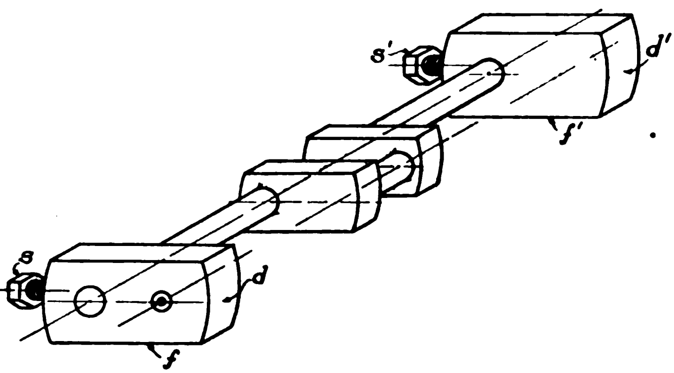


Fig. 2.

It is advisable to turn inside of web *a*, Fig. 3, first, and the job will be swung on the centres for turning crank-pin. From the outside of the webs to the dogs at each end, two bolts *b b′* should be secured, these bolts being about 1-16th in. short of the distance from web to the dog; the remainder of the distance will be made up by tightening nut

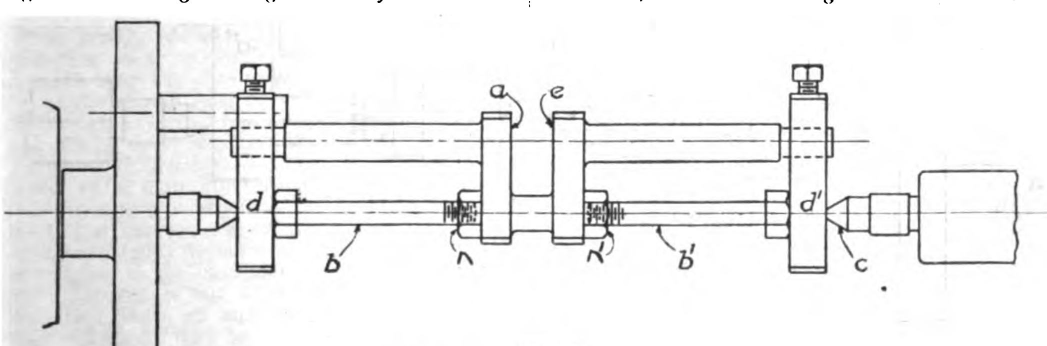


Fig. 3.

n n' which will stiffen the job considerably. After setting a tool in the rest, ground as shown in Fig. 4, the lathe should be started without back-gear, and kept running at a fairly high speed, taking a light cut, and moving the tool inwards to the crank-pin

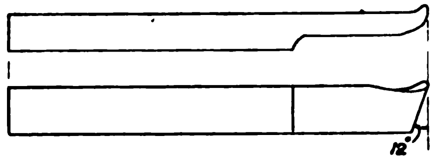


FIG. 4.

with the slide-rest. The tool shown in Fig. 4 will operate on face *a*, Fig. 3, which should be finished first. On completion of this face, draw the back centre *c* and reverse the crankshaft, which will bring the dog *d'* to the headstock end of lathe, and enable the inner face *e* of the web to be faced with the same tool. When sufficient metal has been turned off the faces the crank-pin can be turned to correct size.

On a small crankshaft like this, it is a mistake to run the lathe in back-gear with a heavy cut, as the dogs are liable to be displaced on the shaft, which would throw the centres out of correct position. The writer had an experience of this sort while turning a crank for a small horizontal engine. The dogs in this case were made from brass, but were not alike in shape, and through the dogs moving the centre line of the crank-pin was thrown out of parallel with the centre line of shaft. Considerable difficulty was met with on trying to right this, but had the sides of the dogs been parallel with the turning centres, as those shown in Fig. 2, it would soon have been corrected by placing on a surface plate and setting face *f* parallel to face *f'*.

After finishing crank-pin and inside of webs, the dogs can be removed and the rest of the turning can be done from the centres in the end of the shaft. Before starting on this, a piece of mild steel or brass should be fitted between the webs to prevent them springing inwards with the pressure on centres.

Fig. 5 shows a pair of dogs, right- and left-hand, for turning a crank suitable for an inch scale locomotive. They are made from ⅝-in. mild steel, 2¼ ins. square, and should be machined all over. The holes are bored 9-16ths in. diameter to fit on portion of shaft made to suit the driving wheels. These holes should be first drilled ½ in. diameter, as near their correct position as possible, and the dogs then fixed to the lathe faceplate on two parallel strips, the rest of metal being bored out with an ordinary boring tool, the distance from the square sides being gauged with a pair of calipers. This will ensure far greater accuracy than drilling to the full size. The method of turning is the same as the former, *d d'* (Fig. 6) being the dogs, and *a* the

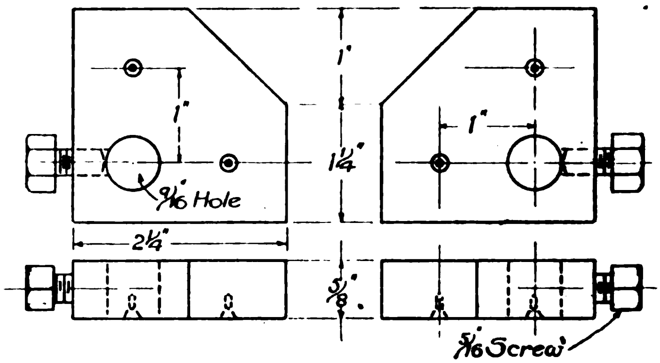


FIG. 5.

first of the journals to be turned. In this case, however, instead of the bolts for stiffening, a pair of screw jacks are shown; these can be very easily made, *t* being a tube in which screw *s* works, and would come in very handy for many a job.

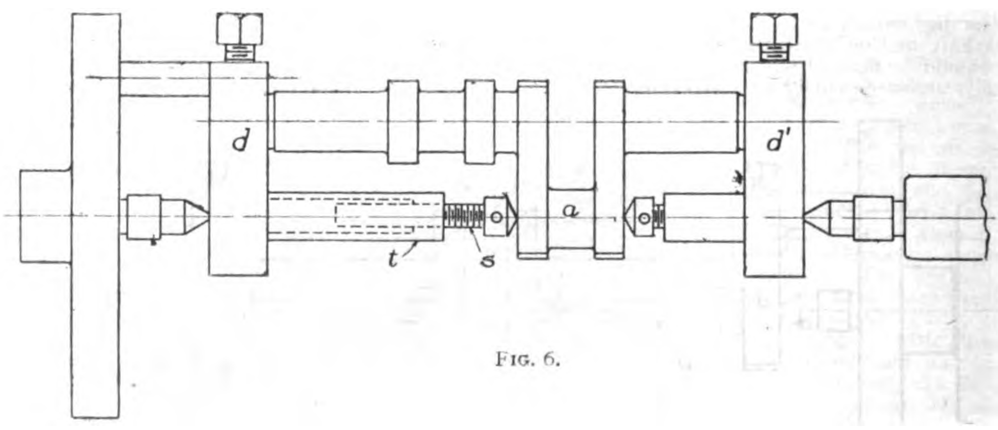


FIG. 6.

FOR particulars of our MODEL MOTOR BOAT REGATTA on Saturday, see page 96.

The Insulation of Spark Coils and other Electrical Apparatus.

By "Zodiac."

(*Continued from page* 63.)

Fessenden's and Tesla's Experiment.—Suppose we take two plates, P P in Fig. 2, 1 cm. apart, and connect them to the terminals of a 10,000-volt alternator. We then get a potential gradient across the 1 cm. air gap of 10,000 volts per cm., as represented by the dotted line. Suppose the dielectric air to withstand 50 per cent. more than this pressure for an indefinite time. If now two plates of glass, G G, be introduced, each 0·25 cm. thick, and having a specific inductive capacity eight times as great as air, the insulation breaks down, although the glass is more volt-resisting than the air. *The voltage divides itself up inversely as the inductive capacity,* so that the fall of volts across each glass slab is 500 volts, while that across the air gap (now reduced to 0·5 cm.) is 9,000 volts, or at the rate of 18,000 volts per cm. Now, as the air can only support 15,000 volts per cm., the potential gradient in the air gap as shown by the solid line is too steep, and the spark can jump the air gap. At every alternation a spark will jump across which will quickly heat up the glass, so that this will give way and the whole insulation be thus broken down. Hence, unless the whole space is filled up, the introduction of a good insulator may actually weaken the insulation as a whole. This weakening is not always apparent at once, as the spark takes some time to eat its way through the dielectric, hence the reason why induction coils very often give way after a few years in use. The foregoing experiment was wrongly taken by Tesla to show that ebonite and glass, etc., were less insulating than is generally assumed; it is, however, of the greatest importance, for it clearly shows that in spark coil insulation we must observe the following rules:—

(1) The dielectric should be homogeneous throughout as regards its specific inductive capacity; the impregnating oil or wax having approximately the same specific capacity as the paper.

(2) Air bubbles in the insulation should be very carefully avoided. The more completely air can be excluded from between the layers of paper, etc., the better.

For further details as to the "grading" of insulation so as to obtain specially high dielectric strength near the wire (where it is most wanted), the reader should refer to a very interesting paper by O'Gorman in the *Journal of Electrical Engineers*, Vol. XXX, 1901, page 608, *et seq.*

Heating of Dielectric.—When an insulator is subjected to a high alternating potential a certain amount of heat is generated in the dielectric itself, due to (1st) current that manages to get through the insulator; (2nd) dielectric hysteresis, owing to the alternation in the electrical stress. If this heat is not dissipated as fast as it is generated, then the insulation heats up and ultimately breaks down. This heating-up may be very rapid, especially with high tension apparatus, or where large capacity is present, the centre portion being badly charred before the outside shows any visible heating effects. The amount of heat so generated in a dielectric increases at least as fast as the square of the voltage. Increase in temperature rapidly lowers the dielectric strength of an insulator; for instance, even mineral insulators become fairly good conductors when raised to high temperatures, as seen in the Nernst lamp. The insulation of a spark coil may thus be easily ruined if worked for lengthy periods off a high-voltage circuit with an electrolytic interrupter, owing to the exceedingly high periodicity (some 1,500 to 2,000 per second) produced by this form of interrupter.

Effect of Heat on Insulation.—Providing that no moisture is present (in which case, of course, heating

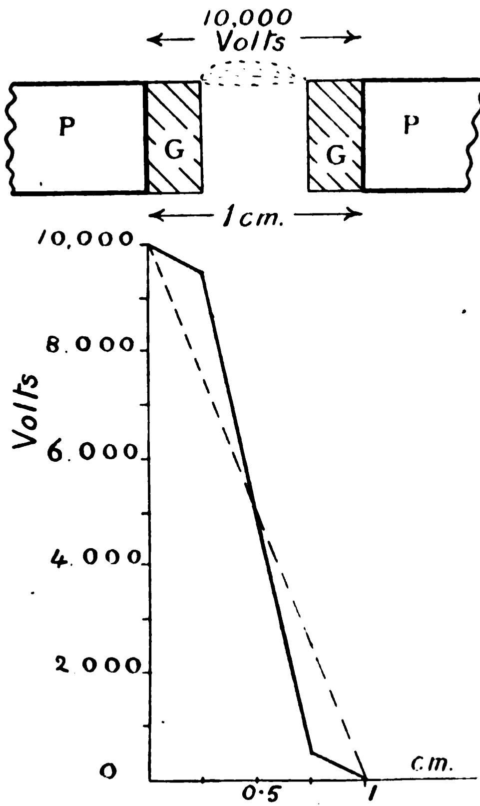


Fig. 2.

would improve the insulation by drying out the moisture), increase of temperature lowers the dielectric strength; in some cases enormously so. Overheating may permanently ruin the dielectric strength; paraffin wax is turned from a white to a yellowish colour, and ruined if heated much above 100° C. (212° F.), and should not be kept heated up even to this temperature longer than necessary, or its insulation qualities will be permanently affected. Nor is there any reason to heat it up to this temperature, seeing that paraffin wax has a melting point of 46° C. (114° F.). It should always be melted over a water bath, glue-pot fashion, care being taken that no steam can reach any part of the insulation material. Bee's-wax melts at 150° F., or 65° C.

Cotton-covered wire gradually deteriorates if subjected to even 100° C. (212° F.) for any great length of time, while above this temperature the cotton turns brown and becomes carbonised pretty rapidly. The practice of passing the wire over a Bunsen burner in order to melt the wax when coil winding, is a bad one, as the excessive temperature is almost certain to seriously affect the insulation. By far the better plan is to run the wire through the hot wax and then straight on to the winding former.

Moisture has always a very bad influence on the dielectric strength, and should therefore be entirely removed from the cotton or silk, wood, etc., preferably by vacuum drying, of which more will be said later on. Few people realise that the atmosphere usually contains at ordinary temperatures from 40 to 65 per cent. of the maximum moisture the air can take up (*i.e.*, saturation point); that perfectly dry (vacuum-dried) wood will, under quite ordinary climatic conditions, reabsorb 15 per cent. at least of its own weight in moisture within forty-eight hours; and that most paper contains at least 5 to 10 per cent. by weight of water.

Oil is very seriously affected by moisture (even the moisture of saturation), 0·01 per cent. (one-hundredth of one per cent.) being sufficient to lower the disruptive strength of a perfectly dry oil from 24,000 to 12,000 volts, while point one (0·10) per cent. will lower it to about 1,800 volts; hence the need for carefully boiling and keeping Tesla transformer oil quite free from moisture. To simply soak, say, ordinary undried wood or paper in melted wax merely imprisons the moisture within the material, while if the temperature is raised above the boiling point of water (212° F., or 100° C.) so as to expel the moisture, the insulating qualities of the paraffin wax are ruined in the process.

Vacuum Drying.—The writer strongly favours the vacuum drying of all paper, wood, etc., before waxing, while for his large coils he always again soaks the secondary, after winding, in melted paraffin wax in vacuum, thus expelling any air bubbles. After half-an-hour's vacuum waxing, the pan is opened, and when the wax is just on the point of setting, the coil is removed. Of course, the coil must be so built that the sections are well supported by the paper discs and cannot be displaced even when the wax is all melted. With a 28-in. vacuum the boiling point of water is reduced to 38° C. (100° F.), while with a 29-in. vacuum it is only 25° C. (77° F.).

As the pressure is only approximately 15 lbs. per sq. in., the construction of a small vacuum pan for coil work does not present any difficulty, while a simple Grove single valve type air pump with vertical barrel (the top of the piston-rod and plunger being kept tight by a layer of very thick cylinder oil) will readily give the desired vacuum. A reasonably well-fitting lid clamped on with a ring of oiled brown paper packing will be quite airtight and readily renewed. The writer's vacuum pan was made from a worn-out float type steam trap picked up from the scrap heap. The thermometer tube is brought out through an asbestos-packed stuffing box. To build any coil above 4-in. spark without such a vacuum pan is false economy. As regards the insulation materials themselves, it will be better to deal with them under their various headings.

***Cotton and Silk-Covered Wire.*—Cotton is generally** used, owing to the expense of silk. Cotton cannot well be spun commercially unless it carries from 5 to 15 per cent. of moisture, the spinning mills being furnished with steam jets to supply and keep the air moist. Hence the wire should be most carefully dried before use. All cotton contains some amount of acid. This, however, is not disastrous, provided the moisture is effectively removed, otherwise the acid and moisture together may form salts of copper and destroy the insulation. As already stated, cotton is readily carbonised at temperatures above 100° C., and should therefore not be overheated. Silk covering is much more expensive, but, of course, allows of more wire being got into a given space, and is a far better insulator. Cranfield & Robinson give the following values for the breaking down voltage per 0·001 in. (cold):—

Single cotton-covered wire ..	289	volts.
Double cotton-covered wire	205	,,
Single silk-covered wire ..	565	,,
Double silk-covered wire ..	412	,,

Paper, as shown in the curve, Fig. 1, is an excellent insulator when well soaked in paraffin wax. The paper should be free from any chemicals, hence the advice to use filter paper or "Ford 428 Mill" paper. Manilla, Express, Bond, and Red Rope paper are even superior to the above, but somewhat difficult to obtain in small quantities. A thickness of 0·4 mm. of Manilla or Express paper will withstand about 3,500 volts even in the untreated state. All paper being very hygroscopic, should always be dried and impregnated before being used. Creasing should be avoided, and care should be taken to inspect for pinholes and particles of metal dust on the surface.

Paraffin Wax is almost without equal for induction coil insulation. It should be a pure white colour, free from acid and without any yellow tinge. Only the best, purchased from a reliable firm, should be used. As already stated, it must not be overheated. It is acid- and water-proof, but dissolves readily in oil.

Bitumen is a very good insulator, 2·5 mm. having a disruptive strength of 30,000 volts; it flows freely above 100° C., and is used chiefly for making insulating varnishes; benzol, naptha, and turpentine being used as solvents.

Ambroin can be turned, drilled, and polished like wood. It does not readily absorb moisture, but will not stand immersion in oil. Various grades are made. The writer prefers it to ebonite for most purposes, as it does not become affected by exposure to air and light. Quality "A. F." Ambroin 0·33 mm. thick, has a disruptive strength of 3,500 volts. Different samples, however, vary in this respect.

Ebonite and Vulcanite are types of hard rubber. They are brittle, and the surface is affected by exposure to air and light. Ebonite 1-40th in. thick punctures at 21,000 volts.

Glass.—Annealed glass is a much better insulator than unannealed glass. Glass varies in quality both as regards specific resistance and dielectric strength. Crystal glass stands first, then soda lime, and next, white French glass. For Leyden jars, etc., only soda or crystal should be used.

Presspahn is of a cardboard nature, with a smooth glossy surface. When vacuum-dried and immersed in oil it gives excellent results, a sample 0·2 mm. thick having a disruptive strength of over 19,000 volts maximum or 13,500 (R.M.S. value)

millimetre of thickness. It is very hygroscopic, and must therefore be carefully dried and impregnated before use.

Horn Fibre is an exceedingly good insulator, 0·2 mm. having a disruptive strength of over 18,000 volts (R.M.S. value) per mm., while when treated with linseed oil the dielectric strength of the sample rose to 40,000 volts. Hence the disruptive strength of this material is equal to that of the best mica. The writer has used this material with great success in those cases where good mechanical support is desirable. In fact, a 10-in. coil in which, in addition to paraffined paper, a sheet of horn fibre was used between each layer, has after twelve months' very heavy use proved highly reliable.

(*To be continued.*)

The Making of Ship's Model Fittings.

By "X. Y. Z."

(*Continued from page* 34.)

FOR a change we will have a turning job, and will proceed with the davits. Take a piece of 12-gauge brass wire and turn as shown in sketch (Fig. 29), using a ball tool to fashion the end.

FIG. 30.

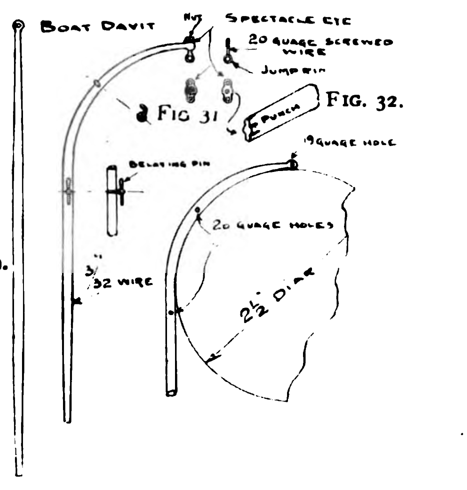


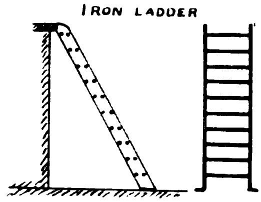
FIG. 29.

Having turned and polished, soften, and then bend to the required radius on a piece of tube or anything else suitable to hand. Now drill a 20-gauge hole in the three positions shown.

We next turn what is called the belaying-pin out of the same gauge wire, and drill as in sketch. Now put a piece of 20 wire in chuck and stick a piece of 22-gauge in the jaws and spin round the 20 wire as shown, making, when they are cut, a number of small eyes. These can be bought ready-made and are called jump rings, but they can be made for practically nothing by the operator. After they are cut off with a fretsaw, tap them flat, and, taking in a pair of pliers, file the joint flat, make a piece of 20 screwed wire, cut into small lengths, and hard-solder to eyes as shown (Fig. 30).

We now have to make what is called the spectacle eye (Fig. 31); this is stamped by making a punch as shown (Fig. 32). Having stamped out the required number, drill holes as shown. We now require a small nut. Put a piece of 14-gauge wire in chuck and file six cants—if there is a division-plate on lathe head, this is an easy operation.

FIG. 33.



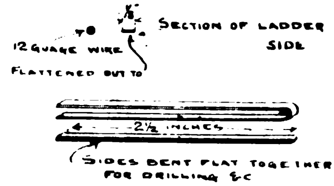
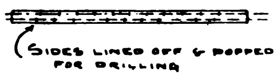


FIG. 34.

In any case, it is advisable to fit one with a division of at least 8, 12, 16. Centre the wire with the flat tool, corner and drill a 20 tapping hole; then cut off, having previously taken the corners off, as is usual in all nuts. To tap out hold by the flats in a pair of pliers. The whole of the parts now

FIG. 35.



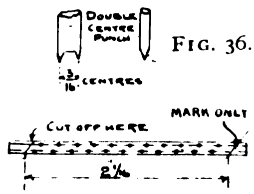


FIG. 36.

should be assembled, and if you are careful it will turn out a satisfactory job. These are fitted up in pairs, and for a special finish a small angle-ring can be turned to lie on deck; this also answers the purpose of covering up the hole drilled in deck, and if the hole happens to be a bad job, it looks all right with the angle-ring covering its beauty.

Having by now got fairly into the way of drilling and soldering, we will proceed to make the ladders. There are, roughly speaking, three kinds in general use—Jacob ladders, flat-step, and wire-rung, or iron, ladders. We will, however, first of all make the wire rung (Fig. 33), as they are, I think, the simplest for a start. The first thing to do is to make the sides. In the model shops this is done by rolling a piece of 12-gauge wire (previously softened) flat until it is about 19-gauge thick. It will then be found to be about ⅛ in. wide, with round edges. As the amateur is not likely to possess a pair of rolls, he will have to cut a strip of 19- or

18-gauge sheet about ¼ in. wide and 5 ins. long. This having been cut off, tap it nice and flat on the lathe bed. Now bend in the centre and tap together at the bend; afterwards tack the loose ends with solder (Fig. 34). We next divide the ladder side into three equal parts and scribe full length as shown (Fig. 35), afterwards having lines

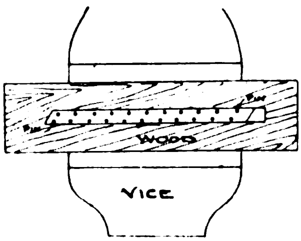


Fig. 37.

across for the steps 3-16ths in. apart. The ladders having a spread, or slope, one set of rungs should be higher than the other, so that when the ladder is in position the steps are flat. A glance at the sketch will explain clearly what is meant. The steps may be set out with the dividers or with a

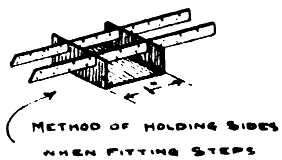


Fig. 38.

little tool (Fig. 36) called a double centre-punch. This is made from ¼-in. steel, and needs no further explanation. The use of this tool ensures all the steps being of equal distances apart and saves a lot of time. There is usually about nine steps in an ordinary ¼-in. scale ladder, but, of course, this depends on the length. Having "popped" all the steps, drill the holes right through both sides with a 22-gauge drill. A twist drill is the best for

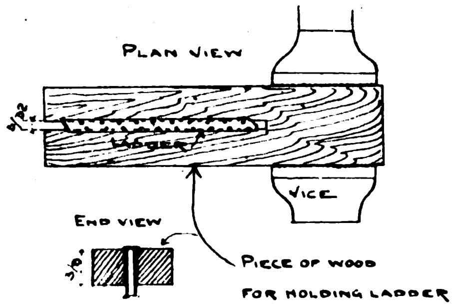


Fig. 39.

this purpose, and can be bought for a few coppers. They should now be marked with the nippers where they are to be bent to form the feet for fastening to deck. Now cut the top off, as shown, the same angle as the steps. The next thing is to separate the sides by warming in gas and dropping on bench. Now put a piece of wood in the vice, lay the side on, and put a couple of pins through holes to hold whilst filing and polishing (Fig. 37). They should be polished lengthwise, and we now require some short pieces of 22 wire (nice and straight). I think for the amateur the best way will be to get a packet of brass pins (cost about 2½d.), or ordinary pins will do, but they do not solder quite so well.

Now make a small tool out of a piece of 20 or 18 sheet brass, as shown in sketch (Fig. 38), bend and file two grooves across, same width as ladder side;

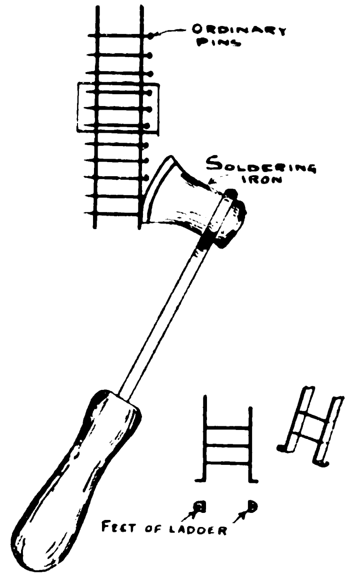


Fig. 40.

now put sides in the grooves and put the steps across. Now take the spirits and touch the top and bottom wires. Tack these with the soldering iron from the outside. See that the solder just appears on the inside; now take out of the erecting-frame and complete the soldering. The next thing to do is to make the feet. Where you have marked across with nippers, file with the edge of a square file nearly through and turn up, and then solder the joint. Now make a piece of wood, as shown in Fig. 39, about ⅜ in. thick and slide the ladder down. It can now be easily filed and polished with an emery stick. Now trim off the feet and put pinholes to suit (Fig. 40). There should also be a hole on each side between the second and third step to take the handrails. This applies to all ladders except the Jacob ladder.

(To be continued.)

Water was completely shut off from the power tunnel at Niagara Falls for five hours on June 14th for the first time in the ten years since it was constructed, in order that divers might examine the abutment of the upper steel arch bridge.

With the Junior Engineers in France.

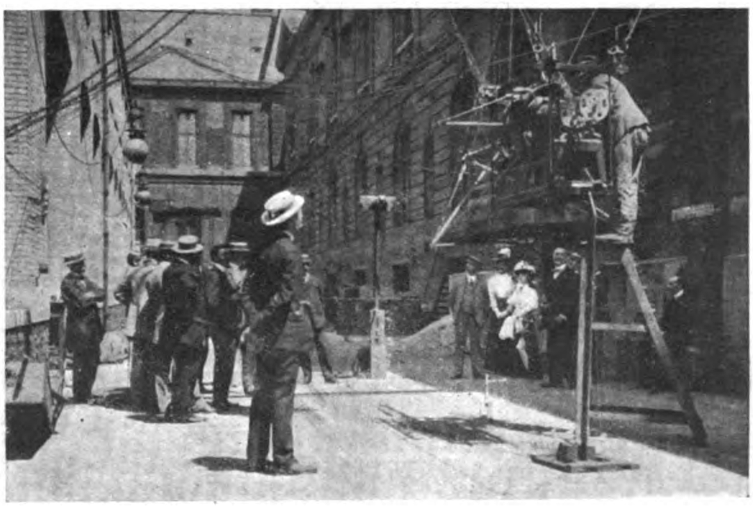
By " ATLAS."

THE " Junior," as the member of the Junior Institution of Engineers is familiarly known to his kind, is a peculiar example of the *genus* engineer. Peculiar, that is to say, not in his personal appearance or in any derogatory degree, but in the characteristics with which he is imbued by the well-established traditions of his Institution. Of enterprising engineers he is the most enterprising; of active engineers he is the most active; of inquisitive engineers he is the most inquisitive—he wants to know things; of enthusiastic engineers he is the most enthusiastic; of good fellows he is the best. Imagine thirty " Juniors," not forgetting several ladies, off to France for a fortnight, and you at once perceive possibilities of our having a great time; and we have had it, for the 1908 Summer Meeting of the Institution has been one of the best on record.

SOME JUNIORS ON DECK.
(Mr. Frank R. Durham, A.M.I.C.E., Chairman, in the centre.)

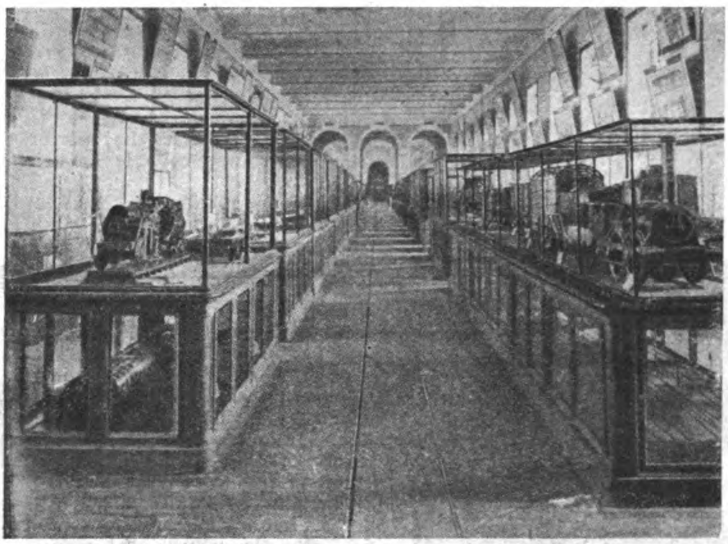
Leaving London on Saturday, June 27th, we travelled direct to Paris *via* Newhaven and Dieppe for the opening portion of the programme. We have not heard of any successful inventions for keeping a level surface on the Channel as the outcome of the trip, but we heard more than one of the party refer in very sorrowful tones to the needless, and even painful, frequency with which our worthy vessel departed from her normal horizontal position. The charming scenery of Normandy, to say nothing of the revivifying nature of the buffet at Dieppe Station, did much, however, to remove any dissatisfaction at the antics of Father Neptune, and by the time we reached the Gare St. Lazare everybody was as happy as everybody else, except those who felt hungry. It was discovered shortly afterwards that even that particular trouble was capable of being remedied.

With the Grand Hotel as our head-quarters, we were admirably placed for seeing the principal cafés—I mean sights—of the city during the Sunday, of which full advantage was taken. The weather was very hot, and the cafés were very near, and the demand in Paris for picture post-cards and mineral waters went up very suddenly. " Why zis rush for limonade ? " said Jules to Jacques. " Mon vieux," replied Jacques, " c'est les Junior Engineers qui arrivent." " Ah, bon," said Jules, as he rushed for six more syphons, and a pail of ice. By the way, did I mention that it was hot ? *Pas demi* ! At nine o'clock in the evening, there being no more lemonade left in Paris, we retired to rest in view of our heavy programme for the week. But it was hot !



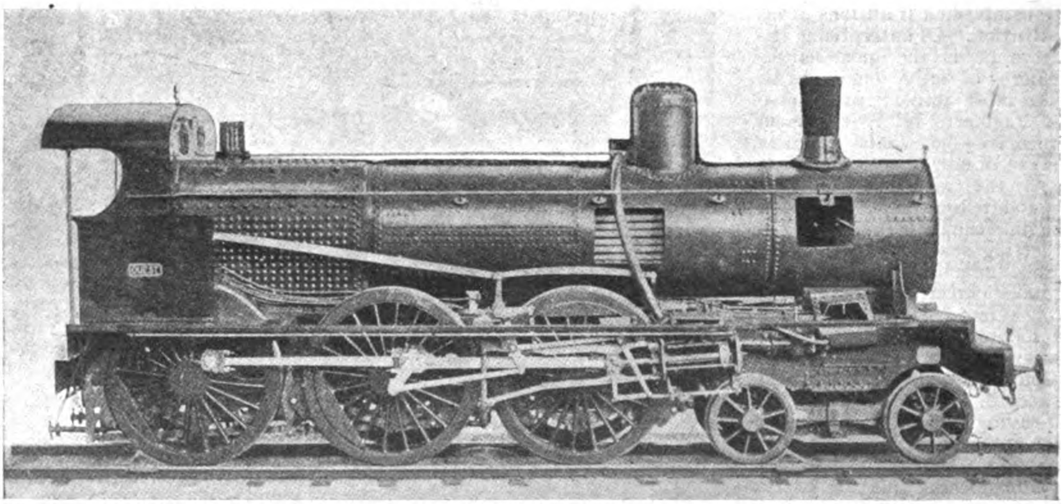
APPARATUS FOR TESTING AIRSHIP PROPELLERS.
(Conservatoire des Arts et Métiers.)

The first item on the agenda for Monday was a visit to the Conservatoire National des Arts et Métiers, the South Kensington Museum of Paris so far as models and scientific apparatus are concerned. This is a fine piece of architecture as will be seen from the photograph herewith, and it is interesting to know that it is situated on a site which for seven hundred years was occupied by a monastery formerly known as the Abbey, and latterly as the Royal Priory of Saint Martin-des-Champs. The old refectory of the Priory now forms the library of the Museum. To the philosopher Descartes is attributed the first suggestion to found such a Museum, his idea being to build some large lecture halls for each trade, and to annex to each hall a room in which should be placed examples of the tools and utensils either necessary for, or associated with, the particular trade in question. He proposed that a professor should be appointed who could not only answer the questions of the various artisans, but who would give lectures on the principles underlying their daily work. This was an excellent anticipation of the modern technical college, but more than a century elapsed between the conception of Descartes and the first attempt to put such a scheme into operation.



THE PRINCIPAL GALLERY OF MECHANICAL MODELS.
(Conservatoire des Arts et Métiers.)

As far back as 1689, however, there was in existence a collection of machines in the Louvre, formed under the auspices of the Académie des Sciences. Although some descriptions of this collection had been privately issued, they were not available to the general public, and it was not until 1775 that Vaucanson took the first real step towards the realisation of the proposition of Descartes. He then rented the Hotel Mortagne, in the rue de Charonne and founded a public collection of machines, instruments, and tools, as used in various trades. At his death in 1782 he bequeathed this collection to the Government, and it is now on record that there were sixty pieces of apparatus particularly adapted to the purposes of public instruction. The King, in accepting the legacy, divided the property between the Académie des Sciences and the Treasury, giving to the former the machines and inventions of purely scientific interest, and to the latter those which had a practical bearing on arts and manufactures. After the Revolution of 1789, a Commission of Monuments was formed; and after various tentative efforts, the Conservatoire des Arts et Métiers was founded in 1794. It was many years later, however, before it began to



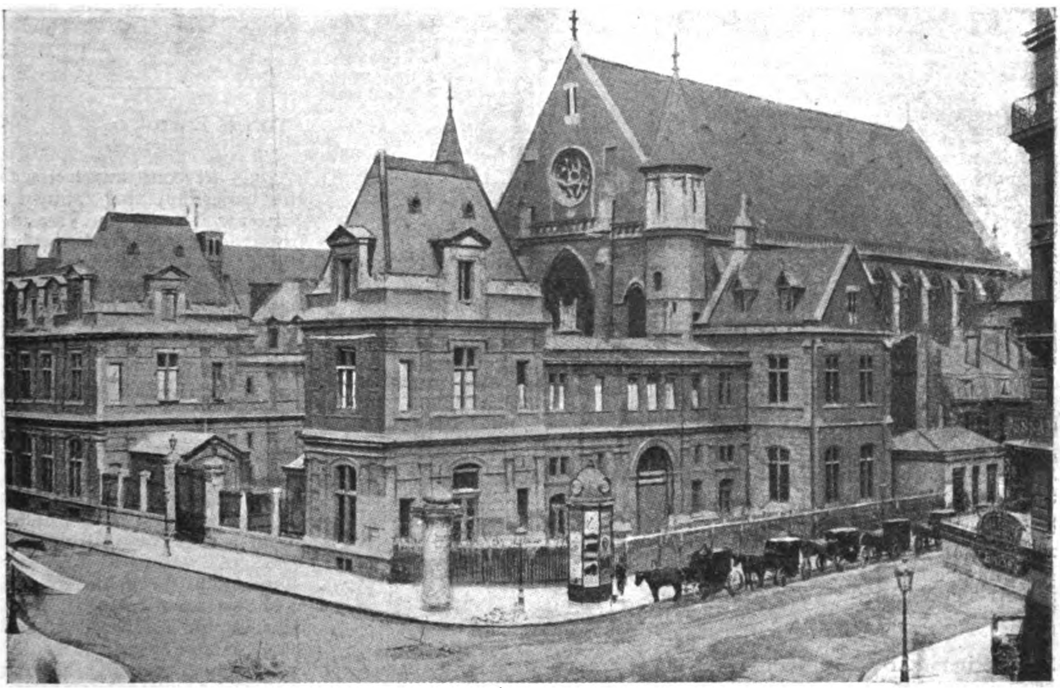
MODEL FOUR-CYLINDER COMPOUND LOCOMOTIVE OF THE WESTERN RAILWAY OF FRANCE.
(Conservatoire des Arts et Métiers.)

sail in smooth waters, for even in 1812 and 1813 there were proposals made to remove it to some less appropriate spot and establish a school in its place. The celebrated French physicist, Regnault, thereupon interested himself in the welfare of the establishment, and in March, 1813, the Emperor issued a decree deciding that the Conservatoire should remain temporarily where it stood. It is still there!

So much for the early history of this fine Museum. It now possesses a magnificent collection of industrial models and scientific apparatus, the total number of items in the catalogue exceeding 14,000. Even this large number would have been greatly extended if the directors had not been careful to exclude everything not of real interest. Anything in the nature of a detailed notice of the models we inspected would not be possible in the limits at my disposal, but I may mention that the many inventions represented include the ideas of Montgolfier, Prony, Pon[illegible]et, Fourneyron, Bourdon, Farcot, Watt, Newcomen, Fulton, Stephenson, Papin, Giffard, Sauvage, and others whose names are well-known to all students of the applied sciences. The models are arranged in glass cases, in long galleries, but unfortunately though many of them are working models, there is no power available for demonstration. Hence they lack much of the interest which attaches to the models in our own finely organised Museum at South Kensington. We were, however, accorded a special privilege in seeing one or two of the notable automata, made a hundred years ago by French mechanicians, put into operation. These included a singing bird, a lady who played six tunes on a musical instrument, and a dancing figure. In these days of Maskelyne and other clever designers of automatic machinery, the automata in question would not arouse more than passing interest, but at the time when they were constructed they were rightly considered triumphs of the mechanician's art, and as such are of great historical value.

At one time it was customary to file in this Conservatoire a standard set of drawings for all industrial machines and engines of approved types, so that the general public might readily obtain particulars of any machine in which they were interested. A number of these were produced for our inspection and proved to be beautiful examples of draughtsmanship, coloured and shaded in a style which has long since been put *hors de combat* by the modern blue-print. Now that the drawings of modern machinery are more or less common property through the intervention of the various engineering journals and text-books, the necessity for preserving a public file of such productions has ceased.

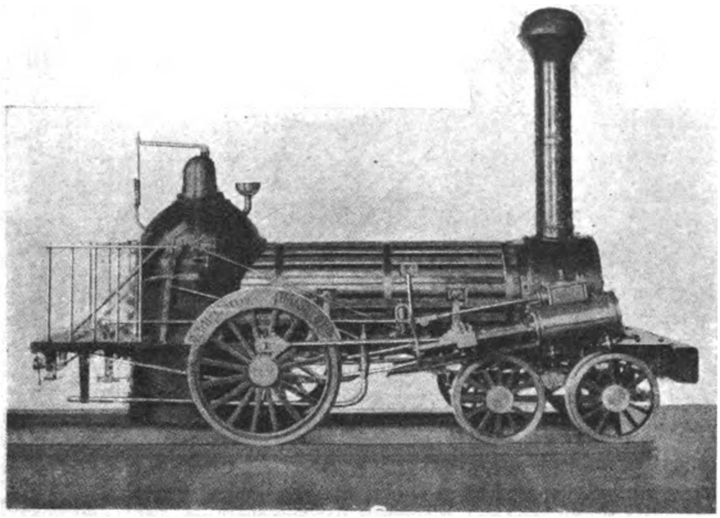
There is a department attached to the Conservatoire which is of great value to the general industrial public. It is for the purpose of testing and reporting on engineering and manufacturing materials, and to show that it is right up to date in its equipment, I may mention that it possesses a 300-ton testing machine by the well-known firm



General View of the Conservatoire des Arts et Métiers.

of Buckton, of Leeds. It is rather a shock to realise that we have no machine of this size in our own country, but some consolation is to be found in the English origin of this giant apparatus. Such diverse problems as cement testing, brick testing, photometry, and trials with propellers for flying machines, are all included in the wide scope of this useful department, which has a corresponding counterpart at home in the National Physical Laboratory at Kew.

Another special section of the Museum is devoted to a display of methods of preventing accidents in workshops and factories. A large variety of machine tools, woodworking machinery, presses,



Model of Old American Locomotive.

(Built by Norris, of Philadelphia, in 1841, and presented by King Louis Philippe to the Louvre in 1846. Now in the Conservatoire des Arts et Métiers.)

and other items in power plant involving the use of gearing or other dangerous details, are on view, and in each case suitable guards have been fitted to the dangerous parts. These guards are painted red, as distinct from the ordinary colour of the machine, so that the dangerous part may be readily recognised. I noticed this feature in some of the works we subsequently visited, showing that it is generally approved.

From these notes the reader will have gathered that there is much to be seen at the Conservatoire des Arts and Métiers, and I can cordially recommend him to pay it a visit when he is in Paris.

(*To be continued.*)

Notice has recently been given by the Suez Canal Commissioners that vessels drawing 28 ft. of water are now permitted to pass through the canal. Hitherto the limited draught has been 27 ft.; the minimum depth in the canal is now between 30 ft. and 31 ft., as compared with 26 ft. 3 ins. when the canal was first opened.—*Mechanical World.*

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender MUST invariably be attached, though not necessarily for publication.]

Motor Bicycle Construction.

To the Editor of *The Model Engineer.*

Dear Sir,—Would "Sregor" kindly say if the ring and adjacent parts of Figs. 112 and 113, described at page 615 of June 25th issue, should be made of brass? Would not the water always present in exhaust gases, cause an iron ring to rust or become useless?—Faithfully yours,

T. M. C.

To the Editor of *The Model Engineer.*

Sir,—*Re* your suggestion that the expansion ring shown in Fig. 112 should be made of brass: there is no reason, I think, that brass should be specified in this case, as you suggest, to prevent corrosion, owing to the presence of water in the pipes. I admit that often water is noticeable in the exhaust box, even when there is no perceptible leak from the water jacket. This water is the result of the hot gases coming in contact with the cold metal, causing what is generally termed sweating of the metal, and which no doubt is aggravated by the presence of water in the water chambers of the cylinders. But, as shown in my sketch, the expansion pipe is close to the cylinder, and any sweating would be blown through to exhaust box, and the hot flame of the exhaust would readily evaporate any moisture. Of course, brass can be effectively used, but the advantage of good cast-iron over brass is the fact that it possesses more initial spring than brass, and retains it longer under the conditions, *i.e.*, expanding from the heat and contracting when cooling. The writer, having had considerable experience with this joint, has found cast-iron quite satisfactory. Hoping this will be of service to "T. M. C.," I remain,—Yours truly,

"Sregor."

In a large Swiss factory there is employed an automatic machine for threading needles that is reported to have a capacity of 1,000 needles per minute, its operation including picking up the needle, propelling it, tying knots, cutting the thread, and returning needle to its proper resting place.—*Mechanical World.*

Queries and Replies.

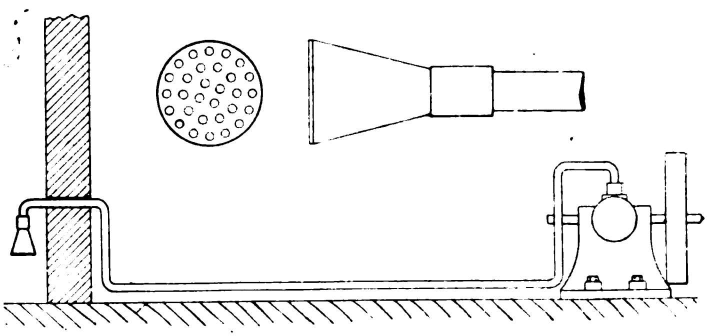
Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[19,912] **Model Locomotive Boiler.** A. C. (Sydenham) writes: I should be much obliged if you would give me your advice on a locomotive type boiler I am shortly commencing with dimensions as follows: Barrel, about 20 ins. in length, 6 ins. diameter: Belpaire type boiler with firebox about 8½ ins. by 3½ ins., with ⅜-in. water space all round, to supply two cylinders, each 1¼ ins. by 2½ ins., at a working pressure of, say, 80 lbs. I propose using ⅛-in. solid-drawn copper tubing for barrel, with gun-metal castings for front tubeplate, throatplate, and backplate. Could I use similar castings for front and back plates of firebox with satisfactory results, using copper inside to preserve the gun-metal from the action of the fire, which will be coal and charcoal? My object is to avoid, if possible, any flanging, as I have no means for heating or experience in copper working. Should you consider this a satisfactory method, kindly let me know what thickness the castings should be made.

The firebox is much too small and the barrel is rather longer than it ought to be. We would make the barrel 2½ times its diameter in length, and the firebox 1¼ to 1½ times the barrel diameter in length. Yes, you can use gun-metal castings, and the writer is designing a boiler to be built in this way at the present moment. The throatplate, front tube plate, and inner firebox tube plates are castings, the two backplates are flanged and embossed out to meet in the centre of the water space for the firehole. The diameter of the boiler is 8 ins. General thickness of castings, ⅛ to 5-32nds in. finished. You can use castings throughout without taking any special precautions except to see that the metal is *good* and not porous. The castings may be hammered to close the pores of the metal. The tubeplates should be 7-32nds or ¼ in. thick where the tubes enter.



[19,352] **Alternating Current Transformer Windings.** J. J. B. (Dover) writes: Will you kindly tell me how to make a choking coil, and how to make a resistance, as enclosed sketch (not reproduced), to work an arc lamp off a house fitting of 100-volt alternating current? What candle-power could I get? I should like to get 600 or 800.

We advise you to make a small transformer. The work involved is not much more than in making a choking coil, and it is more economical. The following are the particulars of a suitable transformer. Core to be made of plain ring armature stampings—outside diameter, 5½ ins.; inside diameter, 3½ ins.; depth, about 1 in. Wind on first some varnished tape or thick paper to form insulation; two thicknesses should be used. Then wind on the primary wire, consisting of 600 turns of No. 18 gauge D.C.C. copper wire (this is for a 100-volt supply). Then wind tape over this as insulation between primary and secondary, and on top wind the secondary, consisting of about 250 turns of No. 14 gauge D.C.C. copper wire. This will give you about 40 volts, which is sufficient for the lamp. Be careful to well wrap the end wires of the primary winding where they come through to prevent the short-circuits between turns of wire. The direction of winding does not matter; simply wind the wire over the core until all turns are on, covering the whole of the core. You can obtain a few volts more or less by winding or taking off a few turns of the secondary (see THE MODEL ENGINEER for March 29th, 1906, and following numbers—"How a Transformer Works"). About 2½ lbs. of wire of each size will be approximately the weight required, but the number of turns is the important thing. You will require a resistance in series with arc to steady the current; a few yards, say half a dozen, of No. 16 gauge bare German silver wire will do; make it into an open coil, like a spring. The lamp may give you 600 c.-p.; it is difficult to say, much depends upon the position of the carbons, so that the maximum amount of light is projected towards the lens of the lantern.

[20,010] **Failure of Model Motor.** J. H. H. (Godalming) writes: I have just finished an electric motor, as described in your handbook, "Simple Electrical Working Models" (page 52), but it will not work. I think this may be owing to the magnets, because, unfortunately, I lost the book, and therefore had to work without its help. I bought four bobbins, each 1½ ins. long, such as are used in ordinary electric bells. I wound these up to about 1-16th in. from the top with a wire, of which I enclose a sample. Please tell me what gauge it is. Would this have anything to do with it not working? I have used brass eyes as bearings, and they just allow the spindle to revolve. I suppose they are as good as proper ones. The connections are correct.

The sample of wire you sent is No. 26, and ought to be satisfactory. It is difficult to advise you without seeing the model, as there are so many things that might cause failure. You should very carefully go through the directions given in the handbook, and compare your machine in every detail with the one described there, making any slight alterations possible to make yours correspond more closely to it. See that the contact-breaker spring is adjusted to touch *only* the corners of the brass square. It appears from the illustration in the handbook that the spring touches the flat side as well as the corners, but this must not be the case, as the letter-press clearly states. Are you sure that the magnets are wound correctly, so that the two legs are of different polarity? Looking at the pole-faces, the current should be going round one limb in a clockwise direction and round the other in the reverse direction. Whatever bearings you have, there must not be much friction. The drum should spin quite easily on being given a turn by the fingers. If all else fails to make the model work, try increased battery power.

[18,914] **Silencing Air Inlet on Gas Engine.** A. B. (Hove) writes: Would you kindly advise me as to the construction of a really efficient air silencer for a ½ to ¾ b.h.-p. gas engine. The air and gas are drawn into cylinder by suction of piston (valve not being mechanically operated), and the "snifting" noise made by the air entering is very disagreeable, which I wish to remedy. I have already connected to the air inlet by a piece of ½-in. brass tube, two cylinders, one inside the other, 4 ins. and 2½ ins. diameter respectively, by 4 ins. deep, perforated with fine holes, but it still is noisy, although not quite so bad. I might say that the engine itself (which I made up from parts supplied by an advertiser in THE MODEL ENGINEER) runs practically noiseless, hence my desire to remedy the above trouble.

We think your best way out of the difficulty is, if possible, to take your air from some position a little distant from the engine, such as suggested by the diagram which we append. There will, of course, always be a certain amount of noise, which is unavoidable, especially in high-speed small power engines. You do not give us any information as regards position and surroundings of your engine, so we cannot advise you very definitely. The main thing, however, is to have a large enough air inlet pipe, which may be gradually reduced in diameter as it nears the inlet valve on engine.

[20,056] **Engine for Model Destroyer.** R. W. (Fleetwood, Lancs) writes: Could you please tell me from the enclosed cutting from THE MODEL ENGINEER, page 487, dated May 19th, 1904, how the valve is operated and what size of cylinders I should require for 3-ft. boat?

Mr. O. D. North's own design of valve for his engine is explained and illustrated in our issue of Jan. 8th, 1903. We have no further particulars of Mr. Fenwick's altered valve. Mr. North's article seems to make clear the manner in which the valve is operated. It is exactly the same motion as that obtained by an eccentric, but a crank on the shaft is used instead. This is plainly shown in the end view drawing on page 43. You will find much that helps to explain the action of slide-valves in our handbook, "The Slide-Valve Simply Explained," 7d. post free. You will notice that, with ⅜-in. bore and ⅜-in. stroke, Mr. Fenwick's boat did not give a good speed. We should suggest that you make the engine as large as the size of your boat and boiler will allow. In future, please comply with our rules re stamped envelope and coupon.

[18,415] **N.E.R. Dining Saloon.** C. E. B. (Bournemouth) writes: Will you please give me a rough sketch of a N.E.R. bogie carriage, showing the necessary dimensions for constructing a ½-in. scale model; also guard's van.

In reply to your query, we have been able to obtain photographs and drawing of a N.E.R. dining carriage, which we give on pages 94 and 95. The detail photograph shows the construction of the end vestibules and the recessing of the doors of the coach. The colour of the N.E.R. carriages is a dark lake. We have no drawings of a N.E.R. brake van.

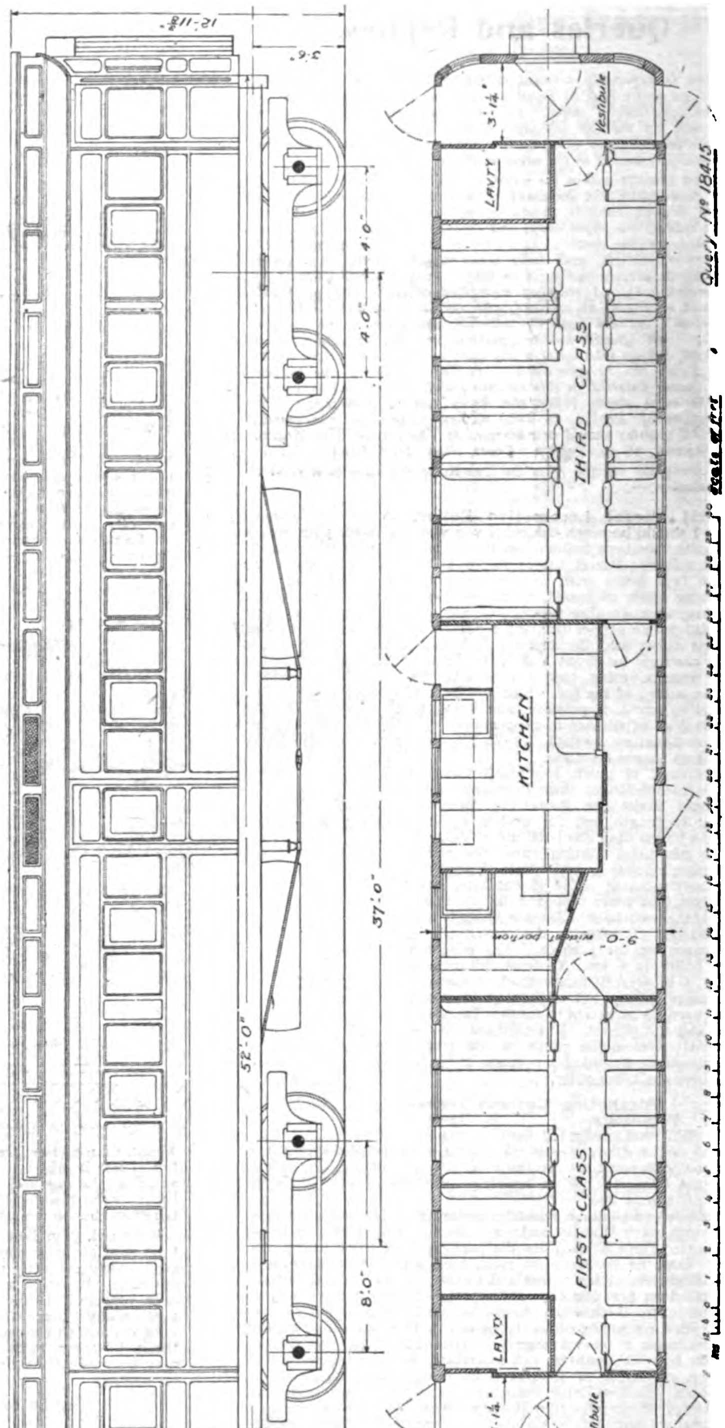
[19,879] **Small Dynamo.** A. D. (Bath) writes: Would you kindly answer the following questions—(1) What gauge wire would be required to wind the field-magnets of the motor, a diagram of which is given (not reproduced)? Also, how much would be required? (2) What gauge and amount of wire would be required to wind armature of same, 1 in. diameter, tripolar? (3) What current would be required to drive the motor? (4) Would this machine run as a dynamo; if so, what current would it develop? (5) Could you advise me as to the best method of getting old paint off field-magnets, which are of such a shape as to render sand-papering impossible? Would this process affect the quality of the iron?

Use on armature No. 24 S.W.G., and on field-magnets No. 26 S.W.G. Get on as much as you can in the space, in both cases. Machine will probably not run satisfactorily as a generator. These machines seldom do. Use a battery of two good large bichromate cells in series to run motor. You could get the paint off by soaking the casting in turpentine. No, neither this method nor the use of emery paper would affect the quality of the iron.

[19,892] **Faulty Induction Coil.** J. C. R. (Liverpool) writes: I should be very much obliged if you could suggest any reason for the peculiar behaviour of a small electrical medical coil which I possess. I use a 2-volt bichromate cell to work the coil, which will not start without assistance, and when it is working, the shock I get from it is very inconsistent and jerky, and very often the shock stops altogether. I have moved the screw of the contact-breaker in all positions, but get no good results.

Your trouble may be due to your not getting a sufficient current through the apparatus. A bad connection would be enough to cause it. You cannot be too particular about the connections, so go over them all, making certain that each is perfectly clean and secure. See that your cell is in good working order. The bichromate polarises rather rapidly, and should not be used for more than about an hour without being allowed a rest. If, with these things in order, and an iron core in your coil, you do not get better results, we would suggest experimenting with a different strength of spring.

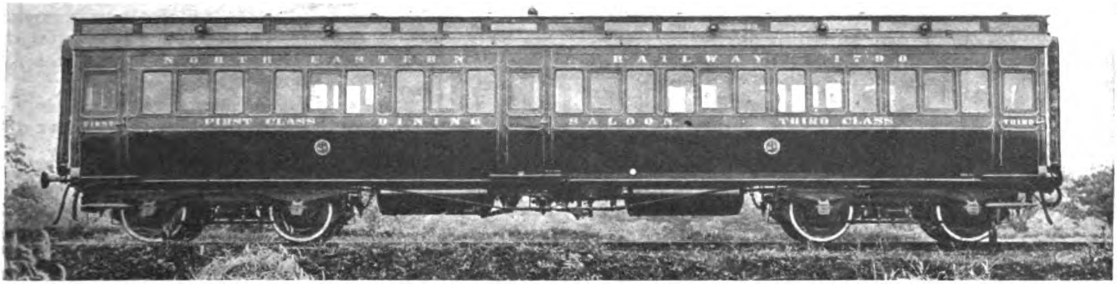
[19,804] **500-watt Dynamo.** D. V. J. (Deansgate, Manchester) writes: I should esteem it a favour if you would give me



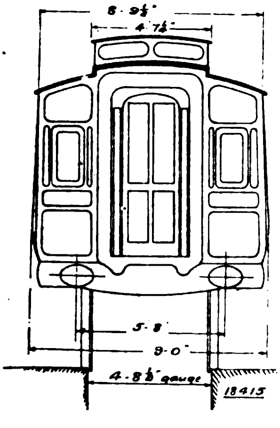
N.E.R. First and Third Class Dining Saloon.

the measurements of the field-magnets in cast iron, and size and quantity of wire, for both field and armature of a dynamo to give an output of 5 volts 100 amps. for plating purposes (ironclad type), size and speed of armature, size and number of conductors on armature (one layer if possible), size and quantity of wire for field-magnets, size and number of segments of commutator; also, if there is any objection to a wood bobbin filled with soft iron wire instead of laminations, as recommended in the "A.B.C." book, and also your No. 10 Handbook.

The dynamo described in Chapter VII of "A.B.C. of Dynamo Design" will give you all the dimensions you require. We advise you to make the commutator slightly larger in diameter, say 2¼ ins. at least, and to make it sufficient in length to take a brush 1¼ ins. in width comfortably. Use copper gauze brushes ⅛ in. thick. Wind the armature with No. 10 gauge D.C.C. copper wire, two turns per section; this will be about right for a sixteen-coil armature; commutator to have sixteen sections also. Weight of wire will be about 3 lbs.; this should be ample. There is no objection to making the armature core of wire, wound on to a wood bobbin; it is rather more difficult to get it true and in balance (see our Manual, No. 5, "Practical Dynamo and Motor Construction"). Probably an outside core diameter of 3½ ins. will be about right, but you should get the No. 10 copper wire first and find out just how much space the turns will require; core out the poles to suit finished armature. For field coils use No. 12 gauge D.C.C. copper wire—about 7 lbs. on each bobbin. Speed must be determined by trial; it may come to about 1,200 to 1,500 r.p.m. Field coils to be connected as shunt.

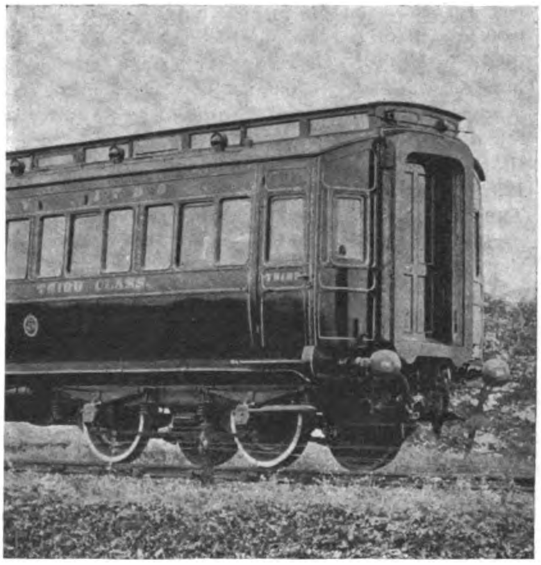


N.E.R. First and Third Class Dining Saloon.



[19,636] **Indentured Apprenticeships.** F. S. J. (Bristol) writes: I shall be glad if you can inform me whether I can get my indentures transferred. I am apprenticed to the engineering for five years, and have already served 1½ years. My firm (motor-cars and engine construction) is not in the line of engineering I want to learn, viz.—the marine engineering, to be a sea-going engineer. Being a reader of The Model Engineer, I thought you could assist me. I was at sea before I was apprenticed, and would like to learn my trade at sea. Would there be any premium to pay? I am just 18 years of age.

The question of transference of your indentures would rest entirely with the firm you are with and the firm you propose to join. You should go through the terms of your indentures carefully and see whether there is any clause in the agreement relating to the matter in question. We should not advise you to attempt to learn marine engineering at sea, as to do this it would take you at least two or three years longer than would be taken by working in some marine shop ashore. Presuming you want to sit for the Board of Trade examination at the earliest possible date, your best plan is to do as we suggest and serve about three years in some shop doing engine and boiler work, first of all, and then put in the minimum time at sea, in actual sea service, in order to complete your time and to meet the requirements of the Board of Trade. If you serve no time in a shop ashore you would have to put in at least five years at sea in one of the lowest positions in the engine-room before the Board of Trade would allow you to sit for second engineer's examination. You do not mention the name of the firm you are with, but no doubt if you explain your reasons for wishing to leave, the firm would probably look upon them in a reasonable way and allow you to make a change.



N.E.R. Dining Saloon: End View.

[20,075] **Steam Ports.** P. S. K. writes: Will you please let me know the correct size of steam ports in a cylinder 1¼-in. bore by 2½-in. stroke?

Make your steam ports ¾ in. by 5-32nds in.

The Editor's Page.

THE event of the week, indeed the event of the year from the model maker's point of view, is the MODEL ENGINEER Regatta which takes place at Wembley Park on Saturday next. Given fine weather this promises to be a huge success, for a splendid list of entries has been received. This applies both to the quality and the quantity of the competing craft, and we shall look with confidence to seeing some fine performances put up. Mr. E. G. Graham, the popular manager of the Wembley Park Grounds, has taken a great interest in the whole of the preliminary arrangements, and besides contributing handsomely to the list of prizes, has done everything possible to ensure the success of this unique event. It is, of course, a score for Wembley Park to secure the first open regatta of the kind, and we hope that both competitors and visitors will be so pleased with their experience that they will want to come again. We advise those of our readers who want to secure good positions to see the racing to take up their places on the bank of the lake in good time, as there is likely to be a crowd.

* * *

In our issue of July 2nd we published a letter from "Country Amateur" offering holiday hospitality in return for workshop services. He now writes us again as follows:—"I have had such a mass of correspondence in reply to my letter in last week's MODEL ENGINEER that I would be glad if you will intimate in next issue that I shall be unable to reply to all writers for a time, but that I hope to write to each one in due course. My time is somewhat limited, and I want to be away for a few days. Meanwhile please accept my thanks for the trouble you have taken in forwarding letters. It speaks well for the wide and large circulation of THE MODEL ENGINEER, for they come from all parts—North, South, East, and West." Seeing that there are so many readers ready to avail themselves of what may be termed an easy working holiday, other similarly situated hosts may like to make corresponding offers. If so, we will willingly give space to them in our columns.

* * *

Those who read Mr. W. L. Blaney's excellent article on "Modelling the Hydroplane" in our issue for June 4th last, may have been somewhat nonplussed by the arrangement of the paragraphs in the opening column. By some extraordinary slip on the part of our printers, five lines from the middle of the column got dropped down to the bottom. To read correctly, the five lines commencing "Firstly then" should immediately follow the paragraph ending "the few notes here given." This mixture was perpetrated after we had passed the article for press, or we need hardly say it would have been promptly straightened out.

Answers to Correspondents.

"LOCOMOTIVE."—We are asked to convey to you "R. E. Y.'s" thanks for the information you recently gave him.

B. R. R. (Nottingham).—Thank you for your letter to hand. We were pleased to hear of such good results having been obtained.

J. D. (Keswick).—The matter was dealt with some time ago, and some information will be found relating to pony trucks in January 1st issue, 1902.

D. V. (London, N.W.).—Your suggestions were welcome, and we hope to move in the matter at an early date.

C. R. (Yeovil).—Your letter has been forwarded.

D. K. (Newcastle).—Probably Ashton Lumb, of Hebden Bridge, would quote you a price for casting for your motor. Many of our advertisers are in your district. You should call upon them.

J. M. (Cardiff).—None whatever. Probably a loss.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

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HOW TO ADDRESS LETTERS.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

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And Electrician.

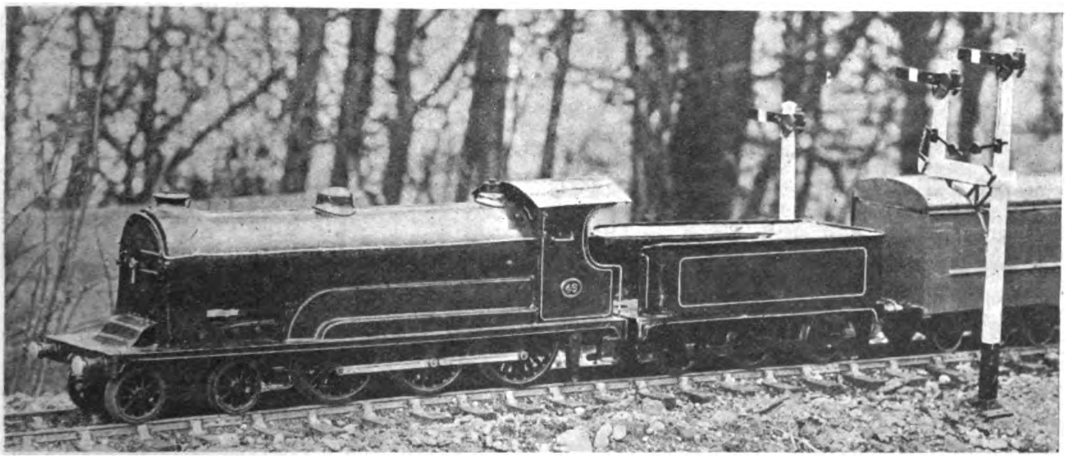
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 379. JULY 30, 1908. PUBLISHED WEEKLY.

Half-inch Scale Model Railway.

By A. B.



A MODEL ½-IN. SCALE LOCOMOTIVE.

THE line (2½-in. gauge) is laid along two sides of an orchard, in the shape of an L with a loop at each end. It is single throughout, with the exception of a passing-place, about a third of the way along the longer of the two sides (see p. 99).

As is shown on the plan, a train runs straight through the points, which are self-setting, on to the passing section, and trail through on to the main line again, and the same thing takes place at the neck of each of the loops. These points—which are Bassett-Lowke's large scale permanent way, as is all the track—are admirable when worked with a lever in the ordinary way; but the orthodox arrangement of the heel of the switch rail fixed in a fishplate necessitated such a strong spring to close the points after the train had passed that the flanges of the wheels, instead of opening the points, rode up over them, and so derailed the coaches, though the locomotives, with their greater weight, negotiated them successfully. To obviate this, a brass plate was soldered across under the heels of the two switch rails, and the plate was held in position by a screw passing through its centre to a sleeper, the switch rails being cut away behind the plate from the adjoining one. Both switch rails were then free to oscillate, with the screw as a centre, and the lightest of spiral springs was sufficient to close the points after the passing of a train. If kept well oiled, the arrangement works quite well. Scale signals are used, but at the time of taking the photographs they were in winter quarters.

Construction.—The whole line was carefully pegged out from fixed centres, and posts 3 ins. by 2 ins. driven in 6 ft. apart on the straight and 3 ft. on the curves, and carefully levelled. For 3 ins. down these posts are reduced to 2 ins. by 2 ins., and on the ledges so provided 3-in. by ¾-in. longitudinal timbers, set on edge, are screwed with brass screws.

This made a firm job, and by making sawcuts close together in the long 3-in. by ¾-in. battens these were bent round at the curves, and the necessary super-elevation obtained by blocking up the battens, and not the sleepers.

The next step was to lay the sleepers, fourteen to a length, instead of twelve, as advised by the suppliers, and to get them fair, four long laths, each 12 ft. by 1 in. by ½ in., were spliced together and tacked to the outer end of a few sleepers, tacked roughly in position, and then any little adjustments were made, and the rest of the sleepers butted up against the laths and nailed down to the longitudinals.

The outer rail was next laid, using a notched bit of wood as a gauge, and the inner rail followed easily with the aid of one of Bassett-Lowke's Simplex gauges; but the actual labour of nailing down the sleepers and driving the spikes for the chairs was something to be remembered. Once round the track is just over 100 yds., and what with crossings, sidings, etc., there are over 400 ft. of track, 2,800 sleepers, 5,600 chairs, 5,600 keys, 11,200 spikes, 5,600 nails, and a great quantity of screws—all put in by one person in his spare time. Banking up was all done after, and the ballasting, which is small coal riddled fine, done last of all.

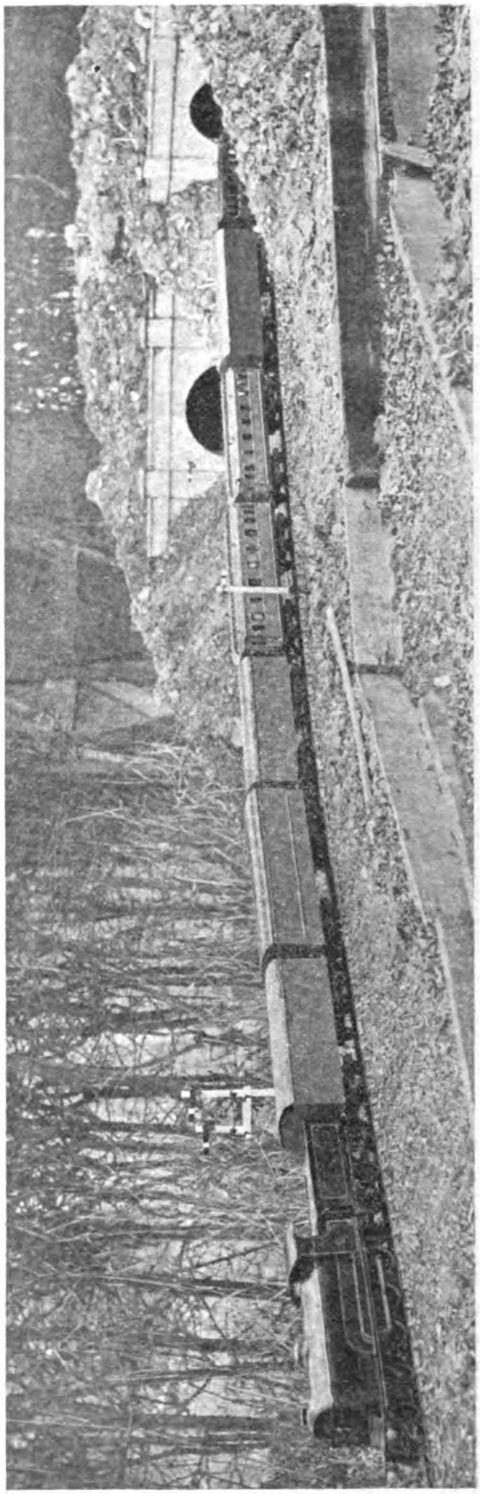
There are three under-bridges of wood and two tunnels, the longer of which is large enough to get inside, in case of accidents, and has a manhole door on the top, as the entrances are to scale.

At the passing-place there is a very strongly constructed shed, which is engine-house, carriage-shed, and repair-shop all in one. This shed is sunk about 3 ft., so that a long sliding window comes level with the rail level, and the long arm of the superintendent can do a lot of operations that were originally automatic. These small automatic contrivances will not stand the weather, and generally get removed, as did a station (home-made, of wood). It should have been mentioned that all the woodwork has been well covered with boiling Stockholm tar, and has stood two winters very well.

Rolling-stock.—This consists of five coaches, on bogies supplied by Carson and wheels by Whitney, the bodies being home-made and, as yet, not quite finished. A number of tinplate bogie coaches, all picked up second-hand through THE MODEL ENGINEER advertisement columns, and a few scale goods wagons, also second-hand, complete a total of twenty-three vehicles.

Locomotives are three—a North-Eastern (by Bassett-Lowke); a "Precursor" 528 North-Western tank, and a six-coupled bogie—both the latter by Carson & Co., of Birmingham. The six-coupled engine is a mongrel design, worked out by the owner, and is the running gear of an "Experiment," with the big boiler, etc., of the South-Western four-cylinder six-coupled, without the water-tube firebox. The result was not unpleasing in appearance, and the working results were magnificent. The engine runs fast, pulls a big load, and has given no trouble. The tank runs equally well, but, of course, has not the same power.

COPPER is stated to be so hardened as to take a cutting edge by adding to it, while in a molten state, about 2 per cent. of potassium ferrocyanide. The colour is not affected. The reason for the change is not clear, but it is supposed to result from the introduction of iron and possibly carbon. —*Mechanical World.*

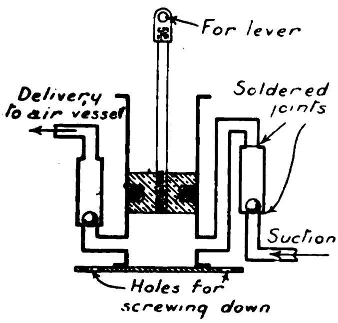


GENERAL VIEW OF A PORTION OF THE ROAD OF ½-IN. SCALE MODEL RAILWAY.

A Model Manual Fire Engine.*

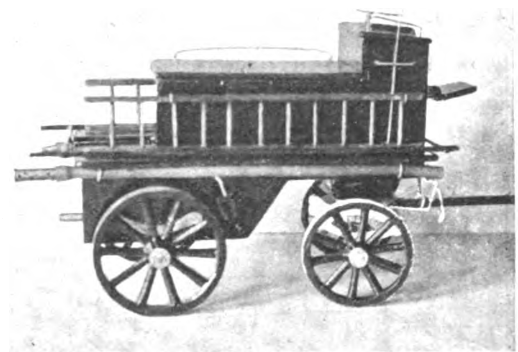
By G. Hindson.

THE following is a description of a small manual fire engine I have just made. She has two single-acting pumps 1-in., stroke ⅜-in. bore (the barrels of which were once oscillating cylinders



on a small engine). I took off the block, and drilled two holes opposite each other, fixing into them brass pipes with seatings for the valves; then a larger size pipe was soldered on to make room for the water to pass the valve, and then a smaller one again to prevent valve from coming out. This may sound rather complicated, but a look at the section drawing will clearly show what is meant.

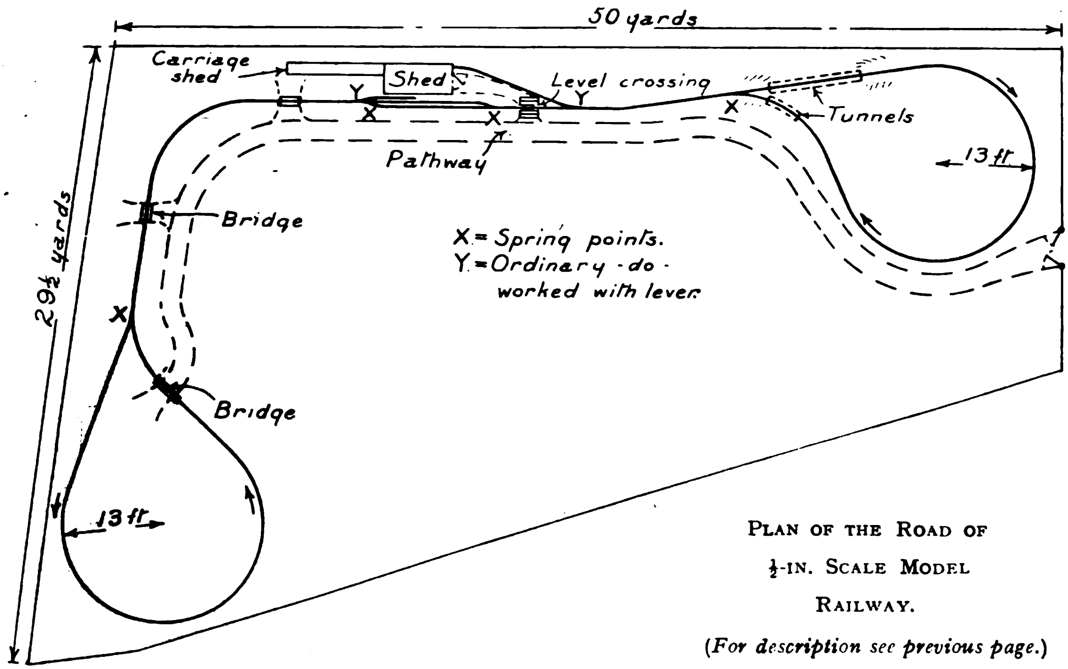
The valves are balls of phosphor-bronze, ⅛ in. diameter, and were ground into their seatings with knife powder and oil. I can get the engine to draw through a vertical lift of 8 ft., which I think is quite good, considering her size; and with the pumps working at 40 or 50 strokes per minute, she will deliver 1 pint in 2½ minutes, giving two jets



Photograph of the Finished Model.

to the height of 5 ft. each, or with the two deliveries taken in a collecting breeching she will give a jet 12 ft. high and 14 ft. horizontally easily.

The body holds 14 ft. of delivery hose, ⅛ in. diameter, and the suction pipe is carried on the sides 16 ins. long, 3-16ths in. diameter. She also carries two scaling ladders, dividing and collecting breechings, and four branch pipes for different sized jets. Her chief dimensions are :—7½ ins. long, 3¾ ins. broad, 6¼ ins. high; back wheels are oak, 2¾ ins. diameter, and front 2½ ins. diameter, with swaying bars and pole for horses.



Plan of the Road of ½-in. Scale Model Railway.

(For description see previous page.)

Engineering Drawing for Beginners.

By H. Muncaster, A.M.I.C.E.

(*Continued from page* 77.)

REFERRING to Figs. 119 to 122 in the last article, in figuring, make the number increase in the direction the crankshaft is to turn; the forward eccentric to have the figures outside the circle, and the backward one inside. The approximate position of the lower end of the link may be denoted and a series of arcs of, say, 3 ins. long, drawn with a radius equal to the length of the rod from each of the points representing the backward eccentric, and numbered to suit.

Take on the trammels the length of the link (10 ins.), and mark off from the various points already found for the top of the link the points for the corresponding positions at the bottom end, 1 to 1, 2 to 2, etc. Now, with radius equal to the length of the eccentric rods, join these points. Where these arcs cross the centre line of the valve rod the relative position of the valve will be given. If the centre of the lower pin of the suspension rods be 10⅝ ins. below the line of valve centre, and the rods be 12½ ins. long, as drawn, the valve will travel a total distance of 2 ins., the letters *d* and *e* denoting the positions when the crank is on the dead centres; these will be found to be 1¼ ins. apart. So that we can allow ⅛-in. lead and ⅛-in. lap at each end, and a total opening of ⅛ in. to each steam port. This gear, in practice, gave a very satisfactory result.

The proportions may be taken as follows :—

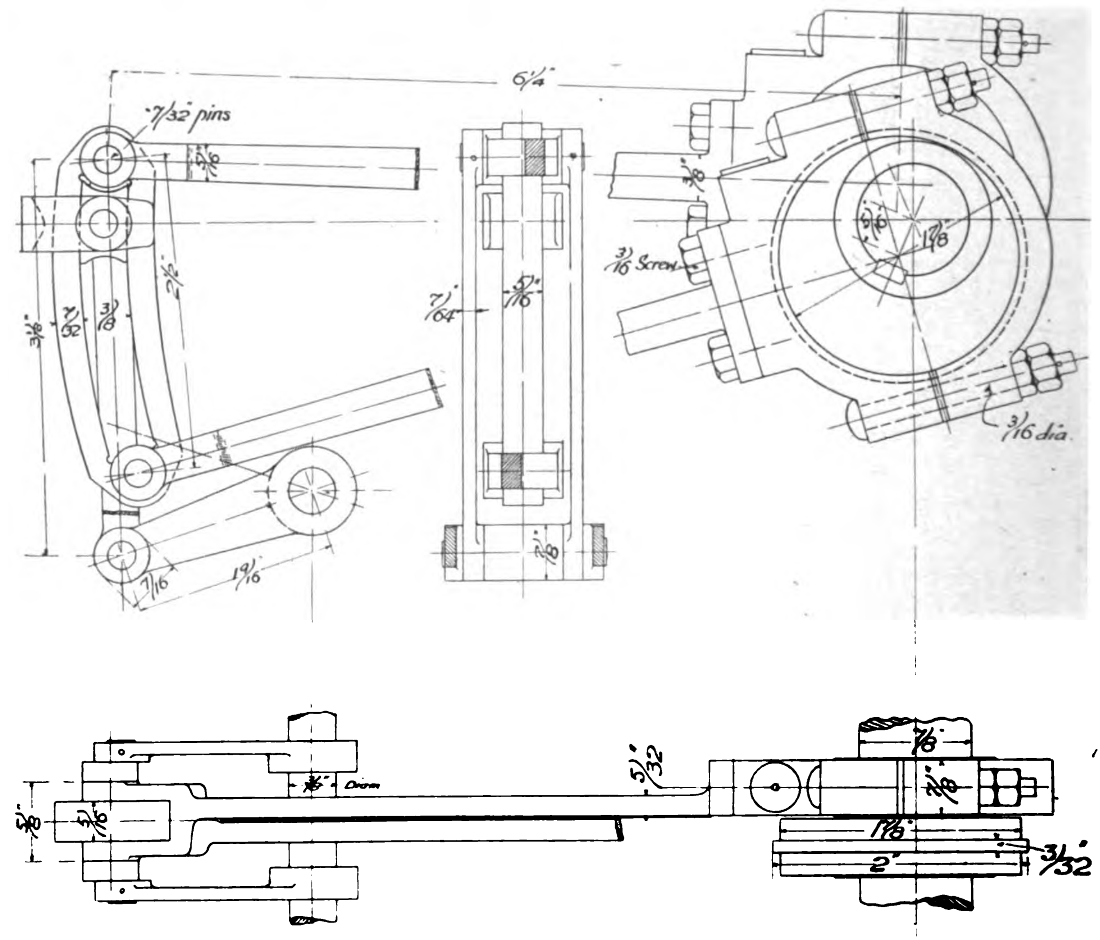


FIG. 123.

Eccentric throw, 100.	Suspension link, 500.
Valve travel, 80.	Angle of advance, 112½°.
Eccentric rods*, 1,000.	Diameter of pins (in
Link (*c* to *c*), 400.	bulk), 35.

To show the difference made by altering the angle

* The backward rod was shortened about 1-16th in., which made a slight improvement. This is frequently done in this class of gear; it is, in fact, generally necessary to do this to connect the distribution when using backward gear.

of advance of the eccentrics, Fig. 122 is drawn, the proportions being identical, except that the link is suspended from the centre. The angle of advance is 108°, so that we can divide into twenty parts.

Number in a similar manner to the last example and draw arcs with radius equal to the length of the eccentric rods from each point in the circle; these arcs should be of some length, to allow a little margin in locating the points, as the position can yet only be guessed. From the point *f* draw the arc *a b*, in which will be the path of the centre of the link. Now make a paper template, as

It is occasionally hung from the same pin (*e*) as that by which the forward eccentric rod is attached, but this method gives a very faulty movement to the valve and should not be adopted.

The complete arrangement of reversing gear to the proportions given above is shown in Fig. 123. Fig. 124 shows in outline a very interesting form of reversing motion—the Allen straight link. As the link is lowered the valve rod is raised, and *vice versa*; the proportions of the various rods are adjusted so that no curve is necessary in the link. The lever on the rocking shaft is to give a lift

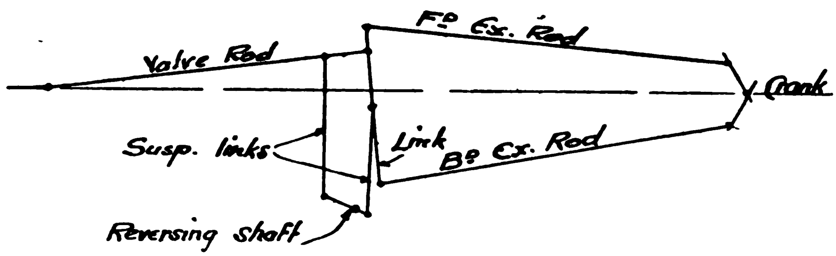


FIG. 124.

Fig. 121, with *x y* equal to the length of the link at *o*. Cut a notch equal to the versed sine; set the template so that *x* and *y* are on the arcs 1 and 1, while *o* is on the line *a b*. This should be done with all the remaining arcs, taking care that *o* is on *a b* each time and marking each pair of arcs with a sharp pencil. With radius equal to the length of the eccentric rods, draw the curves joining the respective points for the top and bottom of the link. Draw the centre line of the valve rod on which

inversely proportional to the weights of these parts, and, in consequence, no balance weight is required. The writer very strongly recommends this gear for its many excellent qualities and for its simplicity.

One other form of reversing we shall notice is that known as the Walschaerts, which is in very extensive use, especially on the Continent. The diagram of this is shown in Fig. 125.

The angle of advance of the eccentric is 90°. The rod of the eccentric is attached to one end of a

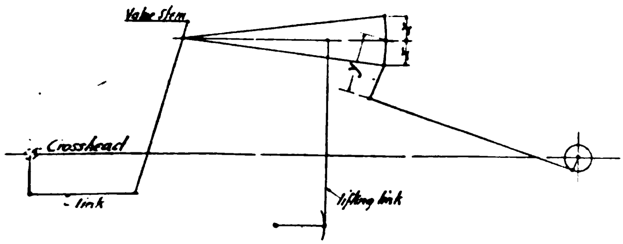


FIG. 125.

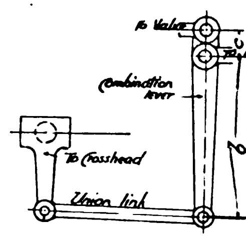


FIG. 126.

will be located the relative positions of the valve. In measuring up, we now find that we have, by reducing the advance of the eccentrics, reduced the amount available for lap and lead to 11-16ths in. and the travel of the valve to $1\frac{7}{8}$ ins. We also notice that the path of the bottom end of the link is more nearly in a straight line than that in the previous example, showing that the movement of the die in relation to the link is not so extensive, so we may assume a slight gain in efficiency by suspending the link from the middle point.

Another form of link in common use is shown in Fig. 122. The valve spindle is in line with the eccentric rod when in full gear; the throw of the eccentric will be nearly the same as the travel of the valve. By preference the link should be suspended from the centre *a*, as in the previous example; the link may be hung from the point *b*.

link, the link oscillating on a point near the middle. If the valve rod were connected directly to the valve spindle and to a die in this link, the engine might be reversed by moving the die up or down the link. There would, however, be no lead and no lap on the valve, as the valve would be in the middle position when the piston was at the beginning of the stroke. To give the necessary movement to allow lap and lead, a lever is introduced between the valve spindle and the rod connecting to the link in such a manner that the end of the rod acts as a fulcrum for the lever, which is attached to the valve spindle at one end and actuated at the other end by a rod connected to the crosshead of the engine. The proportions of the lever being

$$\frac{a}{b} = \frac{2\ (\text{lap} + \text{lead})}{\text{stroke of piston}}$$

a being the distance between the valve spindle and the reversing-rod connections, and *b* between the latter and the pin of the rod connecting to cross-head (see Fig. 126). To find the travel of the eccentric set out (Fig. 127) on a line *x y* equal to the stroke of the piston, bisect at *o*, and from *o* describe the circle *a p* of a diameter equal to the required travel of the valve; measure off *o b* equal to the lap + the lead; through *o* and *b* draw lines perpendicular to *x y*; from the point *a* where the perpendicular *a b* intersects the circle, draw a straight line *a x* cutting *o c* at *c*. Set off *o h* = to *x* (Fig. 125) and *o j* = to *y* (Fig. 125); join *c h*, and draw a line from *j* parallel to *c h*, cutting the perpendicular at *g* from *o* as centre, and with *o g* as radius, describe a circle which will have a diameter equal to the required throw of the eccentric.

The foregoing assumes the use of an ordinary form of slide-valve. In case a piston valve is used a modification of the gear is generally necessary, because the piston valve admits the steam from the inner edge, and not from the outer edge.

To give the lead in the proper direction, the lever must be connected to the valve speed at the middle position, the proportions of the lever becoming—

$$\frac{a}{a+b}=\frac{2\times(\text{lap}+\text{lead})}{\text{stroke of piston}}$$

The throw of the eccentric is also lengthened. This can be found by substituting Fig. 128 for

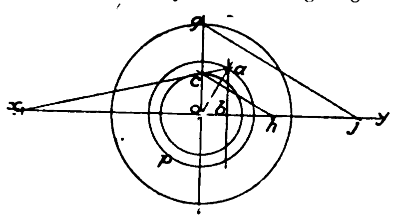


FIG. 127.

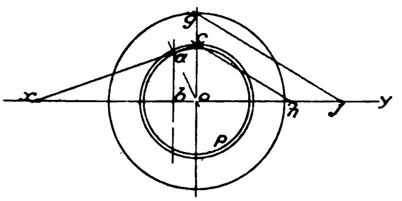


FIG. 128.

Fig. 127 and applying the description there given. Practical considerations prevent the distance *a* being reduced to less than half the sum of the diameter of the two bosses on the eyes of the valve spindle and reversing rod; the length *b* of the lever is considerable and reaches past the centre line of the cylinder. It becomes, therefore, necessary to fix an arm to the crosshead to give a suitable point for the connection to the lever.

It is quite outside the scope of these papers to consider other forms of valve motion, automatic cut-off, etc.

(*To be continued.*)

BOTH the *Lord Nelsons*, says *Engineering*, are now effective units of the fleet. The trial results, full power, eight hours, of these two ships were:—*Lord Nelson*, 17,445 = 18·9; *Agamemnon*, 17,285 = 18·8.

Design for a 5-ft. Speed Boat.

By THOS. DYSART.

NO doubt many of the readers of this paper, since reading the results of last year's MODEL ENGINEER Speed Boat Competition, have been fired with the laudable ambition of trying to eclipse the magnificent results attained by the winning boats.

As it is not every one who can design and build a model "flier" throughout, the accompanying drawings have been prepared with a view of rendering all necessary aid to intending builders, and to show the complete general design of a model speed boat planned to attain a speed of 10 miles per hour by the use of a well-tried type of engine, boiler and lamp, combined with a properly designed propeller.

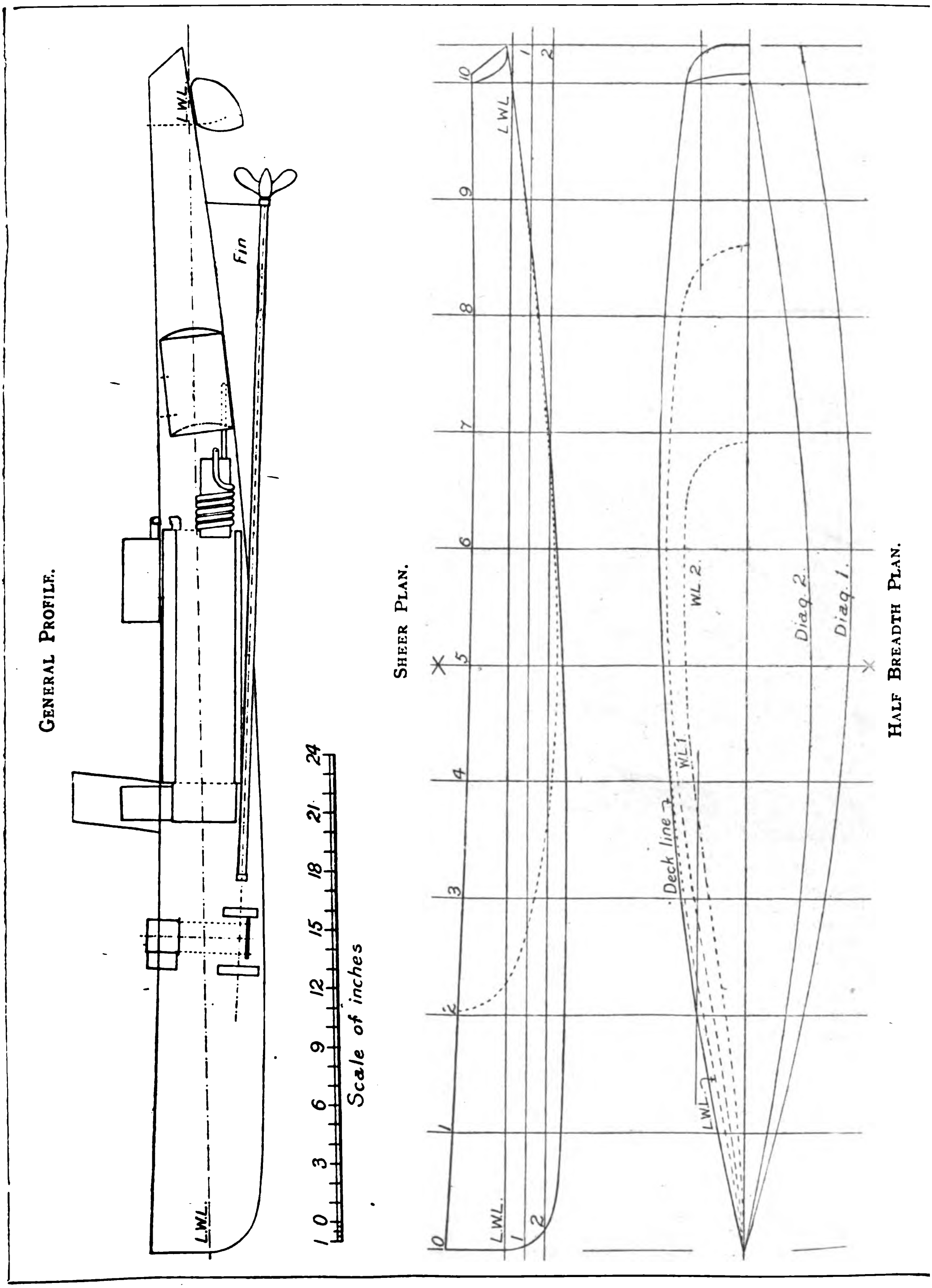
So far as possible, simplicity of construction has been studied throughout, especially remembering that the majority of the readers of THE MODEL ENGINEER are not the happy possessors of a well-equipped workshop, but, given a fairly decent lathe, etc., and the necessary workmanlike touch, if the general design is adhered to, more particularly as regards the boiler and propeller, the speed indicated should be more than attained. A great deal, of course, will depend upon the builder. Those with experience and mechanical skill behind them will certainly obtain better results than others.

A certain amount of detail has necessarily been left to the taste, discretion, and ability of those who may undertake to build to this design; notably, as regards deck fittings, etc. Individual choice will probably govern the latter, and consequently the writer has left these out in the drawings, but he would suggest a fairly high coaming all round the deck to embrace the space occupied by engine, boiler and lamp, allowing a certain margin, of course, to get at things. A turtle deck forward, coming slightly abaft the break of the coaming, would certainly be of advantage, and a neat skylight placed on top of the coaming would serve to cover the steam drum as well as imparting a look of reality to the general appearance. It would be as well, however, to give the boat one or two trial runs before finishing off the deck, as it may be necessary to slightly alter the position of the boiler and lamp, owing to its being practically impossible to designate the actual water-line which the boat will observe when running at top speed.

For a long time past it has been customary in "model" circles to regard the T.B.D. type as the design *par excellence* for a fast boat, but the writer's own actual experience distinctly proves that a fairly beamy boat of average displacement will simply walk away from a T.B.D. type of boat when a length limit prevails.

We will now turn to the drawings and first take

The Hull.—This is 5 ft. 2 ins. over all, 5 ft. on L.W.L., 9 ins. beam, and 2¾ ins. draught on M.S. (No. 5). Sections spaced 6 ins. apart. It will be noticed that the boat is a modification of the double-wedged type, which, for highly-powered craft, is undoubtedly the best. Stability has been studied, even at a slight expense in speed, so as to counteract the usual list, owing to the "couple" of the


General Profile.
Fin
L.W.L.
Scale of inches
0 3 6 9 12 15 18 21 24
Sheer Plan.
L.W.L.
Half Breadth Plan.
Deck line
WL 1
WL 2
Diag. 2
Diag. 1
L.W.L.

screw. The displacement was calculated at 24 lbs., made up as follows :—

	lbs.
Boiler, with smokebox, steam drum, water and fittings ..	10
Engine and pump	3¼
Lamp and fuel	1¾
Hull (in tin)	7
Sundries (propeller, funnel, paint, rudder, etc.), say	2
Making a total of	24 lbs.

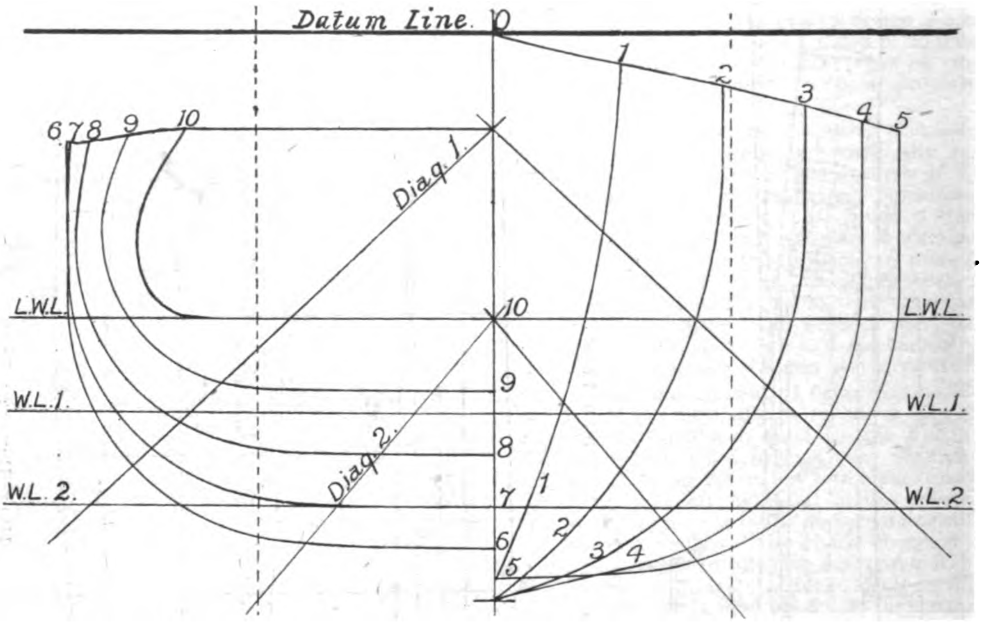
As a matter of fact many expert model builders will be able to construct this boat complete to weigh altogether not more than 21 or 22 lbs., when in running order, especially if a wooden hull be used, and consequently with an improvement in the speed. However, if wood be used, the respective heights of the various parts of the machinery, boiler, etc., will have to be raised proportionately to the thickness of the wood employed.

Taking the displacement co-efficient at ·46, we get

$$\frac{60 \times 9 \times 2{\cdot}75 \times {\cdot}46}{27{\cdot}65} = 24 \text{ lbs.}$$

the last factor in the calculation (27·65) being the number of cubic inches in 1 lb. of fresh water.

So many articles have appeared in THE MODEL ENGINEER on the construction of various kinds of hulls that the writer assumes the method generally employed is well-known to those readers who are nautically inclined, but a few remarks may, perhaps, not be out of place here. About the easiest way, especially for those who are not experts, would be to procure a piece of fairly thick plank, say, 5 ft. 4 ins. long by 6 ins. wide, and about 1 in. thick. This will serve as the building board. One side, at least, having been previously nicely planed, draw in pencil a perfectly straight line down the centre for the whole length, and then proceed to mark off the sections 6 ins. apart, and at right angles to the centre line. Having cut out the moulds, say in ¼-in. stuff, from the sections as shown in the body plan, and carrying them right up to the datum line A, proceed to erect them, bottom upwards, on the building board, at the sections previously marked off, taking care, however, that those moulds *forward* of No. 5 section must have their after sides just on the pencil line, and those *aft* of that section their front sides. The deck line should have been marked off on the moulds previous to this. Next tack a few light battens on to the moulds to keep them in position. Assuming that tin-plate (preferably three-cross) is to be used, the remainder of the construction is then only a matter of a little patience and skill in handling the shears and soldering iron. Commence, however, at the stern, working forward, so that the lap of the strakes will present no obstacle to the boat's passage through the water.



BODY PLAN.

It will be noticed from the general arrangement profile that a fin is soldered to the body of the boat and stern tube. This, in the writer's opinion, is well worth the extra weight and trouble, as it not only acts somewhat as a keel, but has a powerful influence in maintaining a straight course. The stern tube, which is ⅜ in. outside diameter, brass, together with the fin, should be left until the engine is being put into position, so as so get everything central. Too much care cannot be bestowed upon this point.

WE hear that the *Téméraire* and *Bellerophon* have now got their lower tripods stepped, and both ships are making fair progress. These ships look extraordinarily small for their displacement—in striking contrast to the *Lord Nelsons*, which are enormous targets owing to their wealth of upper works.

An Alcester Enthusiast.

By H. G.

(Concluded from page 83.)

ANOTHER interesting point in the construction of the ½-in. scale model N.E.R. locomotive illustrated in the preceding article, is the arrangement of the connecting-rods of the inside cylinders. It is an embodiment of a device common to stationary engine practice in the past, and tends to show the comparative excellence of many almost-forgotten ideas in mechanical engineering in certain specified cases. All who have had to do with the making of small model locomotives (locomotives of ½-in. scale and under) know how difficult it is to provide two or four slide-bars in true alignment, and at the same time to ensure frictionless working. Usually the slide-bars do no work at all, the resultant forces due to the angle of the connecting-rod during the working portions of the stroke being met solely by the piston-rod. This method is, however, quite satisfactory from a point of view of strength, but the packing quickly suffers. To reduce this wear and tear Mr. Averill forked the connecting-rods, and making the motion-plate as shown in sketch (Fig. 4), provided supports for the extension of the piston-rods by guide-lugs cast on the motion-plate. In this way alignment is obtained in a simple manner, and the gear works with the least possible amount of friction.

Among his friends Mr. Averill numbers several locomotive drivers, and discussions on the subject of valve gears resulted in the useful model of Walschaerts' motion shown in Fig. 1. There is nothing very special in the construction of this model. It is made of wood, the vibrating link being of metal, and shows the action of the gear in all points of the reverse lever much more readily than any drawing. This model has already proved of educational value to many practical men who were previously unacquainted with this kind of reversing motion, and also, I hope, will serve as an object-lesson to many other readers of The Model Engineer who may be in difficulty in understanding the functions of any particular mechanical movement. Do not spoil many sheets of drawing paper, but make a model, and when the action is thoroughly grasped, then proceed with the point path diagrams and determine the correct proportions of the various parts.

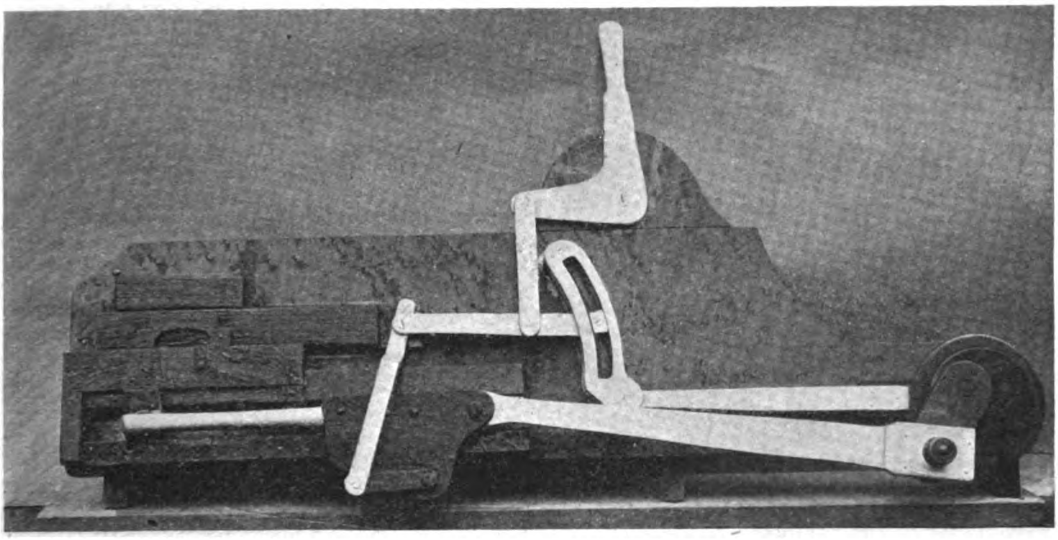


Fig. 1.—Model of Walschaerts' Valve Gear, made in Wood, to show the Action of the Motion in Various Positions of the Lever.

I now come to the chief object of my visit to Alcester, viz., the model 3½-in. gauge G.N.R. "Atlantic" type locomotive of the No. 251 class. This model has occupied most of Mr. Averill's spare time during the six months previous to my visit, and, like the similar model recently described in these pages, has been made from the drawings forming two of the plates in "The Model Locomotive" and from the excellent castings supplied by Messrs. Stuart Turner, Ltd. In building this model Mr. Averill has made many additions of note, some of which I will attempt to describe; but, apart from constructive improvements, the success of the model in actual working is, as far as I can gather, unprecedented. I know of no other 3½-in. gauge model—compound or simple—which can pull from a dead start on a rough track the total load behind the tender of 657 lbs., or 747 lbs. in all—one-third of a ton as nearly as possible.

The test came about in this way. It was decided to devote an afternoon to the running of the G.N.R. and a special truck which Mr. Averill made for riding behind the "G. N.," was oiled up and generally overhauled for the occasion. Some 56-lb. weights were also requisitioned, and after a few preliminary canters, with only the driver behind, a test was made with five "fifty-sixers" and the driver, the load totalling :—

	Lbs.
Engine and tender ..	90
Driver	154
Truck	14
Weights	280
	538

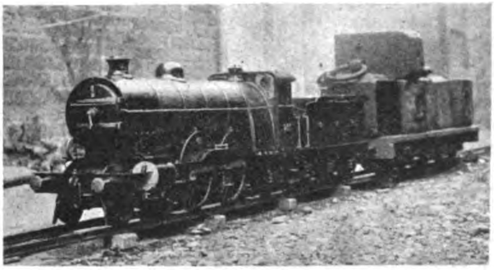


FIG. 2.—THE G.N.R. WITH FIVE 56-LB. WEIGHTS.

The weights and the truck are shown in the photograph. Following this I also mounted the truck in company with another fifty-sixer. The load was then :—

	Lbs.
Engine and truck ..	104
Driver	154
Weights	336
Passenger	147
	741 lbs. = 1/3 ton.

slightly, being replaced subsequently at my suggestion, I have to admit. New pistons provided with hard-brass piston rings were fitted to the cylinders. Two rings were used without a distance-piece between. The slits were diagonal ones, and pins

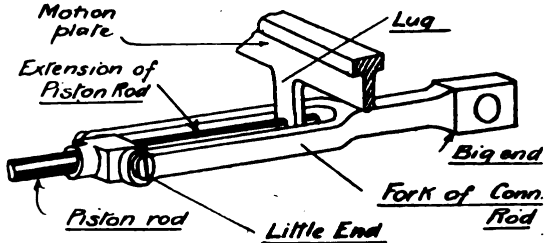


FIG. 4.—THE CONNECTING-ROD AND GUIDE FOR ½-IN. SCALE MODEL N.E.R. LOCOMOTIVE.

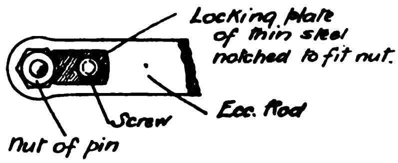


FIG. 5.—LOCKING PLATE FOR NUTS OF LINK MOTION.

were fitted to keep the slits in their respective positions. While these rings seemed satisfactory when the engine was cold, under running conditions, however, the friction appeared excessive, and was no doubt due to the high temperature and com-

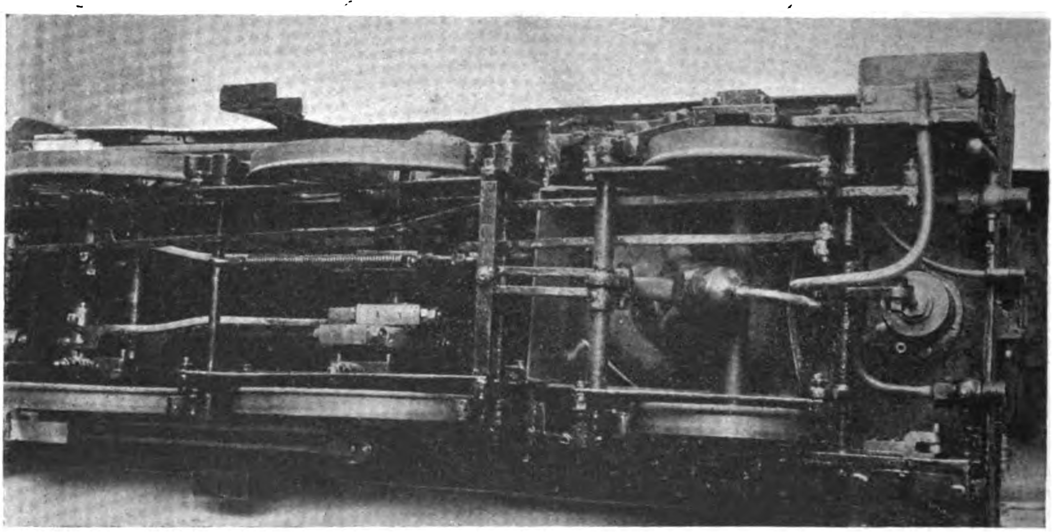


FIG. 3.—UNDERSIDE OF G.N.R. MODEL, SHOWING PRIMUS BURNER AND STEAM BRAKE.

The engine started away with only a small amount of slipping from a dead start, on practically a level track, and with only 10 lbs. drop in steam in the journey of some 30 yds.—the extent of the track. Since my visit this performance has been beaten, the asbestos piston packing, which was blowing

parative inefficient lubrication. As far as I can gather, the real cause of the trouble was due to the "stickiness" which is present when brass and brass work together at high temperatures. A reversion has lately been made to soft packing with excellent results. Four rings of cotton twine (⅛ in. dia.)

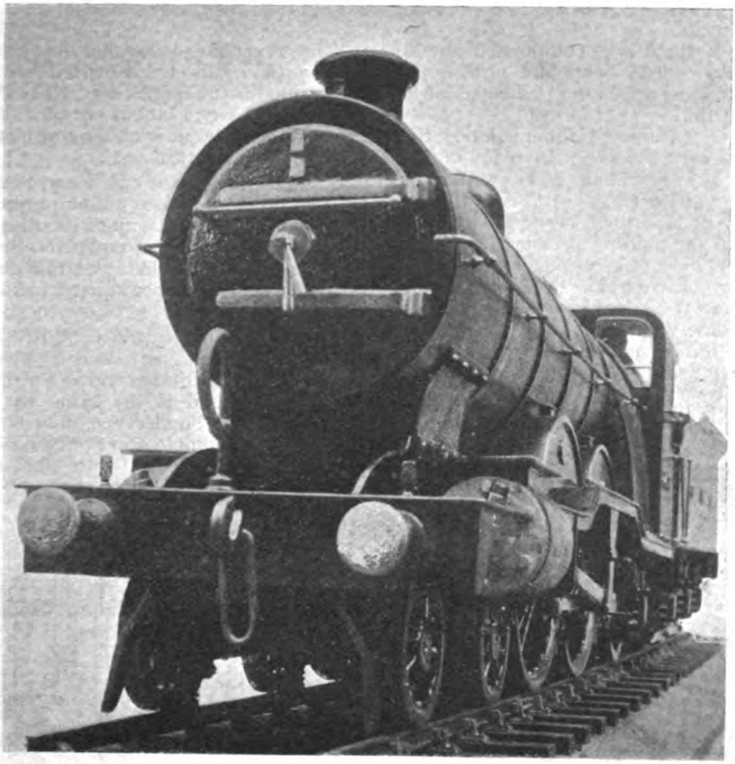


Fig. 6—Front View of Mr. Averill's ¾-in. Scale Model G.N.R. 251.

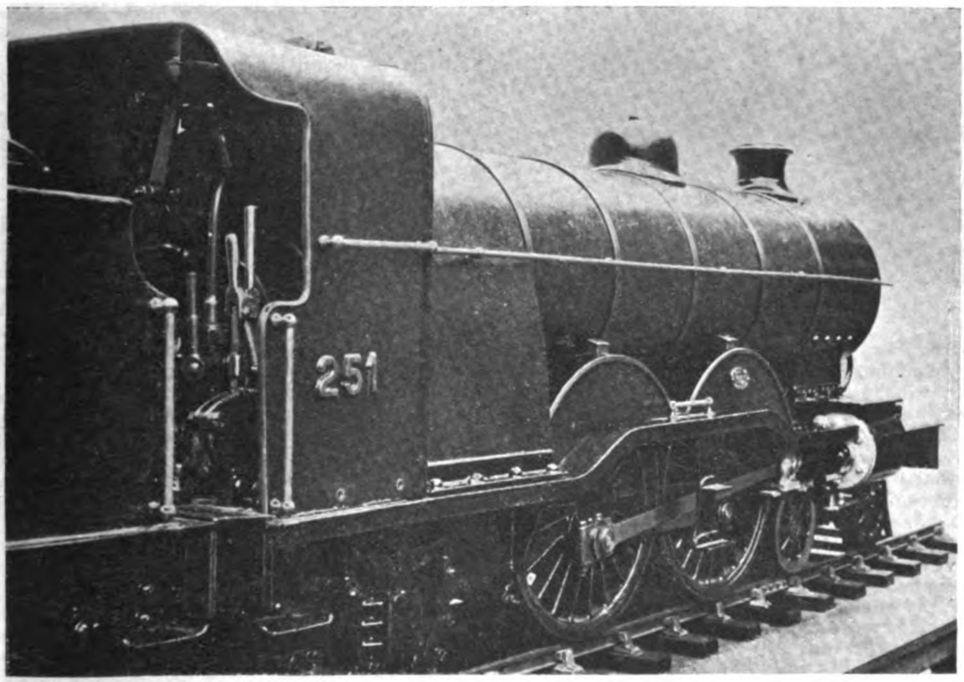


Fig. 7.—Mr. Averill's Model G.N.R., as viewed by a Scale Model Passenger.

are employed, and they are compressed by a chamfered junk ring. The beats are now quite distinct, and the engine gives no evidence of a "blow" in any position.

Among the novel features of the model is the construction of the safety valve. In place of the usual wing valve a bronze ball is employed, as indicated in the sketch (Fig. 9). It will be noticed that the ball is drilled vertically for the spring pillar, so that the point of pressure is applied below the level of the seating, which is a *sine qua non* of safety valve construction. Model engineers should refuse to put trust in safety valves which do not obey this law. In some cases the valve may act properly, but in my own experience the chances are 10 to 1 against, especially where the

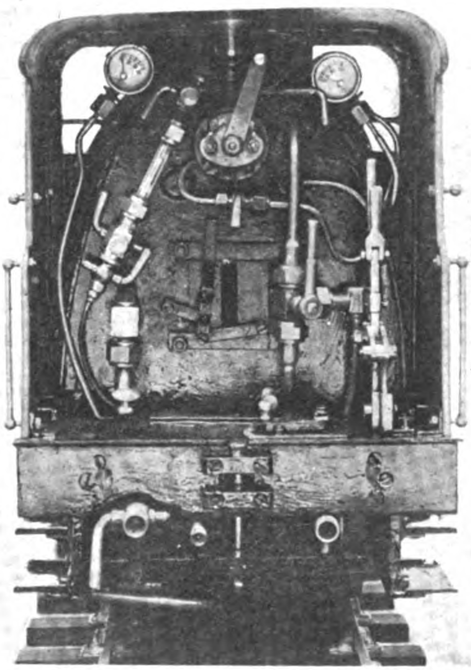


Fig. 8.—Cab View.

ordinary chamfered seating is used. With reference to the drawing, I find, since I made the sketch, that Mr. Averill has used a slight difference in the easing lever. The actual arrangement is the same as in Fig. 282, page 211, of "The Model Locomotive," except that the tops of the studs are slotted and the lever knife edged. This keeps the lever in position sideways.

The model is fitted with steam brakes on the engine and hand brakes on the tender. The cylinder of the engine steam brake is shown in the view I took of the engine on its side (Fig. 3), and the rigging connected to three pairs of blocks on the driving, coupled, and trailing wheels respectively. The reversing lever is placed in the proper position, the extra link gear, passing under the wide firebox, as in the prototype, to couple the weighshaft with the reversing lever having been added by Mr. Averill. This is dispensed with in the original design for the model, but where the builder does not mind the extra labour entailed, it can, as evidenced by the model now under consideration, be arranged quite satisfactorily.

Referring to the cab view, it will be noticed that two pressure gauges are employed. The right-hand one is the steam gauge (reading to 120 lbs. for a working pressure of 60 to 100 lbs.), the other being connected to the oil tank and registering the pressure of air in pounds per square inch over the oil in the tender tanks.

The firedoor is the G.W.R. sliding pattern, the two doors being actuated by one lever. The regulator is of the design shown on the above-mentioned drawings, and is the same as that described for the "1903" undertype model. The steam brake valve is a simple three-way cock, and is found to actuate the brake with the utmost reliability.

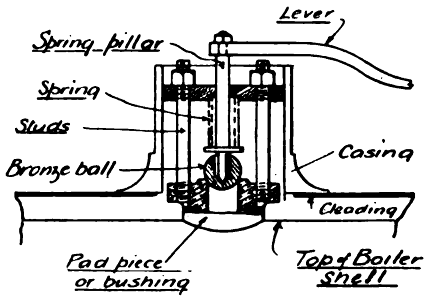


Fig. 9.—Safety Valve.

It is, as shown by the photograph, placed near the reversing lever on the driver's side of the engine.

Showing how painstaking Mr. Averill has been in the making of this model, I may also mention that the link-motion bolts or pins are provided with locking-plates, as shown in the typical example (Fig. 5). These and other evidences of the care taken with the model go to prove the assertion that I have more than once made that it is workmanship as much as design that makes or mars the success of a model locomotive. A model of bad design may work satisfactorily, if well made, but good design will not help the engine which is constructed in an inferior slap-dash manner. The consummation is always obtained where the design does not violate the fundamental principles of steam engine practice and where the workmanship is of a sound practical character. This, I venture to say, can be claimed in the case of Mr. Averill's model, and I await with interest the eclipse of the records he has established. In comparison, the total load behind the tender would be equal to a real train weighing considerably over 1,000 tons—a very creditable performance, indeed.

Readers will doubtless join me in thanking Mr. Averill for the facilities given in the taking of the accompanying particulars and photographs, and to wish him the same measure of success in any future model-making venture as he has obtained with his model G.N.R. "Atlantic."

The Insulation of Spark Coils and other Electrical Apparatus.

By "Zodiac."

(*Continued from page* 87.)

Mica, as shown by curve, Fig. 1*, stands first as regards dielectric strength, but, owing to its very high specific inductive capacity, its use in conjunction with other material requires considerable care. White mica is the best. Mica is not well suited for immersion in oil, which has the curious effect of lowering its disruptive strength; the decrease in dielectric strength may be as much as 40 to 50 per cent. This effect of oil on mica is very curious, as oiled or varnished paper and other artificial insulators show the same resistance to puncture when tested in oil and in air. Mica is not very flexible, and has a fairly large surface leakage.

Micanite, Megohmit, etc.—These are really reconstructed mica, the mica being stuck together with shellac and other insulating cements. They are much more flexible than natural mica, and can be readily moulded when heated. For coil construction the presence of shellac is objectionable; further, Dr. Walters discovered a corrosive action at the surface of the intermediate layers. The voltage would first break down one layer, and then cause a gradual deterioration and local heating in the next layer, and thus ultimately puncture the insulation layer by layer. This action goes on unobserved, until finally the whole insulation gives way. For voltages up to 10,000 or 20,000 these materials are excellent, but should not be used for spark coil secondary insulation.

Insulating Varnishes.—For many purposes where heating would melt paraffin wax, varnishes are most useful, provided the proper class of varnish is used. The varnish must be waterproof, and should not have any tendency to attack or corrode the copper; further, no metallic element in the shape of lead driers, etc., must enter into its composition, nor must carbon or lampblack be used as colouring matters. Cycle enamel, etc., generally have metallic dryers (red lead, sugar of lead, sulphate of zinc, litharge, and white copperas) as one of their ingredients, and should not be used for Wimshurst plates, etc., as they naturally have a large surface leakage. The gums mostly used for electrical varnishes are resin, shellac, asphaltum and copal.

Shellac Varnish is not extensively used now in the electrical trade, but still finds favour with amateurs, owing to the ease with which it can be home-made. Its faults are that it is hygroscopic, softens with heat, and powders under the influence of heat and age. It is hardly possible to make a shellac varnish free from moisture, and the varnish itself is distinctly hygroscopic, and frequently of an acid nature.

Linseed Oil Varnishes.—There are a variety of these on the market, such as Sterling varnish, etc., and while they have been much used, there is at present a strong tendency to condemn them for high tension work. The defects of linseed oil for electrical work are that it rapidly absorbs oxygen from the air (in so doing, *i.e.*, drying, it expands, and is thus useful for impregnating woodwork for low tension work), and ultimately becomes brittle and cracks; it has also a strong tendency to turn acid. As stated, however, such varnishes are extensively used. For low tension work, *i.e.*, dynamos, etc., the amateur will find a varnish made of best boiled oil (linseed) thinned with about one-third of turpentine very satisfactory.

* See previous article.

"*Armalac.*"—This is a black paraffin compound, the melting point being raised by a secret process to over 300° C. It does not become hard or brittle, and is free from acid.

"*Hydrolac*" is a somewhat recently introduced insulating varnish, which the writer has found most useful for ordinary purposes, and for apparatus that is to be oil-immersed. It is acid and moisture proof, very penetrating, and has a high dielectric strength. While the writer has wound spark coils with this insulation instead of paraffin wax, he would not recommend its use for this purpose, except for small coils up to 2-in. spark.

Oil for Insulating.—The great advantage of oil as an insulator is that it is self-healing, and thus presents the same dielectric strength after puncture as before the discharge took place, whereas, of course, a solid insulator is punctured and permanently ruined. The harmful effects of moisture in oil have already been pointed out. Most writers, when dealing with Tesla apparatus, somewhat loosely specify the use of boiled linseed oil. Now the only object of boiling the oil is to get rid of the moisture, and it is not even necessary to boil it providing its temperature is raised above 100° C., *i.e.*, 212° F., so as to expel all traces of moisture. Further, the oil should be poured into the oil case or box while warm, and sealed down, otherwise it will rapidly re-absorb its moisture of saturation, and thereby have its dielectric or rather disruptive strength seriously reduced. The boiled linseed oil of commerce, *i.e.*, as obtained from the paint and varnish stores, must not be used, as it is boiled with lead dryers (litharge usually) in order to make it dry quickly, which is just what is not desirable for this work, while, of course, the dryers seriously affect its insulation qualities for high tension work.

The great difficulty with oil insulation is to get insulating materials that are not acted upon by the oil. Rubber, vulcanite, and ebonite, are unsuitable, but cotton, silk, presspahn and vulcanised fibre are unaffected by the oil. Vulcanised fibre is unaffected by alcohol, turpentine, benzine, and any animal vegetable, or mineral oil. It readily absorbs moisture, and should therefore be carefully and thoroughly dried before use. Resin oil has the highest dielectric strength of any oil, about ten times the disruptive strength of air. Commercial paraffin has about half the dielectric strength of resin oil. Increase of temperature rapidly reduces the disruptive strength of all insulative oils, and especially the specific resistance, a few degrees rise in temperature lowering the specific resistance as much as 20 per cent. Resin oil is very liable to thicken or gum, and also to turn acid, hence for transformer work mineral oil is now always used. Mineral oil has a dielectric strength of from three to five times that of air. On no account must dust be allowed to settle on the oil surface, or it will be carried down into the windings and produce a breakdown of the insulation.

Celluloid.—The amateur will find this material very useful for small dynamo commutators, etc. It can be readily moulded by soaking in boiling water, and then pressing it in a metal or even a hard-wood mould, and will retain its shape when cold. It is, of course, inflammable, but this should not be a very serious drawback, otherwise it would not have such an extensive use for cycle mudguards and photographic films, etc. Its dielectric strength is fairly good, about 15,000 volts (R.M.S.) per mm.

Formation of Nitric Acid.—This is a point which coil builders have not gone into so deeply as they should have done. Whenever an electrical brush discharge takes place in air, oxides of nitrogen are produced, especially if the air is damp. A brush discharge will take place if the potential gradient exceeds a certain value; for dry air this value appears to be about 35,000 volts per cm., although some experimenters put the value as low as 20,000 volts per cm. If moisture be present nitric acid is produced, and, indeed, this acid is now being manufactured on a commercial scale by this method.

When a Wimshurst machine is worked in a damp atmosphere nitric acid is readily detected on the plates, and has been the cause of very serious insulation breakdown in several large high-tension alternators. The writer has from time to time made a careful microscopic examination of the insulation of foreign-made spark coils in which the secondary wire consists of bare copper wound with an air space between each layer. The insulation showed clear traces of green copper deposits, the result of acid in the winding, and, moreover, this deposit was always at the ends where the potential was a maximum.

This is, of course, nothing new, for Cavendish, some hundred of years ago, produced nitric acid by the ozonisation of moist air, but it probably fully accounts for many breakdowns that have been wrongly thought to be due to bad paraffin wax. Now, as all cotton is "dressed" to some extent, and gypsum forms one of the "dressing compounds," the nitric acid, by acting on the gypsum, would easily combine and liberate sulphuric acid. A well-known coil manufacturer recently stated that the life of a large coil, if worked fairly frequently, was, at the most, fifteen to twenty years; this is, however, rather doubtful, provided the coil is properly insulated.

The remedy is to avoid excessive potential gradients by not unduly cutting down the thickness of the dielectric, and to absolutely exclude every trace of air and moisture by thorough vacuum drying during construction and vacuum impregnating after completion of the winding. This may not be necessary for small coils up to 2-in. spark size, but for larger coils it is absolutely the only way to avoid any chance of insulation breakdown. The extra cost is comparatively trivial, and the labour involved well repaid. When it is remembered that the nitric acid trouble has taken place in alternators generating at 10,000 volts, and that the voltage of a half-inch spark coil is over 20,000 volts, it will be readily admitted that the matter is one that cannot be neglected.

As already pointed out, the potential gradient will vary inversely as the specific inductive capacity of the dielectric, so that if mica is used it should be faced with paper each side, so that the change of potential slope is not too steep; an insulation of lower uniform inductive capacity is, however, far preferable. It may also be mentioned that some composite fluid dielectrics, when subjected to electrical stresses, have a tendency to split up into component parts which group themselves in the order of their specific inductive capacities, and it is not improbable that the same thing may occur with varnishes, which would therefore point to their use being inadvisable for very high tension work. The same reasoning would also hold good in the case of mechanical mixtures of oils, such as compound oils, *i.e.*, mixtures of rosin oil and mineral oil, turpentine, etc., for Tesla coil work.

This insulating question is of the utmost importance in spark coil construction, and has therefore been very fully dealt with. The amateur who attempts to make a large coil, especially over 6-in. spark, without carefully paying attention to the matter, is simply throwing away time and money, and courting failure.

The Making of Ship's Model Fittings.

By "X. Y. Z."

(*Continued from page* 88.)

THE Jacob ladder is a vertical ladder, and has only one set of rungs. This ladder side is about 1-16th in. wide, and is bent at the top and bottom, as shown in Fig. 41. The length is generally just under 1¾ ins. Make side exactly the same as in the previous ladder, except that the steps are in the centre. After sticking the sides together,

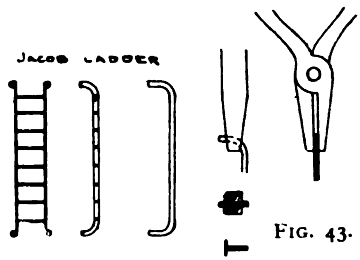


FIG. 41. FIG. 42. FIG. 43.

bend with the pliers as shown (Fig. 42). If they have a tendency to buckle, tap flat with the hammer, repeating until you have it bent to suit. Centre "pop" and drill as before, and insert wires. The distance between the sides of these ladders is 15 ins. (5/16). A small frame should be made and also a piece of wood, as before, for holding and polishing. After all is soldered, grip firmly with the pliers where shown in sketch (Fig. 43), and bend at right angles. Now file, polish and trim the ends and sides, and drill the pinholes.

The flat-step ladders (Fig. 44) are more elaborate and look much better. Make the sides the same in every way, but only one hole in the centre of the side.

The next thing to do is to make a punch, as shown in sketch (Fig. 45). After punching steps out, file and polish the edges and take off the corners on one side. Then knock into a piece of wood and polish both sides. A cutter may be made to cut the pins on the steps all one size, if desired. This ensures a good job, and is invariably done in the model-making establishments. Now put steps in side and tack with the soldering iron. After tacking the top step, cut some small pieces of solder and place together with spirits on the joint inside. Blow gently with blowpipe till it runs and fills up the joint. The ladder is now together and only requires finishing the same as the previous ladders. If a little care is exercised, there should be no trouble in the making of the ladders.

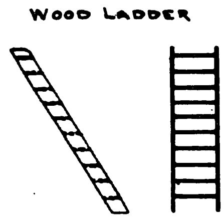


FIG. 44.

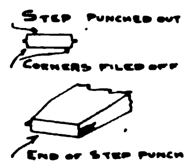


FIG. 45.

The next fitting will be another soldering job—cable chain (Fig. 46). This calls for a considerable amount of—chiefly—patience. For $\frac{1}{4}$-in. scale make a brass mandrel 3-16ths in. by $\frac{1}{8}$ in. a nice oval, and spin some 18- or 19-gauge wire round, after the manner adopted with the jump rings,

FIG. 46.

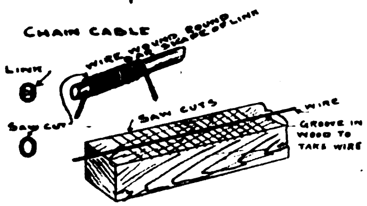


FIG. 47.

cutting off with the fretsaw at ends. Tap flat with the hammer and close the joint nicely with the pliers. To close the joint in link twist sideways; do not try to squeeze together, as it is no use. Now join all the links together, making into a chain. The next thing you require is the centre studs. The easiest way is to cut a piece of wood, as shown in Fig. 47. Now with a pair of narrow-nosed pliers press the stud across. The pressure is then sufficient to hold in position until permanently soldered. Cut some small solder and place a piece on each joint, and pass through the gas until the solder runs, or you can use the blowpipe, according to fancy. With care and patience this will prove to be a satisfactory operation.

The next article is a mushroom ventilator (Fig. 48). Of these there are two kinds; the first one we make will be a simple turning job. Put a piece of $\frac{1}{4}$-in. rod in chuck and turn to the shape and size of sketch. The flat tool is the one to use; set the dividers the length and turn the pin for fixing out of the solid. Polish nicely, as it is intended to silver-plate these fittings.

The other ventilator has a glass fitted and calls for more time and care (Fig. 49). Put a piece of $\frac{1}{4}$-in. rod in chuck and drill a hole $\frac{1}{8}$ in. right through. Now make a cutter 3-16ths in., as shown in side-lights, taking care to leave a small shoulder for glass to rest against. Having cut off, turn a small mandrel and face up. The next thing is to file a cross-bar. Tap a piece of 20 wire flat with the hammer and fit in top and solder neatly. It is now finished, with the exception of glass, which can be put in afterwards.

We will now proceed to make what is called a bunker hatch cover (Fig. 50). Put a piece of $\frac{5}{8}$ in. rod in chuck and turn perfectly flat and polish. Then, with the corner of flat tool, make a number of small marks in face (as shown in sketch). Drill a hole in centre to pin to deck, cut off, and it is finished. These have a pretty appearance on the deck.

The next thing is to make a galley-stove funnel (Fig. 51). This is made by cutting first a small flat disc off a piece of $\frac{5}{8}$-in. rod; soften, and then bend round a piece of $\frac{1}{8}$-in. rod. (Fig. 52) Now cut a piece of $\frac{1}{8}$-in. rod a little longer than the required length. Soft-solder the top in position and turn an angle-ring for the bottom, and soft-solder.

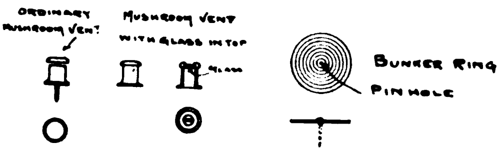


FIG. 48. FIG. 49. FIG. 50.

Now put in chuck and turn a pin on bottom to fix to deck; polish, and the funnel is finished. The above is one of the simplest ones, and is used only on the forecastle and galley stoves. On the saloon is one of a superior character (Fig. 53), entailing more work. A study of the sketch will almost show the operator how it can be made. Turn a piece of 5-16ths-in. rod to shape of top, and set four holes out and drill a 16-gauge hole; now turn four pins, as in Fig. 54, and solder into position. Now mount the lot on a piece of $\frac{1}{4}$-in. rod, turn angle-ring, and finish as in the galley funnel.

FIG. 54.

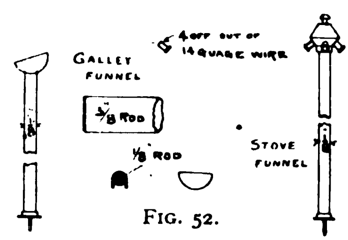


FIG. 52.

FIG. 51. FIG. 53.

We will now proceed to make a flagstaff (Fig. 55). This is a simple job, but, of course, helps to make the model more complete. Put a piece of 12-gauge wire in chuck and taper with turning tool, and afterwards even-up with a file and emery paper. Now turn a small washer with a round edge, or a jump ring will do. This is called a truck, and requires to have a hole drilled through the same size as top of staff. Cut six eyes (jump rings) and hard-solder two on staff, as shown. Now cut two rods of 22 wire, long enough to reach the deck, with allowance for spread of, say 4 ft. (1 in.), lay on the pumice, and hard-solder one on each end. If you slightly bend in the centre it will keep the wire from rolling off. Now cut the staff the length required, generally about 4 ins. (16 ft.), and file bottom to give it the desired angle. Next make a small plate out of 20 sheet, with four pinholes as shown (Fig. 56), and hard-solder the staff to

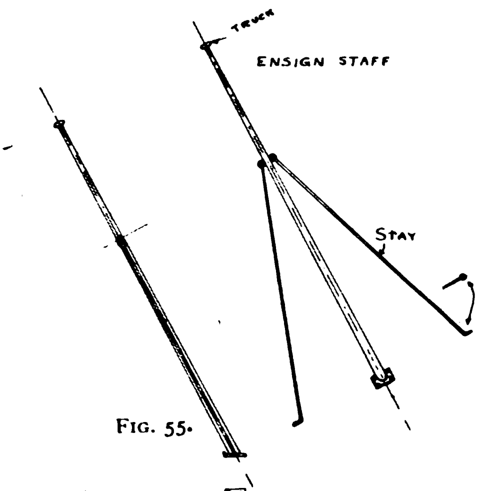


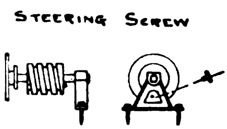
FIG. 55.

FIG. 56.

plate. Now split an eye on each of the stays, and join by closing on to eyes already soldered on staff. Now put the top on flagstaff and soft solder, afterwards filing the top level and drilling a 22-gauge hole through the truck to take the halyards.

We will now make what is termed the steering screw (Fig. 57). This is really a portion of the steam steering engine, but, as the remainder of this is inside the steering-house, it is only for appearance necessary to make the outside drum. The diameter of these vary, but the average size of them is 15 ins., *i.e.*, 5-16ths in. Put a piece of 5-16ths-in. rod in chuck

FIG. 57.



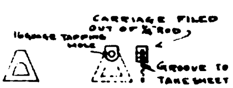


FIG. 58.

and screw with a coarse chaser, say eight threads. If you do not wish to use, or are not proficient in the use of, a chaser the same effect can be produced by simply making a series of grooves with a parting tool. You should now drill a 16-gauge tapping hole right through; now turn both ends, as shown in sketch, and afterwards cut off, tap out the ends, and insert a piece of 16-gauge screwed wire. Now put a piece of ½-in. rod in chuck and drill a hole 1-16th-in. tapping size through the centre; now turn to shape shown to form the stuffing-box, cut off, tap hole, and screw the barrel to the stuffing-box.

This completes the barrel, and we now have to make the stand. File a piece of 16-gauge sheet brass to the shape of Fig. 58 and polish both sides; now make a piece of brass to shape shown to form the carriage out of a piece of ¼-in. rod, afterwards filing a groove across to take the plate. Now cut a strip of 20-sheet about ⅛ in. wide and solder a piece on each side, holding in position with the tweezers; now file the bottom flat and put a strip across the bottom, but long enough to put the pinholes in. Next drill a 16 tapping hole through and tap out, polish the sides, and screw the drum into position, and it is complete. This stand must be carefully made to instructions, or it will end in disaster. I think, however, the illustrations will show the operator exactly the mode of construction.

Having made the screw, we had better make the steam steering wheel and stand (Fig. 59). First of all turn the stand out of a piece of 5-16ths-in. rod to the shape of sketch, with pin on bottom to

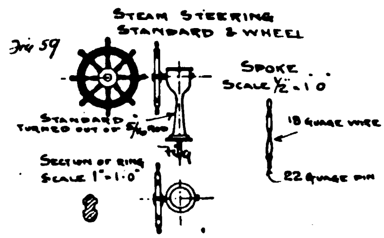


FIG. 60.

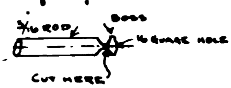


FIG. 61.

drive in deck; now drill a hole, 16-gauge, right through to take the spindle of wheel. We now require the rim for the wheel. Make a jump ring or two by spinning a piece of 14-gauge wire round a piece of ½-in. rod, and after cutting off and closing, hard-solder the joint. Now turn a mandrel in the lathe and press the ring tightly on and turn to shape shown in sectional sketch (Fig. 60). Divide the ring into eight, and drill through the ring, using an 18-gauge drill, to take the spokes. We now require the centre boss. This, is made by turning a piece of 3-16ths-in. rod to shape as Fig. 61, set out in eight, as in the rim, but drilling 20-gauge holes in place of 18. Before cutting off, drill a hole, 16-gauge, right through the boss. Now turn the spokes the length required (this can be taken from a sketch, but it should really be set out with the dividers on a piece of tin to ensure them being the correct length). A small drill chuck, usually sold at 6d. or 1s., as advertised in this journal, is the best for this purpose, as it keeps the wire nice and stiff; pull wire out of chuck a little at a time to keep it stiff for turning. After turning the spokes put the boss on a piece of wire, or you can leave it on the rod, according to fancy, and put the spokes into position, putting the opposite ones in first. Solder the lot together by putting small pieces of soft solder into the hole in centre of boss, and it will run right round nice and clean; it only requires now to be mounted on stand, and it is complete.

(To be continued.)

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.*]

Model Screw Propellers.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Referring to Mr. Garscadden's generally able contribution on the above, although I have hitherto purposely refrained from entering into the vast controversial field of propeller design, yet I trust you will allow me to deal here *ad seriatim*, and as briefly as possible, with a few salient points in connection with the above.

To begin with, in my humble opinion, one of the chief reasons why so many amateur model marine engineers fail to get good speed results is because they begin their design from the wrong end. If they started with the propeller for a pre-determined speed, and *then* proceeded to design the engine, boiler, lamp and hull, to drive and sustain that particular propeller at its maximum speed, I venture to assert that the percentage of failures would be lessened very considerably.

I wish Mr. Garscadden had touched mostly upon the design (*i.e.*, relative diameters, pitches, blade-areas, etc.) for the pre-determined speeds at given powers with assessed displacements, instead of dwelling mainly on the constructional part of a propeller, as there can be no doubt that the correlation of power, dimensions, and speed are infinitely more important factors in speed-boat design than the mere building of the propeller, which almost anyone can make if given the above data. Of course, I do not wish to minimise the importance of a properly-finished propeller; but diameter, pitch, etc., are far more important, and with all due respect to the able writer of the two articles on "Screw Propellers for Model Steamers" (THE MODEL ENGINEER, March 19th and April 2nd, 1903), I do not think that the seeker after speed will find therein the assistance he requires, and to be able to calculate these data with any degree of certainty is far beyond the ability of the average model boat-builder.

Mr. Garscadden says, speaking of "negative slip" (a somewhat vague and misleading term), that he has never seen this high degree of efficiency (?) attained by *models*. I am afraid he never will! True, this so-called "efficiency" is sometimes attained by ordinary steamers with engines turning about 60 to 80 r.p.m., but the reason is fairly obvious to anyone who will inquire into the matter.

I quite agree with Mr. Garscadden that for model work two-bladed propellers are much more efficient than those with three blades, and for the reason stated by him; but I trust he will pardon me for saying that his design for the two-bladed propeller (page 488 of THE MODEL ENGINEER, May 21st, 1908) is certainly not the one best adapted for speed, and yet it is this end at which his article aims! Not knowing the governing factors, such as power, number of revolutions, etc., I cannot speak with the certainty I could otherwise do were I in possession of these data, but, basing my objection on the two factors stated, viz., diameter and pitch, I have no hesitation in saying that the proportions of each to one another are decidedly bad, and the fact of the propeller being a casting (with a badly-shaped boss) would certainly not enhance its efficiency.

Mr. Arkell's method of building a propeller (which is practically the one I adopt) is, in my opinion, much to be preferred—both for efficiency and weight. Of course, I condemn the method of simply bending up the blades by guesswork, but this is practically unnecessary, if, as stated in the beginning of this letter, model boat-builders would first start and design their boats from the *propeller end*, and if a builder has to make a dozen or so propellers for his boat before he finds the most efficient one, then I would suggest that he study up and try to obtain an intelligent grasp of the subject, as obviously he is simply working by rule-of-thumb.—Yours truly, THOS. DYSART.

[See also letter on page 116.—ED., *M.E. & E.*]

Modelling the Hydroplane.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to Mr. Blaney's article on the above, which appeared in THE MODEL ENGINEER issues for June 4th and June 18th last, I trust I am not too late in being allowed to criticise the same, pressure of work having precluded my doing so before.

To begin with, I think it is a "terminological inexactitude" when the writer of the article talks about the disappointing (model) results and the many failures which have come under his notice, and which he has seen.

With one exception, Mr. Blaney's sole experience of hydroplanes is confined to his own model (a weird and unscientific creation), which, after much labour and hacking about, accomplished one short run at about an average speed of 2 miles per hour—and then broke down. And upon *this* experience, with its consequent data, the above "masterly article" was written and published! Further comment is needless. However, seeing that the majority of your readers look to the columns of THE MODEL ENGINEER for data and advice upon which to work, it seems to me, Sir, a great pity that articles should be accepted and published without there first being some test which would provide for the writer having sufficiently creditable, authentic, and practical results behind him to warrant his writing with some amount of authority, instead of mere theory, "crammed" by a hurried, cursory reading.

What we want is theory and practice combined.

After describing the construction of a model hydroplane hull, and stating that an allowance of 5½ lbs. had been made for suitable machinery, etc., to drive the same, Mr. Blaney breaks off here (a most important juncture), leaving it to "the model engineer to rack his brains to get the utmost thrust out of a combination of power-producing and using plant that will come within this weight." Why did not Mr. Blaney, out of sheer humanity alone, prevent such "brain-racking" by describing such a plant? Was it that he felt unequal to the task? But then, to use his own words, "This should not deter even the beginner from having a shot at such an interesting possibility." I can assure Mr. Blaney that if he will proffer me a suitable and efficient design, and also guarantee me a specified maximum speed, I will build a hydroplane accordingly.

I agree with Mr. Blaney when he advises your readers not to dismantle their model steamers and put the machinery, etc., into a hydroplane. He adopted this method, with the results already stated, so consequently upon this one point, at least, he is entitled to speak with some authority.

I sincerely hope that Mr. Blaney's remarks concerning the possible reasons of M. Santos Dumont's failures will be carefully noted by that gentleman, and then I have no doubt his next trial will establish a world's record.—Yours truly,

THOS. DYSART.

A Model Battleship.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I send a couple of photographs which I think may be of interest to your readers. The photographs are of my model of H.M.S. *Dreadnought*. She has a length of 36 ins., and a beam of 7 ins. The hull is built up in two pieces, bread-and-butter fashion. From the "cut-away" in the hull, to allow of the port and starboard guns being trained ahead, to the stern, the deck can be removed, bringing with it the whole of the top hamper, including the forward barbette. The barbettes were cut out of solid wood; I found these more satisfactory than metal. The guns were made with a pocket-knife and sandpaper, of soft wood. The barbettes are mounted on a fixed wooden post, and could be revolved if the stanchions were removed. The boats, of which there are five, including one launch, are made entirely of post

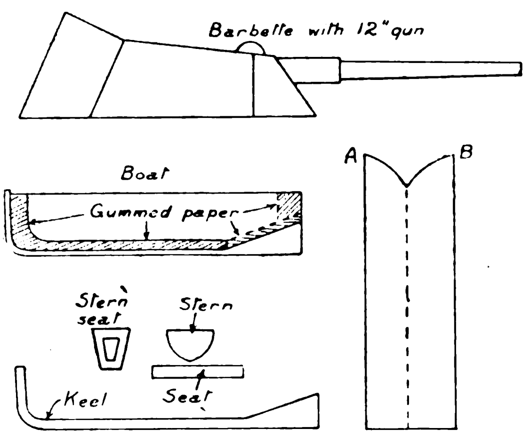


FIG. 1.—SHOWING METHOD OF MAKING SHIP'S BOATS.

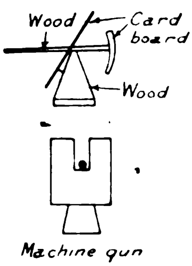
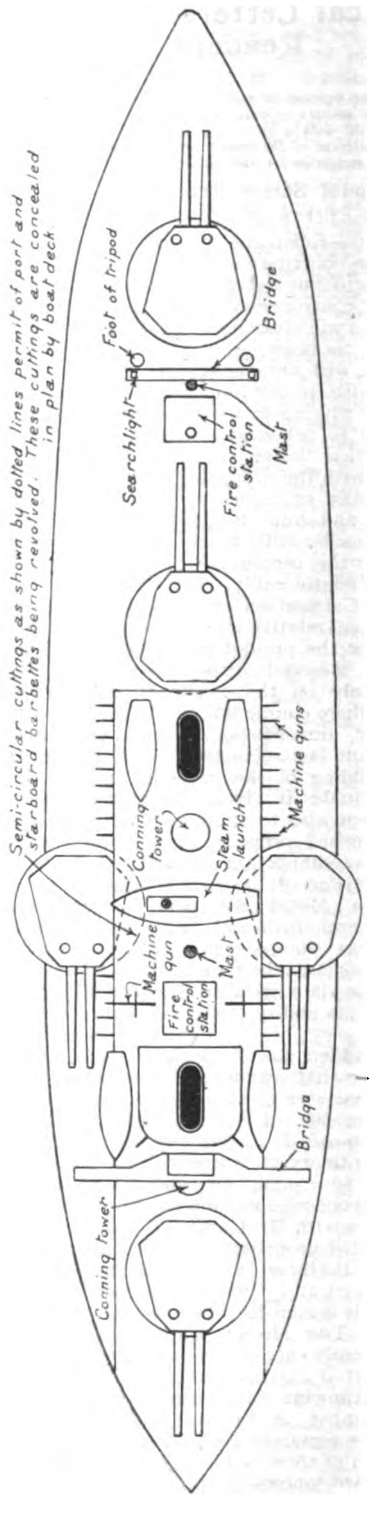
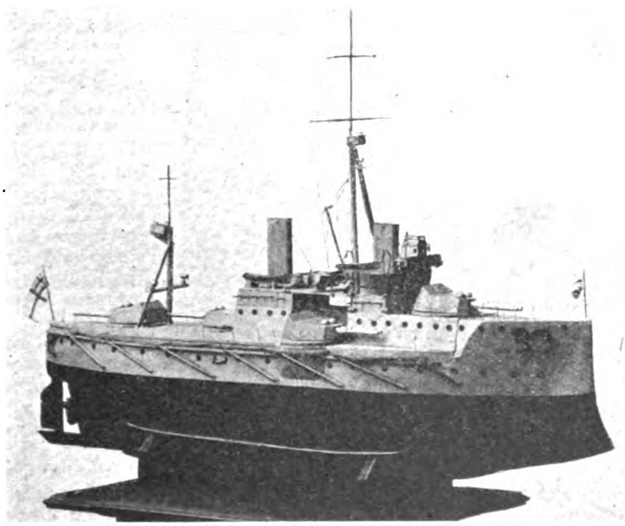


FIG. 2.—DIAGRAM OF MACHINE GUN.



DIAGRAMMATIC DECK PLAN OF MODEL BATTLESHIP.

cards, in three pieces, put together with sticking paper and painted over. When finished they made very good models and floated well. The superstructure is composed partly of cardboard and partly of wood from old cigar boxes. There are three searchlights cut out of wood with silver paper for lenses. There are five stockless anchors—three in the bows and two in the stern. The portholes are "eyelets," such as dressmakers use, glued in and painted black. The charthouse and two conning towers are of cardboard, and the bridge of wood and fine gauze painted over. The torpedo nets are of ordinary fine netting bought at a draper's, painted and rolled on the rest. The smaller guns, of which there are twenty-seven in all—twenty-five in the superstructure and two exposed on the boat deck—are made of wood. When the *Dreadnought* was first commissioned some of these guns were mounted on the roof of the barbettes, but they have since been removed. The funnels are of zinc, oval in shape, and the stanchions are ordinary pins. The vessel is painted the orthodox grey as far as the water-line and red below. As will be seen by the photograph, there is only one rudder and one screw; of course, my model differs from the real ship in that respect. She is fitted with a small electric motor and accumulator. Total weight of engines, etc., 6 lbs., to which must be added a heavy lead keel to ensure stability.



PHOTOGRAPH OF FINISHED MODEL.

The motor used is a No. 2B, by Thompson, of Greenwich, and answers perfectly. The accumulator, by the same firm, is a 4-volt one, and weighs 3 lbs. The motor weighs $1\frac{1}{2}$ lbs. The accumulator will drive the motor (propeller in water) for less than one hour, so for lengthened trials I carry a spare accumulator of the same make. Since the photographs were taken I have added a new steam launch (made, as explained before, of cardboard), and the funnels of the vessel have been fitted with tops which are painted black.

The drawings show ship's boat (Fig. 1), also sections of same. These are best made out of post-cards, cut out as per diagram. Pinch the two pointed ends (A and B) of the rectangular piece together, when they will be found to form the two sides of the boat. The keel piece should then be sandwiched between A and B, and fastened down each side of the bow either with transparent sticking paper or else strong gum. Now turn boat upside down and fix keel accurately along the centre. The keel can easily be held in position with sticking paper along each side of it, and joined to the hull, as shown in Fig. 1 by the shaded portions. The stern can be fixed the same way. The stern seats and the thwarts should be put in position after the other parts have well stuck, and fixed with gum. The whole boat should now be given two coats of paint. Two are necessary as cardboard does not take the first one very well. If the sections are carefully cut out and well put together, the result will be a very good model of a ship's boat, and will be perfectly water-tight and float well.

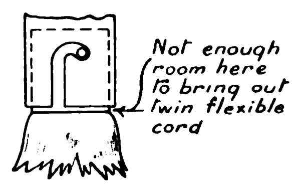
The machine gun is made exactly as diagram (Fig. 2) and the various parts fastened together with glue or gum and painted over. The barbettes are solid blocks of wood. The guns are also of wood, bored with a red-hot wire. The deck plan shows position of deck fittings, but none of the diagrams are drawn to scale.—Yours faithfully,

LAUNCELOT CAYLEY SHADWELL.

A Handy Charging Plug.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to Mr. W. John Howe's friendly criticism of my method of making "A Handy Charging Plug," published in THE MODEL ENGINEER, June 11th, 1908, I wish to say my reasons for so doing were as follows: The lamp fittings to which I have access for charging purposes are of an old pattern in which the bayonet joint slots are extended a good way up side of socket, so that when an ordinary lamp top is properly inserted there is very little of lamp top left protruding from socket, leaving no room to bring out the twin flexible cord at the side (see rough sketch, not to scale). Hence my reason for making a longer plug-piece in place of lamp top, which gives plenty of room for twin cord without fear of abrading the insulation against edge of socket and, of course, this plug-piece can be used with any ordinary lamp socket, whereas an adapted lamp top would not suit the fittings I have access to. Mr. Howe's plug is certainly simpler to make than mine, and no doubt answers well where the lamp fittings of a more modern pattern allow of its use. With apologies



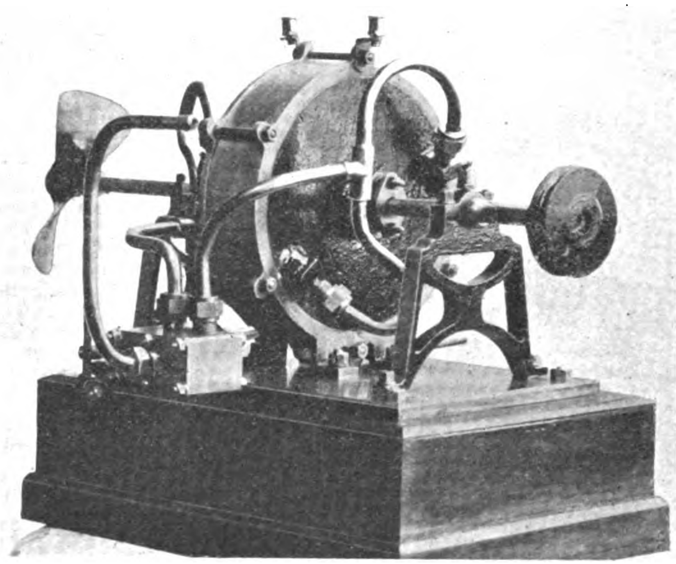
for intruding on your valuable space at such length,
—Yours faithfully, "A DABBLER."

A Reversible Steam Turbine.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I herewith enclose a photograph of a small power reversible steam turbine, which I have just completed, and which, I think, would be of interest to readers of THE MODEL ENGINEER. The idea for constructing a reversible turbine, I may mention, struck me while perusing the pages of one of your handbooks on "Model Steam Turbines," by H. H. Harrison. All the castings for this model are made of gun-metal, and the wheel, which is 4 ins. diameter, contains eighty copper blades, and is run on a 5-16ths-in. steel shaft. I have tested it, with the result that I have got 2,000 to 3,000 r.p.m. out of it with about 20 lbs. of compressed air. The small wheel which is to be seen on the end of the shaft is only a temporary one. The starting lever, which is to be seen on the left of the steam chamber, will regulate the steam as well as reverse the turbine.—Yours truly,

W. CLEMENTS.



Re Model Propellers.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Mr. Garscadden's letter in issue of July 16th does not, as he states, answer my criticisms at all. In a true helix, as in Mr. Garscadden's design, a section at right angles with the axis of rotation will be a straight line. Now, the line along which any drop of water should travel on the surface of the blade (the stream line) should at all points be equally distant from the rotary axis. Since, however, the water is carried partly round it must tend through centrifugal force to fly out towards the tip of the blade: all water thus discharged radially must be replaced by an irregular flow from somewhere. This is further complicated and aggravated by the tendency of water to surge out over the edges of any flat object being forced through it, and I cannot see how Mr. Garscadden's "long continued leading edge" can correct these tendencies, and I think these two faults may account largely for some of the vagaries of propellers in general, and "screw" propellers in particular. These can only be corrected by a design which includes some means of confining the water in its proper course.

There is, however, another, and perhaps equally prolific source of loss which is overlooked by many, and this is the tendency to focus all one's care on the "face" of the blade, smoothing off the back comparatively anyhow. I have reason to think that the shape and finish of the back is at least quite as important as the face. I once tested this and the result was convincing and surprising. I soldered irregular shaped pieces of brass on the face of the blades of a model whose efficiency I knew. The result was disastrous, but when I removed them and put them on the back it was *quite* as bad.

If I am not trespassing on our Editor's space, I would like to invite opinions on the following. All effort seems to be directed to develop thrust without regard to volume of water discharged per revolution. I really think, Sir, the latter is of greater importance and demands first consideration. There is some relation between its capacity per revolution, the displacement of the vessel, and the length of same. It is conceivable that a vessel travels nominally her own length when the propeller discharges a volume of water equal to the vessel's displacement.—Yours faithfully,

JOHN MURPHY.

THE Whitsuntide traffic on the Metropolitan electric tramways includes some striking figures. On Whit-Monday the number of passengers carried was 334,806, and the receipts amount to £2,389. For the week ending Friday, June 12th—that is to say, the week including the Whitsuntide traffic—the passengers numbered 1,391,531 and the receipts amounted to £8,177. This year the route mileage in operation was 42, and last year it was 33. The aggregate receipts for this year up to the date mentioned are £123,161, as compared with £98,371 last year.—*Mechanical World*.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[19,821] **Overheating of Gas Engine.** R. G. H. (Dunstable) writes: Will you kindly answer the following questions respecting a ½ h.-p. gas engine (2⅝ in. by 3½-in. bore and stroke), which I recently purchased new from a S.E. London firm of electricians. I ran it for about 2 hrs. with no load, and the water in the tank was too hot to allow one's hand on the outside of the tank two-thirds of the way down. The tank holds at least 10 galls. The water pipes are ⅝-in. iron gas barrel, and as free from bends as possible. Are these sufficiently large or should the tank be placed higher? It is at present slightly above the top of the cylinder. The cylinder gets very hot all over, even round the water inlet, which I do not think should be so. Would ¾-in. pipes make this better, and also the addition of another tank. Please say how two tanks are connected, if both on same level or one higher. I have a water cock in inlet pipe which is of the type fitted with a loose valve lifted by the pressure of water. Would this affect the flow? Should an ammeter read, when, though connected with dynamo, no current is being used, or does it only register the amount of current used.

We can only suggest that the top circulating pipe has either a partial stoppage or that the rise from the cylinder to the tank is not sufficient. The pipe should rise continuously, even if only slightly, all the way—that is, there should be no straight or horizontal pieces in it. We are not quite clear about the construction of the valve or cock at the bottom of tank, but this should not be in the nature of a valve at all, and, moreover, the water passage should be equal to the full bore of the pipe. The fact of the top part of the cylinder getting hot is nothing extraordinary, but so long as the circulation is as free as it should be the lower part of the cylinder, where circulating water enters, should be perfectly cool, provided the whole of the water in the tank is not hot. ¾-in. or 1-in. pipes would, of course, be more satisfactory. (See Query on page 333, of April 4th, 1907, issue). *Re* ammeter. The ammeter will only register when the current is actually flowing in the circuit.

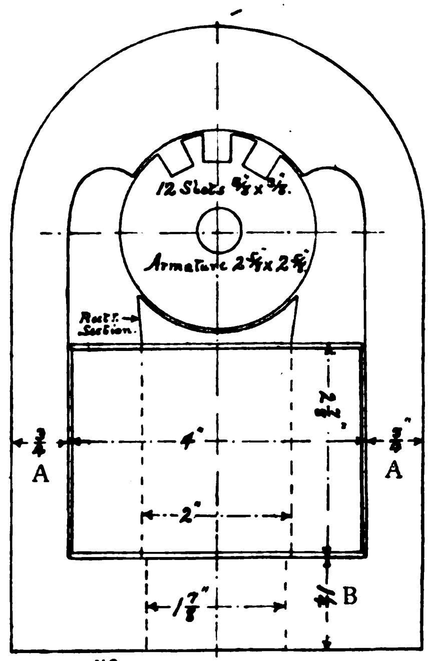
[19,933] **Diagram of Induction Coil Windings.** R. K. (Crewe) writes: I have got your book on "Induction Coils," No. 11 THE MODEL ENGINEER Series of Handbooks, and do not see how to wind and connect up a shocking coil with primary and secondary windings. Would it be troubling you too much to show me how to connect the wires, and also how much and what size wires to put on the bobbin, which is 3 ins. long by 1 in. diameter?

We really cannot give a clearer diagram of windings for the coil than is given on page 19 of our handbook "Induction Coils." For your coil with a core of 3 ins. length the diameter should be about ⅜ in. Wind primary with three layers of No. 18 S.W.G. and the secondary winding should contain about 6 ozs. of No. 36 S.W.G.

[19,922] **Civil Engineering.** L. W. W. (Lincoln) writes: Will you kindly let me know on what conditions and how I could get into an engineering firm who undertake structural and bridge building work on a large scale. Please mention one or two English firms who do this kind of work. I have been two years in an ordinary engineering firm (turning and fitting) on portable traction engine work, and wish to branch out into the kind of work mentioned above. I am 19 years of age, and do not wish to pay a premium. I have had a good education, and have been attending the elementary classes in an engineering evening school. What sort of work should I have to begin with, and are there good prospects for a person in my position? Please advise me.

We give below the names and addresses of a couple of firms doing large work of the kind you mention, but we cannot say whether they have any vacancies at present for apprentices. The best you could do under the circumstances would be to make a selection of a few names from some of the trade engineering journals, such as *Engineering* or *The Engineer*, and write to these firms asking them to put you on their list if they have no vacancies at present. We regret we cannot give you further any definite advice on this matter. John Lysaght, Ltd., St. Vincent's Iron Works, Bristol; Thos. Piggott & Co., Ltd., Birmingham.

[19,877] **Dynamo Design.** M. M. (Portland) writes: I enclose herewith a rough sketch giving the principal dimensions of a 100-watt generator I propose building, and, before making the pattern for fields, shall be greatly obliged if you will kindly revise the design and add what improvements you may consider necessary. I find it is possible, with careful winding, to get exactly 3 lbs. of No. 22 S.W.G. D.C.C. wire on the field-magnet bobbin, giving approximately 14·928 ohms resistance and about 1,900 turns. It is also my intention to wind the armature with 1 lb. (approximate) No. 20 S.W.G. D.C.C. wire. (1) Are the above wire gauges suitable? (2) Will the 3 lbs. be sufficient on the field-magnet, or should it be more (or less)? (3) Is the wrought-iron core (2 ins. diameter) too large or ought it to be larger (or smaller)? (4) Are the ⅜-in. thicknesses at A A thick enough to properly conduct the lines of force? Of course, the complete sections here are 2⅝ ins. by ⅜ in. (5) Could I safely reduce the 1½-in. depth at B, or should it be deeper? (6) Do you think the design would build up into an efficient machine? (7) What would be the probable output in volts and amperes?



QUERY No 19877

We do not advise you to proceed with the construction of magnet carcase as shown in your drawing. It is not very efficient on account of the amount of magnetic leakage which will occur between the pole face and the cast-iron yoke-sides adjacent. For the machine, as in your drawing—(1) The gauges of wire will do. (2) Three lbs. No. 22 is suitable for magnet. (3) Core should not be more than 1 in. diameter. (4) Thicknesses at A A need only be ¼ in. (5) Depth at B need only be 1 in. (6) No. (7) Perhaps about 4 amps. at 10 volts. Diameter of armature should not be more than 1½ ins. We advise you to make a machine from one of the designs ready to your hand in our book, "Small Dynamos and Motors," 7d. post free.

[19,572] **Automatic Cut-out.** A. H. J. (Shanghai) writes: I propose to charge small ½-amp. accumulators off 200-volt alternating mains through a rectifier with lamp resistance. Would you be kind enough to indicate the construction of (1) an automatic cut-out, and (2) an ammeter reading up to 2 amps. only, but having a needle swing of 2 ins. or more, so as to give large sub-divisions.

(1) A working drawing of an automatic cut-out is given on page 219 of THE MODEL ENGINEER, for July 7th, 1904. For 2 amps. wind the magnet with three layers of No. 16 D.C.C. copper wire instead of two layers of No. 10 gauge. Mr. A. H. Avery, of Fulmen Works, Tunbridge Wells, makes a small automatic cut-out, and also sells the castings and parts for it too. But you will not require an automatic cut-out if you are charging through

lamps. (2) You will find drawings and description of a small ampere meter in Chapter II of our handbook, No. 24. For 2 amps. wind with No. 18 gauge D.C.C. copper wire instead of 14 gauge wire. This book also contains useful information on making ammeters and voltmeters and other instruments for measuring electricity.

[19,162] **Model L.N.W.R. "Precursor" Cylinders, 3½ Gauge.** W. G. (Shildon) writes: Would you kindly forward me size of ports for the working drawing of Joy's gear, as appeared in THE MODEL ENGINEER "Query" pages for February 13, 1908, and size of slide-valves?

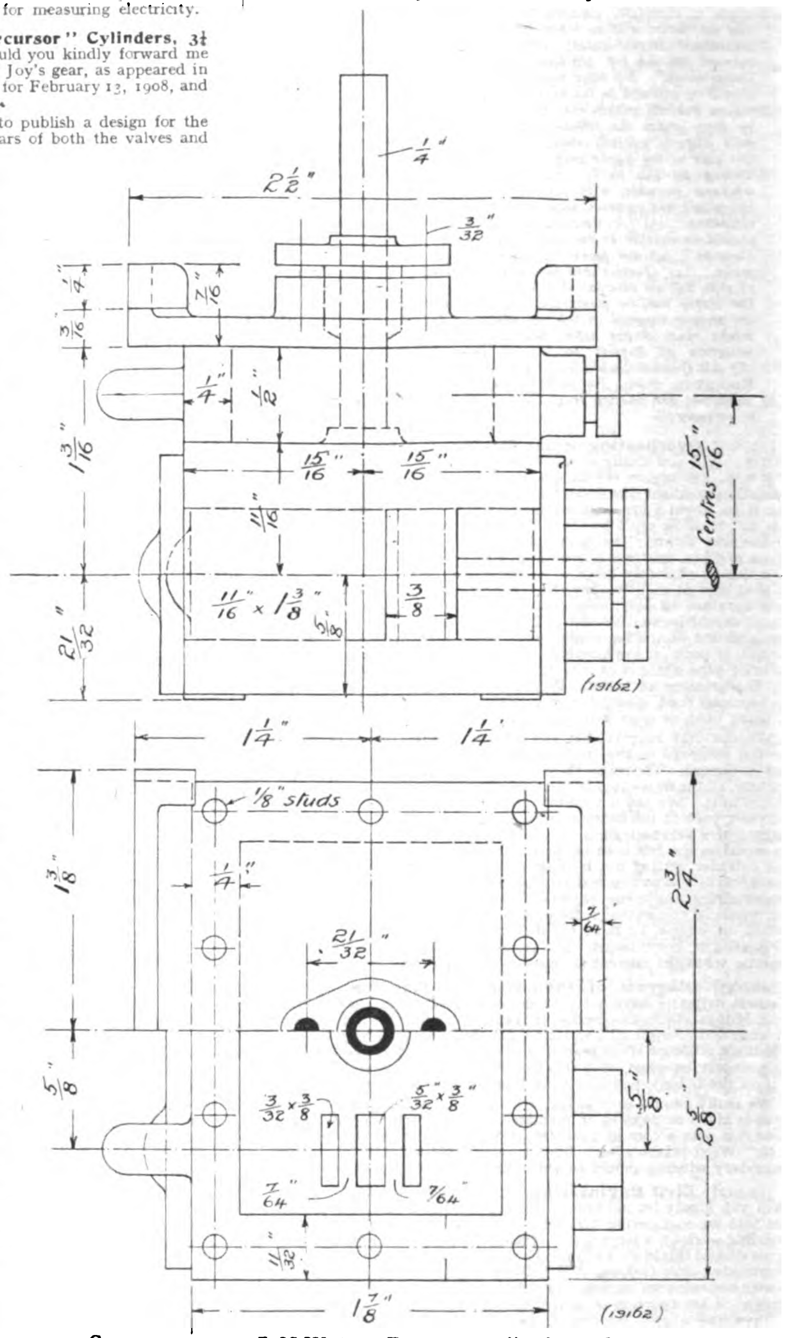
Another reader having requested us to publish a design for the cylinders, we include herewith particulars of both the valves and cylinders. The lap of the valve cannot very well be more than 1-25th in., as it is impossible to place the pins in the vibrating links at the scale distance apart without involving constructive difficulties, and the eccentric pin method suggested in the drawing given with Query No. 18,609, in the issue of February 13, 1908, cannot be proportioned to allow a greater amount of advance than this. The cylinders should be 11-16ths in. by 1⅜ ins., and are generally the same as THE MODEL ENGINEER locomotive cylinders described in "The Model Locomotive" and in Vol. X. The cover is enlarged to form the bottom of the smokebox of the model L.N.W.R. "Precursor" locomotive, for which they were originally designed. The ports are dimensioned as follows: Steam port, 3-32nds in. by ⅜ in.; exhaust port, 5-32nds in. by ⅜ in.; port bar, 7-64ths ins. wide; exhaust passage, 3-16ths in. diameter. The piston-rod should not be less than 5-32nds in. diameter, and the valve spindle less than ⅛ in. diameter, and the cylinder centres are 1¼ ins. instead of 1 in., as those used in THE MODEL ENGINEER steam locomotive. The steam chest cover should be affixed by at least eight or ten studs, and the flange on the top edge of the cover should be drilled and tapped for screws affixing the smokebox. The exhaust pipe should be screwed into the cylinder casting with a fine taper thread (either forty or forty-eight threads per inch), and leakage at the joint with the top cover prevented by a packed gland, as shown. Instead of studded glands, screw-in glands may be used. These offer some advantages, and look well if they are drilled for tommy bar nstead of being made hexagonal.

[19,972] **Elastic Motors.** T. N. (Liverpool) writes: (1) Is the elastic stretched before twisting; and, if so, to what extent? (2) What particular kind of elastic is used, and where obtainable? (3) Give rough sketch of method of making up, and show method of transmitting the motion. (4) Can the power of an electric motor be computed; if so, please give formula.

The elastic is just very slightly stretched and then twisted to the required amount. The purest form of elastic is generally used, being uncoloured. The elastic is simply the flexible coupling between one fixed point and a revolving shaft; any good mechanical method of fixture to the two points may be employed. We do not know that there is any formula to be relied upon for estimating probable power developed. Actual trial is the only reliable method to work upon.

[19,886] **Fixing Metal to Glass.** S. G. H. (Edinburgh) writes: Can you help me in this matter? I am a surgical instrument maker, and I have a lot of German silver mounts to fix on to the ends of graduated glass cylinders of hypodermic syringes, so as to stand being sterilised. I ground the ends of the cylinders and screwed the insides of the mounts, then tried fusible metal; but it is not satisfactory, for the pressure of the piston is very great. Can you tell me what material to use?

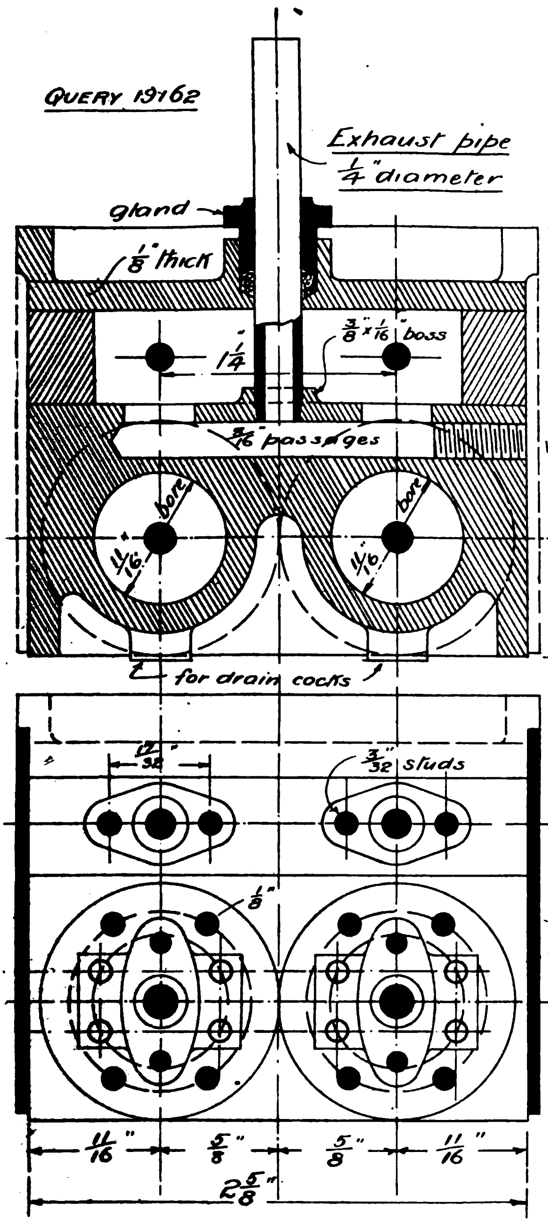
Try a tin alloy made as follows: Melt 5 parts copper and pour into 95 parts molten tin, stirring with a wooden mixer. Afterwards remelt the alloy. This is said to adhere strongly to clean glass and to have nearly the same rate of expansion.



CYLINDERS FOR L.N.W.R. "PRECURSOR," 3½-IN. GAUGE.

[19,071] **Miscellany.** J. H. (Blyth) writes: (1) As I am going to start to make a wireless telegraphy machine to transmit messages at a distance of 1½ miles, could you oblige by telling me the simplest and best book to get—one with the whole of the instructions and drawings—one which you think I can understand best. Do the inventors—Messrs. Muirhead & Co.—not supply books

on this subject? (2) Have all spark plugs platinum wire points on at both negative and positive points? Which is supposed to be platinum wire; or, is the negative just hardened steel, as it looks just similar to steel? (3) Is vulcanite used instead of platinum wire, or will it do for the same purpose, and what does it cost?



(4) Will it do a 4-volt accumulator any harm by disconnecting the two cells and using one cell at a time. This will make each cell 2 volts, as 4 volts is too strong for my coil. Also, will it give the same ampere-hours with each cell at 2 volts. The accumulator output is 20 ampere-hours. (5) Also, could you oblige by telling me the best way to temper wire springs, also which will be the best firm to purchase the wire from? Is there any particular name given to this wire? (6) Could you oblige by telling me the best way to harden punch points? (7) *Re* accumulator lids. These are celluloid lids and cases (also temporary lids). I am going to take the lids off, and I was wondering if you use anything to clag the lids in again.

(1) "Wireless Telegraphy for Amateurs," by Howgrave-Graham, would meet your requirements best, price 2s. 3d. post free. (2) Well made sparking plugs have platinum wire on both tips. (3) Vulcanite can never be used instead of platinum, as it is a non-conductor. (4) Yes, you can disconnect your accumulator and the ampere-hours of each cell will remain the same as before. (5) Wire springs are usually tempered by heating—either in oil raised to a very high temperature, or sometimes by immersing in an alloy of molten metals, according to the temperature at which it is necessary to bring the springs before quenching. Any of our advertisers of engineering materials would supply you with a suitable wire; steel wire is used, of course. (6) Centre-punch points may be hardened by first heating to a cherry red, then quenching to make them dead-hard. From this stage the temper is reduced by slightly heating the far end of the punch, that is, not the point, and then watching the colours come down to the point one after the other. When the right colour appears on the surface of the metal at the tip, the punch should be quenched in tepid water. If you turn up back numbers of this journal, you will find some useful information on all kinds of tempering. (7) Use amyl acetate for your accumulator lids.

[20,046] **Dynamo and Motor Efficiency.** J. G. (Glasgow) writes: I have carefully gone over the designs in "Small Dynamos and Motors," also Mr. Avery's ironclad in "A B C of Dynamo Design," and I have come to the conclusion that the Kapp type (Fig. 11 in "Small Dynamos and Motors") is the most efficient machine. Would you kindly say if this is correct, and am I right in supposing that this is because the length of the mean turn of the field coils in this machine are shorter than in the others? I am making a 30-watt dynamo (Fig. 11), and would like to work out the calculations for same, but I cannot do this with any confidence, because I am not sure of the co-efficient of leakage. I suppose this will be about 1·4 or 1·45? If it would not give too much trouble, I would like to have the co-efficient of leakage for the other machines in "Small Dynamos and Motors."

There is no rough-and-ready rule for determining the efficiency of a machine. It cannot be judged from any one detail, such as that you suggest. The nett efficiency of a dynamo or motor depends upon the amount of power wasted in the machine, and this varies according to many details of construction of the machine, *e.g.*, size of air-gap in relation to size of machine, leakage coefficient, magnetic reluctance of field-magnets (which depends on quality of iron, number of joints, etc.), amount of dead wire on armature, and various other things. It is beyond the scope of our Query Column to work out for you the exact leakage co-efficient of all the machines you mention. The usual value assigned to it is 1·3 for all machines up to ½ kw. (500 watts), and 1·2 for those over ½ kw. and under 10 kw.

[19,598] **Water Motor.** H. A. S. (Bromley) writes: Can you give me any idea how much water per hour at 40 lbs. to the sq. in. would be required by a water motor to produce ¼ h.-p.? as I want to drive a small dynamo in this way? Also what type of water motor would be best. Are they noiseless?

To drive a ¼ h.-p. motor at a pressure of 40 lbs. per sq. in., the water consumption would be approximately 2 cub. ft. per minute. The Pelton wheel type of motor is the best you could use, and it runs practically noiselessly. Any of our advertisers advertising such goods would supply you with a reliable article. We might mention Messrs. Whitney's, of 117, City Road, London, E.C., as a good firm to go to.

[19,975] **Wire Tables.** S. P. (Douglas, I.O.M.) writes: Will you oblige me by answering the following queries? (1) Where could I obtain a table of current capacities of different gauges of wire? (2) What is the biggest current an adapter will carry? (3) Will three adapters carry three times the current if they are joined to one wire and set in three respective sockets?

(1) Any electrical pocket book contains table of wire gauges, carrying capacities, etc. (2) This depends upon the size of the adapter. The latter are made in various sizes to suit the work they are intended for. (3) Yes, if the wire will too.

The Editor's Page.

OUR recent remarks on the subject of the developing of inventions has brought the following letter from H. K. (Weymouth) who writes: "I was greatly interested when I read your Editor's Page last week, as it appealed to me very much and gave just the very information I have been trying to gain. Although I have made no further progress with my idea, I still keep on trying to invent something, and I am never happier than when I am wasting electric current on my various machines. I have lately finished a Morse inker which I required for experimenting. I copied the idea given by Mr. Delves-Broughton, but I included two or three novel ideas which have so far been successful. I am very pleased with it considering it is entirely made from scrap, with the exception of about two items which I bought on purpose for it. I must thank you for the fine hints given last week, and hope it will be a help to others who are situated like myself."

* * *

Chatting with a friend who is one of the leading patent agents in this country, the question of disclosure of inventions when seeking financial assistance was raised. Our friend, speaking from a long experience, did not approve our suggestion that the needy inventor might offer a share in his invention to a friend in return for assistance in procuring the patent. He said that although the friend might make no use of the information disclosed, it would be quite possible that some other inventor might be independently working on the same idea and might apply for a patent before inventor number one had obtained the required help. This would lead at least to a suspicion of bad faith on the friend's part, while, of course, when dealing with strangers the risks of having one's ideas bodily appropriated becomes very real. Our patent friend gives his opinion, and we may say that it is an opinion well worth having, that it is better for a poor inventor to act as his own patent agent and file his own provisional protection, thus saving the patent agent's fees, than for him to run the risk of disclosing his secret to anyone in the world. This is obviously disinterested advice, and is therefore the more valuable. We feel inclined to supplement it by suggesting that the inventor should at least spend 6d. on our little handbook, "Patents Simply Explained." While this advice is also good, we cannot plead that we are disinterested, but we mention it for what it is worth. Those who have read the book say that it is worth a good deal.

* * *

We regret being obliged to hold over the continuation of our Notes on the Junior Engineers' Summer Meeting in France till our next issue, but we have some very interesting photographs in the engraver's hands which will appear in due course.

Answers to Correspondents.

T. D. L. (Audenshaw).—Many thanks for your letter and suggestions. Also for recommendation of THE MODEL ENGINEER, which is much appreciated.

J. D. (Douglas).—(1) Yes, if properly made. (2) 5-in. by 8-in. marine single-flue boiler, as handbook, "Model Boiler Making," 3-16ths-in. steam pipe. (3) We have no information. There was a branch of the S.M.E. at Newcastle-on-Tyne a few years back.

N. G. (Belfast).—Thanks for your letter. You will find the proportions in handbook work out very well in practice, and you will get, by following them, a rather more than saturated solution, that is, some crystals of bichromate of potash will remain undissolved until the solution becomes weaker.

P. H. (Sittingbourne).—A reader wishes to write you *re* 650-watt dynamo. If you will let us have your address, we will put him in communication with you.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE
Model Engineer
And Electrician.
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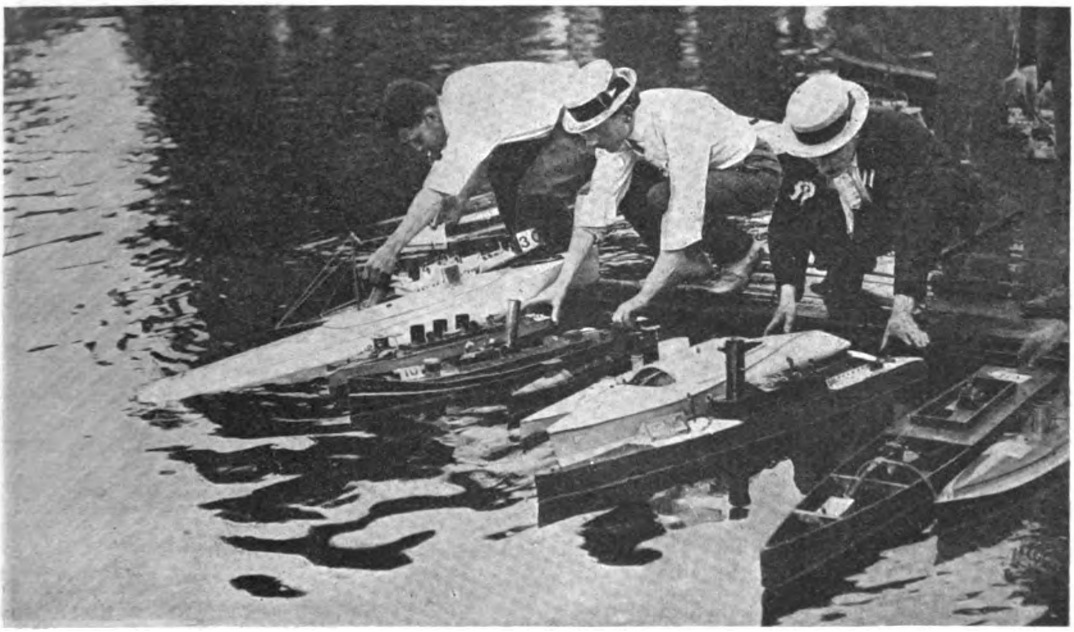
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.
VOL. XIX. No. 380. AUGUST 6, 1908. PUBLISHED WEEKLY.

"The Model Engineer" Regatta at Wembley Park.



SOME OF THE COMPETITORS AND THEIR BOATS.

SATURDAY, July 25th, was a great day at Wembley Park—it was the occasion of the first open Model Motor Boat Regatta ever held in this country. In spite of the holiday season being in full swing, of the counter attractions at the Stadium at Shepherd's Bush, and of other important sporting events, a crowd of fully a thousand people mustered on the banks of the charming lake to witness the various racing events. The weather was fine, the Wembley Park Military Band discoursed sweet music, and some excellent running by the various boats was made.

The afternoon was not without its exciting incidents, and its unfortunate mishaps. The *Moraima II* (Messrs. Arkell's petrol flier), got off her course in one of her trial spins and found a hard place in one of the banks, resulting in a split keel and a split deck. This calamity notwithstanding she was run again, and the trim of the rudder being altered she found herself and made some splendid trips as true as a die. She naturally did not, however, do herself full justice in point of speed.

The sensation of the day was the remarkable speed shown by Mr. David Scott's *Bon Accord*, another petrol boat, hailing from the North Countree. Mr. Scott was most unlucky, for on the first run his boat failed to make a correct course. While holding her ready to put in the water for a second trip her owner slipped in the starting punt, and the propellers catching against the corner of the punt, were instantly stripped and the engine gearing damaged. The mischief was not repaired till too late in the afternoon to make another trial, but on her initial trip it was estimated by competent observers that the *Bon Accord* was doing at least 14 miles an hour. Mr. Scott deserves the fullest sympathy in his real hard luck, and hearty congratulations on the fine work his boat will evidently do. We shall expect great things of the *Bon Accord* in the near future.

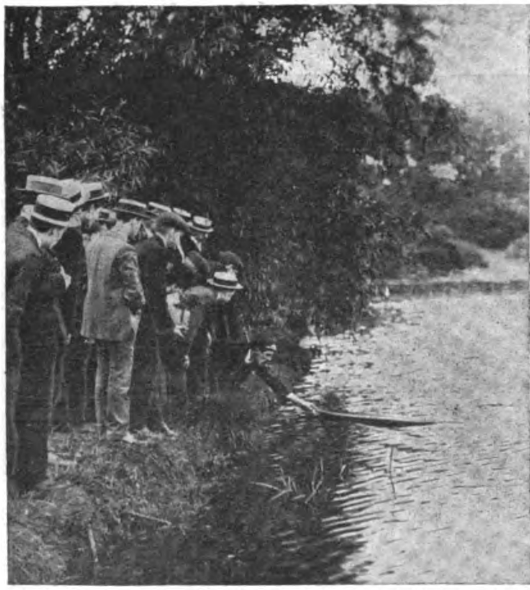
The news that the Victoria Model Steamer Club were building a club steamer, the *Victoria*, specially for the Regatta, had raised anticipations of a keen contest between steam and petrol for the blue riband of the large class, but the time proved too short to get her completed, and for the present event she was a non-starter. By the time these notes are published she may have done some trial trips, and in her the members are confident that they have something which it will take a good boat to beat. Another specially built boat was the steamer *Experiment* by Mr. J. C. Crebbin, in which several novel ideas in the way of feed-water heater, flash boiler, and mechanical lubrication were incorporated. A further piece of bad luck attended this craft, for in getting her into trim the setscrew of the engine flywheel stripped and placed her *hors de combat*. The Victoria Club were thus narrowed down in the large class to a single representative, Mr. W. Smith's *Belvedere*, also a petrol boat. Like many others, she failed to do her best, the engine being plainly heard to mis-fire several times while on the trip. She showed, however, that she possesses excellent speed, and when in her best form will do some really smart performances.

Two other excellent petrol boats ran in the large class—the *Ruby* by Mr. Arthur Sheed, and the *Varuna* by Mr. F. N. Sharp, both members of the Clapham Steam and Sailing Club, which, as our readers know, also claims Messrs. W. H. and H. A. Arkell, the builders of the *Moraima II*. Petrol, therefore, reigned supreme amongst the bigger boats; but whether this will be so on a future occasion remains to be seen. We heard not a few steam enthusiasts express some very strong doubts on this point.

The winners in the first event were as follows :—

First Prize.—*Moraima II*, W. H. and H. A. Arkell (Clapham S. & S.C.). Petrol motor. Length, 5 ft. 6 ins. Speed, 9·26 miles per hour.

Second Prize.—*Varuna*, F. N. Sharp (Clapham S. & S.C.). Petrol motor. Length, 5 ft. 6 ins. Speed, 8·48 miles per hour.



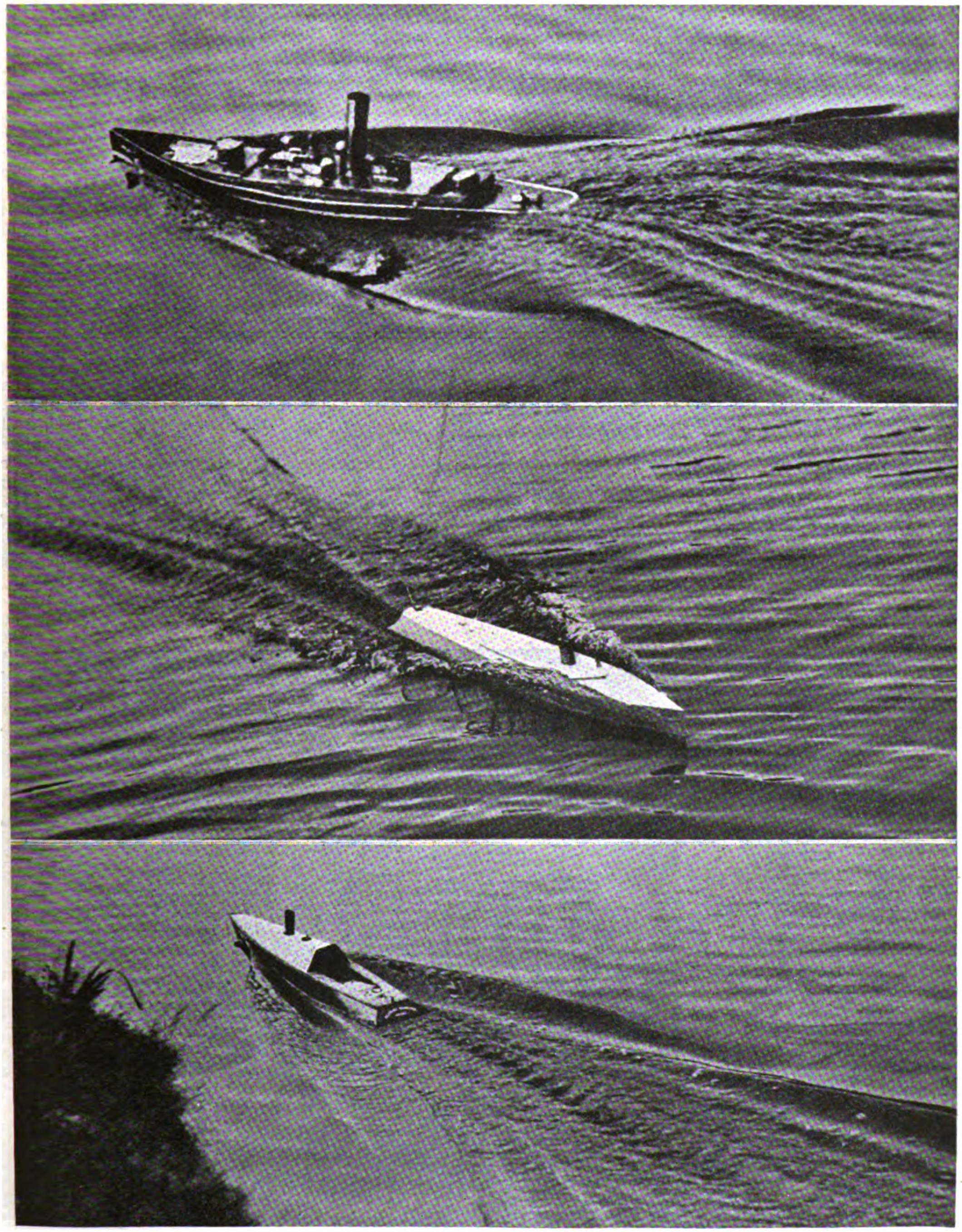
The "Albert" Finishing.

Starting the "Belvedere."

Third Prize.—*Belvedere*, W. Smith (Victoria M.S.C.). Length, 5 ft. Speed, 5·11 miles per hour.

This event was held over a course of 144 yards. Several competitors did not put in an appearance, while others were too late in their arrival to qualify for a run.

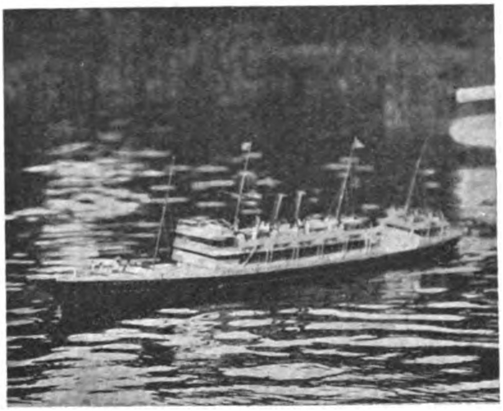
In the second event a much larger number of competitors appeared, and the running was altogether more satisfactory, this no doubt being due to the shorter course adopted, viz., 77 yards. The majority of the boats were steamers, but several electric boats did excellent runs. Among these latter were the *Albert*, a beautifully built model entered by Messrs. Gamage, and the *Jessamine*, another fine piece of workmanship by Mr. R. Martin Weaver of the Clapham S. & S.C. The steamers, however, easily held their own and secured all the prizes. A novelty in the *Folly*, a steam-driven



AT FULL SPEED.

(1) The "Mavis." (2) The "Moraima II." (3) The "Scarlet Runner."

hydroplane entered by Messrs. W. Delves-Broughton and Herbert Teague, attracted much attention. Only finished a few hours prior to the race, it was not surprising that various minor mechanical



Mr. G. F. Young's Model Liner, "Fairholme."

troubles developed and prevented her being given a fair run, but on one or two trial trips she demonstrated a remarkable turn of speed for a portion of the course, and particulars of her future performances will be awaited with especial interest.

By far the best work among the small fry was that done by the *Una*, a metre steamer belonging to Mr. C. Davis of the Victoria M.S.C. Indeed, the Victoria Club swept the board with their metre class, as will be seen from the appended results.

First Prize.—*Una*, C. Davis (Victoria M.S.C.). Length, 1 metre. Standard speed, 6·6 miles per hour. Speed recorded, 6·3 miles per hour.

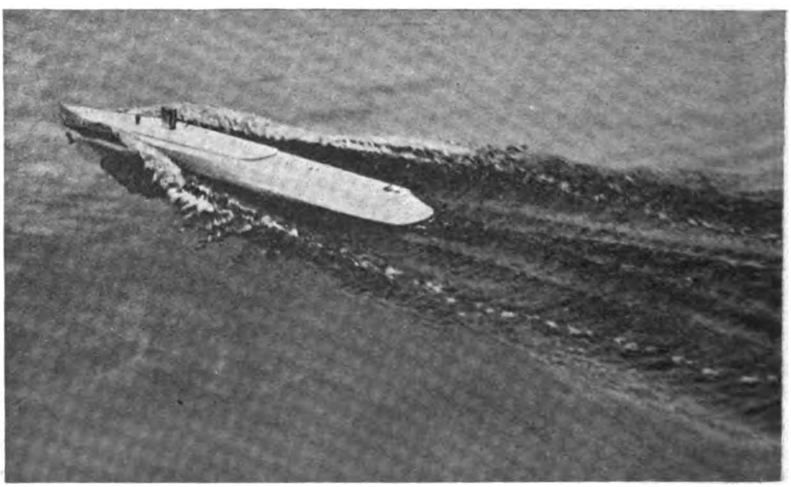
Second Prize.—*Imp*, T. B. Duff (Victoria M.S.C.). Length, 3 ft. 3 ins. Standard speed, 6·5 miles per hour. Speed recorded, 4·79 miles per hour.

Third Prize.—*Leda*, E. Vanner (Victoria M. S. C.). Length, 3 ft. 3 ins. Standard speed, 6·5 miles per hour. Speed recorded, 4·25 miles per hour.

Other good runs were done by the *Mavis* (Mr. R. Church), *Jessamine* (Mr. R. Martin Weaver), *Biddy* (Mr. Henry Cousins), and the *Florida* (Mr. A. Lawson).

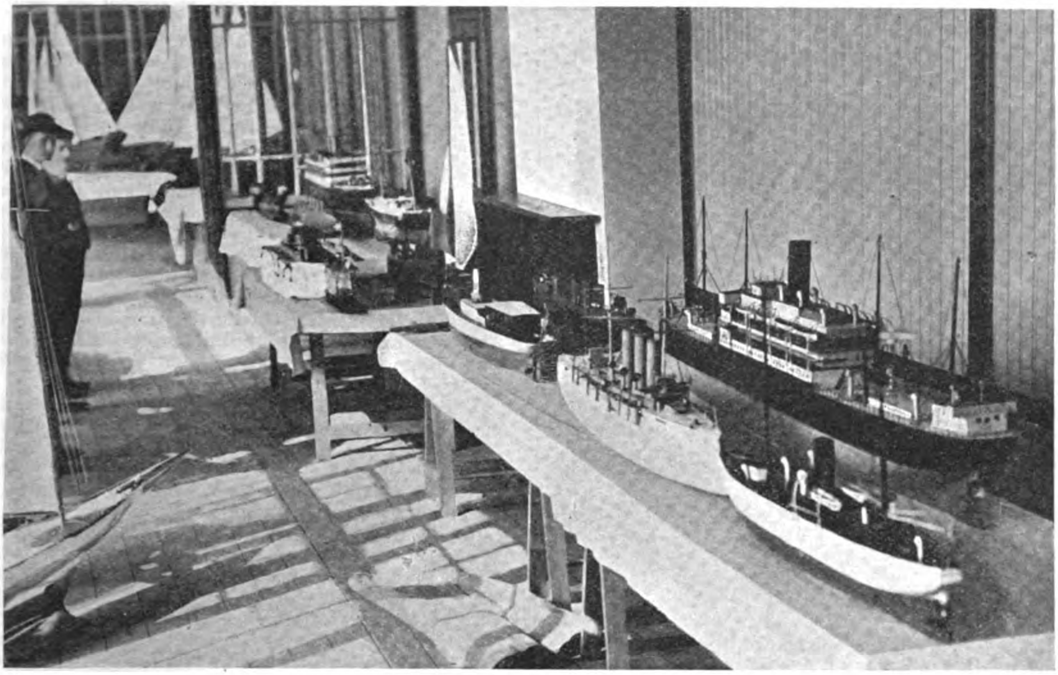
Owing to the lateness of the hour when the time arrived for running off the Inter-Club event, it was decided to race over the shorter course, and as the Victoria Club had only one representative of the larger class present, the Clapham Club in a very sportsmanlike spirit agreed to waive the right to run two large boats, so that the event was decided on the performances of three boats for each club. Owing to a false start the *Moraima II* did not get timed on her Club trip, and the effects of her previous mishap preventing her from re-running the course, the *Ruby* took her place, the other representatives of the Clapham Club being the *Florida* and the *Jessamine*. The *Belvedere*, the *Imp*, and the *Leda* did the runs for the Victoria Club, and the aggregate times of these three boats totalled up to 77½ seconds. The three Clapham boats totalled 112 seconds for the course, so that the Victoria Model Steamer Club were declared the first winners of the handsome Wembley Park Challenge Cup. The victory was mainly due to the superiority of their smaller boats, a fact which the Clapham Club will no doubt bear in mind for future events.

During the afternoon several fine models were given a run on the lake, great enthusiasm among the spectators being evoked by Mr. G. F. Young's imposing model *Fairholme*, a splendid representation of a liner of the Royal Mail Steam Packet Company. This model made several trips, and in spite of being without a rudder made a splendid course each time. A very pretty little model also running on the lake was the electric river launch *Lena*, belonging to Mr. A. A. Aldridge. This is an excellent piece of workmanship and very true to her prototype of the Upper Thames. Mr. Aldridge belongs to the South-Eastern District Post Office, and is trying to organise a model club among his fellow members of the postal service, so that we may look to see the *Lena* soon provided with some appropriate companions.

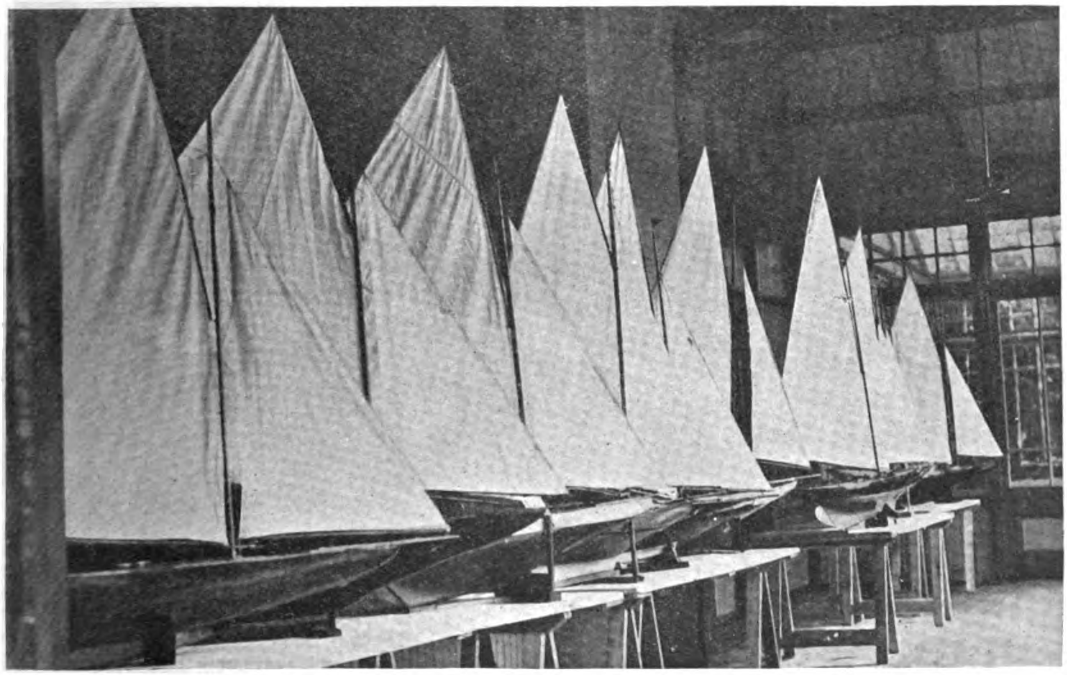


A Fine View of the "Moraima II's" Wash.

The exhibition of model boats in the Glass Pavilion was a distinct success, and attracted a large crowd throughout the evening. In addition to a number of private entries, there were three splendid collective club exhibits by the Clapham Steam and Sailing Club, the Victoria Model Steamer Club, and the Eastern Model Yacht Association. The latter association, formerly known as the

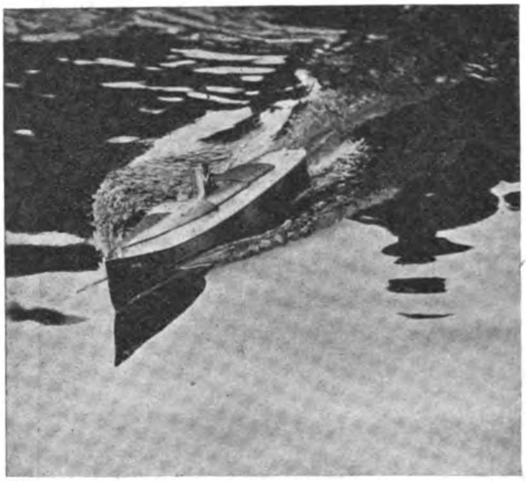


A Portion of the Clapham M.S. & S.C.'s Exhibit.



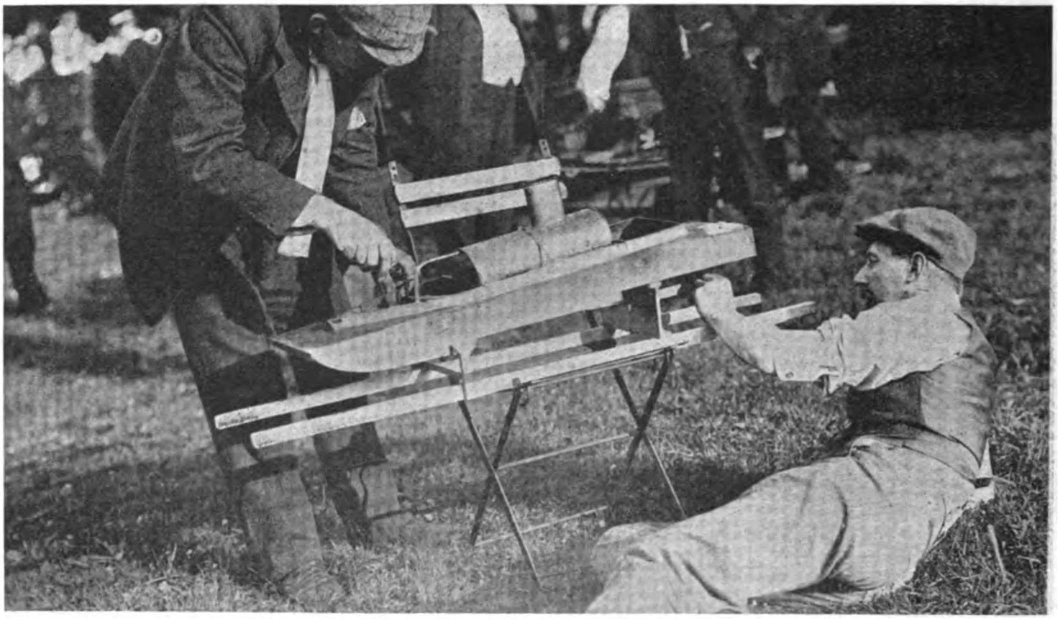
Some of the Eastern M.Y.A.'s 12-metre Models.

Alexandra Model Yacht Club, exhibited a group of fourteen beautiful 12 metre model saling yachts built to the rule of the European Yacht Racing



THE "LEDA" UNDER WAY.

Union, 1908. These models are to the scale of 1 in. = 1 ft., and are actual 1 metre yachts sailed



MR. DELVES-BROUGHTON AND MR. TEAGUE ADJUSTING THE "FOLLY."

without a crew. The displacement in tons = displacement in lbs × ·77

The special trophy offered for the best club exhibit was secured by the Clapham Club, but the Eastern Model Yacht Association were awarded an extra cup for their typical collection of sailing models.

The Clapham Club again scored on the individual prizes, for two of their members secured first and second places for the best exhibits in the power section. Mr. L. M. G. Ferreira was awarded the first prize for his beautifully built model steam launch *Irene*, and Mr. T. Whitmore took second prize for his pretty model launch *Stella*, in the very effective setting of a working model of a Thames river lock. In the sailing section the first prize was deservedly gained by Mr. James Norval, a member of the Leith Model Yacht Club, for his boat *Margaret*, a really superb example of model yacht building. Mr. Hodges, the owner of the *Elaine*, and a member of the Eastern Model Yacht Association, took the second prize The *Elaine* was designed by Mr. T. C. Glen Coats and built by Mr. Gaitch.

The concluding feature of the evening was the presentation of the prizes by Mr. Percival Marshall, A.I.Mech.E., in the Refreshment Pavilion. In the course of his remarks, Mr. Marshall proposed a very hearty vote of thanks to Mr. E. G. Graham, of Wembley Park, not only for his gift of the Challenge Cup, but for his other generous donations to the prize-list and for his unstinted efforts to make the whole event a big success. This was carried with acclamation and with musical honours. Mr. Graham suitably acknowledged the compliment and expressed his pleasure at seeing so many model boating enthusiasts at Wembley. He hoped they would all come again and that the next Regatta would be even more successful still. A vote of thanks to the Committee was also enthusiastically received, and Mr. W. H. Arkell, Mr. J. C. Crebbin, and Mr. G. F. Young made brief but excellent speeches on behalf of the prize-winners and the competing clubs. An extra cheer for Mr. David Scott and his boat the *Bon Accord* completed the proceedings.

We wish to add a note to express our personal appreciation of the willing services rendered by Mr. Graham and the various members of the Committee. The old saying that many hands make light work is never more true than in the conduct of an event of this kind, and it would have been impossible to have held THE MODEL ENGINEER Regatta without the splendid co-operation accorded us by the executive members of the various clubs represented. In one sense, of course, the clubs were antagonistic, for they were competitors, but this did not prevent them from loyally doing their best to promote the success of their meeting. They helped us immensely, and they met each other in the most friendly and sporting spirit. We hope the resulting intercourse of the members will do much to promote not only good fellowship amongst enthusiasts in a common sport, but also that knowledge of each other's work which is needed to enable each club to achieve still better things. While it is, perhaps, invidious to mention names, we would like to acknowledge in particular the services of Mr. L. M. G. Ferreira and Mr. Eustace Rose as time-keepers, Mr. G. F. Young and Mr. Poole as starters, Mr. H. G. Riddle in judging the exhibition, and Mr. Blaney, Mr. Pike, Mr. R. Martin Weaver, Mr. G. A. Smith, and Mr. T. Dysart for their assistance with the many working details.

Although no records were broken, and although mishaps and disappointments occurred, as is almost inevitable on such occasions, the whole event was voted a pronounced success. Much valuable experience has been gained, and there is no doubt that the next Regatta will, in itself at least, create a record.

THE REGATTA PRIZES. (WEMBLEY PARK CHALLENGE CUP IN CENTRE.)

The Portsmouth Model Yacht Club.

THIS Club held a race at the Canoe Lake, on Wednesday afternoon, July 15th, the boats being set going in a stiff breeze by Mr. Broughton. Among the entrants being Mr. Stubberfield, a member of the Highgate M.Y.C. and President of the Forest Gate M.Y.C., who is on a visit to Southsea. Some exceptionally good heats were run off, with very close finishes, the final scores being—out of a possible 36 points—Mr. Wilson's *Florence*, with 30 points; Mr. Coxen's *Saucy Sally*, 26 points; Mr. Cuthbert Payne's *Mascot*, 24 points; Mr. Tallack's *Sport*, 22 points; Mr. Morris's *Bluebell*, Mr. Stubberfield's *Foam*, and Mr. Bignall's *Lily* making 8 points each.

At a later meeting Mr. Hublützel acted as officer of the day. Mr. Coxen's *Saucy Sally* took first prize with 20 points, Mr. Bignell's *Lily* and Mr. Clive Wilson's *Florence* tieing for second place with 16 points each. In the final, Mr. Bignall's *Lily* beat the *Florence* sailing to wind. The other scores were: Mr. Stubberfield's *Foam* (Highgate Model Yacht Club) 6 points, and Mr. Cuthbert Payne's *Mascot* 2 points.

The Portsmouth M.Y.C. invite gentlemen from other model yacht clubs on a visit to Southsea to bring their models with them, and to join in their subscription races, which are held on Wednesday afternoons. The Club sails under the 10-rater rule.—CLIVE WILSON, Hon. Secretary P.M.Y.C.

The Society of Model Engineers.

[*Reports of meetings should be sent to the offices of* THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.*]

London.

FUTURE MEETINGS.—The next indoor meeting will be held at the Cripplegate Institute, on Wednesday, August 26th, and will be made a special locomotive night; prizes will be awarded to those models running most successfully. The following meeting is fixed for Friday, September 18th.—HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green, S.E.

Model Rolling-stock Notes.

By H. Greenly.

Private Open Wagons.

(*Continued from page* 61.)

CONTINUING the description of the various types of private wagons, it must not be forgotten that there are hundreds of trucks in use on our railways which are registered for smaller loads than 8 tons. I include a photograph of one of these (see Fig. 10), and also a drawing giving the leading dimensions. It will be noticed that in addition to the reduced capacity of body and shorter wheelbase, the buffers are of the dumb pattern, formed out of the main timbers of the under-frame. These dumb buffers are under sentence of death, and will shortly disappear, notice having some time ago been given to owners that all dumb-buffered wagons must be rebuilt with spring buffers. The approved designs of self-contained buffers which may be fitted on rebuilding are included in the R.C.H. specifications, and the accompanying photographs show two wagons which have been altered in this particular.

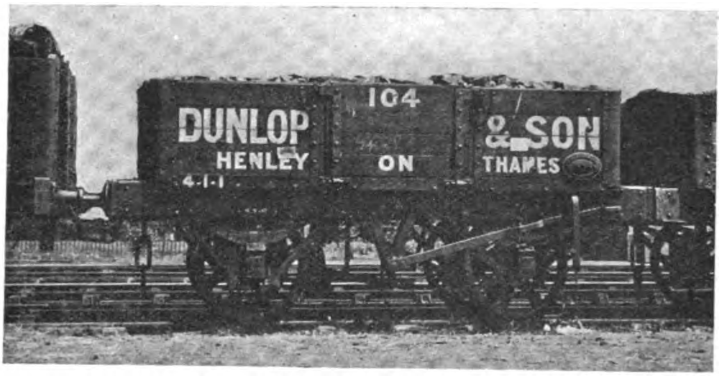


Fig. 10.—Dunlop 6-ton Wagon.

The uses of the dumb buffer for model purposes are, however, not to be despised. For small $1\frac{3}{4}$-in., 2-in., and $2\frac{1}{2}$-in. gauge model railways dumb-buffered wagons look extremely well and also minimise the buffer-locking trouble on sharp curves. For wagons on larger model railways (say, 6- to $10\frac{1}{2}$-in. gauge) I would also recommend dumb buffers where the trucks are likely to be roughly handled by the junior members of the house. In addition, on the tinier railways especially, the bump-bump-bump of a train of dumb-buffered wagons provides a very realistic effect.

As mentioned above, the dumb buffers are elongations of the side frame or solebars of the wagon,

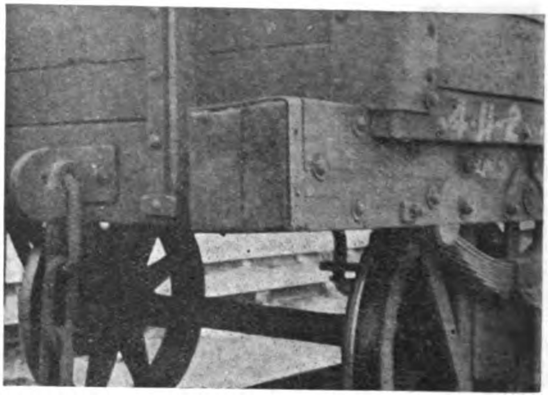


Fig. 11.—Dumb Buffer.
(*Note.—Joint of clump piece with solebar.*)

but as the simple extension of the solebars would not bring the buffer centres to the standard distance apart of 5 ft. 9 ins., they are therefore "clumped" with pieces of wood inside, making the faces about $11\frac{1}{2}$ ins. square and correcting the centres to the standard dimensions.

For a 2-in. gauge model of a dumb-buffered wagon the construction shown on the sketches (Fig. 14) should suffice. There is no need to make the truck with the elaborate under-frame used in the actual vehicles, as shown in the last article in the plan view of the standard 10-ton private wagon. A baseboard the size of the body, and strips of wood to form the headstocks and the solebars, are alone

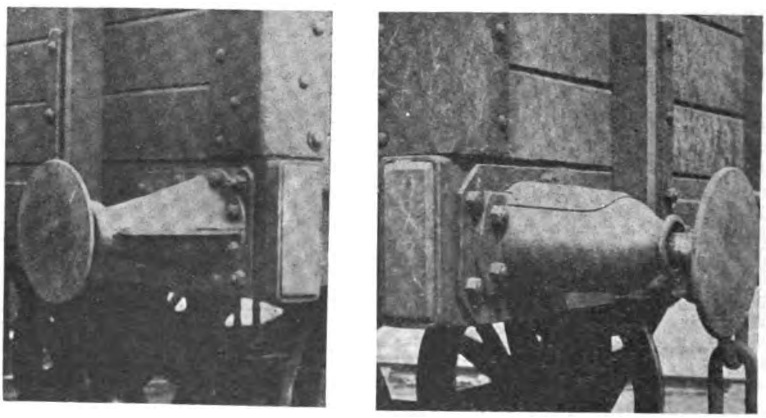


Fig. 12.—Specimens of Self-contained Buffers as fitted to Old Dumb-Buffer Wagons in compliance with new Regulations.

required. The baseboard should be planed flat and square, and marked out for the solebars. These should be secured in position by glue and small brads, or, what some consider really better, paint joints and small screws, holes being drilled before any brads or screws are driven into small friable pieces of wood. The headstocks can then be fastened on and the clump pieces of wood to form the buffer attached as shown. There is no need in a 2-in. gauge truck to place an iron band or ferrule on the end of the dumb buffers, as in the real trucks; a thick paint line may be made to serve the purpose, but in larger trucks ferrules can be made out of strip brass painted black or out of iron or steel.

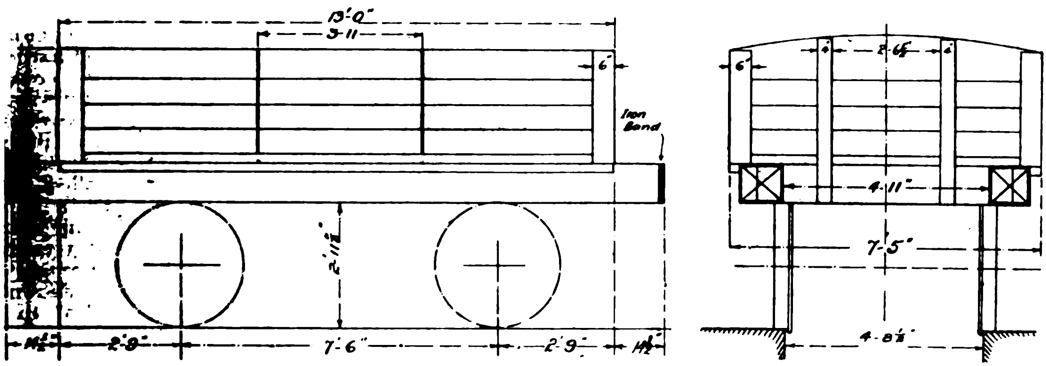


FIG. 13.—DIAGRAM OF OLD 6-TON PRIVATE OWNERS' OPEN WAGON, WITH DUMB BUFFERS.

FIG. 15.—BASALT WAGON.

The body may then be erected on this underframe and the end battens nailed on. Before the pieces of ⅛-in. wood forming the body are put together the builder should consider the question of how he will imitate the ironwork of the truck, *i.e.*, hinge straps, corner plates, etc. In a small model wagon the use of paint to represent these features is quite satisfactory in giving the required effect, and if this course be adopted care should be taken, in engraving on the surface of the wood any lines to represent the joints of the planking, to see that these lines stop short of the ironwork. This is necessary, otherwise the appearance of the finished model will be marred by indentations crossing such features as the corner-plates and other iron strappings.

With regard to the running gear, I do not suppose that other than the standard fittings obtainable will be used. If not the W-irons must be cut from the solid sheet. Gun-metal castings

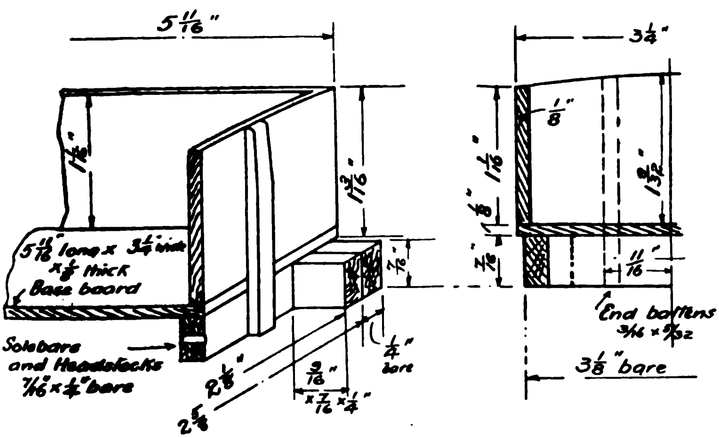


FIG. 14.—SKETCHES SHOWING CONSTRUCTION OF THE BODY FOR 2-IN. GAUGE DUMB-BUFFERED OPEN WAGON. (*Based on 6-ton Wagon, Fig. 10.*)

will not be found satisfactory, except in the larger models (3½-in. gauge and upwards). These fittings should be put on after the truck is painted, but may be tried on before and removed for the operation of painting the body the desired colour and for the painting of the fittings a dead black. Various methods of making axle-boxes, etc., will be dealt with later on.

In addition to the 6-ton open wagon, the accompanying photographs show a low-sided truck used for carrying material like basalt, which has considerable weight for the bulk. The sides of this vehicle are only 2 ft. 1 in. inside, and it is registered for a load of 10 tons. The flooring is 3 ins. thick, and the sides are made up—one 9 ins., one 7 ins., and one 9-in. board at the top. The width of the side door (there are no bottom or end doors) is 4 ft. 2 ins., and it will be noted that this side door extends right to the top.

(*To be continued.*)

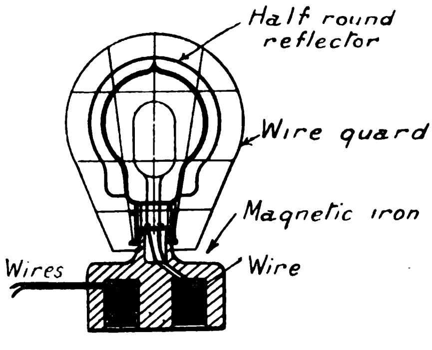
Workshop Notes and Notions.

[*Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked* "Workshop" *on the envelope.*]

Magnetic Holder for Electric Lamps.

By "Edwinstowe."

Sometime ago in your paper you gave some details of overhead tackle for electric light of various interesting designs. I now have the pleasure in



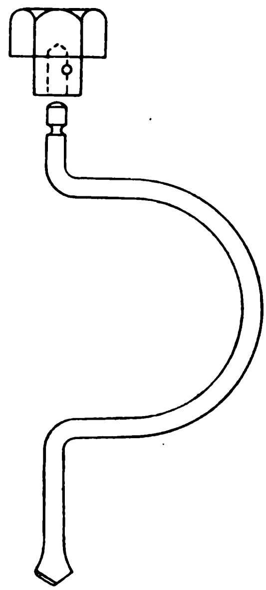
calling your attention to a form of lamp which is becoming largely used in many modern workshops. This type of lamp, as may be seen from sketch, is the ordinary one, with wires running round a core and forming a magnet. The lamp may be placed in any position where there is any metal, on machine tools at almost any place, and also may be placed on the work itself.

A Handy Tool.

By A. T. Smith.

Thinking that all model engineers (and, for that matter, other engineers, too) might be as pleased as I was to see this tool, I venture to describe it. Holes, after being drilled, have almost always to be countersunk; or else the burrs have to be taken off, and I think that this tool will save much time and trouble and will repay anyone for making.

The expenses will probably be *nil*, as the materials required are only: (1) a piece of 3-16ths-in. steel wire; (2) an old ½-in. set pin; (3) a wire nail. The piece of 3-16ths-in. steel wire is bent as shown, and the end flattened, ground, and hardened. The handle could be made in any way, but the one I saw was a short ½-in. set pin with the threads filed off. It was drilled up the shank with a 3-16ths-in. drill, and a small hole about 3-32nds in. drilled through the shank (as shown) at right-angles to the 3-16ths-in. hole. The bent wire has a small groove filed round it, and is slipped up the 3-16ths-in. hole until the groove comes opposite the 3-32nds-in. hole. Then a nail or other bit of iron is pushed in and riveted each end. This allows the wire to turn round freely, but the handle cannot come off.

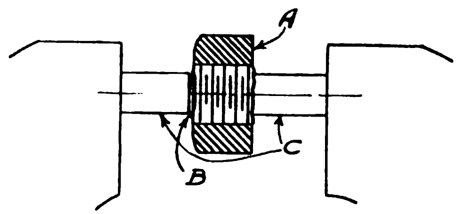


The tool occupies very little room, and is quick to use, when it is not worth fastening another drill in the chuck.

Removing Nut from Broken Stud.

By W. Muncaster.

A nut may be removed from a portion of a stud, broken off short, by placing two pieces of round iron against the stud, one at each end, the whole to be gripped in a vice and the nut removed with



a spanner. The accompanying sketch will make the matter clear. The nut A is a tight fit on the stud B and cannot be removed without the use of a spanner. The two pieces of packing C, which must be of small enough diameter to allow the nut to pass over them, are held, one against each end of the stud, in the jaws of a vice. One of the pieces C being made long enough to allow the nut to clear the stud, the nut can be screwed off in that direction with a spanner.

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

The Western of France Pacific Locomotive.

Referring to the illustrated description of this locomotive, which appeared on page 603 of The Model Engineer for June 25th, a correspondent writes:—"I am very much interested in this design, and, apparently complicated though it is, I am contemplating building a scale model of it, if I can obtain access to the necessary drawings. It is not stated in the description on page 603 whether the four piston valves are actuated by two sets of valve gear or whether each valve has its own separate set, and I should very much like to know which arrangement has been adopted. Also would you please give the working pressure of the boiler and say whether the tubes it contains are of the Serve pattern or of plain bore?"

When writing the brief description of the engine which appeared in the issue above mentioned—and, by the way, it may be remarked that The Model Engineer was a long way ahead of the other London technical journals in publishing an illustration and dimensions of this interesting locomotive development—the writer had only a photograph and a dimensioned sketch (reproduced on page 605 of the same issue) to go upon, so that it was then impossible to state the precise arrangement of the valve gears. Since that time, however, he has been enabled, by M. Sabouret's courtesy, to make a close examination of the locomotive in all its details, and, in reply to the correspondent, would say that the valve gears of the inside high-pressure cylinders are dependent for their initial movement upon the return cranks of the outside low-pressure gears, but beyond that they are independent of the outside mechanism. The writer brought away with him a complete set of drawings of the engine, and some of these will be found reproduced in this issue. The correspondent will thus gather that if he decides to go on with his idea of constructing a model of the engine he will be setting himself a somewhat severe task, unless, of course, he is prepared to sacrifice a large proportion of the detail work and confine himself to reproducing something which, in outward appearance only, shall resemble the prototype. The writer has no wish to say anything in discouragement of the attempt to model the engine, and, indeed, will be glad to lend, for a reasonable period, the drawings in their entirety to the model engineer who has written upon the subject.

The tubes are of the Serve pattern, and the working pressure carried by the boiler is 227 lbs. per sq. in.

Another Correspondent sends a Query.

Another correspondent writes saying: "I thought I read in these Notes some time ago that the practice of 'banking' trains by means of engines pushing at the rear was to be discontinued, as the outcome of the accident which occurred somewhere on the L. & N.W. Railway, and which arose out of this practice. Being under this impression, I was surprised to witness, when at St. Pancras the other day, the 'banking' by the tank engine which had brought it into the terminus from the sheds of one of the most important Midland expresses, which accordingly made a very good start."

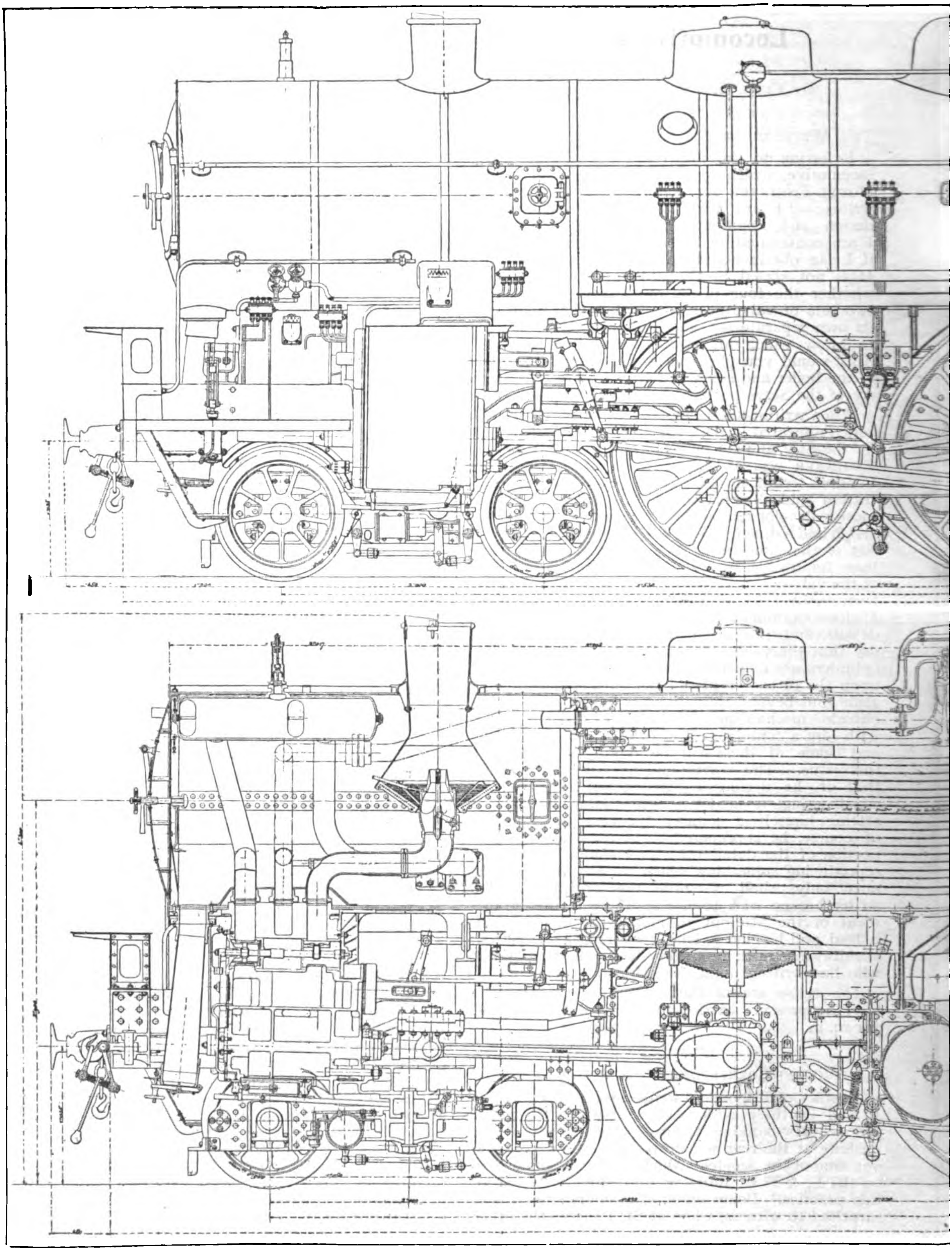
If this correspondent will refer again to the account of the accident on the L. & N.W.R., at Chequerbent incline (see page 570 of The Model Engineer, June 11, 1908) he will find that what is there stated is that in his report to the Board of Trade, the Inspector, Colonel Yorke, *recommended* that the practice of assisting trains up inclines by means of unattached pushing engines at the rear should be discontinued, and that where such assistance was compulsory, the banking engine should be connected up to the train so that the danger of over-running might be obviated. No Board of Trade order to that effect has yet been issued, however, so that railway companies are at liberty to continue the practice if they desire to do so. The Midland have for some time been in the habit of utilising the locomotive which has brought the empty train into St. Pancras station for the purpose of assisting the train engine in getting away with its load, just as for years the L. & N.W. Railway had all its heaviest trains banked up the Camden incline.

The engine leaves St. Pancras on an up grade, and when starting either from Nos. 1 or 2 platforms, has to traverse curves immediately afterwards, and, as rapid acceleration is such an important matter now-a-days, the assistance rendered by the pusher engine at the rear can hardly be over-estimated in value.

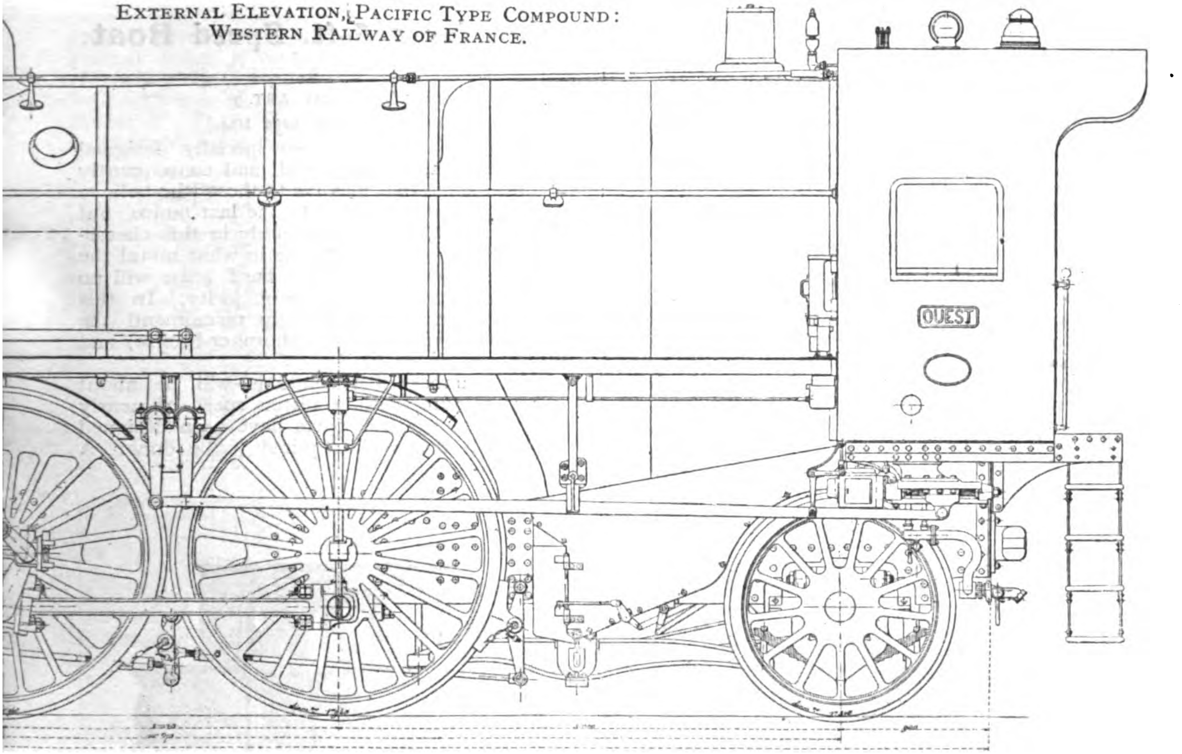
New Great Western Railway Express Locomotives.

Those who may have been thinking that the Great Western Railway would not build any more 4—4—0 type locomotives for use in express passenger service will perhaps be surprised at the appearance of a new series of such engines now being sent out from Swindon Works. The design resembles in all important respects that of the "Atbara" class, but the copper-topped parallel chimney is again reverted to in place of the taper chimney of cast iron. The new engines rejoice in the names of some of the most beautiful flowers; indeed, as a series they will be known as the "Flower" class. Travellers on the G.W.R. having a special interest in floral matters will in future be able to make their journey in company with "Carnation," or it may fall to their lot to have either "Primrose" or "Mignonette" at the head of the train. True, such names have no connection whatever with locomotive engineering, but, for the matter of that, neither have half the names which are applied to the engines on the lines which still retain this ancient custom—a relic of the stage coach era—when numbers are just as effective and far more practical.

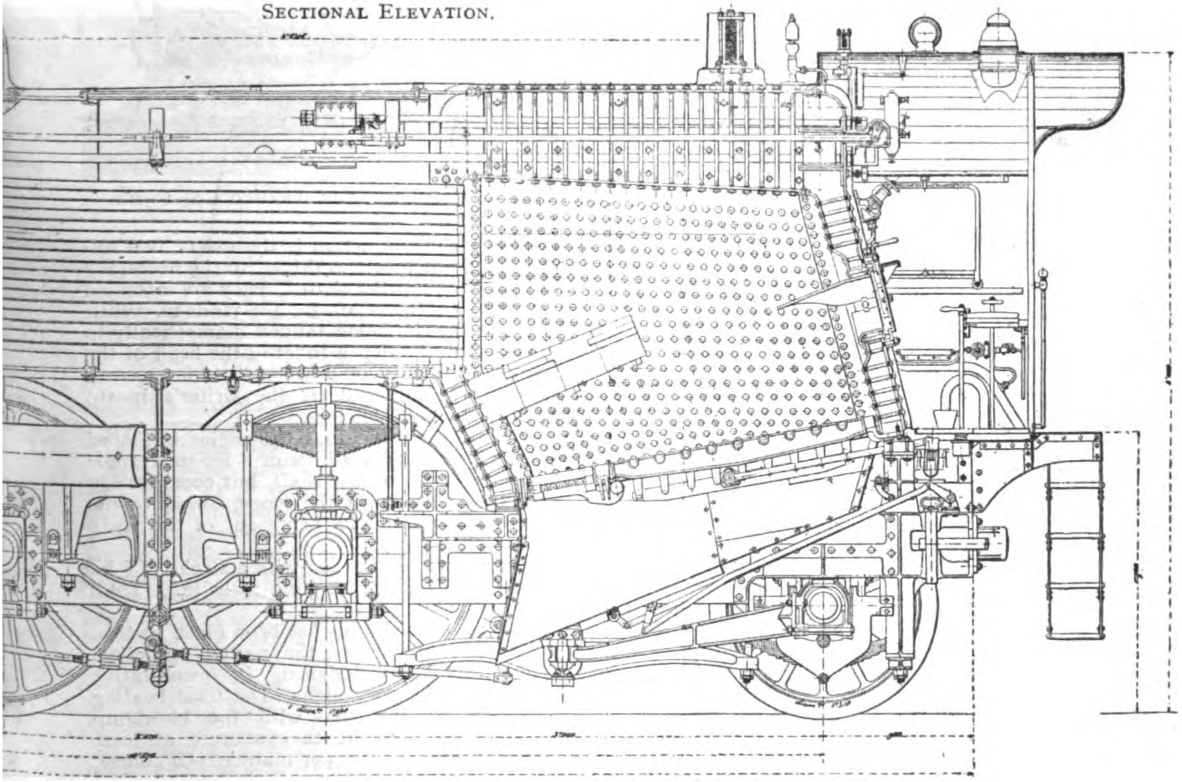
The "Flower" engines of the G.W.R. have inside cylinders 18 ins. diameter by 26-in. stroke, driving coupled wheels 6 ft. 8½ ins. diameter. The bogie wheels measure 3 ft. 8 ins. on tread. The boiler barrel is 11 ft. long, and contains 289 tubes. The total heating surface is 1517·90 sq. ft.; working pressure, 195 lbs., and grate area, 20·35 sq. ft. The maximum tractive effort developed by the engine is 18,365 lbs.



EXTERNAL ELEVATION, PACIFIC TYPE COMPOUND: WESTERN RAILWAY OF FRANCE.

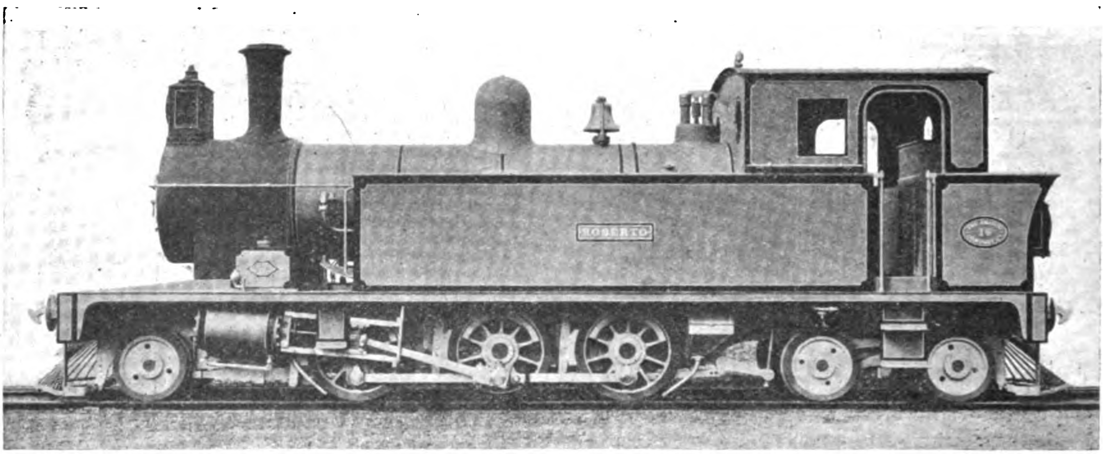


SECTIONAL ELEVATION.



A British Built Tank Locomotive for Use in Chili.

The tank locomotive herewith illustrated is one of several built by Messrs. Robert Stephenson and Co., Ltd., for the Arauco Company, an industrial concern operating in Chili. The type is 2—6—4, with outside cylinders, and the design is regarded as a special one by builders and users alike. The leading end is carried upon a two-wheeled truck, having allowance made for side movement, and the trailing end by a four-wheeled bogie. The spring gear is compensated on the American system, the bearings of the compensating beams being on hardened steel knife edges. The locomotive is fitted with a steel firebox, and the tubes are of the same material. The cylinders are set in an inclined position, and drive the middle pair of coupled wheels; the valve gear, which is of the Stephenson type, is placed inside the frames. A capacious cab is provided, and the design all-round represents in its principal features British ideas in locomotive construction.



Special Type of Tank Engine built by Robert Stephenson & Co., Ltd., for Arauco Co., Chili.

The leading dimensions are as follows :—

- Gauge of railway, 5 ft. 6 ins.
- Cylinders, 15 ins. diameter by 22 ins. stroke.
- Coupled wheels, 3 ft. 6 ins. diameter.
- Fixed wheelbase, 9 ft.
- Bogie wheels, 2 ft. 6 ins. diameter.
- Total wheelbase, 27 ft.
- Heating surface: Tubes, 770 sq. ft.; firebox, 86 sq. ft.; total, 856 sq. ft.
- Grate area, 17·5 sq. ft.

We hear that the Great Eastern Railway Company has fitted the turbine steamer *Copenhagen*, and the twin-screw steamer *Dresden*, with wireless telegraphy apparatus, enabling the public to send telegrams from on board these vessels. The other steamers on the Hook of Holland service are also being fitted with wireless apparatus.

Design for a 5-ft. Speed Boat.

By Thos. Dysart.

(*Continued from page 104.*)

The Engine.—This has been specially designed for hard work at a high speed, and consequently may appear somewhat massive to those who believe in cutting everything down to the last ounce, but the writer does not believe entirely in this cheese-paring policy. It may be made in what metal the builder likes best, but a fairly hard brass will no doubt commend itself to the majority. In this case, the writer would strongly recommend the valve and piston to be of phosphor-bronze, and also the eccentric strap.

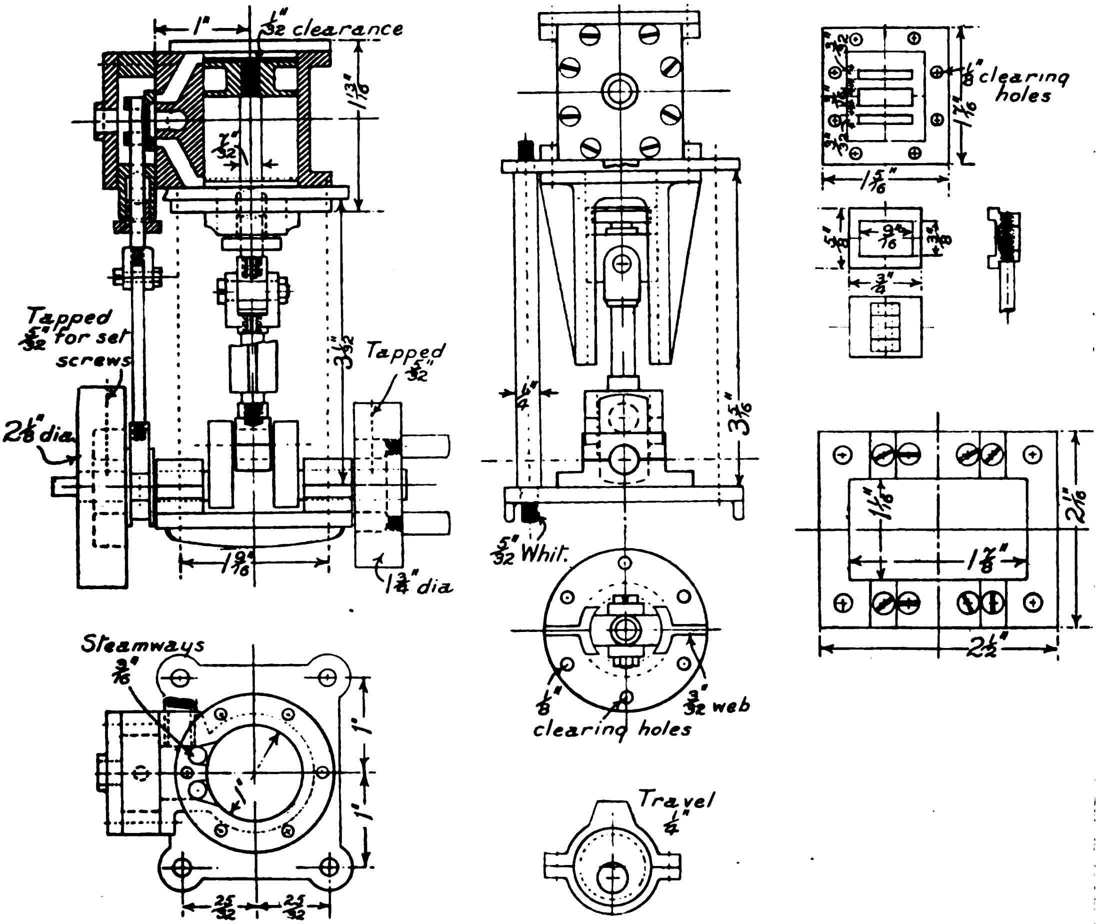
As the number of revolutions will be about 2,000 per minute, with a piston speed of nearly 300 ft. per minute, the ports have been designed to cope with the work required to be done. A notable feature of the design is the use of two flywheels, one of which acts as driver, to the necessary coupling on the propeller shaft. They are intended to be secured to the shaft by a 5-32nds-in. Whitworth screw, the rim being tapped diametrically to correspond, and of a depth to let in the head of the screw flush. "Plenty of flywheel," so far as can be consistently employed, is the writer's motto for small high-speed engines.

It will also be noticed that the engine is placed forward. This not only allows of a lessened angle in the rake of the propeller shaft, but considerably enhances the efficiency of the screw, owing to the deeper submersion, and its being out of the wake of the body of the boat.

The bore of cylinder is 1 in., with a stroke of ⅞ in. Steam ports are 3-32nds in. by 9-16ths in. Total height, 5 ⅞ ins.

The Boiler.—Special study has been given to this, and it is the outcome of the writer's practical experience. Made as designed, its evaporative efficiency should be very high. The total heating surface is 245 sq. ins., and with the blowlamp shown herewith it ought to evaporate at least 9 to 10 cubic ins. of water per minute. Of course, good workmanship is necessary, but otherwise the general design is fairly easy to make. The ends of both boiler and steam drum are castings, preferably in gun-metal, and can readily be turned in the lathe. The boiler shell is 4 ins. outside diameter, solid-drawn *brass* tube, 18 gauge; this gauge and size being procurable in that metal. The furnace is 3 ins. outside diameter solid-drawn *copper* tube, 18 gauge, and the water-tubes (45 in all) are ⅜ in. outside diameter solid-drawn *copper* tube, 20 gauge. It is particularly requested that the water-tubes be spaced exactly as shown in the drawings, as it is important that the flame from the lamp is utilised to the best advantage without choking its passage through to the smokebox. Of course, the water-tubes must be either brazed or silver-soldered into the furnace, and if the intending builder has not had much experience in this direction he would be well advised to get the job done professionally, as upon the soundness of these joints the general success of this type of boiler mainly depends.

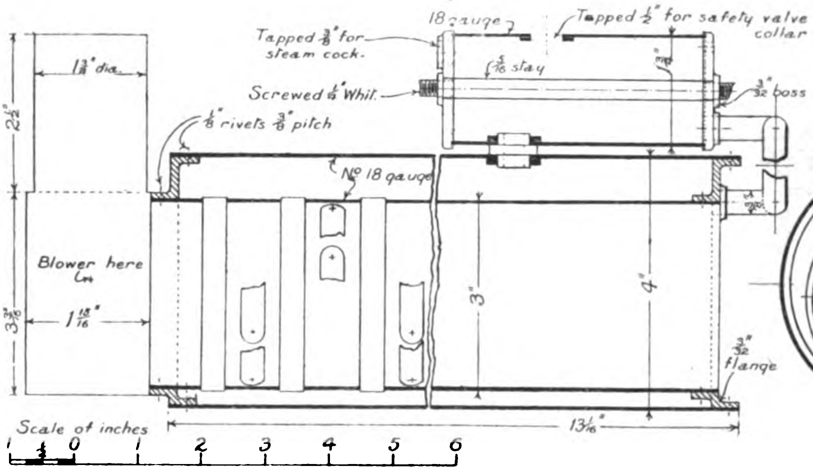
It will be seen from the drawings that the steam drum, which is 4 ins. long by 1¾ ins. outside diameter, and of 18 gauge solid-drawn *brass* tube is connected to the boiler by two couplings. That farthest from the after end of the boiler is simply a piece of ⅜-in. hexagon brass rod, reduced and screwed where it enters both boiler and steam drum to ½ in. (brass thread), strengthening pieces having already been sweated and tapped inside boiler and steam drum to receive it. A 5-16ths in. diameter bore passes right through this coupling, and so completes the connection. When erecting, after having screwed the coupling into the boiler, it is then very easy to screw the steam drum on. The after coupling calls for no special attention, beyond the fact that it is essential that the pipe, which is ⅜ in. outside diameter solid-drawn copper, 20 gauge, be bent as shown, and, owing to the restricted length, it may be found necessary to make a special union.



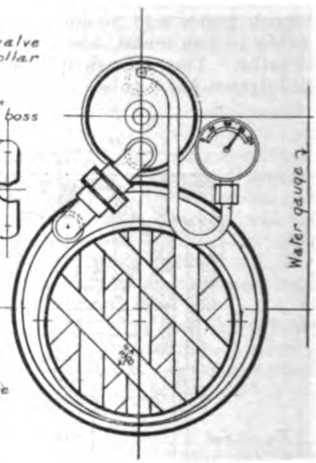
Plan and Elevation, with Details, of Engine for 5-ft. Speed Boat. (*Scale: Half size.*)

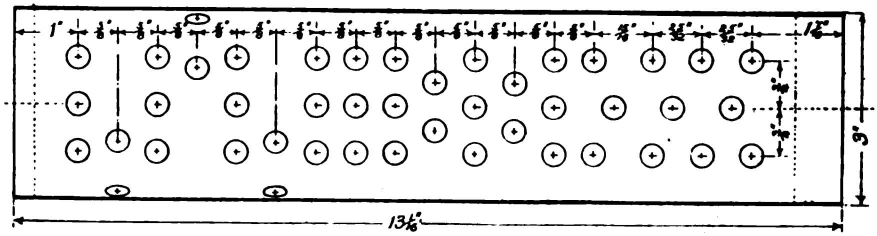
With this type of boiler it is essential that some sort of automatic feed-pump be used, although the boiler as designed has enough capacity to compete in The Model Engineer competition with one charge of water, amply sufficient for the full distance of 300 yards. For ordinary cruising purposes, however, a good pump is advisable, and, as there

Longitudinal Section.

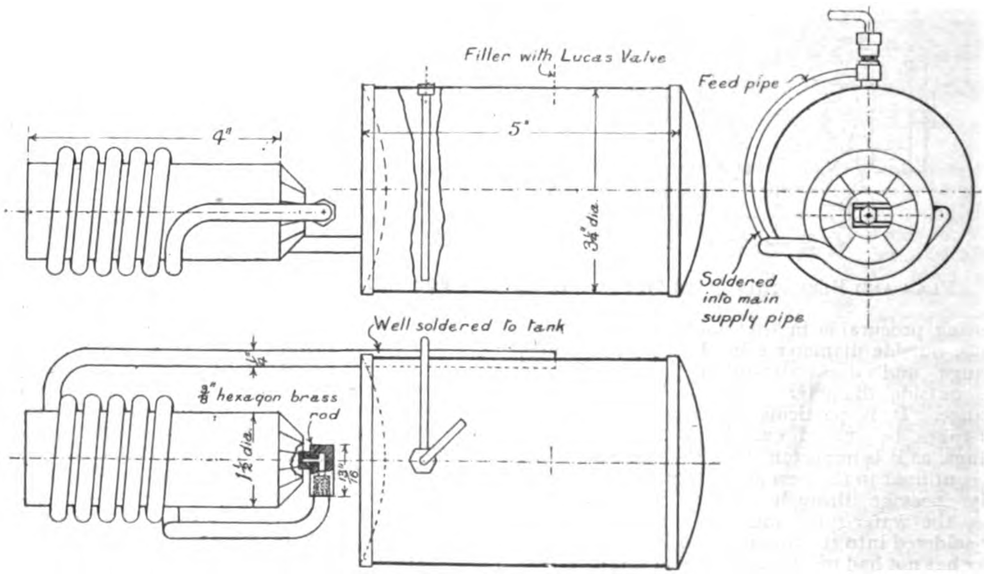


End Elevation.





Setting-out of Water Tubes.



Benzoline Lamp for Boiler.

DETAILS OF BOILER FOR 5-FT. SPEED BOAT. (*Scale: One-third full size.*)

are many really good cheap force-pumps on the market, the writer has not deemed it necessary to design one specially. However, to aid the builder to meet his requirements, the following data are given: estimated evaporative capacity of boiler, 10 cubic ins. of water per minute at 90 lbs. pressure. As the speed of the engine will be about 2,000 r.p.m., it will be necessary to gear down, say 3 to 1, and to this end the writer has shouldered the engine-shaft down to 3-16ths in. diameter at the forward end, so as to enable a small gear wheel to be attached. With nice fitting a good pump can be placed in the boat forward of the engine, as intended. Assuming then that 10 cubic ins. of water be evaporated per minute, it will be found that a pump ¼-in. bore by ½-in. stroke at 700 strokes per minute, and reckoning an efficiency at this speed of 70 per cent., will just meet the demand. However, as the pump should be an easy master of the boiler, it may, perhaps, be found necessary to increase slightly either the bore or stroke. It is advisable that a by-pass be fixed on the delivery pipe between the pump and check-valve on boiler.

The safety-valve (and filler), screwed ⅜ in. for the collar tapped to receive it, should be ¼-in. bore, and set to blow off at, say, 100 lbs. The boiler will easily stand this pressure, an ample factor of safety having been allowed. The steam gauge should register up to 120 lbs. The steam cock should be large enough to take ¼-in. outside diameter solid-drawn copper pipe, 22 gauge, and, as there is a fair length of the latter exposed, it should be well covered with some asbestos lagging and a couple of coils led down through a slot in the funnel into the smokebox, to act as a superheater before it connects up to the engine. A blower will be found necessary. A neat little steam cock, tapped to take ⅛ in., outside diameter copper pipe, can be readily attached to the steam drum, and then led into the smokebox. The nipple can be made from a piece of ¼-in. hexagon brass rod, tapped to take the ⅛-in. pipe, and a small hole, say about 60 gauge, will be quite large enough. The best position for the nipple can only be found after a trial, but about the centre of the furnace tube will be approximately right.

Lamp.—This is intended for burning benzoline, and from the drawings it will be seen that it is powerful enough for the work required of it. Working to the design, it should throw a thick, "fat," flame quite 10 to 12 ins. long. It is important, however, that the lamp must be worked gently until steam is up, and the blower in use, otherwise there will be a liability of its "flashing back."

As regards the construction, the tank, which is 5 ins. long by 3¼ ins. diameter, is intended to be of four-cross tinplate with lap seams, all well sweated. For a few pence a tinsmith will readily make one. The ends are to be dished, as shown, to withstand the pressure.

The vaporiser is composed of ¼-in. outside diameter solid-drawn copper tube, 20 gauge, well annealed before bending. After bending, the main supply end—that leading back to the tank—should be turned over and thoroughly closed with the hammer and afterwards soldered, thus making a certainty of its tightness. That portion of the vaporiser, as seen from the drawing, is then well soldered on to the body of the tank, as shown, a fairly good supply of solder being suggested. At the distance indicated, it is then drilled to take the ¼-in. diameter feed pipe. A little soft solder judiciously applied will complete the juncture. The pin-valve to regulate the supply of benzoline calls for no special comment.

This style of construction is perfectly safe, provided, of course, that no attempt is made to start the lamp by heating it bodily over a fire. It is an exact replica on a larger scale of the one the writer uses in his "metre" boat, with splendid results.

The nipple end of the vaporiser is screwed ¼-in. brass thread, and takes a piece of ⅜-in. hexagon brass rod, 13-16ths-in. long, tapped to correspond. This latter is tapped ¼ in. to a depth of 5-16ths in., and then drilled 3-32nds in. for a further distance of ⅜ in., and at ¼ in. from the solid end it is tapped 5-32nds in. to take the nipple, which is made from a piece of ¼-in. hexagon brass rod. The nipple, 5-16ths in. long, is drilled 1-16th in. from the threaded end to a depth of ¼ in., and then a very fine drill (about 80 gauge) is run through the remaining distance. The writer uses fine sewing needles for this latter purpose, and finds they serve admirably after being ground half-way through.

The size of this central hole, however, can only be found by trial, but a satisfactory result should be obtained after the expenditure of about a pint of benzoline. It is important that this hole should be slightly coned from the outer end, so as to "shed" the flame, and thus keep the coil hot.

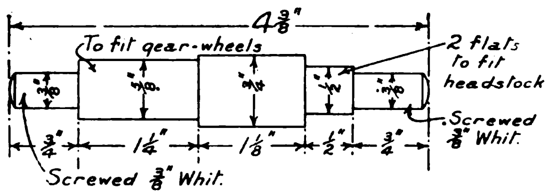
The burner tube is simply a piece of light tinplate cut to the indicated size and then rolled into a cylinder, sufficient allowance being made diametrically for a lap of, say, one-third the circumference. The tube is then gradually twisted spirally into and down the coil. By this method a good tight-fitting burner tube can be got. Before putting the tube into position, however, it will be necessary to take the shears and nick it radially, say ten times, about ½ in. deep. This is to turn down and form the cone, after the best diameter of the aperture for air space has been found by trial, but about ¾-in. bore at this end will be somewhere near the mark.

(*To be continued.*)

To Reduce Lathe Traverse.

By G. Stebbing.

The usual traverse on Drummond lathe (3½-in.) is 110 per in. This is too coarse for some work. The following method reduces feed to 165 per in., and can be done by turning a ⅞ in. diameter 4⅜ ins. long piece of mild steel to following dimensions:



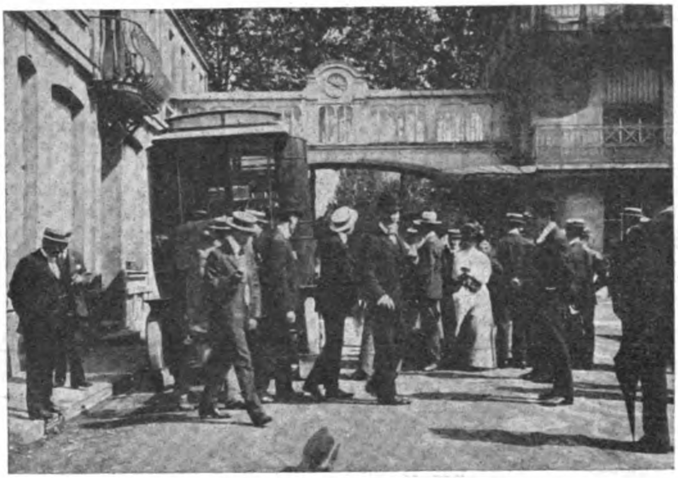
On the ⅝ in. diameter put inside 45-tooth, then 30; gear down same as chart; then cut 165. When working on work in chuck with centre out of mandrel, insert a small cork to fit hole. This keeps all dirt out and is better than a piece of rag.

With the Junior Engineers in France.

By "ATLAS."

(*Continued from page* 92.)

THE next works on the programme for a visit was the *Usine* of the famous De Dion Bouton Motor Company. This took place after lunch, and necessitated a run, per motor of course, through Paris down to the riverside at Puteaux, where the works are situated.



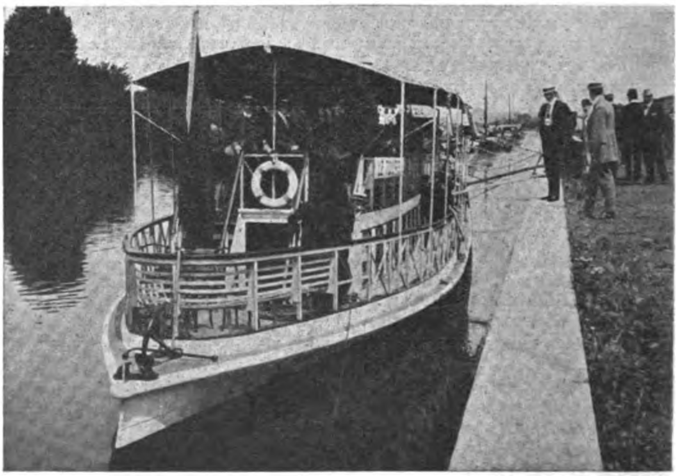
ARRIVAL AT THE DE DION BOUTON MOTOR WORKS.

Here we saw the modern motor-car as it is made in France, and very well made too, for a factory which can keep nearly 3,000 men at work can claim to have earned a reputation for its wares. The power plant alone of this huge works is quite an interesting study, containing as it does some seven gas engines, aggregating 350 h.-p. These are supplied from a producer plant, and are used to drive electric generators from which current for power purposes is distributed through the works. The fine plant of automatic machine tools, the erecting shop, the testing department, the tempering ovens, the sand blast apparatus for cleaning castings, and the manufacture of sparking plugs, were all investigated with considerable interest by our party, and much to be admired was observed. The experimental mechanical and chemical laboratory where the various tests are made is a distinguishing feature of this establishment, but alas! it was not for English eyes, and was *interdit.*

The Monday evening found us with still another visit on our list, but of an even more agreeable kind, its purpose being to make the acquaintance of our professional colleagues of the Institution of Civil Engineers of France. Who could resist such a reception and such hospitality as our hosts extended under the roof of their imposing building in the Rue Blanche? Here the President, Monsieur E. Reumaux, surrounded by his Council, bade us welcome in the most charming of speeches, and the senior engineers of France fraternised with the junior engineers of England as though they were friends of years and not of hours. The handsome meeting rooms were thrown open for inspection, the hosts spoke their best English, the Juniors their best French, and the healths of both Institutions and both countries were pledged and pledged again. Thus were the Junior Engineers welcomed with open arms by their colleagues of *La France.*

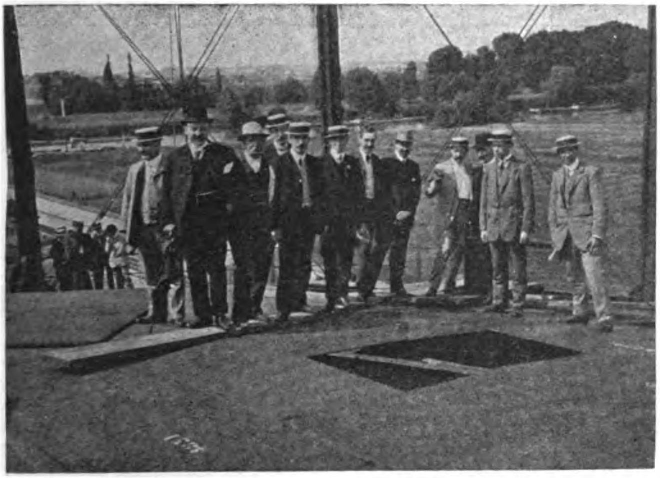
The Institution awoke on the following day to find itself just one year older, for Tuesday, the 30th of June, was Foundation Day, a day which every Junior marks in his diary with extra special red ink. It was appropriate that on such a day some Juniors' work should be inspected, and the happy opportunity was not far to seek. Indeed, it was already scheduled in the programme in the form of a visit to the gas works at Nanterre, where Messrs. Samuel Cutler & Sons, of Millwall have a large gasholder in course of construction, and Mr. Samuel Cutler, jun., has quite recently occupied the proud position of Chairman of the Institution.

It was still very hot, and nothing could have been more appreciated than the kindly thought of Messrs. Cutler in engaging the steamer *Le Touriste* to convey the party to the works. So in the cool shade of the upper deck awning the Juniors enjoyed the scenic beauties of Auteuil, Passy, St. Cloud, Suresnes—and the labels of the lemonade bottles! They had almost forgotten that such things as gas works existed, until some pieces of blue paper were gently inserted in their hands by their ever-attentive secretary. These were blue-prints of the holder they were about to see, and scenic beauty and other things were forthwith completely forgotten



"LE TOURISTE" AT NANTERRE.

what time the Juniors discussed lifts, capacities, weights, water-seals, plating, riveting, and the other many details of gas-holder construction. A brief reception by the resident engineer, a *vin d'honneur*,



On Top of the Nanterre Gas-holder—

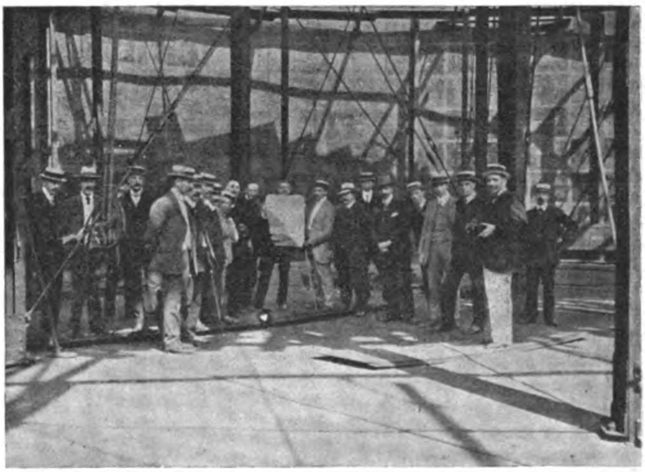
and then the inspection commenced. It was not completed until several of the more energetic of the party had climbed to the topmost plates of the partly-finished holder and been snapshotted on the spot by Mr. W. J. Bassett-Lowke, and by Messieurs Paul and Albert Canet, the two sons of our esteemed President, M. Gustave Canet, who was unfortunately too ill to be able to take part in any of our visits. But what father could wish to be better represented? What Junior could wish for better comrades? M. Paul and M. Albert Canet had won all hearts among the Juniors inside twenty-four hours, and were voted "out and outers." By the way, M. Paul Canet smokes a pipe. Mons. the Director of the gas works knew that Englishmen smoked pipes, and, in his innocence, ventured to compliment M. Paul Canet on speaking such excellent French. M. Canet smiled—and went on smoking his pipe.

The gas holder having been duly approved as a right good British job, built with British steel by British men, the party retraced their steps to *Le Touriste*, and journeyed back to Paris. The boardship hospitality of Messrs. Cutler at teatime was another example of the thoroughness with which the British engineer carries out his contracts, and the Juniors chortled in their joy, in spite of the heat. For it was hot!

The *pièce de résistance* of the week, however, was a trip to Creusot to visit the famous works of Messrs. Schneider et Cie., a visit which possessed a double interest for us by reason of the notable character of the establishment and the fact that our president, M. Gustave Canet, was for a number of years the director of the Artillery Section of the works. Creusot, or Le Creusot as it is properly written, is a long railway journey from Paris, taking nearly eight hours from station to station. The natural law which causes most things to expand by heat was probably answerable for the impression that the eight hours had expanded to eighteen owing to the hot weather; but in a more or less melted condition we at length arrived, the break of half-an-hour at Dijon for dinner having done much to keep us alive. Dinner at the Dijon Buffet is a thing to be remembered. Excellent cooking, a delightful menu, and service like clockwork are not found every day at a railway restaurant. Note, then, for future use, the Dijon Buffet.

At Creusot we found every essential to a perfect visit. Charming hosts, proud of their works and anxious for us to see every part of it we wished, and absolutely perfect arrangements for our inspection. English-speaking guides, carriages to drive us from point to point in the vast industrial domain, and something of special interest to see in every department. In the rolling mills we saw everything the mill produces from heavy armour plates down to girders, bars, and angles, and even to thin iron sheets of the thickness of a visiting card. We saw ingots and castings poured from the steel furnaces, great forgings squeezed and moulded into shape in the huge hydraulic presses, and railway tyres rolled from massive discs as easily as one might shape them out in clay.

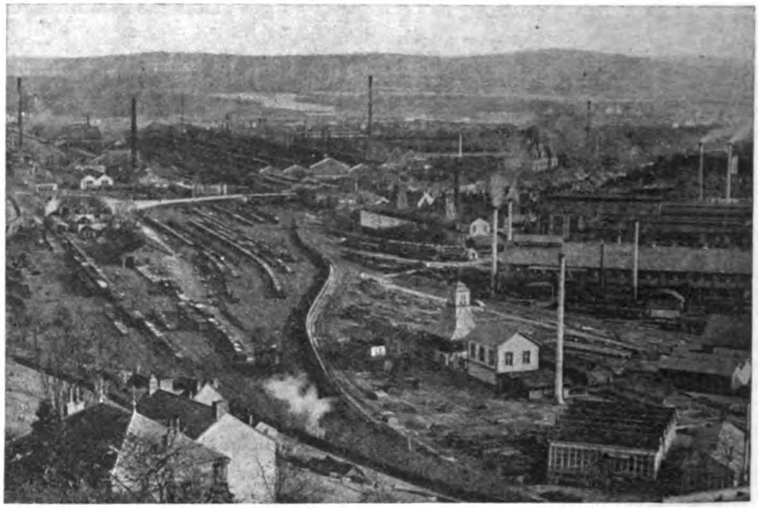
A sight which will live in the memory of those who were fortunate enough to be with our party was the tempering of a long marine turbine propeller shaft. Imagine a narrow pit some 50 ft. in depth, with a door right down one of the sides giving access to a furnace. At a given signal this enormous door swings slowly open, and hanging vertically from a powerful crane above, a giant shaft emerges from the furnace flames. Red-hot from end to end throughout its 40 ft., this monster sheds its rays around, becoming more ruddy than before as the closing of the furnace



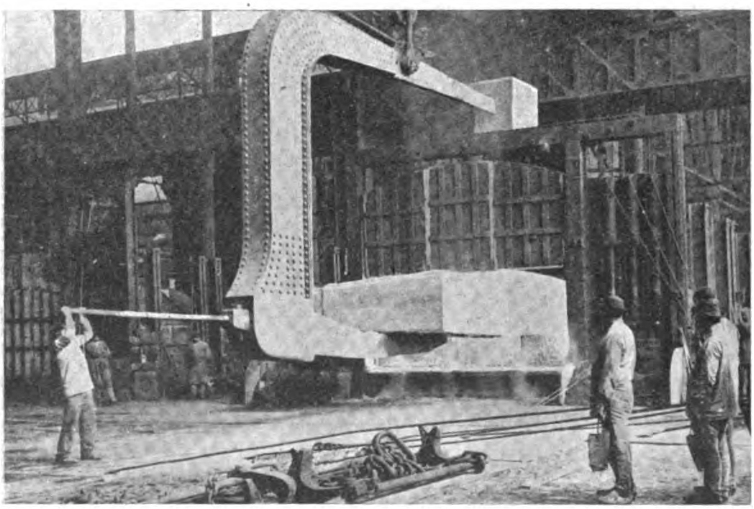
—and Inside.

door enthrones it in the shadows of the pit. Its fiery triumph is short-lived, for captive in the clutches of the crane it is slowly but surely lowered into watery depths below and quenched to a state of cold impassive calm. It does not yield without a struggle; it gurgles in its hollow bore, it spits and steams, and sighs and gasps; till at last the battle of the elements is fought and won, and the water closes over the giant's head in a quiet wave of victory. Such is the tempering of a propeller shaft, a sight which as a spectacle cannot easily be surpassed in any other engineering operation, and we Juniors were privileged to see it at its best.

But Creusot had many other things to show its visitors. Great guns in the making, and great guns complete. Field guns, mountain guns, and munitions of war of every type and calibre made in a way which could only be admired. Steam engines, gas engines, pumps, and turbines in profusion made us marvel at the varied products of this hive of industry, a wonder which only grew the more when boiler shops, locomotive shops, foundries, Bessemer converters, and blast furnaces added interest after interest to our tour. And the spirit of it all! Everybody working quietly and well, the men as interested in their work as the chiefs, the chiefs as loyal to the firm as to their engineering pride. Creusot is truly a *patrie* to its inhabitants, who love it as much as they love the larger *patrie* which dominates every Frenchman's heart.



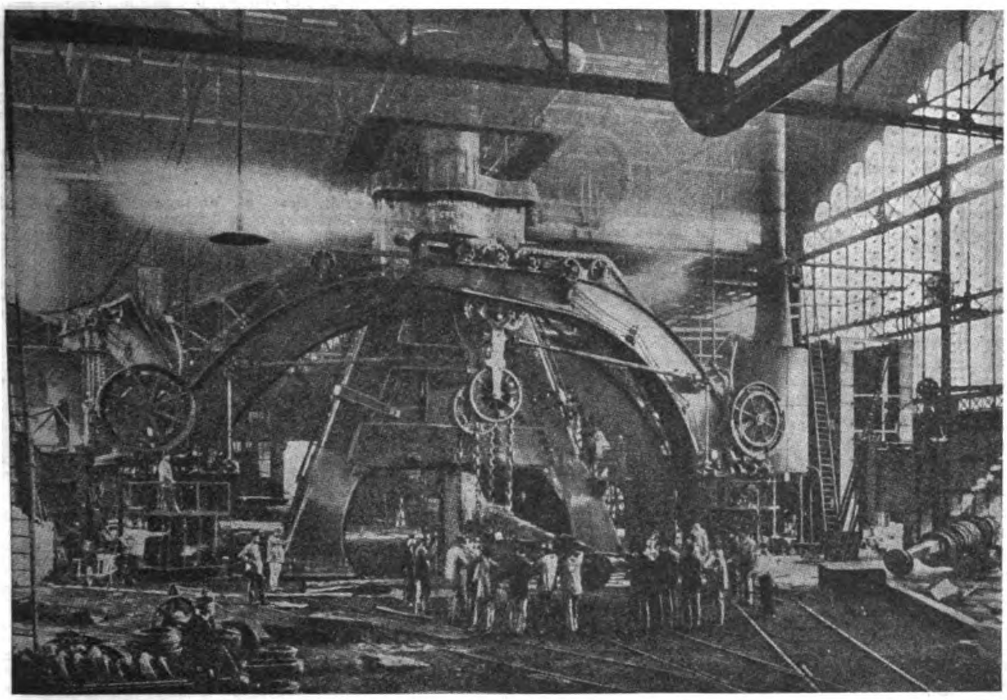
A General View of Creusot.



A 50-ton Steel Ingot leaving the Furnace.

Naturally, such a gigantic works has a history, and the history of Creusot so far as concerns its association with the Schneider family dates back to 1836. Long before this, however, Creusot had been a notable iron-working centre, for in 1785 an English engineer, William Wilkinson by name, had established coal pits and blast furnaces. M. Eugéne Schneider it was, who with his brother, Adolphe Schneider, laid the fortunes of the present house, and the son of the former, M. Henri Schneider, continued the family traditions until his death in 1898, when in turn his son, the second M. Eugéne Schneider, assumed control. The original members of the Schneider family came on the scene at the moment when railways and steamboats were just commencing to make engineering history, and the real growth of the establishment has been concurrent with the growth of steam traction and navigation. Indeed, the house of Schneider still occupies a leading position among the great producers of locomotives and marine engines of to-day. In 1867 steel making as an industry was added to the activities of Creusot, the Siemens-Martin process being the first to be adopted and subsequently that of Bessemer. Steel rails, sheets, and bars were the earlier products of this department, and not the least important, steel guns. In 1875 a forge for heavy steel work was put down, to be followed the next year by the erection of the 100-ton steam hammer, at that time the largest in the world. All-steel armour plating followed as a matter of course, and what more natural than that those who knew most about the manufacture of materials of defence should be qualified to further develop the construction of weapons of attack? Hence the rapid progress in the artillery department, a section of the works which was augmented in 1897 by the purchase of the artillery shops of the Société des Forges at Chantiers de la Mediterranée. Under the able scientific direction of M. Gustave Canet, this department speedily gained a world-wide reputation for its productions. In the domain of electricity MM. Schneider et Cie. have also made great headway, and very fine works specially devoted to the construction of electrical plant have been erected at Champagne-sur-Seine. Of these works the Juniors were privileged to get a fleeting view from the train on the way to Creusot.

(*To be continued.*)



THE 100-TON STEAM HAMMER AT CREUSOT.

THE twelfth yearly Edinburgh and Midlothian Home Workers' Competitive Industrial Exhibition is to be held at Waverley Market, Edinburgh, from Oct. 14th to 28th inclusive. This annual event should be well known to our readers, for it is claimed that it ranks as the largest annual competition of home industry in the world. Over £400 in prizes is to be competed for, the latter being awarded for home work of every description. Amongst the sections may be mentioned: Fine Art, Mechanical Trade Sections; Ladies' Amateur Section; Beehive Wool Competition and competitions of various other natures. Full particulars and prospectus may be had from the Secretary, Mr. A. T. Hutchinson, 16, George Street, Edinburgh. It should be noted that all entries close on Sept. 30th.

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.*]

Modelling the Hydroplane.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have read with some amusement the letter of criticism under the above heading in your last issue, from a correspondent who signs himself, "Thos. Dysart."

If this is the gentleman whom I used to know as a member of the Victoria Model Steamboat Club, I can make allowance for this outburst, and would let it pass were it not for one or two misstatements of fact which must be put right.

In the first place, my actual experience of model hydroplanes is *not* confined to (with one exception) my own efforts. If Mr. Dysart had attended the meetings of the V.M.S.C. a little more frequently during the period of his popularity, he would have seen the creditable, but disappointing attempts to model the hydroplane made by Mr. E. Vanner and Mr. H. Wright, in addition to the exception of which he speaks and my own humble efforts. Since these were all more or less failures, I felt justified in calling them *many* and basing my advice on the lessons that were learned from them.

Your correspondent's remarks about my own model are inaccurate in every detail, possibly for the same reason as before given. The model in question—a three-plane type of machine fitted with a specially built water-tube boiler (passed by your correspondent as a very neat job on one occasion)—made several trials with various screw positions, and careful observations were made of her various performances. These were embodied in the article—" Theory and Practice Combined."

With regard to your correspondent's request for a suitable design of plant, and the covert attack on my possible inability to supply it, I can afford to smile—since I have done even better; but the readers of THE MODEL ENGINEER shall hear more of that anon. In the meantime I can call your correspondent's attention to the remarkable speed (estimated by those who are competent to judge at 12 miles an hour) made by a small hydroplane, the work of Mr. Delves-Broughton and Mr. Teague, shown running at THE MODEL ENGINEER Regatta. The machinery in this model was a splendid example of the possibilities of brains properly applied, and with such an example before him, I recommend your correspondent to try his hand at original thought and its practical application, instead of wasting his superior ink on poor little me.

His reference to my " masterly article " and to the respectful criticism of M. Santos Dumont's machine which I proffered, are purely vindictive, and, as such, are simply silly.—Yours faithfully,

W. L. BLANEY.

Hot Water Supply.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I beg to point out to " Plumber " that his statement about cold water connection to boiler in hot water supply being always a failure and boiler bound to collapse, is not correct. It is the practice in this part of the country to connect as shown on my sketch, and from personal experience I can say it is never a failure. The only system in which I have seen cold water connected to circulating tank is the old " tank " system, usually fitted to poorer class houses, as the cost of material used is only about half of that used in the cylinder system. This system and the hot cistern system are the worst in use. The only part of the cylinder system known to collapse is the cylinder itself. In summer, cylinders collapse more frequently than in winter. One of the causes (local circulation) of this collapse is the sudden condensation of steam through cold water entering cylinder, thus forming a partial vacuum, the ordinary atmospheric pressure then forcing in the sides and tearing them away from the connections. By connecting to boiler this is prevented. To explain fully this cause of collapse would occupy too much space.

I must thank " Hot Water " for his letter, which helps to show that " Plumber's " sentence about failure and collapse of boiler is erroneous, also that we here are not the only ones who advocate cold connection to boiler. *Re* " Hot Water's " remark about incrustation of boiler, if he has any experience at all, he will know that this is governed by the class of water used. Hard water containing lime in solution generally being the worst cause of incrustation of boiler and circulating pipes. How does he account for the deposits formed in ordinary cold supply service mains ?—Yours truly,

A. A. CAMMING.

Queries and Replies.

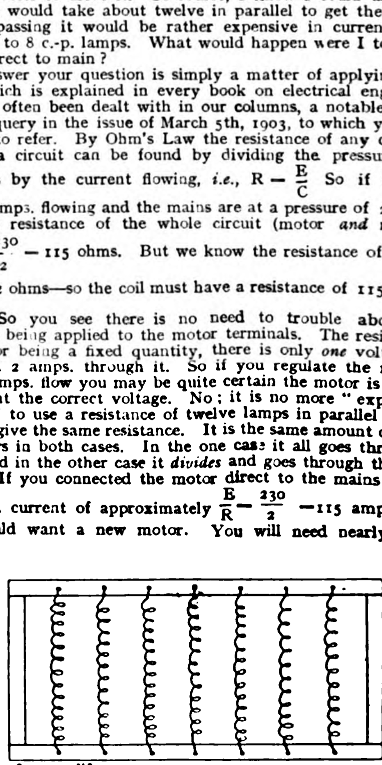
[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope " Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions :—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a " Queries and Replies Coupon " cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently :—

[20,123] **Reduction of Voltage.** N. S. (Goodmayes) writes : I should be much obliged if you could kindly let me know by post the size and quantity of platinoid or German silver wire for making a resistance to reduce 230-volt circuit down to about 4. I presume this would be possible, and if you could tell me of any book where instructions are given for making such a resistance, I should be glad. I have an Edison phonograph motor which I want to drive direct off the main ; it takes 2 amps. per hour at about 4 volts to drive it. Of course, I know I could use lamps, but as it would take about twelve in parallel to get the required current passing it would be rather expensive in current. I am referring to 8 c.-p. lamps. What would happen were I to connect motor direct to main ?

To answer your question is simply a matter of applying Ohm's Law, which is explained in every book on electrical engineering, and has often been dealt with in our columns, a notable instance being a query in the issue of March 5th, 1903, to which you would do well to refer. By Ohm's Law the resistance of any circuit or part of a circuit can be found by dividing the pressure at its terminals by the current flowing, *i.e.*, $R = \frac{E}{C}$ So if there are to be 2 amps. flowing and the mains are at a pressure of 230 volts, then the resistance of the whole circuit (motor *and* resistance coil) $= \frac{230}{2} = 115$ ohms. But we know the resistance of motor—$\frac{E}{C}, \frac{4}{2}$ 2 ohms—so the coil must have a resistance of $115 - 2 = 113$ ohms. So you see there is no need to trouble about what *voltage* is being applied to the motor terminals. The resistance of the motor being a fixed quantity, there is only *one* voltage that will send 2 amps. through it. So if you regulate the resistance until 2 amps. flow you may be quite certain the motor is receiving current at the correct voltage. No ; it is no more " expensive in current " to use a resistance of twelve lamps in parallel than one lamp to give the same resistance. It is the same amount of current that flows in both cases. In the one case it all goes through one lamp, and in the other case it *divides* and goes through the twelve lamps. If you connected the motor direct to the mains it would receive a current of approximately $\frac{E}{R} = \frac{230}{2} = 115$ amps. Then you would want a new motor. You will need nearly 3½ ozs.

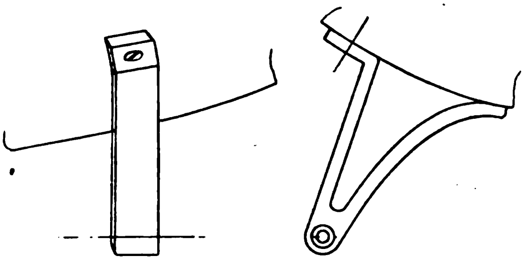


QUERY Nº 20,123

No. 26 (S.W.G.) German silver wire. The making of the resistance is a simple matter. Arrange the wire in coils and stretch on a wooden frame (as sketch). It is preferable to insulate the coils from the wood. Another method is to wind the wire on a tube of porcelain or other insulating material.

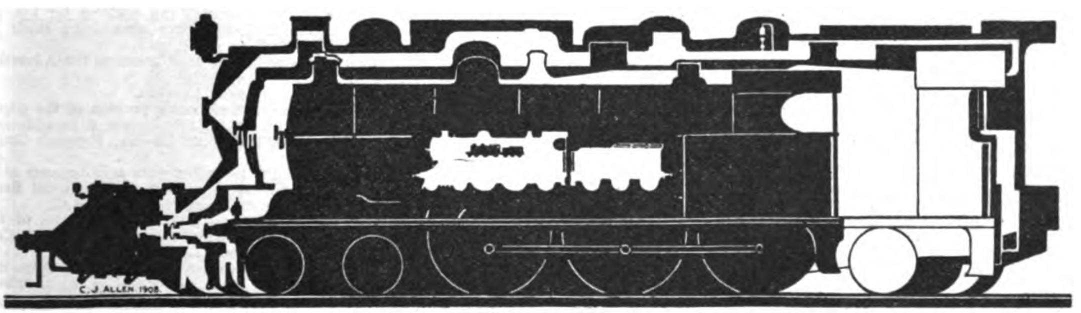
[18,801] **Model Steamer Machinery.** C. H. P. (Worcester) writes: I intend building a model speed steamer—36-in. length, 3½-in. beam, 3-in. depth, and a draught sufficient to completely submerge propellers. The hull is to be carved out of yellow pine in longitudinal layers in No. 2 or 3. A flat stern is to be used, and the layers will be marine-glued together. The engine will have twin-cylinders—⅝-in. bore, ⅝-in. stroke, double-acting slide-valve, working on disc cranks. I may mention that one of the cylinders is nearly finished. I have not yet decided upon the boiler. I should be obliged if you would answer the following queries:—(1) As the beam of this boat is so small, would you advise twin-screws to be used? (2) Could you suggest a method of fixing the stern tubes to the hull itself? (3) I have fourth edition of THE MODEL ENGINEER Handbook, "Model Boiler Making," but I do not see any design of boiler which could be got into so narrow a space as 3½ ins. I thought of using a flash boiler. The great difficulty seems to be the pump. (4) Would it have to be worked off main engine, or would it have a separate steam cylinder of its own—to be independent when engine stops? (5) *Re* propeller, what diameter ought it to be, also pitch?

(1) You will not have much power to spare, and therefore we advise single screws. (2) By using brackets (as sketch). (3) We



QUERY No 18801

do not advise a flash boiler, unless you have had previous experience or do not mind repeated experiments. The engine is hardly suitable. (4) Off the main engine. Use a hand-pump for starting purposes. (5) 1¼ ins. diameter, 3-in. pitch. You would do better with a 40-in. hull.



[20,034] **Induction Coil Failure.** A. C. R. (Bonnyrigg) writes: As a subscriber to THE MODEL ENGINEER I have derived much pleasure and information from its pages, and the object of this letter is to ask you to clear up a difficulty I have with an induction coil I have just completed. The details are as follows: The primary coil is composed of four layers of No. 14 D.C.C. wire, and the length of the coil is 6 ins. Each of these layers was carefully insulated from the others by means of shellaced paper, and when the primary coil was wound on it was then covered with shellac varnish and several thicknesses of thin sheet india-rubber. To finish this off a cardboard tube was now slipped over the whole of the primary, and well covered with shellac varnish. On this core, which now measured 1¼ ins. diameter, the secondary coil was wound, and as each layer was completed it was covered with two thicknesses of writing paper washed in a solution of shellac in spirit. In all there were twenty-four layers in this secondary coil, and each layer was very carefully insulated as detailed above, and the continuity of the wire was tested by means of a galvanometer periodically. The total weight of wire used in the secondary was about 2 lbs. No. 36 D.S.C. The core of the coil consists of a bundle of soft iron wire, No. 22 gauge, ¾ in. diameter, the iron wire in question being repeatedly heated and allowed to cool gradually, so as to ensure its being as soft as possible. The coil will not work. It gives a small spark for a few minutes and then quickly fails. It is of no use whatever with a sparking plug in a small gas engine, the purpose for which it was primarily constructed. I have tried two or three kinds of contact-breakers, and the result is the same with all of them. It has also been tried with and without a condenser. Can you give me an indication as to the probable cause of the trouble?

The only thing we can suggest with regard to your coil is that the fault may possibly lie in the make-and-break you are using. You might try working the coil in a dark room in order to see any faults which would not be observable in daylight. The only really reliable insulation between primary and secondary is a good vulcanite or ebonite tube, but we are assuming that the faults in this direction are non-existent, as you have made careful examination of the coil.

[20,058] **Lapping Cylinder.** J. T. Q. (Godalming) writes: Can you tell me an easy and effective manner to lap a small cylinder of 1-in. bore? I have tried it with a piece of wood and emery powder but I do not like that method.

Try a piece of soft lead instead of the wood, using fine emery powder and oil.

[19,894] **Motor Starting.** E. W. (Leigh) writes: I was intending to put a motor down to drive some shafting, and I want to be able to start and stop the motor from two floors. Could you advise me which would be the best way to do this?

We should suggest that you put a starting rheostat on each floor. Connect the two in parallel. For stopping the motor use a couple of two-way switches, one on each floor.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

* *Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

An Interesting Post-card.

The accompanying illustration is reproduced from a novel picture post-card recently issued by Messrs. W. J. Bassett-Lowke and Co., Kingswell Street, Northampton. It is a composite drawing showing a comparison of the finest locomotives produced by the leading makers of the world during the past year. The largest is the Mallet Articulated Compound "Pacific" Type Engine, built by the American Locomotive Co., of Schenectady, U.S.A., and the smallest a L. & N.W.R. "Precursor" model built by Messrs. Bassett-Lowke. Full particulars of these and the various intervening sizes are tabulated on the post-card, a copy of which may be had free by applying either direct to the firm at Northampton or to the attendant at the L.N.W.Ry Stand, No. 790, in the Machinery Section of the Franco-British Exhibition.

A New Pocket Speed Indicator.

A novel speed indicator has recently been introduced by Messrs. C. W. Burton Griffiths & Co., Ludgate Square, London, E.C., which indicates any number of revolutions up to 10,000 by the dial, which can be read off without any troublesome calculations. The indicator can be used for right- or left-hand driving, and instructions are given for setting the indicator ready for use. We can recommend this to the notice of our readers, and can confidently say that such an instrument would throw much light on many cases of loss of power. An entirely new design in inside micrometer calipers has also been brought to our notice which meets the demand for a tool adapted to small internal measurements. It is claimed that it is the only tool of its kind that will take internal measurements to ·2 of an inch. Further particulars and prices may be obtained from the above-mentioned firm.

The Editor's Page.

WE publish elsewhere in this issue a full report of our first Model Motor Boat Regatta, from which it will be seen that a distinctly successful afternoon resulted. Indeed, we have received a number of letters from spectators who were present expressing the pleasure afforded them by the event. Although no records were broken, it was quite evident from the performances of several of the boats that it is only a matter of favourable running conditions and final adjustments to set up quite a new set of Standard figures for speed models. We shall, of course, again offer our yearly medals for the fastest times in 1908, and we propose that the same conditions as in 1907 hold good. If, however, any intending competitors think alterations are desirable, we are quite willing to receive and consider any suggestions which may be thought necessary. We may here say that one competitor has asked if he may run his boat in a circle, it being tethered by a light line to a central post fixed in the water. The reason for this proposed course is that the only available water this particular competitor has is a river bounded on both sides by stone embankments, and any failure to catch his boat at the finish of a cross-stream run would mean instant death to the little craft. As his tethered circular course will operate rather to the disadvantage of the speed of his boat than otherwise, we do not see that any objection need be raised, if he is willing and enthusiastic enough to compete under such adverse conditions.

* * *

One of the members of the special party who recently visited the works of Messrs. Drummond Bros., Ltd., has sent us a very appreciative description of the outing, which appears to have been a great success. We quote the following from our correspondent's notes: "On arrival the party split up into sections and forthwith began a tour of inspection, each section starting at a different shop. What impressed us most was the excellence of arrangement and the clear evidence of up-to-date methods and systematic standardisation throughout. All the machine tools in the shops are driven by electricity generated on the premises, and are, without exception, of the most modern description, designed to turn out the maximum of work—dead true to gauge—with the minimum of labour. Not the least interesting item was a special grinding machine for finishing the cylindrical beds of the new 4-in. lathe, by means of which these are turned out true to the last degree of accuracy. The visit was pleasantly interrupted by tea, very kindly provided by Messrs. Drummond Bros. in the drawing office, and much appreciated by all. After tea a return was made to the shops to complete the inspection, or to have another look at something which had proved particularly interesting before. Eventually, at 7.45, the party set out for the railway station in their brakes, all much impressed with what they had seen and the hospitable treatment they had received from Messrs. Drummond Bros. The return to London was comfortably made in reserved compartments, and I feel sure that all those who were present will join me in expressing hearty thanks to Mr. Greenfield for a most interesting, instructive, and successful visit, the organisation of which must have put him to considerable trouble."

* * *

Mr. A. S. Rothwell, 85, Park Street, Ashton-under-Lyne, is desirous of forming a local Model Engineering Society, and will be pleased to hear from those interested.

Answers to Correspondents.

M. J. (Belfast).—Thank you for your letter. We shall be pleased to see your contribution.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

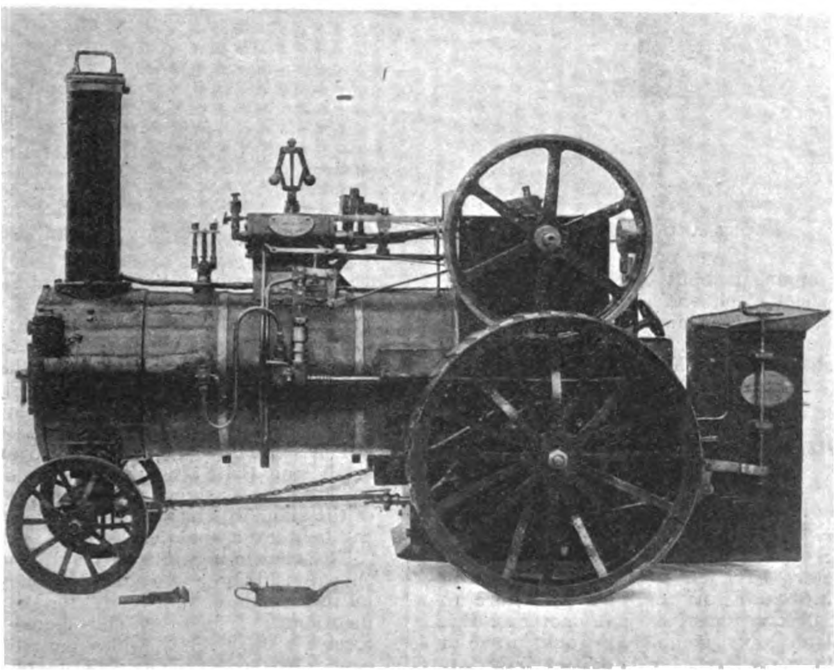
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 381. AUGUST 13, 1908. PUBLISHED WEEKLY

A Model Traction Engine.

By STANLEY FRANCIS.



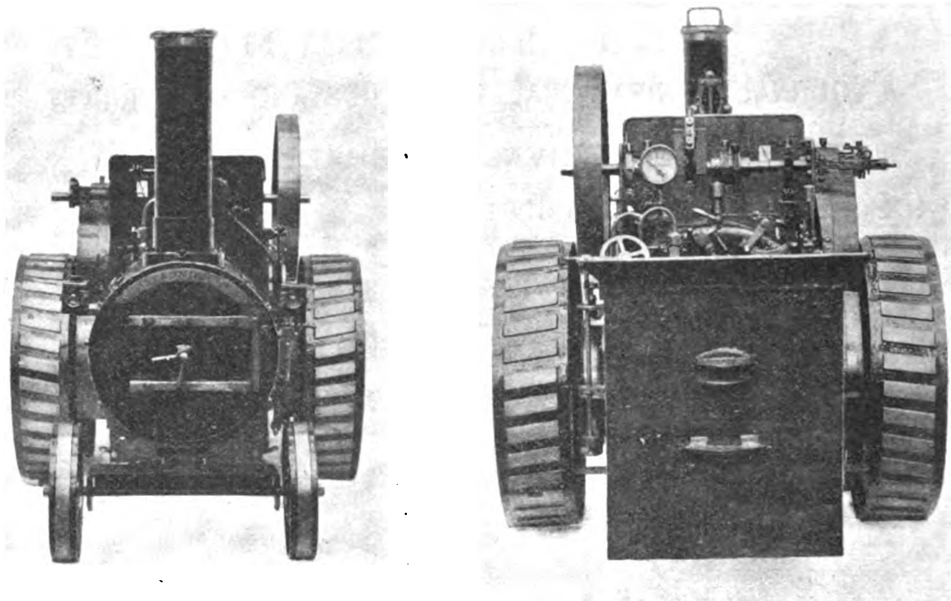
MODEL TRACTION ENGINE "DREADNOUGHT," BY STANLEY FRANCIS.

THE following particulars of an exceptionally well-made model traction engine will be read with interest by many readers, especially when they bear in mind that the builder is an apprentice engineer, only 17 years of age. The workmanship appears to denote great skill and constructive ability.

Barrel, 14 ins. by 5 ins. of sheet copper, full 1-16th in.; one 2-in. tube runs through base of boiler to smokebox. Firebox is 6 ins. long, 7 ins. high, and 5 ins. wide, and burns small lumps of coal very freely. There is a water tank under tender holding one pint of water which is kept hot by firebox and fed to boiler by a pump worked by eccentric on crankshaft. A screw-down valve cuts off water supply when boiler is full. Cylinder bore, 1 in.; stroke, 1¾ ins. Driving wheels, 8 ins. diam. Link reversing gear. Working pressure, 10 to 20 lbs. Length of engine, 2 ft. 4 ins. Two 3-tap water gauges are fitted as well as two water and one steam cocks. Cylinder is lagged with copper and tightly packed with asbestos. The brake has seven blocks of wood on a steel band acting on a gun-metal drum attached to axle.

The engine runs remarkably well and draws a truck laden with two bricks easily. All the turning was done on a 3½-in. gap-bed back-geared screw-cutting lathe, with overhead motion, driven by a 3 h.-p. Crossley gas engine, which also drives emery wheels, a grindstone, circular saw (bench), etc.

long arm *c* and the short one *d* are made out of sheet brass. The short arm is made up of two pieces which are bifurcated at the top ends and then sweated together at *e*, before the hole for the spindle *b* is drilled. These parts should now be



FRONT AND END VIEW OF MODEL TRACTION ENGINE "DREADNOUGHT."

The whole engine is built of sheet copper and brass, scrap sheet steel, and steel and brass rod, and took six months' continuous work to complete. The oil-can, made of tin, is a perfect working model, as is also the screw hammer.

A Double-acting Solenoid Engine.

By Alfred J. Budd.

VARIOUS types of reciprocating electric engines or motors have already been described in The Model Engineer, and I venture to think that a description of a small motor of this type, which I have just completed, would prove of interest to those readers who dabble in this class of work.

It will be seen with reference to the accompanying illustrations that the machine is worked by two solenoids, through the medium of a bell crank device and connecting rod. This arrangement allows the driving axle to be placed midway between the coils, making the complete motor very compact and at the same time imparting to it a somewhat novel appearance.

In constructing this little motor the first part to be tackled is the bell crank arm, shown at *a* (Fig. 4). This is composed of the three parts *b c d*. The spindle *b* may be of iron or steel rod of the size shown, with the ends shouldered down. The assembled, arm *c* being slipped on the spindle to position marked *f*, and arm *d* to position *g*. The arms must be adjusted so that one makes an angle of 53 degs. with the other, as indicated at *h*. They can now be soldered on to the spindle.

The bearings for the latter (see Fig. 5) are made of sheet brass, and the holes drilled to receive the ends of spindle and fixing screws.

The standards (Fig. 6) are also of brass, with a small nut (with thread rimered out) or washer soldered on, as shown, to widen the bearing. One of the standards has a slot *a* cut in it, so as to clear the bell crank spindle.

The connecting-rod can be cut out to the shape shown in Fig. 7, and a small nut or washer soldered on to the side of "big end" for the purpose before mentioned. The other end should be tapped to receive a small screw, which must be a tight fit, so as not to work loose when motor is running.

Fig. 8 shows the flywheel axle and crank. The axle is a length of smooth iron rod, screwed as indicated, and the crank is of brass. A short piece of iron or steel rod of slightly smaller diameter than the axle suffices for the crank-pin. The flywheel can be purchased ready-made for a few pence. (The writer only paid 4½d. for the one shown in the photograph).

Having got so far, the construction of the solenoids can be proceeded with. To carry the windings of these some finely drawn brass tube is required, with an internal diameter which should allow them to be an easy sliding fit to the reciprocating plunger. In the model illustrated part of the "plunger" tubing taken out of a disused cycle pump is used for the former. Two lengths of this tubing should be cut off and the ends squared up. These should now receive a rubbing with fine emery cloth to ensure them being nice and smooth for the plunger to work in. The end supports of coils (Fig. 9) are made of walnut. Four of these will be required, with holes cut out with brace and bit, so as to be a tight fit on the brass tubes.

The plunger should claim attention next. This consists of a length of soft iron tubing (see Fig. 10), with a hole drilled right through in the middle and a $\frac{1}{8}$-in. iron or steel pin hammered in tight, so as to leave about $\frac{1}{4}$ in. projecting on

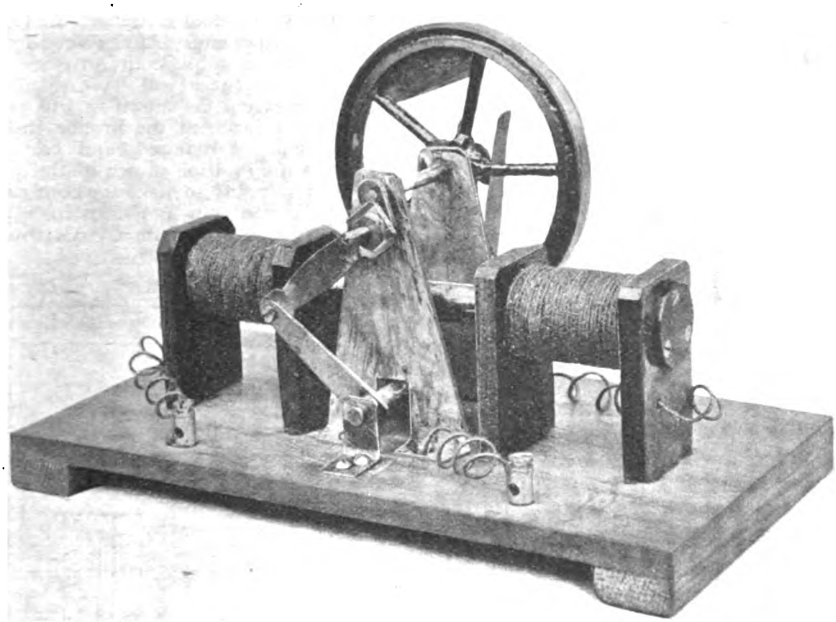
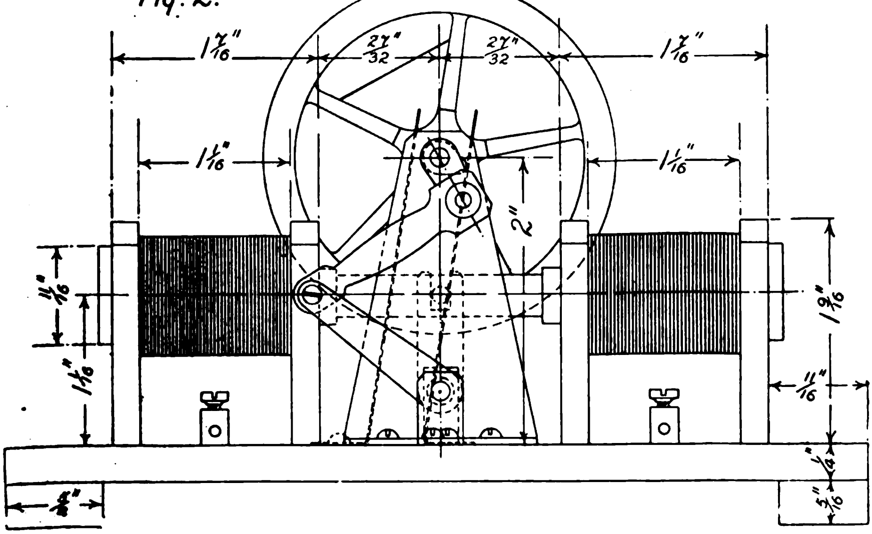


Fig. 1.—The Complete Engine.

Fig. 2.



Elevation of Double-acting Solenoid Engine.

either side. Care must be taken that this pin is quite square with the plunger. Into the ends of this tube short pieces of soft iron rod *a b* are inserted and sweated in place. This allows the solenoids to operate more efficiently.

Now as to the coils. First of all, place a layer of thin brown paper round the brass tubes, and make fast with Seccotine or other adhesive. Then apply a coating of shellac varnish. After this is dry, wind on each tube eight layers of No. 24 D.C.C. wire, leaving about 8 ins. at each end for connecting up. The coils should then receive a good coating of shellac varnish and be allowed to dry.

The small discs seen at the end of coils are of pear-wood, and are attached to the end pieces by three small countersunk screws.

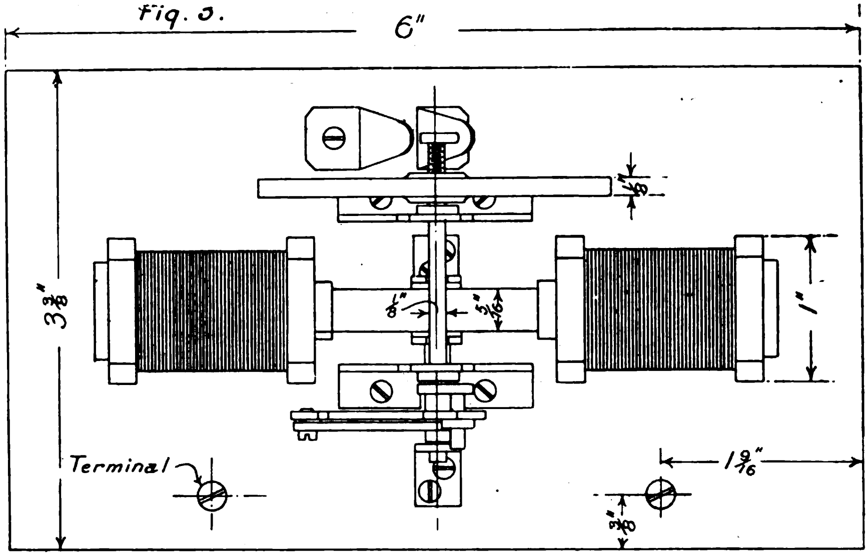
"humouring" the coils slightly with the fingers before finally screwing down tight.

By moving the cross-pin as far as it will go, it can be made to engage in the bifurcated part of the arm in which it works.

The connecting-rod can now be slipped on to crank-pin and attached to the vibrating lever by the screw at the other end. After screwing the contact-breaker on to end of axle the brushes can be fixed to baseboard. These will have to be placed in a slanting position (as shown in Fig. 11) to ensure contact being made at the proper moment. Two terminals will be required, and can be fixed to base about the position shown in the plan.

We are now ready to make the connections. This should be carried out as shown in Fig. 12, which needs no further explanation. All the wires could

Fig. 3.



PLAN OF DOUBLE-ACTING SOLENOID ENGINE.

The brushes, of which there are two, are cut out of thin, springy copper. The contact-breaker is simply a piece of sheet copper 1-16th in. thick, cut and filed to shape shown at *a* (Fig. 11), with a hole drilled and tapped for screwing on to end of axle.

The baseboard is a piece of walnut ¼ in. thick—any other fairly hard wood would do—with the end-pieces screwed on from underneath.

Everything is now ready for fixing to the base. All that will be required for this is ten ⅜-in. and four ⅝-in. brass round-headed wood screws. Now take the baseboard and, with a square and pencil, carefully mark out the positions of the various parts, as indicated in the plan (Fig. 3).

The bell crank arm and bearings should be screwed down first. Then the standards, with axle, etc. One of the coils should next be fixed in position from underneath the baseboard by means of two ¾-in. screws, one for each end-piece. Now insert armature and fix down the other coil. It may be found that on moving the plunger this works a little stiffly, owing to the bobbins not being in perfect alignment. This can be remedied by

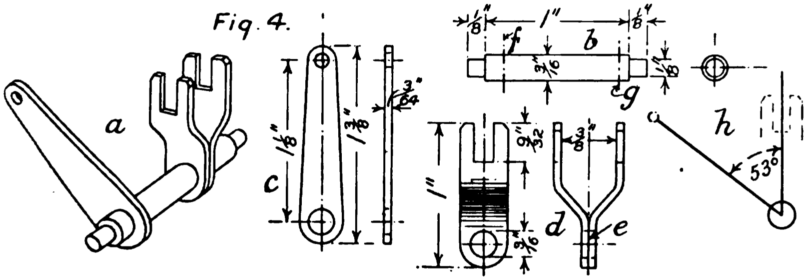
conveniently be placed above the baseboard, with the exception of the one marked *a*. This is taken underneath the base and soldered to the bottom of terminal.

The contact-breaker should be so adjusted that a coil is thrown into the circuit directly after the plunger begins a stroke in either direction.

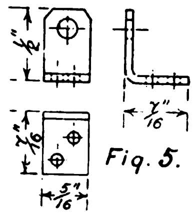
The best position will easily be found by experiment, when the contact piece should be soldered to axle.

A counterbalance will be necessary to ensure even running, and for this purpose a piece of sheet brass about 1-16th in. thick is filed to fit between the spokes of the flywheel opposite the crank and then "tacked" in place with solder.

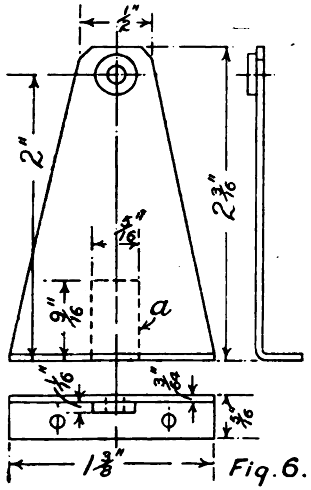
The motor is arranged to go in an anti-clockwise direction. Two pint bichromate batteries or a 4-volt accumulator runs this little motor at a fairly good speed. A word in conclusion may be said in regard to lubrication. Use the oil very sparingly, and so avoid faulty connections and sticking of plunger.



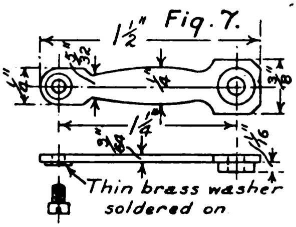
Bell-crank Arm and Details.



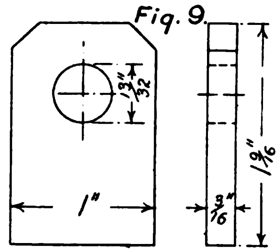
Bearings for Bell-crank Spindle.



Standards with Bearings for Flywheel Axle.

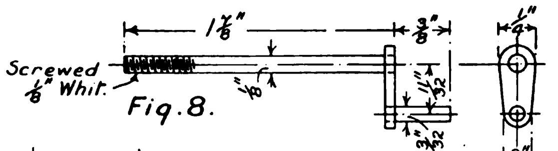


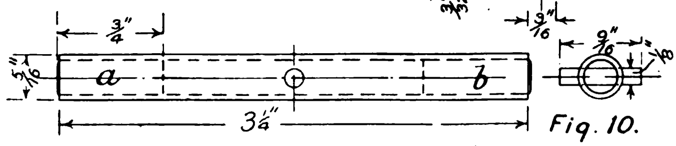
Connecting-rod.



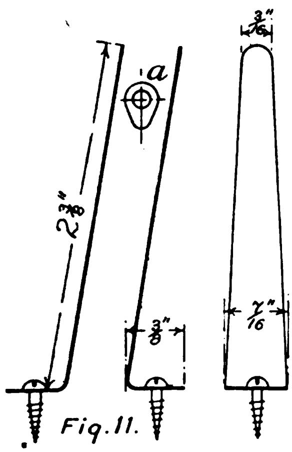
End Supports for Coils.

Flywheel Axle and Crank.





Plunger and Cross Pin.



Brushes and Contact-breaker.

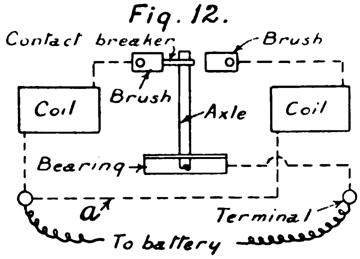


Diagram of Connections.

DETAILS OF DOUBLE-ACTING SOLENOID ENGINE.

By Alfred J. Budd.

Model Fowler Type Traction Engine.

By H. Greenly.

(*Continued from page 7.*)

II.—The Cylinders.

In continuing the description of the cylinders for this model, I may as well first correct two errors in dimensioning the drawing, Fig. 4, which, although trifling, may cause doubt in the mind of some reader following up these articles. Checking dimensions will be given in detailing the cylinders, but mention of this particular point may as well be made at once. The first item is the position of the safety valve centre line, which was omitted on the sectional view of Fig. 4. This should

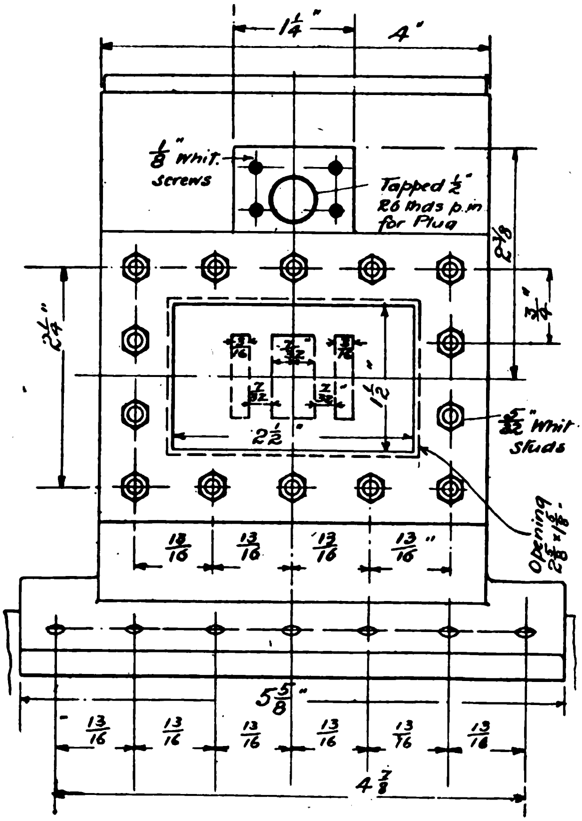


Fig. 5.—Side Elevation of Cylinder for Model Traction Engine. (*Half full size.*)

be 1 9-16ths ins. from the vertical centre line of the regulator valve spindle (see SVC, Fig. 7); secondly, the diameter of the cylinder covers are intended to be 3 5-16ths ins. and not 3 15-16ths ins. as marked on the side elevation of Fig. 4. These covers will be shown in full detail later on.

The steam ports for this model need not be so long as in the original, but for reasons of coring they may be made wider and the thickness of the port-bars increased. Only just lately I have been able to compare the results obtained by modifying "cast in" steam ports in two locomotive cylinders

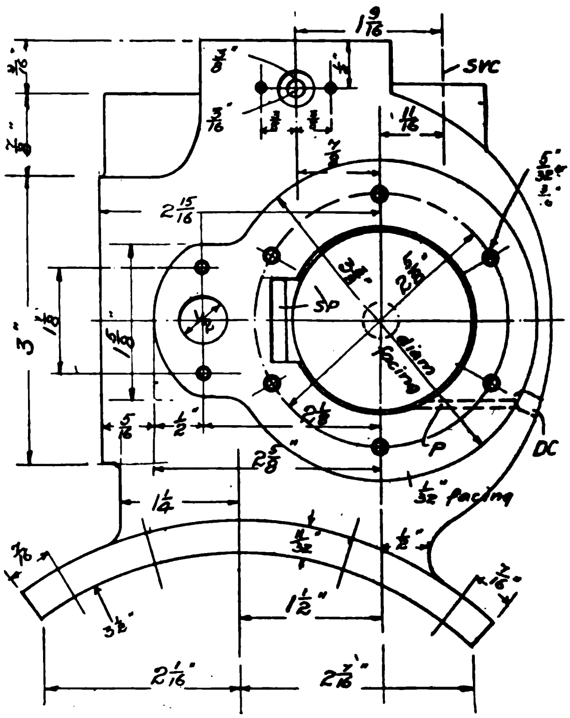
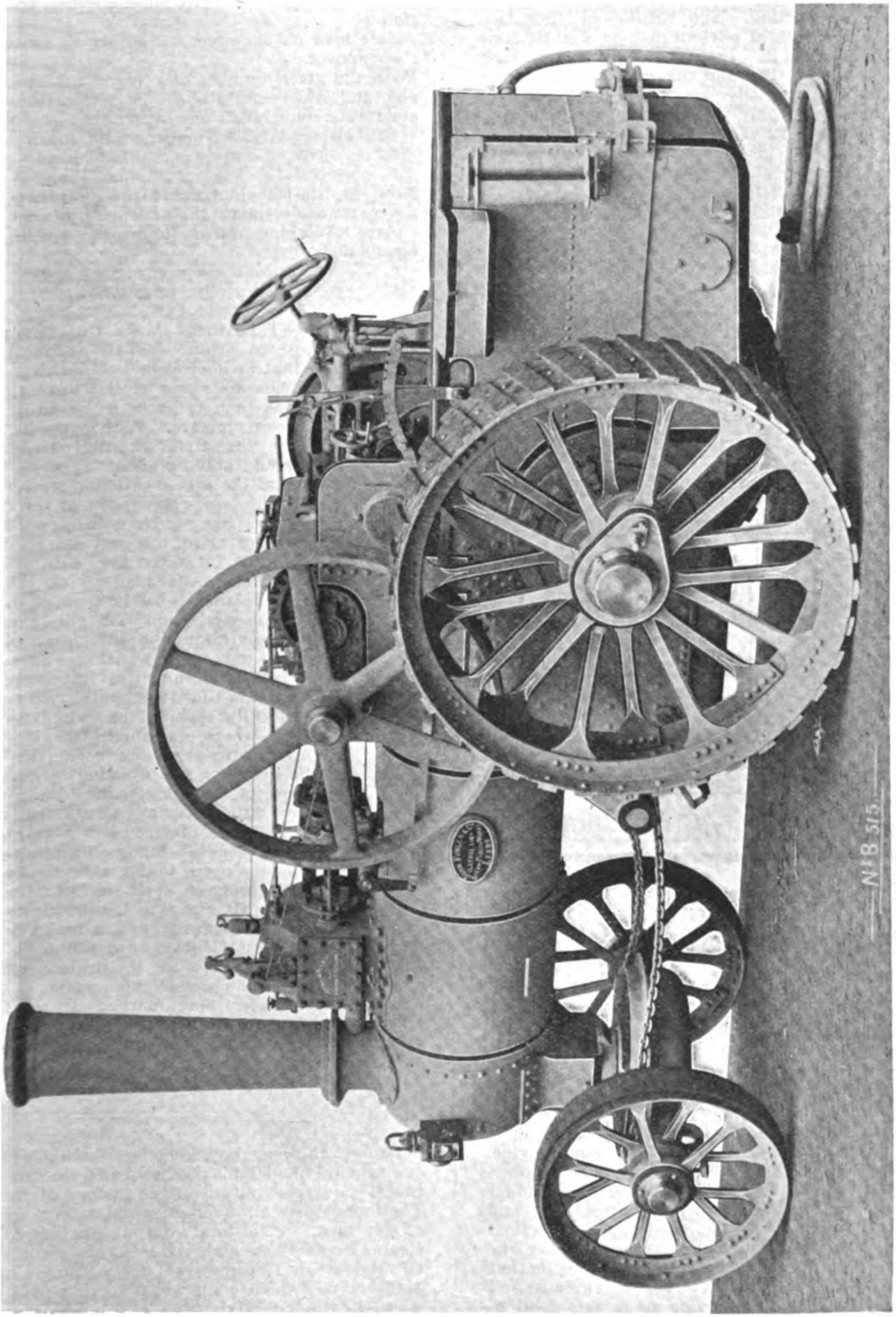


Fig. 7.—Rear End View of Cylinder Casting for Model. (*Half full size.*)

of almost identical design. In the one cylinder the pattern was arranged with the ports of exactly the same proportions to those shown in Fig. 5, whereas in the other an attempt had been made by the pattern maker to obtain ports measuring over three-quarters the diameter of the cylinder bore in length. The resulting castings were as different as chalk and cheese, and although the patterns for the "scale" cylinder were well designed and beautifully made, the moulder had not been able to prevent about 66 per cent. of virtually "wasters" in the batch which was delivered.

From a scientific standpoint there is no need for the very long ports in the model, as the piston speed in feet per minute being very low in a model, there is much less resistance to the passage of the steam to and from the cylinder. This being the case, in a normal engine the steam ports may be about half the diameter of the piston in length and 1-16th the length of the stroke in width. In the present cylinder this rule would give 15-16ths x 3-16ths steam ports, but as the piston speed will not be above normal and 7/8 in. is a round dimension, I have adopted it for this cylinder. The usual rule for port-bars is to make them the same width as the steam ports, and for the exhaust port width to double that of the steam port. Both of these portions have been increased in size to help the moulder to produce a clean sound casting.



Messrs. John Fowler & Co.'s (Leeds), Ltd., 5 ft. 6 in. Traction Engine, Viewed from the Rear.

The valve face is raised so that an end mill can be used through the steam chest opening to face the cylinder casting. The raising of this face increases the work of pattern-making slightly, but I think it is worth it. If it is not done then a chase should be milled all round the working face of the casting so that the valve rides over it at each end of the stroke and only just bears on it on the top and bottom edges. The facing strip should be a good 3-32nds in. in the pattern so that it will machine down to about 3-64ths in., as shown in Fig. 4 in the last article.

The drawings included herewith comprise a side elevation of the cylinder showing the arrangement of the bolts in the steam chest cover and the width of the throttle valve chamber, and a sectional elevation showing the casting cut vertically through the centre line of the throttle and main valve spindle and showing the face of the steam ports. The other drawing (Fig. 7) is an end elevation of the bare cylinder casting, all covers and glands being removed.

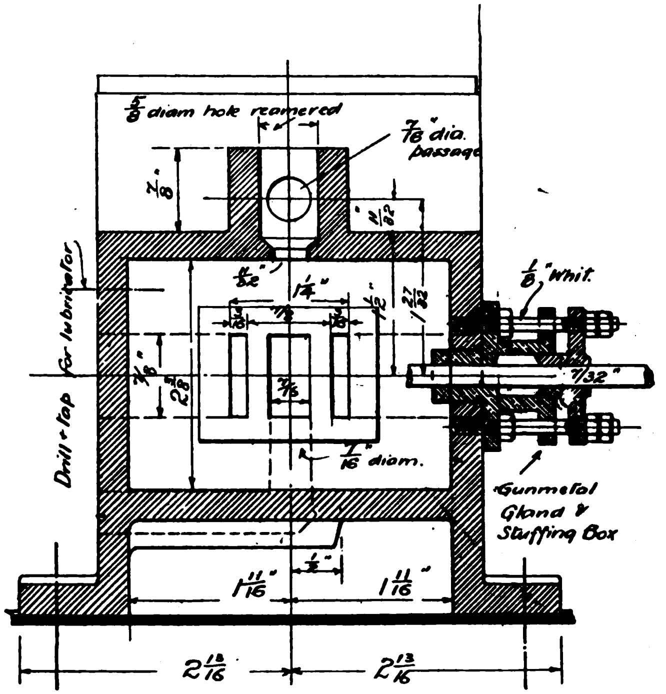


Fig. 6.—Section of Model Cylinder through Valve Spindle and Throttle Valve Chamber. (*Half full size.*)

In Fig. 5 the arrangement of the valve chest studs is exactly the same as in the original engine. The diameter of the studs recommended is, however, 5-32nds in. Whitworth, or, if the builder favours B.A. threads, its nearest equivalent, any diversion being made in the larger direction. Taking the diameter of the 5-32nds studs at the bottom of the thread at ·116 in. (as given in that useful sixpenny handbook, "Screw Threads and Twist Drills"), and reckoning on a safe load of 6,000 lbs. per sq. in., with the whole area of cover, viz., 4 ins. × 3 ins. = 12 sq. ins. and 60 or 70 lbs. working pressure, we can work out the following trial equation :—

Safe load on one stud × Number = Pressure on cover.

With the given number of 5-32nds in. studs (viz., 14) and the safe stress above-mentioned, the equation should work out as follows :—

Safe stress × Area × Number = Safe load.
6,000 × Area of ·116 × 14 = Safe load.
6,000 × ·01 × 14 = 840 lbs.

Now, as this should balance the pressure on the cover, we can estimate the pressure by

Area × Working pressure in lbs. per sq. in., which equals at 60 lbs.,

60 × 4 × 3 = 720 lbs.
or, at 70 lbs. pressure.
70 × 4 × 3 = 840 lbs.

This, then, shows the cover studs to be strong enough at 70 lbs., and that we have always something in hand owing to taking at the outset a larger area than is likely to be subjected to steam pressure. With a perfect jointing the area exposed to pressure should only be about 2½ × 1½ or one-third the area mentioned above.

The same rules apply to the cylinder covers (Fig. 7). Here we have a nominal area of 2¾ sq. ins. and six studs each capable (at 6,000 lbs. safe stress) of bearing a safe load of 60 lbs. each. The balance, it will be seen, is in favour of the studs, and with the worst conditions (taking the whole area of cover, viz., area of 3 5-16ths = 8¼ sq. ins., which is more or less impossible), the stress in the studs would rise to about 7,500 lbs. per sq. in., which is allowable where unwrought steel is used. If 3-16ths studs are used (the option is given on the drawing) the appearance of the cylinder may be improved by using 5-32nds nuts tapped to 3-16ths in. instead of 5-32nds; or eight studs 5-32nds in diameter may be employed, taking care to keep the two studs on each side of the steam port (SP, Fig. 7) in the positions shown on the drawing, and also to see that the stud holes do not fall foul of the tapped holes for the drain cocks (DC) and the connecting passage to the cylinder bore marked P in Fig. 7. Only six studs are used in the prototype as will be seen by reference to the photographs accompanying these articles.

(*To be continued.*)

During the year 1907, says the *Mechanical World*, one firm in Philadelphia produced 2,663 locomotives; this is the largest output in the history of the firm. They employed an average number per week of 18,655 men. The total output included 2,371 steam locomotives and 292 electric locomotives. Of the steam locomotives forty were of the Mallet type, which comprises two sets of driving wheels, cylinders, and valve gear under one large boiler.

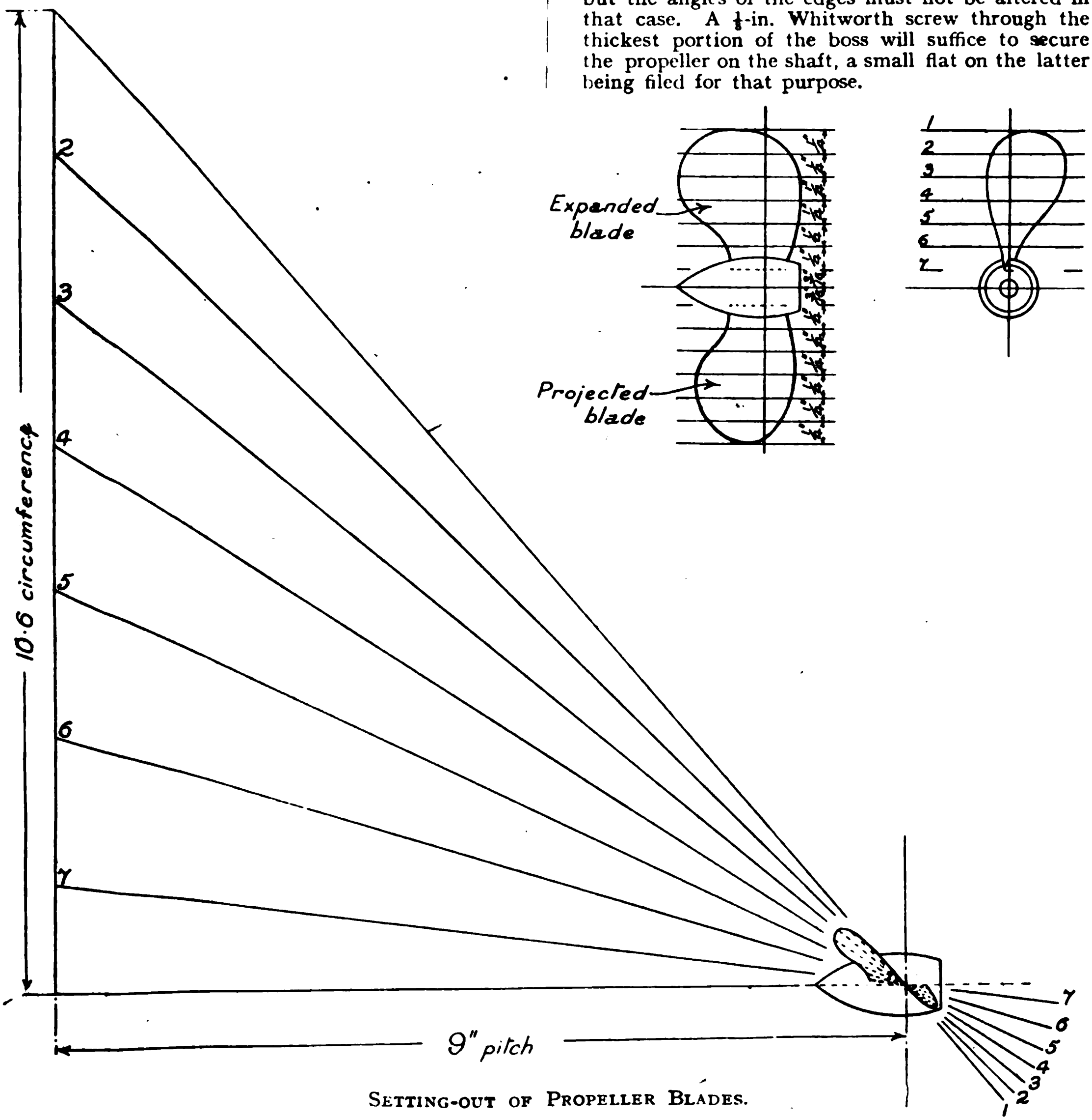
Design for a 5-ft. Speed Boat.

By Thos. Dysart.

(*Concluded from page* 137.)

The Propeller.—This is $3\frac{3}{8}$ ins. diameter, 9 ins. pitch, and *two*-bladed. The boss, $\frac{5}{8}$ in. diameter and 1 5-16ths ins. long, is drilled to a depth of $\frac{7}{8}$ in. to take the 3-16ths-in. propeller shaft. The blades, as shown on the drawings, must be carefully marked out and fixed into the boss. They can be made of 18 gauge *hard* rolled sheet brass, and, if made a nice tight fit into the boss, a good neat fillet of soft-solder will be found quite sufficient to hold them firmly in position. After finishing, the edges must be brought almost to a knife edge, and a liberal use of emery paper employed, as a perfectly smooth, well-finished surface adds considerably to the efficiency.

Care must be taken to get the respective angles, especially at the outer tips of the blades, perfectly right; otherwise the boat's speed will suffer. In fact, one cannot give too much attention to the design and construction of a propeller. A slight curvature in the blades will prove advantageous, but the angles of the edges must not be altered in that case. A $\frac{1}{8}$-in. Whitworth screw through the thickest portion of the boss will suffice to secure the propeller on the shaft, a small flat on the latter being filed for that purpose.



Setting-out of Propeller Blades.

In concluding this article, the writer would particularly request that no scamping of work be allowed, and, if the general design is adhered to, the builder will have a boat which, for speed, will take some beating. At the same time, however, it might be advisable to purchase a pair of specially made thick gloves, as a boat of this displacement and speed will require some stopping.

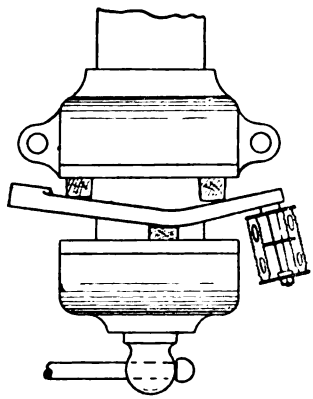
Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "WORKSHOP" on the envelope.]

To Straighten Bent Cranks, etc.

By C. W. CHEVERTON.

Where heating or hammering would spoil plated fittings, they can be straightened as follows:

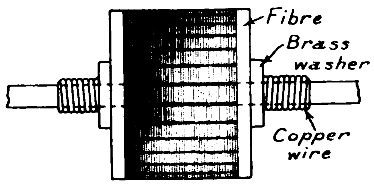


Place in the vice between three wooden blocks, as shown, and screw up until true.

Fixing Stampings on Armature Shaft.

By O. L. HARTLEY.

An idea which may prove useful to those who are scantily supplied with tools is shown in sketch for holding laminations on armature shafts. A spiral wire (10 copper) and brass washer are first soldered to shaft; then, when all laminations are

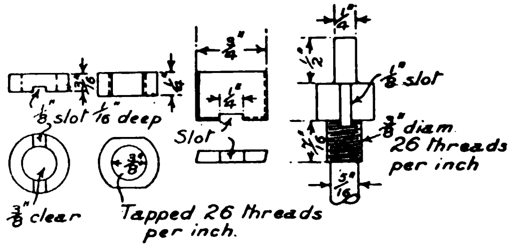


clamped up to this, another washer and spiral is soldered to shaft whilst laminations are clamped up. Laminations held this way give the shaft a lesser chance to get strained, as often occurs with nut-and-thread system. Spirals can be wound on same shaft, faced square with file, using spirit flux to solder.

A Handy Boring Bar.

By F. W.

The boring bar here described is very useful, as it does away with the necessity of making a number of pin drills for various sized holes. The bar itself was made from a piece of ⅝-in. round mild steel 6 ins. long. After being centred, the pin was turned on one end ¼ in. diameter, ½ in. long; reversing it between centres, it was turned 4⅝ ins. from the end to 5-16ths in. diameter, the next ½ in. being left ⅜ in. diameter and screwed 26 threads per in., the remaining ⅜ in. of the bar being left ⅝ in. diameter. The ⅛-in. by ½-in. slot was then



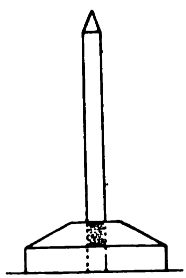
put in, commencing at the base of the pin and breaking through into the screwed part ⅛ in. I made this slot by drilling four ⅛-in. holes through the bar and filing it out with a small key file; care should be taken to drill the holes through centrally, or it will spoil the slot. The two collars were then made from ⅝-in. mild steel—one 3-16ths in. thick, with a ⅜-in. clearing hole and ⅛-in. slot filed across; the other a ¼ in. thick and screwed ⅜ in., 26 threads per in., two flats being filed to fit a suitable sized spanner.

I then made several cutters from ⅛-in. by ½-in. tool steel. The steel was cut off slightly larger than the desired sizes, and a slot was filed in the centre of one edge ¼ in. wide, 1-16th in. deep. The piece was then slipped through the slot in the bar and clamped up with the two collars; the bar was run between centres and the cutter carefully turned to size, afterwards being backed off with a file to make cutting edges, and hardened and tempered. A ¾-in. cutter is shown in sketch.

A Simple Height Gauge for Lathe Tools.

By C. A. WILLHOMES.

This device for accurately setting the tools in a lathe forms a useful adjunct to the workshop, and may be new to some amateur workers.



It consists of a pointed piece of steel screwed into a base turned from a small piece of steel or brass. It is screwed in until the point is exactly level with the lathe centre, when the base is either on the bed or, in the case of Drummond lathes, on the boring carriage. It is convenient to make two — one for the boring carriage, and one for the lathe bed. By means of this device tools can be set and changed without removing the work from the centres. It is especially useful in the case of small diameter jobs where the height of the tool is an important item.

To Fill Holes in Iron.

A mixture of litharge and glycerine applied to iron work will fill up porous spots and make the work light.

Engineering Works and Accessories for Model Railways.

(*Continued from page 555, Vol. XVIII.*)

By E. W. Twining.

THE first drawing here given (Fig. 22*a*) is the perspective of the Keynsham overbridge which further illustrates my remarks in my last contribution.

Of arched structures of the second class, viz., under-bridges—that is to say, those which carry the railway over roads and rivers, I propose to give altogether some six examples; three of these will be in the Gothic style, and three in the Classic or Renaissance. Likewise there will be three of large span crossing rivers, and three of much smaller size spanning roadways. I will deal with the larger structures first.

The wash drawing (Fig. 23) is an elevation of the fine Gothic bridge spanning the river Avon, near Bristol. It is one of the most beautiful and, at the same time has, to the best of the writer's knowledge, the longest span of any bridge yet built with an arch of the pointed form. The architecture is, like all the other works of Gothic character on this part of the Great Western Railway, of the Tudor period. The total length of the structure is approximately 380 ft., of which 100 ft. is taken up by the centre arch, whilst the two flanking arches each have a span of 35 ft. The width between the parapets is 30 ft. The scale at the lower edge of the drawing will provide a means of obtaining all other measurements.

The three drawings, A, B, and C, Fig. 24, give details of the mouldings in cross-section. At A is shown the coping of the parapets. B indicates the form of the string-course which makes an unbroken horizontal line throughout the length of the bridge, and C is the spandril moulding following

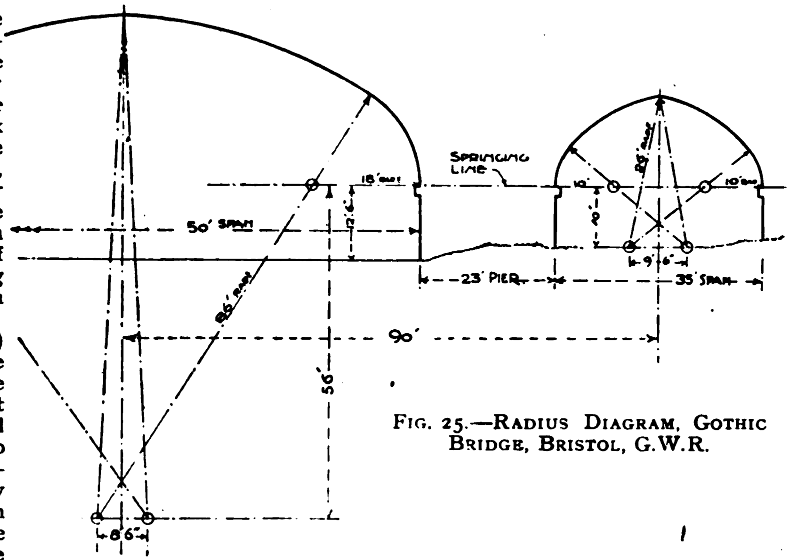


Fig. 25.—Radius Diagram, Gothic Bridge, Bristol, G.W.R.

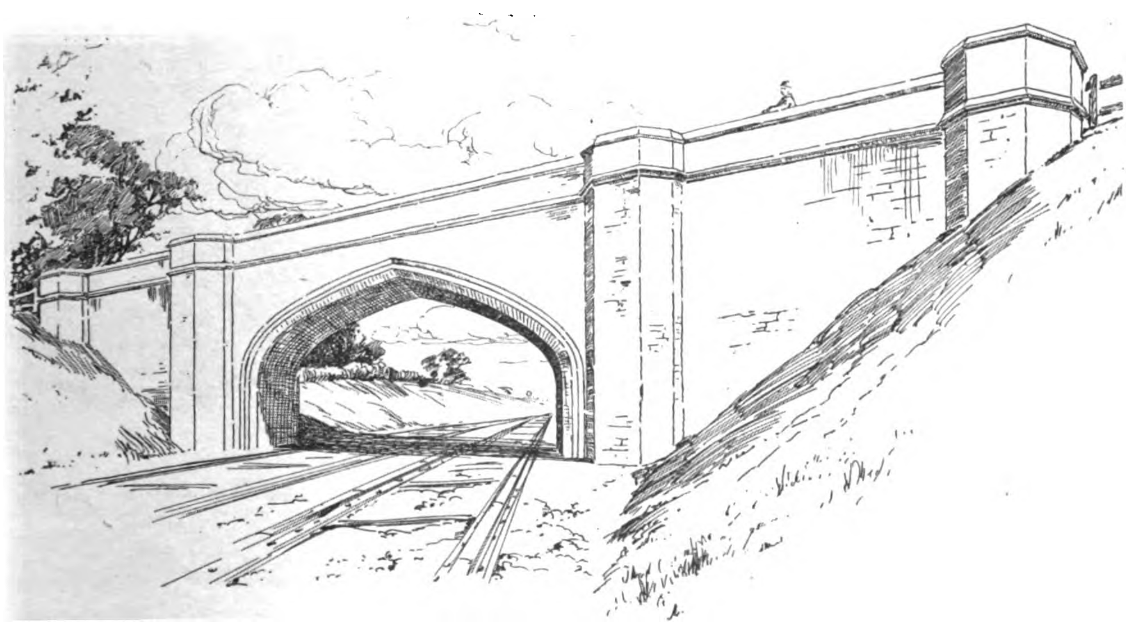
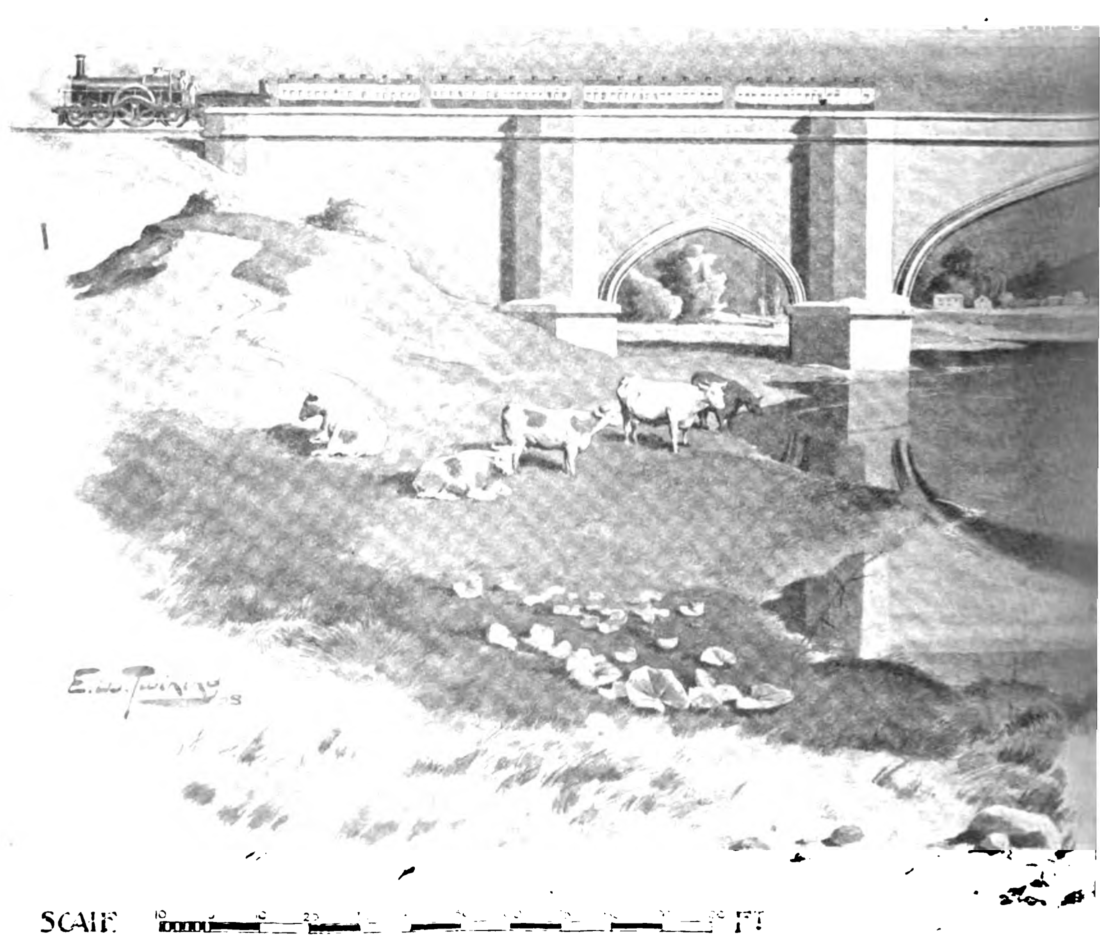
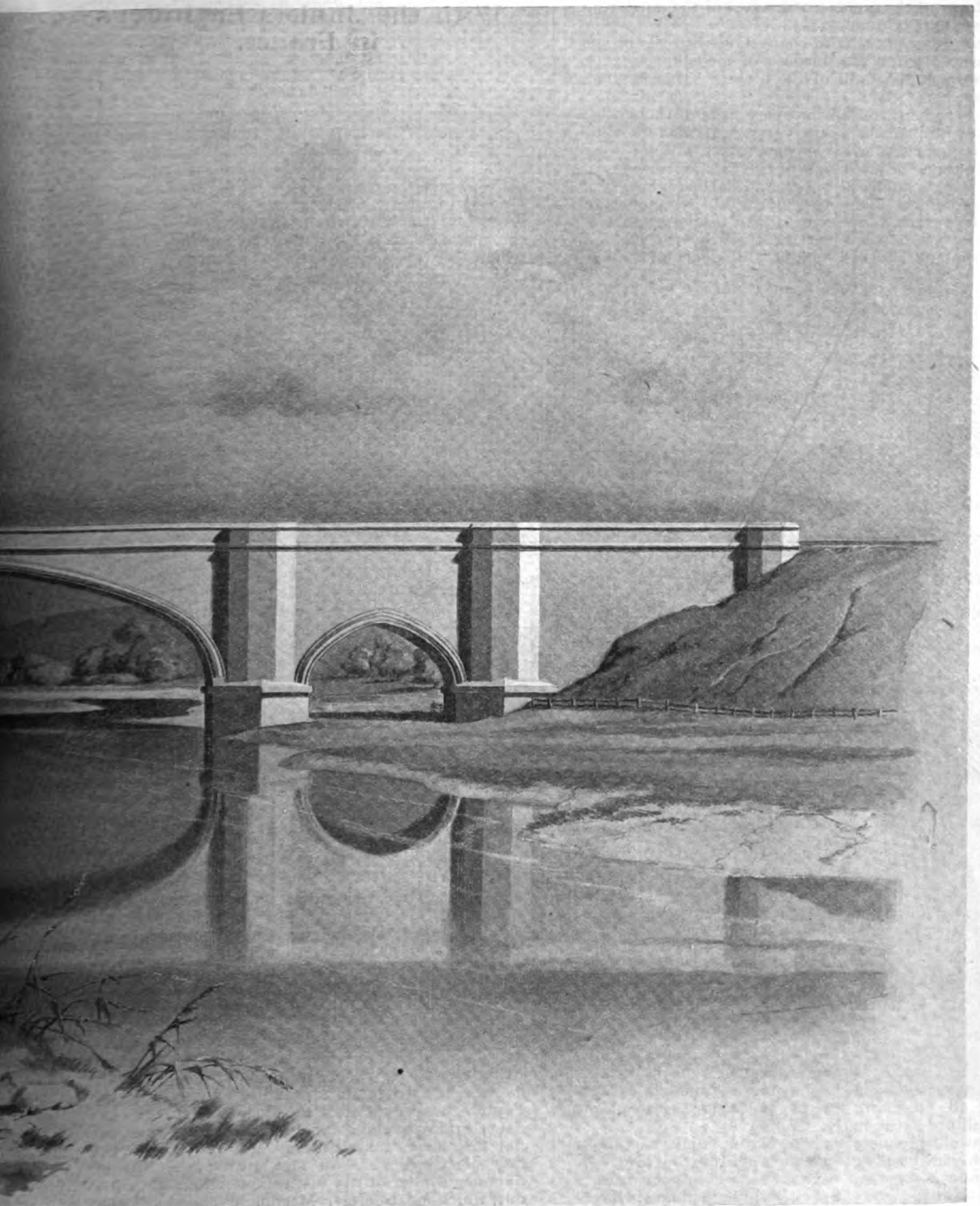


Fig. 22*a*.—Perspective View of Keynsham Overbridge.



GOTHIC BRIDGE SPANNI



THE AVON, NEAR BRISTOL.

the form of the arches on the face of the outer ring of voussoirs or arch stones.

One other drawing in connection with the bridge is necessary for the purpose of modelling, viz., a diagram of the radii of the arches. This is given in Fig. 25.

It is to be regretted that very little of this bridge is now visible, for some years ago when the line was being widened two new steel bridges were erected, one on each side of the existing stone one, the steel cylindrical piers and lattice girders of which almost hide the beautiful symmetry of Brunel's work. It seems a pity that the engineer did not see fit to widen the track by the method followed at Hanwell viaduct, Maidenhead bridge, and most of the other bridges on the line, not with steel, but in masonry of the same nature and form as that employed in the original work.

(*To be continued.*)

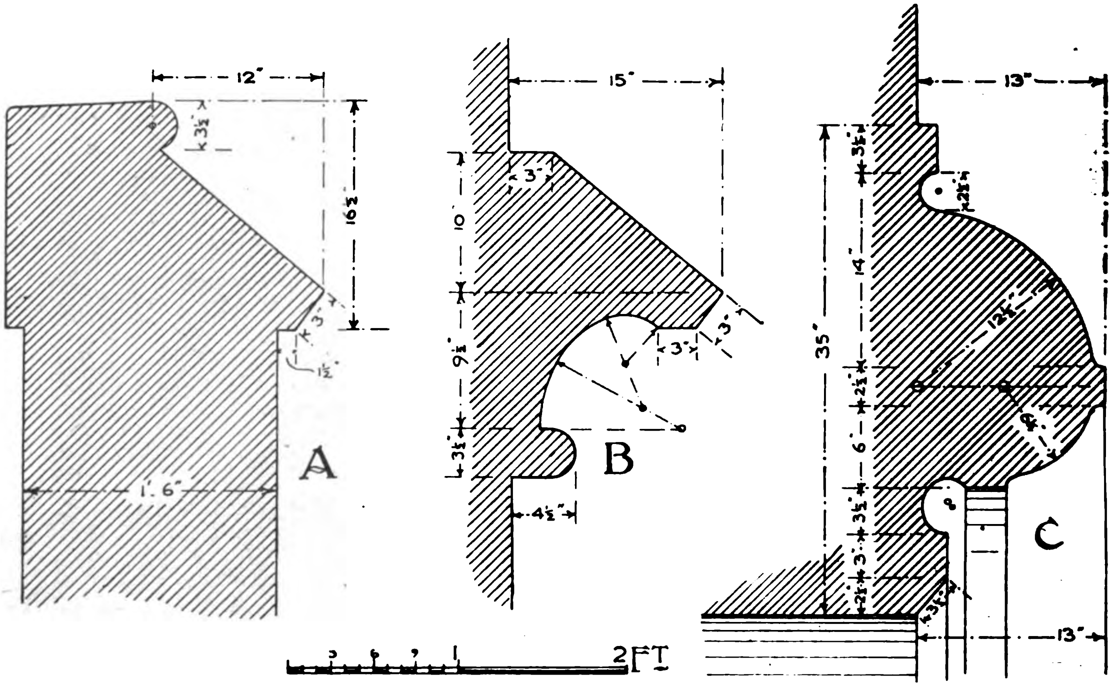


FIG. 24.—DETAILS OF MOULDING: GOTHIC BRIDGE, BRISTOL, G.W.R.

THE Japanese battleship, *Mikasa*, has undergone considerable alterations in her rig during her refit, and her appearance is in consequence much altered. The new armament is the same as the old, except that all guns are now of 45 calibres, instead of 40 calibres as formerly.

THE old Japanese cruisers, *Naniwa* and *Takachiho*, which some years ago had their fighting tops lowered, are now altogether without these appointments, says the *Engineer*. Specially high mainmasts have been fitted for wireless. "Flying topmasts," or top-gallants are being generally fitted in the Japanese fleet for wireless, as in ours.

With the Juniors Engineers in France.

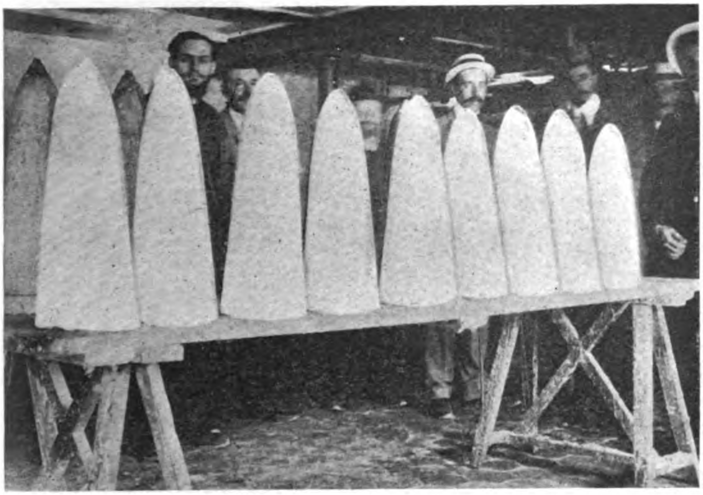
By "ATLAS."

(*Continued from page 141.*)

ON their return to Paris, the Juniors felt tired, for they did the journey by night and sleep was a matter of luck and a corner seat. However, we were not too tired to visit the large refinery of M. Say, to learn how sugar is made, or at least to learn how it is converted from the raw material into the symmetrical and tempting looking morsels with which we were confronted each morning at breakfast—not to mention other times. Here we saw the sugar-loaf—familiar object of our childhood—at home. We saw the sugar syrup prepared, the loaves poured, or cast, and finally the chopping up of the loaves into tasty tablets. The operations are simple, but—carried out on so huge a scale as we were enabled to witness—the plant required is enormous. The boiler range, the engine house, the motor delivery vans, and the syrup filtering and extracting plant provided a feast of engineering material which we appreciated to the utmost; likewise the delightful hospitality extended by M. Peytel, the President of the Board of Direction.

On Friday evening the Juniors dined. This was not their first dinner of the week, but it was the first official dinner. In fact, it was the Annual Summer Dinner of the Institution—a function without which no Summer Meeting is complete. On this occasion it was all that could be desired from the official point of view. A good dinner, with good speeches, everybody very amiable to his table neighbours, especially if they happened to be French, and an early conclusion to the proceedings. No music, no songs, no jollification; just a dinner, nothing more.

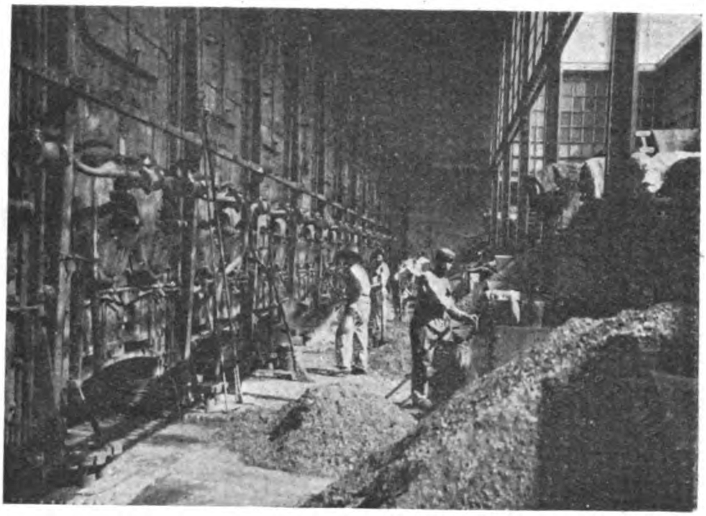
On the following evening yet another dinner, but a contrast. This time the Juniors were the guests of their President and the official mantle of the previous evening melted away like snow. Who could be formal at the Restaurant Pré-Catelan, surrounded by the woods, the birds, and the lakes of the Bois de Boulogne? Here MM. Paul and Albert Canet, with their charming wives and their family friends made the Juniors welcome. Nor did our President, far away on the northern shores of France, forget us, for he wired the kindest of kindly messages to his guests that evening, and the Juniors responded with cheers such that Juniors can only give. That evening will live long in the memory of the party. The dinner, the flowers, the music, each in their way superb, but above all the courtesy and real welcome of our hosts, made an impression on the Juniors which many years will not efface.



A Row of Freshly-made Sugar Loaves.

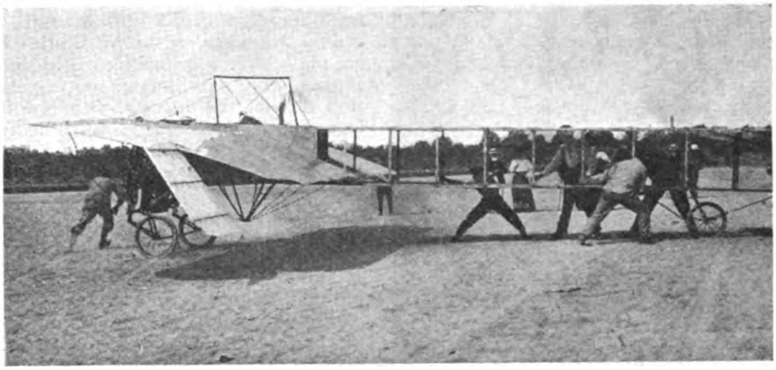
On the Monday the Juniors took their first lesson in the gentle art of flying, the *rendezvous* being at Issy-les-Moulineaux, the famous military exercise ground where so many aeroplanes have flown and failed. It is not easy to procure admission to this ground. Even after passing the scrutiny of the custodians of the gate a dashing cavalry soldier came galloping up to our party and demanded the production of a pass by each and every one. Fortunately these had been duly provided by the kind assistance of our honorary member, M. le Comte de la Vaulx, and the magic signature of M. Archdeacon on our cards satisfied the conscience of our military inquisitor. Our visit was well timed, for M. Bleriot had decided on that day to make a trial for the Armengaud prize, a reward of 10,000 francs (£400) to the aeronaut who stayed for 15 minutes in the air on an aeroplane. But aeroplanes are fickle things, and a defective circulating pump caused a delay of at least two hours before M. Bleriot could make a start. Meanwhile, the celebrated Henri Farman arrived and brought his machine out for an airing. The two inventors are working on somewhat different lines, for M. Farman pins his faith on a double decker, while M. Bleriot has a single plane machine. Twice did Farman try to fly, but on neither occasion did he rise more than a few feet from the ground. He then studied the weather, shrugged his shoulders, and left his machine alone. Events proved his wisdom, for later in the day, when the wind had dropped, he made a further trial and scooped the prize with a magnificent flight of twenty minutes. In course of conversation, he told us that he was not at all convinced that the best form of areoplane had yet been discovered. He said one could only find out by experience which gave the best results, and he was quite prepared for new departures in design.

M. Bleriot at last got going, and gave a couple of excellent demonstrations of what his machine could do, one flight lasting over three minutes and the other over eight. In the latter he circled round and round like some huge bird in pursuit of prey, but what a difference between the flight of nature and the flight of man. The ease, the grace, the quietness of the flight of a bird; how these contrast with the noisy beat of the engine, the almost as noisy whirr of the propeller, and the stiff-necked motion of the mechanical imitation. One cannot help this comparison as one sees an



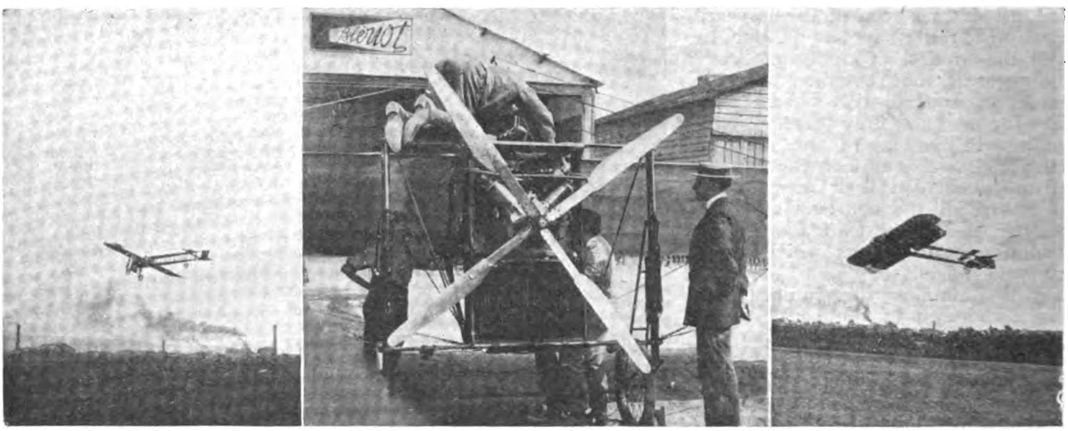
A Section of the Boiler House at M. Say's Sugar Refinery.

aeroplane in flight, but after all it is something accomplished, something done. The day of the commercial aeroplane is however long to come, even though our French friends at the trials were willing to bet that the Channel would be aerially crossed before 1909 was gone. Aeroplanes which fly fast have been built with some success. The man who builds an aeroplane to fly slowly will be the man who wins the race.



Starting the Bleriot Aeroplane.

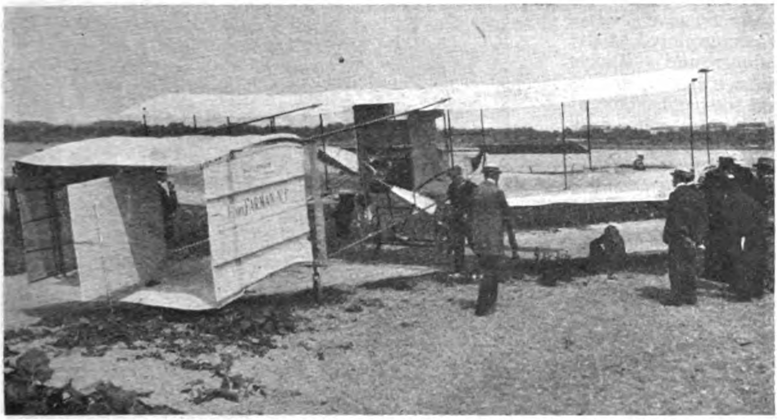
This is an appropriate opportunity for me to acknowledge the expert photographic services of Mr. W. J. Bassett-Lowke, who throughout the trip snapped everything of interest, and very kindly placed the results freely at my disposal for the illustration of my notes. On the flying machine grounds, too, his friend, Mr. T. K. Cobb, secured some excellent views, of which I have been privileged to make use.



The Bleriot Aeroplane at Rest and in Flight.

Not far from the scene of the flying machine experiments, is the cartridge manufactory of the Société pour la Fabrication des Munitions d'Artillerie, and thither the party made their way, by the kind invitation of their President. After all there was something of a kindred nature in this later visit of the day, for are not shells and bullets flying machines of a highly developed kind? The chief process on view was the drawing of the cases of large cartridges and shells from the solid discs of brass, and this was shown in all its stages. First we were shown a complete set of samples of each stage, from the plain disc to the finished case, and by this happy thought on the part of the management we were able to appreciate the more fully the working and the functions of the various machines we afterwards saw at work. It is a wonderful object lesson in the flow of metals to see solid discs, half-an-inch or more in thickness, dished up and drawn stage by stage into the thin elongated tubes which form the familiar cartridge cases. One could see the metal squeezed out as though it were the softest rubber, under the quiet but powerful persuasion of a huge hydraulic press, and to see the process through from start to finish left one filled with a sense of admiration for the master minds which had made this remarkable metallic transformation so easy and so certain in its working. Indeed, the easier the execution of the work, the greater the skill in the contriving of the method, and few mechanical processes illustrate this so well as the drawing of metallic tubes by hydraulic pressure. A flying visit to the electric power station which adjoins this factory, and a return to Paris by one of the always agreeable *bateaux mouches* brought another instructive day to its close.

On the Tuesday morning, a further honour was conferred upon the Institution in the form of a personal reception by M. Gustave Eiffel, the builder of the famous tower of that name. Naturally, this reception was at the tower itself, and M. Eiffel was kind enough to pilot the party throughout the structure from the basement to the flagstaff truck. This truly Parisian landmark has just celebrated its coming-of-age, for it was twenty-one years ago



THE JUNIORS ARE INTERESTED IN M. HENRI FARMAN'S MACHINE.

that the work of construction was commenced. The total height of the tower is 984 ft., and some 7,300 tons of wrought and cast iron were required for its erection. The uppermost platform to which the public are admitted is at a height of

JUNIORS INVENTING A NEW FLYING MACHINE.

906 ft. from the ground and is no less than 53 ft. square. Above this platform rises the campanile in the lower part of which is a spacious and well-equipped laboratory intended for scientific research. There is also a cosy little private reception room to which the Juniors were invited. Here they signed their names in the distinguished visitors book, a precious volume which includes the sign manual of our own King and Queen, of many of the crowned heads and Royal Princes of Europe, of Li Hung Chang, and other wise men of the East, and of scientific notabilities from all quarters of the globe. Here also the health of M. Eiffel was pledged with true Junior musical honours. Needless to say, the speech-making was of a *high* order. Restored to a less exalted position on the first platform, the Juniors partook of lunch in the modest way which becomes the lower stations in life, and afterwards departed to inspect the underside of Paris, by way of a contrast to the excellent view of the city they had previously had from above.

The underside of Paris, as exemplified in the tunnels of the Municipal Metropolitan Underground Railway, was much more restricted in view, but hardly so in interest, for this undertaking shows some really fine civil engineering work. A point of some importance is that for the underground railways the tubes are constructed by and belong to the city. The equipment and working of the railway itself is a separate matter, and is let by contract to a

THE GUARDIANS OF THE TRIAL GROUNDS.

commercial undertaking. The "Metro" in Paris seems to go anywhere and everywhere, and judging by the cheap fares and the crowded trains it is much appreciated by the people. The particular section which the Juniors were invited to inspect was a new line from the Porte de Clignancourt to the Porte d'Orleans. This crosses Paris from north to south following one of the most important lines of communication. It serves the Gare du Nord, the Gare de l'Est, the Central Markets, the City, the Boulevard St. Germain, and the Gare Montparnasse.

Just one more visit remained in Paris, to the St. Denis electric power station of the Société d'Electricité de Paris. This station was completed at the end of 1906 and serves the underground railways of the City in addition to various tramway routes and factories. It also is intended to supply current in bulk to other electricity companies who may have heavier loads than their present stations can supply. The works are divided into three main groups of buildings, viz., the coal stores, the boiler houses, and the generating houses. The total output of the station under normal conditions is 92,000 kilowatts, but this is capable of being exceeded by some 20 per cent. overload if need be. The generators are of the Parsons steam turbine type, made by Messrs. Brown, Boveri & Co., while steam is supplied by twenty-four Babcock & Wilcox boilers.

THE COUNT DE LA VAULX (Hon. Mem. J.I.E.).

Thursday was a *dies non* so far as engineering was concerned. It was occupied by souvenir hunting and final shopping in the morning, and by the journey to Le Havre in the afternoon. But I must not omit a reference to the scene at the St. Lazare Station, where the Juniors said "Good-bye" to Paris. On the platform were the brothers Canet and a host of other kindly friends who had come to wish us all *bon voyage*. The shaking of hands, the waving of handkerchiefs, and, lastly, the Juniors' ringing cheers made the station officials realise that an event was taking place. And so it was, for the only Junior Institution of Engineers in the wide, wide world was taking its leave of the city which it had grown to love, a city long to be remembered for its beauty, its engineers, and its hospitality.

No time was lost in Havre the following day. At nine o'clock in the morning commenced a tour of the harbour warehouses. Here we saw more coffee than most of us thought the world contained.

M. EIFFEL IS HAPPY.

Sacks to the right of us, sacks to the left of us, sacks by the hundred, and all containing coffee, enough to last France for three full years. But, beyond the coffee, there were things of engineering interest. Here something neat in the way of roof design, there a portable sack hoist with novel points; here, again, a stationary hoist operated by an electric motor, and so we wandered through warehouse after warehouse for nearly two hours, getting

M. ARCHDEACON AND M. ALBERT CANET WATCHING THE FLIGHT OF THE BLERIOT AEROPLANE.

a wonderful impression of the enormous import trade of Havre.

Precisely at eleven we crossed the road to the works of the Société des Forges et Chantiers de la Mediterranée, where we saw quite a good example

M. Gustave Eiffel "At Home."
(A snapshot at the top of Eiffel Tower.)

of a big marine engineering shop. Of novelty there was little or nothing, but we saw some excellent plant and some excellent work—two things which an engineer is always pleased to see.

Lunch was the next item on the programme, and no objections were raised to its due observance. Indeed, in a pleasant glass-sided *salon* overlooking the blue waters of the Channel, with lovely flowers on the table, and an excellent *chef* behind the *menu*, it was far from disagreeable, and no one shirked it.

We were again *en route* at two o'clock for the extensions to the harbour. This was quite a contrast to the engineering of the morning, for now we were introduced to new locks, new docks, new retaining walls, and the other features of harbour building work. "Exceedingly good work, too," was the verdict of the somewhat diminished party who braved the mid-day heat to see French civil engineering at close quarters. The object lesson of the morning as to the value of the commerce of the port enabled us to appreciate quite fully the need for the costly work to which we were introduced in the afternoon. Havre evidently does not intend to get left behind in the race for port supremacy.

Our final visit of the day—and, indeed, the only remaining visit of the meeting—was to the fine lighthouse on the cliff just above Ste. Addresse. This proved to be a fine representative of the splendid lighthouse service for which the French coast is famous, and, tired though we were, we thoroughly inspected the plant from ground floor to the topmost gallery. We then adjourned to tea, which we were fortunate enough to discover available on a lawn abutting on the cliff edge, in front of the lighthouse walls. Here we sat and rested and chatted over the doings of the fortnight. Spread before us in a glorious blaze of sunshine was a panorama of scenic beauty which it would be hard to surpass. So fine, indeed, is the prospect from the heights of Ste. Addresse

A Representative Group of Juniors.

(Reading from left to right:—Mr. Frank Durham, Mr. R. H. Parsons, M. A. Canet, Mr. W. J. Tennant, M. Paul Canet, Mr. Percival Marshall, Mr. H. A. Bassett-Lowke, Mr. W. T. Dunn, Mr. W. J. Bassett-Lowke, Mrs. W. J. Tennant, Mr. A. C. Beal, Mr. W. H. de Ritter.)

that competent authorities have compared it with the famous Golden Horn at Constantinople. It had one extra charm at least for us, for beyond the blue horizon lay the homeland so dear to the hearts of us all, to which the morrow would safely bring us once again. And, with the setting sun, the Juniors' Summer Meeting of 1908 came to its regretted but inevitable close.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Model Testing Tanks.

To the Editor of *The Model Engineer*.

Dear Sir,—In your periodical for June 18th last I notice an article on hull design. The methods suggested by your contributor may be all right for models, when great accuracy of comparison is unnecessary and, in fact, impossible. The apparatus shown is really of little use. In the first place, the writer makes a bad mistake.

The "law of comparison" for ships—enunciated by Froude—and also, I think, mentioned by Professor James Thomson in his work on similar structures, is—"The resistances of similar ships at corresponding speeds are proportional to the displacements."

Corresponding speeds, when the wave patterns are similar, are in the ratio of the square roots of the lengths:

$$V : v :: \sqrt{L} : \sqrt{l};$$

and since the resistances vary as the displacements, the power necessary varies as—

$$(\sqrt{L})^7 : (\sqrt{l})^7.$$

There is another thing—it takes a considerable "run" of a model before the model is moving at uniform speed, and until uniform speed is obtained, no results are known or are of use. The method of using multiple pulleys is also open to objection, and even when such tank methods are adopted for ships, multiple pulleys are never used.

Lastly, your contributor assumes the power of his boat (20,000 lbs.-ft. per min.). So the only use of these model experiments is to find the speed. That is to say, to find the best shape it would be necessary to make more than one model in paraffin wax, which, although wax is a most convenient working substance, would necessitate much laborious work.

I must apologise for the length of this note, but the facts are as I have stated, and your contributor's article is rather misleading.—Yours faithfully,

E. C.

Greenwich.

To the Editor of *The Model Engineer*.

Dear Sir,—I seem to have spilt the milk with a vengeance this time! I do not think anyone could have been more surprised or mystified than I was myself on reading the article referred to by your correspondent, which, as a matter of fact, I had entirely forgotten, having written it many months ago. Through some unexplained cause (for the first time since I commenced writing articles for your valuable publication) my proofs of the article went astray. Had I read the article again before it was published, I should have practically re-written it, as, since jotting down those notes, I have made some trials on the lines indicated.

The apparatus described was not intended to compete in any way with the very elaborate testing tanks which have more than once been described in your columns, but simply as an indication of what can be done to find the comparative merits of hulls of equal displacements towed with the same tractive force.

As your correspondent points out, the very inception of the idea is faulty, as multiplying blocks are a long way from being frictionless, but, if properly made and of sufficient diameter, with their spindles properly designed, they can be relied upon to give sufficiently accurate results when there are only slight variations in the weight actuating the mechanism—that is to say, that, although the power transmitted to the model will not be exactly that calculated from the weight employed, the comparative efficiencies of two or more models can be approximately judged.

In any case, the behaviour of a model in the water can be seen and the disturbance of the water can be compared, and the model altered so as to produce the least possible disturbance for a given speed.

As to the question of the length of the tank required to obtain the necessary acceleration, that can be, to a great extent, obviated by having a subsidiary towing-line actuated by an independent weight, which is arrested in its fall after the required velocity is obtained. In practice, it will be found advisable to use a chain or a series of weights attached to a cord, so that the power acting on the secondary tow-line is gradually diminished as the necessary initial speed increases.

In my experiments I used sections of lead water-pipe tied at intervals to a piece of string arranged in such a manner that, after travelling about 3 ft., the first weight came to rest, and, after running for 10 ft., the weight was entirely removed. As my towing appliance allowed of 30-ft. run, this left 20 ft. over which the boat could be timed. This was too short to obtain accurate results with an ordinary stop watch, although, of course, amply sufficient if some accurate recording instrument were used, such as the tuning-fork recorder used for measuring the acceleration and retardation of gun recoils, etc.

But, even if the speed cannot be accurately timed, the experiment is well worth trying by anyone intending to build a high-speed model, particularly if photographs be taken of each hull running under similar conditions—(it is advisable to take the photographs as near the end of the course as possible)—as a comparison of these photographs will enable the best form of hull to be chosen by selecting that which creates the least disturbance in the water.

As stated by your correspondent, the wax models are some trouble to make, but not one-tenth the trouble of making a finished hull; and, in my opinion, it is well worth while to see the comparative performances of each, even if not absolutely correct, before spending a lot of labour on a hull that may give very inadequate results.

In conclusion, I wish to express my appreciation of the kindness of the very eminent authority who has been good enough to correct my figures, and in whose hands I leave the technical side of the question.

The object I had in my mind when I wrote the article, if I remember rightly, was to induce other people to enlarge on the subject, and in this I seem to have been successful.

I should point out that in the article there are some misprints, which, added to my mistakes, increase the confusion. Printers do not seem to appreciate the importance of *powers* and *roots*!

For instance: $\frac{1}{4^3} = \frac{1}{64}$ is printed 1-43rd = 1-64th.

—Yours faithfully,

V. W. Delves-Broughton.

Model Yachting in 1857.

To the Editor of The Model Engineer.

Dear Sir,—Looking through a volume of the *Illustrated London News*, of 1857, I came across the following paragraph in the issue of May 30th of that year:—

> London Model Yacht Club.
>
> A very pretty little match among the models belonging to the London Model Yacht Club came off on Monday on the Serpentine River, Hyde Park. The race was for a valuable Silver Cup and a money prize.

In the light of the present day, interest in model yachting does not appear to be on the wane, even after a lapse of fifty-one years. It sounds rather quaint to read of the Serpentine "river." That the Serpentine forms part of a river is correct, it being fed by streams having their rise in the Northern heights of London.—I am, dear Sir, yours faithfully, A. M. H. Solomon.

Telegraph Connections.

To the Editor of *The Model Engineer*.

Dear Sir,—With reference to the letter of Mr. Johnson in the current issue of The Model Engineer under the above heading, I beg to point out that either one of the lines may be suppressed by using an earth connection at each station. Further, by using the two lines and earth, one battery only is needed, viz., that at A. The arrangement is shown in Fig. 1, in which A is represented ascending to B. With the two switches reversed in position to that shown in the diagram, B can send to A. In Fig. 2 is shown a central battery telegraph circuit, in which only one line and one battery are required. A is represented as sending to B, and, reversing the switches, transmission can be effected in the reverse direction. This circuit has the disadvantage that a permanent current is flowing when the line is not used. It is, however, widely adopted in America, the Colonies, and Germany. It is evident that instead of earthing the line at B, it may be extended to a further station similarly fitted as B, and, in fact, there are many such lines in use having twelve to twenty stations, with only a single battery at the head office.

By adopting the principle that polarised instruments depend for their action on the *direction* of the current, and non-polarised on the *strength* independently of the direction, two sets of signals may pass in opposite directions on *one* line wire simultaneously, and, again, with only one battery. The arrangement is shown in Fig. 3. Normally, a current from the zinc pole of the right-hand battery passes to line. The polarised apparatus P is not actuated by this current, as it is in the wrong direction. The non-polarised instrument is also

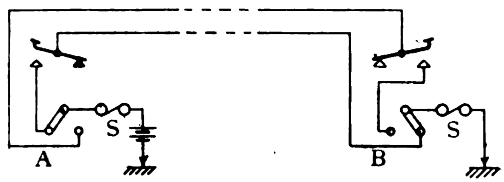


Fig. 1.

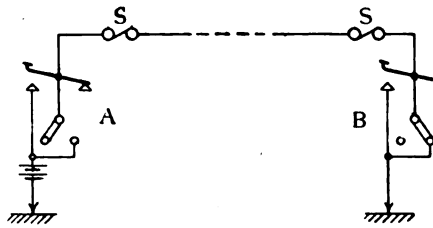


Fig. 2.

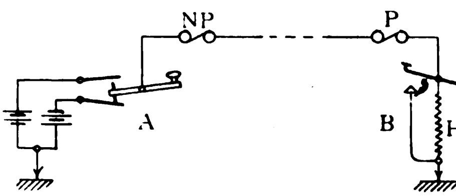


Fig. 3.

not actuated, as the current strength is too low, owing to the high resistance H R in circuit at B. Thus, normally, no effect is produced on either receiver. If the B key is depressed, the resistance is short-circuited, the current increases, and N P is worked. P is not affected, as the current has to change sign. If the key at A is depressed, the current is reversed, as the left-hand battery is now in circuit sending a copper current through the whole circuit. P is thus actuated, while N P is unaffected, the current being too weak. If now both keys are depressed, both receivers work, each one as long as the key at the other end of the line is held down.

This is known as a central battery duplex, and some hundreds of such circuits are now at work in this country, the batteries being fitted at a head office, from which the various lines radiate, thus reducing the apparatus required at the out-stations and the cost of maintenance.—Yours faithfully,

H. H. Harrison.

[Limitations of space compel us to hold over a letter from Mr. S. Wilson on this subject.—Ed., *M.E. & E.*]

Queries and Replies.

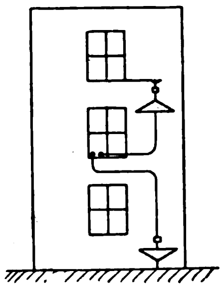
[*Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.*

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26-29, Poppin's Court, Fleet Street, London, E.C.*]

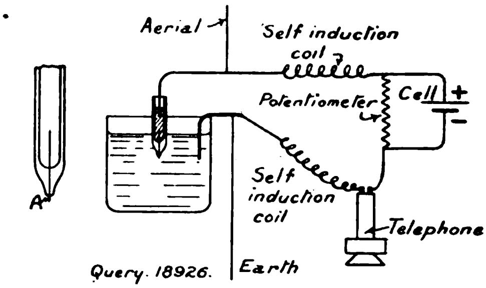
The following are selected from the Queries which have been replied to recently:—

[18,926] **Wireless Telegraphy.** R. B. (Brussels) writes: (1) I am ready to construct an aerial behind my house for purposes in wireless telegraphy, but I know not if I can connect the wire from the induction coil to the middle of the high capacity aerial. My small laboratory is the second annexe, and I have pierced in the wood window a hole in which I have fastened a glass tube as insulator. What is the best way — both the connections being for the high capacity aerial? The induction coil must remain in the annexe. (2) What is better in my case to have for the lower capacity—a true connection with a gas pipe, or a lower capacity insulated from the earth and placed some centimetres over them? (3) In the Castelli coherer which I have made the globule of mercury is after a little time covered with carbon particles. What must I make to have the globule of mercury always clean? The carbon used is rod carbon for arc lamps. (4) I have already the book of "Wireless Telegraphy," by Howgrave-Graham, but could you tell me if the book "Handbook of Wireless Telegraphy," by Murray, is advantageous? What is its number of pages and form? (5) Electric cars run in my street and in front of my house is a feeder; when a car is running a very fat spark is produced near the pulley of the trolley at the rupture of the current. Is this spark due to self-induction and could it act upon a receiver placed in the house? (6) Would a 3-centimetre induction coil work a tube for *X*-rays? (7) Could you give me a sketch of an electrolytic detector (Ferrié).

(1) It does not matter much where your connection to the spark-gap is made. It may be on a level with the "annexe" or lower. Two connections must, however, be made as shown in sketch.

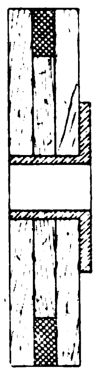


(2) We cannot say whether a direct earth would be better or worse than an insulated lower capacity area. It depends somewhat on the surroundings. We incline to think that for such an installation as this an earth connection would be better. (3) Probably if you give the ends of the carbon plugs a vigorous brushing with a brush of rather fine stiff bristles, such as a clothes brush, you will prevent the detachment of carbon dust and the mercury globule will remain clean. (4) Murray's book is very good indeed, and we are sure you will find most valuable information in it. It is, however, not designed especially for the use of amateurs and goes further into the theory and practice of commercial wireless telegraphy. (5) Yes; the spark at the trolley should certainly act on a receiver in your house. (6) Such a coil is barely sufficient for *X*-ray work, though you could doubtless get some results with a suitable tube. Five or six centimetres is the smallest spark usually recommended. (7) The only really practical electrolytic detector of which we know is made as follows: A short length of the very *finest obtainable* platinum wire is fused into a piece



of glass tube, a very small piece being allowed to project as at A. The wire should be as small as 1-1000th of a millimetre. This thickness can only be obtained by plating platinum wire with silver, drawing it out until the core of platinum is of the right size and then fastening it in place and dissolving off the silver from the tip with nitric acid. The point is dipped into a dilute solution of sulphuric acid into which a piece of thick platinum wire also dips. A potentiometer is used for giving a small and easily variable voltage across the detector and the changes of current produced by the action of the waves are made to actuate a telephone. The thin wire should be positive and the thick one negative. It is advantageous to hammer the tip of the wire to a flat spade-shape before fusing it into the glass. Contact may be made with the fine wire by pouring some mercury into the tube and dipping a wire into it.

[20,084] **Wooden Pulley Construction.** A. E. (Hove) writes: Would you kindly give me instructions as to the best method of constructing a wooden driving pulley of, say, 15 ins. to 20 ins. diameter and 2 ins. to 3 ins. on face. I have already made one from two thicknesses of 1-in. elm board, well seasoned, well screwed together with the grain crossed, but it soon twisted and warped so as to become quite useless. A method such as an amateur could manage would oblige.



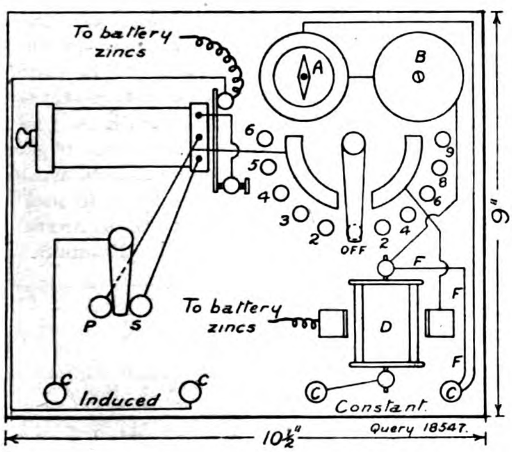
QUERY No 20084

Our issue of July 1st, 1901, contains directions for making pulleys which would probably serve your purpose. You might try the following:—Two discs of wood of the diameter you require and ¾ in. to 1 in. thick are screwed one on each side of another disc of similar thickness but 4 ins. less in diameter. The bush can be made either from a casting or by brazing a ring of brass to a piece of brass tube. The space between the two outer discs is filled in with lead, which gives the pulley a good weight.

[20,055] **Electro-plating Dynamo.** A. V. (New Norfolk Tasmania) writes: I have a compound-wound electro-plating dynamo of American make. I have unwound the wire from field-magnets as I wish to shunt-wind same with one wire only. The magnet cores are 1½ ins. in length, and circumference is 5 ins. and depth of cheek ⅜ in. The dynamo is of the undertype Manchester pattern. I have unwound one of the armature coils, and find it to be the same size as No. 18 B.W.G. and 21 ft. in length, of which there are six on armature, which is a twelve-section one wound in six sections. The armature is 2 ins. in length, 3 ins. in diameter. What wire and quantity must I wind on field-magnet to give the highest efficiency for electro-plating, say 6 volts? Also what amperage would I be able to get, and what would the required speed be? The coil I unwound on armature has twenty-six turns. In rewinding I had to cut off about 6 ins.; will that make any difference? How much silver per hour would a dynamo of 6 volts 5 amps. deposit?

A current of 5 amps. will deposit about 310 grains or 20 grammes of silver per hour. From a dynamo giving only 5 amps. on short-circuit you will not get 5 through your electrolyte. The amount of current depends on its resistance. You do not give an adequate description of the field-magnet, so that we can only roughly estimate the best winding. Try winding with about 160 yds. (2 lbs. 5 ozs.) No. 19 S.W.G. The machine should give you 16 amps. at a little over 12 volts—taking for granted that magnet is about usual proportions. No, the coil which you rewound will not lose in efficiency because of its being 6 ins. shorter, provided that it has the same number of turns as before. Drive at about 2,400 r.p.m.

[18,547] **Shocking Coil and Battery Connections.** F. R. (Garstang) writes: I herewith enclose sketch of a constant and induced current medical battery which I have just come in possession of. What I would like to know is, what is the instrument A as the two wires have been cut which is very like a compass? The wires of B have also been cut which is a switch and should have a handle to work it by, and I think it should be wired as per sketch, and the wire F dispensed with as it has no groove for it to lie in as there is for all the others. D is a current reverser. C is handle terminals. There is only one pair of handles which are of the usual pattern, brass at one end and wood at the other; but when I attach them to the constant side I cannot feel any current at all, but when I connect the terminals to a bell it will ring. Should there be another special pair of handles for this side? The induced side works well.



Without more detailed particulars we cannot give you a sketch of the proper arrangement of connections as you do not say what the construction of the reversing switch is like, or if the semi-circular set of contacts are connected to a resistance or to the cells. The instrument A is a galvanometer to indicate the strength of current flowing when the "constant" arrangement is being used. If it is intended to read directly the word milli-amperes will be marked on it; if not, it would have to be calibrated to read quantitative amounts of current. The apparatus B may be a resistance or a shunt. Your particulars are not explicit as to its construction. If it is a resistance it should be connected in series with the galvanometer as in your sketch, but if it is a shunt, which

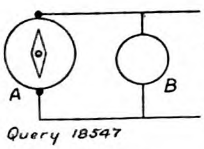


FIG. 1.

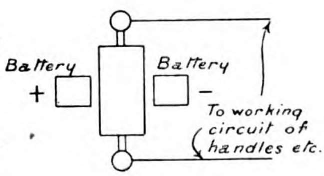


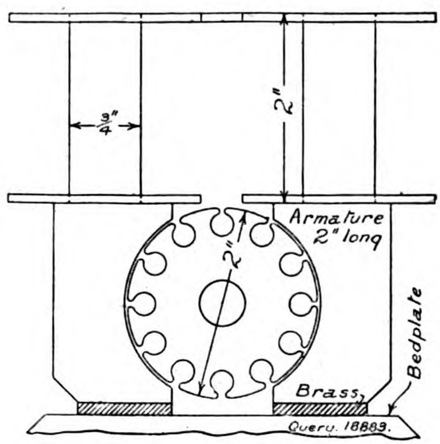
FIG. 2.

we think probable, it should be connected across the galvanometer terminals as Fig. 1. The object of a shunt is to enable the galvanometer to read with both strong and weak currents. When the shunt is switched on nearly all the current may pass through it instead of going through the galvanometer coils. It is necessary to know these proportions to be able to calculate the total current actually flowing from the battery, as it will obviously be shunt current plus galvanometer current. The semi-circular row of contacts may be either for the purpose of putting in a regulating resistance or more or less of the cells. Both poles of the battery must be connected to the reverser and the outer circuit connected to the remaining contacts of the reverser, as Fig. 2. The constant current must be applied to the skin by means of wet handles. These usually consist of metal plates covered with sponge, flannel, or soft wash leather. When applied, they are soaked in warm salt water. Wire F is not wanted.

[19,966] **Apprenticeship.** H. J. L. (Holloway) writes: I know you are always ready to help would-be engineers. I shall be 18 in December, and am studying to become an engineer. I am in my fifth term in the VI Sc. form at a London public school. I passed the London Matriculation about eighteen months ago, and am sitting for the Later B.Sc. (Engineering) soon. In addition to such theoretical and mathematical and scientific knowledge as this examination requires, I have some fair knowledge of integral and differential calculus. I can also read and speak French, and, with some difficulty, read German. I am intending to enter for a scholarship at Cambridge in December, with a view to taking the Mech. Sc. and Math. Triposes if successful. I happened to become aware the other day that Maxim's, of Barrow, pay youths of the status of premium pupils at the rate of 5s., 7s. 6d., 10s., and 12s. 6d. a week during five years. I think this is unusual, but I should like to know if any London engineering works do it. I think I shall pass the Inter Sc. Do you think it would be best for me to endeavour to enter a London engineering works, or to go to Cambridge, if possible? I should prefer a locomotive works. (I think there are three in London)) I have some miscellaneous practical knowledge—gathered partly from S.M.E. visits and a general idea of locomotives, studied as a hobby. It is necessary for me to support myself partly (not less than 8s. a week). I at present hold an L.C.C. scholarship. If I went to Cambridge, I could almost support myself. If I went to a London works, I should try to complete my B.Sc. by study and experience.

We believe most large firms pay the apprentices at the rates you mention, and premiumed pupils also frequently get a small amount of remuneration weekly. Your best plan would be to make personal application to one or two firms you select, and find out what their terms are. We doubt very much, however, whether you will obtain a minimum of 8s. a week to start with if you have not been in the shops before, and all we can suggest is that you try to come to terms with some suitable engineering firm. Your theoretical knowledge might in some measure compensate any firm which took you on for your inexperience in regard to shop work, and might induce them to pay you the minimum wage you suggest. We much regret we cannot give you any further particulars.

[18,883] **Windings for a 40-watt Undertype Motor.** G. Mc C. (Cullybackey, co. Antrim) writes: Can you tell me the size and quantity of wire to use for winding a small motor? You will find a rough sketch enclosed. I have got one of your handbooks and I am working from it. Could so small a one be driven off a 16 c.-p. lamp, or what size of batteries would do?



To run your motor from supply mains through a 16 c.-p. lamp you should wind with 6 ozs. No. 24 S.W.G. on the armature and about 2¼ lbs. No. 26 S.W.G. on the field-magnets. You may require more than one 16 c.-p. lamp to obtain the necessary current. You will find whether this is necessary or not by trial. If more current is required, connect two or three such lamps in parallel.

[19,409] **Penny-in-the-Slot Machine.** S. S. (New Mills) writes: Can you please send me a sketch or information on making a penny-in-the-slot electric machine for exhibition purposes? If it is in any back number of THE MODEL ENGINEER, please let me know.

Some particulars of a penny-in-the-slot machine were given in our issue for October 11th (1906), to which please refer. See page 358.

The Editor's Page.

SINCE our first model Motor Boat Regatta on July 25th last, we have received many letters, couched in very appreciative terms, from readers of our Journal who were present on that occasion, and we take this opportunity of tendering our thanks to one and all. We doubt not but that many who watched the proceedings this year are greatly tempted to take a more than passive interest in this now popular sport in the future.

* * *

An item of interest to model yachtsmen residing in and around Tooting will be found in a letter from Mr. J. R. Jack, which we have pleasure in publishing. He writes: "Dear Sir,—I think it should be a matter for congratulation to amateur yachtsmen to know that the pond on Tooting Bec Common (near the Asylum) is now reserved for boats, the L.C.C. having, upon my representation of the facts, decided to prohibit the bathing of dogs in that water. It would be a pleasure to me to be instrumental in forming a club in the neighbourhood, and I shall be glad to receive the names of any proposed members, either by letter or personally, at this address.—I am, dear Sir, yours faithfully,

8, Rose Villas, J. R. JACK."
Rosenberg Road, Upper Tooting,
London, S.W.

* * *

A reader hailing from West Australia sends us the following letter, which we commend to the notice of those whom it may possibly concern. Had such lack of forethought been evinced by any private individual a plea of inexperience and ignorance might possibly exonerate him, but such carelessness on the part of any business house is only an effective means of preventing orders recurring. This may be an isolated case; we believe it is; but in the interests of our readers abroad we willingly afford our correspondent's letter full publicity: "Sir,—As a reader and interested party frequently purchasing goods from some of your clients, will you allow me to offer a little friendly advice, and when the facts are assimilated it may do good. Some British firms seem to think once they get the cash it does not matter a cent how, when, and where, the customer comes in as regards expense and condition of the goods. This is a trait John Bull hugs, with the consequence orders go to Germany, where packing and forwarding has been brought up to a science. An instance: Last year I bought certain goods, to be sent *via* Singapore to West Australia; although part of the machinery consisted of steel and electrical goods, leaving London during the winter, everything was carefully wrapped in newspaper, the case then filled with damp shavings and shop sweepings, having to come *via* Singapore and lie in a godown till the branch steamer could collect, and, being middle of hot season, goods started to sweat, and by the time I got them, what should have been bright steel work was solid rust, and goods useless. Now, on top of first cost (£16) came freight (£2 10s.), agent clearing £1 10s. od. and Customs on landed cost of £20, £7 10s. od., or a total of £27 10s. od., wasted—simply because the firm could not afford to use a little waterproof paper to wrap. As a matter of fact, there was no difference made in the packing than if they were to have been delivered in some London street, instead of 14,000 miles away. A man gets chary of doing business like this. Being among probable buyers of small machinery, I want to be certain goods will be shipped, so that the buyer stands a chance of getting same in good condition, and I think a word from you may do an amount of good. Also—why do not sellers give weight of articles, to enable buyers at a distance to form an idea of cost?—Yours truly, G. G. MANNERS.
Engineer."

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26-29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

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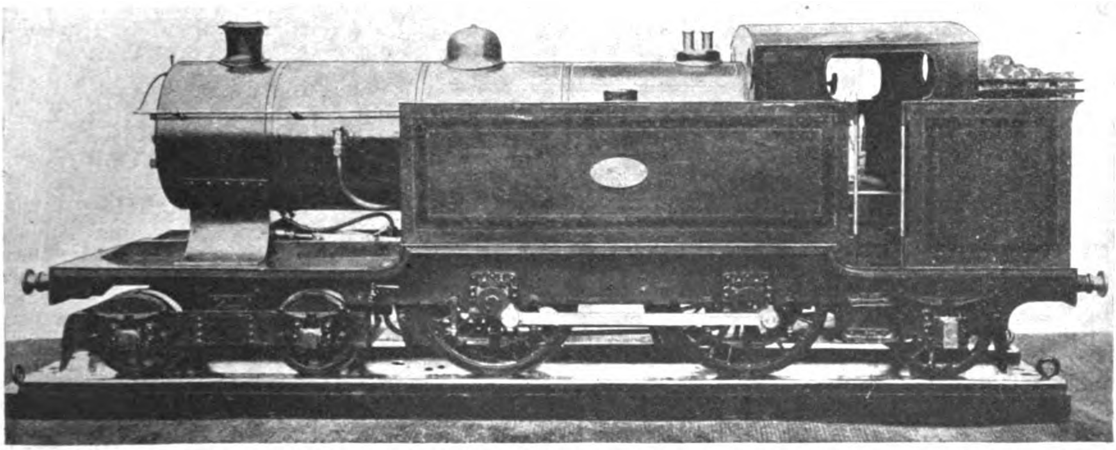
Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.
VOL. XIX. No. 382. AUGUST 20, 1908. PUBLISHED WEEKLY.

A Tank Locomotive.

By J. D. BRYANT.



MR. J. D. BRYANT'S TANK LOCOMOTIVE.

THIS engine was designed for me by Mr. E. L. Pearce, to my own specification, and constructed entirely by myself. It was built to suit Mr. Crebbin's track at Muswell Hill, and is 4½ ins. in gauge. The total length over all is 2 ft. 9 ins; width of footplate, 8 ins.; coupled wheels, 5 ins. diameter; cylinders, ⅞ in. by 1½ ins.; with valves on top actuated by Joy's gear.

The main and bogie frames are cut out of ⅛-in. sheet brass, all the plating is of German silver, to avoid rusting, as also are the piston, valve, and coupling rods. Cylinders gun-metal, with slide-valves of German silver.

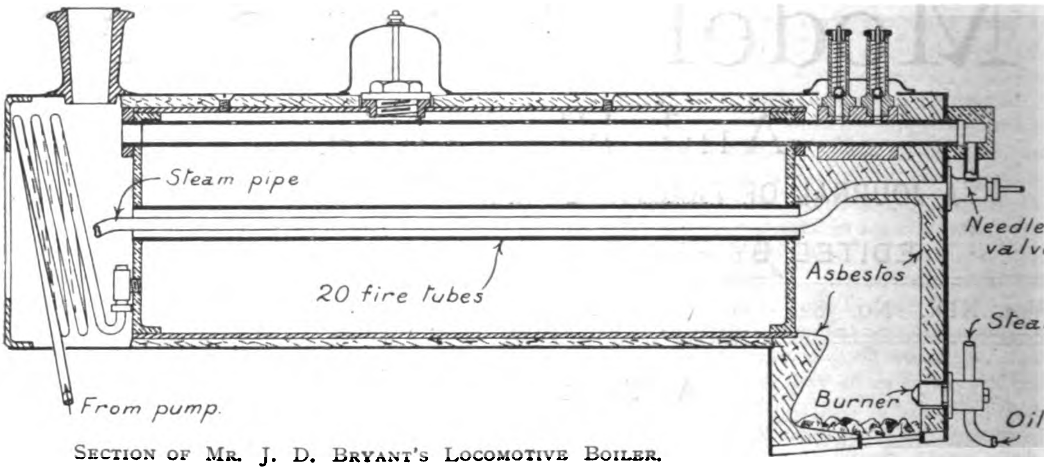
The boiler is a plain copper tube, with gun-metal ends fastened with two rows of countersunk brass screws and sweated; length, 13 ins.; diameter, 4½ ins.; twenty ½-in. firetubes, expanded and sweated. There is no firebox, but the space inside the case round the fire is thickly lined with asbestos. There is no dome to the boiler, but under the dome casing is the filling plug, which is also fitted with connection for bicycle pump and back-pressure valve for starting the burner, which is of the atomising type, particulars of which were given by Mr. Palmer in THE MODEL ENGINEER some time ago.

Along the top of the boiler (inside) a tube is fixed extending at the after end to outside the casing, where it ends in a square block brazed on, from which all the steam connections are taken. There is also another block nearer the boiler, to which is fitted the double-ball safety valve.

The steam is superheated by the steam pipe being taken through the furnace and one of the flue-tubes to the engines. There is a feed-pump attached to the engines which passes the water into the fore end of the boiler through a coiled pipe in smokebox. The hand-pump in the cab feeds through the back-pressure valve at side of boiler.

The boiler steams very freely, and will make more steam than the engines can take, and by putting some cinders or coke in the firebox the boiler will keep steam very nicely when standing by. The cab top lifts off for working the engine, and also the top of the coal bunker, under which is the regulating valve for the fuel.

This boiler is very simple to construct, and for the design I am again indebted to Mr. Palmer.



SECTION OF MR. J. D. BRYANT'S LOCOMOTIVE BOILER.

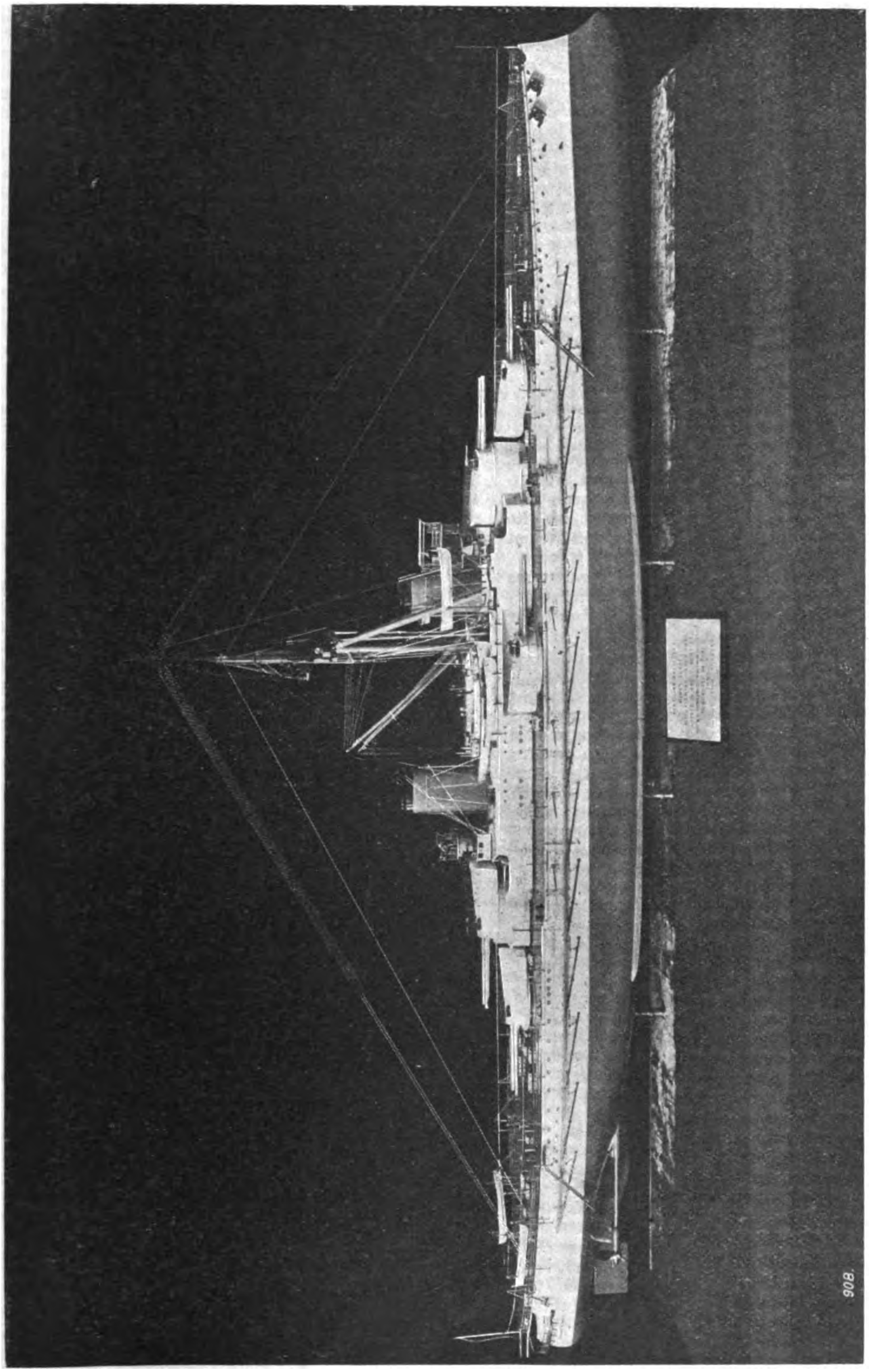
Models and Machinery at the Franco-British Exhibition.

By "ATLAS."

(Continued from page 38.)

THE reader interested in models of ships will be in his element, a magnificent collection awaiting him in the French and British Sections in the Machinery Halls, whilst others are to be found in the various Colonial pavilions. Entering the French Section, and passing by the machinery, we reach the French ship models, and to the left notice that of the first armour-plated ship—*La Gloire*—which changed the method of battleship construction. She presents a curious appearance, with her sails and side battery of old-style guns, amongst the collection of battleships, cruisers, and torpedo-boats. Included in these is the *Danton*, one of the latest battleships, with four screws; the *Victor Hugo*, triple screws; and the *Waldeck-Rousseau*, the commerce-destroying cruiser *Guichen* (23·54 knots, triple screws, over-all length 133 metres, 25,455 h.-p.). France's latest armoured cruiser—the *Ernest Renan*—is also represented (24 knots, twelve guns 164·7 mm., four guns 194 mm., 36,000 h.-p., length 137 metres by 21·36 metres breadth), built by the Société Anonyme Chantiers et Ateliers de St. Nazaire (Penhoet). Messrs. Schneider and Co., Chantiers de Châlon-sur-Saône, exhibit a collection of torpedo-boats and destroyers, including two models of marine engines—one triple expansion vertical, 8,000 h.-p., one-tenth scale; and the second a triple-expansion horizontal engine. One set of models illustrates the history of the torpedo-boat and submarine, some being in section, showing the internal arrangement of engines and boilers, etc. Messrs. Normand & Co., the world-famed torpedo-boat builders, of Havre, who boast that the firm has been carried on by seven generations of Normand since 1688, show, amongst other models, one of Madame Rothschild's fast yacht *Gitana*, built for use on Lake Geneva, speed 26·03 knots. Near this is a model of the vertical triple-expansion engines of the ss. *Perou*, 6,000 h.-p., remarkable in having separate admission and exhaust valves of lift pattern, worked by cams, which receive their motion from ordinary eccentrics and link motion. The link gear drives a rocking shaft, which carries the cams and is placed in an enclosed space at the side of the cylinder. The arrangement is known as the Lentz system, and the model is cut away to show the arrangement of the valves and gear, exhibited by Messrs. Chantiers de l'Atlantique, St. Nazaire (Penhoet). In this hall is a pretty model of a pumping plant, made by Messrs. Forges et Chantiers de la Mediterranée, Havre. It consists of a three-crank horizontal engine placed upon its side, the crankhshaft being vertical, so as to drive direct upon the shaft of a centrifugal pump placed in a chamber underneath. The engine frame is specially designed to suit this application, the machinery being used for pumping out a dock; a neat model of the separate air pump and condenser for this engine is included.

The British ship models show to great advantage,



MODEL OF THE BRAZILIAN BATTLESHIP, "MINAS GERAES." Displacement, 19,250 tons; Speed, 21 knots.

Built by Sir W. G. Armstrong, Whitworth & Co., Ltd. Designed by J. R. Perrett, Esq., F.R.S.N.A., etc.

as compared with those of the French Section, in wealth of detail, as well as workmanship and finish. Our model makers have more than held their own against our friends across the Channel. The British Section is an education to amateur ship modellers, and I am sure our readers will find time go all too quickly as they examine the series of superb examples of so many types, from launches and lightships to cruisers and battleships. Commencing at one end, we find the Fairfield Engineering & Shipbuilding Company, Glasgow, with a model of the first-class battleship *Commonwealth*—425 ft. by 78-ft. beam and 27-ft. 3-in. draught, 19½ knots speed; also a model of the Isle of Man Steam Packet Company's paddle steamer, *Empress Queen*—360 ft. by 42 ft. by 25 ft. 6 ins., 2,500 tons, 22 knots speed. Also a beautiful model of the first-class armoured cruiser *Good Hope*—500 ft. by 71 ft. 1 in., depth 40 ft. 1 in., speed 23 knots. Alongside is a model of the scouts *Forward* and *Foresight*—365 ft. by 38 ft. 9 ins. beam, draught 14 ft., speed 25¼ knots. Then, coming to Messrs. Hawthorn, Leslie & Co.'s stand, we find a model of the ill-fated turbine destroyer *Viper* and one of the Waveny class of 25½-knot destroyers. Messrs. Thornycroft & Co., Chiswick and Southampton, whom we may call England's pet firm of torpedo-boat builders, show a model of the fastest vessel in the world—a turbine-driven destroyer—length 270 ft. by 26 ft. beam by 8 ft. 9 ins., speed 35·363 knots mean on six hours' continuous trial, scale ¼ in. to 1 ft. Also a model of the celebrated *Lightning*, the first torpedo boat built for the British Navy—84 ft. 6 ins. by 10 ft. 10 ins. by 5 ft. draught, speed 18 knots, built in 1876. Messrs. Yarrow & Co., Glasgow—also world-famous for torpedo vessels and shallow draught steamers, always to the front with developments in this class of work—show a very interesting model of a sea-going torpedo boat propelled by petrol; there are four propellers on separate shafts, each driven by a separate six-cylinder engine; length 110 ft. by 13 ft. 6 ins. by 17 ins. draught. The hull is of peculiar shape, and the presence of a funnel gives the boat the appearance of a steamer. This, however, serves as a ventilating shaft, up which a ventilating fan, driven by a special engine, discharges its exhaust. The speed is stated to be 24 knots, but we have been given to understand that this speed has not yet been attained on the trials. There is also here a model of a shallow-draught launch, with propeller partly raised above the water-line; draught is only 11 ins., length 75 ft. by 9 ft. 3 ins., speed 10 miles per hour. The S.E. & C. Railway show a model of their old paddle steamer *Calais-Douvre*, now broken up. This vessel had a twin hull, with central paddle wheels, and was one of the various attempts to combat sea-sickness when crossing the Channel. In contrast is a fine model of their turbine steamer *Queen*. Two splendid paintings of Calais and Boulogne harbours are well worth seeing by lovers of the artistic. At Messrs. Vickers, Sons & Maxim's stand is a model of the famous protected scout, *Sentinel*, a boat from which much has been expected—length 360 ft. by 40 ft. by 13 ft. 8½ ins., 17,700 h.-p., speed 25¼ knots. Messrs. Cammell, Laird & Co., Birkenhead, exhibit a beautiful model of the third-class cruiser *Topaze*—360 ft. by 40 ft. by 21 ft. 9 ins., 9,800 h.-p., speed 22 knots; also a very fine model of the celebrated ocean-going torpedo destroyer *Cossack*—270 ft. by 26 ft. by 16 ft., speed 34 knots. A really superb example of ship modelling—perhaps the gem of the whole collection, though it is difficult to make comparisons—is exhibited by Messrs. Armstrong, Whitworth & Co., Newcastle-on-Tyne. It is one of the Brazilian battleships, about which so many rumours are circulated just now—the *Minas Geraes*, twin-screw, 19,250 tons, 21 knots. (See page 171.) Adjoining, and by the same firm, is a beautiful model of the Brazilian scout *Bahia*—triple-screw, 3,000 tons, speed 26½ knots. The British battleship of to-day is represented at the stand of Messrs. W. Beardmore and Co., Ltd., Dalmuir, N.B., by a grand model of the *Agamemnon*—410 ft. 6 ins. by 79 ft. 6 ins. and 27 ft. draught, 16,500 tons, speed 19 knots.

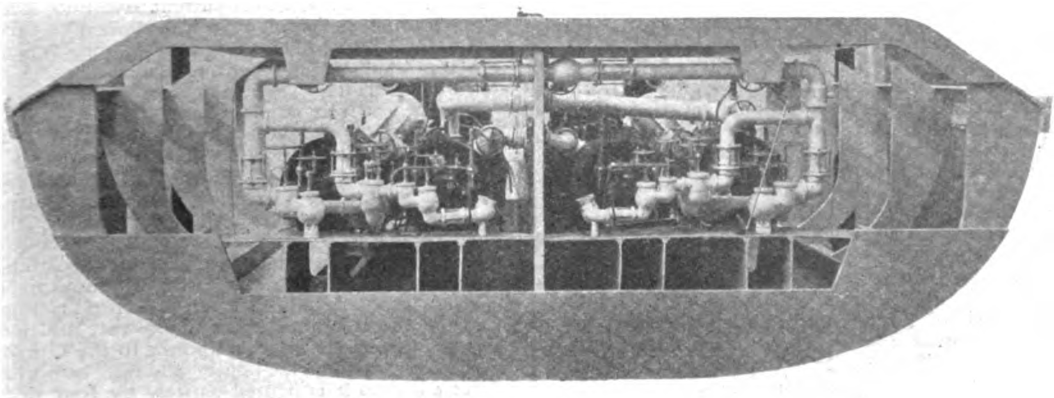
The amateur interested in sailing yachts will find some half models by Messrs. Summers & Payne, Ltd., Southampton; they include *Vendetta* (40-rater) and *Corsair* (40-rater); there is a half-model of the famous schooner *America*, and the beautiful silver model of the *Britannia*, lent by His Majesty the King. The mercantile marine is well represented; there is a model of the *William Fawcett*, the P. & O. Company's first mailboat of 1837. She was only 206 tons and her engines of only 60 h.-p., speed 7 knots—an example showing how great things start from small beginnings. In contrast is a model of the recent P. & O. turbine steamer *Morea*—557 ft. in length, 11,500 tons. Reviewing the exhibition of ship models as a whole, it is interesting to notice the difference in the ideas of the designers of the French and English-built warships. Wireless telegraphy is much in evidence, the various systems of aerial sending and receiving wires being reproduced in complete detail on many of the models. The French battleships and cruisers, with the exception perhaps of the *Ernest Renan*, do not seem to be of so serviceable a design for fighting purposes or so seaworthy as the British-built ships. A remarkable feature is the number of windows—they can scarcely be called portholes—which are cut through the armoured sides, just as if the ships were to spend nearly all their time at anchor in harbours, the comfort of the crews being the most important consideration. Comparisons, as we know, however, are odious. We are not for one moment disparaging our good partners in the *entente cordiale*, but emphasising the unusual opportunity which exists at the moment of seeing a very fine collection of marine models. Messrs. Normand & Co. have some beautifully illustrated pamphlets showing boats and engines of their manufacture; ask one of the attendants in this section for a copy if you are specially interested in yacht and torpedo work.

Messrs. Parsons Marine Steam Turbine Company exhibit two models showing the ship arrangement of sets of turbines with three and four shafts, also models of the *Viper* and *Turbinia*.

The following particulars of their models are of interest:

(1) Model of the *Turbinia*, the first vessel to be fitted with Parsons' marine turbines, was constructed at Wallsend-on-Tyne, in 1894, the dimensions being—100 ft. in length, 9-ft. beam, 3-ft. draught of hull, and 44 tons displacement. She is fitted with turbine engines of 2,000 h.-p., with an expansive ratio of 150-fold, also with a water-tube boiler of great power of the express small-tube type. The turbine engines consist of three

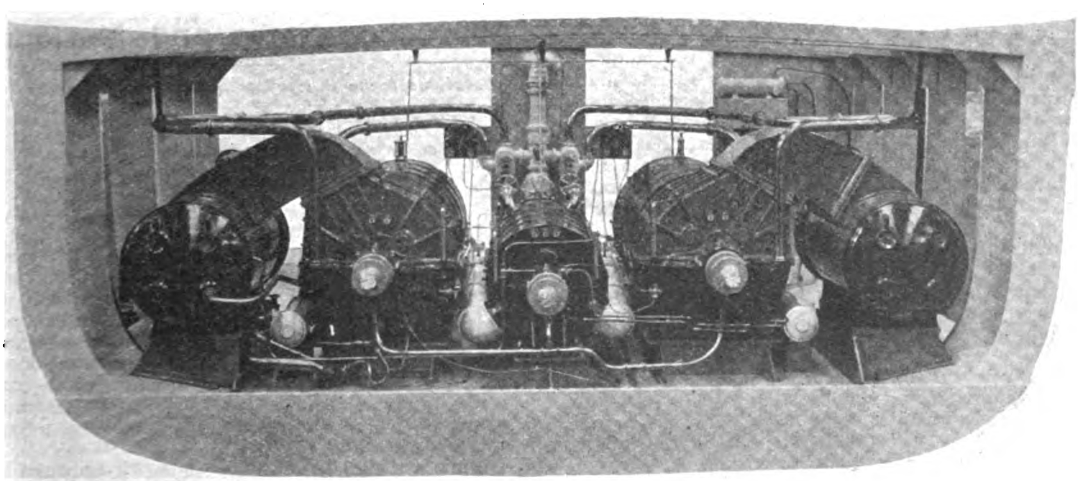
separate turbines—the high pressure, the intermediate, and the low pressure—each driving one screwshaft independently. An astern turbine is fitted to the centre-shaft. The maximum indicated



MODEL SHOWING ARRANGEMENT OF PARSONS TURBINES DRIVING FOUR SHAFTS.

horse-power obtained on runs of about 5 miles duration was 2,300, which gave a speed of 34½ knots.

(2) Model of H.M.S. *Viper*, one of the first torpedo-boat destroyers to be fitted with Parsons' turbines; the turbine engines of this vessel consisted of two distinct sets, one on each side of the vessel. There



MODEL SHOWING PARSONS TURBINES ARRANGED TO DRIVE THREE SHAFTS.

were four screwshafts in all, the outer shaft being driven by the H.-P. turbine and the inner by the L.-P. turbines, and to each of the inner shafts a reversing turbine was also permanently coupled. With the full trial weights on board, and at a displacement of 370 tons, a mean speed of 36·581 knots, or nearly 42 statute miles, on a one-hour full-power trial, was obtained, the fastest runs being at the rate of 37·113 knots, and the fastest pair of runs 36·869 mean.

The illustration below shows the interior of engine-room of a typical three-shaft arrangement of Parsons' turbine machinery, as usually fitted to mercantile vessels and yachts. The arrangement consists of three turbines—one high pressure, driving the centre shaft; and two low pressure, working in parallel, driving the sideshafts; in the exhaust casing of each of the low-pressure turbines is placed the reversing turbine.

The other view shows the interior of engine-room of a four-shaft arrangement of turbine machinery as fitted in large war vessels. The arrangement consists of two complete sets of engines, one set on each side of the vessel, with an astern turbine fitted on each shaft, and cruising turbine on the inner shaft.

Of the various photographs, one shows H.M.S. *Dreadnought*, fitted with turbines constructed by the Parsons Marine Steam Turbine Company, Ltd., of Turbinia Works, Wallsend-on-Tyne. Another photograph shows the *Mauretania*, with the *Turbinia* lying alongside. The photograph gives one an idea of the progress made with Parsons' marine turbines.

In 1894 the *Turbinia* was the only vessel fitted with Parsons' turbines, whilst at the present time the total horse-power of Parsons' marine turbines constructed and on order amount to about 1,750,000.

Messrs. Mather & Platt, of Manchester, exhibit an example of large gas engines; the one on their stand is of 800 to 1,000 b.h.-p. size, with twin horizontal cylinders, speed 107 r.p.m., direct-coupled to a three-phase generator; also an interesting item is an actual wheel of a Zoelly steam turbine, showing the arrangement of the vanes. Amongst the machine tools, Messrs. John Holroyd & Co., Milnrow, Lancashire, show some screw-milling machines, by which the thread is cut by a revolving toothed cutter instead of a fixed single-point tool. Advocates of planers *versus* milling machines will be interested in the remarkable electric-driven planing machine shown in operation by Messrs. Joshua Buckton and Co., Ltd., Leeds. This machine is of large size, and its feature is their patent Regenerative Spring Balanced Table, by means of which a very rapid reversal and return motion is obtained, with an actual decrease of driving power at the moment of reversal. This is effected through the use of spring buffers at each end of the bed, by means of which the kinetic energy of the moving table is absorbed when it is brought to rest and restored after it is reversed. A similar idea has been in use for many years to assist in reversing the type-tables of printing machines; but this machine tool is a revelation to anyone familiar with the difficult problem of reversing and accelerating the table of a planing machine, and shows the great progress which is being made by engineers in reducing labour costs in the production of machinery. A chart which is before me at the moment shows a recorded drop in current from 80 amps. to 30 amps. at the moment of reversal from cutting to return stroke; the current then rises gradually to its former value, dropping slightly at the reversal from return to cutting stroke. This firm also show a small testing machine of their well-known horizontal lever type, with improved recorder; they will break a specimen bar upon request by anyone specially interested.

Messrs. C. A. Parsons & Co., Heaton Works, Newcastle-on-Tyne, have a large steam turbine at work running at 1,800 r.p.m. direct-coupled to two continuous current generators, giving a total output of 1,800 kws. at 560 volts; they also show an actual set of turbine blades. At the same stand they have some models, one of a turbo-blowing engine, scale 1½ ins. to 1 ft., and the other of a turbo-alternator, with exciter, scale 1 in. to 1 ft. Near this exhibit is one by Messrs. The British Westinghouse Electric and Manufacturing Company, of Trafford Park, Manchester, consisting of one of their latest vertical high-speed gas engine, 750 b.h.-p., with tandem single-acting cylinders, driving on to a three-throw crankshaft, direct-coupled to 500-kw. direct-current dynamo, which is connected in parallel to the Parsons' turbo-generator, the two machines supplying current for the whole of the lighting and power in the Machinery Hall. The engine is running with producer gas from a plant just outside, installed by Messrs. The Power Gas Corporation, Ltd., Stockton-on-Tees. It is a good example of an up-to-date gas engine; a finished crank and valve shaft is at the front of the stand, and forms an interesting part of the exhibit. Two more of these engines are at work in the engine-house outside the Canadian Pavilion; each is of 200 b.h.-p. size, running at 325 r.p.m., with illuminating gas—(they give 150 b.h.-p. each with producer gas), and is direct-coupled to a 1,300-watt multipolar dynamo supplying light and power to the Canadian Section. This engine-house should be visited after dark, as it is lighted entirely by four Cooper Hewitt mercury vapour lamps. It is the best example we have yet seen of the possibilities of lighting by means of mercury vapour lamps. The light has a very pleasant effect, and is exceedingly restful to the eyes, in marked contrast to the strain caused by the flame arc lamps in the interior of the pavilion. The effect of the light upon the skin, or any object of a red colour is, as is well known, very peculiar, but it is this very absence of red rays which relieves the eye, and unless one looks at such objects, the effect of the light is most pleasing.

(*To be continued.*)

Workshop Notes and Notions.

*[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "*WORKSHOP*" on the envelope.]*

Hints on the Polishing of Ebonite.

By E. Wilson.

The average amateur experiences more or less difficulty in polishing ebonite to his satisfaction. When "finished," he generally finds a deep scratch here and there, making the whole thing look unsightly; indeed, it appears worse, on close inspection, than if it had been left with the ordinary rough finish. Now all this trouble is without doubt traceable to the desire to scamp the job; and, really, there is little surprise at it, for one must admit that to polish ebonite thoroughly is a very tedious operation.

Now to proceed. Most of the work required by the amateur may conveniently be polished in the lathe. After having cut the piece out roughly with a hacksaw, file it to size, using a rough file, and taking care not to scratch it on any side that may be already polished. Next, use a smoother file on it, finishing up with a "dead" smooth.

Having proceeded so far, the work may be taken to the lathe. First, use a rather coarse emery wheel (a disc of wood with a circle of emery cloth glued on it), keeping it revolving at a high speed, and, above all, see that the wheel is always kept well-oiled for should it run dry, the heat generated by friction of the two surfaces will cause the ebonite to burn, and very soon produce a rough brown surface. Continue using emery wheels, finishing with a "dead" smooth one. Here a hint might not be out of place. Do not use a finer wheel until all the scratches produced by the previous one are removed by the wheel then being used. If one does so, he will sorely regret it after, for this is the cause of nasty scratches appearing on an otherwise finely polished surface; and to attempt to remove them afterwards requires an immense amount of time.

Arrived at this point, the work should begin to present a fairly good surface. The next step is to use a cloth-covered wheel, always having a fair supply of Bath brick on it and plenty of water. This operation will take a considerable time, to say nothing of a vast amount of energy, unless the amateur is fortunate enough to have "power" for his lathe.

During the whole of the polishing, care should be taken to see that the corners of the work are kept "sharp," for such an apparent detail shows the difference between a careful and a "don't care" workman.

This part of the programme at an end, the ebonite should present a fairly good polish, and it will, in most cases, suffice the amateur to stop here; but if he desires to obtain a still higher polish, he may do so by proceeding as in the last operation, substituting rotten-stone for bath brick.

It will be found that if this method be carried out in a careful manner, excellent results are attainable.

An Improved Method of Making Spiral Coils.

By "Nolege."

The following method of making spiral coils for springs or resistances has several advantages

Fig. 1.

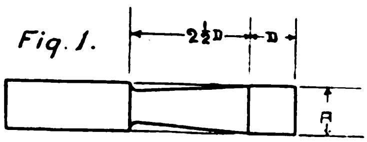


Fig. 2.

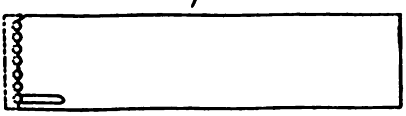
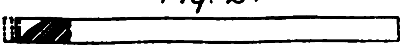


Fig. 2a



over the usual method of coiling the wire, which is kept under tension on a long, circular rod. The chief are—the length of the coil is unlimited, the pitch or number of turns per inch can be made to suit, and the internal diameter of the coil constant.

Fig. 1 is the mandrel. This is best made of silver steel; the amount of taper depends on amount of spring in the wire—the greater the spring the greater the amount of taper, which should be recorded for reference when making other size mandrels.

Fig. 2 is the spacing and forming tool, which is made of mild steel. The spacing of the holes is equal to the required pitch of the coils, which are drilled 4-1,000ths or 5-1,000ths in. larger than the

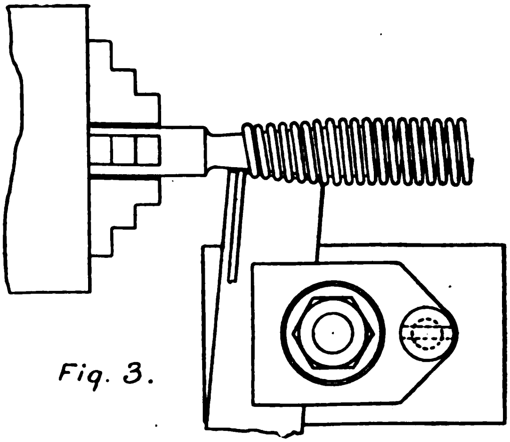


Fig. 3.

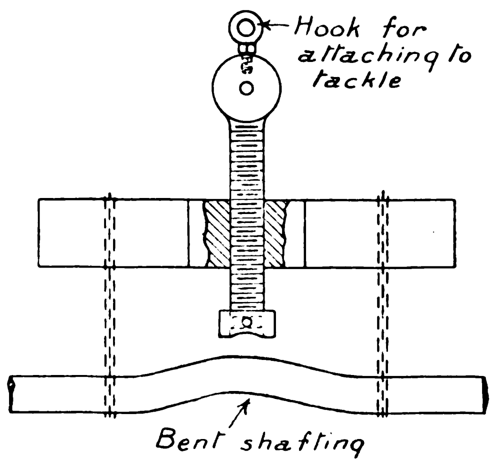
diameter of the wire to be used. The dotted portion is then cut away, leaving half the holes, which act as guides for the coils. The first hole should be given a good lead for the wire (Fig. 2a).

Fig. 3 shows a coil in the making. A start is made by putting a few turns on by hand, which are placed in the recesses of the former. The former is then pressed fairly tight up to the mandrel, and all is ready for turning off the desired coil.

A Useful Chain Cramp.

By C. Timlin.

This cramp is very easily made and will be found useful for removing flywheels from shafts. Fasten the chains round the two opposite spokes and

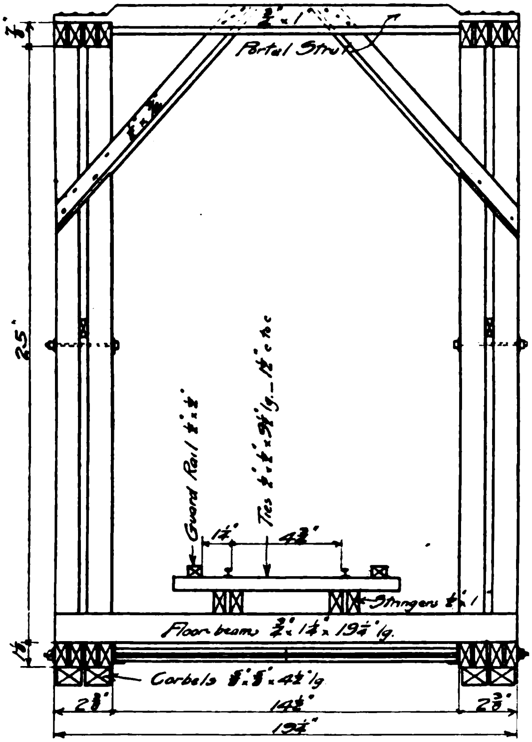


apply pressure with a bar. I have used it for straightening shafts in the way shown above. It is a tool no shop should be without. The chain being adjustable, it can be used for anything where pressure is needed.

A Model Railroad Bridge.

By J. P. Davies.

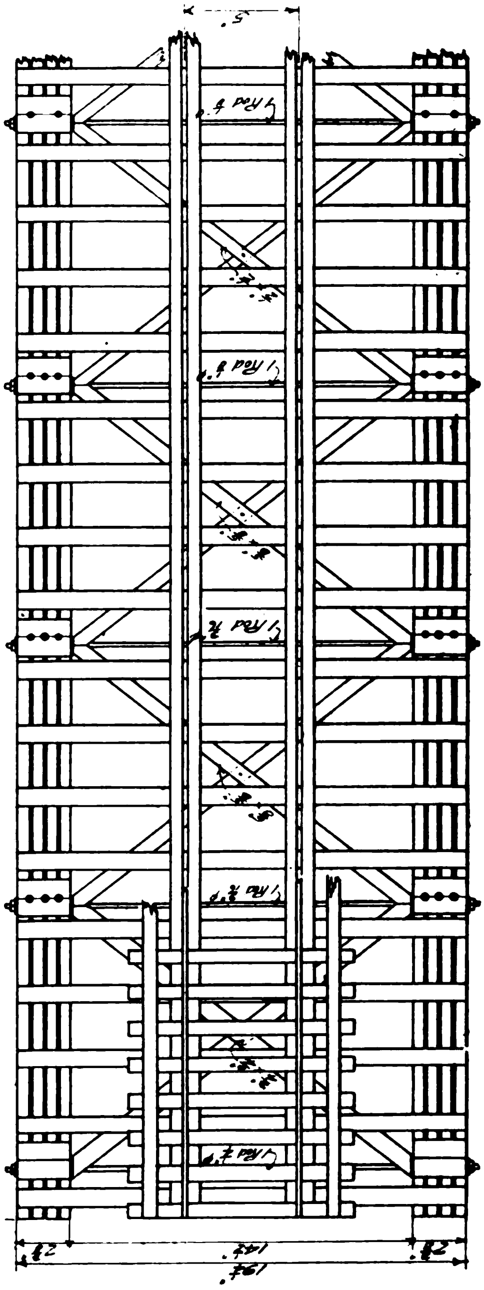
THE accompanying drawing represents a scale model of a typical American Howe Truss railroad bridge. Bridges of this type are now very seldom constructed in the States, and the old ones are rapidly being replaced by steel structures, plate girders being substituted for spans up to about 120 ft., and truss bridges, riveted or pin-connected, for larger spans. For a new country however, where the timber is available, this type of bridge is probably unsurpassed for cheapness and utility.



End Elevation

Scale :] [⅛ full size.

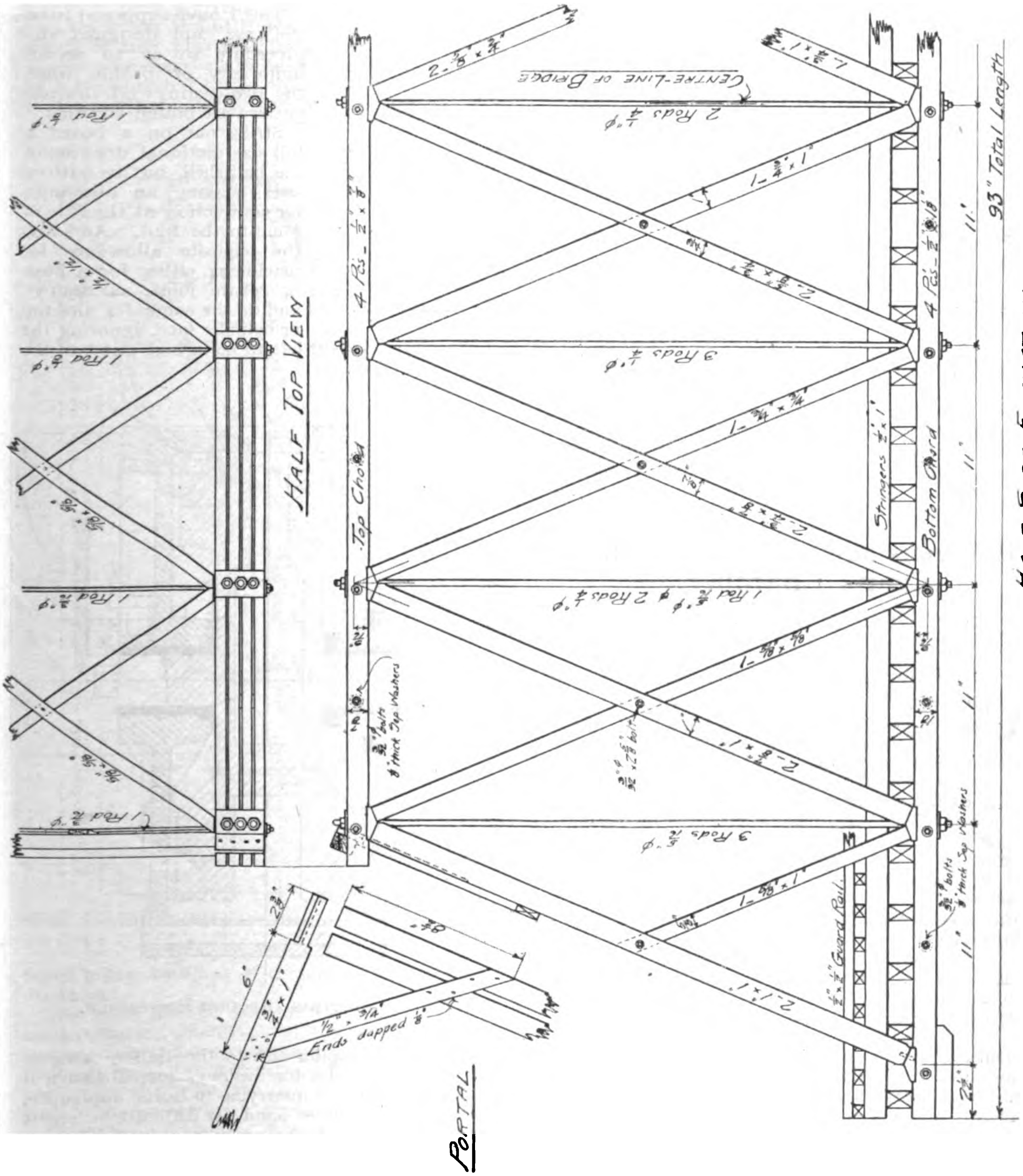
For modellers who may desire to make variations in the design the following points may be of interest. For increase in span up to about 150 ft. the sizes of the wooden members increase only slightly, and the strength of the bridge is largely determined by the size of the vertical rods and their bearing-plates. As a rough guide, it will be noted that each group of "end-verticals" carries a little less than one-quarter of the maximum load on the bridge, and that the load on the other verticals gradually decreases as we approach the centre of the bridge. Knowing the load on the end-verticals in pounds, and dividing it by 10,000 lbs. (assumed allowable tensile unit-stress), we obtain the required net area or area taken at root of threads for these rods. Similarly, the required area of the metal bearing-plates is found by dividing the load by 500 lbs. (assumed safe-bearing unit-stress). If it be desired to construct a bridge of less strength than this



Half Plan of Floor

Scale :] [⅛ full size.

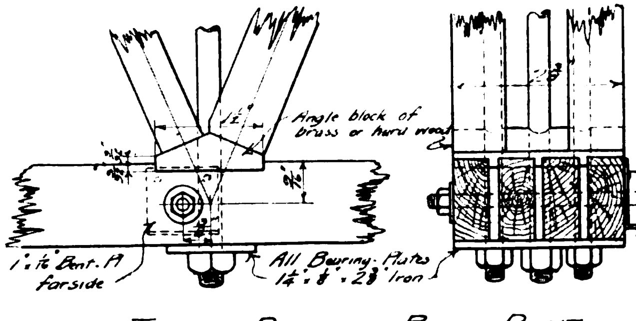
example, the chord-members may be reduced to three sticks each and the size of the web-members reduced to correspond, also the floor-system may



DESIGN FOR A MODEL RAILROAD BRIDGE: 93-IN. HOWE TRUSS SPAN. (Scale: $\frac{1}{8}$ full size.)

be lightened by using a fewer floor beams and only one line of stringers under a rail.

This type of bridge is frequently constructed as a "deck" span, *i.e.*, where the train runs on top of



TYPICAL DETAIL AT PANEL-POINT

Scale :] [⅛ *full size.*

instead of "through" the bridge. In this case the trusses are placed closer together and the floor-system is laid on the top chord, also opportunity is given to insert a system of "sway bracing" to give stiffness against overturning, the lack of which is one of the greatest objections to this type of bridge when constructed as a "through" span.

Patterns for an Aluminium Crank Chamber.

(*With special reference to Mr. Hawley's 2½ h.-p. Cycle Motor.*)

By J. D. GARSCADDEN.

A JOB such as this furnishes an extreme case for the difficulties of the amateur (and professional) in fashioning a pattern out of a material strong only in parallel lines in one straight direction, to a shape designed, of course, without regard to the weakness of the medium that is to produce it. This curvilinear frailty also increasing proportionately to the radial thinness of wood, necessitates in a case like this taking as much pains with a pattern for "one off," as if there were a hundred.

But however much it may be regretted from a commercial standpoint that there is not a more suitable material to make patterns of (or that patterns are necessary at all), the readers interested who will follow my instructions and turn out a good job for this may justifiably think well of themselves and be assured that no purely wood-working difficulties, at any rate, will ever hinder them, either in the pursuit of a pleasant hobby or in grim, commercial production.

The exigencies of space preventing me from repeating elementary instructions already given in "Simple Lessons in Pattern-making," I will presume that readers have profited by those, and proceed to briefly explain the drawings, which, I trust, are already fairly demonstrative.

The first question is whether to make one pattern, with alterations, do for each half, or make a separate one for each with its own particular fittings; but this I leave to be decided as determined by individual circumstances. If the facilities for casting in aluminium are at all handy, and only one set wanted off, then one shell pattern will be sufficient and save a deal of work.

This I have supposed to be the case, and designed the procedure so as to secure uniformity of profile when the two castings off the one pattern are bolted together.

Strike out on a board a full size sectional drawing of the half shell, but to pattern sizes, making an allowance for contraction at the rate of ⅛ in. to the foot. Add also the requisite allowance for machining, either for a flush or rebate joint, as desired, and do the same for the top or cylinder face, ignoring the rebate, as this is best left to be turned out "of the solid," as we say.

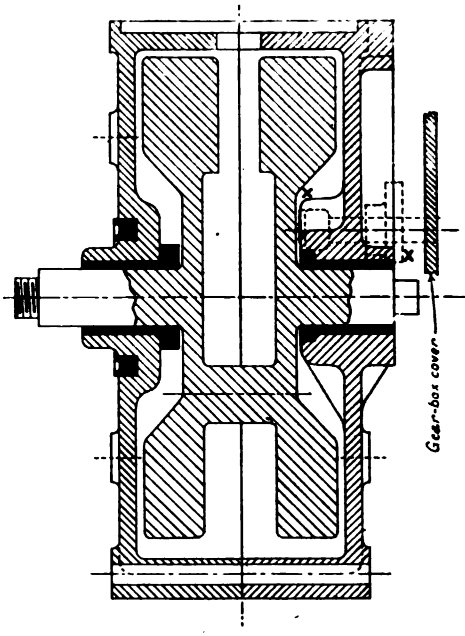


FIG. 1.—SECTION THROUGH ENSEMBLE.

This remark applies also to the ball race recess and the centre holes for bushing, for, although it means a good deal of quarrying to home appliances, it would, on the other hand, be difficult to centre cored holes with the accuracy required in a job like this.

The next step is to prepare a building board (Fig. 3), on which to build a complete ring to form the rim and snugs. Plane this true, and draw the major and minor diameters of the ring on it, allowing a good margin, as shown, to pare ultimately to finished sizes. It is a rather risky process to a novice, but if the reader prefers to ultimately turn the inside to finished sizes, he should begin building on a wood faceplate fastened to the chuck of his lathe, and he will then be able to true up the face of each successive course as he builds.

Be that as it may, however, rough-cut to profile eighteen pine segments (as in Fig. 3), and plane to a thickness of a little over the third of the inside width of rim, plus machining, from wall to joint. Fasten the first course down to building board with decapitated brads, two in each segment, so that the whole can be comfortably removed from

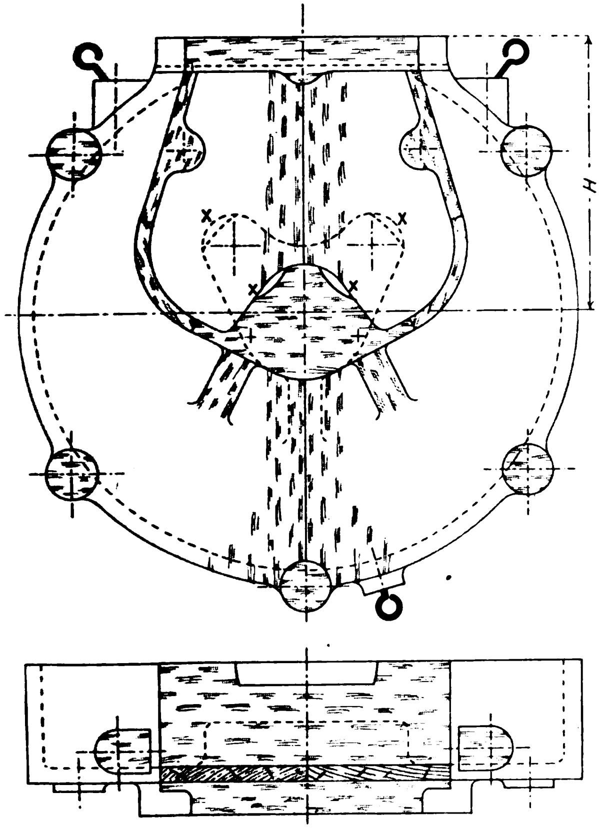


FIG. 2.—FINISHED PATTERN OF GEAR BOX HALF.

board when building is completed and the brads drawn out.

Glue need not be used until the planting of the second course, when it should be applied very hot, and not too thick to prevent rubbing out. Good joints are essential, as the strength of the job depends largely on the glue, the narrow radial width precluding the use of brads when finished.

There are, however, three alternative wrinkles I would submit to you for the overcoming of this typical difficulty.

The first is to drive and punch home two temporary brads in each segment immediately after glueing, in the position shown by arrow-heads on E (Fig. 3); mark the radial position of same on outside edge, and, when starting to cut to profile after all is built up, gouge down well clear of pencil marks, in the manner indicated by dotted lines. A little judicious chipping will then enable the brads to be withdrawn. This plan admits of the building going on continuously, and left to dry as a whole.

The next method is to stitch the glued segments down while drying by two temporary brads *not* driven home, but left projecting sufficiently to be withdrawn by pincers after glue is set.

As this would not have the same holding-down or clamping effect as home-driven brads, attain the latter by driving them through chips of ⅛ in. to ¼ in. thick. These can be easily split off when glue is set and brads pulled.

Mem.—If this plan be adopted, dip the points

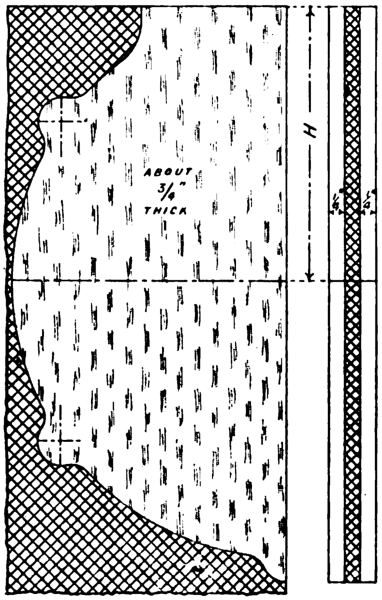


FIG. 4.—METHOD OF MAKING SIDES.

of brads into tallow or oil before entering, *but watch the heads.*

The third way is to insert permanent brads in the previously marked centre of stuff, as shown at E also. This would be my plan, but I warn the reader against it if he is not sure of going straight, as a brad projecting into the line of paring is—well, to speak mildly, not nice.

When the ring is completed, plane to finished thickness and cut away that portion between A A A A, and then cut across from B to B. This can all be done while still attached to the building board, and do not detach it until you have made and fixed the flat piece C, forming crown, by four screws, as shown.

This piece should be kept longer in the meantime, as seen by dotted lines, to facilitate the squaring over of the centre accurately for drawing off.

Now prise the whole carefully and equably from off the board and fit in pieces (not too tight) on each side to carry the centre. From C square the centre-line right round, and also from the still elongated C piece gauge the centre-line across.

Next draw off the *inside* on both top and bottom, making a difference of about 1-16th in. in the diameters for draught, and taking care to produce the radius far enough round to provide extra metal for the cylinder holding-down bolts, as at G.

Now pare from line to line of the inside with a flat gouge, after having cut away the bulk of the stuff with a quicker one, and then leave the rim for a bit until you prepare the pieces forming the wall (Fig. 4).

The method employed here is apparent. Plane a piece of good dry pine to an even thickness, as

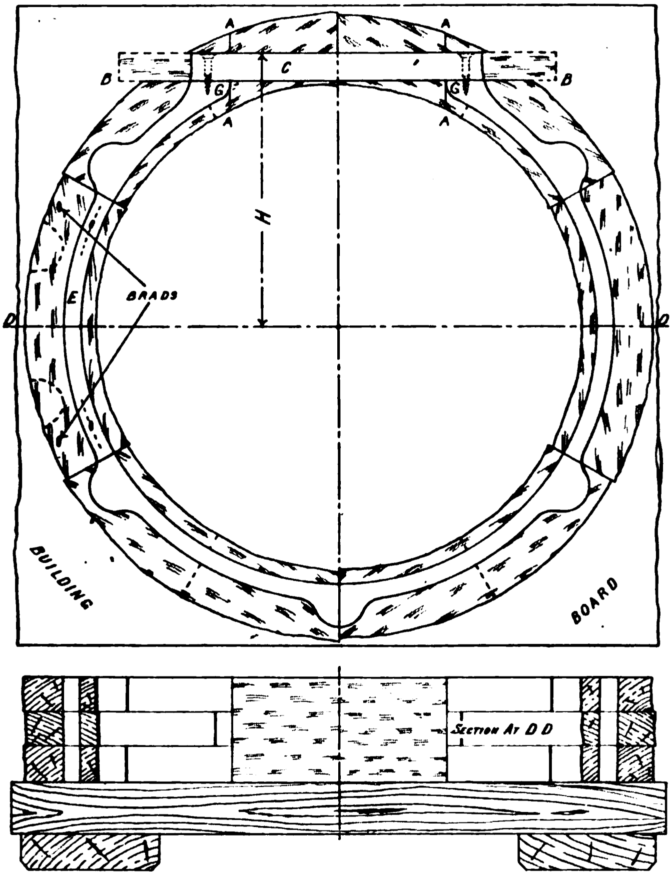


FIG. 3.—RIM BUILT UP AND DRAWN OFF.

shown, square one edge and end, and proceed to draw off *outer profile* of chamber on both sides of the wood. Cut away the crossed portion from line to line, trying it with your square as you go along.

Next set your gauge to ¼ in., and scribe all round the edge from both sides, afterwards sawing apart and planing down. They are now ready for attaching to rim, but before doing so use them as templates for drawing off on the chamber joint face.

When this is done, fasten them down with fine brads into rim, and then pare round to profile.

This does not allow for draught, but it can be managed by paring exactly from the line on the centre-joint and cleaning off the edges of wall in the finishing cut, so to speak, aided by sandpapering with a bias the same way.

Now that the shell is finished, let us see to the fittings. Still presuming that one-half pattern only is being made, I would advise fitting up the ball race side for the first cast. Screw on the bosses for this, and they can then be removed easily and whole, while the fittings for the shield, like gearbox half, are made up of several little pieces, which would be best left on the pattern.

As providing a neater finish to the whole job, I suggest glueing strips of cardboard round the joint edges of the pattern, as shown at F (Fig. 5), and would also save a deal of work, as filing a large surface of aluminium is no joke.

I reproduce a sectional drawing (Fig. 1), through the assembled parts, to illustrate some point worthy of attention in making this pattern, particularly those marked X in this drawing and Fig. 2. The clearance for working parts should be provided on

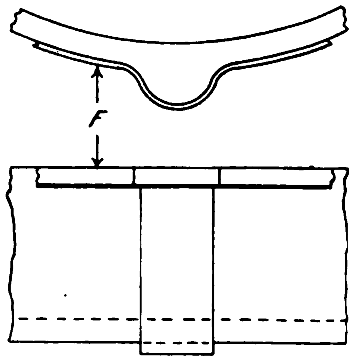


FIG. 5.—PROVISION FOR TRIMMING.

the pattern as far as possible, as in a closely confined area like this the doing of it may anticipate some future trouble which is more easily dealt with now.

ACCORDING to the *Engineering Record*, centrifugal pumps driven by steam turbines of the Curtis type are used on two new fire boats of New York City. The pumps are of the Worthington 12-in. two-stage type, each designed to furnish 4,500 gallons per minute against a pressure of 150 lbs. The turbines are rated at 650 horse power each, with a boiler pressure of 200 lbs., a vacuum of 26 ins., and at a speed of 1,800 revolutions per minute. The rotating parts of the turbine are direct connected by means of a flexible coupling to the rotating part of the pump, and such a unit was found to deliver 1 horse-power at the shaft for every 15 lbs. of steam.

Model Fowler Type Traction Engine.

By H. Greenly.

(*Continued from page* 152.)

III.—Cylinder and its Adjuncts.

REFERRING back to Fig. 7, the end view of the cylinder casting included in the last article, the presence of a facing strip encircling the cylinder bore and hole for main valve spindle may be noticed. This facing is almost essential, as otherwise it will be found difficult to make a satisfactory job of machining the ends of the cylinder. The facing is 3⅜ ins. diameter, *i.e.*, slightly larger than the cover, and is intended to be used at both ends of the casting. At the front end it would be circular—not embrace any other part than the cover. In the pattern it may stand up about 3-64ths in. thick and be machined practically to nothing in the finished cylinder.

In the prototype the stuffing-boxes for the regulator and main valve spindles project from the cylinder face and are solid with the casting. This method of construction is to some extent objectionable in the model, as from what I can see it means loose pieces on the pattern. I, therefore, suggest in the case of the regulator spindle that the core of the regulator valve chest provides sufficient metal for an internal stuffing-box, the outside of the casting being quite flush, as shown in Fig. 8 herewith.

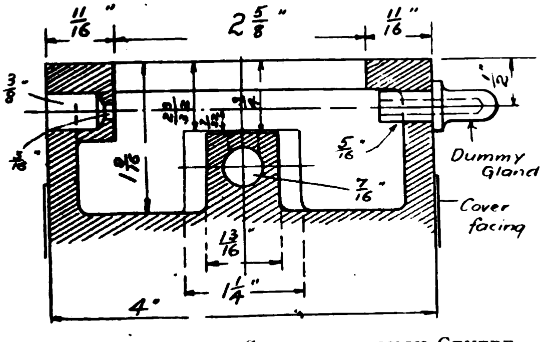


Fig. 8.—Longitudinal Section through Centre Line of Regulator Valve Spindle. (*Half size.*)

For the main spindle (see Fig. 6 last article) there is hardly room enough to do this, and a separate stuffing-box, which may be finished in bright gun-metal, is employed. To keep this stuffing-box to a reasonable size consistent with strength and efficiency, the fixing studs are continued through the outer flanges to hold and adjust the gland. As an alternative, I may mention that the screw-in type of gland has many advantages where it can be readily machined in the lathe all over. Accuracy of fit may then be assured, and the greater ease with which the small screwed-in gland can be packed has almost forced me to consider this alternative. In any case, the patterns can be made to suit either type.

In making gland and stuffing-box patterns the use of the tenon piece should be remembered. Everyone now-a-days does his lathe work with a three-jaw chuck wherever it is possible, and aids to this method of procedure are always welcomed. If the gland patterns are made in the manner shown in the hand sketch (Fig. 10), the time occupied in finishing a gland will be reduced by more than half, and a similar tenon-piece will be found useful on the front of the stuffing-box casting.

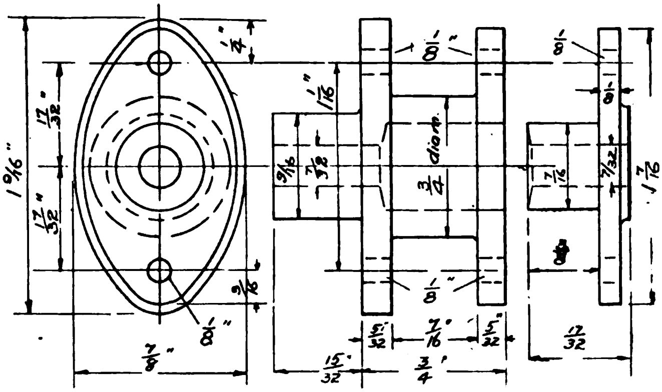


Fig. 9.—Main Valve Spindle Stuffing-box and Gland. (*Full size.*)

The stuffing-box for the main valve should fit down on a facing, which, as shown in Fig. 7 of last article, is combined with that of the cylinder cover, to save the use of loose pieces on the pattern. The exhaust flange need have no facing strip in the cylinder as the pressure of steam is inconsiderable and the surfaces may be finished sufficiently well with a file, a piece of thin jointing being placed between the parts to ensure no bad leakage of steam.

The plan of the cylinder (Fig. 12) shows the regulator port, which may be made by drilling a ¼-in. or 9-32nds-in. hole to meet the horizontal passage to the throttle valve and chipping it down square. The regulator valve face stands up clear of all surroundings, except the metal covering the horizontal passage just mentioned, the face of which should be slightly lower than the valve face. The valve face may be machined by an end mill, or if a planer or shaper is available there is enough room to get a tool in through the opening with sufficient clearance at each end of the stroke.

The cover may be fixed with 5-32nds-in. studs at ⅞-in. pitch, ten studs being used as shown. These would be quite safe at a load of 600 lbs., and the pressure on the whole of the cover with 70 lbs. of steam being 560 lbs., there is a further margin of safety with the given arrangement.

The plan of the cylinder casting also shows the holes in the saddle flange: 3-16ths in. studs are suggested, but more will be said about these when considering the boiler and the erection of the model.

The safety valve is shown in full-size detail in Fig. 13. It is not quite the same as the prototype, which, as far as I can judge from the drawings and photographs in my possession, is a species of

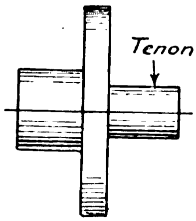


FIG. 10.—SKETCH SHOWING HOW PATTERN FOR GLANDS MAY WITH ADVANTAGE BE MADE.

" Ramsbottom " valve, which could not very well be applied to the model under consideration. The exterior design is, however, much the same. The spring casing is identical in size and covers a single dead-loaded valve 7-32nds in. diameter. The point of contact of the spring pillar should be

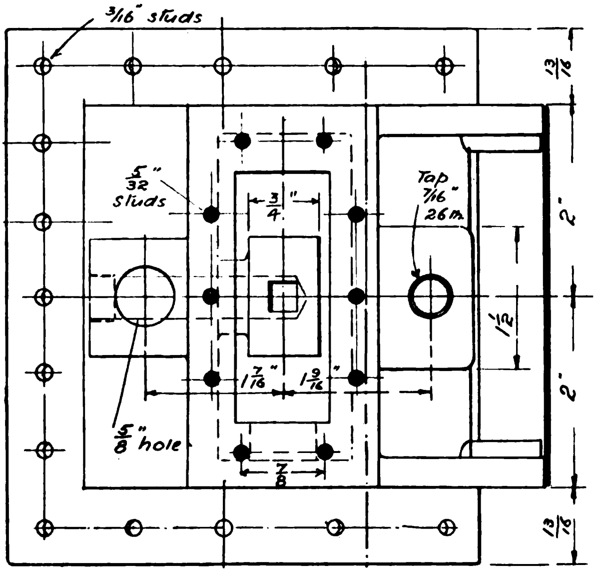


FIG. 12.—PLAN OF CYLINDER CASTING, COVERS, AND OTHER FITTINGS REMOVED. (*Half full size.*)

below the level of the seating as shown, and the spring pillar may be provided with a nut on the outside of the pepper-box. This nut is added not only to make the valve more nearly approach the original in external appearance, but may be used to ease the valve should it stick or should it at any time be found necessary to empty the boiler of steam.

The base of the valve should be screwed into the cylinder casting with a fine thread, say the standard

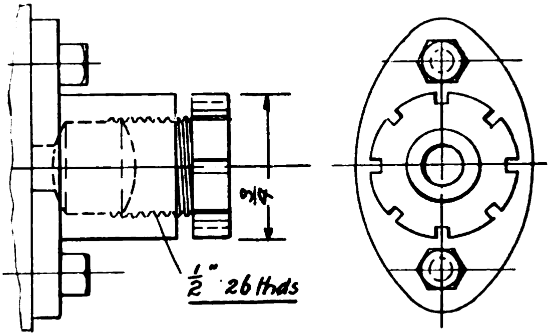


FIG. 11.—ALTERNATIVE ARRANGEMENT OF VALVE SPINDLE GLANDS. (*Full size.*)

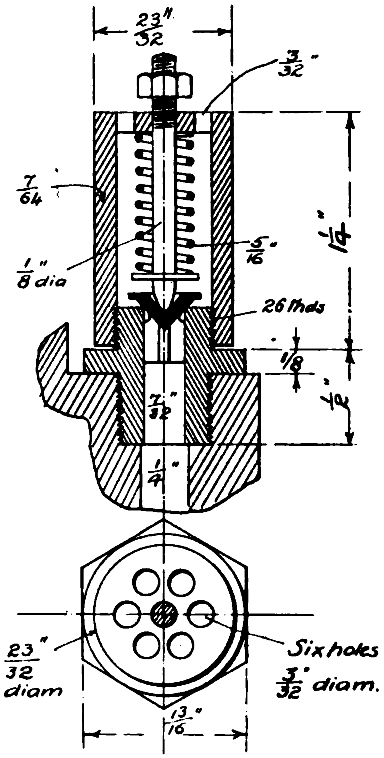


FIG. 13.—SAFETY VALVE. (*Full size.*)

model boiler fitting thread of 7-16ths or ½ in. diameter, 26 threads per inch. The flange may be hexagonal to facilitate screwing it in tightly. The spring should be of steel, 5-16ths in. diameter, eight coils, made of 21 S.W.G. wire. The valve should have a wing or feather which should fit the hole in the seating easily, and if made by filing

3-square should well away, as little or no wear and tear is felt on the edges of the wing.

The pepper-box should be made full long, and the lower edge should be filed away after trial under steam so that it bears hard on the seating flange and locks the valve in position. An "unauthorised" increase of steam pressure cannot then be obtained by meddlesome fingers.

Fig. 8 shows the dummy gland used to support the outer ends of the regulator valve spindle. This is detailed in Fig. 14. The hole for the spindle may be fairly easy. Care should be taken to get

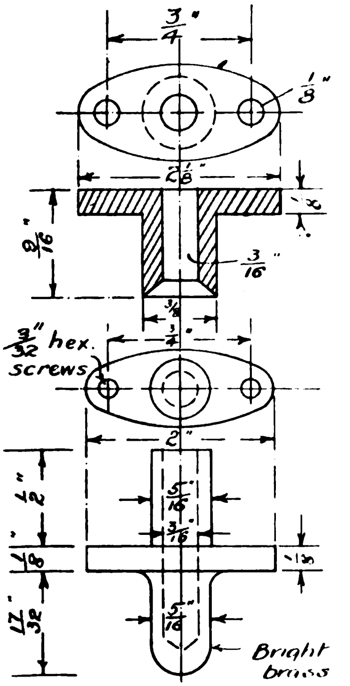


FIG. 14.—REGULATOR VALVE SPINDLE GLANDS.

the holes in the cylinder casting truly in line, and if any binding is felt on the spindle, ease the hole in the bottom of the stuffing-box to the extent of about 1-64th in.

(*To be continued.*)

WE hear that the two 1908 U.S.A. battleships will be named *Utah* and *Florida*. The existing *Florida* will be renamed — presuming that the experimen s now being conducted leave enough of her to make it worth while.

ZOELLY turbines have been ordered, for the German cruiser *Ersatz-Schwalbe* and the des royer *G 173*. The o'her cruisers of the class to which the *Ersatz-Schwalbe* belongs have Parsons turbines, and this is the first instance of Zoelly turbines being fitted in a cruiser.

The Making of Ship's Model Fittings.

By "X. Y. Z."

(*Concluded from page 112.*)

WE will now make a telegraph. Put a piece of ¼-in. rod in chuck and turn to shape, as Fig. 62, leaving pin for deck; then turn the top out of ¼-in. rod also, and turn the front out to represent the dial and mark across in six divisions; this is easily done with the corner of flat tool. Cut off and drill a 20 hole in the edge to take the pin on end of stand. Now fit top to stand and soft-solder together. Next make the handle. This is generally stamped out in the shops, but as we only require one or two it had better be turned the shape and filed flat, afterwards soldering across the face as shown in sketch, and the telegraph is finished.

We will next make the binnacle. This is made from a piece of ⅜-in. rod, and it requires little

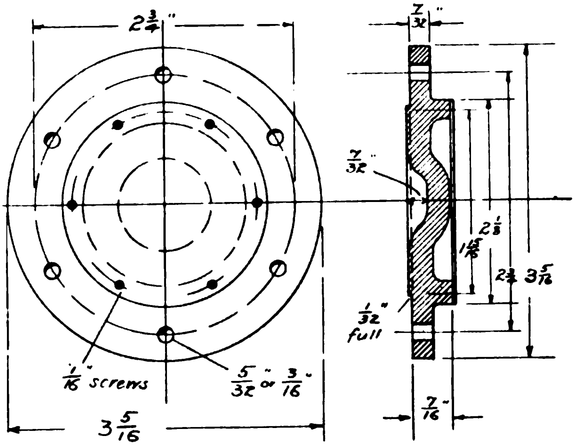


FIG. 15.—FRONT CYLINDER COVER.

explanation, as it is a very simple turning job. Turn to shape in Fig. 63, file on one side a flat to represent the glass, and polish. Next turn two lamps out of 16-gauge brass rod; then file with the corner of a square file a small groove on each side of binnacle to put lamp in. This keeps lamps in position while soldering. This done, the binnacle is finished and we will proceed with the making of the quadrant for the steering gear (Fig. 64). This is really the part that is worked by the steam steering engine by means of chains and rods from the steering screws, the making of which has been previously described. First of all make the rudder post (shown sectional, Fig. 65) out of ½-in. rod. Next make the centre-bar out of a piece of 3-16ths-in. rod filed square.

We now require a double-channel section (Fig. 66) for the quadrant. This is turned from a piece of tube—the method is shown in Fig. 67. First of all, hard-solder the square bar to the quadrant and afterwards hard-solder to stand. It is now completed, excepting the plate, which can be laid on and scribed; afterwards fit in and soft-solder from the bottom.

The operator will now require the steering wheels (Fig. 68). These are made the same as the small wheels already described, with the exception that we use 10-gauge wire spun round ⅞-in. rod for the rim, and the boss is 5-16ths-in. rod, and spokes turned out of 16 wire. This will give you a 6-ft. wheel, as shown in sketch. This wheel is generally mounted on a box which covers the other part of the gear up, as a protection from weather, etc. I give you a sketch in Fig. 69. This is easily made out of a piece of hardwood, and beyond mentioning it requires four small legs (shown in sketch) I do not propose to explain further.

We now require what is termed a buffer spring

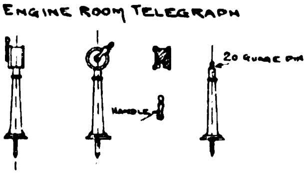


Fig. 62.

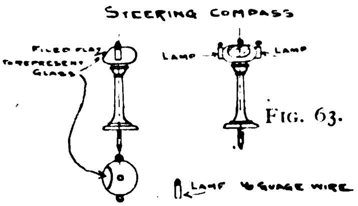


Fig. 63.

Fig. 66.

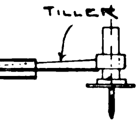




Fig. 65.

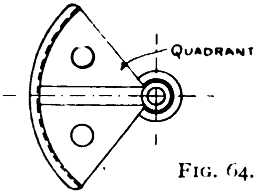


Fig. 64.

(Fig. 70). To make this the same as the real article entails a lot of work, but the same appearance can be obtained in a simple manner. Put in lathe a piece of ¼-in. rod and turn to shape, and cut several marks across, as shown; now file the round flanges at each end square. Next cut off the rod, and, after filing the ends flat, hard-solder an eye at each end, and the buffer is complete. A glance at sketch will make this plain to operator.

The next article we propose to make is a standard compass (Fig. 71). Place a piece of ½-in. rod in chuck and turn to shape of sketch, and polish nicely while revolving in lathe; now put index pointer into division-plate and divide into sixteen; now scribe sixteen straight lines lengthwise on the body of compass to represent the wood cleading. Now set off in four equal parts for position of lamps, magnet, and compensating balls. Now put a piece of 14 wire in chuck and turn two lamps. These finished, turn the two balls out of ⅛-in. rod, using a ⅛-in. balling tool to ensure they are alike. Next file a piece of ⅛-in. rod square and cut two pieces about 5-32nds-in. long. We now have to turn the magnet. This is also turned out of ⅛-in. wire to shape in sketch. It now requires assembling. File two grooves for lamps, as in binnacle; hard-solder the balls on the square blocks, afterwards hard-soldering the lot on to the body of compass Stick the pin you have turned on bottom of com-

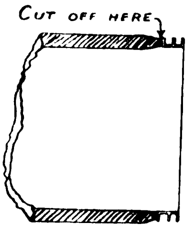


Fig. 67.

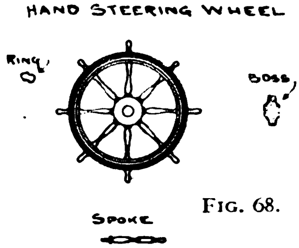


Fig. 68.

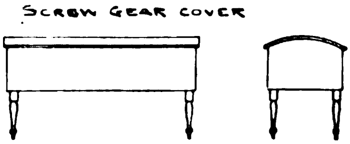


Fig. 69.

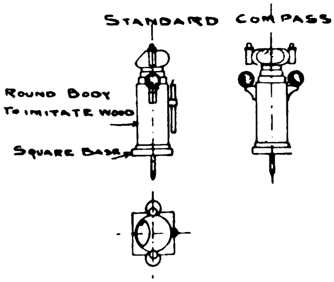
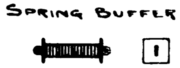


Fig. 71.

Fig. 70.


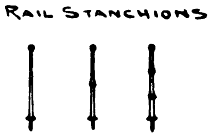


Fig. 72.

pass into pumice for this operation. While the compass is still hot hard-solder the lamps into position, cool the lot, and then soft-solder the magnet to back, as shown, or, if you prefer, you can hard-solder this as well. We now file a flat on the top to represent glass, and if the instructions have been carefully carried out this job should prove successful.

We next intend to make a very simple but necessary fitting, *i.e.*, stanchions (Fig. 72). These are usually 3 ft. high and have one, two, and three balls. Put a piece of 14 wire in chuck and set the dividers from the flange to the centre of balls. Now make a fourteen-ball tool, pull wire out of chuck to about the length between the ball, and turn off the superfluous metal between the balls, afterwards levelling with a flat tool. This is all the information necessary to the making of a stanchion, and after turning the number required, drill through the balls a 21-gauge hole. A little practice will enable the operator to turn these at a good speed.

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.*]

A Small Power Windmill.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I notice there has been some correspondence on windmills during the last few months, but I cannot learn of any amateur driving his lathe, etc., by wind power. Perhaps a short description of my mill might be of interest to some of your readers.

I built the mill over six years ago from designs that appeared in THE MODEL ENGINEER. It was on the old dead-sail principle, and caused me a lot of trouble, and after pulling it about and altering it several times, I made what was practically a rebuild last summer, and I think I am now, though far from perfect, several steps in advance of what I was when I started.

The tower is built of 4½-in. by 4-in. red deal, and it is about 17 ft. from ground level to windshaft. It is 2 ft. square at the top and 5 ft. square at the bottom. It is in the ground 4 ft.; old timbers are spiked on the bottom, and everything below ground is well tarred; 8 ft. from ground is a platform 12 ft. by 5 ft., floored with 1¼-in. boards. At each end of this two 4½-in. by 3-in. timbers go down into the ground 3 ft., so the tower is practically solid up to this height. There are also four iron cross braces 2 ins. by 1 in., 12 ft. long. On the top of tower is a circle of oak 3 ft. 1 in. diameter, 2 ins. thick, on the outside of which is a wrought-iron ring for the rollers of top frame to run on.

The top frame is square and made of oak. The front and back-pieces are 4½ ins. by 4 ins., the sides 4½ ins. by 3 ins. The front- and back-pieces ride on the circular top, and are mortised underneath for the rollers (four in number). These revolve on ⅝-in. pins. The windshaft—of iron 4 ft. 4 ins. long, 1½ ins. in diameter—is carried on top frame. The front bearing is pitched 4½ ins. higher than the back. This is a great advantage, as it relieves the front bearing of a deal of the weight of the sails, which is considerable. A gearwheel on windshaft gears on to downshaft, 10 ft. 6 ins. long, 1¼-in. steel. This runs in a ball-bearing step carried on a timber in lower part of tower. About 6 ft. from top of downshaft is the brake wheel, 12 ins. by 4 ins. The beam is worked by a lever 8 ft. long. The downshaft drives the bottom shaft, about 2 ft. 6 ins. long, 1¼-in. steel. This is under the platform, and a 12-in. pulley on it drives the shafting in workshop, 1-in. steel, 8 ft. long.

The mill sails or sweeps are four in number, of the spring type, 6 ft. long, 2 ft. 2 ins. wide. It is 2 ft. 9 ins. from centre of windshaft to top bar of sail, and the total swing is 17 ft. 6 ins. The whips are 6 ft. 6 ins., 3-in. by 3-in. red deal. The angle of weather or drift of top bar is about 22½ degs., of point bar 7½ degs. This is rather more than in a large sail, but, as an old millwright told me, you cannot, reasonably speaking, give a little mill too much drift. There are twelve vanes in each sail of ⅛-in. deal, carried by a cast-iron pivot at each end in wood bearings. A cast-iron lever at the whip end of each vane is geared by a wooden striking-rod on to the spring pivoted on top bar, single leaf, 21 ins. long, ¼ in. thick in centre, ⅛ in. at each end, 1½ ins. wide. At the other end of spring a 5-16ths-in. iron rod runs down the following edge of sail; a piece of 1¼-in. by ¼-in. iron is brazed on the bottom end, and a ⅜-in. slot cut down the centre, which works on a pin in outside rail of sail, and by means of a thumbscrew it is possible to put any tension on the springs that is required, or set them partly open. Of course, when the mill is not at work, they are set wide open. The stocks which carry the sails are 5½-in. by 3-in. red deal, 12 ft. long, halved in at centre. Two wrought-iron plates cross the joint, 18 ins. by 4 ins. by ⅜ in. The end of windshaft is turned a little taper and plates bored accordingly. The whole is secured by ½-in. steel key in sunk key-way.

As to the gearing, a pair of 7-in. wheels give a 1 to 1 drive from windshaft to downshaft; at the bottom of downshaft there is a 1½ to 1 drive on to bottom shaft; a 12-in. pulley on this drives a 5-in. pulley on main shafting, the lathe c.s. is two-speeded, and is driven by two 12-in. pulleys on main shaft, the pulleys on c.s. are 3 ins. and 6 ins.; the 3-speed pulley driving lathe is 6 : 5 : 4 ins.; thus with the back-gear it is possible to drive the lathe at twelve different speeds. The lathe is the well-known 3½-in. Drummond, and I have turned work on it from ⅛ in. diameter up to castings 6¼ ins. diameter and 16 lbs. in weight. The mill also drives a 12-in. grindstone and a small drilling machine.

The speed of windshaft in a fair breeze is about 35 r.p.m. This gives about 124 r.p.m. on main-shaft and 496 or 248 on lathe c.s.; but very good work is done at a deal lower speed than this, and some of my heaviest boring and turning has been done in light winds that only gave 16 or 18 revolutions at windshaft.

The cost of running is very little. Nearly all bearings are greased by Stauffer lubricators, and I do not suppose oil and grease cost 1s. 6d. per annum. A deal more serious item is paint. The mill must be painted every summer, and in my case I daresay it takes ½ cwt. Another item is damage by storms. I have only had one accident so far: the windshaft bent in a gale and it cost 1s. 6d. to straighten it. The worst point about this job was that the weather continued so rough that it was three weeks before the shaft could be got out. Altogether the mill was laid out for a month.

The chief faults at present are:—

(1) Slow speed of main belt. This is a fairly heavy 2-in. belt and a crossed drive, but it has to be kept very tight and well rosined. The pulleys at present are 12 ins. on to 5 ins. I am just about to fit 20 ins. on to 7 ins., which, I hope, will be a great improvement. It will increase the belt speed about 100 ft. per minute. Of course, the proper way would have been to build workshop round mill tower and gear downshaft right on to shop shafting. This would do away with bottom shaft and belt and reduce friction considerably.

(2) The springs are a little too strong, and the mill cannot relieve herself sufficiently if the vanes are set close in a strong wind.

(3) There is no wind-gear, that is to say, the sails have to be pulled into the wind by hand. This was the cause of the accident referred to. The mill was not able to wind herself during a heavy

gale that sprung up in my absence, and so the windshaft was bent. I intend to fix automatic wind-gear at the earliest opportunity. It will be as Fig. 22, in Mr. Sidney Russell's article on *Traction and Transmission*. There is a lot of work in a gear of this sort, but I am well satisfied that it is the best.

(4) The windshaft is not strong enough, though there are three bearings in less than 4 ft. of length. I think I shall eventually alter the mill from spring to patent gear, and fix a short, heavy cast-iron windshaft.

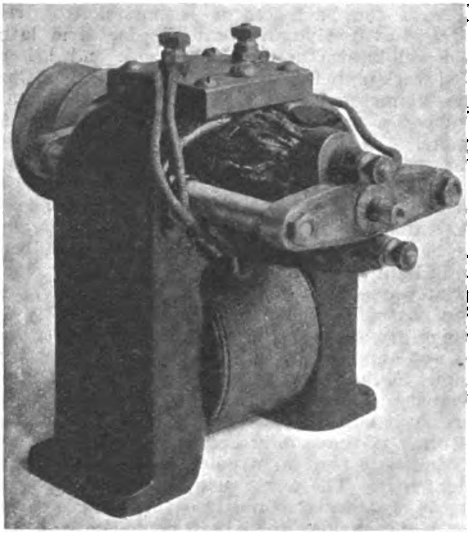
I have enjoyed my researches in the windmill line very much, and I have not finished yet by any means.—Yours respectfully,

Burton-on-Trent. THOS. A. WOODTHORPE.

Telegraph Connections.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—If Mr. A. H. Johnson's system of telegraphy illustrated in your issue of the 16th inst. is original, it does him credit; but if he will look up some of the text-books or current literature he may see less expensive methods described. He opens



A 75-WATT OVERTYPE DYNAMO.

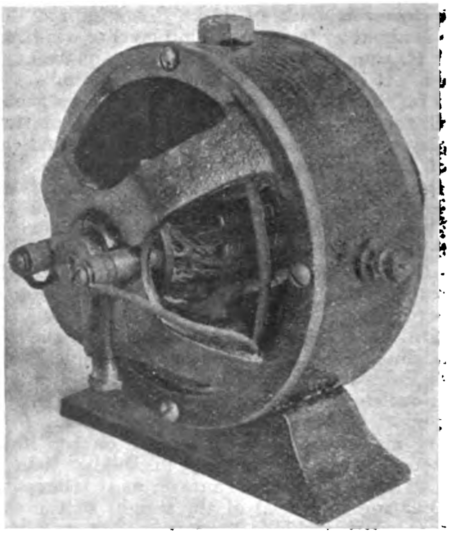
his letter by saying that "a battery is required at each station on a telegraph installation. One of these batteries can be dispensed with by using three wires between two stations." In America they only use a battery at one end of the circuit and only one wire is necessary between the stations. Our own postal authorities have been working hundreds of wires for some time with only one battery and one line, and the latest system is briefly described in your contemporary, *Electricity*, for July 10th. If Mr. Johnson, however, prefers his own system, it should not be necessary to use a second line, as that means heavy expense if the stations are far apart. If he connects the back of the switch at each end to an *iron* gas pipe, or a water pipe, or to a small plate of zinc buried in moist earth at each station, the system will work equally as well.—Yours truly, S. WILSON.

Some Interesting American Models.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The models illustrated (**pages 186 and 187**) may be of interest to the readers of THE MODEL ENGINEER, more especially as they are of American design and make. The little motor is of the iron-clad type, has a laminated armature with six coils, and is shunt wound. Its capacity is about 20 watts. Speed on 4 volts, about 3,000 r.p.m. The overtype dynamo has a capacity of about 7½ amps. at 10 volts. It has a 12-coil laminated armature and a disc commutator with wire gauze brushes. Weight, about 11 lbs; speed, 3,500 r.p.m. The bearing yokes are of bronze. The semi-enclosed dynamo has a field frame made entirely of wrought iron. The yoke (ring) is a piece of extra heavy wrought-iron pipe and the magnet cores are machined from 2-in. by 2-in. wrought-iron bar. The bearings are of Babbitt metal and are provided with oil wells and felt lubricators, and will run for weeks without oiling or other attention.

The little steam engine is built for high-speed and heavy duty. The shaft, ⅜ in. diameter, is machined from solid steel. The cylinder is of brass, lagged with



A SEMI-ENCLOSED DYNAMO.

copper with magnesia insulation. The bore is 1-in. and stroke ⅞-in. It stands about 8 ins. high and weighs about 5 lbs. It has developed as much as ¼ h.p.—Yours faithfully, WM. C. HOUGHTON.

Waltham, Mass., U.S.A.

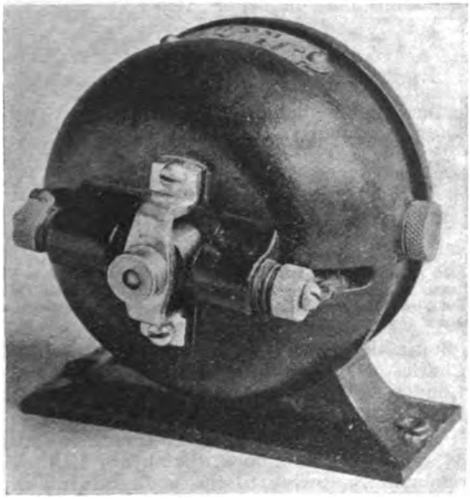
Hydroplanes.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—As far as we can see, Mr. Blaney has generously given to the world (at any rate to the model engineering world) the benefit of his studies on hydroplanes, and even if incomplete, they are sufficient to enable anyone capable of designing the propelling plant a chance of getting some result.

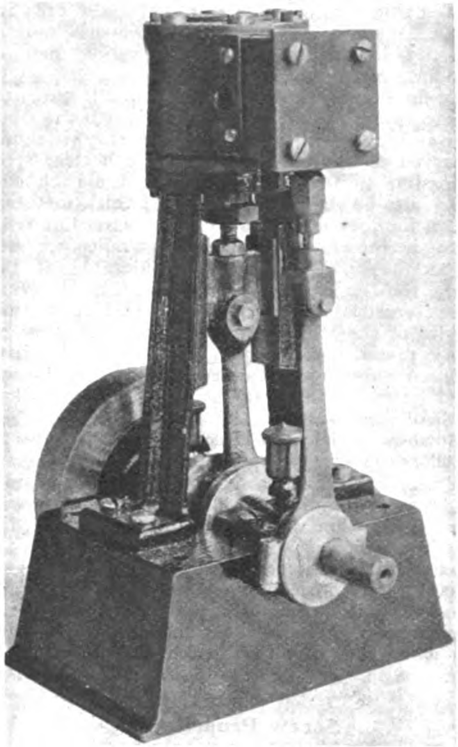
Our boat, if so it can be called, has not yet had a fair run, as, owing to the difficulty of starting it without a hand pump (which was not then fitted) and a serious accident caused by some obstacle striking the propeller when tried at Wembley, besides a burst steam pipe on a subsequent trial on the Crystal Palace lake, what she can do is still undetermined. We rushed the construction considerably, and were obliged to obtain an engine ready made, so we are rather handicapped in the matter of weight. An engine giving the same power could easily be designed and constructed weighing less than half that of the engine fitted, but even with the plant in its present condition the *Folly* rises on her planes, as was seen at Wembley Park.

Her lines are practically a direct copy of those published by Mr. Blaney in THE MODEL ENGINEER, the only difference being in the width compared to the length, and owing to the weight of the engine,

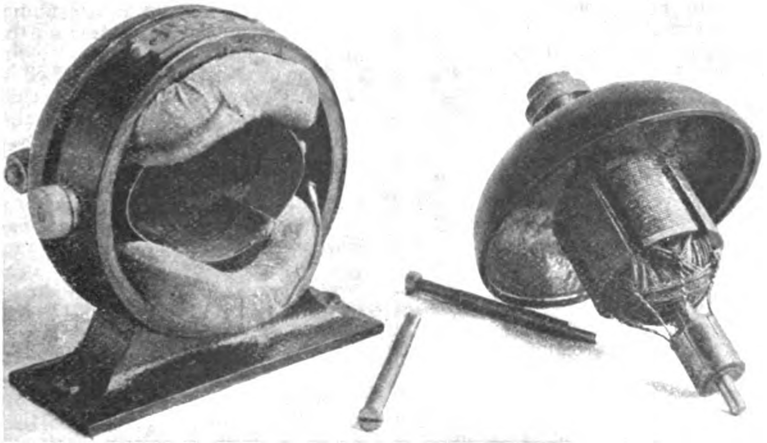


A 20-WATT IRONCLAD MOTOR.

proved, but they are quite good enough for a first trial, and any alterations might be made after a long series of experiments and careful observation



A HIGH-SPEED HEAVY DUTY STEAM ENGINE.



SHOWING PARTS OF 20-WATT IRONCLAD MOTOR.

she is rather too much down by the bows. Her weight is 11½ lbs. against 10 lbs. 5 ozs., as designed. the extra weight has unavoidably fallen right forward, so Mr. Blaney's design has scarcely received fair treatment at our hands.

We think that Mr. Blaney's lines might be improved, but they are quite good enough for a first trial, and any alterations might be made after a long series of experiments and careful observation

In conclusion, we may state that had it not been for Mr. Blaney's articles referred to, we should not have been able to sign ourselves,

The builders of the *Folly* { V. W. DELVES-BROUGHTON, HERBERT TEAGUE.

10, Anerley Hill, Upper Norwood.

On the 5-ft. Speed Boat Design and Modelling the Hydroplane.

To the Editor of *The Model Engineer.*

Dear Sir,—May I offer a few words of criticism on Mr. Dysart's design for a 5-ft. speed boat on page 103, in the hope of raising a discussion on the points mentioned ?

The fin shown supporting stern tube is much too close to the propeller, and would disturb the water reaching it ; but, if considered necessary, it should be carved out so as to leave as much clear space as possible in front of propeller ; the back edge should also be sharp if the fin is of thick metal.

Then he does not give probable water-line when moving at the estimated speed of 10 miles per hour, and as the bow would lift considerably at that speed, the boiler shown would prime furiously owing to restricted water-space above furnace tube, in spite of the steam drum shown (which, by the way, is placed in a splendid position for condensation). A superheater carried through the furnace would be much better and would obviate a long length of steam piping.

The above article and also Mr. Dysart's letter on propellers (page 113) appear in the same issue, and he does exactly what he warns others against, and gives a design for hull without starting with the propeller, then the engine and boiler, and, last of all, the hull.

I should like to suggest to Mr. Dysart, with regard to his letter on Mr. Blaney's article on the hydroplane, that it is *con*-structive, not *de*-structive criticism we want, and if he knows better, will he show where and why that article is wrong.—Yours truly,

T. J. P.

Screw Propellers.

To the Editor of *The Model Engineer.*

Sir,—The correspondence *re* screw propellers might be helped forward (as one at least appears to wish) if the diameter and pitch and blade area be contemplated in proportion to displacement, speed, and under-water form.

A boat of a total weight of 20 lbs. within a 5-ft. limit might be considered with a plant developing 1-16th b.h.-p., and the propeller which gave the highest speed would certainly earn close attention and provide valuable data.

Of course, the lines of boat would have to be taken into account, but it is presumed they are of the usual character : fine entrance, long run.

The wildest statements are constantly being made by amateur engineers as to the power given by their own particular plant, but it is proposed that this sort of thing be knocked down to its proper level by actual test on the brake.

Winners and losers at Wembley Park Regatta may both, if they please, provide a really scientific demonstration of much value if they will undergo this test. The steady pull in pounds in fairly deep water might also be noted. Boilers should also undergo an evaporation test, so that steam consumption could be registered.—Yours, etc.,

B.H.-P.

Perpetual Motion.

To the Editor of *The Model Engineer.*

Dear Sir,—With reference to your correspondent, "Pat," he may be pleased to know that the chemical action on sulphur-dioxide of iodine is a reversible action.

Iodine is reduced to hydriodic acid by sulphur-dioxide in the presence of water. Now sulphur-dioxide and water form sulphuric acid and sulphurous acid, which is really sulphuric acid minus an atom of oxygen. As soon as a small quantity of hydriodic acid is produced, it reduces the sulphuric acid to sulphur-dioxide, water, and iodine. When the direct and inverse reactions are proceeding at the same rate, no further change will apparently take place, though there is every reason to suppose that the reactions continue for ever at equal rates, some molecules of iodine being reduced and some molecules of hydriodic acid being oxidised.

The actions may be represented :

Direct Action—

$$I_2 + 2H_2O + SO_2 = H_2SO_4 + 2HI.$$

Reverse Action—

$$H_2SO_4 + 2HI = I_2 + 2H_2O + SO_2.$$

—Trusting this will interest "Pat" and other *dilettantes*, I remain yours truly,

F. J. Fraser.

For the Bookshelf.

[*Any book reviewed under this heading may be obtained from* The Model Engineer *Book Department, 26–29, Poppin's Court, Fleet Street, London, E.C., by remitting the published price and the cost of postage.*]

The Slide Rule : A Practical Manual. By Charles N. Pickworth. Eleventh Edition. London : Whittaker & Co. Manchester : Emmert & Co. Price 2s. ; postage 2d.

In putting before his readers the eleventh edition of this well-known handbook, the author has taken the opportunity, owing to the book having been reset completely in new type, to include much new matter of considerable importance. Amongst the new matter will be found many practical hints, suggestions for solving formulae, new method of extracting cube roots and of finding small powers and roots, and also a section on the determination of gauge points, etc. We also find various new instruments have been described and some additional illustrations have been included. The question of finding the position of the decimal point has been dealt with, and the author points out that in this case the personal factor has to be reckoned with, and while most practised users experience no difficulty in estimating the magnitude of the result by inspection or rough calculation, others find that rules are of considerable assistance. The author has discussed both methods, in order that the reader may be able to follow his own inclinations in the matter. The value of the book is very much greater than its published price would signify, and we can commend it to engineering students with every confidence that they will find in it a thoroughly clear and lucid explanation, with examples, bearing on the use of the slide rule.

Logarithams for Beginners. By Chas. N. Pickworth. London : Whittaker & Co. Price 1s. ; postage 1½d.

The second edition of this work has afforded the author the opportunity of revising the former edition and making a few corrections where necessary. The purpose of the book is to give a full and practical explanation of logarithams and their applications in order that students may obtain a thoroughly sound grasp of the root principles of this method of making calculations. Read in connection with "The Slide Rule" by the same author, the book will be found extremely useful, and we recommend it to the notice of all engineering students who have not already a thorough understanding of the subject the book deals with.

The Society of Model Engineers.

[*Reports of meetings should be sent to the offices of* THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.*]

London.

FUTURE MEETINGS.—The next indoor meeting will be held at the Cripplegate Institute, on Wednesday, August 26th, and will be made a special locomotive night; prizes will be awarded to those models running most successfully. The following meeting is fixed for Friday, September 18th.—HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green, S.E.

Queries and Replies.

[*Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.*

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26-29, Poppin's Court, Fleet Street, London, E.C.*]

The following are selected from the Queries which have been replied to recently:—

[19,953] **Aluminium Alloys.** H. M. H. (Tividale) writes: I should be glad if you would answer me the following queries. What other metals are mixed with aluminium when used for bars in tension and compression, and in what proportion are they used? What would a cubic foot of this metal weigh? What would be the safe tensile strength and what would be its compressive strength compared with that of steel, or is it practically as strong in tension as compression?

The industrial alloys of aluminium contain either a very small percentage of the other metal or metals, or, on the other hand, a very small percentage of aluminium. Aluminium alloyed with 6 per cent. of copper to form aluminium bronze has a tensile strength as follows:—

	Tensile strength. lbs. per sq. in.	Elongation. Per Cent.
Rolled bars (hard)	35,000	3·5
" (annealed)	25,000	15·5

The following alloy behaves generally like fine German silver:—Copper, 70; nickel, 23; aluminium, 7 parts. Aluminium with a very small percentage of nickel has a tensile strength of 25,000 lbs. to 30,000 lbs. per sq. in. in castings, and in rolled bars or plates 45,000 lbs. to 50,000 lbs. per sq. in. The following are two typical copper-nickel-aluminium alloys:—

	(1)	(2)
Copper	63·33	31·67
Nickel	33·33	66·67
Aluminium	3·33	1·67

The tensile strength of (1) is 118,000 lbs. per sq. in., and (2) 90,000 lbs. per sq. in. (1) gives very little elongation, and (2) about 33 per cent. Pure aluminium has a specific gravity of 2·6, so that 1 cub. ft. weighs 163 lbs. Its tensile strength is as follows:—

	Working strain. per sq. in.
Castings	3,000
" annealed	3,500
Hardened by drop forging	3,000
Rolled bars (hard)	6,000
" " (annealed)	6,000
Hammered bars	5,500

The strength in compression would be less.

[19,918] **Dynamo Windings; Accumulator Manufacture.** J. W. (Derby) writes: I wish to know how to wind "Eickemeyer's" style for dynamos. Have you any work on it, such as Weymauth's "Drum Armatures and Commutators," or Thompson's "Dynamo Electric Machinery"? If so, please send cost of same. Is the Chloride Electrical Storage Company's cell composition public property? If so, have you a work upon it?

We have no cheap book on the particular system of winding. Eickemeyer's English Patent Specification would give you the most detailed description. You can obtain it by sending 8d. to the Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C. Ask for English Patent Specification No. 2,246 of year 1888. A description of a small former wound armature is given in THE MODEL ENGINEER for May 26th, 1904. The chloride accumulator was manufactured some nineteen years ago, so that patents for the original compositions must have run out. The present cell contains specialities in mechanical construction and arrangement, patents for which are probably still in force. You could obtain the patent specification for 8d. from the Patent Office. It is necessary to state the number of the patent and year. Particulars are given in "The Storage Battery," by Treadwell, which may answer your purpose. We believe the Company only now use the chloride system for the negative plates. Commercial lead in fine powder, dissolved in nitric acid, then precipitated by hydrochloric acid. Lead chloride obtained thus is washed and fused with zinc chloride, poured into circular moulds ½ in. diameter for negatives, and square ½ in. side for positives, 5-16ths in. thick. A lead antimony grid is cast around the pellets to form the plate. Formation is by passing a current through the plates—for positives, for a fortnight, in dilute sulphuric acid. Previous to this the plates are stacked between zinc plates in a cell containing a dilute solution of zinc chloride. They are then short-circuited to extract the chlorine, being finally washed in running water.

[19,998] **Spark Coil Proportions and Winding Sulphated Accumulators.** R. M. F. P. (Stratford-on-Avon) writes: Would be much obliged for full particulars of non-trembler coil suitable for single-cylinder motor cycle. I suppose ½-in. spark would be right. Length of core not to exceed 4 ins.; current consumption about ·5 amp. Length and diameter of core, weight and gauge primary wire D.C.C., weight and gauge secondary wire D.C.C. diameter of secondary coil, size and number of condenser sheets, etc. I have your book on "Induction Coils," and have successfully made several coils from instructions given there, so I have had some practice in coil making. Also I have an accumulator which has sulphated. Kindly say how to cure this and how to prevent it in future.

A coil giving a spark of only ½ in. in air would not be reliable in a motor cycle, as the spark is considerably reduced under compression in the combustion chamber. You should have a coil giving at least a ¾-in. spark in air. You will see from the handbook that the usual length of core for this size of spark is 6 ins. If you can possibly use this length, do so. If you cannot, try putting the same weight of wire as given in handbook for 6-in. core on shorter core, and comply with the book's directions for gauge of wire and particulars of condensers. If the plates of your accumulator are badly sulphated they should be taken out and scraped. If they are not in a bad condition, you may get them clean by washing with acid. This can be done without removing the plates, by thoroughly shaking the accumulator. A long charge at a slow rate often puts sulphated plates right. Sulphating is due to neglect or misuse of cells. You may ensure freedom from it by adding about 1 oz. of caustic soda to every 5 gallons of electrolyte.

[20,111] **Electro-magnet Winding.** A. F. H. (Marlborough) writes: Would you oblige me by giving me your advice *re* the following magnet? I want it to have a pulling power of at least 1 lb. at a distance of about ½ in. from the poles. The iron I have made is as shown below (sketch not reproduced), but if this is not large enough I would make another. I should like it to work with four bichromate batteries, if possible. Would you please tell me what size wire to wind it with and how much to put on each pole? Magnet, ½-in. round iron, horseshoe; length from pole tips to back, 5 ins.; distance between poles, 1½ ins.

You can get the best possible results from your magnet by winding each limb with about 485 turns of No. 16 S.W.G. copper wire and passing a current of 1 amp. If your cells are 2 volts, with an internal resistance of not more than 2 ohms, by connecting the four in series you should get nearly this current. You will require a little over 5 lbs. of wire. Do not wind the wire to a thickness of more than ½ in. on any part of the poles. The calculations to get the above information were made on the assumption that your magnet is of soft *wrought* iron. We cannot promise that magnet wound as above will do the work. It is really a matter of experiment. If you try the above, we should be pleased to hear what results you get from it.

[18,960] **Small Dynamo Trouble.** J. C. (Keighley) writes: I wish to construct a small dynamo and have purchased a set of parts for same from a firm advertising in THE MODEL ENGINEER. My knowledge of electricity is very slight and I would like a little advice if you please, as I am very doubtful of the parts supplied, neither can I understand instructions sent with them. I enclose sketch of field-magnet (Fig. 1), and comparing this with dimensions in your handbook No. 10, also with drawing

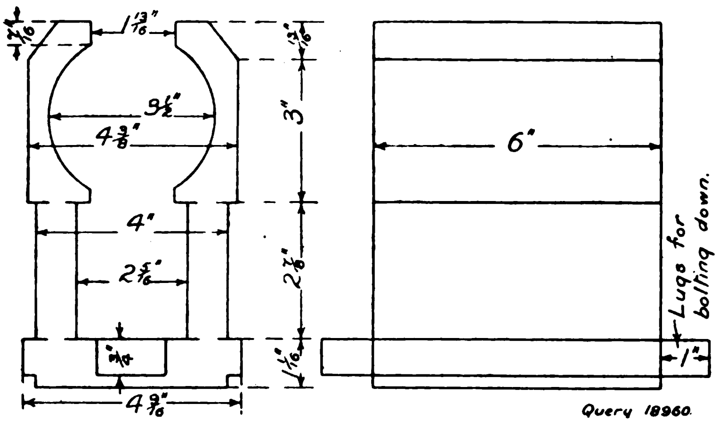


FIG. 1.

appearing in "Queries," there seems to be little metal in the poles. The wire sent for this is about 5 lbs. No. 22 gauge, a small sample of which I enclose. The armature is sent ready wound and is a plain drum except the ends; these seem to be hardwood and have eight cogs, the diameter over cogs being 3½ ins., and thickness about ⅜ in. There are forty-eight layers of wire (No. 18 gauge) in each of the eight sections. There is an open space between each section and the binding wire causes the wires to spread more in this space and, of course, reducing the diameter of armature to 3¼ ins. over the binding wire. I gather that this is too small for the field-magnet, as you sometimes advise winding soft iron wire over the armature to slightly increase same. Could I lay hardwood strips between each section and by pressing the layers closer together and then binding the lot with soft wire? If so, how much, and what is the best wire to use? The armature is 6 ins.

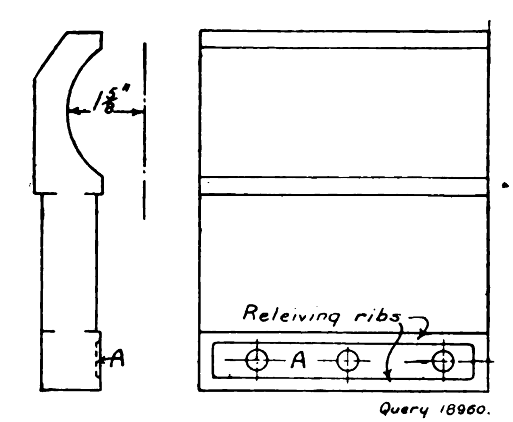


FIG. 2.

long over end pieces. If the armature should be made right, I could make a fresh field-magnet and I should like to make it in three parts and would like you to give dimensions of same for cast iron. Would the bedding strips as shown in Fig. 2 be permissible, and how much wire (No. 22) should I require for same? Also what would be the output, reckoning good workmanship? I have a so-called ¾ h.-p. gas engine to drive same. The same firm supplied me with a set of parts, but most of them had to go to scrap, and I made some ten or more new patterns. The only part I retained was the cylinder and that leaks; the bed, which allows the oil to go all over, and is a bad design; the crank, which is just passable, and the flywheels. All bearings and brass work are replaced by phosphor-bronze from new patterns. The valves are double size those sent and are contained in a projecting part of cylinder end and are in a vertical position. I have got the engine to work and can get 1,200 r.p.m. with a small ½-in. gas cock three-parts on and the opening in air pipe about 3-16ths in. diameter. I think I could get a much greater speed but dare not. Of course, this is without load, as I have not yet connected same to any work.

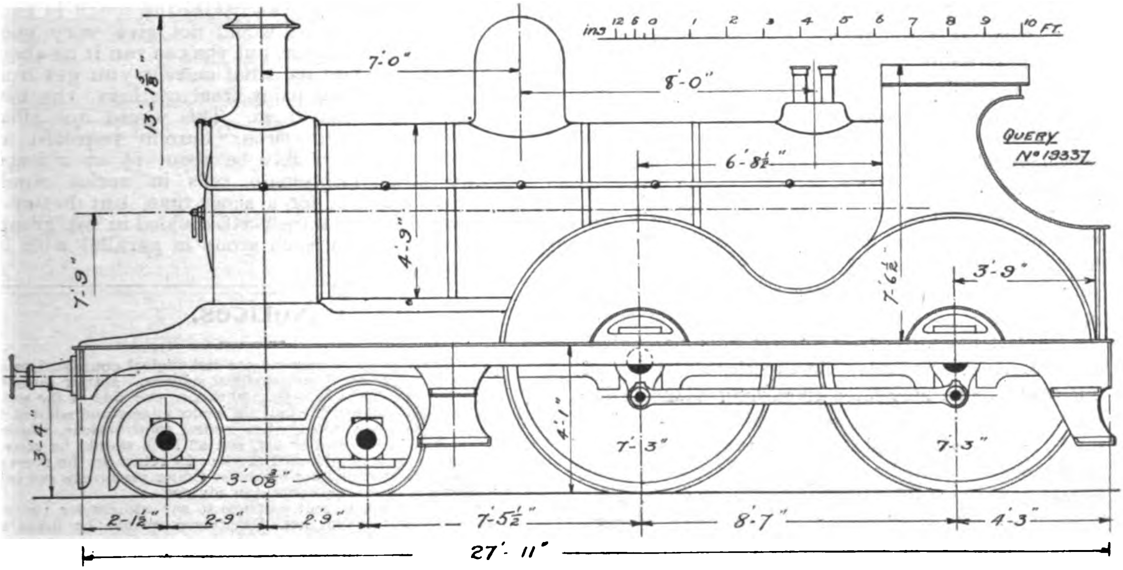
The important factor is the distance between the iron of the armature core and the pole face. It makes practically no difference if the wires are in evenly wound coils so as to stand nearer to the pole or if they are flattened in the way you describe, unless you can decrease the distance between the core and pole face by pressing them flat. You would gain nothing by inserting wood strips between the coils, so as to make them even and nearer to the pole face. But you would gain a great deal if you could bring the pole face nearer to the flattened coils, as by doing this the distance between the core and pole face would be decreased. We advise you to make a new field-magnet with cores 1½ ins. thick, as per your sketch, yoke and poles in proportion, but you may not make the joint as you propose. The surfaces should make very good contact metal-to-metal all over the joint. If you relieve it as suggested, you will very much decrease the efficiency of the machine. There is no harm in making it in three pieces however. The joints must be the full length and at least equal in area to the magnet core, so that you have practically a continuous horseshoe magnet when it is bolted together. Bore the pole-pieces so that they come as near to the iron core of the armature as practicable. Design the magnet so that you can wind to a depth of 1 in. on each core. Wind field-magnet with about 4 lbs. No. 22 gauge s.c.c. copper wire on each coil, and connect in shunt to the brushes as diagram, Fig. 1A, page 12 of our handbook. Output about 40 volts 12 amps., but you can adjust the voltage by running at higher or lower speed; 2,500 r.p.m. would be a fair speed. It will depend very much upon the length of gap space between armature core and pole face; make this as short as you can. It will take about 1 b.h.-p. to obtain this output. You obtain a very good speed from the engine, but, of course, the real test is with a load on. With ¾ b.h.-p. you may expect to obtain about 40 volts 6 amps. if everything goes well.

[20,051] **Fuller Cells and Accumulators.** G. W. R. (Heywood) writes: With reference to the Fuller cell described on pages 24 and 25 of your handbook, No. 5, "Electric Batteries," (1) Will you please tell me what is the proportion of the powdered bichromate of potash and the dilute sulphuric acid? The Economic Electric Company say, in their list, to dilute the sulphuric by adding 10 parts of water to 1 part of acid; whereas you say 15 per cent. Which of these should I follow? (2) I have three Fuller cells for charging 4-volt accumulators. I have a 4-volt celluloid accumulator (with four plates), giving six hours' continuous light from each charge, and I propose to get a 4-volt pocket flash-lamp accumulator giving five hours' continuous light. Could you tell me if one charge of electrolyte in the three-cell Fuller battery will fully charge both these accumulators, if, when one is fully charged, I replace it by the other? (3) I hardly ride at all at night in the summer, so will you please let me know if it is harmful to an accumulator to let it run itself right down? Should I leave the acid in or out during these months whilst not in use?

(1) Make the solution as follows: Crush 1 lb. of bichromate of potash and add to 4-5ths of a pint of strong sulphuric acid, slowly stirring with a glass rod. When this is thoroughly mixed, pour it *very* slowly into 9½ pints of water. If you do not need so much of the solution, reduce these figures proportionally. (2) To say that an accumulator will supply current for so many hours of lighting does not tell us the capacity of the accumulators, unless you tell us what lamps you use or the current consumed. However, you may take it that one charge of electrolyte in your Fuller battery will be sufficient for the work required. (3) An accumulator under ordinary working conditions should never be allowed to run itself down. Cells must not be left standing idle with acid in them for more than a fortnight at most. They can be safely kept idle if they receive a full charge every ten days or so. If you do not wish to give them this attention, act as follows: Syphon out all acid, and immediately fill with water instead. Then allow the cells (which must be fully charged before removing acid) to run themselves down at normal rate of discharge. After about two days water can be drawn off and plates allowed to dry.

[19,337] **L. Y. R. 4—4—0 Type Express Engines.** T. W. (Leeds) writes: I should esteem it a great favour if you will kindly publish at your convenience a dimensioned sketch of one of the standard 4—4—0 type of tender locomotives of the Lancashire and Yorkshire Railway.

We reproduce herewith a line drawing of the 4—4—0 type express engine, as designed by Mr. Aspinall nearly twenty years ago as the standard passenger locomotive for the L.Y.R. These locomotives do not possess any features which would appeal to the model maker, except perhaps the cylinders having the valves on top and the bogie wheels being small enough to pass under the frames. The driving wheels are large—the largest coupled wheels in the country up to the introduction of 7-ft. 7-in. coupled wheels on the N.B.R., No. 1,870 class—the firebox and boiler dimensions are also rather small compared with those of modern locomotives. These engines were the forerunners of the famous Aspinall 4—4—2 type on the Lancashire and Yorkshire Railway. We cannot give you a front view, but the following dimensions, together with a photograph, or an inspection of the actual engine, will help you in making drawings of both smokebox and cab:—Width of footplates, 7 ft. 6 ins.; width over cab sides, 6 ft. 6½ ins.; width over coupling-rod splashers, 7 ft.; centres of buffers, 5 ft. 9 ins.



L.Y.R. 4—4—0 Type Express Engine.

[19,845] **Gas Engine Flywheels.** J. D. (Wigan) writes: Will you kindly give opinion on the following? A 29 b.h.-p. gas engine, one flywheel, weight about 2 tons, speed 180 r.p.m. The weight being all one side, and the pull of belt backwards, *i.e.*, towards the cylinder, would there (besides balancing or equalising the weight on crankshaft) be any gain in putting on another flywheel on the other end of shaft, say a light one equally balanced. I know it would take a little more power at start, but would it be of any advantage to engine? Makers say it would not; but, on the other hand, in their advertisement they say they have improved this type of engine (S type) by speeding up and using two flywheels instead of one. We can easily speed up engine to 200 r.p.m., and it runs very well; in fact, we could, with safety, go higher.

You will obtain no advantage as far as power developed is concerned by introducing another flywheel. The question of wear on bearings is also not an important matter, as the wear on main bearings is very slight, and is a simple matter to look after even when the wear is considerable. For electric lighting work two flywheels are an advantage, as it obviates the necessity of using one very heavy wheel. For ordinary work, however, one flywheel is usually quite satisfactory.

[20,087] **Dynamo Failure; Winding Diagram.** E. T. N. (Doncaster) writes: (1) I have just completed a set of No. 2 Avery dynamo castings, 60 watts (20 volts 3 amps.). The machine runs very well as a motor from a 4-volt accumulator, but will not act as a dynamo. The fields are wound with 1 lb. of No. 22 D.C.C., ½ lb. on each coil, and the armature with No. 24 D.C.C., twenty-eight conductors to each slot, and joined up to an eight-section commutator. The coils are joined up as follows: the finishing of coil 1 to starting of No. 2, and finishing of No. 2 to starting of No. 3, etc. The insulation of both fields and armature is without fault. (2) On page 53, Fig. 40, in Avery's "A B C of Dynamo Design," I fail to see how the coils on the eight-section armature are wound as shown, that is, with coil 1 at the bottom of one slot and at the top of the slot on the opposite side.

(1) Have you sufficient resistance in the outer circuit? Did you carefully move the brushes round one-quarter of a turn in the direction of rotation before trying to use the machine as a dynamo? If these points were attended to, we can only suggest that you carefully go through the list of tests given on page 121 of Mr. Avery's book, making sure that your machine is right in each particular. (2) In the diagram to which you refer the coils are shown in that way merely to make a symmetrical diagram. The first coil wound on the core must, of course, go at the bottom of both its slots.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

** Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

A New Adding Machine.

The British Calculators, Ltd., Invicta Works, Belfast Road, Stoke Newington, London, N.—Readers will remember some particulars that were given in a previous issue of the English Money Machines which this firm manufacture. They have now placed the BriCal Indian Currency Machine on the market in response to many enquiries for such a machine. It adds rupees, annas, and pies up to 2,000 rupees; then automatically repeating. It is worked on exactly the same principle as their other adding machines; that is, by means of a peg. We are told that the first BriCal Indian Currency Machine made has been purchased by the Calcutta Tramways Company, Ltd.

New Catalogues and Lists.

Messrs. G. T. Riches & Co., 19, Store Street, Tottenham Court Road, London, W.C.—We have before us a copy of the latest catalogue issued by this firm, who are well known dealers in motor accessories, tools, and "spares." The list is a most comprehensive one, and is carefully compiled in every way. It contains 200 pages and over 1,000 illustrations, and deals with everything in the way of motor fittings, attachments, parts, etc. Messrs. Riches would be pleased to forward a copy of their list to any reader interested, upon application.

The Editor's Page.

THE recent correspondence we have published in our "Practical Letters" column on the "Modelling of the Hydroplane" has brought us several further letters on the same topic. We regret, however, that as these deal entirely with personalities and so are not of general interest to our readers, we cannot admit them to our pages. The original letter from Mr. Dysart was of a somewhat combative character, but we inserted it thinking it might lead to a profitable discussion on the possibilities of the hydroplane as a speed boat. Mr. Blaney naturally took up the cudgels on his own behalf, but the other correspondents who have followed on have continued the discussion on still more personal lines, and we have no option but to forthwith apply the closure. We do not wish, however, to bar the subject of the hydroplane from our columns, for it forms a most interesting subject for our readers to discuss and to experiment upon. We shall be glad, therefore, to find room for any letters which are of interest from a technical point of view, or to hear the experiences of any of our readers who may have given hydroplane building a trial. But in discussing this, or any other model engineering topic, we must ask our correspondents to confine themselves to the subject in hand, and not to let their epistles develop into mere "ink slinging" and the prosecution of personal quarrels. For intelligent technical criticism, however hard hitting it may be, our columns are always open. as from full and free discussion of any subject much good may be derived; but for petty bickering and personal disputes THE MODEL ENGINEER has no space to spare.

* * *

Our reference in the Query Columns of July 16th issue to the status and remuneration of colliery winding engine attendants has brought us the following letter from a correspondent residing in Lower Gornal: "Dear Sir,—In reply to a letter from 'F. B.' (Barnsley), you state that a winding engineer at a colliery gets a low wage with very long hours. This is not always the case. At present in this district, the wage is 5s. 4d. per turn of nine hours, with an hour for dinner, making £1 12s. per week of forty-eight hours actual winding.—Yours faithfully, J. DANDO."

* * *

We are indebted to two correspondents who have kindly notified us that the Tyneside Society of Model Engineers still exists. Mr. Thos. Boyd, 128, Dilston Road, Newcastle-on-Tyne, is the Hon. Secretary of the Society, and would be glad if any prospective members would communicate with him. We might add that reports and notices for publication from Secretaries of Provincial Societies are always welcome, but they should be sent in ten days before the date of issue in which they are intended to appear.

Answers to Correspondents.

"PERPLEXED" (Newcastle-on-Tyne).—Your description of the test is not sufficiently clear for us to be able to advise you. See "Electrical Testing: A Guide to the Testing of Insulated Wires and Cables," by H. L. Webb, price 4s. 6d. net.

A. O. D. (Bath).—Wind armature with No. 24 S.W.G., and field-magnets with No. 26 S.W.G. Get on as much as you can in the space in each case. The machine would not give very good results as a generator, but you can run it at about 3,000 r.p.m. and see what current you get from it. *Re* removing paint from castings, the best plan is to scrape them. This would not affect the quality of the iron. Current required for motor would probably be about 1½ or 2 amps. Two large bichromate cells in series would probably run it for a short time, but better if you could use four such cells coupled in two groups of two in series, each group in parallel with its neighbour.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26-29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

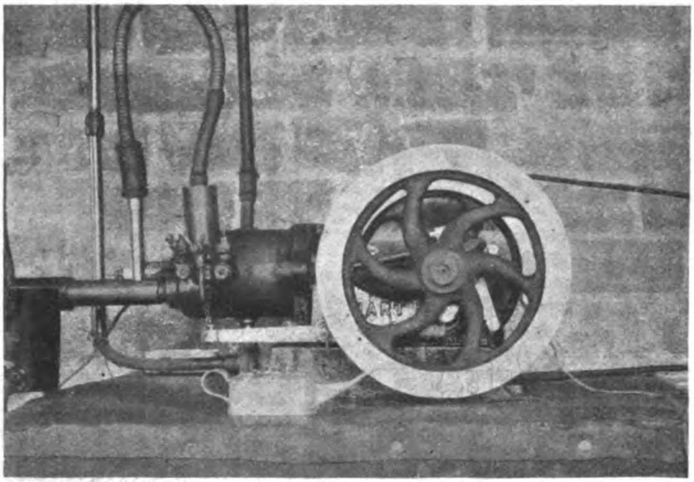
THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 383. AUGUST 27, 1908. PUBLISHED WEEKLY

A Small Electric Lighting and Charging Plant.

By H. D. STEERS.



MR. H. D. STEER'S "STUART" GAS ENGINE.

THE accompanying photographs and drawings illustrate a small plant that I recently installed to charge a few accumulators for miniature electric lighting.

The gas engine was bought second-hand through an advertisement in THE MODEL ENGINEER, and is one of Messrs. Stuart Turner's manufacture, the following being chief dimensions of same:—Cylinder bore, 1⅞ ins.; stroke, 2¼ ins.; flywheels, 9 ins. diameter. The ignition is either tube or electric, the latter being the type in use, which is worked by a wipe-contact, contact being made by a stud fitted on one of the gearwheels.

Although a gas engine, it runs admirably on petrol by means of a home-made spray carburettor shown in Fig. 5. The arrangement can easily be understood by studying Fig. 4, the petrol being contained in the tin with the tube attached to it, mounted above the float chamber (which is, by-the-way, an old "Bluebell" metal polish tin). The petrol being sprayed on to the exhaust tube mixes with the air admitted through the slit in the tubes (Fig. 5), and the now explosive gas is drawn into the cylinder by means of the rubber tubing, which is connected to the cap over inlet valve. This gas is fired by an electric spark from a sparking plug fixed into end of cylinder.

The advantage of having the exhaust tube running through the middle of the vapour passage is that when the exhaust tube has got hot, paraffin can be used instead of petrol, as, being sprayed on to the hot tube, it immediately vapourises. The

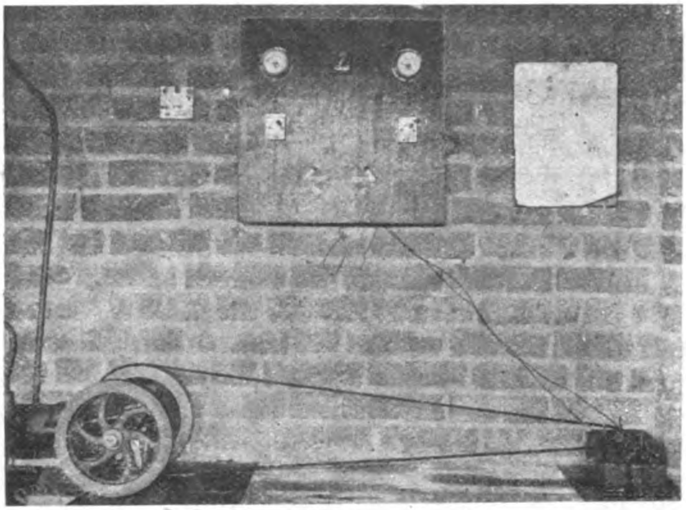


FIG. 2.—VIEW SHOWING GAS ENGINE DRIVING DYNAMO AND SWITCHBOARD ARRANGEMENT.

writer, however, prefers to use petrol throughout, as it is cleaner to work with, does not smell or soot like the paraffin, and gives increased power. The dynamo is a 30-watt machine (10-volts 3-amps.), named by electrical dealers the "Briton," and is very satisfactory.

The driving belt is of the type used for sewing machines, and is quite efficient. This type had to

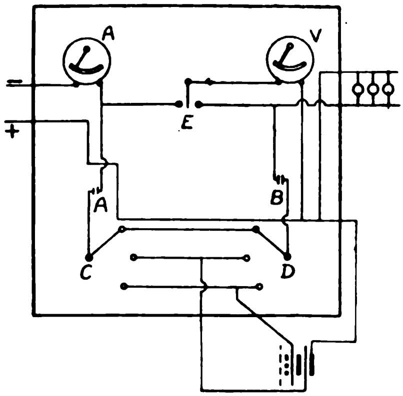


FIG. 3.—DIAGRAM OF CIRCUITS.

be used, owing to there being a V-shaped pulley on dynamo.

The switchboard (Fig. 2) is constructed of whitewood 18 ins. square, and so far fulfils all expectations. A cut-out and resistance is being made, but, at the present time, is far from completion. The winding of the above is shown in Fig. 3.

A and V are the ammeter and voltmeter respectively. Both of these instruments were purchased at Messrs. Armstrong's (of Twickenham) stall at THE MODEL ENGINEER Exhibition last October, and are all that could be desired. A and B are the main charging and discharging switches, respectively. C and D are the regulating switches. If C and D are on top bar, and A and B are closed, lamps can be lit direct from dynamo without accumulators intervening. The lamps can also be lit from the accumulators, whether the latter are being charged or not; but, if the former should be the case, the switch D must be regulated one or two bars to govern right voltage to lamps. The switch E is for indicating by the voltmeter the charging voltage or voltage of accumulators. Only two of the latter are shown, the rest being added on where the dotted line represents an accumulator.

Reverting back to the gas engine a minute, a strainer was made for the waste oil by sewing three thicknesses of flannel to the inside of the perforated lid

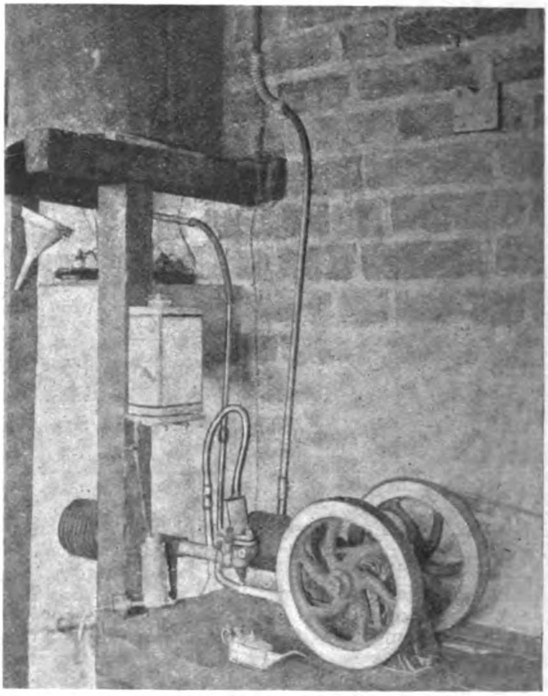


FIG. 4.—VIEW SHOWING COOLING TANK AND PETROL FEED ARRANGEMENTS.

of a "Vim" tin, which was soldered bottom upwards to tube conveying waste oil from well of engine. This strains the oil splendidly.

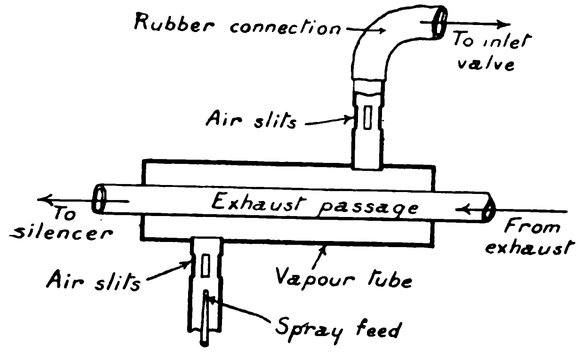


FIG. 5.—ARRANGEMENT OF VAPOURISER.

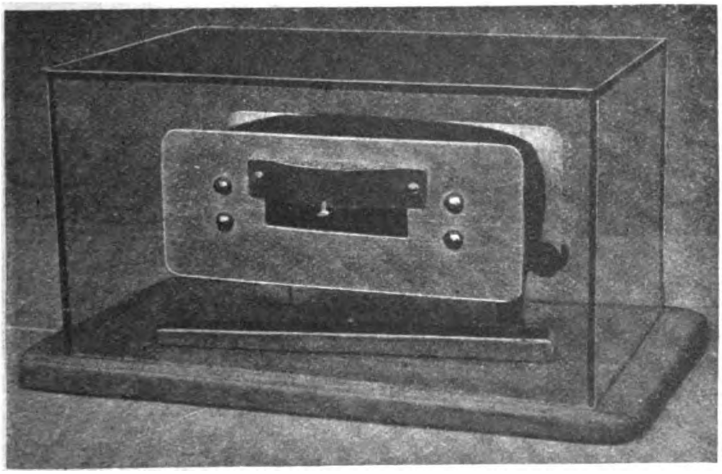
In conclusion, there are two words which sum up the writer's feelings as regards the above set, namely—Quite satisfactory.

A Useful Galvanometer.

By N. G. KAPP.

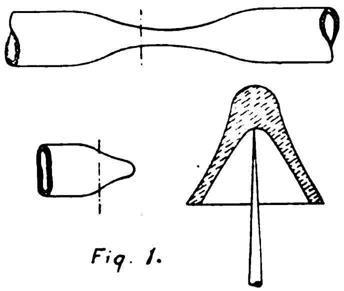
THE illustration below is a photograph of a galvanometer I have just made. The essential parts I have taken from the handbook, "Small Electric Measuring Instruments," of THE MODEL ENGINEER Series, so will not describe those in detail. Some of the details, however, I have, I think, improved.

The body of the instrument consists of a hardwood frame and aluminium facings. The scale is made of thin sheet copper, screwed on to the face

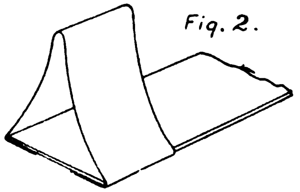


VIEW OF GALVANOMETER INSIDE GLASS CASE.

and bent to form an arc, so that the pointer is always equidistant from the scale. I used copper, as it is much more rigid than paper and adds to the appearance. As to the arm carrying the pointer and needle, I made this of aluminium first, but found that it was necessary to have a heavy counterweight at the back to support it. One could, of course, support the arm near the centre, but then the circle in which the pointer moves would be so



small, and therefore the curvature of the scale so great as to look very bad. I therefore rejected the aluminium arm and made one of mica, which I found



answered splendidly. Mica cuts very clean with a knife, and its property of splitting into layers allows it to be made very thin and therefore exceedingly light, needing no counter-weight beyond the magnet needle. This latter is simply a piece of magnetised watch spring. I found some difficulty in getting an agate pivot for the needle to swing on, the only thing apparently being to buy a compass with needle complete for 7s. This I considered an unnecessary expense, and so made a little cup out of glass, which serves very well.

To make the pivot a piece of glass tube is drawn out something like a fountain-pen filler. It is then cut off at a suitable distance, the point sealed up in a Bunsen burner, and cut off again, so as to form a cup (Fig. 1). The inside of this cup is now perfectly smooth and flat, so that it will swing round on the needle with hardly any friction.

The pointer itself, if made of a piece of paper gummed on to the arm and bent upwards, is not rigid enough to be very lasting. I therefore cut a narrow strip of paper, and gummed its two ends on to the lower side of the arm, its middle part being pinched together and standing upright, as sketch (Fig. 2). Besides being rigid in both directions, this pointer enables one to avoid parallax, which is important in taking delicate readings (see Fig. 2). An adjustable bar magnet, pivoted at the centre and placed just underneath the instrument, enables one to bring the pointer to zero, whatever be the position in the earth's field.

A glass case, made by sticking pieces of glass together to form a square box, covers the whole instrument as a protection against slight draughts moving the light pointer about.

MESSRS. CROSBY, LOCKWOOD & SONS have sent us the first number of a quarterly circular of engineering and technical literature, published at their recently opened book room in Victoria Street, London, S.W. The contents of the circular are classified under subject headings, and embodies the names of most of the important works in engineering, science and technology published during the past three months in England and in America. The list is a useful one and should be well received by all who require to be kept well posted in current engineering literature.

Experiments on Electric Oscillations and Waves.

By R. P. HOWGRAVE-GRAHAM, A.M.I.E.E.

(*Continued from page 536, Vol. XVIII.*)

FIG. 66 shows a rather remarkable experiment, which can be performed with the flat spiral coil described in the issues of September 26th and October 10th (1907).

A 10-volt lamp is connected to a single turn of wire only 4 or 5 ins. in diameter. The lamp burns brilliantly when the turn is placed about 3 ins. in front of the coil. (Here is a suitable place for mentioning that this coil is greatly improved by laying a large sheet of micanite or mica on the wax while it is hot, and cutting the projecting edges of the sheet away when the coil is cold. Thus fronted with mica, the wax does not tend to melt when the iron wire is heated in front of it, and the tinfoil used in a former experiment is prevented from softening the surface and sticking to it.)

Fig. 67 shows an experiment which has already been illustrated, but is repeated here because a far more effective photograph has been obtained.

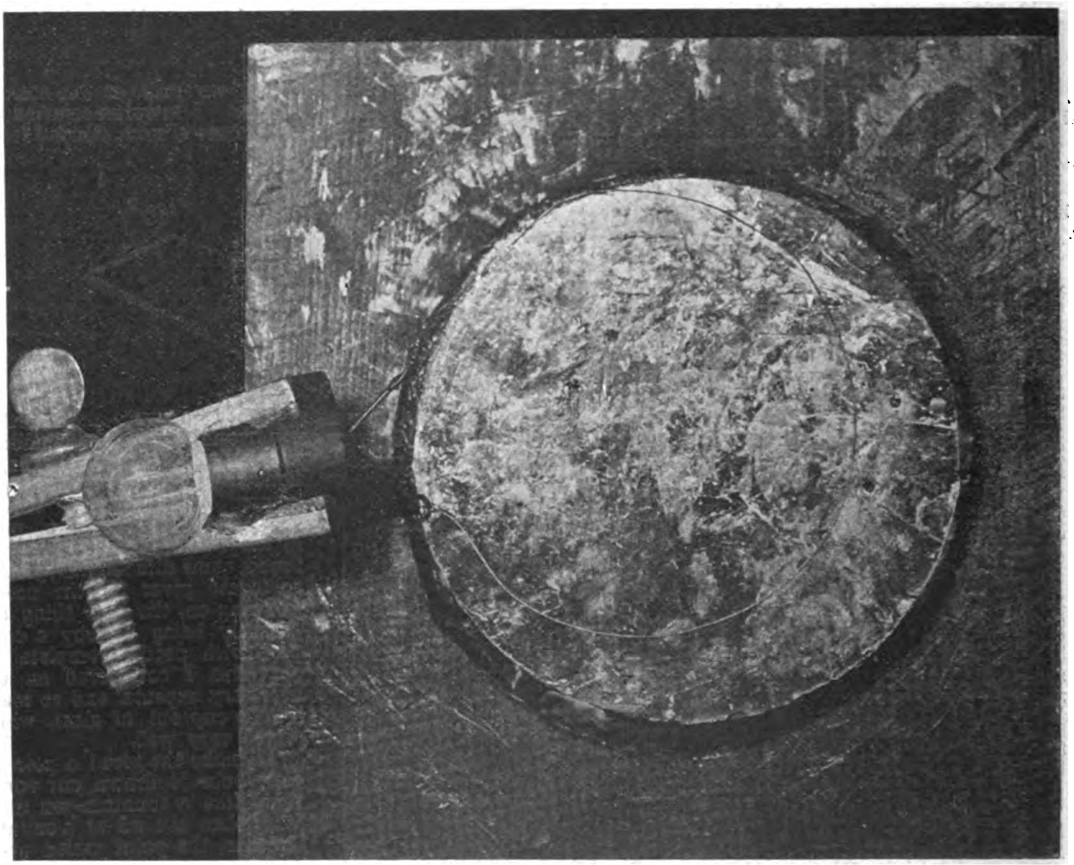


FIG. 66.—LAMP LIT BY INDUCTION IN A SMALL LOOP OF WIRE. (*Exposure: 3 seconds.*)

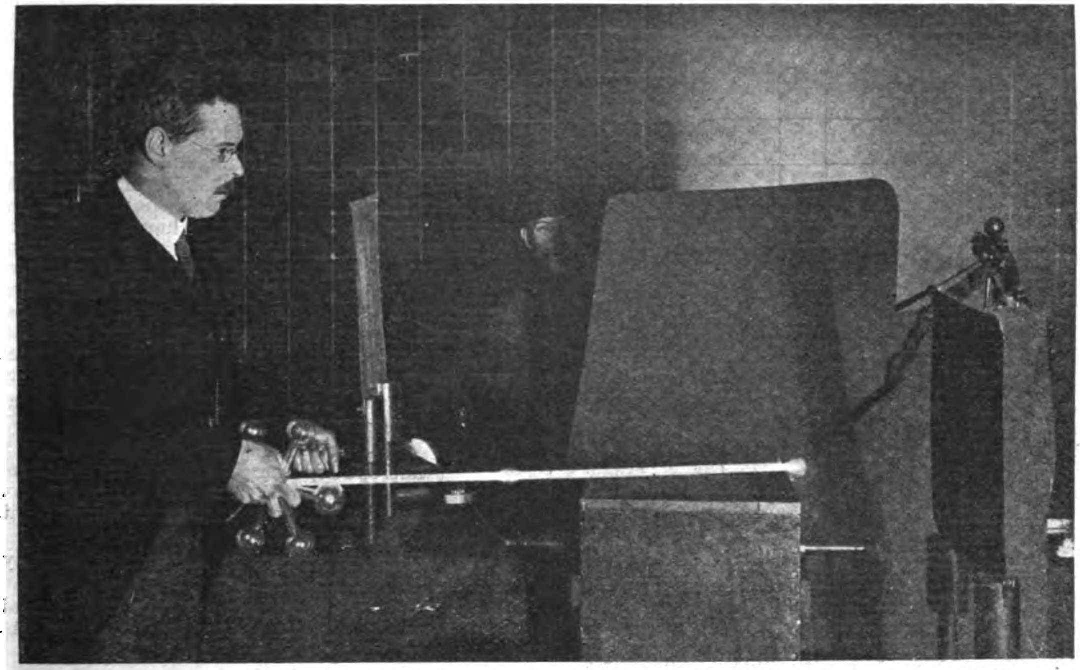


Fig. 67.—Vacuum Tube lit by Electrostatic Induction. (*Exposure about 2 seconds.*)

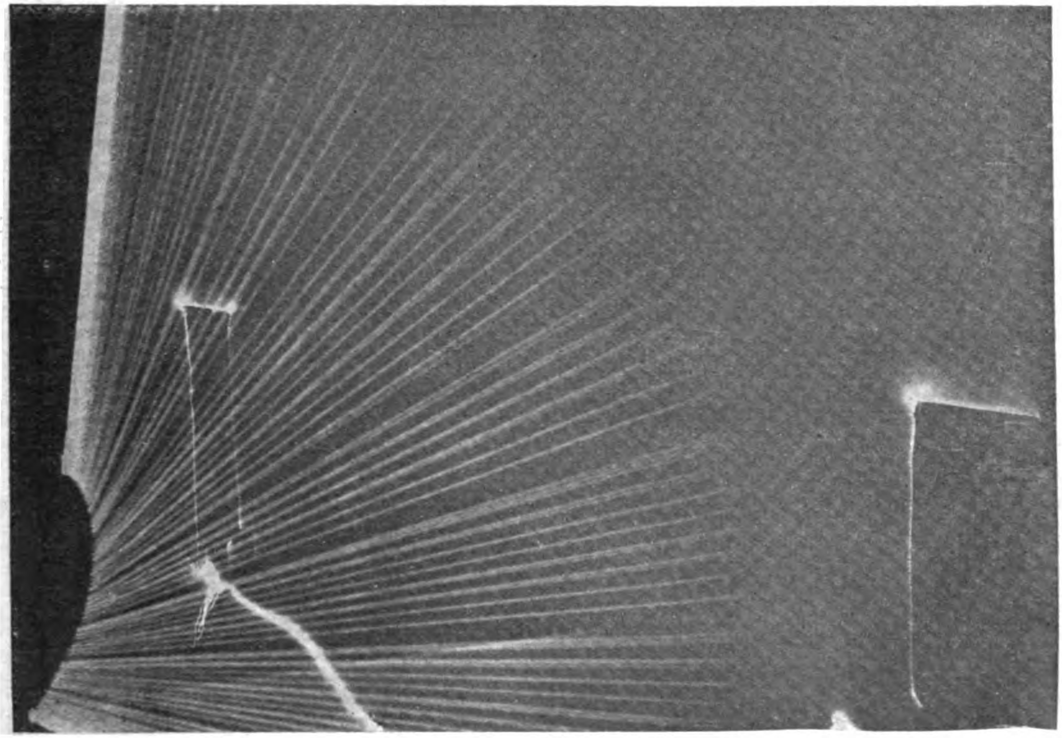


Fig 68.—Vacuum Tube moved in Electrostatic Field.

The experimenter stands on a box (to prevent sparks from passing through his shoes to nails or screws in the floor), and presents some metal object held in one hand to a wire which connects one of the secondary terminals of the Tesla coil with an insulated metal plate. Another plate is connected with the other terminal, and is placed at such a distance that a vacuum tube held in the hand may be brought within a foot or two of it.

The tube is brilliantly illuminated, and if it is brought near enough to the plate, brush discharges issue from the end. The tube may be a long one of the ordinary Geissler pattern, or it may be electrodeless; preferably the bore should be rather small, say ¼ in. It will be illuminated even if it is hung insulated in space at some distance from the plates, but it must lie in a line parallel to the electrostatic field surrounding them. If moved fairly rapidly through the air, the tube appears as a fan made up of beautiful bands of light. Each streak of light is the result of an oscillatory discharge, and the discharges follow each other so rapidly that they appear to occur almost simultaneously.

Fig. 68 is an actual photograph taken only by the light which the experiment emitted. In the right-hand corner of the photograph is a line of illumination due to the brush discharges at the edges of the plate, a similar effect being noticeable opposite to it, where the connecting wire, moved during the experiment, shows as a very blurred line. The sparks passing to the metal held in the operator's hand are also visible.

The curved line from which the streaks of light start is the track made by the operator's hand as the tube was moved downward. This fan of light was produced in rather less than ¼ second, and there are two points about it which should be noticed. One is the irregularity of spacing, rather less apparent to the eye than in the photograph. This is due to variations in the primary spark-gap. The other point is the gradual fading-off of the streaks of light towards the end of the tube which is furthest from the hand.

This is due to a true *current*-gradient in the tube. Energy enters the tube along its whole length, because the electrostatic lines of strain crowd in upon it everywhere to find an easy path through the hand and body of the operator. The flow of current at the far end is therefore only due to the small quantity of energy which enters there, but it flows towards the hand, continually receiving increments which raise the whole current-density, until it is at its maximum value at the place where it is held.

This action is comparable with that of a stream which starts at a small source and receives the successive increments from tributaries until it eventually becomes a wide river.

(*To be continued.*)

A PROSPECTUS of the Edinburgh Twelfth Annual Competitive Home Workers' Industrial Exhibition is before us, and we see there are a very large number of classes in the mechanical and model.making section of the Exhibition. A large number of prizes are offered in several classes, and we recommend those interested to obtain the prospectus from the Secretary, Mr. A. T. Hutchinson, 16, George Street, Edinburgh Application for entry forms should be made early, as all entries close on September 30th.

How Shall I Join Up My Telephone?

By "PHONOS."

JUDGING from the constant stream of enquiries which are sent to THE MODEL ENGINEER office relating to telephone connections, the various branches of the ordinary house or domestic telephone circuit do not seem to be understood by a good many amateur telephone engineers. With a view to assisting them to help themselves, a number of queries have been classified, so that the special difficulties encountered stand revealed.

The points about which questions are raised seem to be :—

(1) How to trace out the connections of an instrument of no special make.

(2) What connections are necessary when a microphone is used without an induction coil, and also, how an induction coil may be added to instruments where this is not provided.

(3) What circumstances determine the employment of an induction coil.

(4) Questions relating to methods of communication between various stations by switching.

(5) Intercommunication.

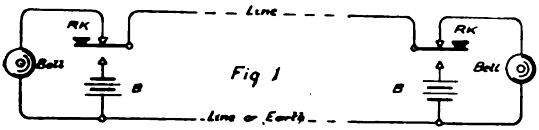
(6) Special cases of switching.

Taking the difficulties in the order they stand, tracing the connections of any instrument becomes a comparatively easy matter, even if these are not, as is often the case, all visible, provided the functions of the various elements of the complete apparatus are thoroughly understood. For a telephone circuit of the simplest character, some means of calling attention is required. This is generally provided for by means of a key or push for signalling to the distant station, and at the latter some form of receiver—either a buzzer, though, more generally, an electric bell—to receive the signals made. In order that calling may be effected in both directions, calling and receiving apparatus have to be provided at each station.

Similarly, a complete conversation can only be carried on when receivers and transmitters are fixed at each end of the line. It is evident, therefore, that the line circuit is put in connection with two circuits at each instrument, namely—a calling circuit, and a speaking circuit; and, normally, when no conversation is taking place, the conditions must be such that calling may be effected from either instrument.

Considering the calling circuit first, Fig. 1 shows a simple ringing circuit provided with two ringing keys R K, ringing batteries B, and two bells. If either of the keys are depressed, the circuit for battery B is made through the key lever, line, distant station's key, the top contact of the key lever, bell, and the return line or earth, as the case may be. It should be noticed that the ringing station's own bell is not included in the circuit, as the depression of either key disconnects that branch of the circuit in which the bell is placed. In any diagrams that follow a return line will be shown, though it may, unless otherwise indicated, be replaced by an earth connection at each station.

Fig. 2 illustrates a simple form of talking circuit, in which T represents the transmitters and R the telephone receivers. It should be noted that the batteries are so introduced into the circuit that they each tend to send a current round the circuit in the same direction, *i.e.*, against the clock, as indicated by the circular arrow. The resulting current in the circuit is due to the combined batteries. If one of the batteries were reversed, then —if they were equal in E.M.F.—no current would result and speaking would be impossible. The operation of the circuit is very simple: speech tones impinging on the transmitter diaphragm alter the resistance of the transmitter, and varying currents traverse the circuit actuating the telephone receivers. It would take too much space to give an elaborate explanation of the composition of speech tones, but a broad explanation of the electrical transmission of speech in such a circuit as that of Fig. 2 is that given above. It may be pointed out here that the distance to which speech can be transmitted by the circuit of Fig. 2 is very limited, the reason being that, unless the resistance of the transmitters is considerable, as compared



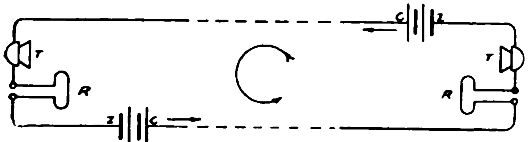
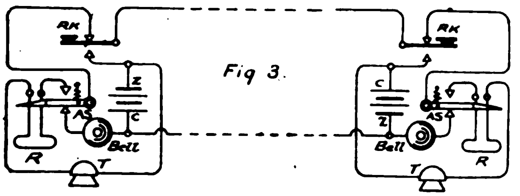


Fig. 2.



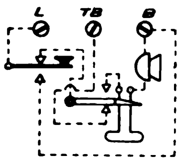


Fig. 4.

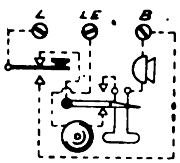
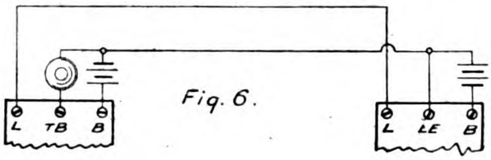
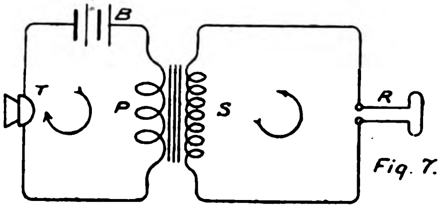


Fig. 5.

with that of the rest of the circuit, the variation of the *total* resistance of the circuit when the transmitter resistance varies is small, and the corresponding current variations are also very small, and their effect at the receivers is feeble. Generally, it may be said that such a circuit is only suitable for room-to-room communication where the resistance of the line is small, say 1 or 2 ohms, compared to the transmitter, which may be anything from 10 ohms upwards.

We have now to see how the circuits of Figs. 1 and 2 may be combined to permit of signalling or calling and speaking. Three changes have to be effected to enable speaking to take place. (1) The bells have to be taken out of the line circuit; (2) the batteries inserted in the line; and (3) the





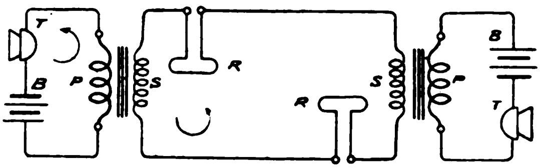
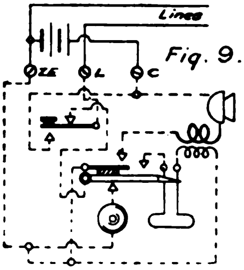


Fig. 8.



transmitters and receivers also put in the line circuit. These changes are automatically made by a switch, which is held in one position by the receiver being hung on to it, and which, when the latter is removed for conversation, moves to another position under the action of either a coiled spiral or a flat leaf spring.

Fig. 3 gives the connection for the complete circuit, and is shown with the receivers on the switch-hooks or automatic switches A S, giving the conditions of Fig. 1. It will be noticed that the bell at each end is now in circuit through an extra contact, viz., that at the switch-hook. In all other respects the conditions are identical with Fig. 1. If, now, the receivers are both taken off their hooks, the bell circuit at both stations is disconnected, since the switch-hook rises and leaves the lower or bell contact. In this position of the switch-hook the conditions of Fig. 2 are reproduced as tracing the circuit from either battery, the current goes through the transmitter, receiver, upper contact of switch-hook, pivot of latter, upper contact of ringing key, key lever, to line entering the distant station by the ringing key,

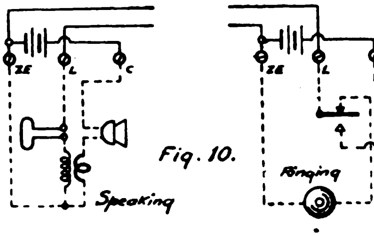


Fig. 10.

upper contact, switch-hook pivot, upper contact of this, receiver, transmitter, through battery and back by the other line to the first battery. Such simple telephone sets as above described are made in three-terminal and four-terminal patterns, and also have slight modifications, depending upon the maker. We will deal with these briefly, and then pass on to the consideration of telephones with induction coils. The three-terminal sets are made in two patterns; with external and internal

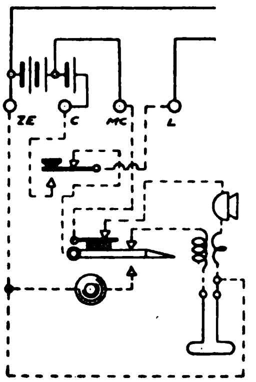


Fig. 11.

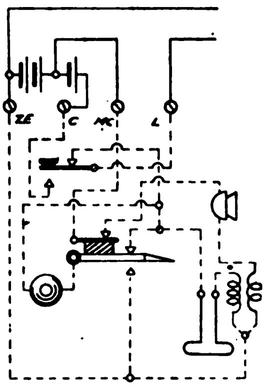


Fig. 12.

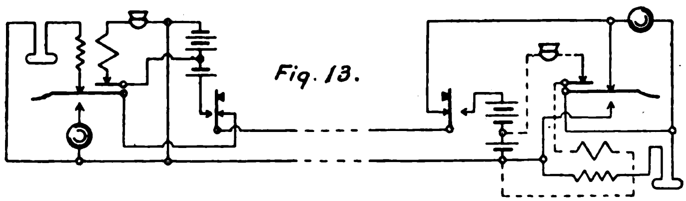


Fig. 13.

bells, respectively. Fig. 4 shows the internal connections of a three-terminal set requiring a separate bell, and Fig. 5 a three-terminal set with internal bell. The external connections of both of these patterns are given in Fig. 6.

As previously pointed out, the simpler form of telephone, consisting of microphones and receivers only, has an extremely limited range, and is only suitable for room-to-room circuits. To get good results from a microphone it requires to be placed in a circuit where it itself forms the principal resistance. To enable this to be attained, an induction coil is used. This consists of two wires wound on an iron core. The microphone and battery are joined up to one winding, the other winding including the line and the receiver of the distant station, as shown in Fig. 7. Varying currents

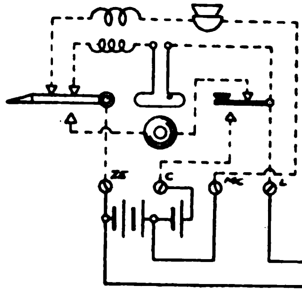


Fig. 14.

in the transmitter or primary circuit give rise by inductive action to variable currents in the line or secondary circuit, which currents actuate the telephone R. The introduction of the induction coil enables speech transmission to be enormously improved in two ways. By making the primary coil of a small number of turns of comparatively low resistance we have the necessary conditions, as just explained, for maximum efficiency of the microphone. Forming the secondary of a large number of turns of small gauge high-resistance wire, the secondary current is reduced, while the secondary E.M.F. is raised. As a result, the energy to be transmitted in the secondary circuit is not wasted by large heating losses in the line (such losses increasing as the square of the current) and, consequently, smaller line conductors may be used. The induction coil is, in fact, a "step-up" transformer, and the ratio between the primary aud the secondary voltages is theoretically equal to the ratio btween the number of turns of the two windings. A complete talking circuit between two stations is shown in Fig. 8. A combination of Fig. 8 with Fig. 1 will readily yield the necessary connections to the automatic switch. The full connections for a three-terminal set are given in Fig. 9, while the connections during speaking or ringing are shown in the two diagrams of Fig. 10. Referring to Fig. 9, it will be noticed that the switch-hook has an auxiliary contact-arm insulated from the main body of the hook, and also that the primary and secondary windings are joined together at one end in the speaking position, as is more clearly shown in Fig. 10. The object of this last is to simplify the switch-hook construction, as otherwise an extra contact would be required. This simplification in no way interferes with the action of the primary and secondary circuits, as an inspection of Fig. 10 will show. Incoming speech currents pass through the telephone, the secondary coil, and the switch-hook to the return line, and the primary circuit clearly has no shunting effect on these. Variable currents in the primary circuit are transmitted inductively to the secondary circuit, formed of the secondary coil and the line circuit in the ordinary way. The three terminal set just described is suitable for short distances only, as the same battery is used for signalling as for speaking. On a long line the current required for ringing requires a larger battery on account of the voltage drop in the line. Such a battery is too strong for the speaking circuit, as it causes arcing to take place between the carbon granules of the microphone, and the speaking is impaired. This difficulty is got over by the use of a four-terminal instrument, in which the battery for ringing purposes may be made as large as necessary, a portion only (say one or two cells) being tapped off for the speaking circuit. There are two patterns of the four-terminal instrument—one in which the switch-hook in rising disconnects the bell circuit and connects up the talking circuit (Fig. 11), and the other in which the switch-hook short-circuits the bell or talking circuit, accordingly as the telephone is off or on the hook (Fig. 12). The separate circuits can easily be traced, but are perhaps better seen by reference to Fig. 13, in which both instruments are in the talking condition. The two classes of instrument are sometimes referred to as "series" (Fig. 11) and "shunt" (Fig. 12

Fig. 14 shows an alternative method of connecting up a four-terminal "series" telephone, which has the advantage that a simpler form of automatic switch-hook may be used.

Having now reviewed the connections of the various instruments of the domestic or office type, the reader should have no difficulty in tracing out for himself the connections of any instrument he may be in possession of, no matter how it may vary in details from the standard forms dealt with. The consideration of and getting to work any simple room-to-room circuit should be an easy matter. With the Editor's permission, points 4, 5, and 6 will be dealt with in a later issue.

(To be continued.)

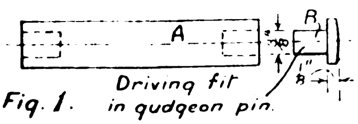
Workshop Notes and Notions.

*[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "*WORKSHOP*" on the envelope.]*

Gudgeon-Pin Fixings.

By W. H. Islip.

Most motor-cyclists have had trouble with the setscrews holding the gudgeon-pin in position, causing more or less serious damage, even to the extent of a smashed cylinder. I will therefore give a few alternative methods of securing gudgeon-pins.



Gudgeon-pin with Brass Ends.

Fig. 1 shows a simple and, moreover, efficient method; one thing the writer would like to impress on readers of this article, and that is—always have the gudgeon-pin a light drive fit, leaving one end ·001 to ·003 larger than the other end, as the writer believes a great deal of trouble is caused by gudgeon-pins being too poor a fit.

Turning to Fig. 1, A is the gudgeon-pin, which must be ⅛ in. shorter than bore of cylinder; drill down each end a ¼-in. hole about ⅜ in. deep. B is a brass button, the ¼-in. part of which must be a tight fit in the hole bored in gudgeon-pin. The best way to make the button ends is to turn a piece of brass down to fit the hole in pin tight (one in each end); then hold the gudgeon-pin in chuck and finish off the ends spherical. Whilst still in the chuck the brass ends should be reduced slightly smaller than diameter of pin.

Fig. 2 shows a very simple method. A is the piston, B the gudgeon-pin, which should be a good fit. Fix gudgeon-pin in position and drill a hole to tap out ¼ in. about ⅜ in. deep, and fit a button-headed brass screw C.

Fig. 3 is a very good method, and gives the advantage of an additional piston ring. B is the gudgeon-pin, C is a groove about 3-32nds in. deep (no more); the width of the groove should be slightly larger than the diameter of gudgeon-pin. The reason a shallow groove is suggested is because this article is intended to apply to pistons formerly having setscrews to hold the gudgeon-pin in position, and therefore, if a deep groove were used, it would weaken the piston considerably. D is a concentric ring to fit in groove C, and should be fitted as an ordinary piston ring.

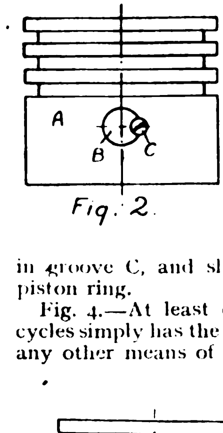
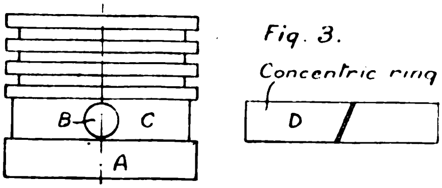


Fig. 2.

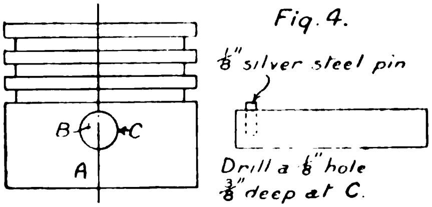
Fig. 4.—At least one first-class maker of motor cycles simply has the gudgeon-pin a drive fit, without any other means of securing it; in such cases the



gudgeon-pin should be prevented from turning round. Referring to Fig 4, B is the gudgeon-pin hole, which should be plugged with a piece of mild steel. Dot at C and drill a ¼-in. hole about ⅜ in. deep. On removing the plug, we shall have a slot merging into the gudgeon-pin hole; put a ¼-in.

silver-steel peg in gudgeon-pin as shown, so that the gudgeon-pin will be prevented from turning round.

Fig. 5.—This is probably the most efficient of the setscrew type of fastening. Make a pin same



METHOD OF SECURING GUDGEON-PINS.

size thread as original one, but with a longer head. Square a portion of the head as shown and drill a 1/8-in. hole at C. Put the pin in and screw up tight in the usual way. Next make a square hole washer D to fit the square head of pin; then note

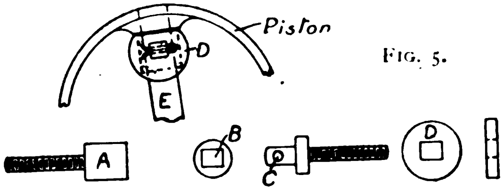


FIG. 5.

METHOD OF SECURING EXISTING GUDGEON-PIN SCREWS.

what part of the washer would touch against side of piston, mark it; then file the part away—the drawing will explain. Having fitted the washer, a stout split pin should be put through the hole C.

The writer has had these methods of securing gudgeon-pins under observation for many miles' running, and can recommend same from practical experience.

A Method of Cutting Large Glass Tubing.

By E. WILSON.

The following method of cutting large glass tubing has been found to be very successful. Cut two narrow strips of blotting-paper long enough to go round the tube. Wet these and stick round tube within 1/4 in. of each other at the point where it is desired to cut it. Previous to this file a notch on the glass between the strips. Then, with a hot wire or a piece of fine glass tubing heated to redness, touch the glass at the notch. A crack is developed, which is prevented from spreading by the paper strips. By tapping the glass now it may be broken, and in most cases a clean, square break is effected.

Lubricant for Aluminium Cutting.

One of the best lubricants for cutting aluminium in a lathe is said to be kerosene oil, as it, to a great extent, prevents the liability to tear the surface of the metal and enables a better finish to be obtained.

Notes on Calipers and Micrometers.

By GEORGE GENTRY.

(*Continued from page* 79.)

THE form of registering caliper, which we have had under consideration, is usually engraved with a metric scale in centimetres and millimetres upon the reverse side of the quadrant to that of the inch, entailing the use of a separate index which is generally fixed. If the zeros of the scales do not coincide and the indexes do, or *vice versa*, one scale is always out of calibre. Now, it is rather an unsatisfactory job to try and re-engrave an index, and the writer has found that the addition of an

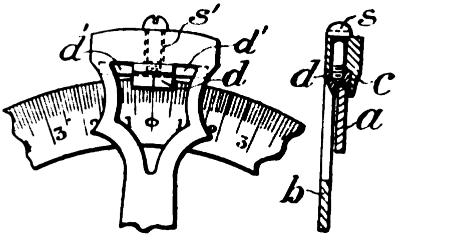


FIG. 10*a*.

adjustable index on either side serves the purpose and is far more accurate. Fig. 10*a* is a full-size elevation of the metric index which, in this case, is the movable pointer. Referring to the section, *a* is the quadrant, *b* the index arm, *c* the fixed index on the inch side, and *d* the adjustable index on the metric scale. The arms *d'd'*, shown on the elevation, are one with the adjustable index and lend it rigidity. The fixing screw is shown at *s*, and the oval clearance hole—to allow of the movement of the pointer—is shown dotted at *s'*. The play in this hole need not exceed a total of 1-32nd in.

Fig. 10 is a design of the form of caliper last described, made by a well-known English firm, the quadrant scale being engraved on a plate, while the index is a hand or pointer travelling below it. These are constructed so as to be clamped rigid on any point.

A small handy form of registering caliper has been imported from Germany in which both the recording arms consist of quadrant scales running against each other back to back, centimetres being engraved upon one and inches upon the other, the zero point being carried over upon the adjacent edges, so that the zero of one scale records the measurement upon the other.

Fig. 11 is a very good design of a slide caliper for inside and outside work. The index frame on the sliding leg is engraved top and bottom with verniers to record a tenth of a millimetre on the metric scale and 1-128th of an inch on the inch scale. The smallest size is made to 11 centimetres length, which is slightly over 4 1/4 ins. The adjustment is neatly maintained by means of a spring (shown dotted) upon the underside of the arm, which, together with the locking screw *a*, takes up all wear. The projection *b*, which travels along the upper side of the arm, is used in conjunction with an inch scale divided upon the reverse side (not shown) of the arm, reading inwards with the zero at the point of the same. This projection will also record a depth in millimetres, but great care must here be taken as the reading is the wrong way about. The form of the legs is such that with known dimensions *c* and *d*, and making deductions for these, inside dimensions can be very accurately taken. This tool is of German manufacture, is very accurately divided, and is sold at as cheap a figure as 4s. 6d. The only drawback about it is that the jaws are very thin, being only about a full 1-16th in. metal. Failing the ability to procure more expensive articles of this sort, this tool should be an extremely useful adjunct to any reader's workshop.

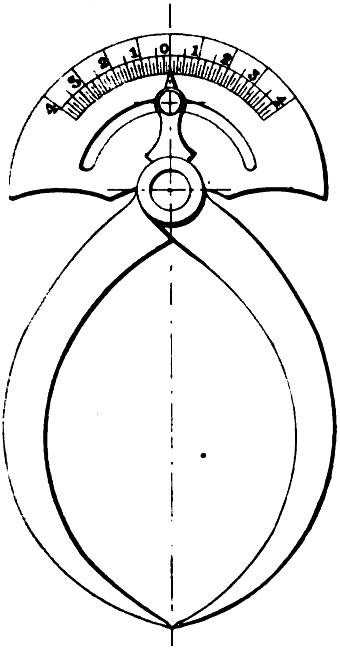


FIG. 10. (*Half full size.*)

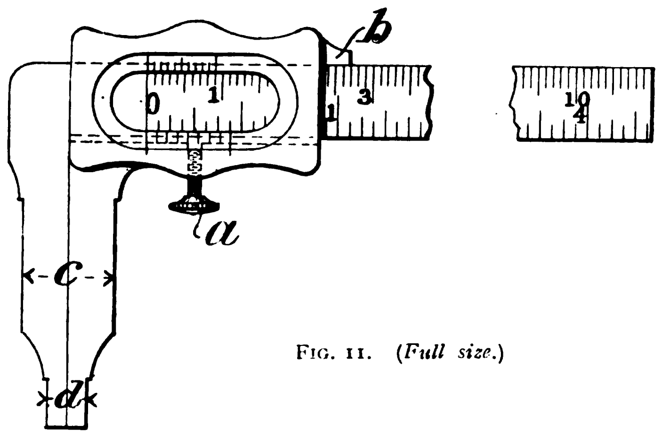


FIG. 11. (*Full size.*)

Micrometers. — As has been previously mentioned, the principle of the micrometer has been very aptly described in these pages before, but a brief recapitulation will be useful to explain the construction of the latest form of this handy instrument. Fig. 12 is an elevation of the simplest form of micrometer and one which in the hands of a skilful workman will read to as fine a dimension as 1-10,000th of an inch. This tool is of English manufacture, and—unfortunately—is consequently a high price. The parts are as follows :—*a* is the frame in one piece with the sleeve *b*, which is internally threaded in a portion of its length with 40 threads to the inch. In this works the screw spindle *c*, which is in one piece with the thimble *d*. This latter works upon the outside of the sleeve, and has a milled portion at the end of the outside for convenience in operating the screw. The sleeve is split from the inner end for a portion of its length, rather longer than the internal thread, and is carried upward over the end of the frame in the form of two lugs, one of which is screwed, a countersunk screw being introduced to draw these lugs together, and incidentally to close together the sleeve so as to either take up wear on the screw or grip it rigidly; *e* is the adjustable anvil, which is tightly screwed into the outer arm of the frame. The inner surface of this constitutes the zero mark on the micrometer. When the end of the screw butts on to this the recording edge *f* of the thimble stands level with the zero of the scale on the sleeve. This latter scale is divided along a line running parallel with the axis of the screw, and is engraved upon the outside of the sleeve. On a 1-in. micrometer this scale consists of 1 in. divided up primarily into ten divisions, each 10th being divided into a further four. As the screw has forty threads to the inch, one of these small divisions corresponds to a revolution, and being 1-40th in., is therefore equivalent

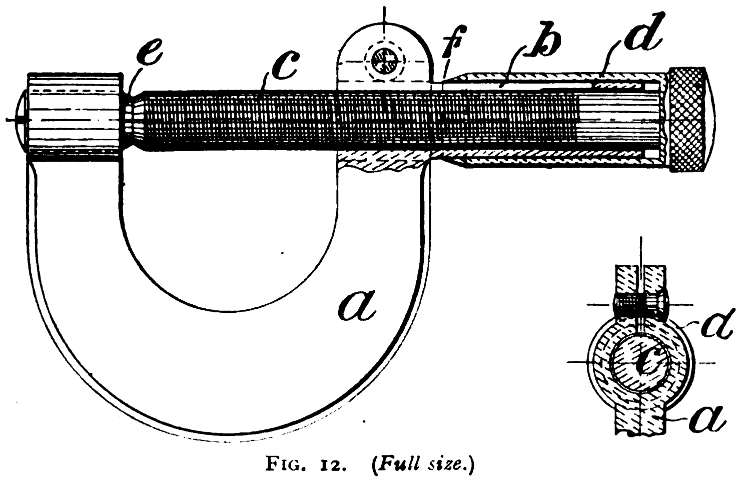


FIG. 12. (*Full size.*)

to 25-1,000ths. To reduce the measuring capacity, it is therefore necessary to divide the circumference of the thimble into 25 divisions. This is done upon the edge *f*, the scale being marked out into five primary divisions, marked 5, 10, 15, and so on; 0 and 25 being engraved against the same mark. If, therefore, the thimble be unscrewed from its zero mark through one of these 25 divisions, the point of the screw has been withdrawn from the face of the anvil through a space equal to 1-25th of 1-40th, which is 1-1000th of an inch. A certain amount of familiarity is necessary to read a micrometer in thousandths of an inch readily, but it should always be remembered that the primary divisions on the sleeve scale equal ·1, ·2, ·3 (and so on) of an inch, always also remembering to add 25-1000ths for each small division, and in addition to add to this amount the number of thousandths to their zero recorded upon the circular scale on the edge *f* of the thimble. In metrical micrometers the screw has two threads per millimetre, and the thimble fifty divisions giving 1-100th mm. per division = 1-2540th in.

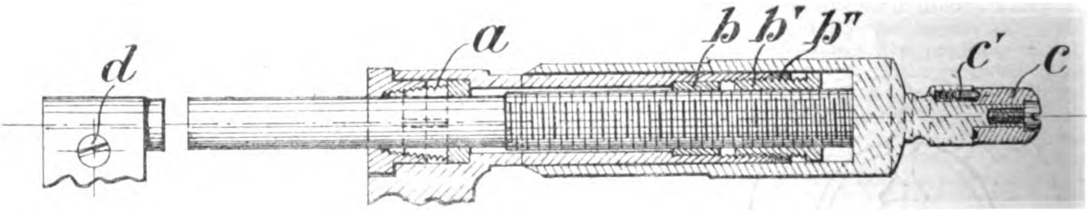


FIG. 13. (*Full size.*)

Several excellent improvements have been made on the above instrument by Messrs. Brown and Sharpe, of Providence, Rhode Island, U.S.A. Fig. 13 is a section of the Brown & Sharpe micrometer as it is now made, except that they now fit a quick-action locking nut. It will be noted here that the arm of the frame carrying the anvil is reduced considerably, almost to the diameter of the anvil itself, and that there is no bevel upon the edges of the measuring surface, consequently the measurements can be made close up against a shoulder, which is impossible in the older form. In addition to this, the screwed portion of the spindle does not now project beyond the inner arm of the frame, the internal threaded portion of the sleeve being on the outer end, and the whole of the screwed portion of the spindle being enclosed in the sleeve. As the spindle has now a smooth turned surface a very apt device is added in the form of a split bushing, shown at *a*, which has a tapered external thread articulating with a similarly screwed milled nut, the action of which being that when it is screwed up tightly the arms of the split bushing grip the spindle, with more or less frictional resistance, so as either to lock the micrometer or render it more suitable for use by a heavy handed person. The internal screwed portion of the sleeve is made in two separate parts, shown at *b* and *b'*, portion *b* being fixed tightly; portion *b'* is screwed into the sleeve, and fitted with a locknut *b"*, so that any backlash which makes itself apparent in the nut, due to wear, can be rectified by moving b' against the fixed nut *b*, locking it in its new position by means of the locknut b". Any degree of tension can be put upon the screw permanently by this means without any reference to retardation of action brought about by the use of the locking device shown at *a*. The small milled projection *c* is known as the ratchet stop, and is applied to micrometers for the purpose of ensuring the same degree of tension being applied to an article being measured by one person as by another. A ratchet pawl *c'* allows of the free movement of the thimble and screw until such pressure as is sufficient to record the exact size of the article between the points is reached, when it gives way and allows the milled end *c* to slip round with the characteristic clicking noise peculiar to a ratchet. The action of this is positive on the unscrewing direction, so that by means of the small diameter of the finger piece, the micrometer can be unscrewed at a much greater rate than were it to be operated by the larger diameter of the thimble itself. The method of graduating these tools is exactly the same as the one described above. The function of the screw shown on the frame at *d* is to allow of the adjustment of the anvil to compensate for wear between it and the end of the spindle.

(*To be continued.*)

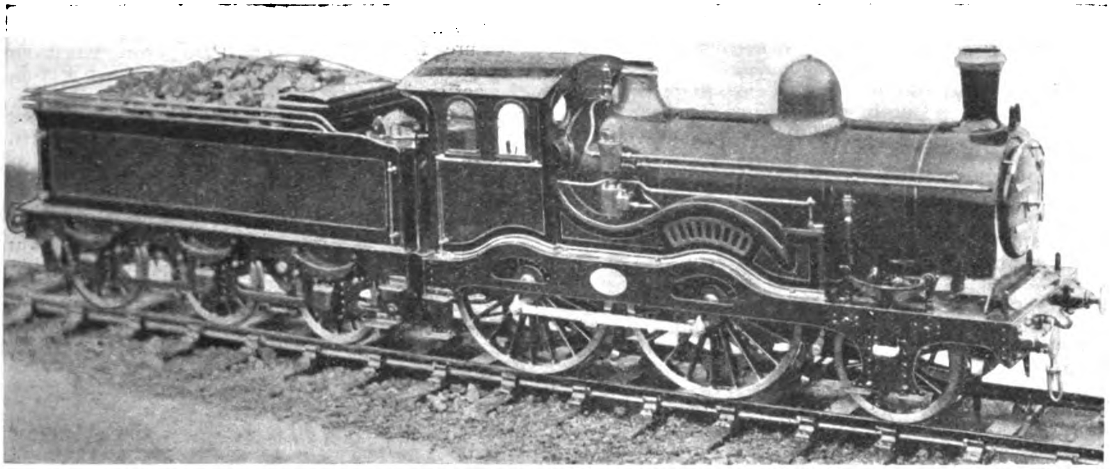
Description of a Model 2—4—0 Locomotive.

By RICHARD J. TAIT.

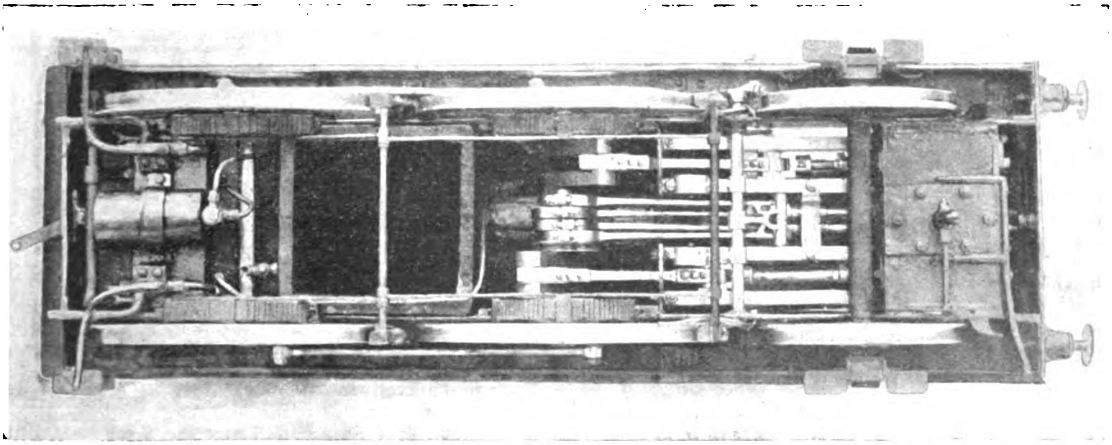
A FEW months ago, when visiting an elaborate Model Exhibition in the country, the writer's attention was attracted by a small crowd of would-be sightseers intent on some article of special interest. The object turned out to be a model locomotive enclosed in a glass case. The name-plate showed it to be the handiwork of Mr. Thomas Wood, a plumber, in the employ of the Lambton Collieries, Ltd., and it was plainly evident that his engine was one of the chief attractions of a thoroughly well-stocked show of electrical, mechanical, and marine models, costing from a thousand pounds to a few shillings.

Of course, those interested in the development of the modern locomotive saw at once that this model represented an almost obsolete type of engine, but this was immaterial to the lover of a "reproduction in miniature" so strikingly graceful and finished with such delicacy as seen in Mr. Wood's model.

Although termed "obsolete," few of your readers will deny that some of the remaining 2—4—0 engines are, even now, worthy of admiration, embodying speed, economy, and compactness when working a fairly light load under favourable conditions. Albeit this was the leading fashion in the North when Mr. Wood commenced to build the model under notice. It took four and a half years of his leisure time to complete, and during that period several new features were being introduced in the N.E. engines, one of which was the improved cab, and it was thought desirable to incorporate this departure in the model, although the hood type of cover still exists on the original type.



General View of Mr. Thomas Wood's Model 2--4--0 Locomotive.



View from Underneath 2--4--0 Locomotive.

Armed with a whole-plate camera, after a drive of nearly 5 miles, the writer found Mr. Wood "mending his ways" in the little garden plot reaching from the front of his cottage to the small workshop some few yards distant. Here, then, was the home of the model locomotive which attracted so much attention, whether at the Paris Exposition or the local flower show. Some short distance off can be seen the engineering works of the great colliery company, at which formerly were built the large six-coupled tender locomotives used in hauling the 2,000,000 tons output of coal, conjointly on their private lines and on the N.E.R. to Sunderland Port.

No doubt Mr. Wood was wont to watch the evolution of these engines from week to week during their construction, as he passed through the shops, and being a man of keen perceptive faculties, he one day allocated to himself the task of building a locomotive entirely without aid. The results are embodied in this engine-in-miniature, and although, in his interview with Mr. Wood, the writer was requested "not to praise his work, as he has still much to learn," it is difficult to withhold one's admiration.

It was thought desirable that a photograph of the maker should be included, but nothing would induce him to consent. Self-disclosure is not one of Mr. Wood's qualities.

The engine was then placed upon the kitchen table and every facility afforded for examination. Mr. Wood answered the writer's questions both orally and by supplementary sketches in a straightforward manner, and from the information thus obtained the following descriptive notes are made.

Height from rail: To footplate, 4¼ ins.; to top of funnel, 12½ ins.

Length of engine and tender over all, 3 ft. 9½ ins.

Frames: Width (inside), 4¼ ins.; (outside), 6¾ ins.; length, 1 ft. 10⅝ ins.

Diameter of wheels: Leading, 4½ ins.; driving and trailing, 7 ins.

Distance between centres: Leading and driving, 6¾ ins.; driving and trailing, 7½ ins.

Diameter of boiler shell, 4¼ ins.

Length of boiler and firebox, 10½ ins.

The wheels are of cast-iron, with steel tyres shrunk on. The boiler is copper-plate riveted, wood-lagged, then covered with sheet iron. The firebox is also of copper 1-16th in. thick, lap jointed; tubeplate, 3-32nds in. thick; twenty-four 3-16ths-in. internal tubes are provided. The foundation-ring is of copper (3-16ths in. by ¼ in.).

The dome and valve covers are of sheet brass; the former was cut from a sheet to form a cone minus its apex, then hammered out to shape, and a convex crown silver-soldered in to give the orthodox form. The safety valve is of the usual Ramsbottom duplex type. The regulator valve in the dome is a flat slide held to the face by means of crossbars. The cylinders are made from brass tubes 1⅜ ins. diameter by 2-in. stroke, and built up with sheet brass ports and covers. They were accurately bored out in the lathe. The motion bars are of mild steel (5-16ths in. by ⅛ in.). The crossheads were cut out of solid steel turned in lathe, and the space between jaws sawn out. The crank-shaft was made from a single piece of mild steel forged into shape, portions sawn out to form the webs; the latter twisted round to an angle of 90 degs., then finished in the lathe. The eccentric sheaves are of brass, made in two pieces. The slot links are of steel, drilled and filed to shape.

Two injectors, with jets and valves, are provided.

Mr. Wood, not being a railway servant, had much trouble in obtaining many dimensions, but any deviations in this respect can amount to very little, and are nowhere apparent to the eye. He had many difficulties to overcome, and only a resolute determination to succeed prevented him from frequent failures in his enterprise.

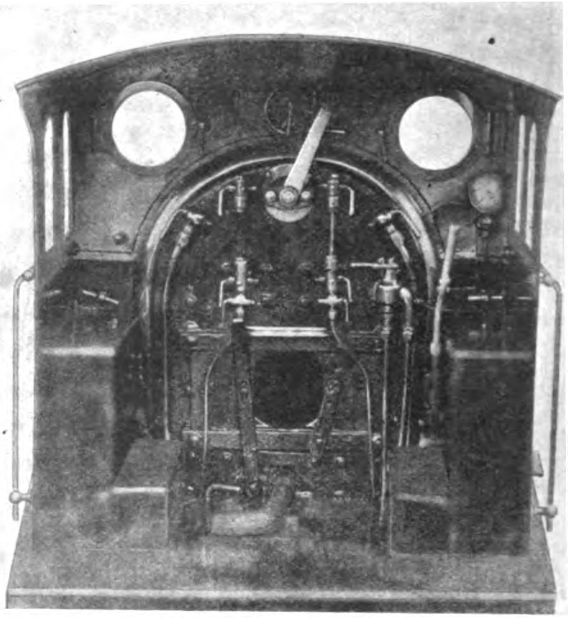
All necessary patterns and special tools were made by Mr. Wood, also every bolt and nut, as well as the full equipment of mountings, the latter being built up piece by piece of required shape, and silver-soldered.

If any feature of this model appealed to the writer with more vividness than another, it was the Westinghouse automatic brake. Outwardly, the apparatus occupies no more than its relative proportion of space, yet it contains all the valves, spindles, pistons, and portways of the larger article, reproduced with watch-like delicacy. A rectangular main reservoir, also the brake cylinder, are fitted under the footplate; beneath these are the small reservoir and triple valve.

The driver's brake valve responds to the various requirements of the positions for actuating and releasing the brake, and a gauge indicates the pressure of air in the main brake pipes. The air-pump is not sufficiently powerful to furnish the necessary pressure for applying the brake, but when air is otherwise compressed into the main reservoir, the action is perfect.

The automatic brake is fitted to engine portion only, a hand-brake being provided for the tender. It will be observed there are no flexible couplings fitted in the frames. This somewhat detracts from its appearance, especially when the apparatus is otherwise complete.

The engine has been much under steam, but provision is made for admitting compressed air,



INTERIOR VIEW OF CAB.

by which means it has, for many years, been run at exhibitions continuously from 10 a.m. to 6 p.m.

The locomotive is now in the Franco-British Exhibition, and those of your readers who examine it will be ready to admit that the "colliery mechanic" is not the rough-and-ready workman he is sometimes represented to be. Mr. Wood's little workshop contains a 3½-in. back-geared lathe (formerly treadle), a double horizontal engine with link motion, and a large vertical steel boiler—all of which he made himself.

WE hear that France is to have two motor shows this year, one for private and another for commercial vehicles. Both will take place in the Grand Palais. The show for pleasure cars will be open from the 28th November to the 13th December, and that for commercial motors from the 22nd to the 29th December.

Elementary Ornamental Turning.

By T. Goldsworthy-Crump.

(Continued from page 582, Vol. XVIII.)

In considering spiral and multiple spiral cutting, the addition of a reciprocating apparatus which converts the spiral into a waved or undulating line will now be described. The diagram (Fig. 37) shows the general arrangement. A is the lathe mandrel, to which is clamped an arm, either wood or metal, with holes drilled at various distances. B is a stud on quadrant, and carries a change wheel and an eccentric which are in engagement with each other. The eccentric is connected to arm on A by means of a vertical member provided with a pin at the upper extremity, which fits

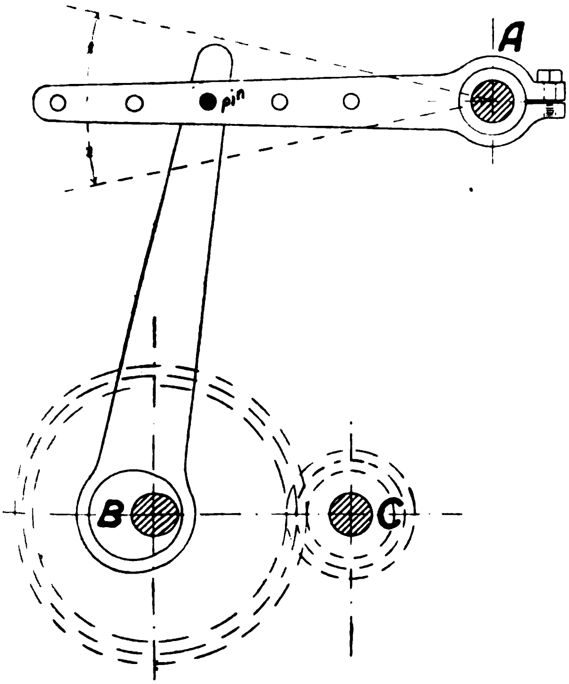


Fig. 37.

holes, as shown. C is end of lead-screw, with change wheel gearing into wheel on B.

It will be seen that on C being revolved by handle on lead-screw motion is conveyed to wheel and eccentric on B, which, in turn, is transmitted to arm on A, causing the latter to rise and fall such distance as may be determined by the amount of eccentricity at B and length of leverage of arm on A, thus causing any work held in a chuck or between centres to oscillate, while at the same time the slide-rest is traversed, thus producing an undulating line, the size and length of such being governed by the change wheels employed and the amount of travel of arm on A. The length of the wave is determined by the change wheels, the height by the eccentric and top arm.

The line produced can be made to vary in very wide limits, from almost a straight line to one of very sharp undulations, and can be interwoven and compounded into many complicated patterns and designs, and again further by the drills and cutters used.

The flattest waves of any length are produced by using less eccentricity and the longest length of arm on A, the steepest by maximum of eccentricity and shortest connection to arm. As an exercise, a 6-in. length of hardwood by about 1 in. in diameter is turned cylindrical; the drill spindle and overhead fixed up and a pointed drill selected, a small

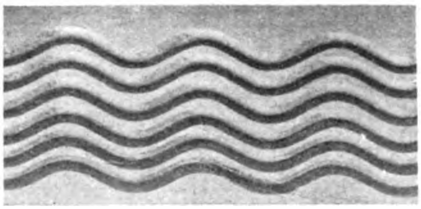


Fig. 38.

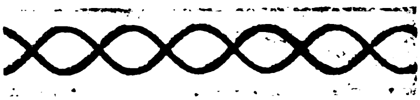


Fig. 39.

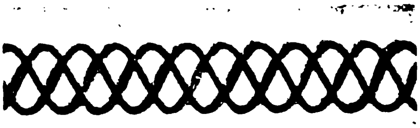


Fig. 40.

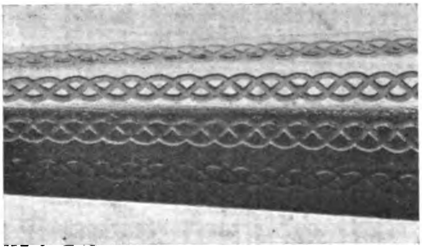


Fig. 41

Fig. 42.

change wheel is attached to end of lead-screw, say 20, gearing into one of 60 teeth. The eccentric and arm in midway position, as shown in Fig. 37.

The mandrel head is set so that some division of either division-plate or teeth can be identified, and the pinching screw at A tightened. The slide-rest should have been previously run back to exactly the end of work, or to a line scribed upon same, so that it can be returned to this exact position when required. The amount of penetration being determined, the drill is set in motion and the lead-screw slowly revolved by its handle, when one waved line will be the result. At the end of the traverse the drill is withdrawn and the slide-rest returned to its starting-point without disturbing any wheels or gearing. The pinching screw at A is now slackened and the mandrel revolved "*x*" divisions, and the sequence repeated, thus producing a series of waves, as shown in Fig. 38.

If—instead of revolving the mandrel after the first line is completed and the slide-rest returned to its starting-position—the wheel and eccentric at B are carefully disconnected from C—the teeth

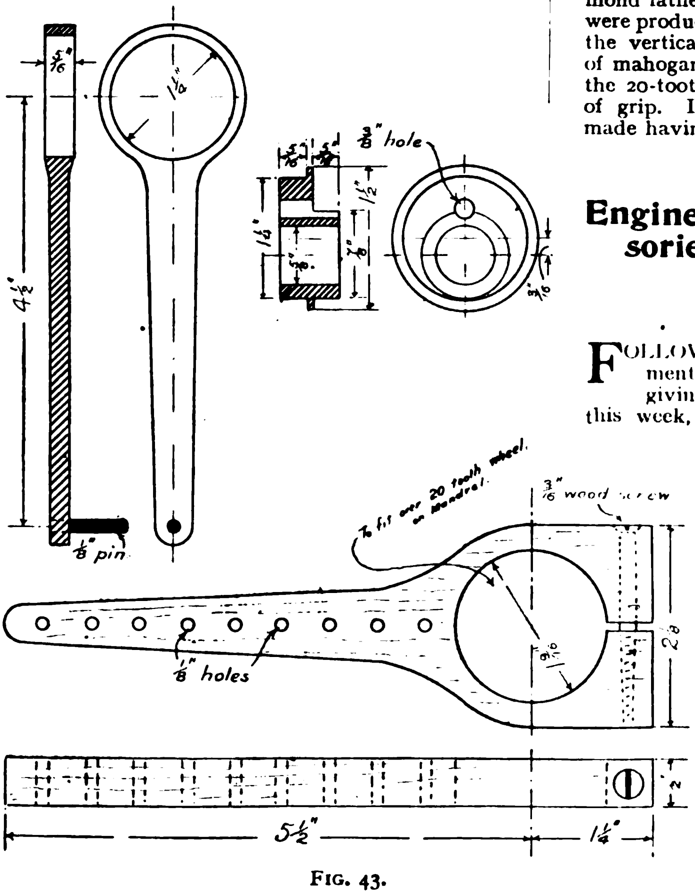


Fig. 43.

in engagement being previously chalk-marked, and the wheel and eccentric revolved and replaced exactly half a revolution, in this case 30 teeth—the pattern shown in Fig. 39 will be produced. By revolving stud wheel one-third revolution will produce design as Fig. 40. It will now be seen that the operator has enormous scope in the making of patterns by the many variations of divisions from headstock and change wheels and the position of the eccentric and top arm. In producing complicated designs the greatest care must be taken that everything is at zero or its proportional position before commencing a cut, and that after completing the cut the tool be returned to its starting position before altering the divisions or change wheels. There is a curious property in work produced on the taper with this apparatus, and that is the gradual enlargement of the pattern as the diameter of the work increases, as shown in Fig. 41. Should the lathe be fitted with self-surfacing, it is possible to produce similar designs on the flat.

Fig. 42 shows the result of not returning the slide-rest exactly to its starting point before altering the engagement of the change wheels. It will be seen that the small spaces in centre of pattern are not true, and vary alternately in inclination.

Fig. 43 shows the apparatus as made for a Drummond lathe, and by which the examples illustrated were produced. The eccentric is made of coco wood, the vertical arm of iron, and the horizontal arm of mahogany, the latter being made to clamp over the 20-tooth change wheel, and thus having plenty of grip. If necessary, extra eccentrics could be made having different length strokes.

(*To be continued.*)

Engineering Works and Accessories for Model Railways.

By E. W. Twining.

(*Continued from page* 158.)

Following up the programme which I mentioned in my last instalment, viz., of giving examples of three large bridges, I give this week, as the second design, another Great Western bridge, spanning the Avon at Bathford, situated between Box and Bath.

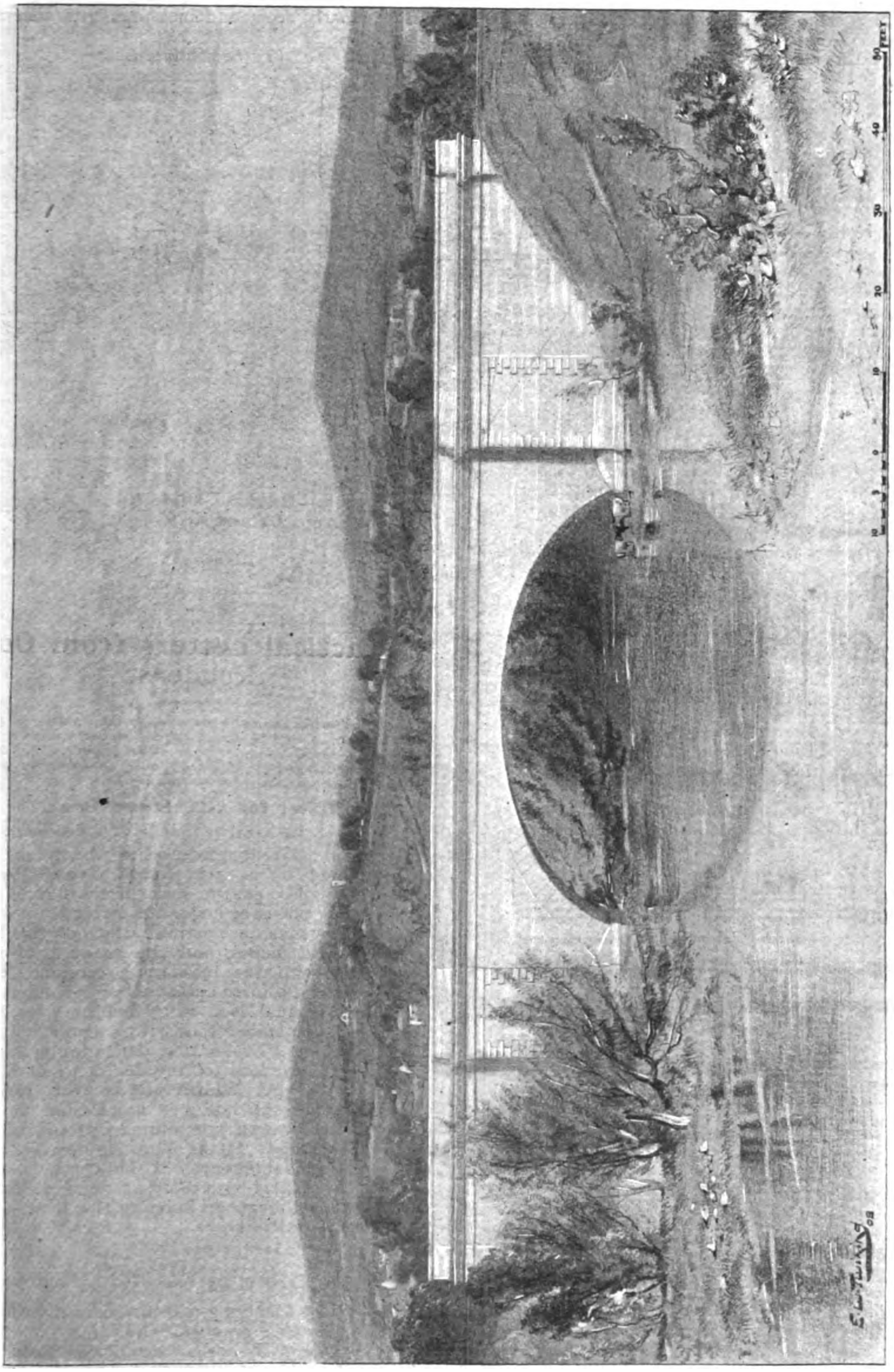
Though of much more simple design and smaller in size than the Gothic one at Bristol, this bridge, both in proportion and detail, is extremely beautiful. It has a single elliptic arch of perfect symmetry, measuring 54 ft. in span; this is flanked by abutments, each having two projecting piers. The total length of the bridge over the parapets is 140 ft. approximately.

The architectural style is Roman—a plain entablature, with cornice and frieze of the Tuscan order running throughout the length of the bridge. The piers have, in addition, an architrave consisting of a fillet and single facia.

The quoins of the piers project and are chamfered on three angles of the face of each. These are the only ornamented stones, apart from the cornice, the voussoirs being quite plain.

Fig. 26 is a view of the Northern face of the bridge, looking southward, showing Farley and Claverton Downs in the distance, the village and church of Bathford being seen on the left.

Fig. 27 is a diagram showing how the semi-ellipse of the arch may be set out. This method does not, of course, describe a perfect semi-ellipse; it is really a succession of radial segments, which decrease in length of radius from the centre of the arch each way, but it is nevertheless sufficiently accurate for the purposes of a model. It should be noted from this figure that the springing line



THE GREAT WESTERN BRIDGE SPANNING THE AVON AT BATHFORD.

of the arch is somewhat below the point where the first voussoir appears.

The next drawing (Fig. 28) is an enlarged drawing

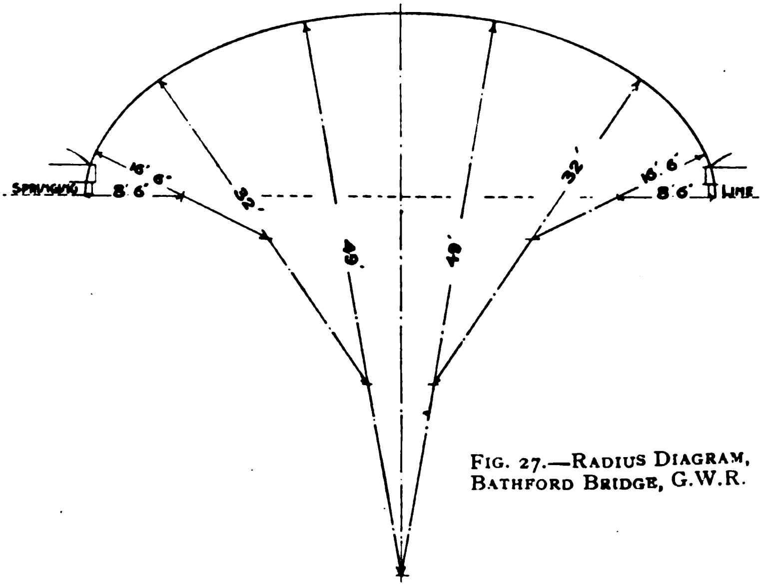


Fig. 27.—Radius Diagram, Bathford Bridge, G.W.R.

of the upper portion of one side of the projecting piers, showing the masonry up to the top of the parapet. From this the form of the projecting cornice can be clearly seen, and measurements accurately taken off.

(*To be continued.*)

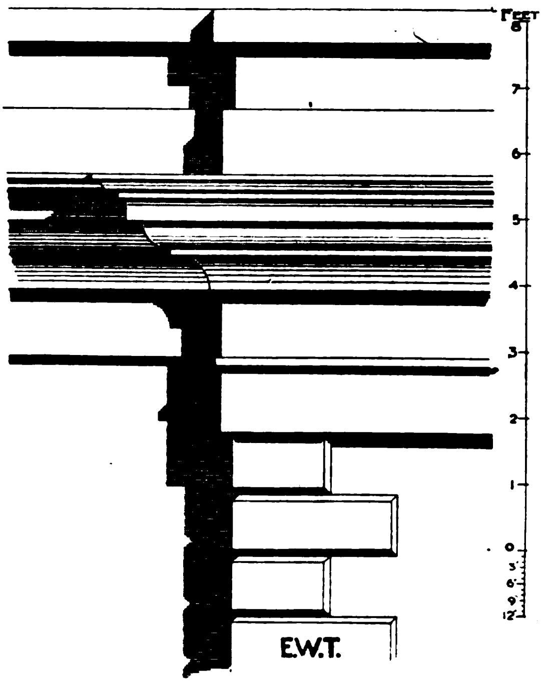


Fig. 28.—Details of the Entablature, Bathford Bridge.

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender must invariably be attached, though not necessarily for publication.*]

Boiler for 5-ft. Speed Boat.

To the Editor of *The Model Engineer*.

Dear Sir,—With reference to the recent article, "Design for a 5-ft. Speed Boat," by Mr. Dysart, I shall be glad to know if the figures given for steaming power of boiler are correct?

Mr. Dysart says the heating surface of this boiler is 245 square inches, and the amount of water evaporated with the blowlamp recommended is, approximately, 9 to 10 cubic inches per minute.

In your manual, No. 13, "Machinery for Model Steamers," you state "that with a small boiler the amount of water evaporated per minute is about 1 cubic inch for every 100 square inches of heating surface." If your figures are correct, then Mr. Dysart's boiler will not give more than 2½ cubic inches of evaporation per minute, instead of the 9 or 10 he specifies! Is the lamp he mentions going to make *all* this difference? I think not.

I shall be obliged by a reply at your earliest convenience, as I thought of building this boat.—I am, Sir, yours respectfully,

R. McDowell.

To the Editor of *The Model Engineer*.

Dear Sir,—Replying to your correspondent, the rule he refers to is practically obsolete.

Given a properly-designed and well-made boiler of the *water-tube* variety, with a powerful and efficient blowlamp, an evaporation of anything between

3½ to 5 cubic inches of water per minute for every 100 square inches of heating surface can be obtained.

Assuming fair workmanship and a certain amount of experience, the speed of the boat, as designed, should be somewhere near that indicated.—Yours faithfully, THOS. DYSART.

Model Lancashire Boiler Construction.

To the Editor of *The Model Engineer*.

SIR,—Being on the look-out for an efficient boiler, which would be at the same time easy to construct, I was much interested in that described by Mr. James Burr in your issue of July 16th. If the writer of the article in question would kindly give me the following further particulars, I should esteem it a favour :—

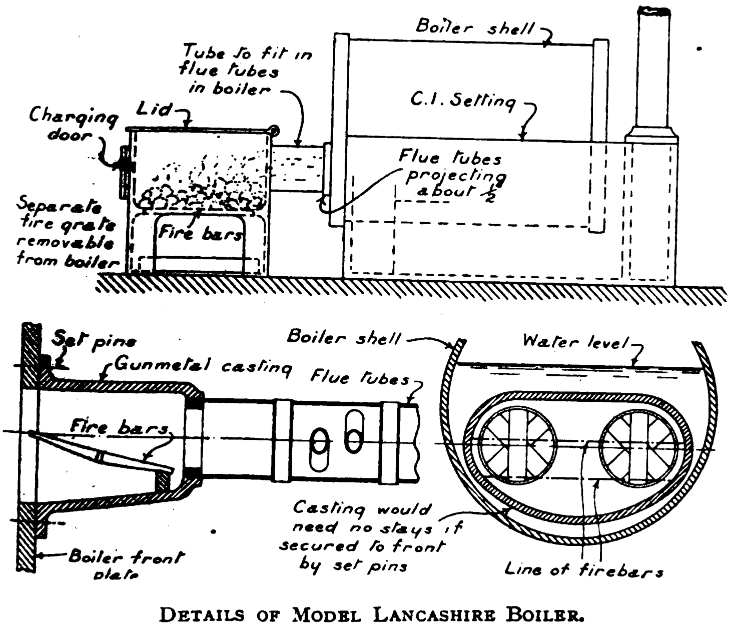
Of what are the boiler ends made ? Where can the Mannesmann steel tube used for boiler shell be obtained ? Of what thickness is cast-iron setting on which boiler is mounted ?

Would Mr. Burr also kindly state what alteration would be necessary to adapt boiler for heating with coal or coke. I take it that this would necessitate deepening the setting so as to take firebars. If so, I should be glad to have dimensions.

Thanking you for the insertion of this letter, and also Mr. Burr, in anticipation of his reply, yours truly, "BOILER MAKER."

To the Editor of *The Model Engineer*.

DEAR SIR,—In reply to "Boiler Maker's" letter : (1) The boiler ends are made from steel plates of boiler quality. He may think ½ in. a little too



DETAILS OF MODEL LANCASHIRE BOILER.

thick, but I advise him not to go less than ⅜ in., or difficulties may arise.

(2) The original piece of tube was obtained from the British Mannesmann Steel Tube Company, Ltd., of London, but any good quality of weldless steel tube would suit his purpose, pleasing himself as to thickness.

(3) The cast-iron setting is in one casting of ¼ in.-thick metal all over. This is very heavy in my case, but if the quality of metal used runs well it may be very conveniently made as thin as 3-16ths in. thick, special care being taken with pattern so as to draw plates from the sand. The two sets of dotted lines in plan near chimney indicate two special passages in sand to take metal to bottom (or top) of the baffle plates while casting without undue cooling down.

(4) The boiler as designed is not at all suitable for coal or coke firing, besides which, in a Lancashire or Cornish boiler, the fire is always in the tubes and not underneath the whole boiler. It could, however, be made to do so by adopting either of the two methods as per sketches, no further alterations being necessary than those to the tubes. As to dimensions, these should be made to suit the size of boiler required.

Hoping this will assist him in his design, yours faithfully, JAMES BURR.

Traction Engine Castings.

To the Editor of *The Model Engineer*.

DEAR SIR,—There is no doubt that a model traction engine built to the designs now appearing in THE MODEL ENGINEER would make an excellent working model, the size chosen being such as would not cause the making of the details to be too much like clock-making. I am looking forward to seeing the further articles on this subject.

Now, Sir, most model engineers prefer, when possible, to purchase a set of castings rather than spend the enormous amount of time necessary in making the requisite patterns for such a piece of work, especially if only one set of castings is required. Possibly some enterprising firm would put on the market a first-class set of castings to the published design if there is sufficient demand. If all readers who would purchase such a set would let you know, Sir, the demand might be approximately gauged.

When dealing with the boiler, will Mr. Greenly give us his views as to firing with Primus burners instead of coal ?—Yours truly, "ROAD LOCO."

A HEAT-PROOF putty, says the *Mechanical World*, is formed by mixing a handful of burnt lime with 4·25 ozs. of linseed oil, boiling down to the usual consistency of putty, and allowing the plastic mass to spread out in a thin layer to dry in a place where it is not reached by the sun's rays. When required for use, it is made plastic by holding over the funnel of a lamp ; on cooling, it regains its previous hardness.

For the Bookshelf.

The British Model Yacht Clubs' Guide: A Handbook of the entire subject and the Rules of Yachting. Edited by G. Colman Green. Price 1s.; postage, 1½d.

Model yachtsmen throughout the country should be more than interested in the announcement of the publication of this Guide, for we believe it is the first time in the history of model yachting that such a compilation of data and other information relating to this sport has been issued. The subject matter of the Guide is divided up under seventeen headings, as follows: The National Flag; The Burgees of the British Model Yacht Clubs; A Brief History of Yachting; Famous Yachts; Maps—England and Scotland; Model Yachting: Its Value and Future, by Major Scharlieb; History of the Yacht Measuring Rules; The 1730 Rule; The Sail Area Rules; The International Rule; Sailing Rules; How to Start a Yacht Club; Aims for Model Yachtsmen; The National Championship; the Sub-Associations; The America Cup; and Notes on Sailing.

The portions of the Guide dealing with yacht measuring rules will be undoubtedly of the greatest service to model yachtsmen, and particularly so to those about to enter into this sport. Explanations are given of what these rules were intended to produce, and what they did produce, and formulas are given and explained. Further examples are given showing how to measure a model yacht. The sail area rules are dealt with in the same complete fashion, and tables for various ratings are included. Many of the illustrations are from photographs of various crafts on various waters, and others are line drawings prepared by the Editor, with the dual object of enlivening the reading matter and instructing the reader. Without going to considerable length and, indeed, quoting largely from the contents of the Guide, it would not be possible to give the reader an exact idea of the usefulness of the book, but we are confident that those who obtain a copy will not be disappointed in their small investment.

The Society of Model Engineers.

London.

Future Meetings.—The next meeting will be held on Friday, September 18th, at the Cripplegate Institute, at 7 p.m., when Mr. Percival Marshall will discourse on "Originality in Model Work." The following meeting will take place on Friday, October 9th. Full particulars of the Society and forms of application may be obtained from the Secretary, Herbert G. Riddle, 37, Minard Road, Hither Green, S.E.

Manchester Society of Model Engineers.

The Editor's notice *re* formation of the above Society, in the issue of July 9th, having resulted in applications for membership from about twenty readers and friends, a preliminary meeting was held on August 6th in the Smoke-room of the Manchester Social Club, Lower Mosley Street. The chair was taken by Mr. B. H. Reynolds, who, after giving a brief sketch of the foundation of the Society, with its future social and financial prospects, proceeded to put to the meeting a rough draft of suggested rules, which were carefully considered, amended, and adopted by the members present. It was decided to start the official and financial year of the Society in October, the annual general meeting to be held on the first Thursday evening in October each year. Regular meetings of the Society to be held fortnightly at 8 p.m. on Thursdays. The subscription was fixed at 5s. per annum., payable in October, with an entrance-fee of 1s., payable on election to membership. Entrance fees were collected at the close of the meeting. Although the model engineers assembled were absolute strangers to one another on entering the room, they quickly became the best of friends, and the meeting was most enthusiastic. It was decided to hold one more meeting before the official start of the Society, in order to keep the members together, and also so that they should get to know one another better to facilitate the election of officers. A meeting will, therefore, be held on September 3rd, at 8 p.m., in the Smoke-room of the Manchester Social Club, Lower Mosley Street (alongside Central Station). All the members are requested to bring some model, tools, or other apparatus they have made, so that an idea can be formed of the work now going forward. Any visitors interested will be heartily welcome.—Basil H. Reynolds, Hon. Sec., 35, Torbay Road, Chorlton-cum-Hardy, Manchester.

The Portsmouth Model Yacht Club.

The Portsmouth Model Yacht Club held a race at the Canoe Lake on Wednesday afternoon, July 29th, the miniature craft being in charge of Mr. Bernard Tallack, of Glasgow, who kindly acted as starter. A very flukey wind was blowing at the start, which finally settled down to a westerly breeze, which held until the finish of the regatta.

Mr. Coxon's *Saucy Sally* was first with 24 points, Mr. Richard Tallack's *Sport* second with 20 points, and Mr. Clive Wilson's *Florence* with 18 points; other scores being: Mr. Wm. Constant's *Togo* (Vice-Commodore P.M.Y.C.) 16 points, Mr. Moon's *Bluebell* 8 points, and Mr. Bignall's *Lily* 6 points.

The inter-club match arranged for August Bank Holiday, between the Southsea M.Y.C. and the Portsmouth M.Y.C., did not take place. The Ryde M.Y.C. paid the return visit to Southsea to sail the final on August 12th. Ryde M.Y.C. is leading at present by 2 points.—Clive Wilson, Hon. Sec., P.M.Y.C.

Liverpool and District Electrical Association.

On Saturday, Aug. 15th, a party of members of the above Association paid a visit to the Grafton Street Pumping Station of the Liverpool Hydraulic Power Co. The visitors were met on arrival by Mr. George R. Bayley, the Resident Engineer and Manager, who very kindly conducted them over the plant, and explained the various details. On the whole a very interesting time was spent, due in no small measure to the courtesy and attention of Mr. Bayley, and Mr. S. Frith (the Association's Hon. Secretary and Treasurer) has written the firm in acknowledgment.

Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

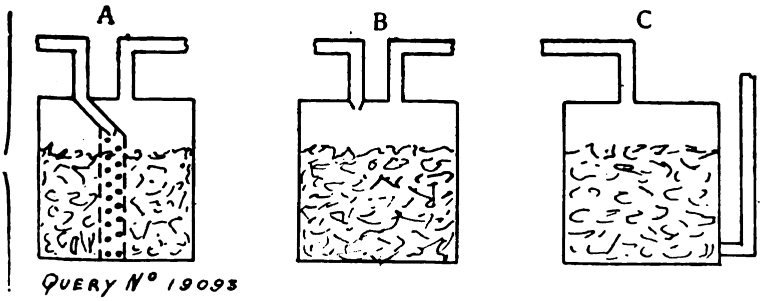
Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, 26–29, *Poppin's Court, Fleet Street, London, E.C.*

The following are selected from the Queries which have been replied to recently:—

[19,982] **Electric Light Steam Plant.** F. W. (London) writes: I have a vertical multitubular boiler, 2 ft. 6 ins. high, 1 ft. 6 ins. diameter, with forty-two tubes ¾ in. diameter, and one central tube 3 ins. diameter. The working pressure of boiler is 50 lbs. per sq. in. There are also eight field tubes underneath boiler, 1½ ins. diameter, 8 ins. long. The firebox has no water space and it is made of sheet iron lined with firebricks. This boiler drives a horizontal slide-valve engine, 2½-in. bore, 3½-in. stroke, at about 200 r.p.m. The flywheel is 9 ins. diameter. I drive direct off this. I want to know what size dynamo this engine and boiler would drive and the number of lamps it would light.

It is rather difficult to estimate from the particulars sent as so much depends on the coal consumption under normal conditions of working. If the evaporation is forced by means of induced draught you might easily get double the amount of work which is developed under natural draught. Nominally the plant should give at least 50 to 60 c.-p., *i.e.*, about 180 watts. We recommend a brake test of the plant (see back issues for methods). The particulars of tests given do not state whether the results were obtained with the engine under load.

[19,093] **Small Acetylene Generators.** W. N. F. (Teddington) writes: I should be much obliged if you would help me to design a small acetylene generator for my bicycle. It is to be of the "water-dripping-on-carbide" type, and the water reservoir is to be entirely separate, connected to the carbide container only by a flexible metallic tube, and the two vessels will be attached to some part of the frame of the machine. The water container is to be made of a piece of brass tube which I have, and will be 9½ ins. by 1½ ins. diameter (inside measurement), which means, I think, a little more than 14 cub. ins. capacity. (1) How big should the carbide container be to need refilling *twice* as often as the tank? (2) Is it necessary for the water to drip down a perforated tube in the middle of the carbide (as in the only acetylene lamp I have examined), as diagram A, or might it drip direct on to the top of the carbide, without there being any tube, as diagram B, or rise into contact with the carbide, beginning with the bottom layer, as diagram C? (3) What is the best ratio of height to diameter of the carbide container (cylindrical shape)—tall and narrow or low and of large diameter? (4) Must the gas pass through a purifier of felt or rag before burning; if so, why? (5) Is carbide best in large lumps or small? (6) Can you give me any further advice on the subject? I have your handbook on acetylene gas.



(1) Since the water tube holds just under ½ pint of water, it will be sufficient to generate gas from nearly ¼ lb. of carbide. Hence a generating chamber for ½ lb. carbide will be required, so as to receive two charges. Remembering that ordinary size carbide takes up about 12 cub. ins per ¼ lb., and allowing carbide to take up but two-thirds of space within chamber, a tube containing at least 9 cub. ins. will be required. (2) The perforated tube principle is preferable to either of the others, for it allows the water to attack the carbide more easily. Either of the other arrangements you suggest are possible. In the case of "C" arrangement, there would be a great tendency for the sediment from the sludge (when gas is exhausted) stopping up the water supply. (3) With perforated tube arrangement a suitable ratio of height to diameter would be about 2 to 1 for small generators. But for direct drip, 1 to 1. (4) Not necessarily, but it is well, as it removes some of the impurities of the gas, which otherwise cause carbonisation of burner. (5) Small; a good size is that broken to pass through a mesh from ¼ in. to ⅜ in. (6) Do not forget to provide a small hole in top of water chamber to allow of entrance of air as water is withdrawn. We presume that you have arranged for a graduated tap or needle valve between water container and generator.

[20,078] **Windmill Design.** H. W. (New Cross) writes: Being a reader of THE MODEL ENGINEER, I thought I would write and ask you if you could tell me where to get drawings to make a small windmill from about 1-12th h.-p., also speed-regulating gear.

Several designs of windmills have appeared in the pages of THE MODEL ENGINEER, and we think that if you will refer to these, you could, by adaptation, get a design to suit your special requirements. Full particulars of a very fine 16-ft. windmill appeared in our issues of March 5th and 12th this year. The mill described in our issue of December 5th (1907) is about the power you require. The best windmill design which has appeared in our journal is that of which a coloured plate was given in Jan. 3rd issue, 1907. Articles descriptive of this mill appeared in seven issues, Vol. XVI, pages 12, 57, 108, 158, 204, 252, 402. The mill described in our issue of March of this year has a speed-regulating gear.

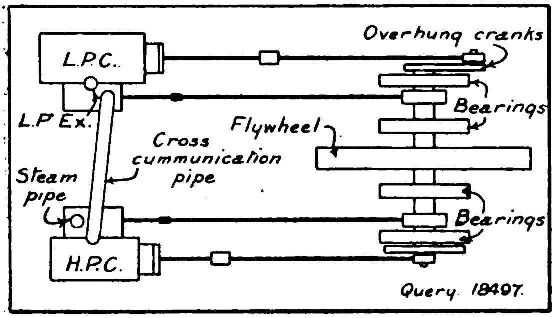
[19,539] **Winding 500-watt Dynamo to Run as Motor.** C. B. (Oldham) writes: (1) Can you tell me what has become of the firm, Marshall and Woods, as I wrote to them last week, addressing my letter to Avenue Works, Park Street, Acton? The letter has since been returned by the London Post Office. (2) Can you tell me where I could get castings for a centrifugal pump alone, suitable for direct coupling to a ¼ h.-p. electric motor? Messrs. Marshall & Woods, I believe, made up a set of this size. (3) I should like to know if it is possible to get castings for a totally enclosed electric motor, for bolting on to lathe slide-rest for grinding up centres, etc., about 1-12th h.-p. Do you know of any firm who would supply these? I have a 500-watt Avery-Lahmeyer dynamo (50-volt 10-amp.), compound wound, and now wish to rewind it as a ¼ h.-p. shunt motor, suitable for driving the above-mentioned centrifugal pump from a 220-volt circuit. The speed required is about 1,600 to 2,000 r.p.m.; I think 1,600 would be high enough. The present armature is a 16-slot drum, 4 ins. by 4 ins., with 7-16ths-in. by 7-16ths-in. slots and sixteen-part commutator. I believe there is 1¼ lbs. 18 S.W.G. wire on armature, and 10 lbs. 2 ozs. and 4 lbs. 12 S.W.G. on the poles, which measure 4 ins. by 3 ins. This is as much as I can possibly get on the pole-pieces. I should be glad if you could give me the necessary particulars for the sizes of wire for use on a 220-volt circuit. I shall require to reduce the speed of the motor at times, and intend to use an adjustable resistance for this purpose.

(1) The firm mentioned does not now exist; the business was absorbed by some firm, but we do not know the name. You may be able to get some information through Messrs. Poppleton and Appleby, accountants, 4, Charterhouse Square, London, E.C. (2) Small complete centrifugal pumps are made by Messrs. W. H. Bailey & Co., Albion Works, Salford, but we do not know where you can obtain sets of castings. (3) Try A. H. Avery, Fulmen Works, Tunbridge Wells; or The Crypto Electrical Company, 157, Bermondsey Street, London, S.E. *Re* dynamo to be rewound as a motor. You do not state the speed at which it now runs. However, if you could rewind the armature with four times as many turns of wire as there are on at present, it should run at about the same speed, or rather less, when driven as a motor from 220-volt mains. No. 24 gauge wire would carry the current and should enable you to get on the required number of turns; if you get on more, the speed will be slower in proportion to the increased number of turns. If you intend to connect the motor spindle direct to the pump spindle, a series winding will be suitable for the field-magnet and easier to put on. No. 18 gauge copper wire D.C.C. will be suitable. If you intend to drive by belt, a shunt winding should be used; No. 28 gauge S.C.C. copper wire will be suitable.

[18,868] **Pelton Water Wheel.** J. W. (Mardy) writes: I have seen various articles on Pelton water motors in your paper. Would you kindly inform me what size of wheel, number of cups, and the size of cups, also size of nozzle I should require to get ½ h.-p. with 12-ft. height of water. Would a Pelton wheel be fairly efficient with such a small pressure? If not, what other form of simple motor could I make instead? I was reckoning that a 1½-in. nozzle would be about right, but I have no idea what should be the size of cups.

You would need a discharge of 1½ ins. to obtain anything like a ½ h.-p. with a head of 12 ft. The consumption would be approximately 12 cub. ft. per minute. The size of the cups would be very great, approximately having 16 sq. ins. of contact surface, that is, 4 ins. each way in length and breadth. The diameter of the wheel could be 12 or 15 ins. The cups mounted in the usual way. As regards the general construction, we can refer you to the article in our issue of December 15th, Vol. V.

[18,497] **Compound Engine and Boiler.** L. K. A. (Bristol) writes: I should be much obliged if you would answer the following queries:—(1) I have two simple horizontal steam engines which I have made—one 1 1-16th-in. bore by 2-in. stroke, the other 1 7-16ths-in. bore by 2½-in. stroke. Would it be possible to utilise these cylinders to make a compound engine? (2) What book would give me the necessary details of construction as I am not very conversant with the working of the valve gear in compound engines? (2) What size boiler of the type described on page 46, Fig. 17, of "Model Boiler Making," would drive the engine as converted? What pressure ought each cylinder to be worked at? (4) Would you advise an injector or a force pump (I wish to drive a dynamo)? If a force pump, what size ought it to be? (5) What horse-power would the engine give, and how large a dynamo would it drive comfortably?



(1) The cylinders should work in very well for a cross compound engine, viz., a type of engine shown in the accompanying diagram. (2) There is nothing special about the valve gear. Read up the recent queries on Compound Engines, and also Mr. W. J. Tennant's book, "Compound Engines," price 2s. 9d. post free. In your case set both valves to cut off at three-quarter stroke and work at 80 to 100 lbs. boiler pressure. (3) We recommend a boiler with at least 400 sq. ins. of heating surface. This would be obtained by the use of about twenty-five tubes ½ in. diameter and 12 or 14 ins. long. (4) We would advise a carefully regulated force pump. It should be about ⅜ in. diameter and about ½-in. stroke, fitted with a by-pass from the delivery to the suction. (5) We would estimate that the plant would drive a 30-watt dynamo without trouble—that is, if the engines are well made and are reasonably economical.

[20,156] **Bells; Sparking at Brushes; Inspectorships.** G. M. (Cullybackey) writes: (1) Can you please explain what would be the matter with an electric bell when it ceases to ring either from hall door or from eight rooms (it won't ring from any), although the cells have been renewed. What would be a likely cause? (2) Also, what will prevent a dynamo from sparking badly at the brushes (carbon brushes are used)? (3) What qualifications would be required for an electric tester or boiler inspector for an insurance company, such as the Vulcan?

(1) As the bell will not ring from any push, it is probable that there is a break in the main circuit. This might be caused simply by bad connections either at bell or battery. Make sure that terminals and wires are quite clean and that you have good contact. If this does not put things right, the break must be somewhere else, and must be found by trying to get current to flow through each length of wire separately and through the bell separately. If the bell rings when connected direct to battery terminals, you may be sure there is a fault in wires or pushes. But we think that as, apparently, the installation was working satisfactorily until you renewed the cells, you will find that the fault is simply in the battery connections. (2) There are many things that might cause the sparking. If the machine is badly designed the sparking may be incurable. But do not conclude that it cannot be overcome until you have tried all means of remedy in vain. A dirty commutator will cause sparking. Rub it well with an oily rag till you are sure that if it sparks dirt cannot be the cause. Another cause is want of adjustment in the brush gear. There is one position of the brushes in which the machine should run sparklessly, and if you have the brushes either one side or the other of this position you will get sparking, so try shifting the brushes. If these means fail, you may conclude either that there is a broken wire in the armature or that the machine is badly constructed. (3) To be efficient as an inspector and tester of either electrical or mechanical machinery, you should have a thorough knowledge of both theory and practice of the construction and use of that machinery. This is best gained by spending some time at its manufacture and by studying technics. We do not know just what qualifications the particular firm you mention require in their inspectors. You could probably get this information by applying to the firm direct.

[19,398] **Painting Models.** T. F. C. (Exeter) writes: Having had an accident with my locomotive, I should be glad if you would kindly send me particulars of how to enamel, etc., same. Or could you tell in what book I might find something about the subject?

Full particulars of methods of enamelling locomotives, etc., were given in a recent article in our issues for July 19th, August 2nd, and September 13th (1906), to which please refer.

[19,654] **G.E.R. Express Locomotive No. 1,853.** J. F. B. (Stratford) writes: As I am a reader of your MODEL ENGINEER will you kindly give me a dimensioned sketch of one of the G.E.R. express, No. 1,853, so that I may be able to draw an outline of it.

You will find a drawing of the G.E.R. engines in our issue of October 17th, 1907 last.

[20,140] **Vacuum Incandescent Lamps.** R. G. B. (Barry Dock) writes: I bought one of your books a few days ago, viz., "Electric Lighting for Amateurs," No. 22, to find out how to make electric lamps, but it only gives up to about 4 or 6 candle-power lamps. Have you a book to instruct how to make 16 and 32 candle-power incandescent lamps? What I want to get at is, how I can get a perfect vacuum, as I am told there must not be a particle of air in the globe to make it burn. If you can enlighten me on this point or put me into communication with someone who might be able to, I shall be very much obliged to you.

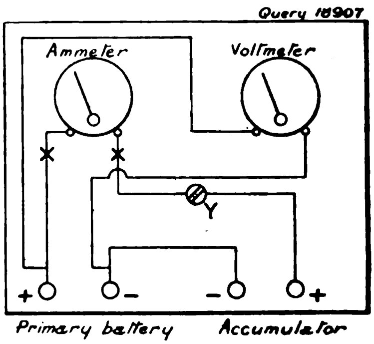
The making of vacuum incandescent lamps is a process which requires rather costly and intricate apparatus and presents many practical difficulties. It is described in Messrs. Slingo and Brooker's "Electrical Engineering" (12s. 6d. post free). We do not recommend amateurs to attempt making such lamps.

[19,967] **Gas Engine for Lathe.** R. C. (S. Wimbledon) writes: Will you kindly let me know what power gas engine will be required to drive a 3½-in. Drummond lathe light screw-cutting (for ordinary work)? And also the best firms from which I could purchase same.

Anything from a ¼ h.-p. to ½ h.-p. would be suitable for the job. Much depends upon the speed of cutting and the gearing between the engine or motor and the lathe.

[18,907] **Switchboard Connections for Charging: Voltmeter Windings.** R. M. F. (Stratford-on-Avon) writes: Please give size and quantity of wire required for a voltmeter and ammeter, as described in Chapter II of your book, "Small Electrical Measuring Instruments." The voltmeter is required to register about 8 or 10 volts, and the ammeter up to 20 amps. Please also give diagram for connections of these instruments on a switchboard for charging accumulators from primary batteries. Would German silver wire be better for voltmeter? If so, please say quantity and size.

For the voltmeter use No. 32 gauge S.S.C. copper wire; about 4 ozs. will be sufficient. For the ammeter No. 8 gauge D.C.C.



copper wire is the size, but as this would be very stiff to wind you can use two No. 12 gauge D.C.C. copper wires in parallel, winding the two wires on together side by side; about 6 ozs. will be sufficient. Fill up the bobbin comfortably in each instance

Switchboard connections as sketch. An indicator to show which way the current is flowing would be useful at Y. A double-pole switch and fuses should be inserted at *x x* if you are going to use them. Not absolutely necessary for charging by primary battery.

[18,007] **Partial Dynamo Failure.** C. L. S. (Abingdon-on-Thames) writes: Will you kindly reply to the following? I have altered a small dynamo from Siemens' H to 8-cogged drum for accumulator charging. I have taken special care in insulating and building, and have made several very successful dynamos, but this one appears to give a great rush of current at too low a voltage to charge the ordinary 4-volt ignition accumulators. It will, when started and running quite slowly, light up 8-volt lamp, and voltmeter shows 8–9 volts, but when any 4-volt cells are switched in, the voltage drops at once to from 3½ to 4½ volts, while armature runs up to 10 amps. Increasing speed only seems to increase amperage, and has little effect on the voltage. I have put the field coils in parallel. This makes very little difference. Iron wire resistance in outer circuit raises the voltage, but seems to be a waste of current. Will you kindly say what is best to do? My other dynamo adapts itself splendidly to either 4 or 8-volt accumulators, without any resistance, merely by altering speed of gas engine. Fields 4½ ins. by 6 ins., wound with about 2 lbs. No. 19. Armature 8-cogged drum—about 14 ozs. No. 18 wire, 2 coils in each space; 8-part commutator. Armature bore, 2½ ins. Ammeter always in circuit when charging, voltmeter switched across as required.

If the total amount of wire on the field-magnet is only 2 lbs., its resistance is rather low for a voltage of 10 volts. If you mean 2 lbs. on each coil, which is more like the amount for a machine of this size, the resistance is about right for 10 volts.. Perhaps your other dynamo has more iron in proportion in the magnet cores, so that the magnetism responds easily to increase or decrease in the magnetizing power of the field coils. We advise you to try winding the field-magnet with No. 20 gauge wire (both coils in series), if you have 2 lbs. on each coil, or No. 21 gauge if you have only 1 lb. on each coil; 2 lbs. of No. 20 gauge on each coil would be the better thing to try. The machine appears to be working just right for charging the 4-volt cells, which are probably very much run down; as they recover and their back E.M.F. rises the dynamo volts will rise also. See THE MODEL ENGINEER for December 27th, 1906, page 611, "How a Dynamo Works." The dynamo will not give 8 or 9 volts when charging a 4-volt accumulator; you don't require it to do so; all you need care about is to get the right flow of current. If the current is too heavy your voltage is too high, and you must regulate it by lowering the dynamo speed or other means, increasing the voltage as the back E.M.F. of the cells rises to maintain the current at its proper value. It is the current which does the work in a circuit. The voltage sends it through. If you are getting the right flow of current, it does not matter what the voltage is, except from the point of view of consumption or expenditure of energy.

[20,072] **Marine Boiler Steam Ports.** C. C. (Lowestoft) writes: Having a 1-in. bore, 1-in. stroke slide-valve engine, and wishing to run it at about 500 r.p.m. at full load, with a small light-weight marine boiler at about 100 lbs. pressure, would a flash boiler made from 8 ft. or more ¼-in. copper or iron ⅛-in. bore pipe, coiled in 2-in. circles and fired by petrol blowlamp, or the boiler described in Vol. XVI, February 14th (1907), page 156, be more suitable. Also, will you kindly send particulars of steam and exhaust ports, with valve to give best results with 1-in. by 1-in. cylinder?

We cannot point to any successful model flash boiler, but you will find several designs in our back issues. We can recommend the boiler given in issues of February 14th (1907) as a practical and efficient generator. We have given rules for steam ports several times of late. Steam ports, 1-16th in. by ⅛ in.; exhaust, ⅛ in. by ⅛ in.; portbar, 1-16th in.; or, if width of steam chest is restricted—steam ports, 3-32nds in. by ⅜ in., and exhaust 5-32nds in. by ⅜ in. would work well.

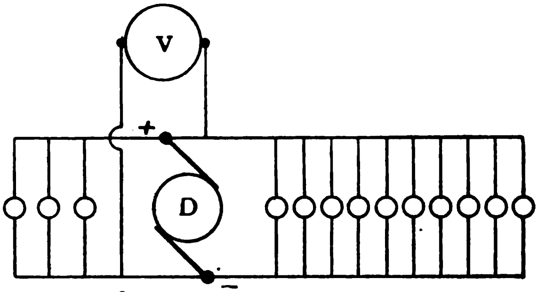
[20,132] **Kapp Type Dynamo.** J. B. (Birmingham) writes: I am desirous to build a small Kapp type dynamo which will light about six eight c.-p. lamps. (1) Can you give me the dimensions of field-magnets and of armature for dynamo to supply this installation? (2) What size wire shall I put on magnets and how much? (3) What size shall I put on armature and how much? (4) What voltage and amperage shall I get? Shall I be able to put a small electric radiator in circuit when only three lamps are alight from dynamo?

An 8 c.-p. lamp of ordinary make absorbs about 32 watts. So six would take about 192 watts. A 250-watt dynamo would probably suit you, and you will find full particulars for building and winding this in our handbook, "Small Dynamos and Motors," price 7d. post free. With three 8 c.-p. lamps in circuit you would have 154 watts available for radiator. Whether this is a suitable supply depends upon the size of the radiator.

[19,310] **Small Searchlights.** C. C. (London) writes: Having been a subscriber to your valuable paper for some long time now, I should be very glad if you could give me a few hints on the following. I propose to fix a searchlight on my workshop, and do not quite know how to make it. I have a 5-in. reflector concave mirror, a 4-in. condenser, and a metal cylinder 6½ ins. by 10 ins. I also want to use acetylene gas with it. I have fixed it together, and, on trying it, I find that it does not throw a very long beam of light—only just enough to reach to the top of the house, and it can hardly be seen looking up to it from in front. Do you think that acetylene gas is powerful enough light for it, and is it necessary for a condenser? I have tried it all ways, such as altering the distance of the gas jet to or from the reflector and condenser, and have used one glass only from the condenser, but cannot get any better result. If I direct the light over the house from the garden at the back, I cannot see any light at all from the front of the house. I should be very pleased to get a much better result, as I want it to be seen for a considerable distance, if possible. I saw one used on a motor-car once which was very powerful, and was lit with acetylene gas; hence the idea.

If you obtain a parabolic reflector and place that at the back of the light, we think you will find you get better results. This type of reflector is essential in order to give a parallel beam of light. Such a reflector could be obtained from any good optician, such as Dollond, of Ludgate Hill, E.C. Or, provided your source of light is very concentrated, you would find a double convex lens give satisfactory results.

[17,666] **Electric Lighting.** J. W. J. (Milkwall) writes: would you kindly answer me the following queries? Sketch herewith represents ten 20-volt lamps connected in parallel to a 20-volt dynamo. (1) Would the last lamp burn as brilliantly as the first; if not, how should I have to connect them? (2) If I connect a set of three 20-volt lamps in parallel with the other set, would it decrease the voltage or ampereage? (3) Would a 20-volt dynamo light



QUERY Nº 17666

these lamps if it gives the number of amperes to suit the whole circuit; if so, how would I get it?

(1) Yes, slightly, depending on the gauge of wire used to carry the current to the far end of circuit. (2) The ampereage would be increased, *i.e.*, the dynamo supplying current would have to give a greater output in order to cope with the current required by the two sets of lamps. (3) This depends upon the size or candle-power of the lamps and the size or output of the dynamo. (4) Yes. Your queries are rather vague, and we advise you to look up some text-book on the subject. See also March 5th (1903) issue, Query Reply 8,106, on "Reduction of Voltage."

[20,155] **Steam Launch.** C. G. D. (Belfast) writes: I should be very much obliged if you would send me a design with dimensions of a 12-ft. steam launch for river work. I merely want the design, as I know how to do the actual building, and have finished the engine.

In our issue of March 1st, 1902, we published a valuable article on building hulls of model steam launches. The particular boat illustrated is not much more than one-third the size you require but we think that by keeping to the proportions given in this article and increasing the dimensions to suit the greater length of your boat you could get a satisfactory design.

New Catalogues and Lists.

Messrs. The Sanitas Electrical Co., Ltd., 61, New Cavendish Street, London, W.—We have received a new catalogue of some 350 pages from the above firm. It is descriptive of all that is new and worthy of notice amongst electro medical and allied apparatus, and contains a large number of illustrations. The first hundred pages are entirely devoted to *X*-ray and high frequency apparatus. Following this, various patterns of electric light baths are illustrated and described, and the next 50 pages are given to a description of the Schnee 4-cell bath. A large amount of matter of an instructive and interesting nature relating to the application of the different currents by Schnee's method is also included. Other sections are devoted to descriptions of apparatus using current from the electric mains for a great variety of purposes. Readers interested in medical electricity will find this list of great use.

The Editor's Page.

MANCHESTER has not been slow in responding to the call for a Society of Model Engineers. Only a little while previous to our July 9th issue we had occasion to comment on the lack of a Society in that city; and in our issue of July 9th we were able to announce that Mr. Basil H. Reynolds had volunteered to assist in the formation of such a Society. We are now pleased to be able to publish on another page the first "Notice" of the Manchester S.M.E., and take this opportunity of congratulating the members upon their hearty response to the commendable efforts of Mr. Reynolds.

* * *

As the founding of any such Society undoubtedly involves much hard work, perseverance, and not a little organising ability and tact, we think the following extracts from a letter to hand from Mr. Reynolds will be not only of interest, but of service to other readers who may, no one knows when, be called upon to act a similar part in the good cause. He writes: "I am now in a position to tell you a little more *re* the efforts on my part to establish a Society of Model Engineers in Manchester. Your kind note in the Editorial column of THE MODEL ENGINEER met with instant response, for I received calls from two enthusiastic readers on the same evening that THE MODEL ENGINEER is on sale here, viz., Thursday, July 9th. A letter or two arrived within the next day or two, then there was a lull for a short time. Meanwhile I had urged every applicant for membership to talk about the Society and advertise it as much as possible among his friends. I wrote to the big Manchester papers, and two of them at least—the *Manchester Courier* and the *City News*—were kind enough to give notice of the formation of the Society a prominent place in their columns. Mr. H. Wiles (of Wiles' Bazaar) also very kindly consented to exhibit a notice in his shop window, which, as his premises occupy a commanding position in the busiest street in Manchester, was of no small assistance. The united advertising efforts of everyone, were, I am glad to say, entirely successful, and we have now twenty members on the books, and enquiries are still coming in. Many members also have promised further introductions. A suitable room was obtained, and the first preliminary meeting was held on August 6th. It was a very enthusiastic affair, and it was decided to start the Session in October next, when officers will be elected. I am glad things seem to be going all right, and I am very much obliged to you for what you have done, and your kind offers of future assistance."

Manchester's aspirations appear to have spread with remarkable rapidity into Lincolnshire and Warwickshire. We have before us two letters from two model engineers residing respectively in Lincoln and Birmingham, who would each be glad to assist in the formation of a Society in their own district. Will interested readers in Birmingham who are willing to co-operate with this end in view therefore communicate with Mr. H. L. Phillips, Beechnut Lane, Solihull, Warwickshire; and those in Lincoln with Mr. Francis A. Garrett, 53, Belmont Street, Lincoln. With regard to the proposed Birmingham Society, we must also mention the name of Mr. Edward Fearn, 149, Walford Road, Sparkbrook, who wrote us on this matter just a year ago (see August 29th, 1907 issue, page 209). We need not say that we shall be pleased to see these projects carried through successfully. We send good wishes to our two enterprising friends, and trust they will meet with the same enthusiastic support that was accorded Mr. Reynolds at Manchester.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

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HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

THE
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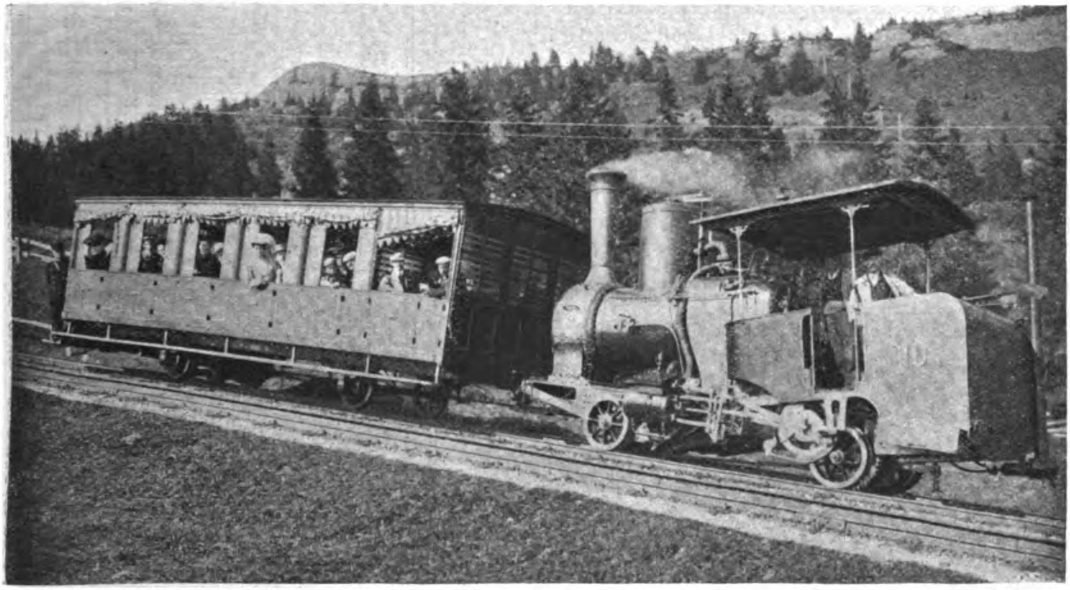
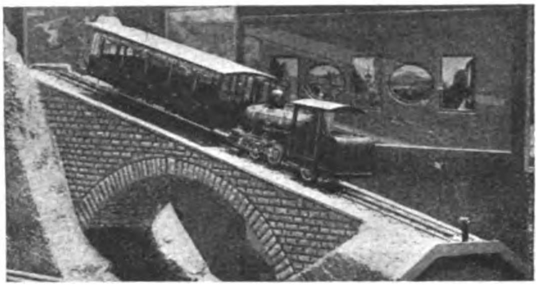
A Model Rack Railway Locomotive.



A LOCOMOTIVE AND CAR OF THE RIGI RACK RAILWAY.

BY the courtesy of the Polytechnic Touring Association, of 309, Regent Street, London, W., we are able to show a photograph of a very pretty and interesting model rack railway locomotive and car, which at the present time are on show at their stand and advertisement on the main line departure platform, Victoria Station, London S.E. & C. Railway. The model represents one running on the Rigi Rack Railway, from Vitznau, Lake of Lucerne, to the top of the Rigi Mountain, about 4,400 ft. in height, with a mean gradient of 19 in 100. The railway was constructed between 1869 and 1872. This model is well made and worth an inspection. Readers looking out for something to make out of the ordinary style of locomotives may be interested. The cylinders drive on to a single-reduction train of spur wheels, which are placed under the boiler and which gear into a rack placed in the centre of the track; powerful screw brakes are fitted. The valves are driven by Walschaerts' gear from an outside crank-pin, and are placed on the top of the cylinders.

The above photograph shows one of the actual engines at work; the design differs to some extent from the model, but the general idea is similar. An account of this railway is given in *Engineering*, March 29th, 1872, from which it shows that the original locomotives had vertical pattern boilers inclined to the frames, so that they assumed an upright position on a gradient of 1 in 4; the cars were double-decked; and speed 1 mile per hour.



A MODEL LOCOMOTIVE AND CAR OF THE RIGI RACK RAILWAY.

The accompanying photographs are, therefore, interesting, as showing the present development of design.

By taking advantage of one of the Polytechnic Association's tours it is possible to spend a week in Lucerne for 5 gns., and thus have an opportunity of inspecting the Rigi Railway.

A New Design for a ¾-in. Scale Locomotive.

THE accompanying reproduction is made from a full-sized drawing of a ¾-in. scale locomotive, designed by Mr. J. Newton Collins, who was for a number of years on the engineering staff of the Canadian Pacific Railway.

As will be seen, the general outline follows very closely that of a L. & N.W.R. express 4—4—2 tank engine. This type of engine offers many advantages for model work over the tender type of locomotive, inasmuch as the completed model is self-contained, has no troublesome flexible connections between engine and tender, and, lastly, can be built much more cheaply.

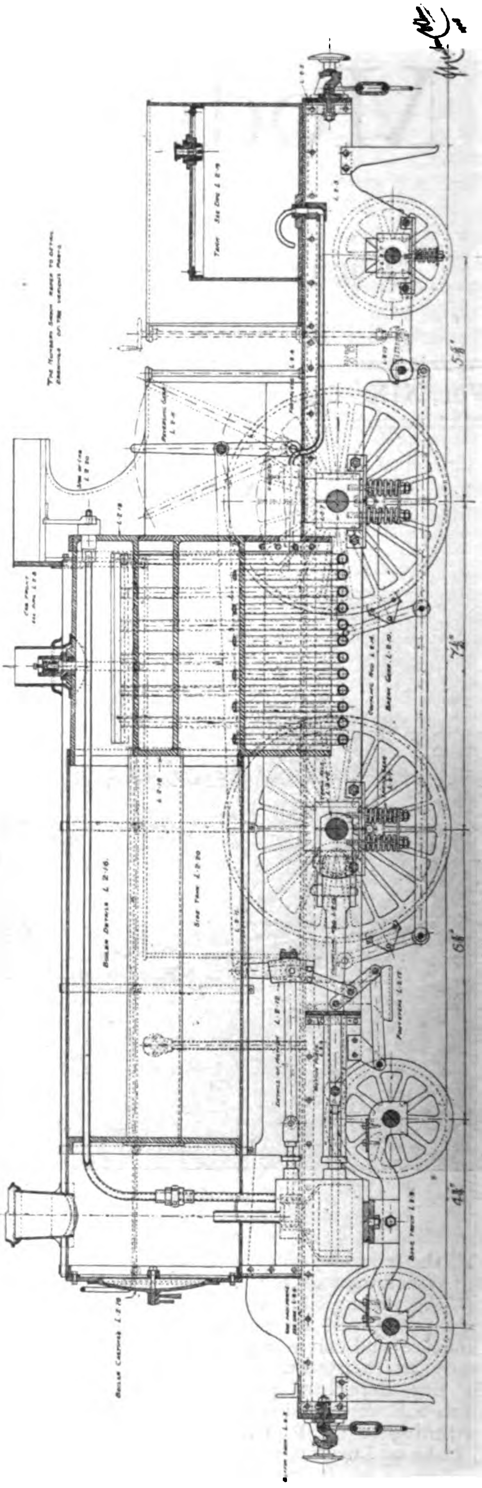
In designing this model the following points have been kept in mind. First, simplicity of construction, combined with practicability and good appearance; second, minimum cost of material and labour; and, third, efficiency and power.

From the accompanying illustration it will be seen that the total wheelbase is 24½ ins., while the height from the rail level to top of smoke stack is 10 ins.

The cylinders, which are placed inside the frames, are ¾-in. bore by 1½-in. stroke, and the piston valves are operated by Jov's gear.

A very simple and effective arrangement of spring gear has been adopted, and the drawhooks are also mounted on spiral springs. Brake gear is fitted to the driving wheels, operated by a small hand-wheel mounted on the stoker's side of the cab.

The most novel feature of the design is the boiler. This has been evolved after a great deal of time



DESIGN FOR A ¾-IN. SCALE LOCOMOTIVE. BY J. NEWTON COLLINS.

spent in carefully considering the somewhat stringent requirements of a boiler suitable for an engine of this size. Inside and outside fireboxes have always been a stumbling-block to the amateur model builder; at the same time the necessity of a water-space is obvious, and in the present design this has been provided for in the following way.—

The back tubeplate is of hard gun-metal, and, in addition to carrying the two 1½ ins. diameter firetubes, which are expanded into it, is cast with two barrels with blank ends on the opposite side of the plate. These barrels are seen projecting through the upper end centre portions of the firebox in the illustration. Into the lower barrel are brazed twelve ¼-in. diameter copper tubes, arranged in two rows on opposite sides. These tubes are bent down and round from each side, thus enclosing a circular space through which the flame from the Primus or other similar burner enters the firebox. The tubes, which are brazed into the right-hand side of the lower barrel, are carried up, and form the left-hand side of the firebox, and *vice versa*. The top ends of the tubes are secured to pads, which are studded to suitable facings on the top barrel.

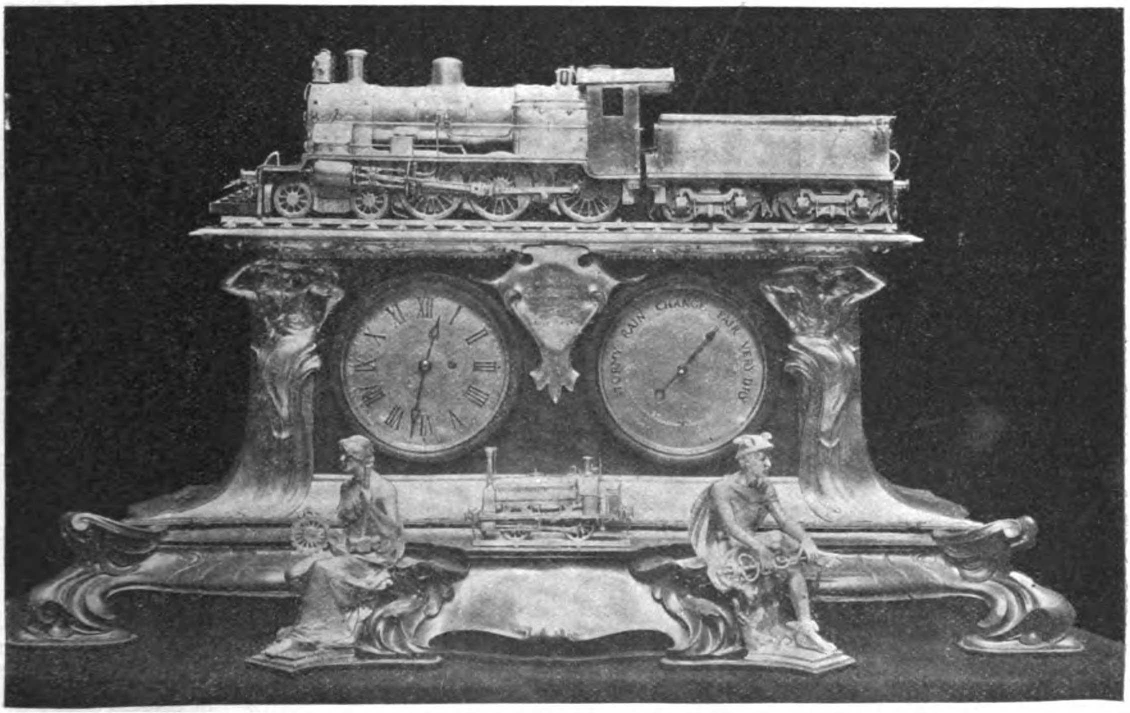
We understand that a set of twenty-one full-sized working drawings, including the general arrangement shown here, has been prepared, and any readers who would care to secure prints, can obtain full particulars from Mr. J. N. Collins, Kenora, Bickley, Kent.

Models and Machinery at the Franco-British Exhibition.

By "ATLAS."

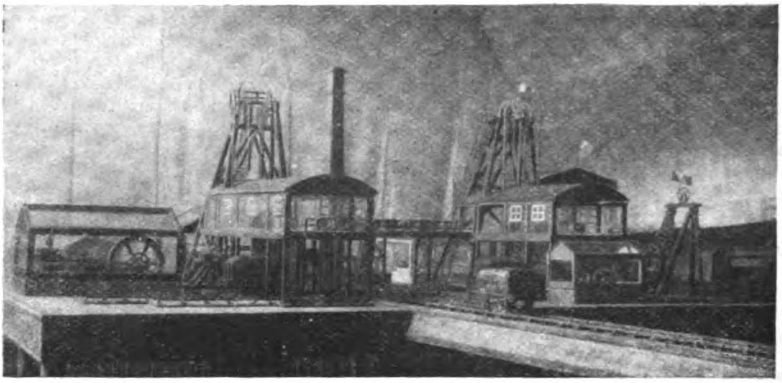
(Concluded from page 174.)

READERS who are interested in watch and clock work have an unusual opportunity of seeing some examples of escapements in motion made to a large scale. They are near the wall to the left hand as you pass through the French Educational Section from the Uxbridge Road entrance, and are well worth an inspection by anyone interested in fine mechanical work. The exhibit is by the Ecole National d'Horologie, the examples being the work of students there. Each consists of the escapement placed in full view above a plate, beneath which is the movement which keeps it going. There are Graham's cylinder escapement, the lever escapement, and the rare Tourbillon escapement, invented by Breguet, or, as some maintain, by Arnold in this country. The movement is very pretty, the whole escapement rotating around a fixed centre wheel, thus removing errors due to position. This form of escapement may also be seen, by inquiry, actually applied to some watches at Messrs. Frodsham's stand in the British Applied Arts Section, in which building



A PRESENTATION CLOCK IN SILVER AND BRONZE. BY MESSRS. ELKINGTON & CO.

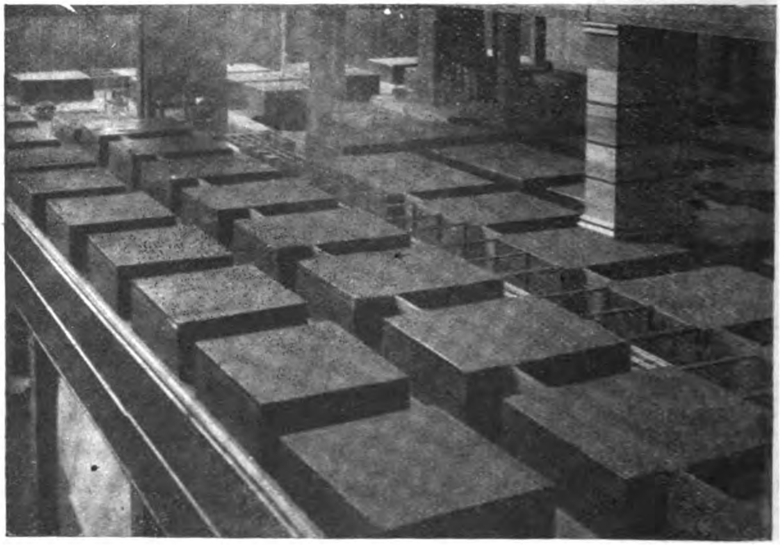
there is an exhibit by the Royal Observatory, Greenwich, of some historical chronometers, including John Harrison's chronometer, by which he gained, in 1759, the £20,000 prize offered by the British Government to anyone who should determine a degree of longitude to within 30 geographical miles.



MODEL WORKING COLLIERY: SURFACE VIEW.

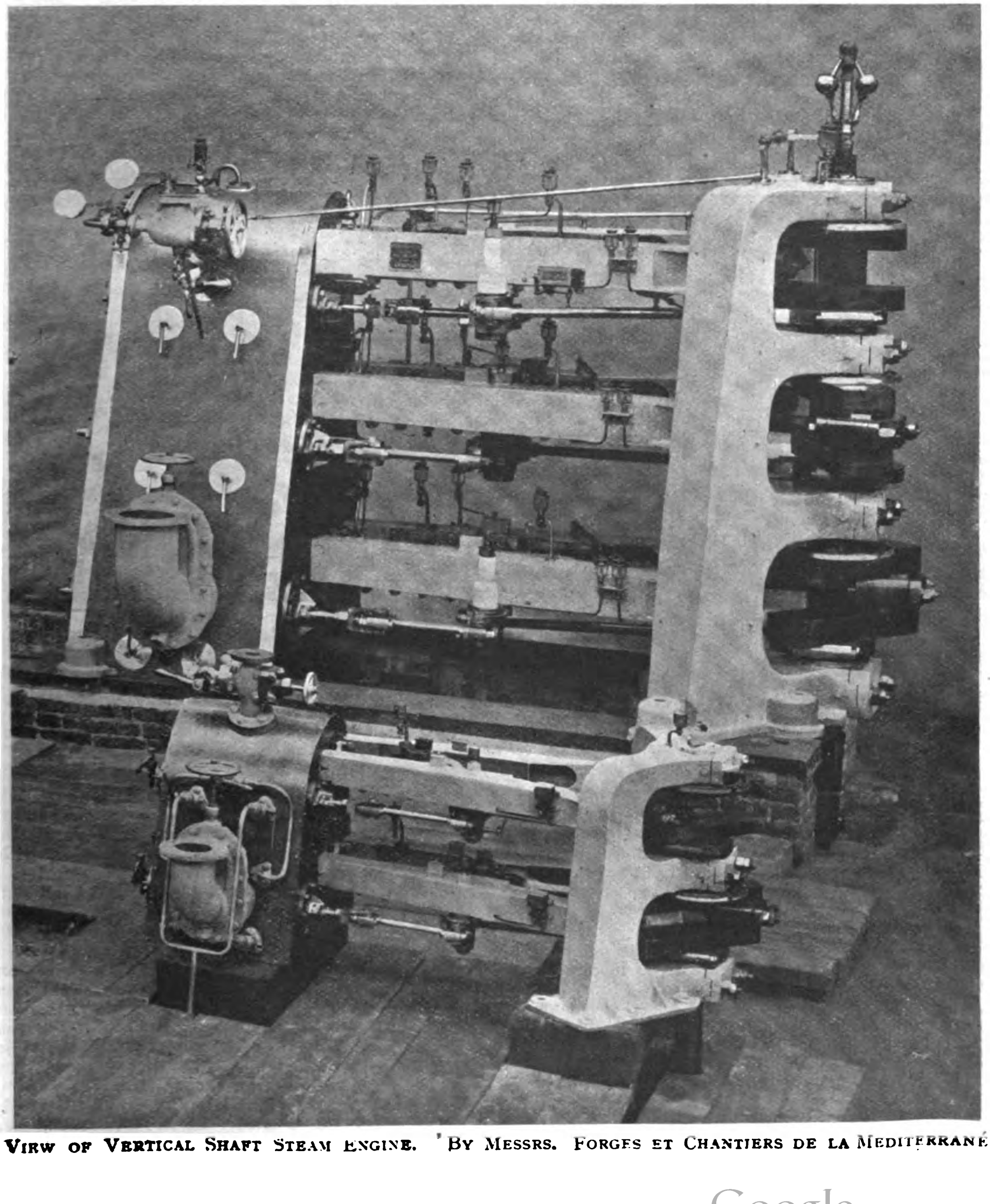
In the British Science Section, already referred to, is an interesting model of Moir's Medical Air Lock for the treatment of Caisson Disease. This ailment is caused by air pressure, and affects divers and workmen engaged in tunnelling and other engineering operations, where they have to work in an atmosphere of compressed air. The unusual pressure causes an excess of air to enter the blood, with the result that if a man leaves the dense atmosphere too quickly, the pressure being removed, permits the air absorbed by the blood to bubble out like gas from soda water, causing severe pain and often death. The proper treatment is to immediately put the man under air pressure again and reduce it very slowly until normal atmospheric conditions are reached. By this means the air escapes from the blood at a slow rate, and no bad effects are experienced. The model is similar to an ordinary cylindrical boiler, placed horizontally and fitted with windows, door, and regulating cocks to control the air pressure. Inside are couches and medical accessories, access being through an air lock, so that attendants can enter and leave without disturbing the pressure. Near this is one of Whitworth's machines for measuring pieces to the one-millionth part of an inch, and a collection of screw and end gauges, with some photographs of measuring machines, exhibited by the National Physical Laboratory, Kew.

In the British Textile Section is a Jacquard loom, shown by Messrs. W. H. Grant & Co., Coventry, at work weaving illustrated book-markers; no novelty now, but all the same a fascinating machine to watch, and noteworthy as the origin of that wonderful invention for controlling the operations of mechanism by means of perforations in cardboard or other material. This principle, known as the Jacquard, enables any sequence of operations to be repeated over and over again to any extent. It is probably still only at the commencement of its applications, one of which is well known in the system of operating pianos and organs by means of levers controlled by a perforated roll of paper. Near the entrance-hall from Wood Lane is a machine at work producing perforated music rolls. Several sheets are punched at once, the dies being controlled by a master sheet, which has been cut by a musician. The exhibitors are the Perforated Music Company, Ltd., of 94, Regent Street, London, W. An genvelope-umming and folding machine and a Wharfedale printing machine, at the stand of the Cambridge University Press, are also at work in this section.



MODEL WORKING COLLIERY, SHOWING HAULAGES AND PART OF THE STOOP AND ROOM SYSTEM.

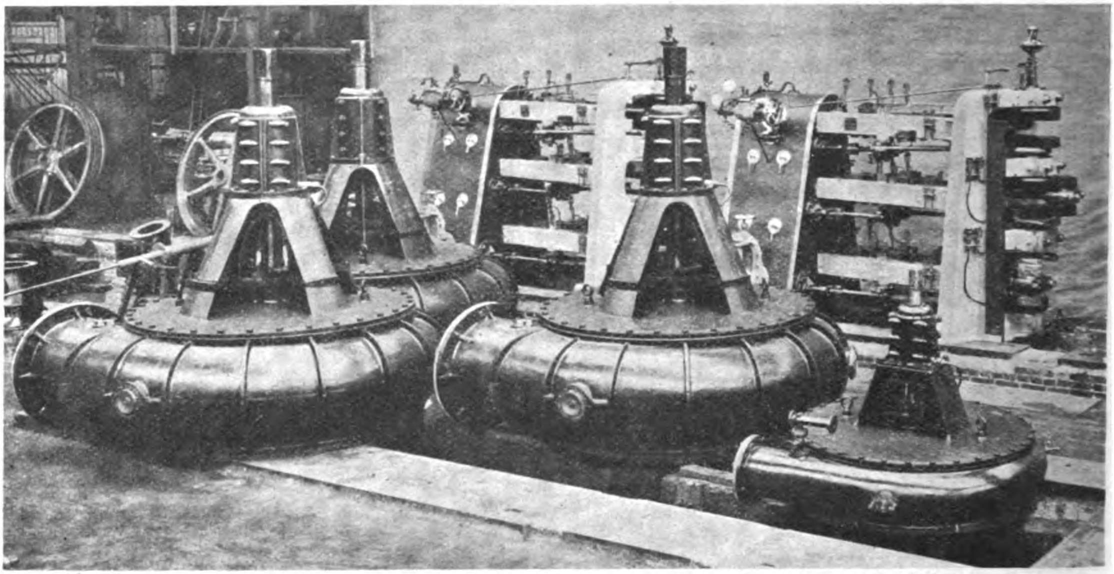
In the grounds, to the right of the "Flip Flap," at the far end of the Eastern Avenue, is a working model of a colliery. It is in the nature of a side-show, and the modest sum of 3d. is charged for admission. As an educational exhibit, the model is very instructive. It was made by two working colliers named John Paul and Alexander Hardie, who were both brought up in the mines of Hamilton and Motherwell districts. They had no mechanical training, and the model was made during leisure-hours in their dwelling-houses, amongst family and domestic surroundings. Eight years were occupied in making it, the parts being put together finally in a building hired for the purpose. The complete structure measures 30 ft. by 12 ft. by 9 ft., and consists of a general sectional view of the underground workings, showing the system of ventilation and haulage, with miners at work hewing coal. A model electric locomotive is at work drawing trucks in the mine, and another is conveying coal at the surface to a ship moored at a loading stage. The engine for driving the hauling cable



View of Vertical Shaft Steam Engine. By Messrs. Forges et Chantiers de la Mediterranée.

is at the surface, and tension gear for taking up slack in the cable is fitted, as in actual use. The following is a list of the engines at work: single-cylinder horizontal hauling engine, pair of high-pressure horizontal engines for main winding gear, beam pumping engine driving rocking beam pumps for clearing water from the workings, electric winding engine, winch engines, horizontal fan engine for ventilating, horizontal auxiliary winding engine. All the steam engines are being driven by means of compressed air. There is a model of the colliery workshop and of the dwelling-houses in which the model was made. An attendant gives any explanations which are required, and a collection of actual miners' safety lamps completes an exhibit which, representing, as it does, one of the great industries of this country, should be of great interest to others besides those specially examining it as model makers; as an object lesson for the young it can decidedly be commended.

and right-hand sides respectively. The model of the modern engine is about 20 ins. over-all length, six-coupled outside cylinder express, with bogie; tender has double bogie. The model of the old pattern engine is about 18 ins. over-all; it is of four-coupled tank pattern, and named "La Portenta." Both models are excellent examples of workmanship, and, though some details are not complete, on the whole the construction and mechanism is very well and faithfully reproduced. The valve gear has been omitted, an intention quite justified by the purpose of the models; but such fittings as lamps and cowcatcher are in their places, and a portion of track adds completeness to the general appearance. These models were designed and made in Messrs. Elkington's workshops; they are really good representations of the real thing, very different to the usual ornamental model, and well worth inspection; they bear the hall-mark of model workmanship as well as the hall-mark of genuine silver. We are glad to be able, by the courtesy of Messrs. Elkington, to show a reproduction of an excellent photograph of this fine piece of silversmith's art, kindly sent to us by Mr. Loaridge, of their publication department.



SOME OF THE PUMPING MACHINERY FOR THE ARSENAL OF SIDI ABDALLAH. BY MESSRS. FORGES ET CHANTIERS DE LA MEDITERRANÉE.

In the centre of this hall is the exhibit of Messrs. Elkington & Co., the well-known silversmiths, of London and Birmingham. Upon their stand is a fine example of model engineering, as applied to decorative purposes—a direction, by the way, in which some amateur engineers looking out for a new class of work might turn their attention. It consists of a presentation clock and barometer, in silver and bronze, and was supplied through their City house, 73, Cheapside, E.C. The inscription states that the piece was presented to David Simpson, Esq., by the employees of the Buenos Aires Western Railway Company. On the top is an exact scale model, in silver, of one of the latest locomotives used by this Company, and at the front of the base is an exact scale model, in silver, of the first locomotive used by the Company; silver figures representing Labour and Mercury (as typical of power) are to the left

At the commencement of the French Machinery Section is a very large electric searchlight projector, 2 metres (6 ft. 6¾ ins.) diameter, and a four-cylinder Diesel oil engine, 450 r.p.m. direct-coupled to a 100-kilowatt dynamo, exhibited by Messrs. Sautter, Harle & Co. Messrs. Schneider & Co., of Creusot, show a number of quick-firing naval and field guns; attendants are at hand to explain them, so that there is here a good opportunity for anyone to see the breech mechanism and other details. The firm also show a three-throw crankshaft for a high-speed engine, which is a fine example of lathe work. A sectional model of a Niclaussé water-tube boiler is in this section. Near the exhibit of the Société de Laval is a model which should encourage the amateur whose kit of tools and appliances is of a humble nature. It is a model horizontal tandem compound engine and boiler. According to the inscription, it was made out of odd pieces, entirely by hand, and is the work of Mr. Duval, engine-driver of the North Railway Company. Expansion gear and governor are fitted, and has a peculiar arrangement of valves. It is a very creditable piece of work, and a tribute to the ingenuity and perseverance of the maker. M. J. Mandot, of Paris, shows a compressed air-breathing apparatus, for use in smoke-charged or poisonous atmospheres, the air being carried in a cylinder on the wearer's back. Messrs. Forges et Chantiers de la Mediterranée, Havre, have kindly sent us a photograph of the very interesting vertical shaft engines and centrifugal pumps which they make. We referred to the model of this in a previous part of our report. As they were unable to send a picture of the model, our friends have sent one of some actual engines and pumps of this design with some particulars and principal dimensions. We are very pleased to reproduce these on pages 221 and 222, as the design of the engine is very unusual and has a neat and workmanlike an appearance. As a solution of the problem of driving a vertical shaft, it is worthy of notice. The photograph is of a set of pumps and engines made for the arsenal of Sidi Abdallah. Dimensions of the principal pumps and triple expansion engines are as follows: Diameter of cylinders (high pressure), 300 mm.; intermediate, 450 mm.; low pressure, 650 mm.; stroke, 650 mm.; revs. per minute, 160; diameter of pump vane, 2 metres; water delivered, 8,000 cubic metres (1,759,352 gallons) per hour. The smaller set is for charging the large pumps. The engines are compound. High pressure cylinder, 200 mm. diameter; low pressure, 310 mm.; stroke, 350 mm.; speed, 235 revs. per minute; diameter of pump vane, 1,400 mm.; water delivered, 600 cubic metres (131,951 gallons) per hour. In the English Machinery Section there are two full-sized steam travelling cranes and a collection of guns, armour plates, and machine tools. The Chemin de Fer du Nord have a fine exhibit of railway signals, with a portion of full-size track, which also includes telegraphic apparatus; an attendant is in charge to explain the working. Readers who have not yet seen the excellent model of the old locomotive, "Agenoria," made by Mr. J. Chadwick Taylor, of the London Society of Model Engineers, will have an opportunity of doing so, as it is exhibited in this section with a model of the L. & N.W. Railway Webb system compound engine, "Scottish Chief"; also a model of the Caledonian engine, "Dunalastair," and a model of a G.W. Railway broad-gauge engine. At the L. & N.W. Railway Company's stand are some good models of two of their locomotives, which can be set in motion by a penny in the slot; they are "Queen Empress" compound and "Diamond Jubilee" four-cylinder compound. There is a large model of an early railway coach which ran between Liverpool and Manchester, and of the saloon in which His Majesty the King travels; also a model of an electrically controlled signal, which is operated at intervals.

Some models will be found in the various pavilions: in the Indian Pavilion is a very pretty model of the two-deck, shallow-draught river steamers *Mercury* and *Iris*, built by Messrs. Denny and Co., of Dumbarton, for the Rivers Steam Navigation Company, of Calcutta; they have enclosed screw propellers, placed partly above the water-line, scale 1¼ ins. to 1 ft. Also a model of the three-deck paddle steamer *Thoreah*, built by the same makers for the Irrawaddy Flotilla Company, Ltd., scale ½ in. to 1 ft. In the Canadian Section is a model of the Allan Royal Mail turbine steamer *Virginian*, triple screws, this ship, with the *Victorian*, being the first Atlantic liner to be propelled by turbine engines. There is also a pretty petrol-driven screw canoe—a nice little outfit for river or lake use. In the New Zealand Pavilion, as may be anticipated, the frozen meat trade is given a prominent show. There is a sectional model of the *Elderslie*, the first steamer specially constructed for carrying frozen meat; the model shows the internal arrangements, ventilating fans, etc., and lifts for the carcases. There are models of twin-screw steamers—*Turakina* and *Ayrshire*. On the steps of the Pavilion outside is a large model of the Ormondville Viaduct, New Zealand Government Railways, Wellington-Napier line, scale 2 ft. to 1 in.; it was constructed by the N.Z. Railway Department. The Australian Pavilion is rich in ship models; there are models of the *Oronte* and *Omrah* twin-screw steamers of the Royal Mail Line, a fine model of the New Aberdeen liner *Pericles*, twin-screws, built and engined by Messrs. Harland & Wolff, Belfast, and the White Star liner *Runic*, twin-screws, by the same maker. An interesting model is exhibited by the Mount Boppy Gold Mining Company, Ltd., of their mine, showing treatment, plant, stamps, and other appliances for dealing with gold ores.

The *Daily Mail* Pavilion gives an opportunity of seeing what a modern newspaper printing machine is like; it will be a revelation to anyone who has never seen machines of this class. Biscuit- and sweet-making machines, tobacco-cutting and cigarette-making machines are also on view at the various places. Tin box making and filling with paste by machine can be seen at the building occupied by the Chiswick Soap & Polish Company. Two Renard road trains, each consisting of a front car carrying a petrol engine, which drives a jointed transmission shaft, transmitting driving power to each trailing car of the train, run in the grounds and take passengers at a small fare. This invention was described in THE MODEL ENGINEER for April 11th, 1907. The Flip Flap is a novel amusement contrivance decidedly worth inspection as a piece of engineering, for some interesting problems occurred in connection with the design and arrangements. It forms a useful study in constructive ironwork, and the gearing will provide the amateur with something to think about. A full description, with drawings, is given in the *Engineer* for May 22nd, 1908.

Our sincere thanks are due to the various firms who have kindly lent photographs or blocks for the illustrations shown.

To Messrs. Armstrong, Whitworth & Co. and Messrs. The Parsons Marine Steam Turbine Co. we are much obliged for their trouble in sending photographs, and we wish to specially acknowledge the kindness of the engineer-in-chief of Messrs. The Forges et Chantiers de la Mediterranée, who has responded with all the courtesy for which la belle France is so distinguished.

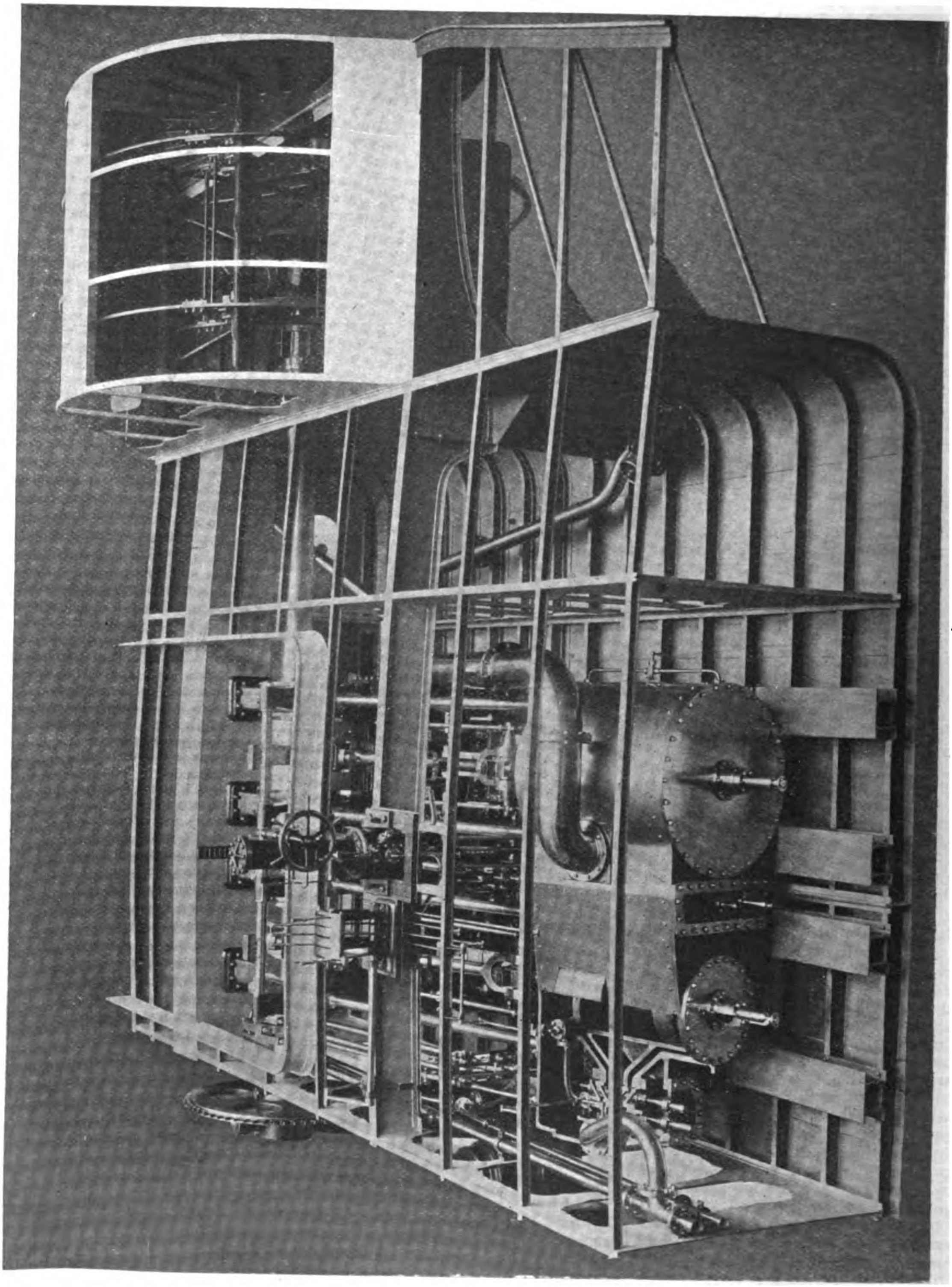


Fig. 9.—Half Model showing Arrangement of Diagonal Paddle Engines in a Shallow Draught Steamer.

THE ROYAL SCOTTISH MUSEUM, EDINBURGH.

A Visit to the Royal Scottish Museum, Edinburgh.

Machinery Section.

(*Continued from page* 322, *Vol. XVIII.*)

ANOTHER model exhibited in this section which is certainly well worthy of mention, especially as such an excellent photograph has been obtained for us, is that of a diagonal paddle engine fitted into a portion of a shallow draught steamer (Fig. 9). Only one half the beam of the boat is shown, as the other half would be absolutely in duplicate; the extreme left of the photograph coincides with the centre of the boat. To those of our readers who have not had the privilege of a close inspection of the engine equipment of a paddle steamer the reproduction will be instructive, showing, as it does, the construction of the hull, the H-section bearers to which the engine is bolted, the relative positions of pumps, reversing gear, starting wheel, etc., whilst to the extreme right of the photograph a fair idea of the construction of the paddle wheel and box can be had. The engine is a two-cylinder compound condensing, the H.-P. cylinder being fitted with an expansion valve. It will be noticed that the cylinder is in section. The air-pump is driven by rocking levers from the L.-P. crosshead. The feed-pumps and bilge pumps are similarly driven from the H.-P. crosshead. The condensing water is circulated by a centrifugal pump coupled to a high-speed engine. The paddles are fitted with feathering gear. Reversing is done by a Brown reversing engine. The cylinders of the prototype are respectively 35 ins., and 56 ins. bore by 48 ins. stroke. The model is built to the scale of 1½ ins. to 1 ft. By pressing a button motion is obtained from an electric motor on the floor of the case, as in the other models. This model was constructed in the Museum workshop.

The sectioned example of a Parsons type of steam turbine, which we show in the accompanying illustration (Fig. 10), was originally used for lifting purposes on board H.M. cruiser *Gossamer*, launched in 1890. It is an early form, and, as will be seen, is coupled direct to a dynamo. The steam from the boiler passes through a fine strainer, to remove small portions of solid matter which might damage the blades of the turbine, and enters the turbine casing, through a valve controlled by a governor, near the middle of the turbine. The steam then flows axially along the turbine in one direction. Owing to the pressure of the steam, it flows at a high velocity towards the exhaust opening at the end of the casing, and in doing so it has to pass between the " blades " of a series of rings which fill the annular space between the " drum " which forms part of the revolving shaft and the fixed casing. The rings are fitted to the drum and the casing alternately. The blades of the fixed rings are sloped in one direction (\\), and those of the moving rings in another direction (/). The steam tends to flow in a straight line, but is first guided in one direction through the spaces between the blades of a fixed ring; it then strikes the blades of a " moving " ring and is deflected in another direction, and so

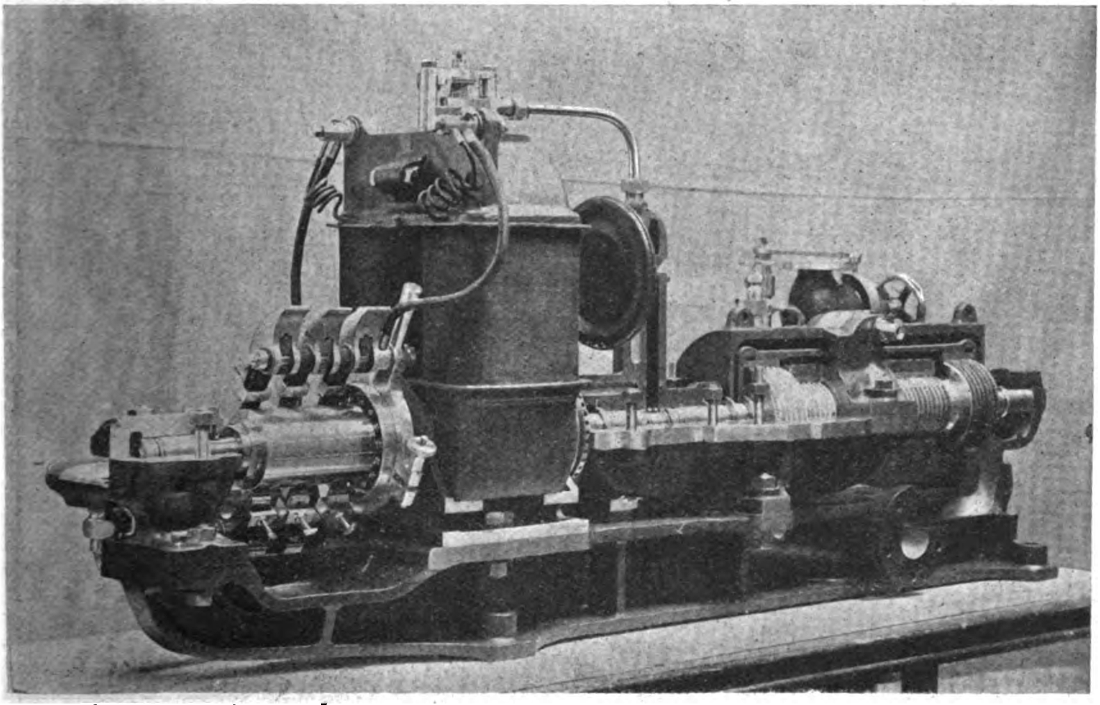


FIG. 10.—SECTIONAL MODEL OF PARSONS STEAM TURBINE: THE ROYAL SCOTTISH MUSEUM, EDINBURGH.

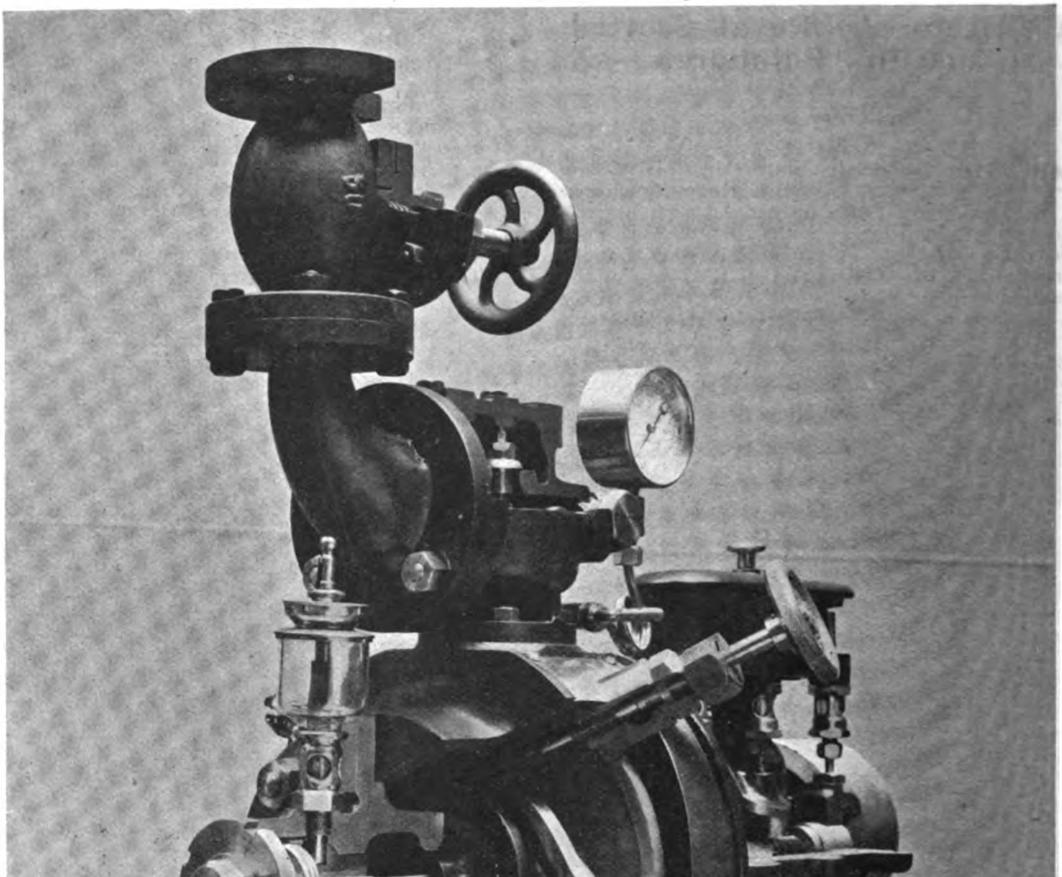


FIG. 11.—SECTIONAL MODEL DE LAVAL STEAM TURBINE.
THE ROYAL SCOTTISH MUSEUM, EDINBURGH.

on through the rest of the rings. This change of direction of the rapidly moving steam reacts on the blades of the movable rings, causing these rings and the shaft to which they are attached to revolve with great rapidity. In this machine the steam flows in one direction only, and the pressure is balanced by "pistons." The bearings consist of concentric tubes, each of which is separated from the others by a film of oil. The speed of the machine is regulated by means of a magnetic arrangement, acting in conjunction with a leather diaphragm.

As readers know, the De Laval steam turbine is also a very popular type, and rightly occupies prominence in the Museum: a picture is shown in Fig. 11. The principle employed is somewhat similar to that of the Pelton water-wheel (of which we noticed a sectioned model elsewhere in the collection). Briefly stated, the steam from boilers issues from diverging nozzles and strikes a single ring of buckets attached to the periphery of the wheel, thus driving the wheel round. The wheel of the prototype revolves at 30,000 r.p.m., which is reduced by means of double helical gearing to 3,000 r.p.m. The speed is controlled by a centrifugal shaft governor which operates a valve admitting more or less steam as required.

(*To be continued.*)

How It Is Done.

Making Brass Bearings.

By "SREGOR."

THE accompanying sketches show methods of machining accurately the common form of engine and general machine bearing. Most readers who have attempted the making of this plain bearing on accurate lines and to produce same quickly, no doubt have realised the difficulty of ensuring the joint face being exactly in the centre of the two halves of the brass, the necessity of this accuracy depending upon the general design of the machine or parts into which the bearing fits. But, theoretically speaking, the joint face should be at the centre of the two halves from the fact that when one half is less than the other (as shown in Fig. 1, exaggerated), it cannot receive the journal B it is intended for, but a reasonable amount of difference is not very noticeable as the bearing is usually scraped away each side of the joint face to provide a clearance for oil. But to ensure accuracy, say, to two or three thousandths of an inch, special provision must be provided. The first thing to determine is the amount of metal there is to remove from the casting in the machining operation, then the casting should be placed on a pair of parallel strips between a machine vice jaws (as shown in Fig. 2), the strips to be such a distance from the milling cutter that will allow a uniform quantity of metal to be removed.

The turning operation, when the cutter is once set, any number of castings can be milled to the same size (allowing, of course, when necessary to grind cutter). Having milled the joint faces, they are ready for the first operation on the lathe. A very suitable method of chucking these is to provide a split ring hinged at one side (as shown in Fig. 3). The more common practice is to hold the one flange in the chuck and fix a cramp on the other, but owing to the small amount of grip available on the narrow flange, and the distance the opposite end projects from chuck, makes it impracticable to take a heavy cut. The split ring overcomes these difficulties; the brass being firmly gripped in the centre and the diameter of

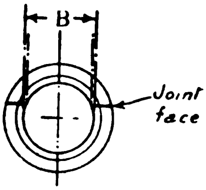


FIG. 1.

ring securely held in a 3-jaw self-centreing chuck, with the one side of ring pressed against the chuck jaws, which should ensure the joint faces of the brass running true. This arrangement is shown in Fig. 3, a front and side view, the front view showing the most suitable position for the chuck ring to be held in the jaws to equalise the pressure

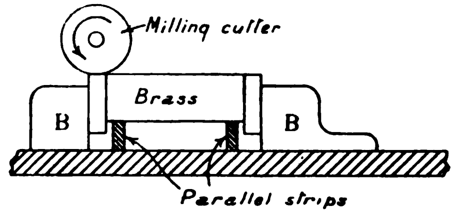


FIG. 2.

from same. The idea of the chuck ring being hinged is to keep the two halves together, and are much more convenient to handle, as shown. The ring is split through the centre and a portion of the one side is shaped away to receive the hinge block J. The brass can now be bored and the one side of the flange faced and a radius formed, if the design of brass is as shown in Fig. 4, also the

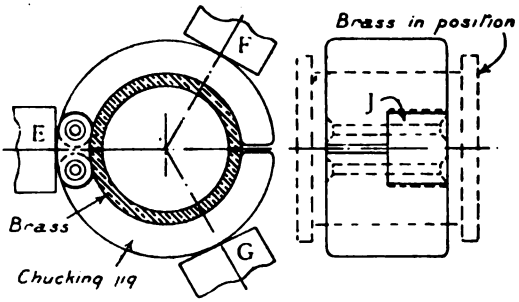


FIG. 3.—FRONT AND SIDE ELEVATION.

diameter of the flange must be turned to finished size which completes the first lathe operation.

The chuck jaws should now be eased back and the ring and brass reversed in the jaws, taking care that the brasses do not move when changing the position, and again pressing the back of chuck ring hard against lathe chuck jaws to ensure running true. The other flange, face, and diameter can now be turned, and the radius formed, if necessary. The last operation is accomplished by fixing the brasses on the mandrel (as shown in

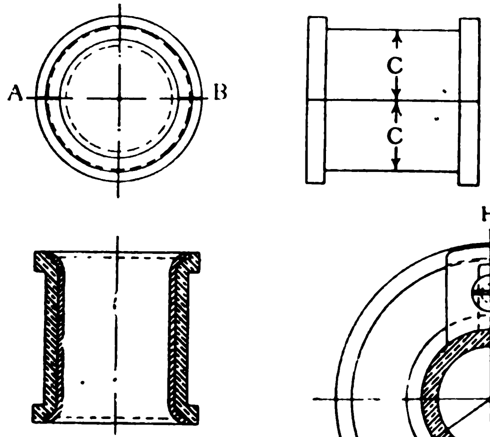


FIG. 4.—PLAN.

Fig. 5), which consists of the centre-piece BB, which is turned to slightly clear the bore. The two flanges serve to hold the two halves of brass true and tight together under the pressure of the nut C, when the centre part of brass can be readily turned to size with the mandrel between the centres in the usual way. The angle part of the flanges readily centralise the brasses by locating on the edges of the already turned flanges. The adjustable loose sleeve D should be a nice sliding fit on the mandrel and designed with a long bearing, as shown, to eliminate any possibility of the face of flange tipping out of the true position.

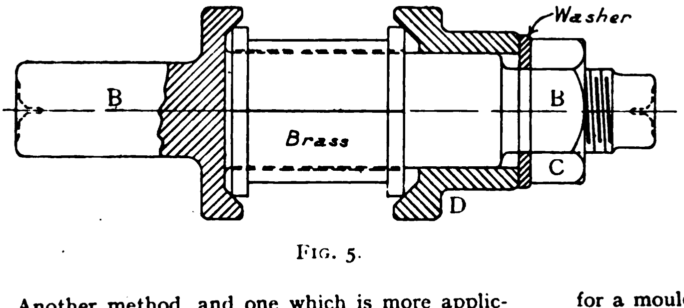


FIG. 5.

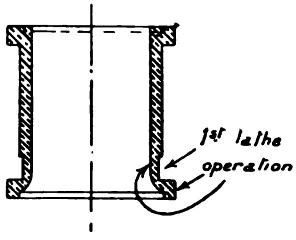


FIG. 7.

Another method, and one which is more applicable to the ordinary capstan, and dispenses with the necessity of the lathe centres, is that shown in Fig. 6, which illustrates a plain cast-iron casting of suitable size, and bored and screwed to fit the capstan nose, after which it is recessed as shown to receive the turned flange of the brass after the first operation. The diameter is also reduced to a distance (as shown in Fig. 7), to receive the holding-down clip N; these clips are slotted with an open end so that they can readily be slipped on and off the set pins O. The three holes are drilled and tapped equidistant around the face for the clips; the outer end of these holes are recessed to receive the pin heads so that they may be readily screwed in out of the way for the next operation. The arrangement as shown can be used for facing the one end flange and turning diameter of same, and forming the radius as the second operation on the brass, as shown in Fig. 7. The clips serve to hold the two halves of brass in position in the recess during the operation of turning the opposite end flange, after which the end plate, which is similar to that shown on the mandrel (Fig. 5), is

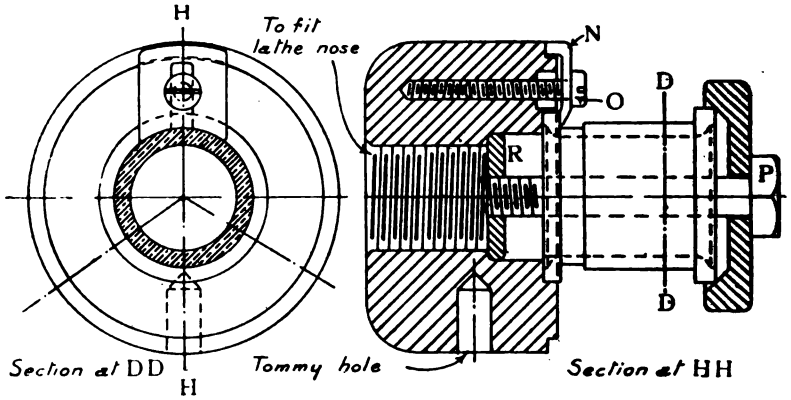


FIG. 6.

held against the flange with the bolt D which screws into the piece R, which must be secured in position. The plate or clip N can now be released and the pins O screwed into the casting out of the way and the centre part finished and turned, which completes the brass.

The three views shown in Fig. 4 are the outline of the finished brass. The sectional plan shows a liner of white metal in the bore. I shall show in the continued articles on this subject a suitable design for a mould for running the metal into position on the brass, and method of machining same to ensure even thickness of metal, etc.

(*To be continued.*)

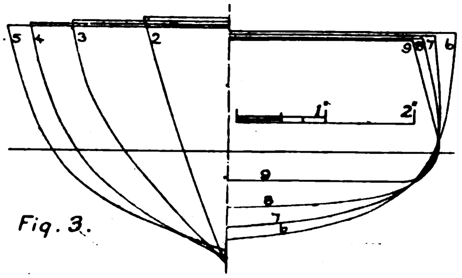
THE U.S. fleet collier *Vestal* was recently launched at New York. Displacement 12,585 tons; coal capacity, 6,400 tons, plus 1,576 tons for her own use. Her speed is 16 knots.

A Featherweight Steamer.

By "The Carpenter's Mate."

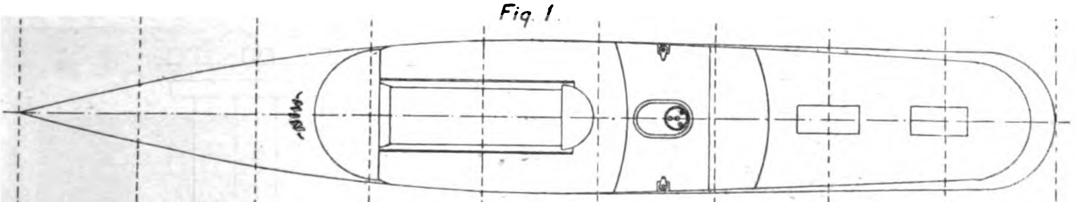
It has long been a conviction of the writer's that sooner or later model marine engineers would get an object-lesson in scientific weight-cutting and its possibilities for speed, and the results in Class C of the last Model Engineer Speed Competition has realised that expectation to the full. It is true that at the time it was a source of chagrin for both myself and my immediate friends, who had confidently regarded that Silver Medal as our own, but we were destined to be beaten by a "feather." All honour to the winner. After I had read the description of the winning boat in The Model Engineer my disappointment was turned to satisfaction and my chagrin to admiration at the wonderful exposition of applied ingenuity that was represented in the *Morearad*, and I trust the builder—should he read these lines—will accept my sincere congratulations on his success. It was while perusing that description and in consequence of a friendly difference of opinion with a fellow-clubman, that I suddenly decided to build a copy of the *Morearad*, and the resultant featherweight is the *Min*.

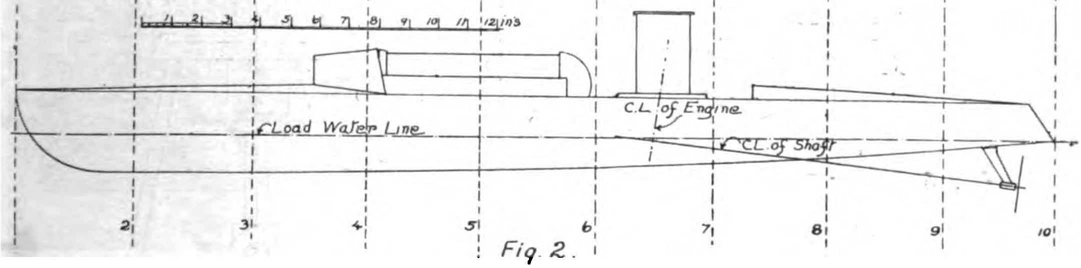
Starting with the firm conviction that I could produce the same result without assistance, I purposely refrained from applying to the builder of the *Morearad* for further particulars, and so, with only the description given in The Model Engineer, I set to work to riddle it out. My object has been achieved, for the weights of the *Min* tally very closely with the original, and her speed is nearly the same. I know not whether I have hit on the same methods as my *confrère*, but perchance, if this should meet his eye, he will favour me with a little criticism. Anyway, it may perhaps interest the readers of The Model Engineer to know how the *Min* was constructed, and, even if it does not set the fashion in featherweights, it may at least bring into prominence the measure of praise due to the winner of the Silver Medal in Class C.



Body Plan.

Deck Plan.

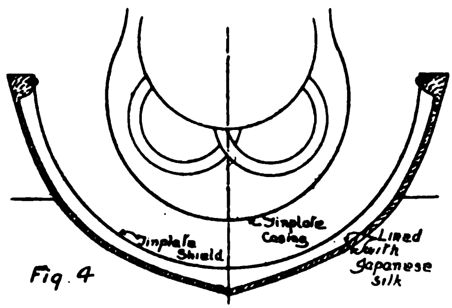




Sheer Profile.

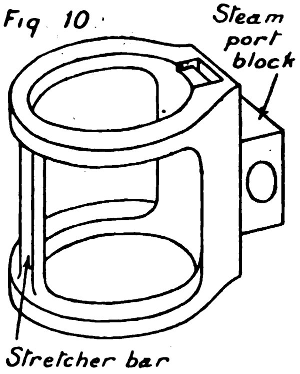
The hull (with which I commenced) did not present many difficulties, for I am an old hand with the chisel and gouge. I must confess I did not like the idea of using wood, because wooden hulls for steamers are a pet aversion of mine; but, reflecting that possibly the skin of Japanese silk would be its salvation, I bottled my painful experiences and got out another "chunk" of the time-honoured yellow pine—better known in the trade as deal—3 in. by 8 ins. With a little care and a lot of labour and patience this was finally evolved into the shape shown, with a thickness all over of 1-16th in., except stem and top strakes, which were left thicker for obvious reasons of strength. Also the parts where the engine and the skeg screw on to were left sufficiently thick for these purposes. It is almost inevitable that the chisel should go through once or so during the chopping-out process, in which

Fig. 4



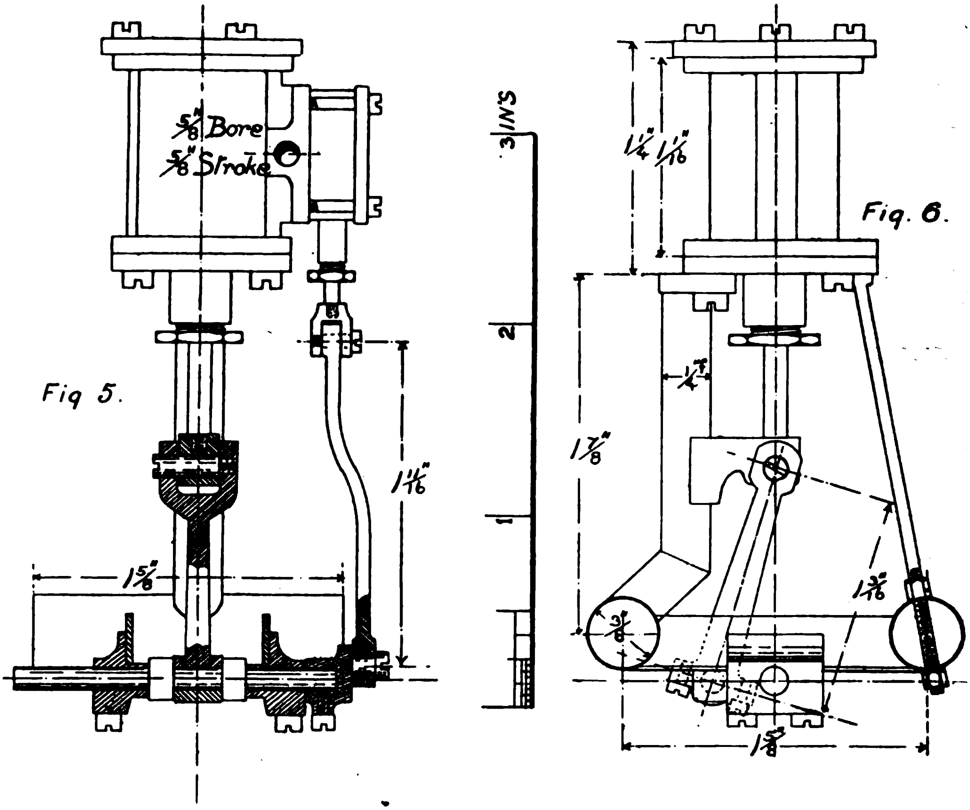
SECTION AMIDSHIPS.

Fig. 10



SKELETON FRAME OF CYLINDER.

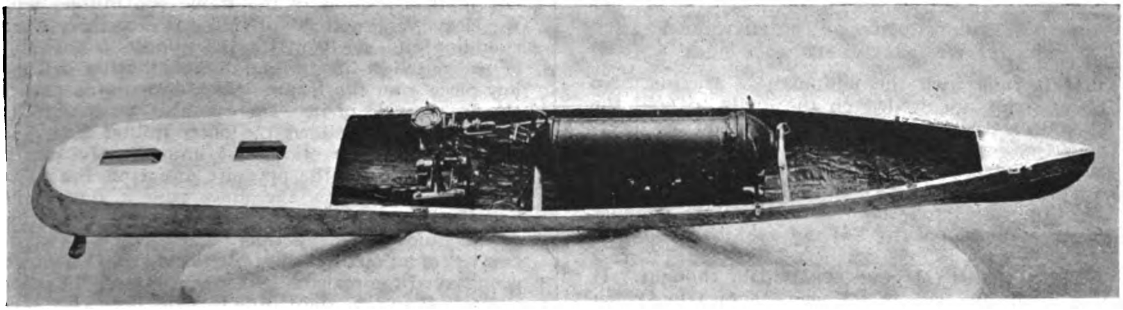
Fig. 5. Fig. 6.

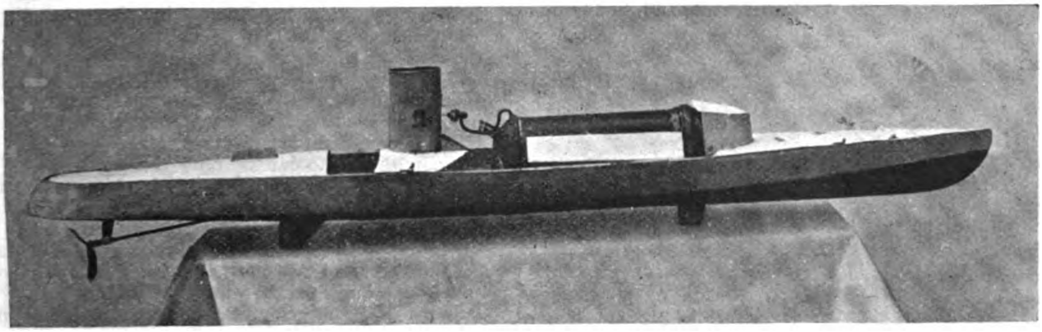


PART SECTION AND END ELEVATION OF ENGINE.

case the chip must be pressed into place with varnish for an adhesive.

Japanese silk is not a very expensive commodity, nor is it difficult to obtain, especially if you are favoured with enthusiastic lady friends; if not (in which case you have my sympathy), you are forced to the humiliation of a visit to a drapery store, where, under the focus of many fair eyes, you tremblingly ask for "a yard of nine-three"—I believe that is the expression. I lined my boat inside and out, and I think it is all the better for it. It stretches very nicely over the outside, and provides an excellent ground for paint-work. The varnish I used for laying this in was composed of copal varnish (2 parts) and dark gold size (1 part), used warm. I found it better to work in sections, doing the outside in three pieces, slightly lapping at the connecting edges. It must be left for at least a week to dry properly before handling.





Featherweight Steamer, "Min."

The next part to tackle was the engine—4 ozs., please! Well, in order to try a scheme that occurred to me, and at the same time use up some available material, I decided to make this ⅜-in. bore by ⅝-in. stroke. This engine, with full crank, split brasses, and split big-end, complete, without flywheel, weighs 4 ozs. 4 drs. I do not use a flywheel at all, although I think it would be an improvement, if a suitable one could be devised. In the case of the *Min* the engine shaft is coupled up rigid with the propeller shaft, and the propeller to some extent provides the virtues of a flywheel. It is, however, very difficult to start away under about 40 to 50 lbs. steam pressure.

The cylinder was made in a somewhat unusual way. I had an ordinary ⅝-in. by ⅜-in. cylinder in stock, and at first I tried to trim this down to a reasonable proportion of the weight, but I could not get the cylinder walls thin enough to suit me without danger of distorting the bore. Finally, I filed all the cylinder away, leaving only the covers, the steam port block, and a thin stretcher-strip as a solid skeleton frame (Fig. 10). This was then bushed with a piece of thin triblet tube taken from an elderly cycle inflator, driven in a nice fit, and tacked in place with solder. The solder does not prevent the use of superheated steam, its only purpose in the construction being to prevent the bushing from shifting while working on the cylinder. The covers were turned down as thin as was consistent with strength, and the piston being a good deep one, had the inside turned out—to use an Irishism. A thin cover was fitted over the turned-out cavity in this to prevent the wastage of steam. The steam chest was duly trimmed down in every possible way, and as a round-off to this part the weight-cutting was carried to the extent of filing the contact surface of the steam chest—on the port face—to a knife edge and dispensing with packing. The effect of this is that when the holding-down screws are tightened up, the knife edge of metal burrs down to a perfect metal-to-metal contact all over. The principle is used, I believe, on some makes of American locomotives. It is quite a success in this engine.

The back standard and crosshead guide is a piece of 5-16ths-in. triblet tube, with a lug silver-soldered on the top end. This lug fixes under the bottom cylinder cover, using the same screws that hold the cover on. The crosshead shoe is simply one-half of a short piece of the same tube split lengthways. This is flattened slightly and is soldered into place on the crosshead after everything is put together. The advantage gained thereby is

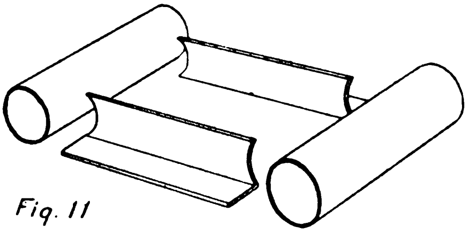


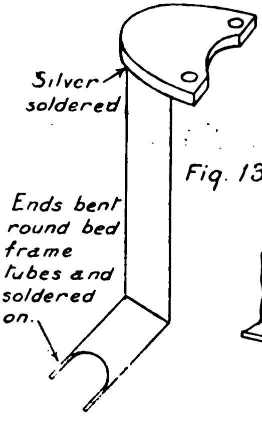
Fig. 11

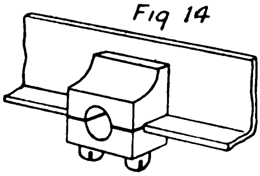
Showing Construction of Bedplate or Frame.

that it runs with the minimum of friction. No cover strips are needed on the guide to hold the shoe in, as the engine is arranged to run the direction that ensures the shoe always being pressed against the standard.

The front standard consists of a short length of 1-16th-in. steel rod screwed into bottom cylinder cover and secured to bed by two nuts screwed on.

The bedplate (?) gave some little thought. It was finally evolved in the shape shown in sketch (Fig. 11). Two pieces of ¾-in. cycle inflator tube were spaced apart by L-shaped pieces of bent-up





Back Standard. Method of Fixing Bearings.

thin brass sheet and soldered together to form the frame.

The bearings were then got out of little blocks of brass—bored, split, and fitted with screws. The superfluous metal was then pared down in every possible way, and it is astonishing what this means when you turn your hand to it. These were fixed into place on the stretchers by soldering. The necessary strength is obtained by the ledge of the L entering little sawcuts in the bearing-blocks. The usual eccentric is dispensed with, its place being taken by a very small crank.

(*To be continued.*)

Notes on Calipers and Micrometers.

By George Gentry.

(*Continued from page 204.*)

Figs. 14 and 15 illustrate the latest improvements in micrometers as made by the L. S. Starrett Company. The principal features here are a quick-action locking attachment *a*, Fig. 14, shown in cross section in the same figure, together with an improved method of taking up wear *b*, and a device *c* for setting the index on sleeve to the zero on thimble. Fig. 15 constitutes quite the latest departure in this class of tool—a quick-action adjustment. Referring to *a*, Fig. 14, a slot is cut in that portion of the frame continuous with the sleeve, and a steel cut ring *d* is introduced surrounding and nicely fitting the spindle. This ring is prevented from turning by conflicting with a key-piece *e* on the frame, which articulates with a slot in the side of it. There is also a silent roller ratchet *f*, which allows the outer milled ring *g* to revolve in one direction, but immediately this is turned slightly in the opposite direction the roller takes up and closes the inner ring *d* on to the spindle, locking it very rigidly. The feature in this is the quick-locking action. The device *c*, which consists of an outer shell of the sleeve, and on which is engraved the scale, is free to revolve on the inner sleeve. Being a tight fit, it can only be conveniently operated by means of a small ring spanner (provided) working in the opening *c'*. Should the anvil or spindle show signs of wear and the zero on the thimble advance beyond the index on this loose sleeve *c*, a slight turn forward with the spanner will bring these again into alignment. The inner sleeve is threaded at the point *b*, and is further split (chuck fashion) in three places, so that any wear in the same can be obviated by screwing the ring nut *b'* up the tapered jaws, also by means of the ring spanner. The ratchet stop *h*, having two reverse ratchet wheels which fit together and are kept so by a spiral spring until the resistance becomes too great, forms a very good wearing device and a very positive one in back action.

In Fig. 15 the principle of the quick adjustment is well worked out, in the following manner:—The spindle *a*, turned smooth and parallel throughout, is attached to the thimble *b* by means of a boss and four spokes or wings, two of which are shown at *c c*. In one with the boss, and outside the spindle, is a thin split barrel *d*, carrying the internal thread at its further end *d'*. This works upon the male thread cut upon an inner sleeve *e*, which is one with the frame of the micrometer, and is bored to fit the spindle. Normally, *d* would spring out so that the female thread would clear the male ditto—the thread being of buttress form (with the vertical face of the male thread facing in the direction of the anvil) to facilitate the action of gearing together—but the action of a sheathing cylinder shown in solid section at *f*, which clips the points on their outside tapered surfaces, and by virtue of the forcing action of the spring *g*, which, by means of the ratchet box *h* and slotted cylinder *i*, all of which work together, closes the female thread and holds it firmly to its work during the action of finely adjusting the instrument. But should it be necessary to open out or close the spindle some considerable distance, all that is necessary is to compress the ratchet box into the thimble by means of the thumb pressed into its hollowed out end (the thimble being held meanwhile between the first and second fingers) against the spring *g* when *f*, having passed the points of the spring barrel *d*, will release the threads and allow the spindle to be moved to any position or withdrawn entirely from the frame. The cylinder *f* is made separate from the slotted cylinder *i*, as the length of the slots in the latter determines the limit of the action of the spring; and the position of *f*, which can be screwed on and off *i*, determines the tension between the male and female thread. This tool is fitted with the outer adjusting sleeve *j* and is in fit, action, and accuracy, one of the finest pieces of work the writer has seen.

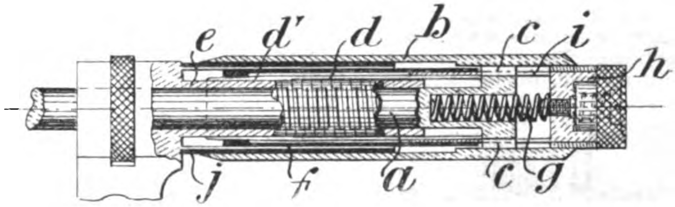


FIG. 15. (*Full size.*)

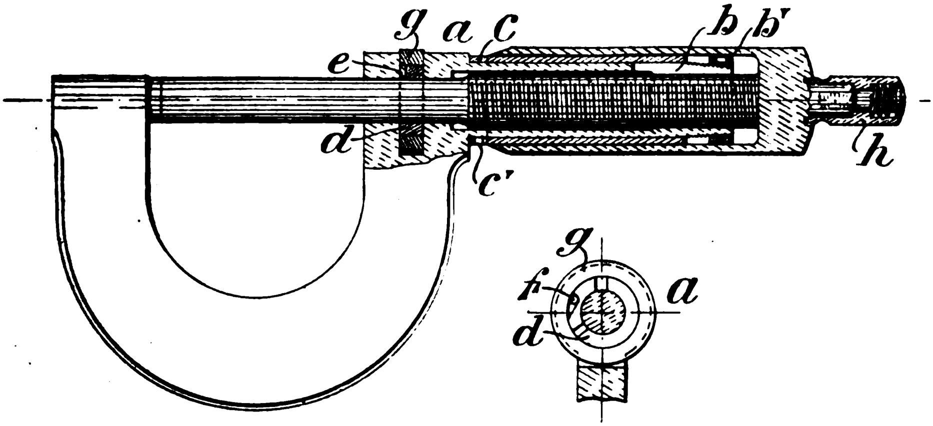


FIG. 14. (*Full size.*)

Fig. 16 shows the method of taking up wear in the Slocombe micrometer, which is of American manufacture. This micrometer is not fitted with any locking device, and has only recently been made with a ratchet stop. The principal feature is an ingenious device for taking up wear, which answers the double purpose of compensating for backlash and also for wear on the anvil and spindle surfaces. The internally threaded nut is made in two pieces, *a* and *b*. The former, which is the main nut, is externally screwed, with 32 threads to the inch, tightly into an internal thread of the sleeve. The second nut *b* is held in action with *a*, by means of a set of 56 *V*-shaped teeth on the annular surface of either nut shown at *c*. These teeth lock together. If, therefore, any backlash becomes apparent in the fitting of the main screw, all that is necessary is to withdraw the spindle and advance the nut *b* one or more of these *V*-shaped notches, when the wear will be compensated for upon the principle of the ordinary locking nut. Normally, a slight tension is put upon the nut *b* by means of a light spiral spring inserted in the space *c'*. To compensate for wear on the anvil and spindle, the action of the differential screw brought about by screwing *a*, by means of its 32 threads to the inch, into the sleeve, as against the 40 threads on the main screw, will, in the case of such wear bring the zero on the thimble back to its original mark when the worn surface is closed together, and by unscrewing *a* the opposite effect would be produced. These micrometers are made with a specially stamped and embossed frame, and

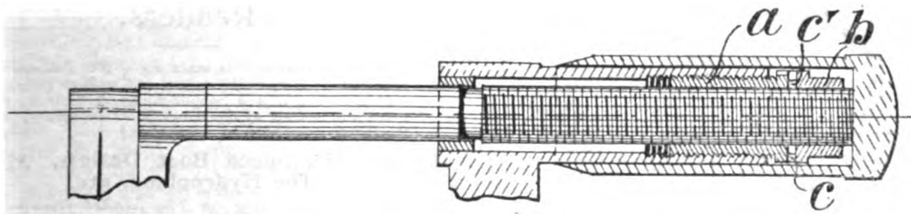


FIG. 16. (*Full size.*)

considering that they are regarded as cheap instruments, are wonderfully good value for the money, a 1-in. micrometer of the form shown in Fig. 16 being listed at as low a price as 17s. 6d.

In reference to cheap micrometers which run into a few shillings, and are usually of Continental make, great care is necessary in the choice of such as these. The writer has been enabled to thoroughly test several samples, and can recommend the two

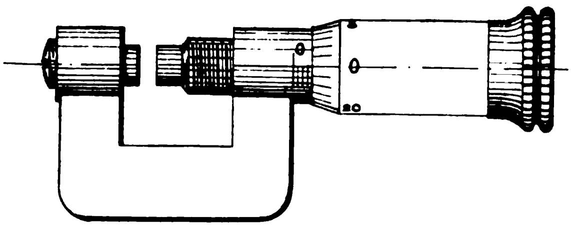


FIG. 17. (*Full size.*)

forms shown in Figs. 17 and 18 as being eminently suitable for the use of model engineers. Fig. 17 has a nickel frame fitted with a special milled friction nut (shown shaded) at the end of the thimble. There is no locking device on this tool, and the sample submitted showed an error of rather over half a thousandth of an inch in half an inch. The friction nut is silent, and is not actuated by means of a ratchet.

Fig. 18 in many points is a more suitable micrometer than the one above for model engineers, in that it has a steel frame, and has a locking device, to some extent capable of taking up wear. Tests made on this instrument show that in ·6 in.—which is their maximum reading—as low an error as 2½-10,000ths was all that could be found. The greatest disadvantage of this instrument is the small size of its points, which renders more care necessary in taking measurements of comparatively large

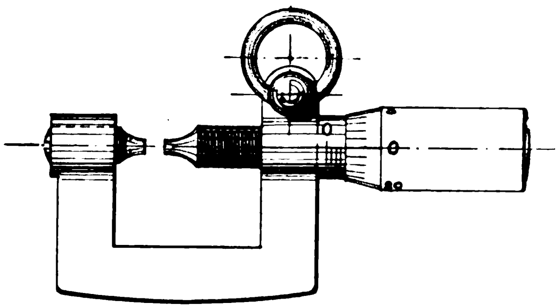


FIG. 18. (*Full size.*)

diameters. The price of Fig. 17 is 6s. nett., and the vendors are Messrs. E. Gray & Sons, of 118, Clerkenwell Road. The price of Fig. 18 is 6s. 6d., the vendors being Messrs. C. Nurse & Co., 100, Fleet Street, E.C. A beautifully-finished small micrometer, reading to ·4 of an inch and graduated in thousandths, is imported from the Continent by Messrs. Henri Picard & Frère, Bartlett's Buildings, Holborn Circus, and retailed at as low a price as 4s. The writer has been enabled to carefully examine one of these little tools, and, though it is not quite so accurate as the gauge last mentioned, it is sufficiently so for most practical purposes of the readers, being well within a thousandth of an inch in its entire range. It is plated all over, and compares with quite the best quality work for finish and compactness; the entire length when closed being on 2¼ inches, and the design exactly as that of Fig. 18. There is a very good design of micrometer used in the clock trade, and sold in Clerkenwell at a very low price. It has a brass frame and steel fittings, and is fitted with a ratchet stop, the important feature of this tool being that thousandths are read off a dial of large diameter by means of a hand attached to the thimble. The advantage of this form of reading is that the divisions are so large that half and quarter thousandths are very easily determined.

It does not come within the scope of these notes to more than refer to such forms of micrometer as the beam micrometer, in which there are measuring points capable of sliding along a beam and of being locked to the same at stated intervals, the fine adjustment being performed by the usual 1-in. micrometer head, attached to one of the points. This form, together with the micrometer sets, are for much larger work than usually falls to the lot of the model engineer. Micrometer heads have been successfully applied to such as surface gauges, and special tools for testing the truth of planer tables, lathes, gear wheels, and other purposes of a like sort. Indeed, the mechanical engineer can now boast of applications of this useful tool which can bring his work within a range of accuracy probably not equalled in an optician's practice, and certainly not surpassed by the watchmaker. It only remains for him to perfect his sense of "touch" in the matter of measurement, as in the case of the watchmaker, and not rely too much upon these excellent mechanical devices, which, in proportion to their fineness of accuracy, are the more liable to derangement.

The writer is indebted to the London manager of the L. S. Starrett Company for his courtesy in allowing him to examine and test several samples of his Company's valuable tools.

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.*]

On the 5-ft. Speed Boat Design, Modelling the Hydroplane, etc.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Replying to "T. J. P.", the fin-supporting stern tube is intended to be made of three-cross tinplate, and therefore—apart from its longer entrance—would not disturb the water reaching the propeller in anything like the quantity which the ordinary solitary (and consequently thicker) bracket would.

As to giving the boat's probable water-line when running at full speed, this is practically impossible, and your correspondent should be aware of this. It is also mere assumption on his part when he says the bow will lift considerably at that speed. It is quite possible that the boat would rise bodily, and her sections are calculated to attain this result. *Moraima II* has very full shoulders, and one would expect her bow to be entirely out of the water when running. As a matter of fact, she preserves a level water-line.

As regards possible priming, etc., if "T. J. P." will refer to the beginning of my article, he will there find that it is not intended to leave the steam drum uncovered, and I believe the ordinary method of conserving heat by lagging, etc., is not unknown to the majority of model engineers. As to the superheater suggested, this would be all right if made of *steel* tube; but I think the one I have indicated will more than check any tendency to priming, especially as the water-level is meant to be only up to two-thirds the height of furnace tube. Personally, I should work this boiler (as I do a similar one, but of smaller dimensions) with the water-level at about one-half the height of furnace tube. This, however, would necessitate dropping the lower connection of water gauge.

With regard to the penultimate paragraph of "T. J. P.'s" letter, here, as Mr. Squeers might say, is "richness." My letter (page 113) where I mention about starting at the propeller clearly refers to the *designing*. It is practically immaterial in what order the component parts of the boat are *published*.

Adverting to your correspondent's concluding paragraph, my criticism of Mr. Blaney's article was based upon an intimate personal knowledge of his work. Mr. Delves-Broughton and his colleague hit the pith of my criticism when, in their letter, they use the words, "anyone capable of designing the propelling plant." Almost any amateur now-a-days can turn out a decent speed-hull (hydroplane or otherwise), but to design and construct the requisite propelling plant — "Ay, there's the rub."

Let me supplement Mr. Blaney's article, so far as regards the "Polysphenic" (not "polyphensic") models of Mr. Ramus. In the experiments by the late Mr. W. Froude (who was requested by the Admiralty to report upon Mr. Ramus's claims) the models had two consecutive inclined planes, with a slope of 1 in 50, as suggested by Mr. Ramus. In no case did the speed exceed 12½ knots. The slope of 1 in 17 was ascertained by Mr. Froude's calculations, and afterwards adopted by Mr. Ramus. Mr. Froude, himself an expert rocket-maker, experimented with a number of these propulsive agents so as to ascertain the exact governing factors. The results of his experiments and trials were such as to enable him to prove conclusively that the speeds claimed by Mr. Ramus were utterly impossible of attainment with the means employed. The whole report is strongly condemnatory, and Mr. Froude concludes by saying: "Looking at the character of the experiments themselves, the inferences drawn from them, and the proposals based on these inferences, they seem to me to present accumulated and conclusive evidence of Mr. Ramus's incapability of dealing with the subject to which he is devoting his attention." As Mr. Froude was a very eminent authority, it is just possible that Mr. Ramus possessed the failing, not uncommon, of over-estimating his results.

That the hydroplane has great possibilities before it in the matter of speed cannot be gainsaid. The Crocco-Ricaldoni hydroplane boat is credited with a performance of 43½ miles an hour. This boat is 26 ft. 3 ins. long, and with all aboard weighs 3,300 lbs. The motor is 80–100 h.-p., and drives two *aerial* propellers at 1,200 r.p.m. The boat presents original features, the planes being only at its stem and stern. When running at the above-mentioned speed the *hull* is about 18 ins. out of the water, supported only by the peculiar V-shaped planes.

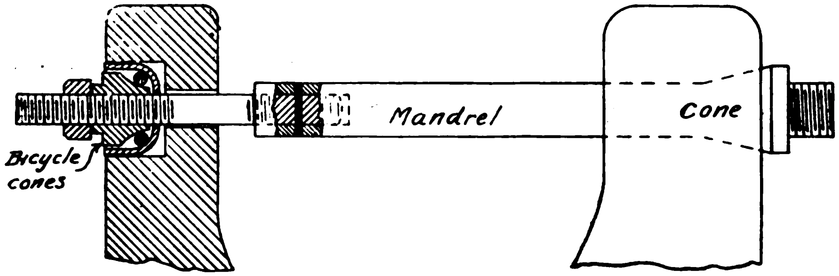
In the ordinary type of hydroplane notice will have been taken of the very serious eddy-making behind the ends of the planes. It is probable that this could be avoided to some extent were the forebody of ordinary construction, and the propeller might be placed further astern than usual, with benefit.—Yours truly, THOS. DYSART.

South Hackney, N.E.,
August 22nd, 1908.

Fitting Ball Bearing to Badly Designed Mandrel.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In reference to Query 19,673, in July 16th issue, the way I got over a similar difficulty was to fix a $\frac{3}{8}$-in. bicycle spindle truly in the back of the mandrel, then bore out back limb of headstock (with a makeshift boring bar) to a correct size to take the ordinary bicycle cones.—Yours truly, "CIG."



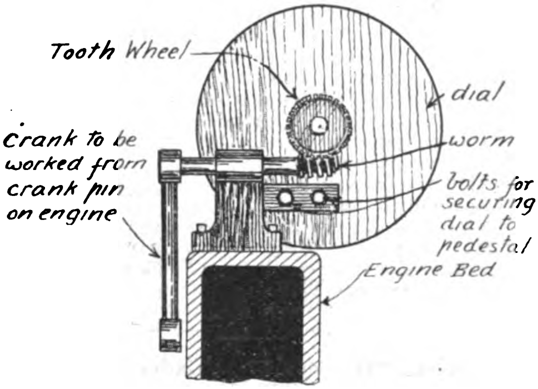
Colliery Winding Engineers.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In your issue of THE MODEL ENGINEER of the 16th inst you give advice on a simple revolution indicator (Query 19,935); also on how to become a winding engineer. I beg to give a few additional particulars in regard to the above.

To become a colliery winding engineer the aspirant has first to get accustomed to engines, by having charge of haulage or fan engines; then, if he seems an intelligent sort, he can, if he has applied and the surface foreman thinks fit, in his spare time practice handling the levers under the supervision of the engineer whilst winding coal. After about twelve months of this, he will probably be allowed to raise and lower men under the eye of the engineer until proficient, which will be a long time, as, with high-powered engines the slightest mistake is sure to be attended with disastrous results.

Regarding the indicator, I give a sketch, showing the back view of the apparatus. It consists of a pedestal, secured to the bed of the engine, and carrying a shaft with a worm at one end, geared into a toothed wheel. To the other end of the



shaft is secured a crank arm, the loose end of which is secured loosely on to the crank pin of engine. It is evident that every revolution of the engine causes the worm to revolve, which transmits the motion through the toothed wheel shaft to a finger on face of dial. The dial can be marked as required. —Yours sincerely,

John Heyes.

Perpetual Motion.

To the Editor of *The Model Engineer*.

Dear Sir,—I am writing to point out a mistake in Mr. Fraser's letter about the action of sulphur dioxide on iodine. He states that sulphur dioxide and water form sulphuric acid and sulphurous acid; but when sulphur dioxide is passed into water, only sulphurous acid is formed.

Both his equations are also wrong, and I conclude that he intends the equation—

$$I_2 + 2H_2 \ \ + SO_2 = H_2SO_4 + 2HI$$

for

$$I_2 + 2H_2O + SO_2 = H_2SO_4 + 2HI,$$

which is also wrong, because—

$$H_2O + SO_2 = H_2SO_3.$$

But, of course, I agree that sulphurous acid is changed very slowly into sulphuric acid if exposed to the air for a long time, but that is no reason why he should state that sulphur dioxide and water form sulphuric acid. Trusting that Mr. Fraser will pardon my pointing out his mistake, I remain, yours truly,

J. F. Perrin.

The *Lusitania* has recently established some new records: From Daunts Rock to Sandy Hook, 4 days 15 hours, *i.e.*, a reduction of 3 hours 40 minutes on previous time. Best day's run, 650 knots; average speed, 25·66 knots. Average for passage, 25·05 knots. Her commander, Capt. Watt, having reached his retirement age, intends retiring from the sea.

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of The Model Engineer *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.]*

London

Future Meetings.—The next meeting will be held on Friday, September 18th, at the Cripplegate Institute, at 7 p.m., when Mr. Percival Marshall will discourse on "Originality in Model Work." The following meeting will take place on Friday, October 9th. Full particulars of the Society and forms of application may be obtained from the Secretary, Herbert G. Riddle, 37, Minard Road, Hither Green, S.E.

The Victoria Model Steam boat Club.

ANNUAL GENERAL MEETING.

The postponed annual general meeting of the above Club took place on Saturday, August 15th, at Trinity Church Schoolrooms, Stepney. Although the meeting was essentially a business one, the table was tastefully decorated with the old deep blue Club colours and adorned by the handsome Wembley Park Challenge Cup, a white writing card being placed before each member. The minutes and balance-sheet having been read and passed, the Chairman (Mr. W. L. Blaney) gave a short *résumé* of the work of the year, concluding by formally handing the cup into the charge of the President (Mr. J. C. Crebbin) by the unanimous wish of the members. The late officers having then officially resigned, Mr. Crebbin took the chair *pro tem.* by request and invited discussion on any subject previous to the election of officers. Several resolutions of infinite value to the Club were then decided on, and the meeting proceeded to the election of officers for the ensuing year, when the following gentlemen were returned:—Chairman, Mr. W. L. Blaney; Hon. Secretary, Mr. W. Poole; Hon. Treasurer, G. P. Crowe, Esq. Committee: Messrs. Eustace Rose, Henry Cousins, A. Davis, E. Vanner, and J. Callaghan.

The Club is now in a very flourishing condition, and the enthusiasm for its success is even greater than before. The membership has steadily increased during the last four years with, of course, a large influx since the Regatta. There are now no limitations to the number of members the Club is prepared to receive, the only qualifications for membership being a keen interest in model power boats and a definite promise to build one, if not already the possessor of such. The beginner is especially invited to join and the modest ones need have no fear of being overawed by the old expert member, as the members make it a point to encourage new recruits and make them quite at ease. The educational value of the Club is no small one, as the various stages of a model maker's progress can always be seen and studied, from the "condensed milk tin" stage to the petrol flier. The entrance-fee is 2s. 6d., and the subscription 1s. per quarter.—W. Poole, Hon. Sec., 396, Old Ford Road, Victoria Park, E.

Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[19,300] **Apprenticeship.** H. W. T. (Slaithwaite) writes: I have been reading your recent articles on "How to Become a Mechanical Engineer," and should be very much obliged if you could advise me what to do in this case. I have succeeded in getting into a small millwright's shop here (where they employ about sixteen men) to learn the business. I have been here about six months, and find that the work done is extremely rough, most of it being done to about 1-16th in.—none more accurate than 1-32nd in. I have signed no indentures. Could you advise me what to do? If you think I had better leave, could you give the names of some firms in London?

We are afraid that the whole matter rests more or less upon your own personal efforts. We think your best plan is to make application to a few London firms, preferably in your own district, and make a selection of names from some of the trade papers, which can be seen in any library. We regret we do not know personally of any firm in London which is open to take further apprentices, but if you go round or write to a few firms, as we suggest, you would probably get a reply direct from them, saying whether they had any vacancies or not. On the other hand, if you feel sufficiently competent, you could try to get a job at the bench as an improver. But this depends upon your abilities and other qualifications, of which we know nothing, and we therefore cannot give you any more definite information.

[20,170] **Steam Pump.** H. S. (Guildford) writes: I have a slide-valve cylinder, ¾-in. bore by 1½-in. stroke, which I want to couple direct to a pump, ½-in. bore by 1½-in. stroke. (1) Could you give me a rough sketch and dimensions for the slide valve gear? (2) What size boiler tubes should I want (see Fig. 1)? (3) What size suction and delivery tubes would the pump want? The pump will not be worked to feed any boilers, but just pumping.

(1) We should require dimensioned sketches of the cylinders before we could make any definite suggestions. You cannot work the slide valve of the steam cylinder simply by a rod from the crosshead. There are many devices in use, the most reliable in actual practice being the steam relay valve as used in the "Tangye" pumps. These arrangements, however, do not seem to be very successful in model work. (2) For simply working the pump (under light load) a 2½ ins. by 8 ins. water-tube boiler will suffice. Use four water-tubes ¼-in. diameter. (3) For suction and delivery ¼-in. pipes should be used. See Professor W. W. F. Pullen's book "Steam Engineering," for particulars of the "Tangye" type of pump, price 4s. 9d. post free from our publishing department.

[20,137] **How to Oxidise Copper.** A. C. I. (Halifax) writes: (1) Please can you inform me how to oxidise copper to give the metal a dark brown polish? (2) Also have you in print a back number of THE MODEL ENGINEER that fully describes how to make an engraving machine (electric), or could you inform me how to make same?

(1) Thoroughly clean and polish the metal; then, with a camel's-hair brush, apply evenly to the surface a coating of a cream made by mixing "crocus" (iron oxide) with water. Then hold the metal over a clear fire till thoroughly dry. When the metal is cold, brush the surface with a hard brush till it becomes quite clean. If the colour is not dark enough, repeat the process. (2) Two articles on "How to Make an Electric Engraving Machine" appeared in our issues of March 26th and April 2nd (1903), which are still in print.

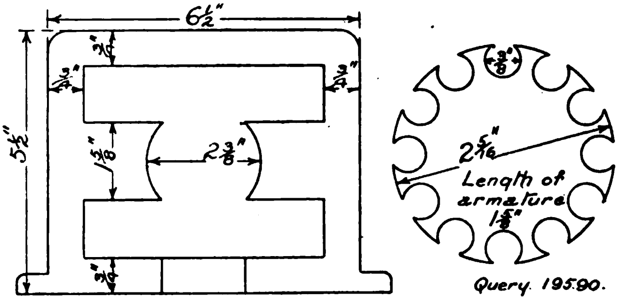
[19,779] **Medical Electrical Outfit.** J. L. D. (Dumfries) writes: Would you kindly give me some information on the following piece of apparatus which is fitted in a mahogany box with a hinged lid. Underneath are the cells, which are thirty in number. The cells are connected up in series, and have each got what looks like a rod of carbon and a thin rod which looks like zinc; they are sealed with pitch and have a plug in each cell. Can you tell me what kind of cells these are, and if they can be recharged, by what means. The box is half filled with pitch, which makes the cells immovable. Above this there is a shelf. The wires are connected from the respective cells to regulating and plug switches. There is also a reversing switch, and also a pair of shocking coil handles. Can you give me any information as to what this apparatus is?

This is evidently a medical electrical outfit for applying electricity to a patient either through the handles or by sponges or pads, needles, and so on. The galvanometer will probably be graduated to read in milliamperes, that is one-thousandths of an ampere, as such currents are applied in very small doses. The three plug contacts appear to be shunts to multiply the indications of the galvanometer by 10 or 20; that is, if the plug is in the 10 hole the galvanometer indication should be multiplied by 10 to give the true reading, and so on. The switch arm and contacts is a cell select or to put 2, 4, 6, etc., cells in series, according to strength of current wanted. The reverser is to reverse the direction of the current through the patient. Charge the cells with a bichromate solution, 1 part bichromate of potash, 2 parts sulphuric acid, 6 parts water, by weight, or chromic acid powder 5 ozs., water 1 quart, acid (sulphuric) 3 ozs. The apparatus is really only of use in the hands of a medical man and for specific purposes; it is not a "shocking" apparatus. You could use it for testing purposes.

[20,212] **Displacement Lubricator.** E. C. (Walsall) writes: I want to fit some kind of automatic lubricator to the cylinder of a Stuart 1½-in. by 1½-in. engine, and I understand that a displacement lubricator is the most satisfactory. Would you kindly describe how such an one works, and give dimensions or sketch of one suitable for this engine? I have seen the article on "How to Make a Sight-feed Lubricator," in THE MODEL ENGINEER some time ago, but I want, if possible, something simpler and easier to make.

We published an illustrated article descriptive of a displacement lubricator in our issue of June 23rd, 1904, to which please refer.

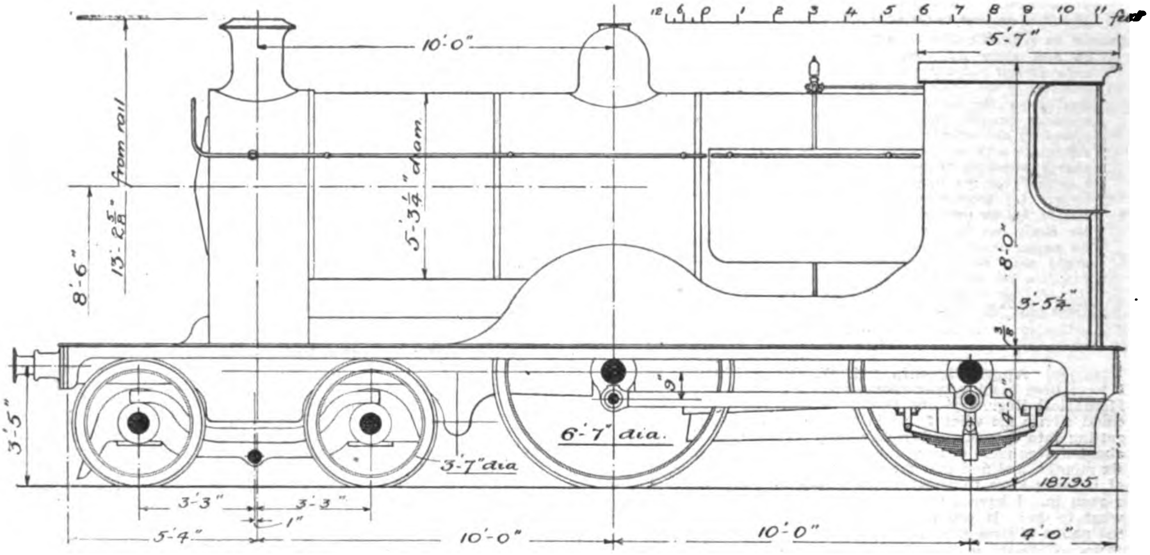
[19,590] **30-watt Dynamo Windings.** P. C. (Leith) writes: I have made a small dynamo, sizes of which are given on enclosed sketch, and I would take it as a great favour if you could give me the most suitable windings for same. I may mention that the commutator has twelve bars same as armature, which will, of course, mean two windings in each slot. (1) How much wire shall I have to put on the fields and about what gauge? I have plenty of wire lying by me same as enclosed. Would that be suitable? (2) How much wire shall I require for the armature and what gauge, and would smallest enclosed do? (3) Is this method of winding an armature correct: Starting in No. 1 slot you wind over to No. 6, and so on until the whole amount of the first coil is put on; then you take the finishing end of No. 1 coil and join it to the beginning end of No. 2, and so on all round the armature, joining the finishing end to the starting end in rotation all round the armature? (4) How much can I expect to get out of this machine? (5) Are both coils of the fields wound in the same direction? (6) Does copper gauze or carbon make the best brushes and where can I obtain same? (7) Are machine proportions correct?



Query 19590.

You can wind armature with No. 19 S.W.G.; about 5 ozs. will be required. With this winding on armature No. 22 would do for the fields, about 1½ lbs. being required. This winding would give you rather a low voltage, probably not more than 5 or 6 volts at 2,800 r.p.m. A better winding would be No. 22 on armature, and for fields No. 24 S.W.G. Output of machine will be approximately 30 watts, and the latter winding should give about 10 volts. Particulars of methods of winding are given in our handbook, "Small Dynamos and Motors." We should be inclined to use copper gauze brushes in preference to carbon.

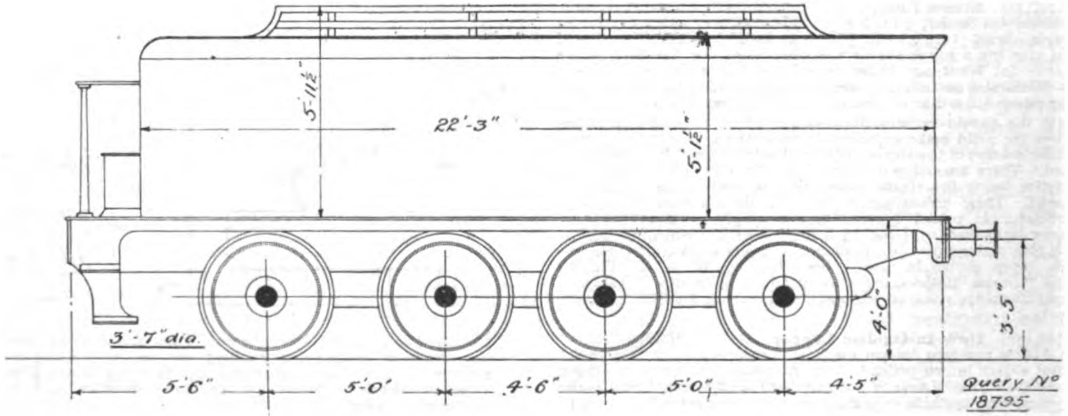
[18,795] **L.S.W.R. Locomotive. 4—4—0 Type, Class No. 415.** W. A. K. (Lurgan) writes: (1) Could you give me a drawing for a ½-in. scale L.S.W.R. engine of the same kind as Mr. W. J. Russel's in Nov. 21st, 1907, issue. I would like it driven by one cylinder. (2) Would a cylinder ½ in. by 1 in. be large enough? If not, please state size. (3) I don't understand the reversing motion by slip eccentrics.



L.S.W.R. Locomotive, Class No. 415.

(1) We include a drawing of both engine and tender. The width over the footplates is 8 ft. 1 in., and over cab sides 7 ft. 2 ins. (2) Yes, one cylinder would work the model well, ½ in. by 1 in. or 9-16ths in. by 1 in. (3) See Greenly's book "The Model Locomotive," price 6s. net, 6s. 4d. post free, also reply to recent query.

[19,428] **Small Dynamo Construction.** H. S. (Guildford). writes: Please will you answer the following. I am about to make a small dynamo. The field-magnet is to be made of iron bar



Tender for L.S.W.R. Locomotive, Class No. 415.

1 1-10th ins. by ⅜ in. Two portions are to be bent into the horseshoe form and put side by side, thus making the field-magnet 2 1-5th ins. wide. Pole pieces to suit armature 1¾ ins. long by 1¼ ins. are to be fitted. Will this arrangement be suitable to generate 10 watts (5 volts 2 amps.), and if so, with what wire, and what will be the best way to fix the pole pieces? Also Mr. Bottone, in his book on "Electrical Instrument Making for Amateurs" gives a chapter on the "Uni-direction Machine," which he says will light an arc lamp. Is it possible that so small a machine as this will give over 39 volts? I note he says the arc lamp can be shown, by which I presume he means lighted in the ordinary way. What voltage and amperage would you calculate it would give?

The arrangement you suggest would be quite suitable, but we advise you to make the joints of the iron forming the field-magnet cores as perfect as possible. The pole pieces should also be firmly fixed to the magnet cores, either by means of rivets or screws, and special attention should be paid to making the surfaces of the metal bear well against each other. To give 5 volts, 2 amps., we should wind armature with No. 24 S.W.G., as much as you can get on, and field-magnets with about 7 ozs. of the same gauge connected in shunt to the brushes. This machine, if wound with finer wire on the armature, could be made to give about 40 volts, but the current given would, of course, be proportionally small.

[20,216] **The Action of Lightning.** F. J. F. (Caister-on-Sea) writes: In consequence of a discussion I would be much obliged if you would answer the following query. If, in an open place, there were to be a pole of iron and another of wood, the wood higher than the iron, would lightning strike the wood (being the first thing it came across) or the iron? Also, are green leaves more attractive to lightning than are trunks of trees? Are some trees more attractive to lightning than others, because a small

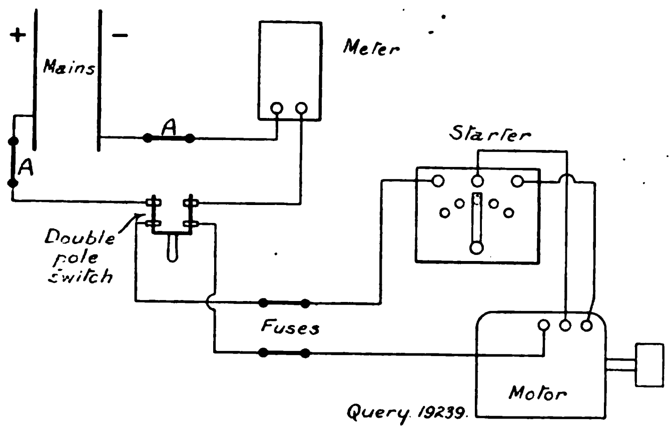
tree in our garden was struck by lightning which left a high house and high tree (which stand a couple of yards away) intact.

It is generally thought that lightning takes the easiest path to earth—that is, the path which offers least electrical resistance. So if two poles are standing together—one of wood and the other of iron—the probability is that the iron one would receive the discharge rather than the wooden one, as its resistance would be so very much less. And since a young leafy tree is, by virtue of its moisture, a better conductor than an old dry tree-trunk, it is more likely to be struck. But science has not yet discovered all the laws of the lightning-flash, and is much puzzled by its vagaries, so we cannot take upon ourselves to predict just how the celestial electricity will behave in given circumstances.

[19,936] **Horse-power.** J. C. (Preston) writes: Will you please tell me the meaning of brake horse-power, nominal horse-power, and indicated horse-power, and how is brake horse-power calculated?

We have fully explained all these points in back numbers of this journal, to which please refer. We give dates of one or two issues below: April 26th and May 10th, 1906 (Model Engine Testing); May 28th, 1908 (Dynamo and Motor Testing). See also chapter on Testing in "Gas and Oil Engines," by Runciman, 7d. post free.

[19,239] **Motor and Switchboard Wiring Connections.** S. S. (Suffolk) writes: Kindly help me out of my difficulty. Will you please give me the connections to connect up the motor, etc., to the mains in the following sketch (not reproduced)? There are three terminals on motor and three on rheostat. I suppose it is for a shunt wire. If you could give me the necessary connections, you would greatly help me.



Query 19239.

The actual connections of the meter will depend upon the regulations of the supply company and the particular type of meter. The particular terminals on motor and starter for shunt armature and main leads should be marked. We give you the general method of connecting, but you must check this by your own local information. There should be a double-pole fuse between the meter and mains. The supply company provide this.

[20,129] **Voltmeter.** E. E. A. (Bristol) writes: I have made a voltmeter to plans in No. 24, Model Engineer Series, pages 24, etc.—wood bobbin, paper tube core, and wound it with about 6 ozs. No. 36 cotton-covered copper wire, which nearly fills the bobbin. Used round nail for W (Fig. 18) about ⅛ in. diameter. Made spindle out of brass ⅛-in. pins at end, as described; bearings, thin sheet brass. Copper wire supports from spindle (22 W.G.), and used part of an oval French nail ⅞ in. long for part F on Fig. 17; balance-weight, solder. On trying this with four accumulator cells (8-volt) I found no movement of spindle; nor, when shunt-connected, with dynamo giving 20–30 volts. When 4 volts are passed a magnetic compass is deflected, but cannot ring an electric bell if connected in circuit with two cells and voltmeter.

The resistance of the coil in your voltmeter is about 380 ohms and the current that flows in circuit is, by Ohm's law, equal to the voltage divided by the resistance. So that even if we leave out of account the resistance of bell and battery, the current would only come to 8-380ths amp. (less than 1-40th of an amp.), and as most bells require at least ¼ amp. to ring them, you need not be surprised that the bell does not ring. The bearings for the spindle are a vital part of the machine. A poor fit here would be enough to account for the failure of the instrument. If that point seems satisfactory, try altering the iron pole-pieces, since the whole action of the meter depends upon the degree to which these are magnetised. You should make sure that they are sufficiently large and of good soft iron. Do not have the magnets too far apart. The nearer they are, the greater will be the repulsive force. But they must not press one on the other.

[20,208] **London Motor Omnibus.** C. B. T. (Barnstaple) writes: Will you please give me a sketch and dimensions of a London motor omnibus (petrol)?

The information you require has been given in The Model Engineer. In our issue of September 21st, 1905, there appeared a good illustration, with many particulars, of a Straker motor omnibus for the London Road Car Company. In the November 23rd issue of the same year there were given a few particulars of the same Company's Clarkson chassis, with two illustrations of it. Our November 2nd, 1905, issue contained detailed drawings of the Milnes-Daimler 3-ton chassis, which is fitted to many London motor omnibuses.

[20,226] **Making Plante Type Accumulators.** H. W. (Coventry) writes: I should be very much obliged if you can help me with instructions for making accumulators. I have got your Handbook on same, and having dynamo I can use, I have decided on Plante type. (1) How many charges will be required to obtain full amperage? (2) What amperage per square foot of positive plate can I expect? (No knowledge of algebra.) (3) In charging and discharging do I completely empty or retain portion of charge for forming? (4) Suppose fourteen cells are fully formed and charged in series, what will be result if two more fully formed, but uncharged, are added in series? (5) Can the two outside plates be made half thickness, as in pasted plates?

(1) This is a matter for experiment. (2) Your cells will have a capacity of somewhere about 20 ampere-hours per sq. ft. of positive plate. They should not be charged or discharged at a rate exceeding about 6 amps. per sq. ft. of positive plate. (3) Never discharge much below 1·9 volts. (4) The uncharged cells will be spoiled by being charged the wrong way by the current from the other fourteen. (5) Yes.

[20,076] **G.E.R. "Claud Hamilton."** T. M. S. (Tottenham) writes: I am thinking of constructing a 2-in. gauge (7-16ths-in. scale) Great Eastern Railway express locomotive ("Claud Hamilton" type). Can you give me a sketch of same, with dimensions?

Particulars of "Claud Hamilton" locomotives to scale of ½ in. appeared in The Model Engineer of September, 1900. Dimensioned drawings to ½-in. scale appeared in issue of Jan. 15th, 1901, with further particulars and drawings in issue of May 1st, 1901. *The Railway Engineer*, of May, 1901, contained, as a supplement, a large working drawing of the "Claud Hamilton."

[20,125] **Lighting Handbook; Osram Lamps.** G. R. (Weymouth) writes: Can you kindly recommend me a book *re* electric lighting. I have a copy of your "Private House Electric Lighting," but part of same is of no use to me, as I want information as to lighting from 230-volt circuit from town mains. Is there any book published dealing entirely with this side of the subject, but after the way of book above named. Also, are Osram lamps reliable for using on a 230-volt circuit? Some little time ago I was told they were not very satisfactory.

We advise you to get Clinton's "Electric Wiring," price 2s. 3d. post free. "Osram" lamps are very satisfactory on any circuit if they are in a position where they are not subjected to shaking or vibration. But the filament is very fragile, and easily breaks if the lamp is knocked or shaken in any way.

[20,047] **Winding for Motor Field.** G. F. B. (E. Greenwich) writes: I have a slotted drum armature, core 2 7-16ths in. by 2 ins., ten slots, wound with 450 turns of ·0065 in. wire. I enclose a rough sketch (not reproduced) of the iron of field-magnets, and I want to wind them for 200 volts. Could you also tell me what current the machine would take, and also the revolutions it would run?

Your magnet is very badly designed, there not being nearly sufficient iron in the core to properly magnetise the armature. We advise you to use a magnet of about 4 sq. ins. cross-section (cast-iron) in the magnet core, and 2 sq. ins. cross-section in the sides. Wind the magnet in shunt with 1 lb. 2½ ozs. of No. 36 D.C.C. Speed about 2,600 r.p.m.

[20,211] **Model Locomotives.** E. E. P. (Oldbury) writes: I am about to construct a 7-16ths-in. scale model 4—5—0 locomotive; the boiler will be 2½ ins. by 13½ ins., and the driving wheels 3 ins. diameter. Could you recommend the use of a single inside cylinder of a fair size only? If so, what size it would require to be and the approximate load the finished engine would pull.

We would recommend driving wheels not more than 2½ ins. diameter for single cylinder. You may use a ⅞-in. by ⅞-in. cylinder and obtain good results. The load your engine will pull will depend solely on the excellence of the workmanship. The maximum for short distances would be about 40 lbs., and, continuously, about 10 lbs. behind the tender.

The Editor's Page.

TWO correspondents—W. N. F. and J. F. Perrin—have written to call attention to an error in one of the equations in Mr. F. J. Fraser's letter, on page 188 of August 20th issue. This is obviously a misprint, and the equation should read—

$$I_2 + 2H_2O + SO_2 = H_2SO_4 + 2HI.$$

The second correspondent also draws attention to confusion in the letter in which Mr. Fraser says—sulphur dioxide and water form sulphuric acid and sulphurous acid, whereas he apparently intended to have said—"sulphurous acid." Whilst there is probably some truth in the statement that these reversible actions go on more or less indefinitely, yet our correspondents must remember that all these chemical reactions depend upon thermodynamics, just as much as any heat engine. They all involve the running down of energy from a higher to a lower potential, and cannot be reversed without the application of fresh energy. These reversible actions are not so reversible as they appear on paper.

* * *

Concurrently with Mr. Perrin's letter, we received the following from "Pat." He writes: "I had hardly hoped that my humble opinion on this subject would have received even the slight support which Mr. Fraser contributes. The subject is usually treated with such contemptuous ridicule that I was rather expecting to be relegated to 'Limbo,' or the 'land of fools.' In thanking Mr. Fraser, I may say, however, that what he describes would not produce much mechanical energy; still, he points out one—of which there must be many—chemical action which is regenerative. I believe, Sir, it is true that all chemical action produces electric phenomena, and it is the collection of current from a regenerative series of chemical elements that will, I believe, eventually solve the problem. My object in writing, first of all, was to show that the subject is not so utterly ridiculous as scientists would have us believe, and certainly does not deserve the sweeping denunciation it generally receives." As this subject is undoubtedly an interesting one, we hope to deal with it at greater length at some future date.

* * *

Somewhat akin to the subject we have just left, inasmuch as its possibilities of discussion appear to be unlimited, is the question of lightning. Several readers have recently shown signs of perturbation, apparently attributable to the fact that atmospheric disturbances have prevailed in certain localities lately, and they have in consequence asked us for any reassuring information we may be able to afford them. Much as we should like to, we must confess our inability to be of service in this respect. The vagaries of lightning are, in truth, often inconceivable; its effects are not seldom tragic; and yet again it can perform such antics as might well move even scientific minds to mirth. We have heard it said that it has been known to melt a man's watch in his pocket, take the soles and heels off his boots, and yet leave the individual uninjured. It is, we believe, on record that it has struck one man and caused instantaneous death, whilst his companion, standing by his side, remained untouched. And so instance after instance might be given, and the facts as easily verified. Unfortunately or otherwise, from whichever point of view we take, as lightning does not permit of experimental research, our correspondents can only draw their own inferences from reliable reports of the effects of lightning which are published from time to time in the electrical press, coupled with, of course, a thoroughly sound knowledge and wide experience of electrical phenomena.

Answers to Correspondents.

F. F. R. (Wimbledon).—We do not know of any firm supplying the castings you mention.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS, should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

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And Electrician.

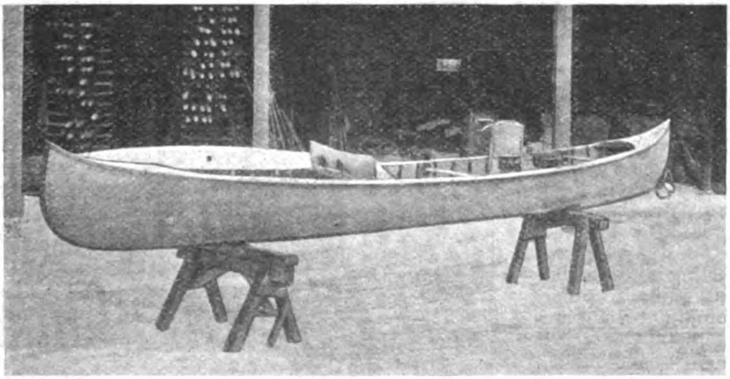
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 385. SEPTEMBER 10, 1908. PUBLISHED WEEKLY

A Steam Canoe.

By O. L. BICKFORD.

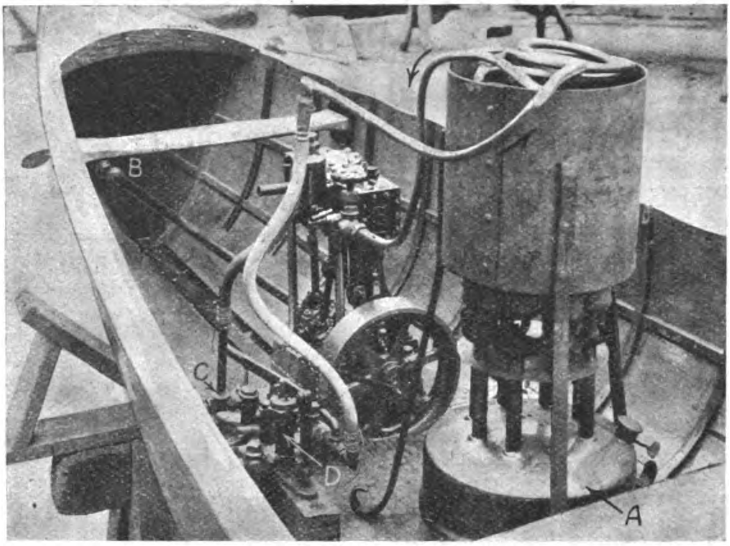


GENERAL VIEW OF MR. O. L. BICKFORD'S STEAM CANOE.

WE are indebted to a correspondent, Mr. O. L. Bickford, for the following interesting notes concerning his steam canoe. He tells us that he was prompted to send us these particulars as he had seen some correspondence on the subject of power-driven river skiffs in our recent issues, and he thought that perhaps his experiences might interest other readers. At first he had a boiler 14 ins. by 14 ins. specially made for the job, but this turned out altogether too heavy, weighing about 135 lbs., and was, of course, no use for his purpose. The canoe he bought, and also a No. 3 Stuart compound engine and an eight-burner intensive Primus stove. The usual fittings were employed, such as gauges, hand-pump, unions, etc., and the whole thing was connected up with motor pump tubing. The flash generator consists of 30 ft. of seamless steel tubing, at 3d. a ft.; the boiler and Primus stove, complete, weighing only 25 lbs. It is possible to keep up 70 lbs. of steam with engine running at 500 to 600 r.p.m., driving a 7-in. three-bladed propeller, the speed attained being 5 miles per hour. A force-pump with variable throw, ¼-in. bore, keeps up the steam at about one-eighth throw, the pump running at the same speed as engine. There is also an auxiliary hand-pump fitted for starting, sudden spurts, etc.

The canoe carries two passengers and an engineer, our correspondent taking these duties upon himself. If it may also be said, the same engineer frequently fills the position of quarter-master, and, with a paddle, occasionally back-paddles, so to speak, against the engine, to swing the canoe round almost right-angle corners on the River Cherwell.

For next year Mr. Bickford intends to fit a 2-in. by 2-in. single-cylinder engine (as he finds it more powerful at equal steam pressures), together with a 14-in. locomobile steam car burner and a 10-in. two-bladed propeller. He recently tried the experiment of installing a 1½ h.-p. motor bicycle petrol engine, 2-in. by 2¼-in. stroke, air-cooled, but the vibration set up made the seams of the canoe leak, and the noise was worse than the roar of the Primus stove. Besides this, the Thames Conservancy would not pass the job, as it kept catching fire, and so, Mr. Bickford concludes: "Steam is, after all, the best for me."



View of Engine and Water-tube Boiler for Steam Canoe.

The foregoing interesting notes should serve as a very useful guide to other readers at present thinking of making some attempt in the direction of actual marine engineering on a small scale We believe great possibilities lie in this direction, and the many advantages, both as regards facilities for working and managing such a craft, as well as others in the way of actual pleasure do not need to be emphasised to make them apparent. We shall most certainly look forward to hearing of Mr. Bickford's further results with as much interest as any of our readers.

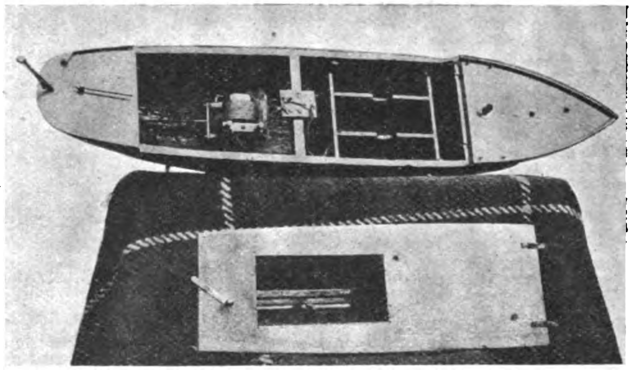
A Model Electric Launch.

By G. P. Potts.

THE following is a description of a small electric launch, which has occupied my spare moments during the past winter. The hull was carved from a piece of yellow pine dug out in the usual manner, and is 2 ft. 6 ins. long, 6 ins. beam, and 5 ins. deep. It was originally intended to be driven by steam, but as I failed to make a satisfactory engine out of a set of castings I obtained, it was put on one side for some time. It was then decided to drive it by electricity, so the hull was then given its finishing touches and hollowed out to give a flat bottom for the motor and accumulator, and then given a good coat of red enamel inside.

The deck was cut from a piece of 3-16ths-in. baywood, the beading being a narrow strip with the top rounded. The deck is in three pieces, and is supported by two cross-beams—one at the after end of the forward section and the other under the skylight. The middle section is removable to get at the motor and accumulator, it being fixed by two pieces of thin brass fixed to the underside, which slide under the forward portion into two grooves in the cross-beam, and a small catch, which is turned from the skylight.

The skylight was made from pieces of 3-16ths-in. baywood (with the exception of the top, which was worked up from a piece of ½-in. by ½-in. mahogany) fixed together on the lock-corner principle, and well glued, and measures 6⅜ ins. long, 3½ ins. wide, 2¼ ins. high at centre. The lights are fitted with thin glass made from old negatives, each light containing two pieces fitted in grooves cut in the frames, and a thin strip of baywood glued over the joints, and each are hinged to top by two brass hinges, so that they can be raised and lowered to get to the starting switch, which is screwed to the crossbeam.

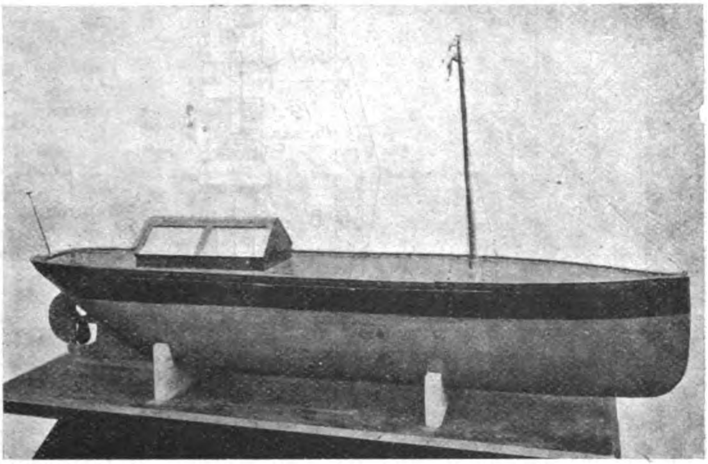


Showing Interior Arrangement of Model Launch.

The motor was made from a set of castings obtained from a firm advertising in The Model Engineer, and is wound for 4 volts, current being supplied by a 4-volt 9 amp.-hour accumulator. The latter is fitted in a light case made to fit the inside of the hull, which keeps it very firm, and can easily be adjusted by means of the wedges, which keep it in position.

The propeller was built up as described in The Model Engineer handbook, "Machinery for Model Steamers," and is 2½ ins. diameter, the shaft being ¼-in. silver steel; the stern tube is a piece of ¼-in. brass tube plugged at both ends and filled with tallow, which makes it practically water-tight, and at the same time causes very little friction.

The rudder is made from a piece of sheet brass soldered into a groove cut in a piece of ¼-in. brass rod, which is reduced at the bottom end for ⅛ in.



General Exterior of Model Electric Launch.

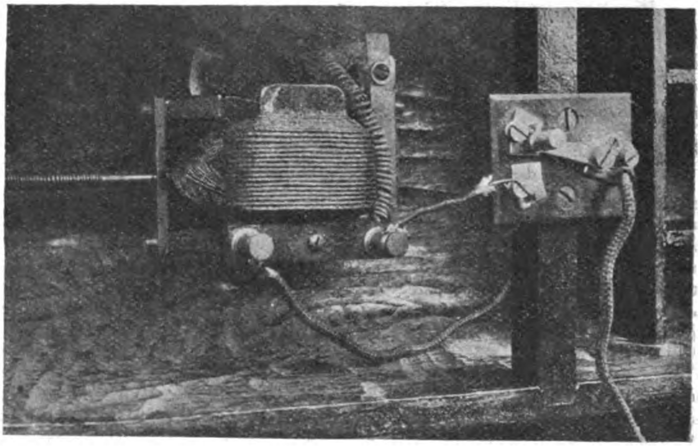
to ⅛ in. diameter, to work in a small brass cap fitted into the keel, and to 7-16ths in. at the top end, to work in a piece of tube fitted in the hull. The tiller is turned from a piece of brass rod, one end being tapered to fit a hole in the rudder stock, and is kept in place by a 1-16th-in. nut.

It was found necessary to fit a light lead keel on the boat, to keep her on an even keel when under weight, so that she is as steady as a rock, and if she is heeled over till her deck touches the water, she easily rights herself.

As will be seen from the photograph, she is fitted with a mast forward and a flagstaff aft, both of which are fitted with trucks so that the flags can be raised and lowered. The flagstaff is 3½ ins. long and the mast 10 ins.; they are each fitted into sockets screwed to the deck, so as to be removable.

She is painted black above the water-line and salmon pink below, with a coat of varnish over all, including decks, masts, etc.

This boat has given plenty of pleasure in the making and sailing, and has well repaid the trouble expended on her, as she travels at a good speed.



Showing Motor and Switch in Plan.

A new Society is being formed in St. Petersburg says *The Engineer*, for the purpose of designing and constructing airships. Some members have gone abroad to study the subject.

A Centre-finder and Punch.

By John Heyes.

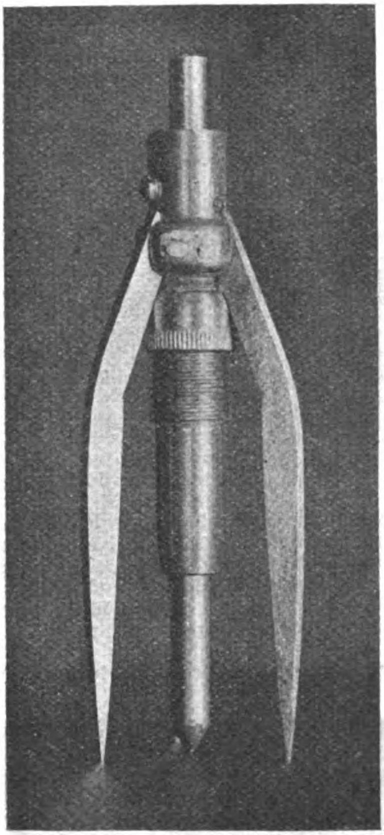
THIS appliance, which, I believe, is original, would be found very useful in the amateur's workshop for quickly finding the centres of holes in sheet metal. In use the plate containing the hole is placed over the metal plate to be centre-marked, and the centre-finder is then expanded until the points of the legs touch the sides of the hole in the top metal sheet. The punch is then tapped, which, if the appliance has been carefully made, gives the exact centre from which any size circle can be struck, as required.

Excepting the punch, which is silver steel, it is made of mild steel. A piece of mild steel, 3 ins. by ⅞ in., is turned down as shown in the sketch A. The part shown screwed is 1 in. long, 19 threads per in. This allows of a fine feed, as the points of the legs expand very quickly as the nuts near the top.

The nut is ⅞ in. outside diameter, is turned bevelled, as shown, to allow it to get to the top of the threaded part and also more easily under the legs. It should be knurled at the back end. A ¼-in. hole is bored through the body of the tool to take a silver-steel punch, hardened at the pointed end. This punch should have a flat filed on it ½ in. in length, to accommodate the grub screw which prevents it from sliding out either way.

The positions for the three slots should be marked out on the body of the tool. This can be done by dividing the faceplate of the lathe into six parts with the compasses, and fixing a suitable pointer to stop at every other division-mark; a centre-line can then be drawn with a sharp-pointed tool and the slide-rest. These slots should be cut right through to the bore, as, if they were not, the metal left between the bore and the bottom of the slot would be bulged in, as it were, and thus prevent the easy working of the punch.

To cut the slots, make a milling wheel out of a thin file, put it on a mandrel, and turn it to 1 in



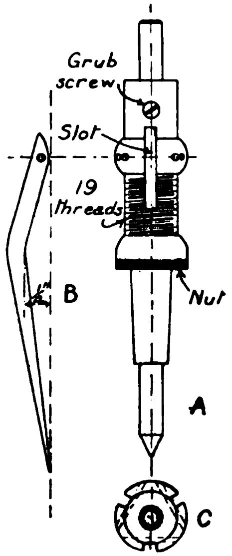
A Combined Centre-finder and Punch.

diameter; file teeth round the circumference, and then turn it to about 1-64th in. less than ⅛ in. thick, backing it off towards the centre. It can then be taken off the mandrel and hardened outright. I made my milling wheel out of mild flat steel, which is readily obtainable, and case-hardened it. It did not show any signs of wear even after cutting the three slots.

The most difficult part of the job consists in drilling the three holes for the pins to secure the legs. (See dotted lines in sketch C.) Perhaps they are better drilled before the slots are cut. They are 1-16th in. diameter, and must be accurate to ensure the legs working exactly apart.

The legs B are made of mild flat steel, ¼ in. by ⅛ in., bent as shown, and then filed to shape. They must work without the least play in the slots. They can be put in the slots and drilled to take the pins. The pins should be made with a little taper, to be a tight fit in the holes. This prevents them turning round with the movements of the legs.

I have shown the nut larger on the drawing than



Sketch showing Construction.

the one on the photograph, as I have since found it to be an advantage. If required, a spring could be fitted on to the appliance to draw back the punch after each blow.

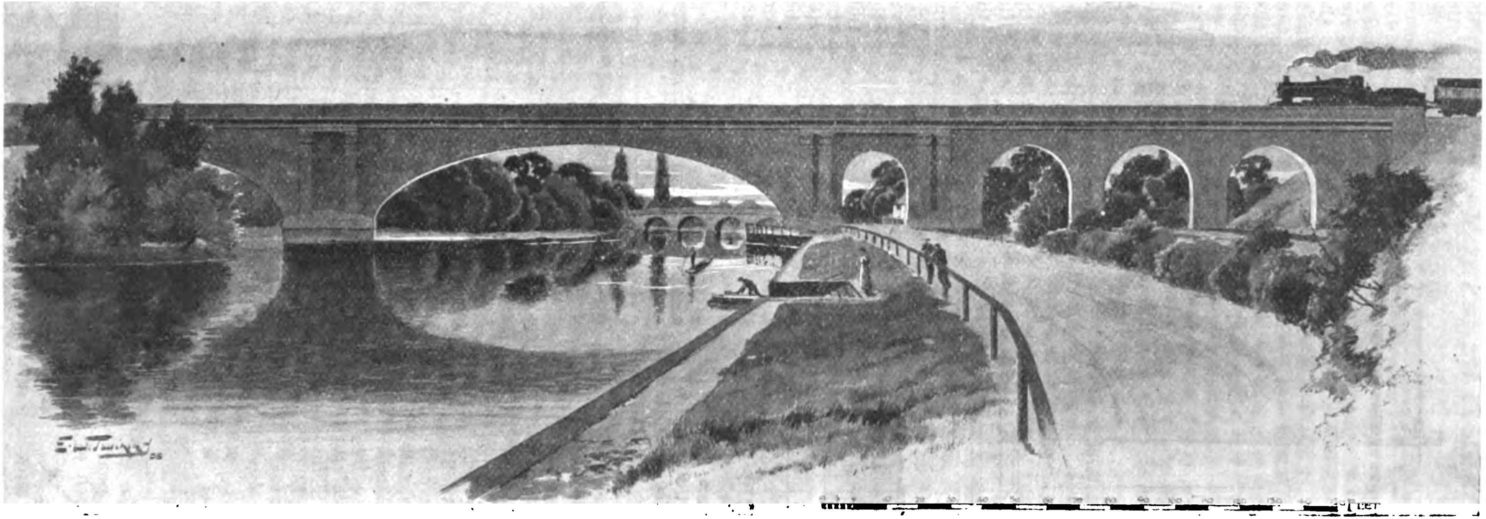
Engineering Works and Accessories for Model Railways.

By E. W. Twining.

(*Continued from page 210.*)

FOR the third example of bridge construction on a large scale I have chosen the famous long span bridge carrying the Great Western Railway over the Thames at Maidenhead. This structure, at the time of its building caused, perhaps, more bitter controversy, jealousy and "hateful misrepresentation"—to quote from one writer of the time—than any other of a similar nature. The point under discussion and around which the war waged was the great length of the span, viz., 128 ft. in the two river arches, coupled with a rise or height from the springing line to the crown of the arch of only 24 ft. 3 ins.

The form of the arches is that of a semi-ellipse of such flatness that the engineers of that day were almost unanimous in predicting the collapse of the bridge as soon as the timber centreing was removed. Such an arch had never before been constructed in brickwork, yet Isambard Kingdom Brunel insisted and proved to his own satisfaction by his calculations that he was right and pressed on with the construction. One morning a paper came out with arguments more emphatic than usual: it happened, however, that during the night a storm



VIEW SHOWING PART OF THE GREAT WESTERN RAILWAY BRIDGE SPANNING THE THAMES AT MAIDENHEAD.

For description] [*see pages* 244–247.

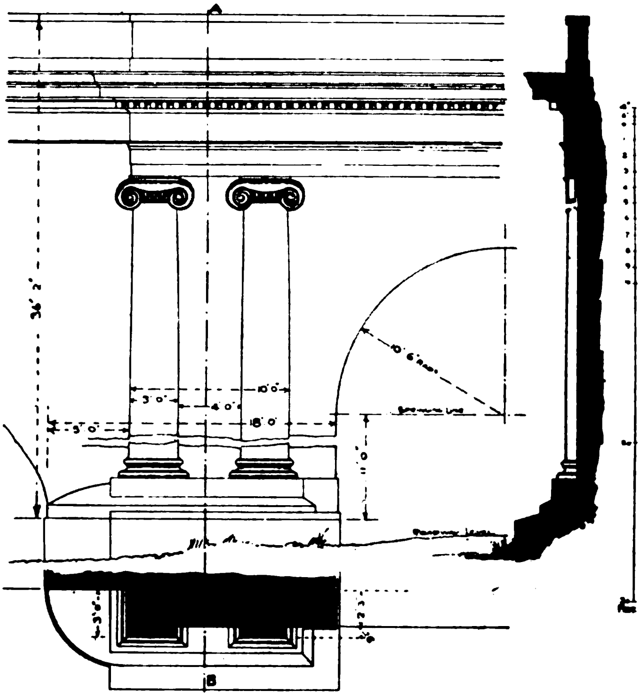


FIG. 32.

thick at the foot and 20 ft. high from the lowest line of the foundations to the level of the springing line of the arches, and is built solid, whilst the land piers are hollow, the thickness of each of the latter being 10 ft. The height from bottom of foundations to the top of the parapet is 56 ft. 2 ins. The bridge has a total length of 768 ft. and is constructed of brickwork in English bond with footings to the piers; cornice, pier-caps, and coping of Bramley stone. The parapets have a thickness of 13½ ins.

It may be taken as evidence of the soundness of Brunel's design that the Company, when the time came for widening the line in 1893, built an extension of the bridge northward, making the arch of the new work to follow the exact elliptic curvature of the original structure. The width of the widened bridge, measured across the soffit of the main arches, is 56 ft. 6 ins., through the side arches the measurement is 61 ft.

I have shown on page 245 a general view of half of the bridge; to show the whole work would have necessitated an inconveniently small scale, besides which, such a complete view is not necessary, the other portion being a duplicate of the one I have drawn. In the view I have departed from truth somewhat, as the three

had carried away a part of the centreing, and that before the ink was yet dry on the paper the bridge was standing alone, as it stands to-day, a monument to the skill and daring of one of our greatest, if not *the* greatest, of railway engineers.

The reason for the adoption of two arches only to span the river was that there here exists a shoal virtually forming an island in the centre of the stream; on this the main pier was placed, bedded on a foundation of hard pebble conglomerate overlying the chalk. This fact regulated the length of span, the height of the rails, only 40 ft. above water level, deciding the amount of spring or rise.

Besides the two river spans, there are eight land arches uniformly disposed on either side of the river. These are all semi-circular, those nearest the river being each of 21 ft. and the others each of 28 ft. span, the rise or versed sine being 10 ft. 6 ins. and 14 ft. respectively. The central or river pier is 40 ft.

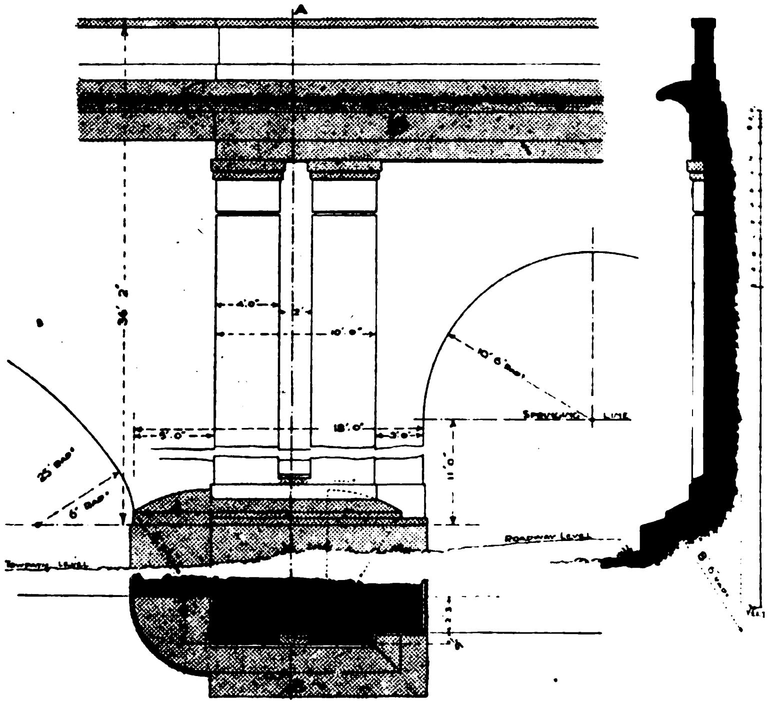


FIG. 31.

larger land arches are in reality obscured by trees from the particular point of view chosen.

Fig. 30 is a diagram for setting out the ellipse of the main arches by means of radii; and Fig. 31 gives details of the cornice, pilasters, etc., of the piers in elevation, sectional plan and vertical section. The shaded portions here indicate stonework, the other parts being in brick.

It will be noticed that the general design of detail in this bridge is not in any definite style. This, to the writer's mind, is a matter to be regretted, more especially as the cornice and pilasters might just as well have been Renaissance or Classic of one of the Greek or Roman orders. In this respect I have somewhat departed from my rule of selecting works of pure architectural style. I have chosen it partly on account of its fame as an engineering work and partly by reason of the extreme beauty of outline produced by the flat ellipses of the

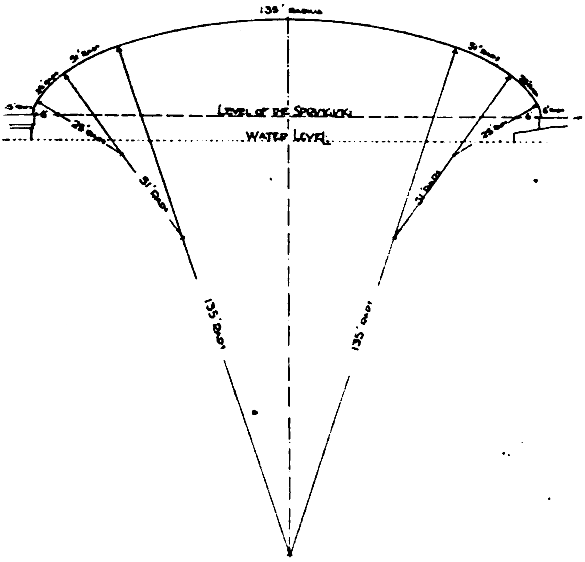


FIG. 30.

central portion. In view of the possibility of my being so fortunate as to have this opinion regarding the architecture shared by some reader who may care to model the bridge, I have ventured to give another drawing (Fig. 32) showing a suggestion for modelling the entablature, capitals, and pilasters in the Grecian Ionic order, retaining the general measurements of the actual work.

(*To be continued.*)

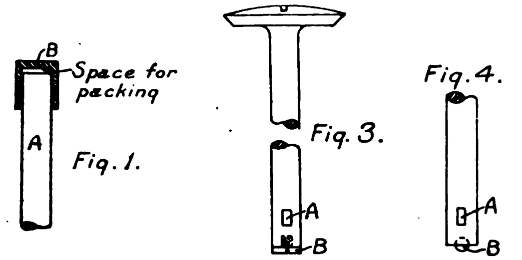
WE hear that an interesting railway will be opened in Moscow, Russia, in the near future. The line forms an irregular oval round Moscow at various distances from the city barriers. It intersects all nine of the Moscow railway lines, and will be used for transferring goods from one line to another, thereby saving cartage and also considerably relieving the congested state of the streets of Moscow. It will also tap a whole series of factories which have hitherto been off any line.

Workshop Notes and Notions.

Adjustable Valve Tappets.

By W. H. ISLIP.

Very few motor-cycle engines have adjustable valve tappets to compensate for wear on the cam valve stem and tappet, and very few have the note-paper clearance after being run a few miles. It is certainly worth the time and trouble to make an



METHODS OF PACKING VALVES TO INCREASE LIFT.

adjustable tappet, as a great deal of power is lost, *besides overheating*, through too much clearance between valve stem and tappet.

Fig. 1 shows a very simple type, for use with a plain round steel tappet. A is the tappet, B is a hardened steel cap to fit over A. As the cam and valve stem wears, B is simply taken off and a disc of steel inserted the thickness of same, equivalent to the wear on cam and valve stem.

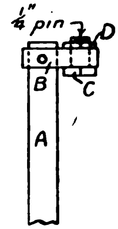


Fig. 2.

Fig. 2 represents a type commonly used on motor-cycle engines, and is easily made adjustable by simply drilling and tapping the footpiece B, and fitting a hardened pin C and lock-nut D.

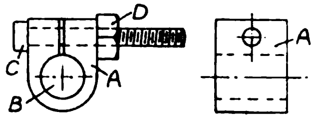
In cases where it is not practicable to use an adjustable tappet, and no brazing hearth is handy to braze a piece on the valve stem, which is the general practice in such cases, the following method will be found useful: Drill a hole in the end of valve stem to tap out 1/8 in., and fit a hardened cheese-headed screw to give the desired amount of clearance. (See Fig. 3.)

Fig. 4 shows a very simple and quick method, which is simply fitting a small bicycle ball in the centre-hole of valve stem and touching round with solder to keep it in place.

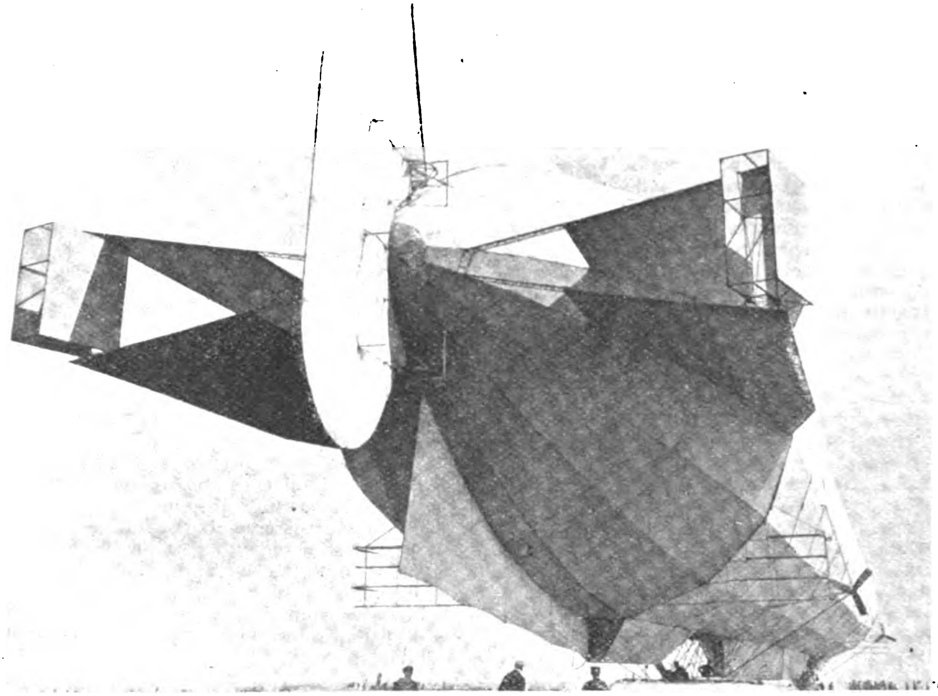
Clips for Holding Rod.

By W. H. ISLIP.

When turning or polishing metal rods in the lathe, I have found the clip shown far better than a carrier or clamps, as it holds well without marking



the work. Various sizes should be made, say from 3-16ths in. to 1/2 in. A is the clip, B the bore of same, C the pin, and D the nut for tightening the clip up



COUNT ZEPPELIN'S AIRSHIP, ON HER LAST VOYAGE, DESCENDING ON THE RHINE TO REPAIR SLIGHT DAMAGE TO HER MACHINERY.

THE REMAINS OF THE ZEPPELIN AIRSHIP AFTER THE EXPLOSION.

A Small Grinding and Milling Attachment for Lathe.

By J. Aird.

No doubt many of the readers of The Model Engineer have at times wished they were the possessors of some means for grinding and grooving portions of their lathe work, and to them perhaps the following description of such a piece of apparatus may be useful.

There are two or three points in its favour, viz., small size, cheapness, and simplicity. The one shown was made for a Barnes 3½-in. lathe, and is arranged to fit either on top or side of slide-rest. It should be mentioned that the slide-rest of a Barnes lathe has a T slot into which the tool-holder is fitted, but the arrangement shown, which would do admirably for a Drummond lathe, could readily be adapted to any type of slide-rest.

Figs. 1, 2, and 4 show respectively a front and side elevation of the attachment, and a plan of the bottom showing slot. Only two castings are required; these should be in gun-metal—one for the frame and the other for the grooved pulley shown. The pattern for the frame should have a slight draught or taper from the bottom to the top, say 1-32nd in. in the total height, but the slot in base should have about 1-32nd in. in the ¾ in., and if made fairly smooth, well shellac varnished, and rubbed down with a piece of fine glasspaper afterwards, there will be little to do except drill holes and tap and cut the vertical slit with the hacksaw.

The pulley pattern should have the left-hand boss only fitted; the thickness of the pulley portion should be such as to allow for the small right-hand boss being turned from the solid. The pattern should not, of course, be grooved, nor is it advisable to have the hole cored. The draught should, as before, be about 1-32nd in.

The mandrel is made of 5-16ths round bright steel turned down at one end and screwed No. 0 B.A. or ¼-in. Whitworth. Personally, I prefer the B.A. threads for model work; they are a finer pitch than Whitworth, but still sufficiently strong for such work, and I may add that my practice for years past has been to use only the even numbers in the B.A. system, viz., 0, 2, 4, 6, 8, etc., the difference between 0 and 1 and 2 and 3, etc., not being sufficient, in my opinion, to justify stocking the various plates, taps, screws, etc., required. The mandrel nose having been screwed, a collar of either steel or brass should be screwed up tightly and then faced up in the lathe. A nut to fit nose completes the mandrel.

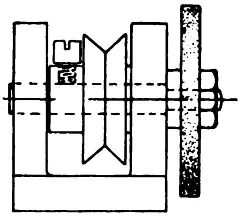


Fig. 1

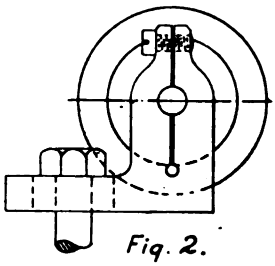


Fig. 2.

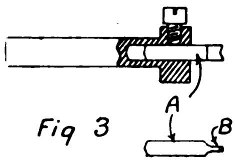


Fig 3

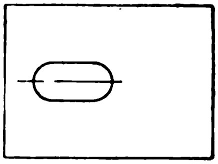
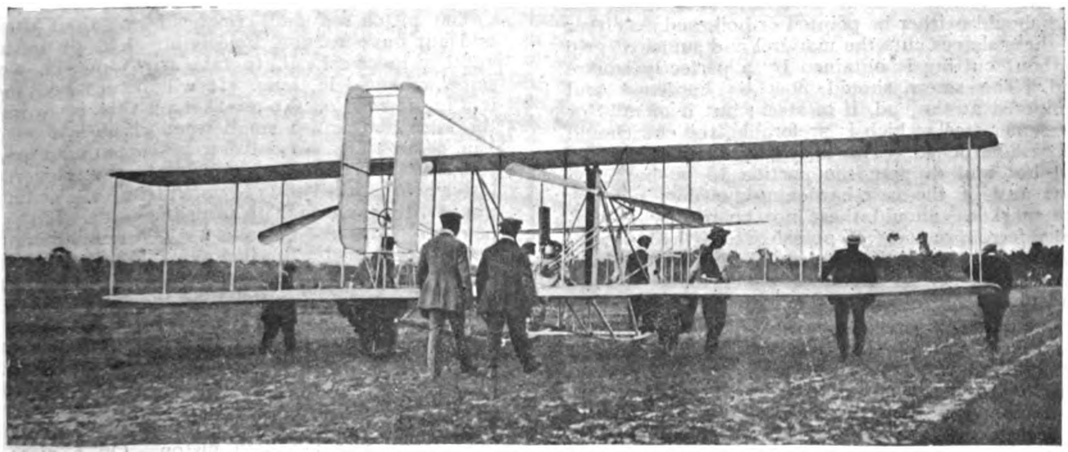


Fig 4.

Fig. 5.

Emery wheels from 1½-in. to 2-in. are not expensive, and if one keeps one's eyes open they may be picked up very cheaply. The writer bought several in Farringdon Road some months ago at



View of Mr. Wilbur Wright's Aeroplane, taken at Le Mans.

2d. each, new. The frame should not want more than a few rubs of the file on the bottom, but, of course, it may be machined if desired; it should then be placed on the surface plate and the holes for mandrel carefully marked. These holes should be drilled with a drill, say, 1-64th less than the size of steel to be used for mandrel, say, a 19-64ths drill, and finished with a D-drill made from the steel to be used. In case the term "D-drill" is not familiar to some of our readers, perhaps the following explanation may be useful:—The round steel is chucked true and the end chamfered, say, 1-16th in.; it is then filed up as shown at Fig. 5, ground, hardened, and tempered. It will be seen that such a drill must cut a hole exactly the size of the stock, not two or three thousandths larger as is frequently the case with badly-ground twist drills. Having passed the D-drill through both cheeks, the ¼-in. holes near base should be drilled, also the holes at the top of each cheek for clamp screws. In drilling the latter, a clearing drill should be used for the first half and a tapping drill for the last half. The holes should be tapped No. 2 B.A. and steel or iron screws fitted. The inside and outside of the cheeks should now be filed up as parallel to each other and as near right angle to the mandrel bearings as possible, and the vertical slots cut with the hacksaw. This affords some means of adjustment in the bearings.

The pulley casting should be chucked by the big-end, drilled, then the D-drill passed through, the left-hand boss turned and one end of pulley faced and a No. 0 B.A. steel screw fitted as shown. A piece of the 5-16ths in. steel should now be chucked true, the pulley casting slipped on and clamped by screw, and the pulley completed.

It will be noted that the V-groove is a very wide angle, the meaning for this is that the driving wheel on overhead is grooved and is a fixture, and the cord or gut would in a narrow angled groove tend to slip off when the grinder was moved a short distance from the vertical line of driver. The wide angle gets over this difficulty. The length of pulley and bosses from end to end should be slightly less than the distance between the cheeks of the frame, end thrust being prevented by the mandrel collar on one side and one end of the pulley on the other. The No. 0 B.A. screw should be slightly chamfered at the end as shown, but the end should neither be pointed or hollowed, as either of these shapes cuts the mandrel and sufficient grip without cutting is obtained by a perfectly square end. The screw should now be hardened and tempered at the end, if of steel; but if of mild or Bessemer steel, which is preferable, the end should be case-hardened. This is readily done by making red hot and dipping the portion to be hardened into any of the case-hardening powders now on the market. Should these not be readily obtainable, ferro prussiate of potash, to be had at any chemist, may be used. It should be powdered and the red-hot article must be again made red-hot and plunged into cold water.

The various parts may now be assembled, care being taken to put a thin leather washer on each side of the emery wheel, and the apparatus is ready for grinding. The total cost for materials, exclusive of emery wheels, should not exceed half-a-crown.

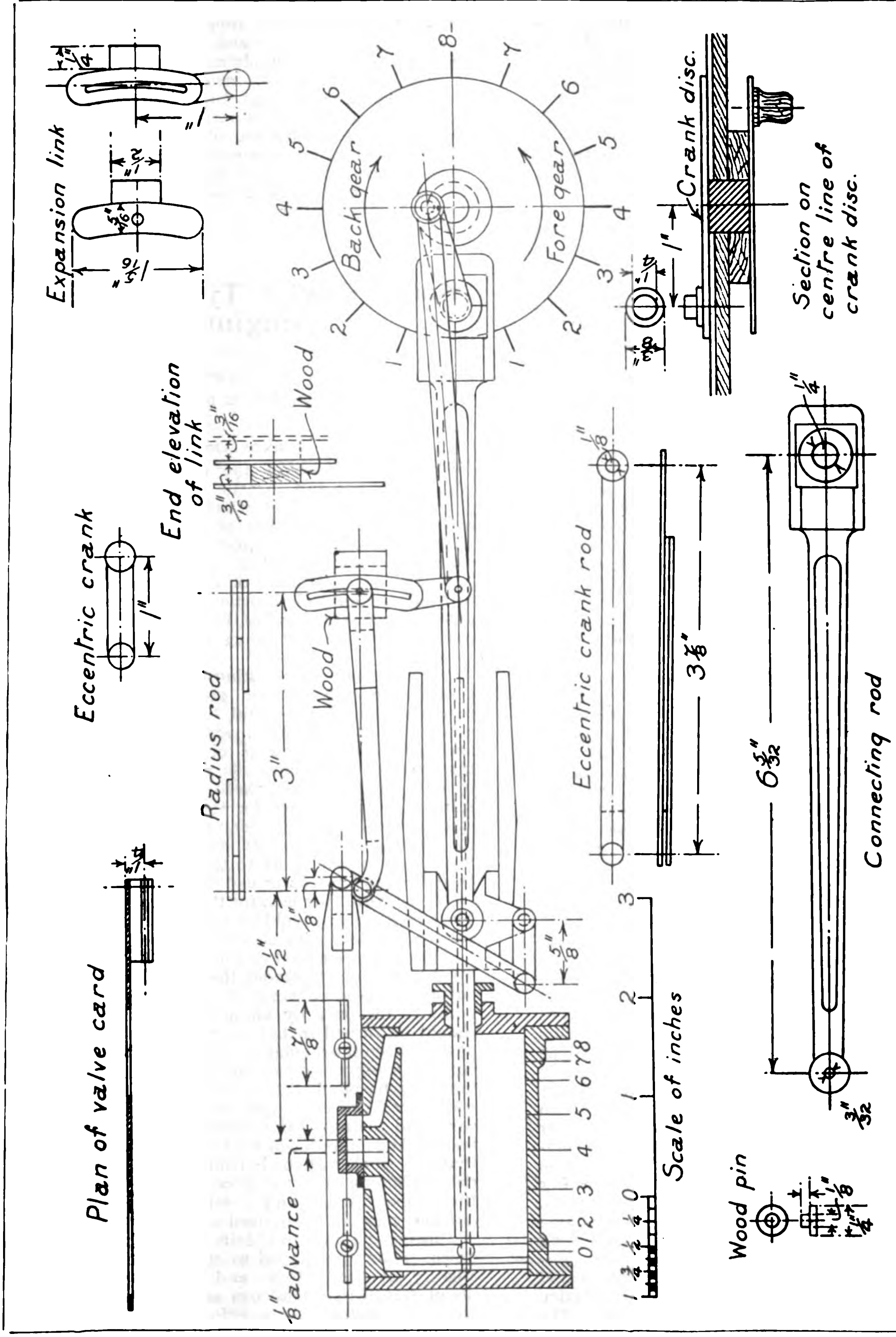
(To be continued.)

How to Make a Working Model of Walschaerts' Valve Gear.

By H. Green.

THE model about to be described should be very useful to students and others interested in locomotives, as all the effects of linking up can be seen as in the actual engine, and the cut-off, expansion and exhaust, can all be observed. All the working parts are made of stout Bristol board, about 1-16th in. thick. On a piece of card measuring 6 ins. by 13½ ins. draw a cylinder in section 1¼-in. bore and 2⅜ ins. between the covers, steam ports are ⅛ in., port bars ⅛ in., exhaust port ¼ in. Then draw the slide-bars (these are shown in elevation). At a point 9½ ins. from centre of cylinder bore a ½-in. hole. This will take a round piece of wood which serves as driving axle. Cut a slot 3-32nds-in. wide on the centre line and extending from back cover to the end of slide-bars; in the drawing this slot is indicated by the dotted lines on piston and connecting rods. Then cut a piece of wood same size as the card. A slot is also cut in the board 7 ins. long and ⅜ in. wide; glue or seccotine two battens across the ends at the back of board; now fix the card with seccotine to the board so as to make the small slot in card exactly coincide with centre of slot in board. When the card is quite dry, the ½-in. hole can be bored through. The next part to make is the crank disc. This is simply a round piece of card 2⅜ ins. diameter, with a crank drawn on it, and a small wood rivet stuck on 1 in. from centre of disc, and forms the crank-pin. A round piece of wood 7-16ths in. long and ½-in. diameter is stuck exactly in centre of disc at the back. It is then put through the ½-in. hole in card and board, and a wooden washer 1½ ins. diameter and 3-16ths in. thick is put on and stuck to the round wood. Cut another card disc 2⅜ ins. diameter, and fix a small wood knob on it, then stick it firmly to the washer. The knob is to turn crank disc and so operate the gear; it should turn freely, but without any shake. In the centre of drawing, the valve gear is shown complete as it should appear when all is fitted together, and the details, which are all drawn to scale, so any dimensions may be taken off the drawing.

The piston-rod and crosshead are then drawn and cut out; a small hole is bored in piston and another in crosshead, to take a 3-32nds-in. wood screw, about ¼-in. long. It will be noticed there is a lug formed on the crosshead; this is to make the stud bar, and a small wood rivet is fixed on ⅝ in. below crosshead centre to take one end of union bar. The other end works the combination lever, the latter being forked to take union bar. An ordinary pin is pushed through to form the joint. The pin, of course, must be cut short. The connecting-rod needs no special attention, as it is very simple. It is 6 5-32nds ins. between centres. At the small end bore a 3-32nds-in. hole, at the big end a ¼-in. hole. The connecting-rod and piston may now be fixed in their position. They are secured to a strip of wood 6½ ins. long and ½-in. wide, by two 3-32nds-in. wood screws passing through the small holes already prepared for them and slot in the card, the strip of wood being in the large slot cut in the board, and working with piston. On a piece of card 4⅜ ins. by ⅞ in. draw the slide-valve. Exhaust



DETAILS OF A WORKING MODEL OF WALSCHAERTS' VALVE GEAR.

By H. Green.

cavity is ½-in. wide, lap 3-32nds in., and it has 1-32nd-in. lead, so the advance = ⅛ in. At the valve head three strips of card are stuck on, in order to raise the combination lever to clear crosshead. Two slots are cut in the valve card, and it is screwed to the large card, so as to slide over the steam ports (see drawing), two small washers being interposed between screws and valve card. It must not be screwed too tight or the radius rod will buckle.

The combination lever is a strip of card ¼ in. wide, and measures ¼ in. from valve head to fulcrum, and 1⅞ ins. from fulcrum to union bar, and is forked as mentioned before. The method of making the fork or jaw is to stick a narrow strip of card the same width as rod, about ⅜-in. long, and ⅛ in. from end of rod, then another strip 1⅛ ins. long is stuck on to come up to the end of rod. When they are quite dry the pinholes can be made in them, and fixed in their respective positions.

The radius rod will be the next part to make. It measures exactly 3 ins. between centres, and is forked at both ends. At the valve end the fork is on the underside of rod, and at the link end on the topside, because the link is raised about ⅜ in. from the card. It will also be seen that the radius rod is curved at the valve end so that it clears the valve head when in top foregear. Now the link can be taken in hand. It is made in two pieces, as shown in drawings. Both parts are cut with a lug on, ½-in. long and ¼ in. wide; the link vibrates on a small piece of wood ½ in. by ½ in. and 3-16ths in. thick, stuck on the card in such a position as to just clear connecting-rod when the latter is at its highest point. In centre of bottom half of link is a small hole to take a 1-16th-in. wood screw. To find the correct point for screw, fix wood as near the right place as possible, place the compass point on the centre line; then, with pencil point, mark a line on the piece of wood exactly 1 in. from centre line. Now place compass point on fulcrum of the combination lever, and with pencil point mark a line on wood 3 ins. from fulcrum. Where the two lines cross is the point for screw. Place a washer under screw-head before fixing. When the bottom half of link is secured in the right place, stick a small piece of wood ½ in. long, ¼ in. wide, and 3-16ths in. thick on the lug, then stick top half of link by the lug on it to the bottom half, taking care that centre of curved slot comes exactly over screw-head. Place radius rod on link, and place a small wooden pin through hole and slot, and secure with a touch of seccotine. Try the rod up and down in link to see if it works free without any bind. The eccentric crank is about ¼-in. wide, 1 in. between centres. On one end fix a small wooden pin (see drawing for dimensions of pins). The other end is fixed to the pin on the crank disc and serves to keep connecting-rod from coming off when the model is being worked. The eccentric rod is ¼ in. wide, and 3⅞ ins. on centres. An ⅛-in. hole is bored in one end, the other end being forked and connected to link by a pin-head. The end with hole in it is placed on the wood pin on eccentric crank, a small card washer being stuck on the pin to keep rod from working off. A washer is also stuck on stud bar pin to keep union bar on. Ordinary pin-heads about ¼-in. long are used for all the joints in combination lever. The cylinder is divided as shown. Also the circle round the crank disc is divided, so that crank position can be noted at admission and cut-off, etc. The writer, having made several models as described, can heartily recommend anyone to make one, as it is a very interesting model. If all is not clear, I shall be pleased to supply any further information or sketches, through the medium of THE MODEL ENGINEER. The amount of eccentricity of the eccentric crank is 9-32nds in. from the centre of the crank disc. The long end of a rat-tail file is the best tool to bore the holes with in the various parts. The ½-in. hole is bored with joiner's centre bit. The curved slot in the link should be cut with a very sharp penknife. Care must be taken to cut it to the exact radius, which is 3 ins.

Model Fowler Type Traction Engine.

By H. GREENLY.

(*Continued from page* 183.)

IV.—GOVERNOR AND THROTTLE.

THE accessories of the cylinder include the governor and throttle gear, lubricator, and a whistle—all of which are not absolutely essential to the working of the engine, but are desirable features to a model having any pretensions to accuracy of detail.

I have no particulars of the inner construction of the governor and throttle, and therefore I have arranged the same in what, I think, is a workmanlike manner, the exterior being more or less exactly to scale.

After the necessary castings and material for the governor gear have been obtained—for which I recommend cast gun-metal for the main bracket, gun-metal castings for the throttle stuffing-box and gland, steel castings or mild steel rod for the governor arms and balls, mild steel rod 1¼ ins. by ⅝ in. for the governor head, brass rod for the top spindle, German silver for the throttle valve and spindle, hard brass tube for the liner, mild steel for the governor wheels, shaft, and pulley, the passage from the regulator port to the throttle valve may be drilled and the outer end tapped ¼ in. diameter, 26 or 32 threads per inch for the plugged-up portion. The throttle liner should be a tight fit in the cylinder casting, the hole being cleaned out with a ⅜-in. rimer and slightly chamfered at the top. As will be seen by the drawing, to render the use of an expanding cutter unnecessary, steam is able to get at all the ports in the liner by virtue of the groove, which should be turned in the liner exactly opposite the passage from the regulator. To drive the liner home without using a hammer, an ordinary ¼-in. bolt and nut may be employed, as shown in the sketch, a washer of brass or copper intervening between the work and the nut. If a reamer is not used for the hole, and examination of the hole after drilling shows that it is smaller at the bottom than at the top, the risk of finding that the liner will not go down to the proper depth, and possibly cannot, without damage, be withdrawn, need not be taken. Instead of turning the liner to obtain a bearing all the way down, it may be shaped as shown at A in sketch, Fig. 17, at the bottom, and larger at the top for about 1-16th in. The sizes are exaggerated in the freehand sketch. A sufficiently good metal-to-metal joint will then be obtained between liner and casting for all practical purposes. A throttle valve need not be quite tight in any of its parts, as its function is not to shut off the steam entirely (the regulator does this), but to regulate the flow of steam according to the load and to prevent the engine racing should the load be suddenly removed. The liner is kept in place by the stuffing box, a steam-tight joint being obtained, a little hemp

So much for the liner. The valve should be an easy fit, and, if possible, be made of German silver, as recommended above, so that dissimilar but non-rusting metals are used in conjunction with each other. The valve must be balanced by having two or three holes drilled through it longitudinally. The diameter of these holes need not be more than 1-20th in. diameter.

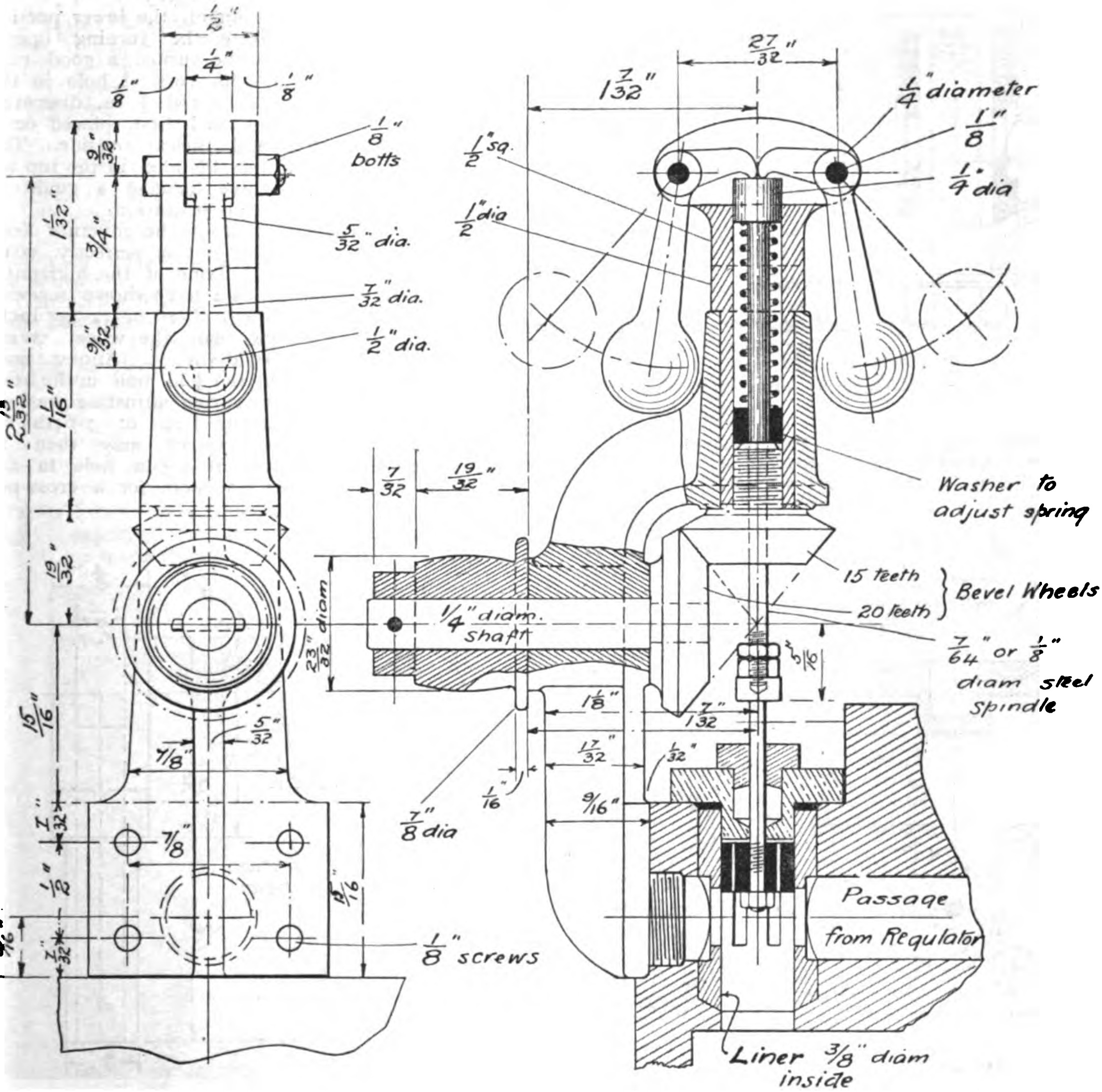


FIG. 16.—GENERAL ARRANGEMENT OF GOVERNOR AND THROTTLE GEAR. (*Full size for model.*)

smeared with red lead paste in the space shown black in Fig. 12. If a vertical slide and milling spindle is available the six slots in the liner may be milled with a 7-64ths-in. or 3-32nds-in. saw milling-cutter. The work may be held in the self-centreing chuck if the tube is long enough in the first instance and cut off to size afterwards.

The spindle should be of German silver also, and should be screwed and soldered or lock-nutted to the valve. The top should be enlarged (a boss may be silver-soldered on or the whole may be out of one piece, the spindle being turned or run down with a cutter from a piece of ¼-in. rod), to form an adjustable socket joint with the spindle of the governor. The top of the socket portion should be filed hexagonal so that it may be held when tightening up the lock-nut on the governor spindle.

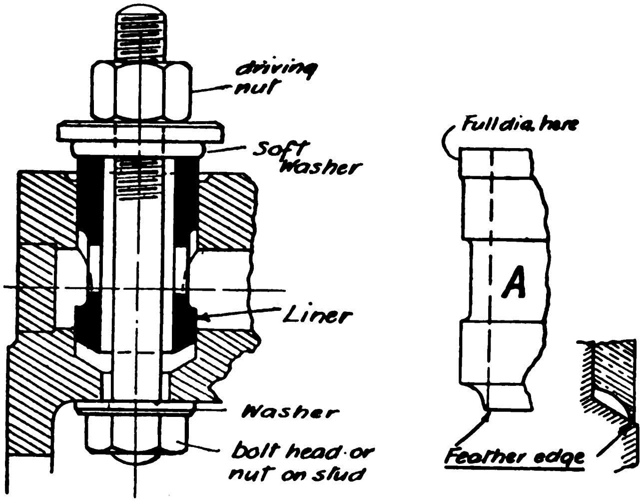


FIG. 17.—DRIVING THROTTLE VALVE LINER.

Another way of making this joint is shown in Fig. 18, the socket being a separate piece and longer than shown in the general view, Fig. 16. Two lock-nuts must then be used to prevent the spindles slacking back.

It goes without saying that the proper working of the governor will only be obtained by perfect alignment of all working parts. Care must therefore be taken in threading the various spindles, as, if they are at all uneven they will tend to bind and affect the sensitiveness of the governor. After the brass plug has been fitted to the orifice of the regulator passage, and it has been filed off quite flush, the governor bracket may be machined and fitted in place.

The governor head may be a steel casting or turned from the solid mild steel. The outline should be first marked out and sawn and filed up roughly to shape, the corners being taken off the lower portion so as to facilitate the turning operations. It should be turned a good running fit in the ⅜-in. vertical hole in the bracket and then bored ¼ in. diameter, or, better still, bored first, placed on a ¼-in. mandrel, and turned outside. The ⅛-in. slot may then be filed in the top for the arms, the hole forming a guide to accuracy during this operation.

The only portion of the governor head which is, perhaps, not a perfectly satisfactory job is the fixing of the horizontal bevel wheel. This I have shown screwed (with, say, a thread of 26 or 32 per inch) into the governor head, the wheel having a spigot piece solid with it. Another way would be to drill the ¼-in. hole in the head only as far as the spring adjusting washer, continuing with the ⅛-in. or 7-64ths-in. hole. A ¼-in. diameter spigot may then be formed on the head and fit a ¼-in. hole in the gear wheel. There is no room for a cross-pin to fix the gear-wheel, and therefore a small grub screw may be used, axially, half in the wheel and half in the spigot of the head, to secure the wheel. Another way would be to screw the wheel on to the spigot, a fine thread being used. This method of fixing is shown in Fig. 19.

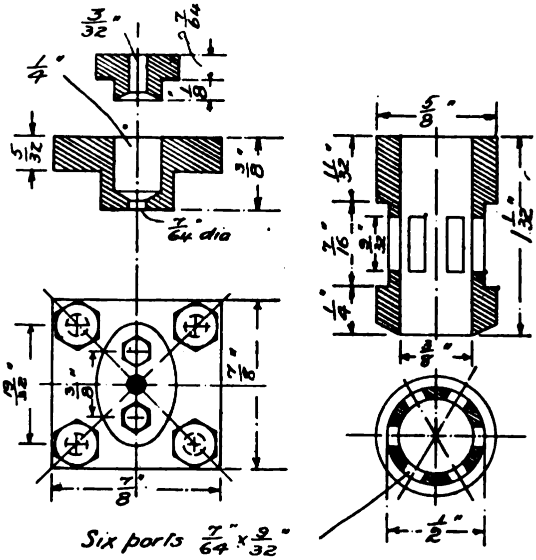


FIG. 21.—CAP AND GLAND OF THROTTLE AND THROTTLE VALVE LINER.

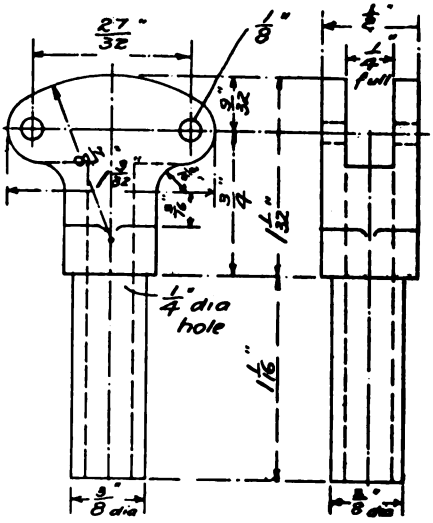


FIG. 20.—GOVERNOR HEAD.

The other wheel may be fixed into the ¼-in. shaft the same way, or may be solid with this shaft. I prefer the latter method. Instead of using a separate collar on the outside of the pulley, as in the original engine, the pulley being keyed, I suppose, I also propose this to be solid with the

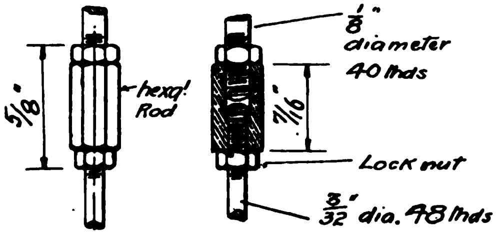


FIG. 18.—ALTERNATIVE SOCKET JOINT FOR GOVERNOR AND THROTTLE VALVE SPINDLE.

pulley, a 1-16th-in. pin securing it to the shaft as indicated.

The spring which the governor balls compress can only be adjusted by experiment, loose brass washers, of varying thickness, being inserted under the spring, as shown in the general arrangement.

The points of the flyball arms and the top of the

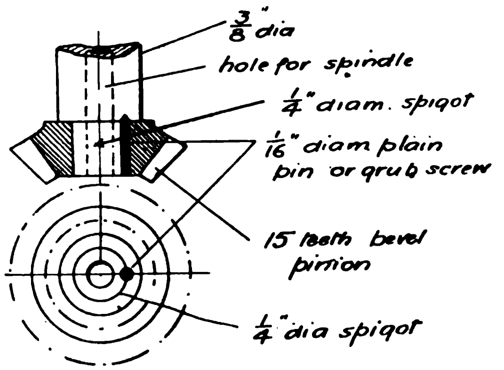


FIG. 19.—ALTERNATIVE METHOD OF FIXING BEVEL PINION ON TO GOVERNOR HEAD.

plunger should be potash-hardened to resist wear and to reduce the friction.

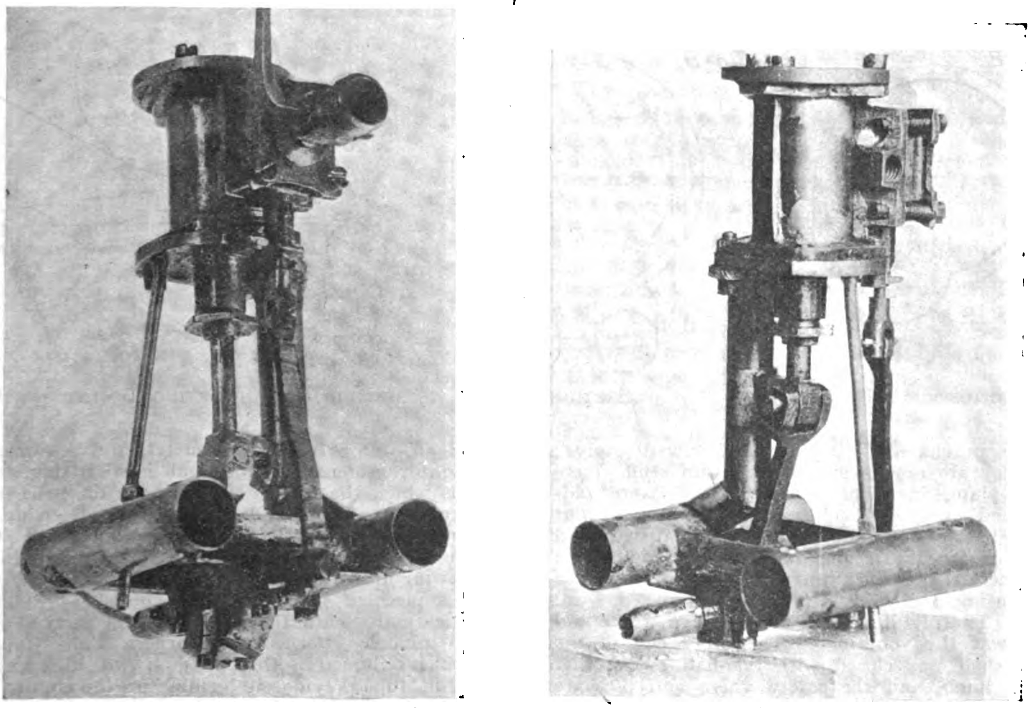
(To be continued.)

A Featherweight Steamer.

By "THE CARPENTER'S MATE."

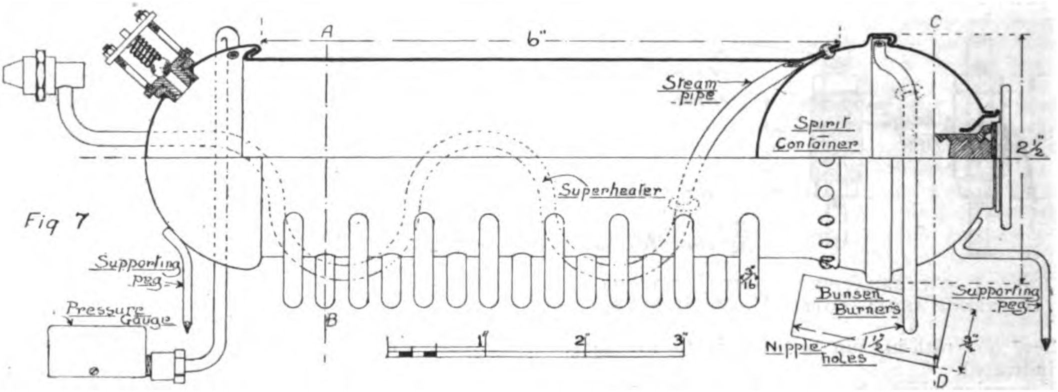
(Continued from page 232.)

THE next item to consider was the boiler and vaporiser—at 1 lb.! It is possible that but for an inspiration about that I should never have attempted to get it down to the weight. The inspiration in question consisted of the idea that, if a partition was placed across the inside of the



TWO VIEWS OF THE ENGINE FOR A FEATHERWEIGHT STEAMER boiler, completely separating two portions, it would be possible to boil the water in one compartment and use the transmitted heat through the partition to vaporise the spirit in the other. This was put into practice, and it works perfectly.

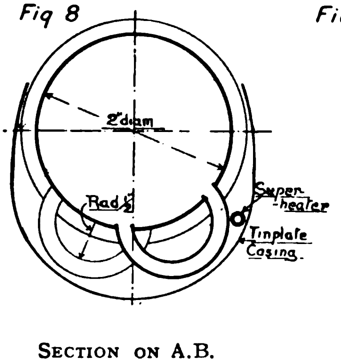
The bottom of the boiler was fitted with fifteen 3-16ths-in. water tubes (as shown), after the pattern of the Prize Design published in THE MODEL ENGINEER of February 14, 1907. The open end of the container was then closed by solder-



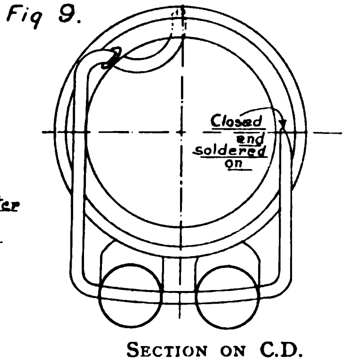
PART SECTIONAL ELEVATION OF BOILER AND VAPORISER.

The boiler barrel is a piece of 22 gauge brass tube, which is the thinnest I could get in the seamless variety. The ends are hemi-spherical (about 28 gauge brass). The original purpose of these nicely stamped ends may perhaps cause a smile. I had settled that they must be hemi-spherical, and was cogitating how best to get them out when my eye happened to rest on a discarded ornamental brass bedstead knob. The very thing! Spherical, of good quality brass, and thin enough for my purpose. I have since ascertained that these

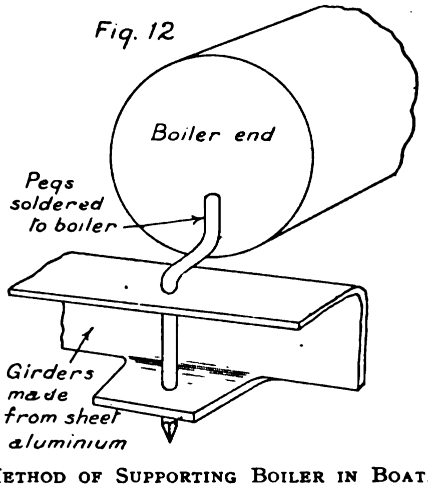
ing on a large brass eyelet, such as are used for tarpaulin, a screw-filler being fitted into the hole in this. The screw-filler was taken from a nickelled cycle oilcan, and its special virtues are twofold. The screw-plug is ingeniously stamped up, thread



SECTION ON A.B.



SECTION ON C.D.



METHOD OF SUPPORTING BOILER IN BOAT.

can be purchased separately at ironware stores; but they are now made of very thin stuff—mere stencil-plate, in fact. Those I used were old-fashioned ones of much more substance. I cut off the base of the knob, which was filled with lead inside for some mysterious trade purpose, and riveted the spherical container thus formed on to the boiler shell, using 1-16th-in. copper rivets spaced ⅜ in. apart. The dividing partition between water and spirit was thus obtained. The other end of the boiler shell was closed with one-half of another similar knob, and the safety valve and pressure gauge fittings attached thereto.

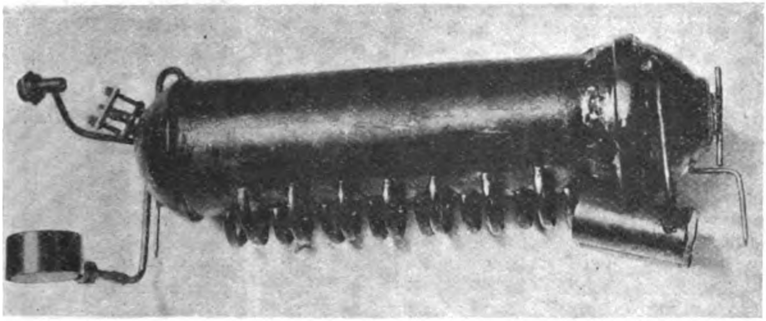
and all, out of thin sheet metal, and so—from a weight consideration—forms an ideal fitting. The arris which the leather washer beds on to is semi-circular in section, and this little detail ensures it being quite petrol-tight. A short length of stout wire is soldered to the cap to form a handle for screwing up by hand. The vapour is brought down by a piece of ⅛-in. tube, and this, bent at right angles underneath the container and pierced with two pinholes, forms the burners. The Bunsen effect is obtained by threadling on two short lengths of ¾-in. tube previous to bending up the conducting pipe.

The casing of the boiler is a very simple affair—merely a piece of tin around the lower two-thirds of its circumference. The boiler is supported in the boat by two pegs fitting into holes in aluminium stretcher beams, as shown in sketch (Fig. 12).

The boiler—which must be started up with an auxiliary lamp—is a very efficient steam-raiser. The burners light up automatically, and the steam pressure rises with great rapidity.

The deckwork is all of thin aluminium (35 gauge). A novelty about this is that the funnel is over the engine, and so hides what would be an unsightly cylinder stuck up in the air.

As an instance of the extremes that were gone to in the elimination of superfluous weight, I must mention that I reduced the weight of the pressure gauge (a bought one) to one-half. When I overhauled it I found the front was glazed with a piece of glass over ⅛ in. in thickness. Out that came, and a piece of mica took its place, also the thick brass ring which separates dial and glass had to go, and a piece of thin bent-up aluminium replaced it.



Boiler and Mountings for Featherweight Steamer.

For some time I regarded the heavy brass casting which forms the body with a dubious eye, but finally I tackled it and filed away most of that without imperilling the working of the gauge. The boiler was tested hydraulically to 80 lbs. per sq. in., and the container to 100 lbs. ditto. The weights came out as follows:—

	lbs.	ozs.	drs.
Hull, including stern, shaft, propeller, skeg, and deck-work, etc.	0	15	12
Boiler and vaporiser (empty)	1	1	0
Engine	0	4	4
Total	2	5	0

The high speeds being stated in the daily Press to have been achieved by the *Invincible* class should be received with a grain of salt, says the *Engineer*. It is quite correct that 27 knots has been touched, but 25 knots is nearer the mark for any long performance. The ships so far have proved fully up to and a little over designed speed, and to be quite successful steamers.

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

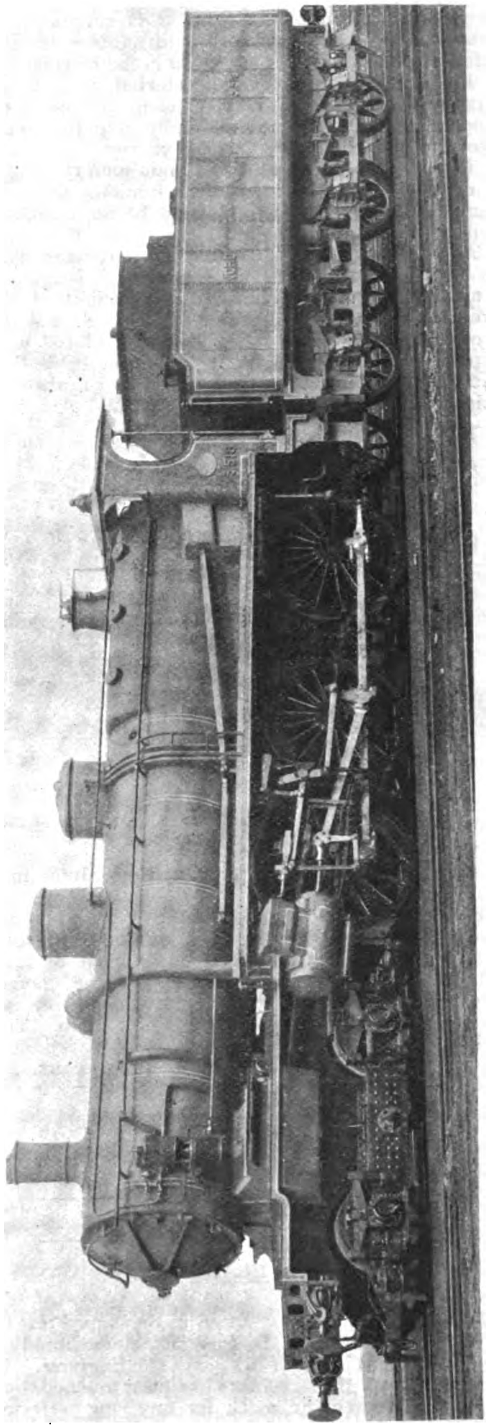
New Locomotive for the Northern Railway of France.

Some few years ago the locomotive engineer of the above Railway—Mons. Du Bousquet—decided to give a trial to the 4—6—0 type compound locomotive, then an uncommon type in European practice, although long previously established as a regular one in America. He therefore had built a number of engines with the 4—6—0 wheel arrangement and the De Glehn system of four compound cylinders, and a moderate wheel diameter was adopted because of the fact that the engines were intended for working what is known as "mixed" traffic, comprising passenger trains and also those conveying perishable traffic, while the engines played a by no means inconsiderable part in the conduct of the heavy mineral traffic which the Nord Railway does between Paris, La Chapelle, and Lens and Hirson. These 4—6—0 locomotives haul the trains mostly between Paris and Lens, while at the latter point the large and powerful articulated locomotives, specially built for this work, take charge for the transportation of the loads, which range from 900 to as much as 1,000 tons, over the trying grades to Hirson. These ten-wheeled mixed traffic locomotives have proved uniformly successful on the Nord Railway, and it has often occurred that they have been called upon to run express trains running in the fastest schedules and taking the place of the "Atlantic" and 4—4—0 compound express locomotives, which, of course, have very much larger diameter driving wheels.

Encouraged by these good allround results, Monsieur Du Bousquet decided to build a new series of 4—6—0 type locomotives, having in some respects the same dimensions as those which have proved so suitable in the earlier series, but possessing a largely increased boiler capacity and several minor improvements. The first of these new engines is, by M. Du Bousquet's courtesy, illustrated herewith and its chief dimensions given. Compared with the previous engines, the new design presents a much more imposing appearance, owing to the boiler being larger in diameter and higher pitched, but it should be noticed that the cylinder diameters and other main features and dimensions have been retained. In the new engines the running board or footplate around the boiler is raised so as to be entirely above the coupled wheels, which do not therefore require splashers. The steam chests of the outside high-pressure cylinders are located above the cylinders. The exhaust steam from the high-pressure cylinders travels forward, on the way to the low-pressure cylinders, through an outside pipe, seen in the illustrations, to a receiver, also located outside and at about the centre of the bogie. Steam passes to the high-pressure cylinders themselves through a steambox on top of the boiler in front of the dome and the usual outside "dry" pipe encircling the outside of the boiler. The boiler barrel is built in three telescopic rings of steel plate. It is 5 ft. 3 ins. diameter outside by 14 ft. 6 ins. long, and contains 127 Serve pattern tubes. The firebox is of great length and of the Belpaire type. The tender is carried on three axles and is fitted with a supplementary tank, also with special brake rigging. The wheels are unequally spaced and arranged so that the load to be carried is distributed with better effect. The engine has leading dimensions as follows :—

Cylinder (diameter)—High-pressure, 14 ins.; low-pressure, 22 ins.; piston stroke, 25½ ins.
Coupled wheels diameter, 5 ft. 9 ins.
Coupled wheelbase, 14 ft. 6 ins.
Total engine wheelbase, 28 ft. 2 ins.
Boiler centre above rail, 8 ft. 9 ins.
Heating surface: Tubes, 2,298 sq. ft.; firebox, 167·5 sq. ft.; total, 2,465·5 sq. ft.
Grate area, 29·4 sq. ft.
Working pressure, 227 lbs. per sq. in.
Weight on driving wheels, 48 tons.
Weight of engine (in working order), 68 tons.
Weight of engine and tender (in working order), 116 tons.

The tender carries 4,000 gallons of water and 7 tons of fuel, mostly briquettes. The new engines will work under substantially the same conditions as the earlier ones.



NEW 4—6—0 TYPE COMPOUND LOCOMOTIVE: FRENCH NORTHERN RAILWAY.

THE GREAT CENTRAL THREE-CYLINDER SIMPLE LOCOMOTIVE.

There seems to be some misapprehension about the three-cylinder simple locomotive which has been planned by Mr. J. G. Robinson, chief mechanical engineer of the Great Central Railway, among those who write upon locomotive matters. It has been variously stated that the engine is a new one and that it is practically completed. It would appear that neither statement is correct. The engine, as a matter of fact, will be evolved from one of the existing two-cylinder "Atlantics"; and, although work has not been commenced on the conversion, or had not when the writer was in the Gorton Works at the end of July, it is expected that it will be begun at an early date. The success met with from using the three-cylinder simple principle in the "Wath" shunting engines of the Great Central Railway has doubtless been a determining factor in the decision to apply the same principle to an express locomotive, and it appears certain that under the conditions that will prevail, the engine will stand every chance of proving an unqualified success.

LESSONS ON THE LOCOMOTIVE AT THE FRANCO-BRITISH EXHIBITION.

The fine express locomotive of the S.E. and C. Railway now standing on show at the Franco-British Exhibition has rightly attracted a great deal of admiration from all who have seen it, and some of those who have been permitted on the footplate, probably for the first time in their lives on any engine, appear to have been quite overcome by the novelty of the experience, if we are to judge by the exclamations and questions which have emanated from them. One gentleman was heard to enquire "Whether it is true that"—as he had heard—"the engine has been built to run at 100 miles an hour?" while another mistook the steam and cataract reversing apparatus for the "steering gear." Even this, however, was eclipsed by the visitor, who, standing on the floor level and peering into the open smokebox, remarked to his friends, who apparently regarded him as an authority, that "those holes you see there" (the tube ends) "are for getting rid of the steam and water at the end of the day's run." Obviously these visitors were *not* readers of The Model Engineer.

What a Small Driving Wheel Can Do.

Instances often occur in the every-day working of a railway in which it is necessary to call upon locomotives designed for a totally different class of duty to perform tasks, nominally, and theoretically at all events, beyond their powers. They generally, in these circumstances, prove fully equal to the occasion, and put up an excellent performance, despite the natural disadvantages from which they suffer. Quite recently, on one of the English trunk lines, an "Atlantic" locomotive failed, with a run of 58 miles before it and only 1 hour 3 minutes in which to cover the distance punctually. The only engine available at the time was a 4—4—0 type, with 5-ft. 6-in. driving wheels, and this being coupled on to the train at a few minutes' notice, succeeded in developing an average speed of 52 miles per hour, with the result that the passengers were landed at their destination only a few minutes late in spite of the delay which had occurred lower down the line.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender MUST *invariably be attached though not necessarily for publication.]*

Screw Propellers, etc.

To the Editor of *The Model Engineer*.

Dear Sir,—Your correspondent, "B.H.-P.," seems to have a poor opinion of the brake horse-power of model boat plants. I have just been trying our plant on the *Folly*, with a total displacement of 11 lbs. 7 ozs., and obtained considerably more power than he estimates for a 20-lb. boat.

I do not intend for the present to quote the power developed, as the *Folly* is still more or less in embryo. I, however, entirely agree with him as to Mr. Dysart's articles, and fail to see how the latter makes out any logical sequence in his design.

The fact is—that no part of a steamer can be worked out independently of the rest; it has to be a question of "give and take" and "trial and error," combined with a little of the "survival of the fittest."

It is just in this that the sport comes in. If a man could sit down and calculate out the best ship by an equation or some other mathematical problem, there would be no good in holding regattas or speed competitions.

Then, again, the absolute building of the ship has something to do with the speed attained, and the construction of the engine more so. If people are content to work with engines in which the pistons leak and where the friction accounts for half the power developed, they must be content with the small brake horse-power which, according to your correspondent, is usually found in model steam plants.

The design of a steamer seems to resolve itself into the following sequence:

First.—Determine the general lines of the hull and calculate the displacement.

Second.—After allowing for the weight of the hull and accessories, design a propelling plant that will give the greatest power possible for the available weight.

Third.—Design the propeller, if you are clever enough!

This last item is perhaps the biggest of the whole lot. Look at the number of ships which give better results on being fitted with propellers of another form from that originally designed. If this difficulty obtains in large ships, where any amount of information is available as to previous performances of practically similar ships, how much more so in small models, where comparatively no information is available.

Then, again, it is quite an easy thing to sit down and sketch a propeller on paper, but quite another thing to make a propeller to drawing.

Judging from what I saw at Wembley, the general tendency seemed to me to make the blade areas too great in proportion to the engines used to drive them.

It must be remembered that no amount of observation of boats being tried in tanks is of the slightest use unless the water is made by some mechanical means to flow past the propeller at the same rate that the boat would travel through the water. In the year 1885–6 (?) I saw such a tank fitted up at Messrs. Thornycroft's works at Chiswick, but I was told then that propellers which, tested in the above manner gave good results, did not sometimes give such good results as comparatively inefficient propellers did in actual practice. Altogether it seems to me quite the wrong end of the stick to start at.

It seems absurd to choose the part of a ship about which nothing is definitely assured, and cannot be designed with any certainty of arriving at a given result, and from this indefinite basis to start the calculations for the other parts, about which a great deal of information is available.

I firmly believe that a propeller twisted and cut to shape by eye, provided it is properly balanced, will often give better results than a propeller calculated and constructed with the greatest accuracy. A model boat builder, however, must be prepared to make a number of propellers and allow the "survival of the fittest."

Mr. Dysart, in his articles on a 10-mile-per-hour boat is not particularly interesting or novel in his designs. What your readers want is a design for a boat that will have some chance of beating all records, which certainly his boat won't! — Yours faithfully, V. W. DELVES-BROUGHTON.

Upper Norwood.

The Society of Model Engineers.

London.

AN ordinary meeting of the Society was held on Wednesday, August 26th, at the Cripplegate Institute, Golden Lane, Mr. A. M. H. Solomon taking the chair and upwards of eighty members and some visitors being present. The minutes of the previous meeting having been read, four new members elected, and other formal announcements made, a discussion arose on a suggestion made by Mr. W. B. Hart that the Society should acquire by purchase or otherwise a model locomotive adapted for use on the track. A counter-proposal that an electric motor for connecting to the lighting circuit and to be used for testing small dynamos, etc., was also discussed, and, on a show of hands, it was evident that both proposals commended themselves to the members, and the matters were referred back to the committee to discuss means of carrying them out. A fresh feature was announced by the Chairman, who stated that the committee had decided to award a small cash prize at each meeting to the member exhibiting the best piece of work made by himself, and that for purposes of comparison an announcement would be made at each meeting of the particular class of work for which the prize would be available at the next meeting. It was accordingly announced that the award would be made at the next meeting (September 18th) to the member showing the best steam engine cylinder or pair of cylinders, the work not necessarily being done between the present and the next meeting. The Chairman hoped that the offering of this prize would induce members to show work in course of construction more freely than in the past. The Chairman then requested the Secretary to read the rules governing the Locomotive Competition. This having been done, it was announced that three steam and two electric locomotives had been entered, and some of these were then tested for drawbar pull and speed by means of apparatus made for the purpose. Each model was given a number of runs at varying loads, and the tests excited a great deal of interest. These not being concluded when the meeting adjourned, it was decided to resume them and announce the results and awards at the meeting to be held on October 9th. Among the exhibits were two finely made horizontal engines, with Corliss trip valve gear, made by Mr. Arthur S. Lane, and a petrol blowlamp for a marine boiler, shown by Messrs. Butcher & Co., of Watford. The meeting adjourned at 10.15.

FUTURE MEETINGS.—Friday, September 18th: Paper, by Mr. Percival Marshall, A.I.Mech.E., on "Originality in Model Making." Friday, October 9th: Adjourned Locomotive Running Competition. The Secretary will be glad to have notice of any further entries.

VISIT.—On Saturday afternoon, October 3rd, a visit will be made to the Generating Station and Works of the Metropolitan Railway Company, at Neasden.—Full particulars of the Society and forms of application for membership may be obtained from HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green, S.E.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, 26-29, *Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[20,188] **Model Locomotive Design.** F. W. (Sheffield) writes: *Re* the very interesting article in THE MODEL ENGINEER about Mr. Averill's ¾-in. scale G.N. locomotive, there are several points about this excellent engine which puzzle me exceedingly. (1) Firstly, the extraordinary weight pulled, *i.e.*, 741 lbs. Allowing a resistance of 1 lb. in 25, this requires a tractive force of 30 lbs. at least. Now I believe the size of cylinders of Stuart Turner's engine is 1 in. by 1¼ ins., and the driving wheels 5 ins. diameter. This would necessitate, to give a tractive force of 30 lbs., an average steam pressure in the cylinder of 100 lbs., which I consider most unlikely, seeing that it is fired by one Primus burner. (2) Again, the weight of the engine and tender is given as 90 lbs., and if we put the weight available for adhesion as 55 lbs., I should think it would be the absolute maximum. Now how is this, when the minimum adhesive weight required for a tractive force of 30 lbs. should be 90 lbs. at least, according to the "Model Locomotive," page 43?

(1) We would point out that while the allowance for model train resistance of 1 in 25 is a very good figure to adopt in designing a locomotive, it must by no means be taken as an ultimate standard which cannot vary. The formula given in "The Model Locomotive" is designed to allow for extreme cases, and possibly only about 1 lb. tractive force was required for 30 or 40 lbs. It is not pretended that the engine would pull this load continuously—mile after mile, so to speak—and we believe Mr. Averill's track is a short one. However, this does not lessen the value of the performance, as without good workmanship and the perfect "tuning up" of the mechanism the load could not have been hauled. The heating power of the single "Primus" burner used by Mr. Averill has been increased by the well-known expedient of reamering out the nipple so that it passes more oil per minute with the same pressure of air and gives a larger flame. (2) The co-efficient of adhesive largely depends on the state of the rails. On a smooth brass rail slipping will occur with a lower steam pressure than where iron rails (laid out-of-doors) are employed. Of course, the train resistance is increased by the use of rougher rails, but as to which gives the best results can only be decided by careful scientific experiments. Perhaps Mr. Averill will make it convenient at some future time to make experiments to determine the resistance of the complete train by the method shown in Fig. 38 of "The Model Locomotive" by weights or by a spring balance.

[20,175] **Joining Broken Band-saw.** W. J. W. (Bures) writes: Can you please let me know the best way to braze band-saws ends together, the width being ½ in. I am a joiner, and have to use woodworking machines, and as saws often break I should like to know of a good way to mend them, also best stuff to use, as they must not be cooled too quick, as if so they get too hard and will not bend round the wheels of machine. I have the use of blacksmith's shop and forge, but no brazing lamp.

With a file you must scarf the ends to be joined for a distance of about ¾ in. Then find some means of fixing the two ends in position to be joined without making the joining place inaccessible. Damp the two ends and cover with a little powdered borax and coarse brass spelter. Now grip the joint with a large pair of tongs, the nose of which has been made bright hot. When the brass has melted remove the big tongs, substituting instantly a smaller pair heated but black. After a few moments the joint should be safe and may be trimmed with a file.

[20,033] **Small Motor Failure.** R. S. (Alloa) writes: Please give me a suitable field winding (shunt) for a small four-pole motor, made from your handbook, but with armature 1 in. long and other parts in proportion. I expected to get about 25 watts. The armature is a drum, with sixteen slots, wound for a four-pole field with No. 26 D.C.C., thirty turns per slot, 480 conductors altogether, sixteen-section commutator (not cross-connected, as I had not room, so have to use four brushes). The fields are at present wound with 1 oz., on each pole, of No. 27 S.S.C., but it is not a success. I run it from a charging board through 30-volt lamps from a dynamo made with your assistance five or six years ago, and it takes 4 amps to make it go, and then it just manages to drive itself and no more; but if I lift two of the brushes, it goes off at a great pace, but sparks a good bit. I want to make a small charging dynamo of it. If you do not think it will be a success as a dynamo, you might give me a field winding (series) for a motor, and say if you think I would get a better result from a small two-pole, say Manchester type, for charging from water motor, where pressure is barely 20 lbs.

The No. 27 S.W.G. is a suitable wire for the fields, but you probably need more than 4 ozs. altogether; therefore we think it is probable there is some other fault causing the failure you mention. Probably, your windings are not correct, and some of the poles may be of wrong polarity. This appears to be the case from what you say regarding the motor running better with only two of the field coils in circuit. The machine will naturally take a large current unless it is running at a fairly high speed; this is the object of inserting a starting resistance where large machines are concerned. For running as a motor, series wound, use No. 20 S.W.G. approximately the same weight as is already on. For real work, however, you cannot beat a bipolar machine where small powers are concerned.

[20,169] **Power of Engine: Fixing Glass of Aquarium.** B. M. (Hackney Downs) writes: I have a horizontal engine (1-in bore, 2-in. stroke, and 4½-in. flywheel, about). I want that engine to drive a dynamo. What size should I want and how much would it cost, and where am I likely to get a good one? Also, another question I would like to ask: I am building an aquarium for goldfish. I have made the frame of tinned iron, and have fixed in the glass. What would be the best thing to stick the glass with—cement, or putty, or what?

With proper steam supply you should be able comfortably to drive a dynamo of 30 watts output. Any of the electrical manufacturers advertising in our columns would quote you a price for dynamo. For fixing the glass, take 2 parts (by weight) of ordinary putty and 1 part of red lead, and thoroughly knead the two together with gold size to a consistency such that it leaves the hands without sticking.

[19,574] **Wireless Telegraphy.** D. G. (Kings Heath) writes: Will you kindly allow me to take advantage of your Query Column by answering the following questions? Having experimented with wireless telegraphy for several years, and been able to transmit and receive up to 30 miles on a simple antenna 120 ft., coupled directly to a 6-in. spark coil—(1) Will you give me particulars of transformers, etc., in order to work with two different-tuned circuits? (2) Also an arrangement for cutting-out atmospheric discharges.

(1) We fear that you will not get very satisfactory tuning with a simple aerial, as the capacity is rather small and the damping fairly big. Oscillation transformers for receiving can be wound

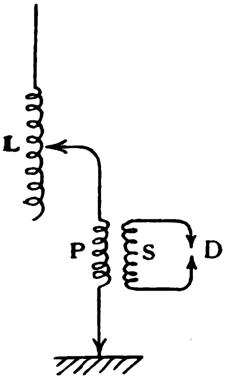


FIG. 1.

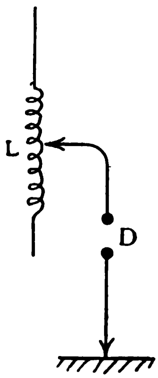


FIG. 2.

on cardboard or ebonite tubes an inch or two in diameter and 4 to 5 ins. long, and they do not require very many turns in either primary or secondary. A few trials will probably produce a satisfactory transformer. No iron core must be used. This should be inserted in circuit with an adjustable self-induction coil, so that by shifting the point of contact along the coil the receiving apparatus may be made to respond to various tunes. If current-operated detectors are employed, the transformer is not required. Where two fixed tunes are to be received, the aerial may divide through two adjustable self-induction coils, with a change-over switch to connect either to the detector, but the switch may be dispensed with if two detectors are used. For discussion of distinctions between current-operated and voltage-operated detectors see "Wireless Telegraphy for Amateurs," price 2s. 3d., post free. Tuning is a comparatively easy matter with the modern electrolytic

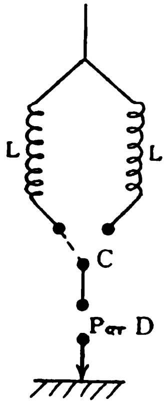


FIG. 4.

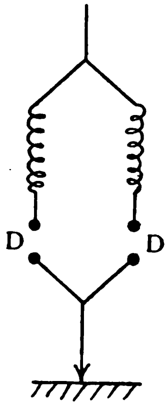


FIG. 3.

detectors, which need only be connected between an adjustable self-induction coil and the earth or lower capacity area. (2) Where an oscillation transformer is employed, atmospheric disturbances usually pass quietly through the primary coil to earth, but we know of no other way of getting rid of them. Fig. 1 represents one adjustable coil with oscillation transformer; Fig. 2, one coil with detector direct to earth; Fig. 3, two coils of different self-induction, with change-over switch; Fig. 4, two different coils with two detectors, where P—primary of transformer, S—secondary of transformer, C—change-over switch, L—self-induction coil, D—detector.

[20,183] **Steam Gauges.** J. S. (Darlington) writes: Would you kindly answer the following question in your columns? Is it ever the proper thing to place a steam gauge *below* the working water line in any kind of a boiler? You will see from the sketch (not reproduced) that the syphon of steam gauge enters the boiler exactly on the same line as the middle of the hexagon nut of the *lower* water gauge cocks, so that even before the water appears in the water glass the steam gauge syphon is in water. At working level of water the gauge syphon would be covered by about 1¼ ins. of water. I have protested against this to the makers who say the steam gauge is in the proper place. I will never admit this except on very good authority. May I trouble you to answer?

We cannot call to mind having seen the pressure gauge placed below water level in any large boiler, simply because there is generally ample room for the mountings above water level. In a model the congestion of the fittings often necessitates fixing the pressure gauge below the average water level. Furthermore, there is no question of the eye line in a model. To come to scientific considerations, it does not matter in the least where the pressure gauge is fitted *so long as it is provided with a syphon*, as water is a non-conductor of heat and if convection currents are prevented by the use of a syphon pipe, the gauge cannot become overheated. If a gunmetal syphon fitting is used there is rather more chance of the gauge becoming hot than with a coiled pipe, as the heat is more readily conducted to the gauge through the greater mass of metal. There is one advantage in placing the gauge syphon well above water line—*i.e.*, there is less risk of the entrance to syphon becoming choked by a floating particle of dirt or a chip of wood or metal in the water. This does not count very much in a small model, as we have known a blower valve in the top of a boiler to become choked owing to the water being splashed about when the boiler was moved. The possibility of this happening is less with a pressure gauge as there is practically no flow of steam or water. With regard to your remark connecting the working of water gauge and steam gauge, where a syphon is used the pipe or fitting after the first steaming will always be full of water independent of the level of the water in the boiler. The position, therefore, is immaterial. The idea of the syphon is to "trap" the water, see explanation given in reply to query No. 17,890, issue of December 5th, 1907.

[18,670] **60-watt Undertype Dynamo Windings.** W. H. M. (London, S.E.) writes: Will you please help in the following? I bought a set of dynamo castings through advertisement in THE MODEL ENGINEER, which were advertised as 64 c.-p., and as neither volts, amps, nor watts were mentioned, I do not know with what to wind it. It has a cogged drum armature—12 sections, 2¼ ins.

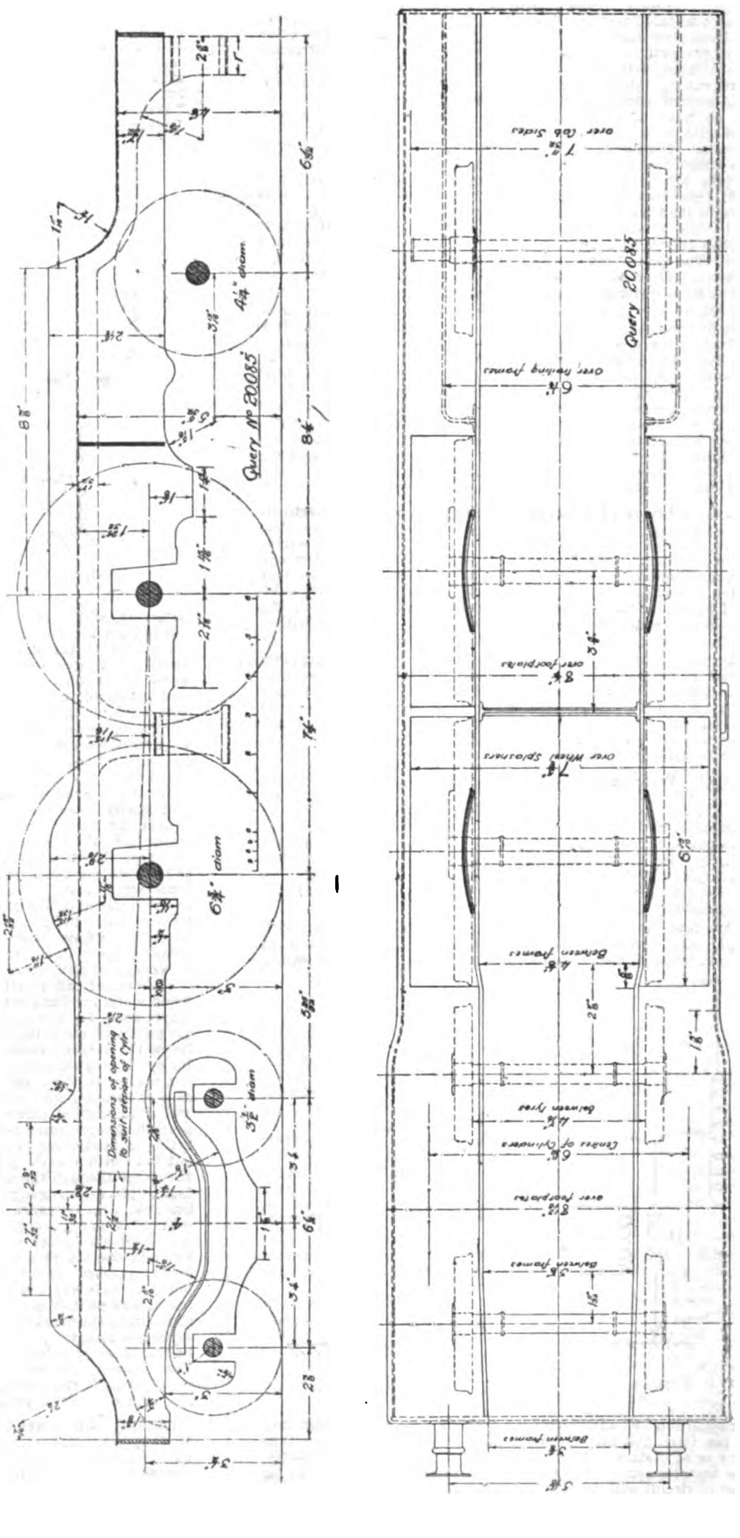
diameter, 2¼ ins. long, slots ⅜ in. deep, 5-16ths in. wide; commutator—twelve sections, wrought-iron core, 3 ins. long, 2 ins. diameter. Will you please give exact amount and size of wire for armature and field-magnets to get this candle-power. I want it for lighting and charging. I have No. 10 (Handbook Series), but windings are given from 150 to 250, and as it is something between that I am rather in a fix.

Your machine will not give more than about 60 watts output. A useful voltage to wind for would be 30 volts. For this wind armature with 6¼ ozs. No. 22 S.W.G., and field-magnets with 2¾ lbs. No. 23 S.W.G. connecting shunt.

[20,085] **G.C.R. "Atlantic" Locomotive: Frames and Footplates.** W. H. (Manchester) writes: I am getting out the frames for a 1-in. scale Great Central "Atlantic" locomotive. Frames are 2 ft. 11¼ ins. long, 4 ins. apart; outer frames at firebox end 5⅜ ins. apart, ⅛ in. thick. Would you kindly tell me what is the outside measurement over footplates. Will the buffer plates be of the same thickness of metal (⅛-in. mild steel) as frames. The model will have cylinders 1¼ ins. by 2¼ ins. What weight should this locomotive pull? I intend to fit a a large boiler.

We append herewith three drawings, giving full particulars of the frames of the G.C.R. "Atlantics." The inside bearings for the trailing axle are omitted as unnecessary for the model, the outside frames taking the whole weight. The piece of frame which is patched on the main frames to take the inside horns is therefore not included. The frames you are getting out are a little too short. They should measure about 36 3-16ths ins., but if the deficiency is at the trailing end, it will not matter very much. We would make the cylinders 1¼ ins. by 2 ins. The ¼ in. taken off the stroke should be put into the piston. A thick piston is a desirable feature. Use a piece of 5½-in. tube for the boiler barrel. As to the load the model should pull, you may reckon on one person easily *and continuously*, and three or four persons for short distances, according to how well the engine is made. We would make the firebox 8½ ins. long and as deep as possible. You will notice that the footplate width varies at the front and rear. The drawings are fully dimensioned in this particular. The buffer planks may be of the same material as the frames. We can detect no difference in the original engine.

[19,657] **Partial Failure of Dynamo to Generate.** F. D. (Exeter) writes: I have made a dynamo from directions in handbook (No. 10), "Small Dynamos and Motors," Kapp type, Fig. 11, page 18. I have carefully followed directions, and have no leakage anywhere, but it will not generate; it works well as a motor from 4-volt accumulator. I have tried brushes in every position, and fields in shunt and series. I have tried separately exciting the fields with 4-volt accumulator, then I get about 1 volt. The machine is wound for 5 volts 4 amps., wrought-iron field-magnets in three forgings, eight-slot drum armature (wound in four sections). This is my first attempt, so I hope it will not be a failure. I have found The Model Engineer a very great help to me in many little difficulties, and hope to again. If you can advise me what



Plan and Elevation, showing Wheelbase and Framing for G.C.R. "Atlantic" Locomotive.

to do, I shall be much obliged. The field-magnets are 2 ins. by ½ in., wrought iron; armature, 2 ins. by 1½ ins. diameter.

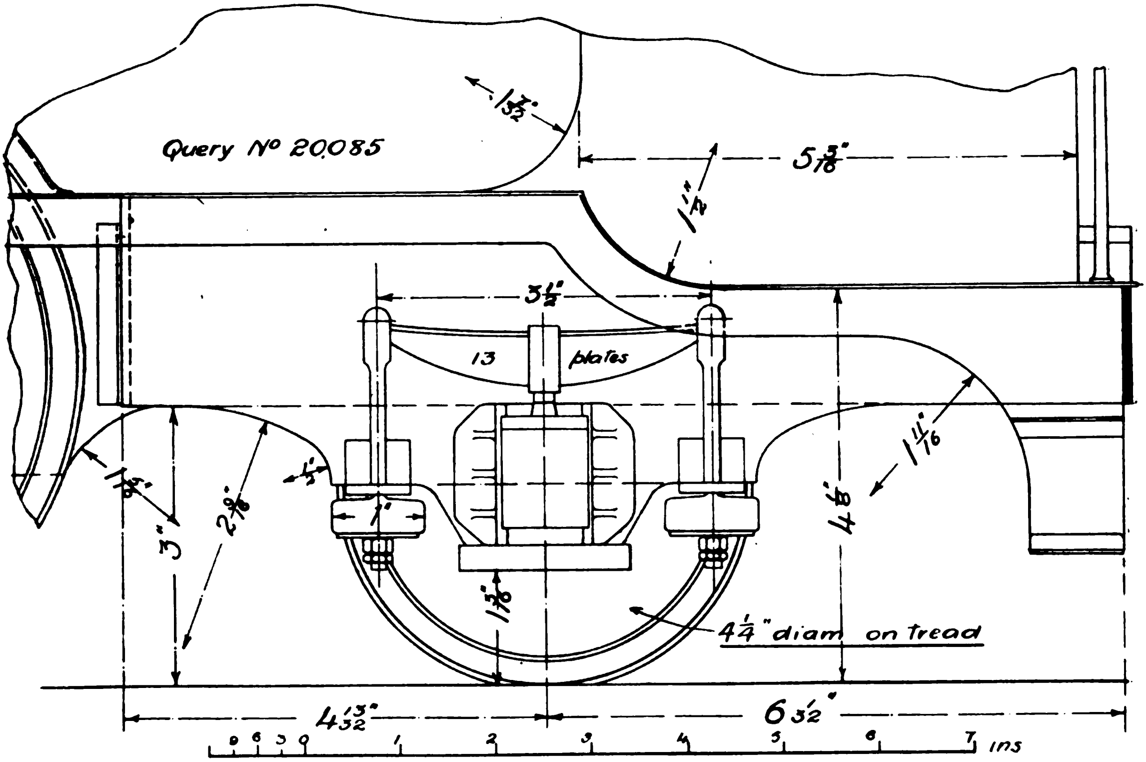
As far as we can say from your description, the fault probably lies in the connections between the various pieces forming the field-magnets. If the joint between the two field-magnets and the yoke are not thoroughly good ones, with metal to metal, you will lose a great deal of strength which ought to be available in the field-magnets. We presume the air-gap is not excessive between the armature and pole-pieces, and also that you are running at a speed of not less than 2,900 r.p.m. This is one point that you should make quite certain about, as in driving such small machines the theoretical speed does not always tally with the actual speed you are getting, owing to belt or cord slipping considerably. Provided your windings are correct, and as described in handbook, we see no reason for failure, although, of course, small machines of this description commonly run much better as motors than as generators.

[20,095] **Model Electric Railway.** "Shah" (Bromley) writes: I am thinking of making a model railway (electrical), one of the chief points of which must be the capability of drawing a child about 50 or 60 lbs. weight. Cheapness also is essential. (1) I suppose it would need a gauge of 4 ins. or 5 ins.? (2) How many volts would it be desirable to have the motor work at, on the three-rail system? (3) I propose to lay the rails on boards 8 ft. or 10 ft. long and to join up as required, sometimes indoors and sometimes on the lawn. Would this do? (4) Is there any useful book you know of?

The tractive force required to draw 80 lbs. is about 5 lbs., so you will require an engine to give about this pull. (1) We think 6 ins. would be the minimum gauge to be safe. (2) The motor should be designed to work at a low voltage, so that a few accumulators would suffice to drive it. (3) Yes, we think the boards would be a suitable arrangement. Provide a device for locking the ends together, and we suggest a few cross-pieces, after the fashion of sleepers, for stability. (4) There is not much literature on the subject of *miniature* electric railways. Rider's "Electric Traction" (10s. 6d. net) deals with the subject generally, also the "Electric Tramcar" Handbook, 2s. 9d. post free. Several electric locomotives have been described in The Model Engineer. In our issue of Nov. 16th (1905) we published a photograph showing Col. Harvey's locomotive hauling a boy of 6-stone weight. This car was described in issue of May 11th, 1905. We think you could not do better than adapt this design to your requirements, as the power of the car is just about right.

[18,175] **Small Dynamo Winding.** E. H. (Bucks) writes: I am asking your advice on the following. I have a dynamo field casting by me, which was, I understand, taken from one of the Universal Electric Supply Company's O.B. size "Empire" dynamos, 8 volts, 6 c.-p., at 3,000 r.p.m., H armature. I intend fitting same up again as a dynamo, with 8-slot laminated cogged drum armature with 8-part commutator for accumulator charging. What I want to know is: gauge and quantity of wire for field, gauge and quantity for armature, which is 1¼ ins. diameter by 1¼ ins. long; voltage and speed to be same as before; and would dynamo light a room 9 ft. by 12 ft. by 8 ft. sufficient for all ordinary purposes, using "Osram" lamps?

Wind the armature with No. 25 gauge s.c.c. copper wire, get on as much as you can (about 3 ozs. will be required. Wind field magnet with about 10 ozs. No. 24 gauge s.c.c. copper wire, and connect as a shunt winding. We cannot say that you will obtain the output required at 3,000 r.p.m., for equal machines and speeds a drum armature does not give so much output as a shuttle, H pattern armature. If you do not obtain the desired output, try running it at a higher speed. Make the clearance between armature and magnet poles as small as possible. *Re* lighting of room, this must be a matter for trial.



The News of the Trade.

* *Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

Small Permanent Way.

We have received from Messrs. W. J. Bassett-Lowke & Co., 20, Kingswell Street, Northampton, a sample of their 1½-in. scale small permanent way. This is being produced at an extremely reasonable price, and should come within the requirements of a large number of model locomotive enthusiasts.

Change of Address.

We have recently been notified by Mr. George Goodman that he has opened a shop at 1, Nelson Street, Bristol, for the supply of all kinds of amateurs' goods, small machinery, apparatus, etc. Mr. Goodman, we regret to say, has been incapacitated from doing any business lately owing to a very severe illness. He is, however, now quite recovered, and will be pleased to see any of our readers at the address mentioned above.

The Editor's Page.

WE have received the following interesting letter from Mr. Edward Fearn, 149, Walford Road, Sparkbrook, Birmingham, on the subject of the proposed formation of a Society of Model Engineers in Birmingham: "I am very pleased to see your editorial to-day with reference to the formation of a Model Engineer Society in Birmingham, and am writing to Mr. H. L. Phillips, Solihull, to arrange a meeting, and trust we shall be able to make progress towards the object in view. With reference to my previous communication to you on the matter, and which you have kindly revived in to-day's issue, I should like to say—or, rather, I do not like it, but am obliged to say—that I received one visit only—from a gentleman in Small Heath. Unfortunately, it was a beastly night, and one not calculated to arouse one's enthusiasm in anything, and, most unfortunate of all, I forgot to make a memorandum of the gentleman's name and address, and have therefore been unable to invite him to pay me another visit, although he promised to come again, he has not done so, and I am very sorry. I think a great drawback to the formation of a Model Engineer Society is the question of tools; no doubt there are many clever fellows who would like to join such a society and who would like to make models, but, to begin with, they are faced with the difficulty of tools. Now to remove this difficulty somewhat, as far as Birmingham is concerned, and to encourage model engineers who have not the 'needful' to acquire tools of their own, but would like to begin model making, and will come forward and assist in the formation of a society (model engineer), I am willing to allow them the free use of my workshop and tools free, *gratis*, and for nothing. They can bring their work here and peg away to their hearts' content. I think I have pretty well all the tools required by a model engineer, including as good a lathe as ever was treadled, and I have also got something to show them—what a model engineer can do who knew nothing to begin with about engineering, but had all his pockets stuffed with perseverance and his head with patience. So to all those model engineers who will, by this offer, have their initial difficulty removed, I offer a most cordial invitation. There is many a young fellow, no doubt, at the present time beginning his model engineering career, the same as I did mine in the little back room upstairs, with a ricketty bench, a very small vice, and a few old files. I can imagine these young enthusiasts spotting something in THE MODEL ENGINEER they would dearly like to make, but are brought bang up against this tool difficulty. 'I should want a lathe, you see'—so they argue to themselves, and so their ardour is checked. To all these I offer freely the best assistance it is in my power to give, and trust that—should you deem fit to make this offer known to THE MODEL ENGINEER readers—it may be the means of enabling us to establish a successful Society."

* * *

Mr. Fearn's offer mentioned in the foregoing letter is one which should prove of service to many Birmingham readers who are debarred from model making for the lack of a suitable workshop equipment, and is just the right sort of practical help to give a Society a good start. To make a society of this kind a success, some real enthusiasts must get together and put their shoulders to the wheel, and then things will go. We are glad to hear from Mr. B. H. Reynolds that several further members have joined the Manchester Society, and we hope that in both these cities the new Societies will have a long and healthy existence.

Answers to Correspondents.

C. E. B. (Leeds).—We recognise the advantage of the suggestion you make, but the expense would be prohibitive. The difficulty you mention could easily be got over by the purchase of an extra copy of the journal.

P. B. (Drogheda).—We have sent you a list of contents of back numbers of THE MODEL ENGINEER, which will show you just what has appeared on the subjects you refer to. As regards propellers, even experts are divided in their views as to the best designs, and the subject could not be settled in an article such as you suggest. The recording of readers' actual experiences is the most useful form of information.

W. P. (Croydon).—Messrs. Melhuish, of Fetter Lane, E.C., would supply you.

J. G. B. (Biggar).—We have no drawings in hand, but may be publishing something suitable in a short time. See designs in Vols. IV and V.

Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 386. SEPTEMBER 17, 1908. PUBLISHED WEEKLY.

Model of a Colliery Hauling Engine.

By R. YOUNG.

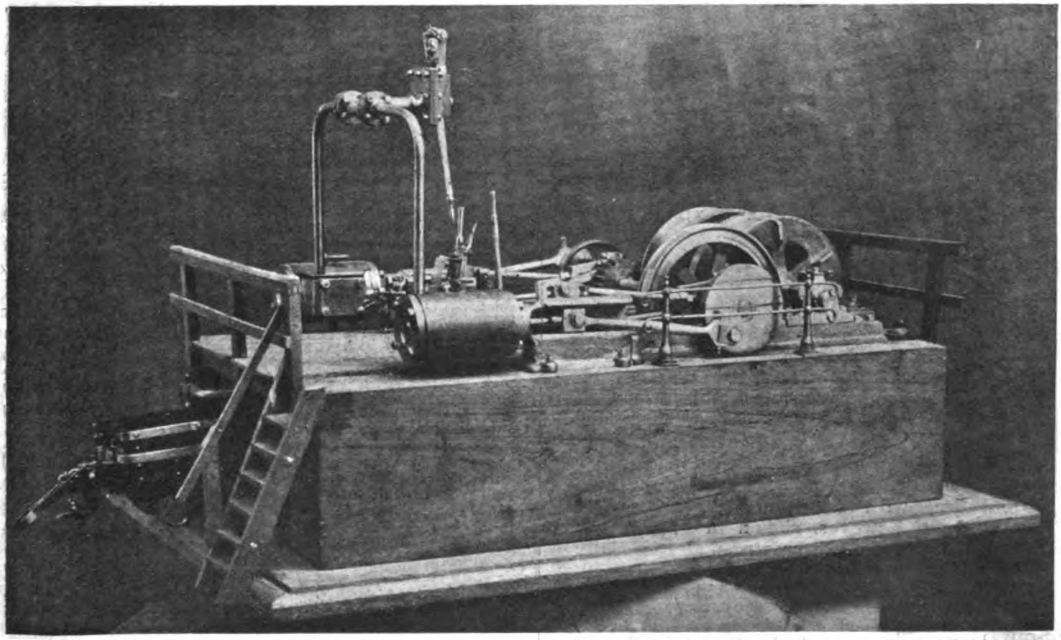


FIG. 1.—MR. R. YOUNG'S MODEL COLLIERY HAULING ENGINE.

THE accompanying photographs and description refer to a working model I have recently finished, and represents, to ½-in. scale, an underground hauling engine. The prototype is employed hauling "sets" of fifty or more "tubs," a model of one being shown to left of Fig. 1. These "sets" are hauled for a distance of sometimes two miles from the workings to the shaft bottom of a coal mine by means of steel ropes 1¼ ins. diameter fastened to the drums shown. These drums, which run loose on the drum shaft, 'are put into gear with the engine by means of a solid two-jaw clutch sliding over two bed keys fastened on the drum shaft, and wind and unwind the rope alternately.

This clutch, shown in Fig. 2, is worked by the upright lever, weigh-bar, arms and straps. Each separate bedplate is bolted to pieces of mahogany, 2 ins. thick, 4 ins. high, and 19 ins. long (representing cement pillars in the prototype), and these are placed 6 ins. apart to allow the sets of tubs to travel on permanent-way laid between them.

Wood flooring is laid level with engine bedplates. The cylinders (⅞-in. by 1½-in. stroke), steam chest, and trunk I had machined a little, and drums, disc cranks, flywheel, and eccentric straps were cast to own patterns. The engine shaft is ⅜ in. diameter, and drum shaft ½ in. diameter, driven by gearing 3 to 1. The drums are fitted in two pieces, the barrel being 3 ins. diameter and 1¼ ins. long, and drum sides 4 ins. diameter.

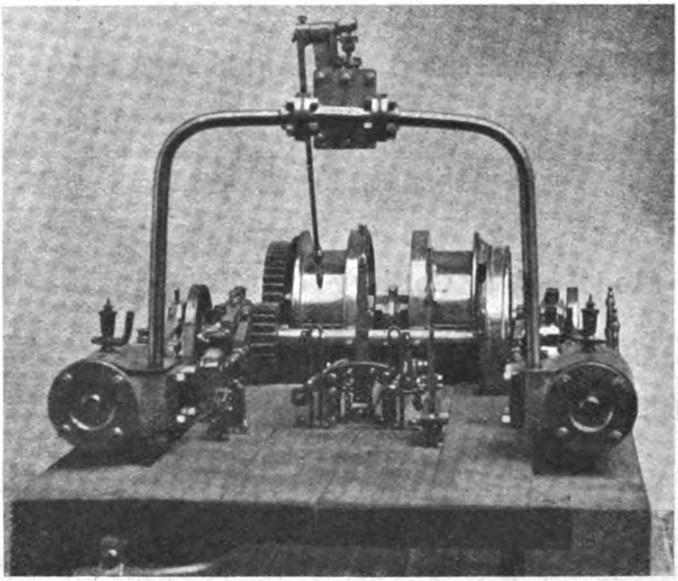


FIG. 2.—END VIEW OF COLLIERY HAULING ENGINE.

Fig. 2 shows brake levers to drums with guards, pins, and chains, clutch lever with sector plate and pins to fasten lever when in gear; also throttle valve fitted to T-piece to admit steam to each cylinder. Stephenson's reversing gear is used, and the slide spindles working in V guides. The eccentric rods are screwed at the ends and fitted into recessed strap by nuts and check nuts to allow of better adjustment of slides. Hand rails, step ladder and seat with box for tools are fitted; the latter is not, however, shown in Fig. 1. In the prototype the engine is erected under specially built brick archway, one side of which runs up close to engine pillar and the other side allows for a travelling way underneath where the brass hand-rail is shown. A correct model of a coal "tub" is seen on the left of Fig. 1 and holds 11 cwts.

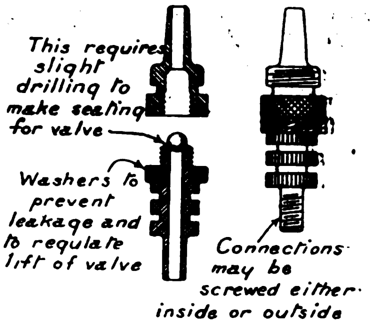
A Small Steam Engine and Boiler.

By L. BARNACLE.

THE following is a description of my small engine and boiler, which I hope may be of some interest to many of THE MODEL ENGINEER readers. I am sending this chiefly on account of my small valves, which I have found to be very useful, and which I am sure are worth trying, especially on small models.

The boiler is made of fairly stout sheet copper, riveted along the seam, 7½ ins. long by 2¼ ins. diameter. The ends are put in as described in "Model Boiler Making," the ends of the barrel being flanged over the discs and soldered; two copper water tubes are placed in the bottom of boiler.

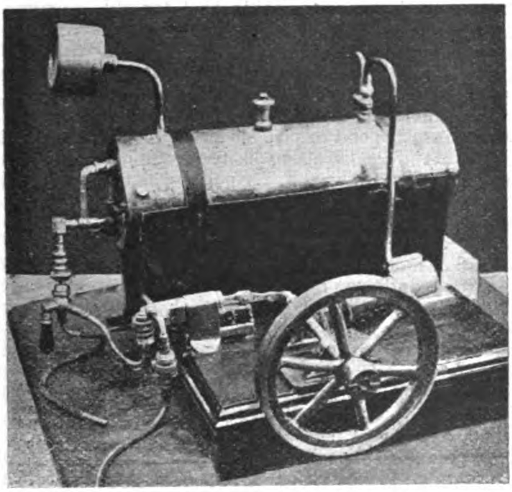
This is my first attempt at boiler making, and is quite as satisfactory as I expected it would be. With a two-wick lamp (methylated) the boiler



steams the engine well, and will pump a plentiful supply of feed-water. I have not made any actual test, but I have had 30 lbs. of steam on.

The engine cylinder I purchased, and it is ¼-in. by 1-in. single-acting oscillating. The bearings are castings filed up, and are split. The flywheel also is a casting (brass) turned up; other parts are made from oddments.

An old oscillating cylinder (1-in. by ½-in.) is used for the feed-pump, and is fastened down opposite the engine worked by the engine crank by a part crank, which gives a stroke of from $\frac{1}{2}$ in. to $\frac{1}{8}$ in., and is quickly regulated by turning



forward or backward the part crank, as the case may be.

To return to the valves; these are made from bicycle-pump connections, a sketch of which is given on previous page.

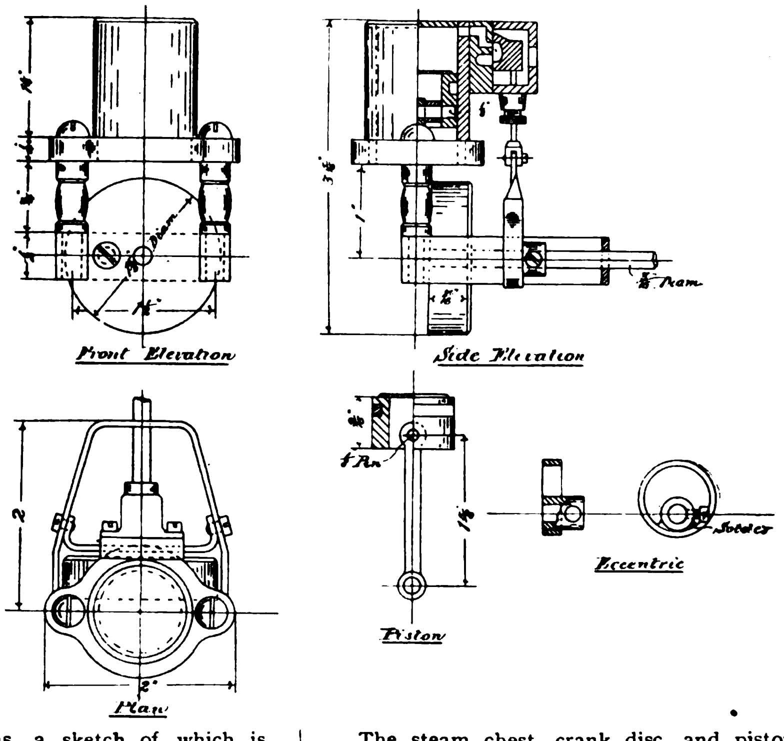
In conclusion, I may say that I have had the model running for hours without a stop, and have had no trouble with the valves of the pump. The check valve to boiler is also made in the same way, and is quite a success.

Several of my engineering friends have adopted the idea, and are pleased with it, as I have not seen valves made in this way in THE MODEL ENGINEER. I have given a drawing of this type of valve, which I trust will be of some interest to other MODEL ENGINEER readers.

A Model Launch Engine.

By PERCY G. SMALES.

THE following is a description of the construction of a model high-speed single-acting launch engine which I have built up almost entirely of scrap material, no castings being used. The cylinder is a piece of solid-drawn brass tube, $\frac{7}{8}$ in. internal diameter, $1\frac{1}{2}$ ins. long. It was forced on to a wooden mandrel and turned down at one end so that it could be forced into a flange. The inside surface of cylinder was finished off with emery paper. The flange was cut from $\frac{1}{4}$-in. sheet brass, and rests on two supporting columns turned from $\frac{3}{8}$-in. brass rod, drilled and tapped at one end to receive screws from cylinder flange. The cylinder cover is forced in flush and afterwards sweated round with solder. The steam ports are cut in a piece of $\frac{1}{4}$-in. sheet brass, which is brazed to side of cylinder.

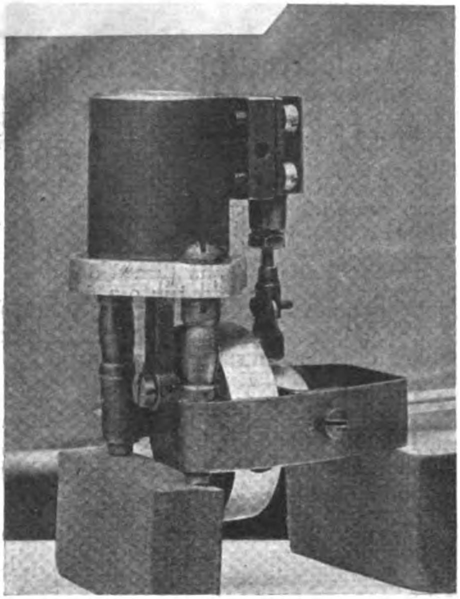


A HIGH-SPEED SINGLE-ACTING MODEL LAUNCH ENGINE.

By PERCY G. SMALES.

The steam chest, crank disc, and piston were cut from $\frac{1}{2}$-in. sheet bars. The piston has a $\frac{1}{4}$ in. hole drilled through for connecting-rod to swing in,

and has a piece of sheet brass soldered on the top end. The engine bed is made from 1-16th-in. sheet
form shown, the two
bottom ends of the
eated with solder.
pieces of brass tube,
together as shown,
1. steel shaft by a



General View of Small High-speed Launch Engine.

The construction of any part I have not described in detail will easily be understood from the accompanying drawings and photograph. I intend to make a suitable hull for this engine, to be supplied with steam from a flash boiler of my own design, and when the whole is finished I shall be pleased to send you full particulars of its doings.

A Small Grinding and Milling Attachment for Lathe.

By J. Airn.

(*Concluded from page* 250.)

By substituting such a mandrel as is shown at Fig. 3, this appliance may also be used for milling or grooving on a small scale, and, for want of more expensive apparatus, is quite handy for cutting keyways on shafts, etc. The mandrel D should be made preferably of ⅜-in. cast steel, which is cut to the length required, chucked in the lathe, and one end after the other faced up. While running, centre one end and drill a 9-64ths-in. hole with a twist-drill, finishing off with a D-drill made from 5-32nds-in. round bright steel; this hole should be about ⅝-in. deep, and should be slightly countersunk to fit lathe centres. Having done this, take it out of the chuck, and chuck a small piece of mild steel (brass would do at a pinch) and turn a pin about ⅜ in. long to fit the 5-32nds-in. hole already bored; chuck the piece of ⅜-in. steel on this pin, and carefully centre the outer end. A small sharp graver is the most suitable tool for this purpose. Drill a 1-16th-in. hole, say ⅛-in. deep, and countersink same. It will probably be found that the stock revolves eccentrically, but by centreing in this manner you get the hole true with the mandrel. Now chuck between centres, and turn down on your slowest speed to 5-16ths in. full. If the turning is cleanly done, nothing is required but polishing up with fine emery, a strip of which should be fastened to a narrow piece of wood. A good way to do this is to use a warm flat iron and iron the wood, applying beeswax to the surface. Tear off a strip of emery cloth (blue back) a trifle wider than the wood, and iron down with the iron, using it only warm enough to soften the wax; then trim up nicely with a sharp knife, keeping the emery face downwards on a piece of glass, or across the grain of a hard board. If the work requires it, use files, but before doing so, put on your highest speed, and finish with the finest file you possess, using emery, of course, afterwards.

Get mandrel to a good running fit; then reverse it between centres, and true up the larger end—a small piece of brass should be put between carrier and mandrel—and fit a No. 2 B.A. Bessemer steel setscrew with the point chamfered as before. The reason I suggest Bessemer steel for such purposes is that it is not nearly so liable to break as cast steel, and can be made sufficiently hard to do the work required. Nothing is more annoying than to have a setscrew break just when you have tightened up on a tool, and nothing is more difficult to rectify.

A few small tools should now be made from 5-32nds-in. round bright steel of various shapes for the work, somewhat as shown at A Fig. 3, a flat being filed lengthwise for the screw. It is sometimes a little difficult for the amateur to grasp the principle of such rotating cutters, but it is simple if the tool is looked upon as a series of lathe tools revolving on a common axis. For instance, in such a tool as is shown at A, if an imaginary line is drawn from the point of the V longitudinally through the tool, it resolves itself into two flat hand-tools set up back to back. These tools would, of course, be exactly similar, but when placed back to back one is necessarily reversed and the cutting edge is in the opposite direction to the other one. Such a tool as this, if caused to rotate and brought up against a stationary piece of work, would cut a cone-shaped projection; but if the work was rotated or the rotating cutter traversed on the stationary work, a flat-bottomed groove would be the result. Working on this principle, a tool made from a piece of round steel rounded up at the end, filed flat as shown at B, with a narrow V or slot cut in it lengthwise, and the two halves backed off in opposite directions, will cut a round-bottomed groove in any work in which the rotating cutter is traversed. Proceeding on these lines, cutters of various shapes may be made, and as thirteen of them can be cut from one length of steel, a fair variety can be had at a low cost. The use of a milling or grinding attachment necessitates a dividing arrangement of some kind on the lathe head, and an overhead shaft to obtain the necessary speeds. As there is no such arrangement on the ordinary single-acting lathe a description of how I dealt with my "Barnes" may be useful.

The cone pulley on lathe mandrel is three-speed flat for 1-in. belt, and on the largest pulley at the mandrel nose side is dished out, leaving a thickness of metal about 7-64ths-in. thick. While running a line was scribed in the centre of this edge and carefully divided into twenty-four spaces. This number was selected for two reasons: I wanted to use a good strong pin to lock the head in position, which prevented me getting in more than one row of holes, and the other reason is that for a limited number twenty-four gives the best range. You can divide into 2, 3, 4, 6, 8, 12, and 24, but you cannot divide into 5, 7, or 10, etc., and the first-mentioned series seemed to be the most desirable. ¼-in. holes were drilled on the edge of the pulley at the points marked out, 3-16ths-in. deep, and numbered from 1 to 24. A stout piece of spring steel carrying a shouldered stud turned to fit the holes, which stud had the end slightly rounded, and was fastened to a small right-angled bracket by means of a shouldered screw, allowing it to be thrown in or out of action as required. This right-angled bracket was fixed to the front bottom edge of headstock in such a line as to allow the spring to be vertical when the stud was engaged. The bracket should be kept as low down as possible, for the greater the distance between the pivot and the centre line of the pulley, at which point the stud should engage, the heavier the gauge of the spring may be and consequently the more rigid the locking. By putting another stud similar to the first one on the steel spring, but nearer the pivot by one-half of the distance between two holes on the pulley, you can sub-divide into forty-eight spaces if required. In this case the width of the spring should be such as to allow of the second stud being fitted so that it will not foul the pulley when the first one is engaged. Fig. 6 shows a front view of the arrangement fitted to the head. I used No. 16 gauge steel about ¾-in. wide for the spring, tapering down above the studs and carrying up to a point above the line of the pulley for convenience of handling. There now remains the overhead. This was made from a piece of ⅞-in. round Bessemer steel, which is usually sufficiently well finished to do without any machining for such a purpose. The bearings were made of 1¼-in. by ½-in. T-pieces fitted together with a short piece of ½-in. gas barrel, and the gun-metal casting as shown in Fig. 7. These castings were obtained with a ⅜-in. hole cored in them, and if the pattern is made to the outline shown, and with core prints put on in the proper place, castings will be obtained which will require the minimum of turning. It may be pointed out here that all that is necessary to obtain a cored casting of this description is to turn a solid pattern to the outline, leaving core prints projecting, say, ¼ in., and painting them a different colour from the body. The general practice is to paint the casting portion black and the core prints red, shellac varnish mixed with suitable dry colours being used. These remarks apply only to round cores, which are straight; irregular shaped cores require special core boxes.

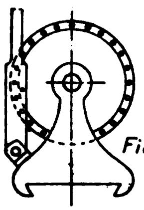


Fig 6

The castings should be chucked by the flange and the hole bored for the shaft, an easy running fit being required, and after this operation they should be chucked on a pin, and the flange faced up and edge turned. Two countersunk holes should be made in the centre of the barrel-shaped portion to receive the two screws shown in Fig. 8. The position of these screws should be such as to allow of the flange being kept about 1-32nd-in. clear of the face of the T-piece. This

Fig 7.

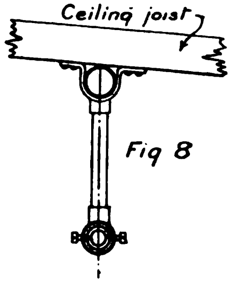


Fig 8

gives what is practically a self-aligning bearing. The screws may be No. 0 B.A., turned to a point as shown. Collars of brass or gun-metal or pieces cut from a 1½-in. shaft and bored must now be fitted to shaft and kept in place by steel set-screws with hardened points. The end of the shaft over the head of the lathe is fitted with a 10-in. by 1¼-in. wood pulley corresponding with a similar one fitted on the outside of the lathe driving-wheel, and a three-speed cone pulley, also in wood (I used oak) to correspond with the one on the lathe mandrel. These are fitted close together, forming really a four-speed coned pulley, of 10-in., 4-in., 3-in., and 2-in. diameters respectively, and are driven on friction tight. Another pulley is required, which in my case is made of mahogany, 14 ins. in diameter, 13 ins. in the groove, and 1 in. thick. This is fitted with a brass flange bored to fit the shaft, and can be locked at any point on it by means of a ⅜-in. set screw. The turning of such a pulley is frequently beyond the capacity of the lathe at hand, but the job may be got over by cutting out the wood and paring up as true as possible with the wood chisel. Now reverse the headstock and screw the work tightly to the worm centre, and by rigging up a rough rest out of some pieces of wood and taking a light cut with a scraping tool, and finishing with glass-paper, a very satisfactory result will be obtained; boring the hole to fit on the shaft is, of course, the last operation. The overhead will now require to be fixed — in my case the workshop being a wood erection; the two top T-pieces are fastened to the ceiling joists by means of iron clips made of ½-in. by ¼-in. strip. This, with the arrangement of the G.M. bearings, allows considerable latitude, and there is no difficulty in getting an easy-running shaft. In the case of a flat ceiling the same arrangement can be used, or ½-in. gas flanges substituted for the top T-pieces.

Working out the speeds, it will be seen that, assuming a speed on treadle of 120, if the 10 to 10 is used and the 13 ins. to the cutter, the diameter of which pulley is 9 ins., we have a speed at cutter of approximately 1,600 r.p.m.; if, however, the 24 ins. to 4, and then the 13 to cutter is used, the speed is approximately 10,000. These speeds are not out of the way, for their respective purposes, as the lower would do for metal-cutting and the higher for grinding. The various makers give different speeds for different kinds of emery; these vary from 5,000 to 10,000 for a 2-in. wheel, but in practice I have found that the nearer the higher speed the better the work, and the longer the life of the wheel. Wheel should be kept clean, not smothered in oil and grease, as one frequently finds them, and it may be mentioned here that there is a simple and effective way of truing up an emery wheel, which is usually at hand in every amateur's workshop. A small piece of copper rod held in a hand vice and applied to the running wheel will perform this operation quite as well as any diamond tool, and has the distinct advantage of being much cheaper. By its use wheels can not only be trued up, but the edge may readily be altered to suit the work in hand. A few words may be added about the driving band. ¼-in. gut, though undoubtedly the best for grip and wearing is not to my liking; the difficulty of joining the ends without hooks and eyes is considerable, and a permanent fastening would require some cord tightening arrangement, and the hook and eye passing over the small pulley gives a most annoying click. To avoid these troubles I use a fine twisted cord, simply tying the ends together, and though this stretches considerably at the start, it is easy to shorten it by re-tying. It, again, has the advantage of cheapness and grips sufficiently well to do the work. In the case of slipping, a little resin dissolved in methylated spirit and applied to the cord will prove very satisfactory.

Model Rolling-stock Notes.

(Continued from page 130.)

By H. Greenly.

Private Owner's Lime and Salt Trucks.

Another interesting type of private owner's wagon is the lime or salt wagon. Although important from a model maker's point of view, I find that vehicles of this class are not particularly dealt with in the Railway Clearing House specifications, owing, no doubt, to the differences being confined principally to the shape of the body. The latter evidently does not matter to the railway company so long as the over-all limits of size are not exceeded and the recognised sizes of timbers are employed in the construction.

The underframes should be the same as any other wagon, and, therefore, drawings already published may be employed in building up this portion. For small models, the simple methods of construction indicated in the sketch for the 6-ton open wagon in the last article may be adopted (see Fig. 14), dumb buffers being substituted for conical spring buffers, as shown in the photograph.

In the case of larger models the correct timbering of the underframing may be modelled in a more or less perfect way, according to the purpose of the model. There is one point in which all models that are intended to stand rough usage should

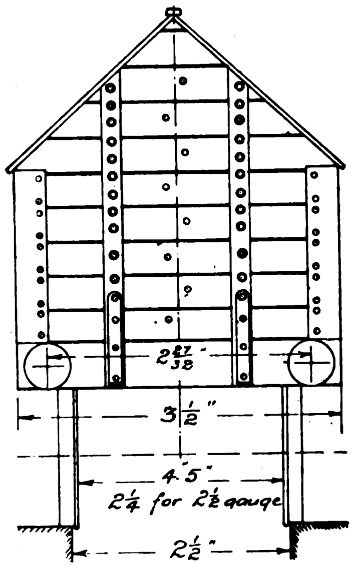


Fig. 18.—End View of Cement Wagon.

follow the practice adopted in all real wagons of wooden construction, viz., the bolting of the headstocks with longitudinal bolts, either to the transverse beams, or, where transverse beams are not used, with longitudinal bolts from headstock to headstock, a pair of longitudinal timbers being used to bolt against and form a rigid structure. The floor, if the grain of the wood runs transversely,

Fig. 16.—Portland Cement and Lime Wagon.

may be made to take the place of cross beams and give lateral strength to the framing. This arrangement is shown in Fig. 20. With such bolts, the work of modelling the draught gear employed on the actual trucks, excellent though it is, may be saved, and the simple device of a spiral spring behind the drawhook may be adopted, as indicated in Fig. 20, at A.

Whatever may be the system of timbering used, some longitudinal support is necessary to the headstock. The work must not be left solely to the joints of the headstocks and solebars. One must picture). The proportions are more or less standard, the wheelbase being 8 ft. 6 ins. instead of the usual 9 ft. of the 10-ton private owners' wagons, and the length over body 14 ft. 6 ins. instead of 15 ft.

The side doors do not lift down, but open outwards. The roof is not continuous, but is omitted in the centre at the door, no doubt to facilitate top loading from the crane, and instead of a movable lid or trap-door being used, the opening is covered by a tarpaulin. Rings are fixed to the sides and roof of the wagon to which the holdfast ropes of the sheet are tied, as shown in the photograph.

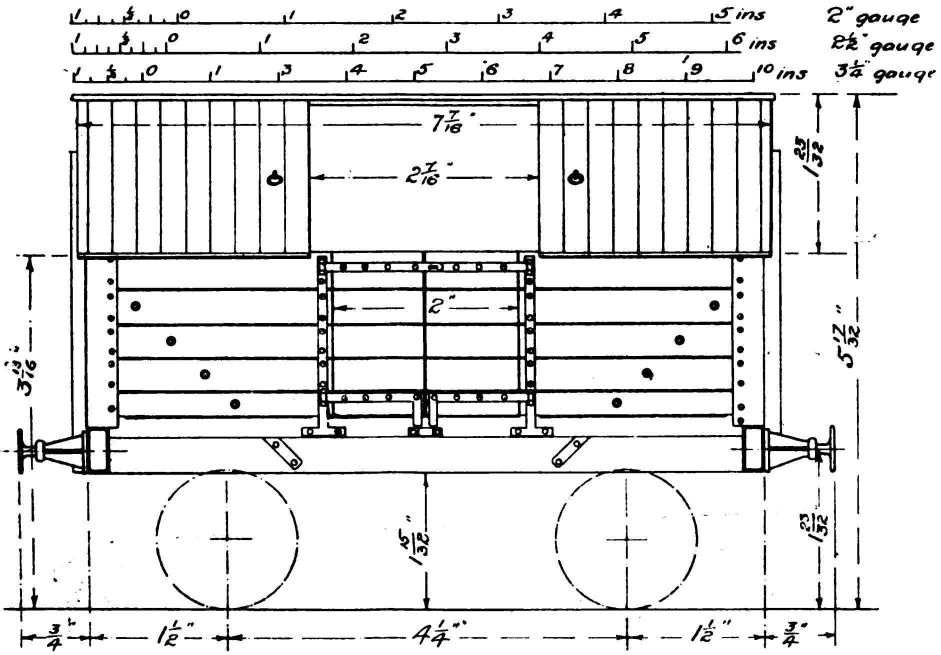


FIG. 17.—ELEVATION OF LIME AND CEMENT WAGON. (*Dimensioned for ½-in. scale model.*)

not forget also that the nearer the construction approaches that of the prototype (which is the result of years of railway engineering experience) the stronger it will be, and in omitting any of the timber usually employed, care must be taken to see that those omitted do not seriously weaken the whole structure.

In the case of the present model, however, great strength is not the essential point. A model lime wagon, in all ordinary circumstances, will be nothing but a model lime wagon. It will not be subjected to the strains which an open wagon for a 1½-in. or 2-in. scale railway will be likely to receive at the hands of the younger members of the family. Therefore the underframe construction may be left to the builder to faithfully reproduce or to modify according to the time at his disposal.

The lime or cement truck, shown in Fig. 16, is one I happened to come across, newly painted and looking fresh and clean. It is evidently an old dumb-buffer wagon, rebuilt with patent pressed steel, self-contained spring buffers of the type detailed in Fig. 12 of the last article (the left-hand

The drawing of the wagon is figured for ½-in. scale, and scales are introduced to enable a prospective builder of one of these wagons to arrive at the dimensions necessary for 7-16ths-in. and 11-16ths-in. scale models.

To make the sheeting, a strong piece of unbleached calico should be obtained from the good lady of the house, duly hemmed all round to the required size, and ten strings of whipcord or good sea-fishing line tied on to suit the rings fixed to the wagon body. The sheet I suggest should then be coated with Stockholm tar and hung out for a few days to dry. It may want a couple of coats to get the right colour, but, in any case, it will have the correct odour.

In making 2½-in. gauge models it must be remembered that the gauge is a little wider than scale, and allowances must be made in the transverse dimensions to suit.

Salt is commonly loaded in wagons of the same general type as those used for lime and cement, *i.e.*, roofed with a pointed roof having gable ends for the protection of the contents. A typical vehicle is shown in the accompanying photograph, Fig. 19. It differs from the Harbury cement truck, depicted in Fig. 16, mainly in the design of the roof. In the salt wagon the roof is continuous and is covered by tarred canvas sheeting,

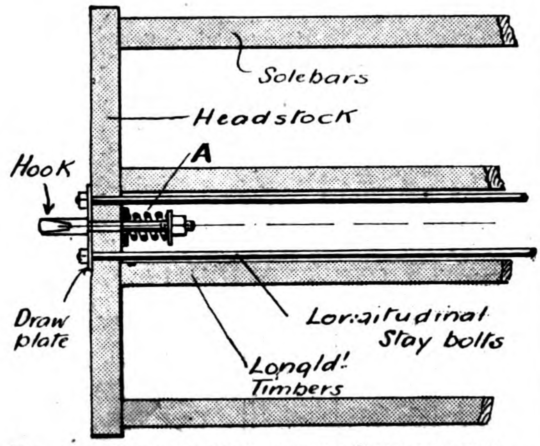


FIG. 20.—SKETCH SHOWING THE LONGITUDINAL BOLTING OF HEADSTOCKS.

turned over the eaves of the roof and nailed with round-headed nails. This wagon can only be loaded from the side. The doors fold over one another, and are secured by a "dog" fastening top and bottom. The roof is of flatter pitch than the cement wagon, and the sides slightly higher.

The "Model Engineer" Suction Gas Plant.

By W. A. TOOKEY.

AS a complement to the small horizontal gas engine, of which drawings were given in THE MODEL ENGINEER some little while back (see *Supplement* to January 4, 1906, issue), it will no doubt interest many of our readers if we give working drawings of a suitable model suction gas plant.

Suction gas power within the last few years has taken a prominent place and has helped the gas engine to successfully compete with other forms of prime movers. The great advantage claimed is the low fuel cost incurred in generating power, and this is especially noticeable in engines of 10 h.-p. and upwards when constantly in operation and where no town gas is available. For smaller sizes also it is used, but oil engines being simpler, costing less as regards initial outlay and requiring rather less attention, any slight saving that would be possible in favour of "suction gas" over "oil" fuel on small sizes, is thus counterbalanced.

These questions, however, would not weigh much with the readers of THE MODEL ENGINEER who are interested as model makers rather than power users.

The smallest size of gas producer known to us is one of 4 b.h.-p., and it will be at once evident that such a size would be much too large to serve the small gas engine to which we have alluded. We can, therefore, claim to be breaking new ground in designing a plant of so small a capacity, and herein lies a difficulty not so much in theory as in

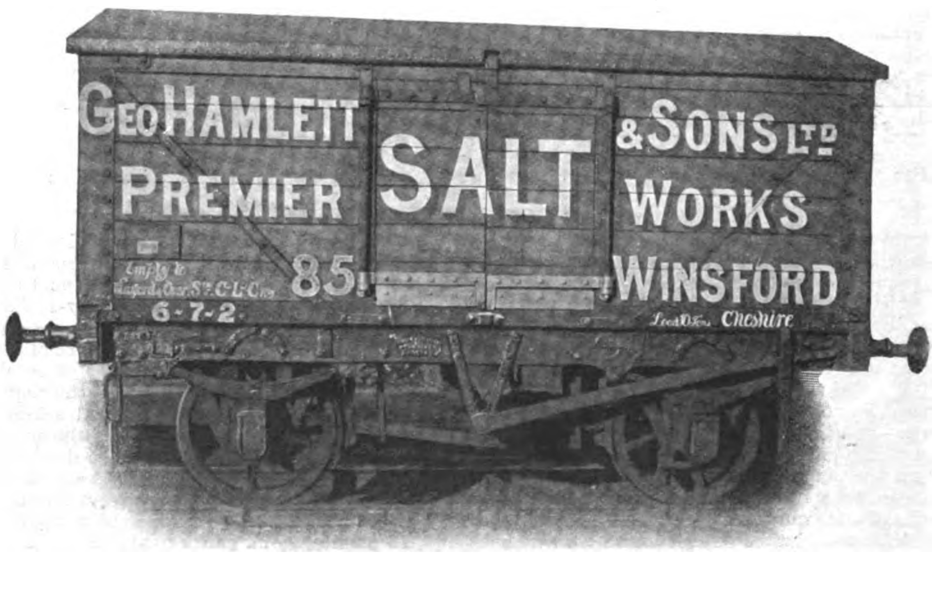


FIG. 19.—A CHESHIRE SALT TRUCK.

Standard axle-guards, grease axle-boxes, and springs, are used in both cases, and also washer plates for the axle-guard bolts.

(*To be continued.*)

practice, it being necessary to keep to such dimensions as will allow the proper settlement of fuel in the generator while, on the other hand, these dimensions must be small enough to maintain a constant working temperature in order that a supply of good gas may be relied upon.

In order to acquaint our readers with the principles involved and also to instruct them how to make good gas, it will be helpful if we give some preliminary notes upon the subject before proceeding to deal with the particular designs we now present to our readers.

The Process of Manufacture of Producer Gas.

The gases generated in any producer gas plant are evolved from a mass of incandescent fuel through which (primarily) air is passed. It is necessary that this body of fuel should provide a sufficient depth of incandescent carbon to allow the proper chemical actions and re-actions to take place. That is to say, the generator must have a "combustion" zone and also a "reduction" zone, while there are also "ash" and "distilling" zones which are formed from residue and fresh fuel respectively.

The combustion zone must be sufficient depth and area to be able to convert all the air admitted, when making gas for full load demands, into carbon di-oxide (CO_2), in preparation for a further chemical change of the carbon di-oxide into carbon monoxide (CO), which is the inflammable gas that it is desired mainly to produce.

Good gas for full load can only be produced when the generator is of such capacity as will allow sufficient depth of fuel to become incandescent to serve for both "combustion" and "reduction" zones. At such times there is, of course, the largest demand for gas and, if the depth of fire be limited, while the "combustion" zone would take care of itself and extend from the base of the fuel to such a height that would ensure the air becoming converted into CO_2, the "reduction" zone would suffer, with the result that the gas produced would only be of poor quality; any CO_2, remaining unconverted, diluting the CO formed in the reduction zone.

Reference to the sketch here given (Fig. 1) will, perhaps, make this clear to our readers. It will be seen that we show, throughout the height of the producer, four different zones. The undermost is the ash zone, being the incombustible residue of the fuel and which, ever increasing, has to be removed from time to time when continual operation is desired. Above this there is the combustion zone in which the air is converted into gas.

The Combustion Zone of a Gas Producer.

Air consists mainly of oxygen and nitrogen in the proportion of 21 parts of oxygen to 79 parts of nitrogen. It is the oxygen of the air which becomes converted, the nitrogen being incombustible and passing through the generator merely as a diluent. Incandescent carbon has affinity for oxygen and, when exposed to a current of air, becomes gaseous, uniting with the oxygen (in the proportion of 1 part of carbon to 2 parts of oxygen) to form carbon dioxide (CO_2).

Consideration of the functions of the generator in relation to the demands of the engine will make it clear that the area of the combustion zone with which we are now dealing will vary in accord with the load upon the engine. Under light loads when less gas is wanted, the area would be more restricted than when full loads involve an increase in the amount of gas required. The combustion zone, therefore, is not strictly defined.

Further consideration will show that the area of the combustion zone is really fixed by the average size of the fuel, inasmuch as before all the air—or rather, the oxygen in the air—can combine with carbon, it must come in contact with a sufficient surface of the latter. The smaller the fuel the more surface available, and *vice versa.*

There is a practical limit, however, to the average size of fuel. If the pieces are too small the fire will be very compact, and excessive restriction will be placed in the way of the air. This restriction will react upon the power developed by the engine, for it stands to reason that the more easily the engine can suck its gas the more power is available for work outside the engine. If the fuel is too large, the chemical combination of oxygen and carbon cannot be completed.

The Reduction Zone of a Gas Producer.

Above the combustion zone there is still further mass of incandescent fuel, in which, however, the heat is less intense. This portion completes the

Fig. 1.

chemical process which, as previously explained, consists of the further combination of incandescent carbon with the CO_2 evolved from the lower layers of fuel, another atom of carbon being taken up as indicated in the chemical formula $CO_2 + O = 2CO$. This reduction zone must be of an area sufficient to convert as much as is practically possible of the CO_2 into CO, and must, therefore, extend to such a point as to allow the exposure of sufficient incandescent surface of carbon to effect this. There is no limit to the height to which the fuel may extend, the extra height only slightly increasing the power absorbed in overcoming the resistances of the fuel to the passage of gases throughout the whole apparatus, but it will be evident that, if the reduction zone be unduly restricted, some portion of the CO_2 would pass away with the combustible ingredients and thus the calorific value (or heat value) would be decreased per unit of volume.

The Distillation Zone of a Gas Producer.

Above the reduction zone there is the fresh fuel, fed into the generator at intervals. This fresh fuel, becoming warmed, gives off its volatile constituents which, in the form of gas, pass away with the gases evolved lower down, leaving the solid fuel, in the form of coke, to sink gradually to the firebars.

* * * * * * *

Up to this point we have been tracing the manufacture of producer gas as if it were formed by the passage of air through the incandescent fuel. In present day practice, air and steam is used instead of air only. The earliest type, similar to that invented by Siemens many years ago, in practice was found to involve difficulties in operation due to the excessive working temperatures producing fusion of the fuel into clinker, thus rendering it necessary to have a battery of generators for continuous working, so that one could be shut down, cleared and re-lighted without interfering with the others. It is not our intention to deal with the history of producer gas manufacture, but it is interesting to know that it was to lessen the excessive temperatures that water was first introduced into the producer gas generators, and it came as a surprise to the experimentalists that the introduction of water entirely changed the composition of the gas.

It is to Mr. J. Emerson Dowson that the successful application of a combined blast of air and steam in producer gas generator is due as, until his invention in 1878, it was impossible to obtain continuous working with one generator. Mr. Dowson obtained steam from a separate boiler and caused a blast of steam and air to pass through the fuel simultaneously. The air was split up in exactly the same manner as we have just described, but the steam was also decomposed into its constituent elements of hydrogen and oxgyen, the oxygen combining with a further amount of carbon, while the hydrogen passed through without further change. This process involved a certain amount of heat to be absorbed from the fuel and thus lessened the working temperatures. The resultant gases consisted of carbon mon-oxide (CO) and hydrogen (H) together with a small percentage of marsh gas (CH_4), the latter being given off by the fuel in the upper layers from the more volatile constituents. It is from Mr. Dowson's producer that suction gas producers have been evolved.

In 1895, Leon Benier, of Paris, and Messrs. Korting, of Hanover, were, unknown to each other, working upon the same idea, which was to do away with the separate boiler which formed part of Dowson's apparatus, the steam being formed by a regenerating device in which the sensible heat of the gases leaving the generator was absorbed by being brought into contact with water. As the gases became cooler the water became hotter, and gave off sufficient vapour to supply the steam necessary for the maintenance of continuous working conditions in the generator.

Experiments determined, however, that steam thus produced was only available in sufficient quantity at atmospheric pressure, and had therefore no power to force the air and steam mixture through the fire. Thus it became necessary to adopt some method of forcing the gas to the engine.

Benier's method was to arrange an auxiliary piston, coupled to the engine crankshaft which acted as a gas pump drawing the gas from the generator through the cleaning apparatus to the engine cylinder, while Korting used a blower and a small gas-holder. Without stopping to trace the pioneer suction plants and their present day prototypes it is sufficient to record that, now the connections are so arranged that the outward movement of the working piston of a gas engine during its charging stroke is utilised in drawing the air and steam mixture through the fuel without auxiliary devices.

The apparatus necessary is therefore of a simple character and consists of (1) the generator in which the gas is produced, (2) a cooler and washer in which the gas is purified, and (3) an expansion vessel in which the sudden demand of the engine for gas is damped down to more steady flow, for, instead of the air and steam mixture being sucked through the fire at each outward movement of the piston which occurs for one stroke only in each power cycle, by means of this expansion box the making of gas is spread over the four strokes of the "Otto" cycle.

The advantage of a "suction" gas plant over the "pressure" type is not due solely to the simplification of apparatus. It is much more efficient, seeing that the sensible heat of the gases is utilised in the manufacture of steam and in heating the air and steam mixture before entry into the generator.

The gas is produced only in such qualities as is called for in response to the load upon the engine, and no gas is therefore blown away to waste as frequently happens in the pressure type of plant when light loads only are being carried.

The suction plant is able to deal with all variations of load upon the engine in this manner, whereas the manufacture of gas by the pressure type of plant could only be reduced by 25 per cent. without recourse to blowing away of gas to waste, any excessive reduction of the blast resulting in the manufacture of bad gas.

Another great advantage of the suction type of plant is due to the fact that, throughout the whole of the apparatus, the gas is at less than atmospheric pressure, and there is therefore no possible leakage of producer gas to the atmosphere. Any imperfect joints would allow air to enter into the connections and spoil the quality of gas, but under no circumstances during the operation of the engine can the gas escape from the apparatus.

This is a matter of some moment, seeing that producer gas consists so largely of carbon monoxide, which is of a poisonous character. The gas is, of course, invisible, but is the more deadly, seeing that it has no odour to characterise it, and detection of leaks, when under pressure, through imperfect joints, is consequently difficult. In a suction plant, as we have said, this danger does not exist under working conditions, but it is necessary to give a word of warning as to its poisonous character because, before the engine is set to work, the passage of air through the fire to produce the proper working heats necessary to the production of gas, is obtained by the means of a starting fan, which creates pressure through the plant.

For this reason it is necessary to provide a vent pipe for use when blowing up, of such a length as will conduct the gases high enough above the ground to avoid "gassing" of the attendant, while, during the starting up process, any gases permitted to escape at the ground level (as at the trial cocks when ascertaining the quality of the gas), should be burnt off by keeping a lighted lamp at such orifices.

(To be continued.)

A Visit to the Royal Scottish Museum, Edinburgh.

Machinery Section.

(*Continued from page 227.*)

AN exhibit which will be especially interesting to builders of model marine engines is illustrated in Figs. 12 and 13, in which are shown two views of models of the engines of the s.s. *Zealandia* and *Australia.* The model is built as well as by hand gear. The surface condenser is placed at the back of the engine, and the water is circulated through the tubes of the condenser by two reciprocating pumps which are placed behind the condenser. These can be seen in the end view. The two air pumps are also placed behind the condenser, and with the circulating pumps are worked by means of links and levers off the L.-P. cylinder crosshead. The feed and bilge pumps are placed beside the other pumps and worked in the same manner. These engines indicate

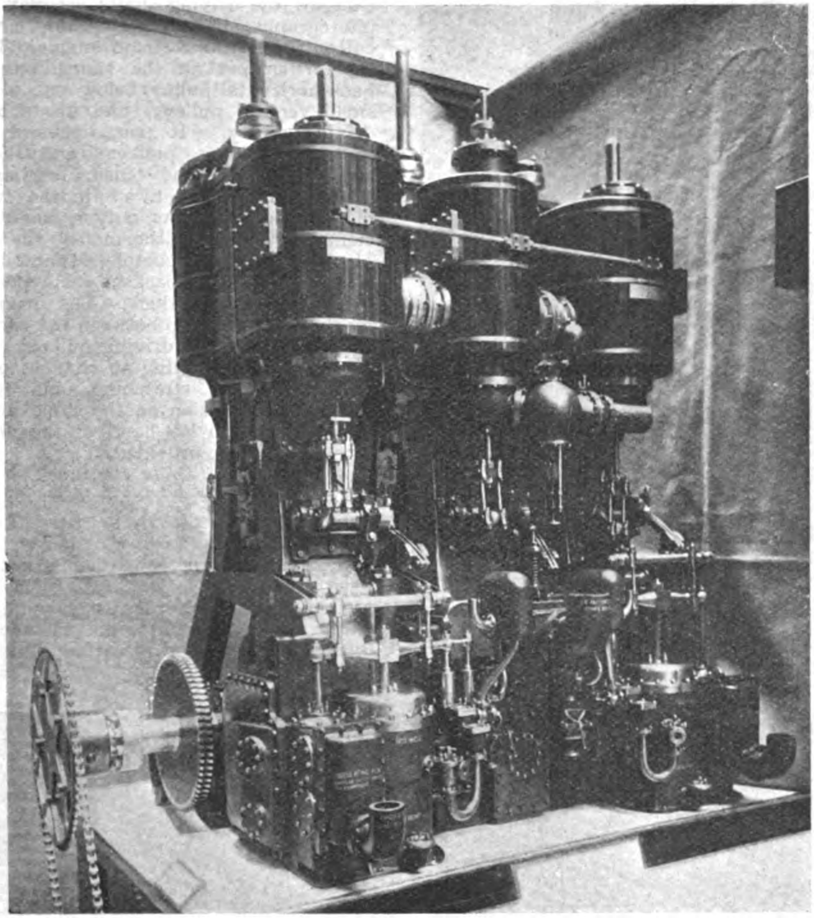


FIG. 12.—MODEL ENGINES OF SS. "ZEALANDIA" AND "AUSTRALIA": THE ROYAL SCOTTISH MUSEUM, EDINBURGH.

perfectly to scale in all its details, and some idea of the proportions may be gathered from the following particulars that we have to hand concerning the prototype. The engines are compound, with three inverted cylinders—one high-pressure, 45 ins. diameter; and two low-pressure, 62 ins. diameter. The stroke of each is 4 ft. 3 ins. The H.-P. cylinder is placed between the two L.-P. cylinders. The piston-type valves are placed behind the cylinders, and worked by eccentrics and link motion. The engines are reversed by a steam reversing engine about 1,800 i.h.-p. at sea, when making 60 r.p.m., with 60 lbs. boiler pressure.

The next model we have thought worthy of a place in these notes is one of unusual interest (see Fig. 14). It illustrates one of the best systems for driving a wire rope used for haulage, and was made from drawings lent by the Glasgow District Subway Company, Ltd. The system is largely used in mines, etc., at home and abroad. In passing we may say that an example of the method is installed on the Glasgow District Subway Railway, and the

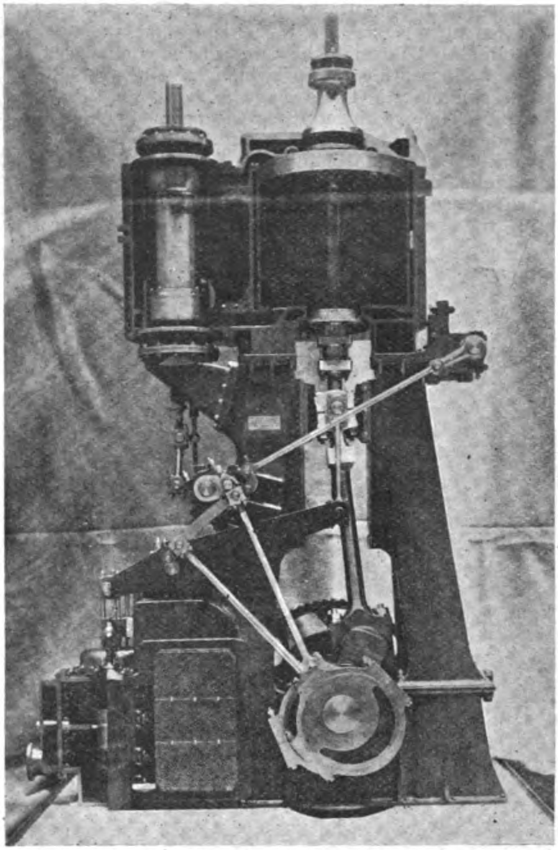


FIG. 13.—SECTIONAL END ELEVATION OF MODEL MARINE ENGINES.

model is a representation of the essential features of that installation. Each line of rails is laid in a separate tunnel, and there is a separate driving mechanism for the cable in each tunnel. One of the mechanisms is completely represented in the model, as well as a very short portion of one of the tunnels, each of which forms a complete ring ten miles round. The mechanism in the model is driven by an electric motor below, by means of two leather belts which pass over two belt pulleys fixed to separate driving shafts, seen at the top right-hand part of the model. In the subway at Glasgow the driving shafts, as may be seen from photographs in the Museum, are driven by cotton ropes from a steam engine. The rope from the further part of the tunnel passes round the back horizontal pulley, below one of the adjacent small vertical pulleys, and up to the right-hand driving pulley. It passes several times round the two driving pulleys, and then round the large pulley on the tension carriage, back to a similar pulley and away to the tunnel, passing out at the front. As only a small length of the tunnel is shown in the model, the cable, instead of going round the complete tunnel in a circle, has had to be brought back at each end of the section by pulleys shown there. The driving is effected by the frictional grip between the wire rope and the grooves of the two driving pulleys. The length of the rope varies, owing to changes of temperature and mechanical stretching, and to maintain a fairly steady tension on the cable, an arrangement, seen at the top left-hand of the model, called a tension gear, is provided.

(To be continued.)

ELECTRIC RAILWAYS IN THE ALPS.—According to the *Elektrotechnischer Anzeiger*, the Bavarian Government proposes to construct a system of narrow-gauge electric railways in the Bavarian alpine district, in order to encourage the tourist traffic. The district would include the fourteen highest peaks of the Bavarian Alps.

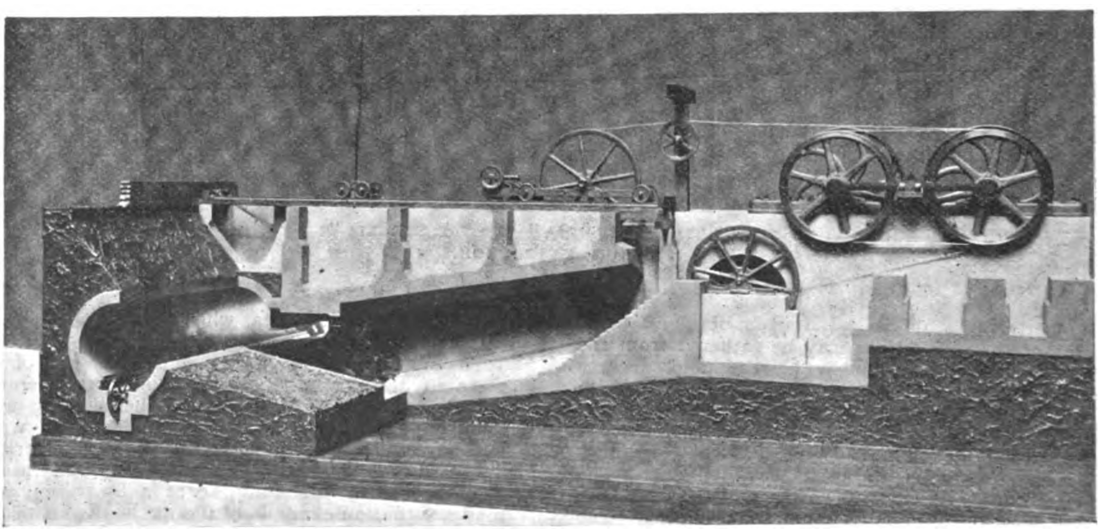


FIG. 14.—MODEL CABLE DRIVER: GLASGOW DISTRICT SUBWAY RAILWAY.

How It Is Done.

[For insertion under this heading, the Editor invites readers to submit practical articles describing actual workshop practice. Accepted contributions will be paid for on publication, if desired, according to merit.]

Making Brass Bearings.

By "Sregor."

(*Continued from page* 228.)

THE previous article explains the making of brass bearings within a limit of accuracy, suitable for general purposes, combined with rapid production. The following description is intended to illustrate method of producing bearings, either if used as a plain brass or white metal surface, and to be on absolute interchangeable accuracy. Of course, what is inferred by accuracy in the case of this article is meant that whichever method is used will guarantee the ordinary degree of accuracy, that is, so that the bore shall be a true, round, and parallel hole, and the outer diameters shall be concentric with same; and whether the joint face is exactly central and parallel with bore does not make any material difference as regards the function of the bearing. But in the event of

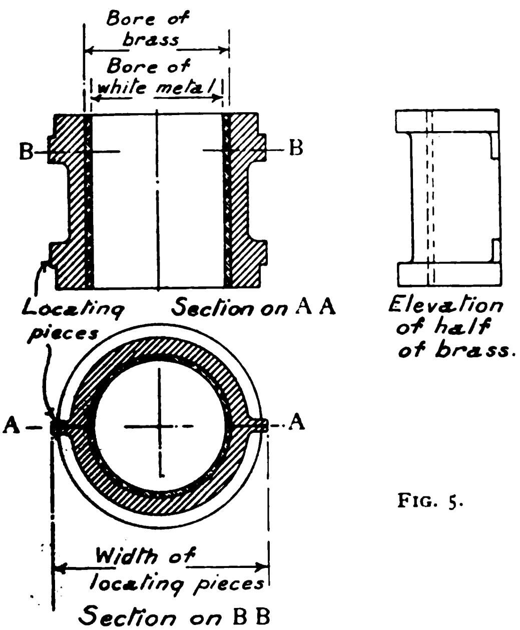


Fig. 5.

attempting to produce each half of the bearing exactly the same, and to guarantee interchangeability, the joint face obviously must be exactly central of the two pieces. Most up-to-date engine manufacturers will attempt to obtain this accuracy, and it is the object of this article to illustrate how the writer has obtained the desired end. It will be observed, from the illustrations previously shown, that the method there described provides for ordinary accuracy combined with cheap production. The points of difference between that method and the one described in the following lines are:—The fact that the castings of the brasses are provided with special locating pieces, as shown in Fig. 5. It will be observed that the width of these pieces is greater than the diameter of the flanges of the brass. The object of this is to provide a definite interchangeable width, to locate and fit the jig into which it fits for the turning

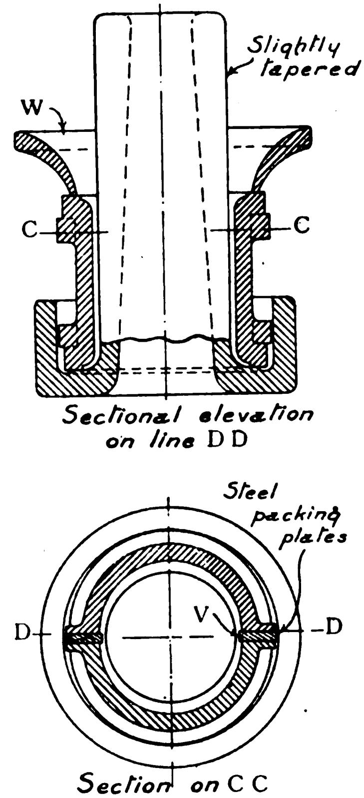


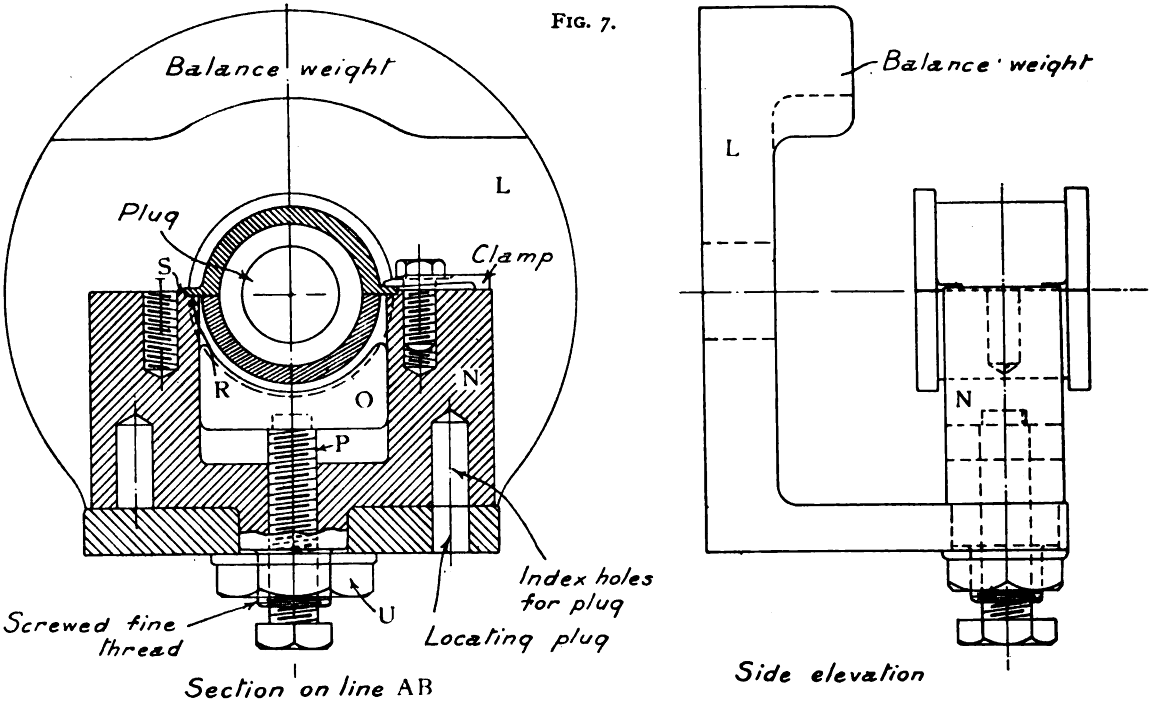
Fig. 6.—Jig for White Metalling Bearings.

operations. The second point of difference is the design of the jig for boring and turning. As shown in illustration Fig. 7, this consists of the angle plates L, which locate on the plug M, which, of course, is turned to size in position, to guarantee running true. While mentioning this plug, I would suggest that this should be made a definite decimal standard size, say 1 in., to fit a standard 1-in. reamered hole, from the fact that, knowing the exact size, it will be useful for gauging purposes for other operations, not particularly applicable in this article. Continuing the parts of the jig, upon the angle plate is mounted the reversible block N, into which the one half of the complete brass is located. The other half brass is held in position by the block O and screw P. The reversible block N is provided with a hole, which must be absolutely in alignment with centre of lathe. These are used for indexing the block when reversing to operate on the opposite end of the work when in position in the jig. Obviously, the two flat faces R must be exactly in line with the centre of the lathe, otherwise the bore of the two brasses will not be equal depth from the joint face. Alsc the two side locating faces S must be equal distances from lathe centre. It will be observed that only the one half brass has the locating piece cast on.

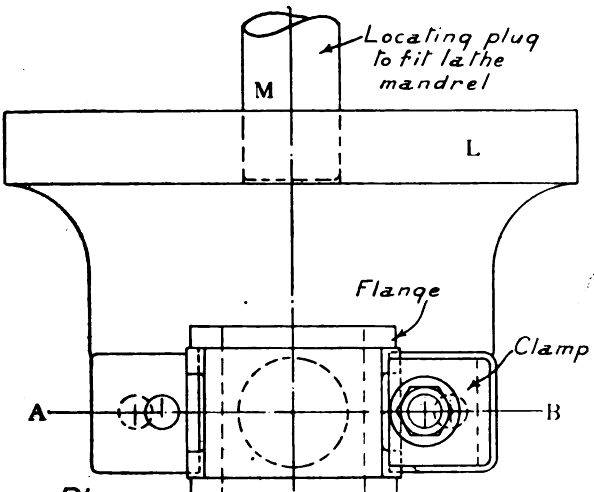
The operations on the brasses are as follows, and a difference of processes between this and that described previously is :—The brasses are made and used as a brass bearing in the previous pages, but in this it is the intention to show how to produce the two halves as a white metal bearing. The advantage of the latter type as a bearing is in the virtue of the white metal, an alloy which, in the writer's experience, is second to none as a high-speed bearing, which can readily be renewed when worn. Again, the cost of the two classes of brass that may be used will differ considerably. A good mixture should be used in the former class, whereas a comparatively soft cheap material can be used in the latter, ensuring cheapness and rapid manufacture. The machining operation on the white metal bearing in the first cost will be more than the plain brass bearing, but this is well counterbalanced by the advantage of being able to renew the metal in the old bearing when repairing. I shall show an addition to the jig, shown in Fig. 7, to effectively deal with the remetalling and boring of the repair bearings to ensure accuracy later in the article.

The operations for the white metal bearing here described are :—Facing the joint faces with the milling cutters, as described previously for the plain brass, with the addition of two side-facing cutters to clean up the sides of the locating pieces, which ensures all brasses will be exactly same width, and snugly fit the jigs. This is accomplished at one cut. The other half of brass receives a cut over the joint face. The pair of brasses are now located in the turning and boring jig, as shown in Fig. 7, the locating half being secured by the two straps T, while the other half is held tight against other by the saddle piece O, and the fine threaded screw P. Referring to the plan view, Fig. 7, it will be seen that the two flanges of bearing overlap the jig, which provides for these being turned at the same setting as for boring. Having secured the brasses in position, the bore can be machined, and when used for white metal it should be a coarse traverse and a rough finish; also the outer flange can be turned to size and the end faced, after which the nut U is slackened slightly, and the locating plug removed, when the reversible block can be turned round until the other hole comes in line with the locating plug holes, which give the correct position. This brings the other flange to the front, and which can now be turned to size, and the end of bore radiused, as shown in Fig. 6, if necessary. In the event of the ends of brass being radiused, it is advisable to recess the ends as shown in Fig. 6, which provides for an even amount of metal at the radiused part, as along the bore. This completes the boring operation. The two halves can be removed from jig, and secured on the special mandrel, as shown previously, and the centre part of the bearing finished, which completes the bearing in the event of it being used as a plain brass bearing. But as a white metal surface the bore must be tinned and lined with this metal. A jig is shown in Fig. 6 for this purpose. When a quantity are required to be metalled, a jig such as shown will be a great advantage, as it provides for a minimum amount of metal being used, and ensures a clean job, and protects

FIG. 7.



the joint faces from getting covered with it. The process is to place the bearing in the jig after the rough boring operation. It will be observed that pieces of steel packing are placed between the joint face of the two brasses; this is to provide a space, and the small amount of metal, as shown at V, can be readily cut through with a saw. Also the thickness of these two packing pieces must be such as to provide that the diameter of the brasses at right angles to the packing will be about equal to the diameter across the locating pads. This gives a definite location in the recess in the jig. The diameter of the bore of jig should be such as to allow the brass to easily enter, after which a plain cramp can be applied against sides of brasses holding the two halves and packing pieces tight together. The bell-mouth top piece W serves as a receiver for the molten metal, and guides same



Plan.

into the brass. The centre portion of jig should be slightly smaller at the top than the bottom, so that it will more readily leave the metal when withdrawing after the brass is lined. The hole in centre of jig is intended to receive the Bunsen flame of gas to readily heat the jig, this being the essential part to be hot when running the metal. As soon as the metal is set, and jig cooling down slightly, a blow on the top of jig with a wood mallet will separate the brasses from the jig, when the two packing pieces can be removed, and the two halves separated, when they are ready to again locate in the turning jig (Fig. 7) to be bored. After which they will be finished on special mandrel same as previously described for the processes on plain bearings. The boring jig must, of course, be provided with at least two holes in back of angle plate at convenient places to bolt jig to lathe faceplate. The jig can readily be removed and accurately refixed by locating on the plug. The jig angle plate is provided with an enlargement to counterbalance the opposite side.

A SPECIAL wireless mast about 140 ft. high has recently been fitted to the French coast defence ship *Furieux*.

Gear Wheels and Gearing Simply Explained.

By ALFRED W. MARSHALL, M.I.Mech.E., A.M.I.E.E.

ONE of the common methods of transmitting motion is by means of wheels which make contact or gear, as it is called, with one another. Movement being given to the first wheel, is communicated by it to the second wheel. Any number of such wheels can be geared together—the movement of the first wheel can be communicated to the second wheel, and by the second to the third, and so on. Two such wheels are called a pair; if there are more than two, the arrangement is called a train of wheels. If the edges or surfaces by which contact is made between one wheel and another are smooth, the power is transmitted by means of the friction existing between the surfaces. The wheel which is transmitting the power is called the driving wheel, and the one receiving it is called the driven or following wheel. The wheels may be of equal size, or one may be larger than the other. In this latter instance the smaller wheel is called a pinion. Fig. 1 shows a diagram of a pair of wheels in gear. If D is the driver, F is the driven

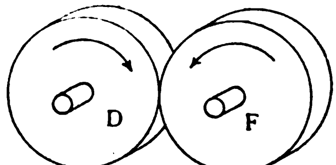


Fig. 1.

wheel or follower. Fig. 2 shows a diagram of a train of wheels; if A is the driver, its motion will be transmitted by B and C in turn to D. Any one of the wheels can be made the driver; for example, B, which will then communicate its movement to A and to D through C. Fig. 3 shows a wheel W and pinion P. The driven wheel will

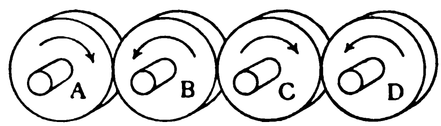


Fig 2

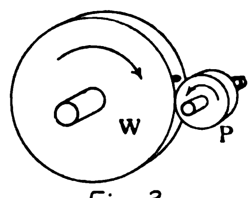


Fig. 3.

resist the action of the driving wheel. It will do this because some friction must exist at its bearings even if no other load is placed upon it. The amount of power transmitted by the driver will vary according to the resistance to motion offered by the driven wheel. If this resistance is too great to be overcome by the frictional grip existing between the contact surfaces of the wheels, the driven wheel will lose movement, and there will be slip between the contact surfaces. To prevent it the surfaces are cogged, or cut into teeth and

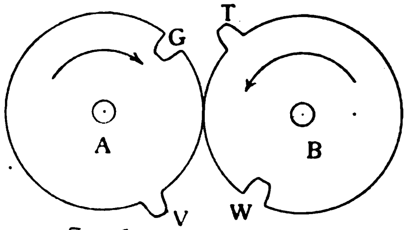


Fig. 4.

made to engage positively with each other so that there can be no slip. By this means an accurate transmission of the motion is ensured. Such wheels are called spur or cog wheels.

Imagine a pair of gear wheels, A B, Fig. 4; B is the driver giving motion to A. If we fix a tooth T upon B to prevent slip, we must cut a groove G in A for it to engage with or the wheels cannot continue to rotate. A series of such teeth spaced at equal distances may be fixed upon the circumference of B, and a series of grooves to receive then cut in the circumference of A. Slip cannot then take place. B is geared into A and drives that wheel positively, or A may be the driver and give

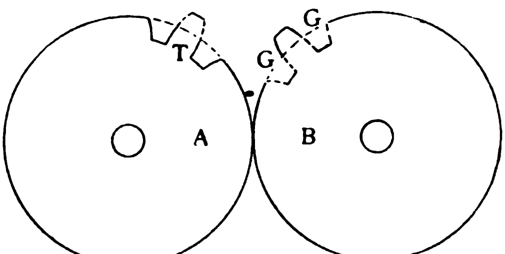


Fig. 5.

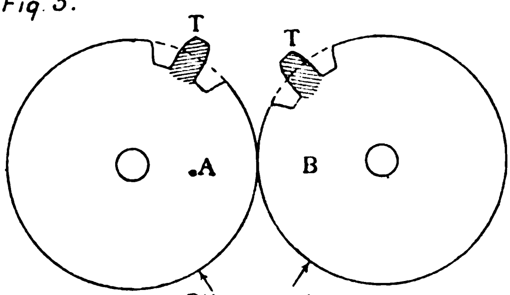


Fig. 6. Pitch circle

motion to B. This positive engagement between the two wheels is entirely due to the teeth T projecting beyond the circumferential surface of B. Matters will be equalised, and the time during which any particular tooth of one wheel is engaged with the other wheel will be prolonged, if teeth are placed upon the circumferences of both wheels. In this instance we should place teeth V upon wheel A for this purpose. We must then cut grooves W in B to receive these teeth. As A is already cut with a series of grooves, and B is provided with a series of teeth, the new grooves and teeth must be placed at the unoccupied parts of the respective circumferences. The teeth will therefore be placed on the parts T of A, Fig. 5, and the grooves cut in the parts G of B as indicated by the dotted lines.

This explains that the teeth of a cogged wheel are made up of two parts, one of which is inside and the other outside the true circumference of the wheel, as indicated by the shaded parts T, Fig. 6. When designing a pair or train of toothed wheels we should therefore primarily imagine them to be without teeth and merely rolling against one another with frictional contact only. In fact, we should plan them as friction gearing and merely add the teeth to the plain wheels thus designed. The circumference of such a plain wheel is called the pitch surface, usually referred to as the pitch circle, because when setting out the gear upon paper

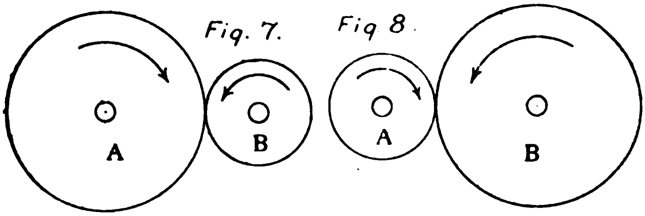


Fig. 7. Fig 8.

circles are drawn to represent these pitch surfaces. In Fig. 6 these circles are shown and represent the imagined pair of plain wheels in contact at their pitch surfaces. The part of the contact surface of the tooth which is outside the pitch circle is called the face, and that part inside the pitch circle is called the flank. The entire portion of a tooth which is outside the pitch circle is called the addendum. When planning a pair or train of wheels, the first consideration is the value or ratio of the gearing. This means the relation between the number of complete revolutions made by the first and last wheels respectively in any given interval of time; or time can be left out of consideration and the value of the gearing be regarded as the number of complete revolutions which the last wheel will make whilst the first wheel makes one complete revolution. The first wheel is considered to be the one which sets the whole train in motion. If the last wheel makes one complete revolution whilst the first wheel also makes one revolution the train is said to be of equal gear ratio. But if we arrange the sizes of the wheels in suitable proportion, the last wheel can be made to give more or less than one revolution for each revolution of the first wheel. If it has rotated more than once when the first wheel has made one complete revolution, the train is said to be geared up; if less, it is said to be geared down.

The ratio of revolutions is determined by the diameters of the pitch surfaces. Thus, if the wheels A and B, Fig. 6, are to make equal revolutions, B making a complete revolution for each complete revolution of A, the pitch circles must be equal in diameter. If B is to make two revolutions for each one made by A, the pitch circle of B must be exactly one-half the diameter of the pitch circle of A, Fig. 7. Suppose that A is to make 1½ revolutions for each revolution of B; the pitch circle of B must be 1½ times as large as that of A, Fig. 8. Thus the required ratio of revolutions

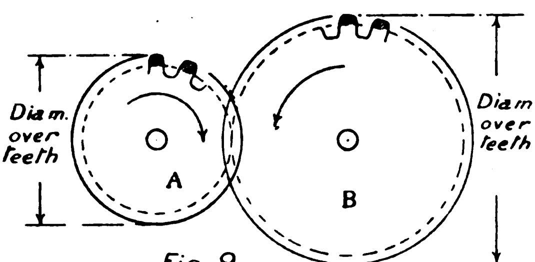


Fig 9.

between the driver and driven wheel is determined, not by their diameters as measured over the points of the teeth, but by temporarily leaving the teeth out of consideration and calculating the sizes of the pitch circles as if there were to be no teeth. Having decided the diameters of the pitch circles, the diameters of the wheels measured over the tops of the teeth is determined by adding an allowance sufficient for that part of the teeth which projects beyond the pitch circles. This is shown by Fig. 9, the pitch circles being the dotted lines and the full circles the over-all diameters of the wheels. The part of the teeth which projects beyond the pitch circle is shaded. Patterns or blanks from which the wheels will be made would, therefore, be turned to this over-all diameter, which thus provides the

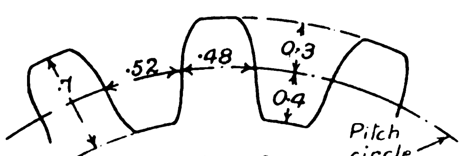


Fig 10

requisite allowance to complete the teeth. When turning up the wheels in the lathe it is frequently the practice to mark a line representing the pitch circle upon the side of the wheel. This serves as a guide when cutting the teeth and fitting them in their place for working.

The ratio of revolutions between one wheel and the other also depends upon the relative numbers of teeth. If wheel A has 20 teeth and wheel B 30 teeth, A will rotate one and a half turns to one complete revolution of B. Therefore we must not only design the pitch surfaces so that their diameters bear the proper proportion, but we must also make the numbers of the teeth in the same proportion. To some extent this question decides itself, because the teeth upon A must be spaced at a distance apart to correspond with the spacing of the teeth which are upon B, or the two sets will not fit properly together; the numbers of teeth should, however, always be calculated and made to correctly correspond in proportion to the diameters of the pitch surfaces. Some difficulty may occur in doing this. The distance from the centre of one tooth to the centre of the next is called the pitch. It is measured along the pitch circle. If the two wheels are to gear properly together, the pitch of the teeth upon A must be the same as the pitch of those upon B. When determining the number of teeth for, say, wheel B, you may find that any number which gives a reasonable pitch and is a convenient fraction of an inch, such as ½ in. or ¼ in., will not divide the pitch circle of A into the correct number of teeth. You cannot have fractions of teeth. If the wheel centres are not fixed the matter may perhaps be adjusted by a slight alteration in the sizes of the pitch circles, still keeping them to the desired proportion. If the centres cannot be altered, you must then arrange a pitch which is as near as possible suitable to the available cutters if the teeth are to be cut, or make a special cutter. There is another method of reckoning the pitch. Instead of measuring it along the circumference, it is measured as so many teeth per inch diameter of the pitch circle. Thus, if a wheel having a pitch circle diameter of 3 ins. is to have 24 teeth, they are said to be 8 pitch, because there are 8 teeth in one inch of the pitch circle diameter. Awkward fractions of an inch can thus be dealt with in a simple way; No. 8 diametrical pitch would be ·393 circumferential pitch. If the circumference of the pitch circle is made of such a size that fractions are avoided the diameter may be some awkward dimension. By working to diametrical pitch, the pitch circle diameter can be made to a dimension which is convenient to measure. Tool makers use this method to a considerable extent, and supply a variety of cutters made to diametrical pitch. Therefore, as a rule, there is no need to go to much trouble when arranging gear wheels, as in all probability you will be able to obtain a diametrical pitch cutter to suit the number of teeth decided upon for your gear. The following formulæ are useful for calculating gear wheels:

The pitch (circumferential) multiplied by the number of teeth and divided by 3·1416, will give the diameter of the pitch circle.

The diameter of the pitch circle multiplied by 3·1416 and divided by the number of teeth will give the circumferential pitch.

The diameter of the pitch circle multiplied by 3·1416 and divided by the pitch will give the number of teeth.

To obtain the diametrical pitch from the circumferential (also called circular) pitch, divide 3·1416 by the circumferential pitch.

To obtain the circumferential pitch from the diametrical pitch divide 3·1416 by the diametrical pitch.

(To be continued.)

Electricity from Peat in Germany.—Preparations are now being made for the building of another large power station in Holstein. The work has been undertaken by the firm of Gebr. Körting Akt. Ges. The large gas engines will be supplied from gas producers generating the gas from air-dried peat. The generating costs are estimated at 0·1d. per horse-power-hour. Electrical energy for light and power will be distributed to various local authorities and manufacturing concerns within the district.—*Electrical Engineering.*

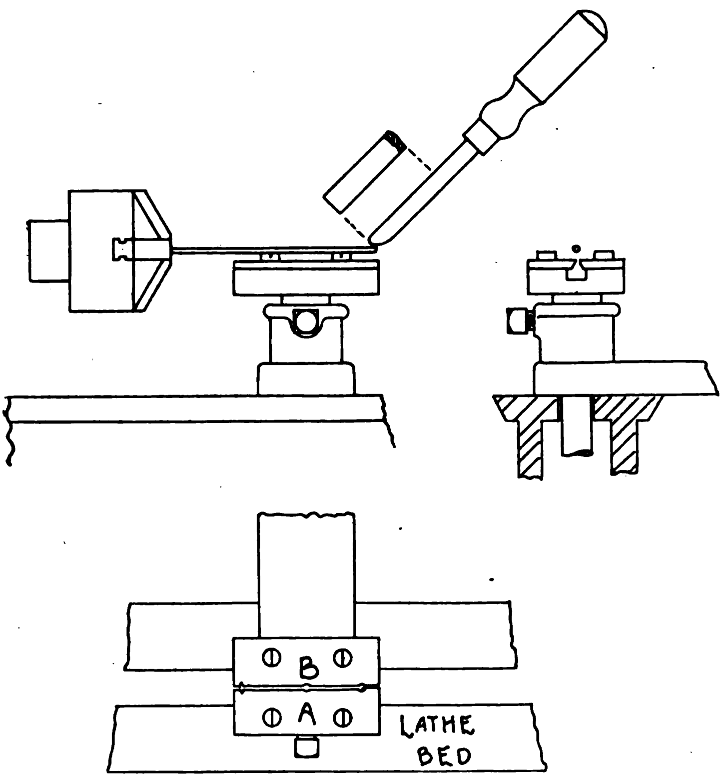
Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Ship's Model Fittings.

To the Editor of *The Model Engineer*.

Dear Sir,—I have read the excellent articles on "The Making of Ship's Model Fittings," by "X. Y. Z.," and they are just what I have wanted for a long while. But I think that the making of stanchions, etc., could be made much easier by using the tools shown in the drawing. The cutter-plates could be made of sheet steel case-hardened, but, better still, of an old flat file softened and filed to shape. The plate B does not require a cutting edge, as it is only a guide. The holes for the screws must be oval, so as to allow of adjustment.



The casting may be of brass or iron to fit the ordinary hand T-rest. The slot is for clearance when the wire is pressed down by the tool C. This tool C may be any old piece of iron or steel, provided it is polished and rounded, as shown. The cutter-plates should be adjusted nearly level with the lathe centres, and a length of wire placed in the chuck. The back centre taken back out of the way; then (the belt being on the fastest speed) the wire should be pressed on to the edge of the cutter by placing the tool in the position shown and pushing it towards the chuck till all the wire over the cutter has been forced through into the slot. A small file should be used to part the now-finished stanchion from the rest of the wire. The wire may now be brought further out of the chuck, or the rest moved and the operation repeated. Before drilling the holes in the balls for the railing wire, each ball should be flattened by tapping with a hammer on a piece of iron. This will facilitate the operation of drilling. I have seen this tool in use in a local model maker's shop, and the stanchions (some only half-an-inch long and as thick as a pin) were turned out at a great rate. I hope this will be of help to some of your readers.—Yours faithfully,

H. K. Lancaster.

Wood Pulleys.

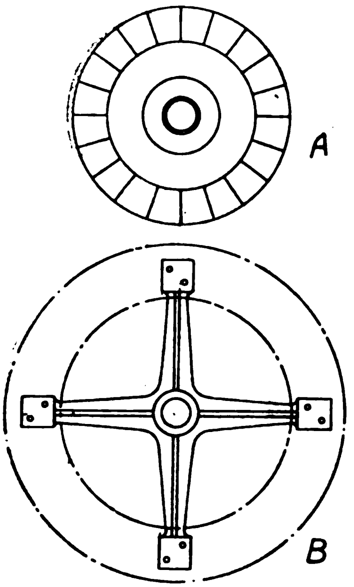
To the Editor of *The Model Engineer*.

Dear Sir,—May I be permitted to criticise your reply *re* above, on page 166 of The Model Engineer for August 13th, not, I trust, in a fault-finding spirit, but in order to assist your many readers who have, like myself, obtained many useful tips and hints from your valuable columns.

As a maker, on several occasions, of wood pulleys, I would like to say that I have found the best results from the following form of construction (A). Take a piece of thick plank about three-quarters the size of the desired pulley, turn up on the faceplate of the lathe, and secure a stout plate to each size (or a cast bush is better, as shown on page 166 of The Model Engineer, as above). Then plane up a number of segments, as shown, and nail same on the central piece or body, taking care to drive the nails well in. Finally, key on a mandrel and turn up true, polish and give whole two coats of varnish, which is far better and more preservative than paint. This will make a first-class pulley, and either hard or soft wood may be employed, depending on the work the pulley is required to perform; but a hardwood body and soft wood segments makes a good job. From my own experience I fear lead could not be used, as suggested, as, being a soft metal it has a tendency to work loose. An iron pulley, however, may be lagged or "cleaded up" by drilling holes through the iron and screwing wood segments on, and this makes an excellent pulley, although somewhat clumsy.

Another very old idea—and one formerly much used by the old millwrights very successfully—when iron was scarce and engineers' lathes still more so—was to cast a four- or six-armed casting with flat "palms" at the extremities, as shown (B). The rim of the pulley was built up of segments (breaking joint between the palms, of course). The palms were screwed to the segments, and another course screwed on each side to cover the heads of the screws. This made an extremely strong pulley, but, of course, somewhat clumsy. I can confidently assert, however, that they will stand up to any amount of hard work, and the belts have a good hold on them.

Trusting you will pardon me for trespassing to this extent on your valuable space, and thanking



you in anticipation for insertion.—I am, Sir, yours faithfully, SIDNEY RUSSELL.

Cranbrook,

Hot Water Supply.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—After reading Mr. Cumming's last letter in THE MODEL ENGINEER, I am bound to come to the conclusion that he does not keep himself up to date in hot water practice. He says he must thank "Hot Water" for his letter, which he says upholds his method. I take it that "Hot Water" intended to point out that the cold supply was in danger of being furred over, thus stopping the cold water supply to boiler. If Mr. Cummings will take the trouble to read very carefully "Hot Water's" letter again, he will find he says, "This is the worst place it could be," also that he has had to clean out boilers connected in this way every three months, no doubt owing to the cold supply becoming choked. Would Mr. Cummings call a job that had to be cleaned out every three months a success? Even in the worst case of furring, if supply is connected to cylinder, the boiler would not require cleaning oftener than once in twelve months. If he must connect to boiler, why take it through the bottom? Would it not be just as well taken into side at the same level as the return or into the return itself? Where does he obtain a copper boiler with hole in this position? I have looked through half a-dozen makers' lists, and I cannot find one listed with a hole in bottom, or anywhere else except holes for circulation pipes. This in itself proves that it is not the general way of doing it. On the other hand, cylinders are always listed with four holes—flow and return steam and cold supply. Does Mr. Cummings, then, say that manufacturers of these goods make them in a different way than hot water fitters require them?

Mr. Cummings says in his letter that the cylinder is the only part of this system to actually collapse. This is quite true, but I cannot agree with him that this occurs more frequently in summer than in winter. A cylinder will not collapse if the steam pipe and cold supply pipe is quite clear, as it is impossible for a vacuum to occur in cylinder if these pipes are free to the open air. The only case of this kind that has come under my notice, and I have been in the trade now about fifteen years, was brought about by the supply tank and expansion pipe being frozen. The fire was lighted, and the hot water bath tap had been opened by someone, which thus allowed the water in cylinder to escape as the pressure began to rise. The people in the house, on finding the bath-room full of steam, put out the fire and shut the tap. Next morning the cylinder looked as though someone had used a good size hammer on it. In this case, if they had not shut the tap, the cylinder would not have collapsed, as air would have entered cylinder through tap to take the place of the steam as it condensed. In the summer there would be no danger from this cause, as the cylinder, if fixed properly, would always be full of water, and therefore could not contain steam. If the water was turned off from the main and cold supply cistern was empty, the cylinder would still be full, and the expansion clear; it would be impossible for a vacuum to occur in cylinder. Perhaps Mr. Cummings does not know there are such things as vacuum valves for fixing to cylinders to prevent this. He also says: "How do you account for the deposit found in cold water service mains?" The deposit in cold water service mains is quite different from the deposit found in hot water pipes, and does not in any way affect the question of the position of the connection of cold supply to hot water installations. When I answered "W. C.'s" query, I did not intend to be drawn into this lengthy correspondence. I did it just to help a fellow-reader out of a difficulty, and, if he has adopted my suggestion, perhaps he would let us know whether he can now get enough hot water for his purpose.—Yours faithfully,

"PLUMBER."

A Small Power Windmill.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—You have been kind enough to insert several letters from me on this subject, and being greatly interested in the letter under the above heading in the August 20th issue of your valuable paper, may I again solicit your kind indulgence for a few words?

First, may I be allowed to heartily congratulate Mr. Woodthorpe on his success? It is not a light matter to build even a small windmill, while it is also far from an easy task to handle one, especially in an exposed position. May I endeavour to assist him on the points he refers to?

First.—Mr. Woodthorpe is quite right; his pulleys are too small. I would suggest that he increase the size 26 to 12 ins., instead of 20 to 7 ins., as proposed.

Second.—The usual arrangement to set the springs is a friction cam, fixing the shutter or spring rod at any desired tension. I have also seen a hand-wheel and screw used, but in this case the mill cannot be instantly relieved or "struck," which is sometimes necessary.

Third.—By all means fix self-acting gear, but the usual "fan-tail" is a costly affair to fix up. Could not Mr. Woodthorpe arrange a vane or "tail" like the windmill described by Mr. Powell at the beginning of last year in THE MODEL ENGINEER? If, however, Mr. Woodthorpe still desires to fix the automatic gear (and it is much the best) I shall be pleased to assist him if he cares to communicate with me, as I may be able possibly to put him up to one or two wrinkles.

Fourth.—A cast-iron windshaft is much stiffer and perhaps preferable, but makes the mill very heavy aloft, and is not so light running as Mr. Woodthorpe's present arrangement. I should be inclined to increase the size of the present windshaft to 2 ins. and still use wrought iron or steel.

I note Mr. Woodthorpe is contemplating fitting his mill with "patent" sweeps. He will find these much easier to handle, but at the same time, speaking from experience of both, it is right I should caution him that they do not give such a strong drive as his present "spring" sweeps, and it is possible he will lose a little power. However, the convenience of "patent" sweeps (especially in an exposed position) is so great that it is well worth losing a slight amount of efficiency. In this connection may I offer another suggestion? With "patent" sweeps there must be a hole through the windshaft for the "striking rod." Now, this will mean re-constructing the whole, and I would suggest that a simple and easy method would be to provide a four-armed casting to receive the stocks or "middlings" that carry the sweeps, and to key this casting to the end of the windshaft, which might be made of a piece of hydraulic tube, if it is possible to get it so large in diameter as 1½ ins. to 2 ins.

I trust you will pardon me for taking up your valuable space, and can only plead in extenuation the interesting nature of the subject, and the pleasure I have taken in reading Mr. Woodthorpe's experiences. Thanking you in anticipation, yours faithfully,

SIDNEY RUSSELL.

Cranbrook.

The Society of Model Engineers.

London.

FUTURE MEETINGS.—Friday, September 18th: Paper by Mr. Percival Marshall, A.I.Mech E., on "Originality in Model Making." Friday, October 9th: Adjourned Locomotive Running Competition. The Secretary will be glad to have notice of any further entries.

VISIT.—On Saturday afternoon, October 3rd, a visit will be made to the Generating Station and Works of the Metropolitan Railway Company, at Neasden.—Full particulars of the Society and forms of application for membership may be obtained from HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green, S.E.

Queries and Replies.

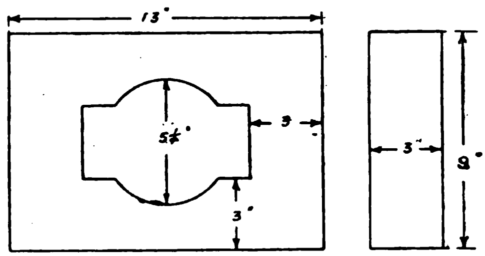
Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26-29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[20,152] Alternating Current Transformer and Motor. J. J. writes: (1) I am desirous of making an alternating current transformer and should be very glad if you would give me the necessary information. I should like to make it of the ring type and, if possible, of iron wire. I should never want to take more than 400 watts off the secondary. I want to use it on the local supply mains, which are 200 volts, at 68 cycles, and the secondary to give 40 volts 10 amps. (2) I have bought, second-hand, an alternating current mains motor. The rotor is of the gramme ring, plain type, and is wound in 40 sections with about 1 lb. of No. 24 D.C.C. copper wire, and has a 40-part commutator. The ring is 3 ins. long, outside diameter 5 ins., and inside 3¾ ins., and is laminated. The stator is unwound, a dimensioned sketch of which I append. Could you tell me about what power I might expect, and also give me a suitable winding for the above to work on 220-volt 68-cycle mains? The stator is laminated and weighs 56 lbs.

(1) Core, ring shape, outside diameter 7 ins., inside diameter 4½ ins., depth 2 ins.; can be made of soft-iron stampings or soft-iron wire, which should be coated with shellac varnish or similar



Query No. 20152

insulating substance. Primary to be wound on first and consist of about 1,320 turns of No. 20 gauge D.C.C. copper wire. Secondary to consist of 240 turns of No. 14 gauge D.C.C. copper wire; about 3 lbs. of wire will be required for each winding; but you should work to the number of turns and not the weight. The secondary voltage can be adjusted by trial. Take off or put on a few turns of secondary until you get the exact voltage wanted. (2) Wind stator with about 4 lbs. of No. 14 D.C.C. copper wire on each core. Connect in series with armature and make a trial. You can only arrive at a workable winding by trial. If motor runs well but takes too much current, wind on some more wire; if it does not start or runs slow, try connecting the two field coils in parallel with each other and in series with armature as before, or take off some of the winding. Try them in parallel first. The position of the brushes is of very great importance and they should be shifted to various places until best results are obtained. Motor should be tried without load. If it fails to run you can try connecting the field coils direct to the main and disconnect from the armature, then connect the brushes by a piece of wire and move them to various positions. Perhaps motor will do better on that system. It will then be a repulsion motor. You may obtain about ½ h.-p.

[20,179] **Magnet to Withstand Pull of 600 lbs.** W. D. G. (Heyside) writes: (1) I want to make an electric magnet that will withstand any person pushing or pulling the keeper from the magnet when the current is on. Is it possible to do so? (2) How many turns of wire will it take for the bobbins, also what size of wire to use, and what size of bobbins and keeper would you estimate? (3) What kind of dynamo would it be best to use so as to have it constant? Also what voltage and current should it be? (4) Can you give me a definite answer to this. How much voltage will resist a person pushing or pulling against it, and how much current? (5) Would an aluminium keeper be better than one of soft iron? If not, what kind of metal would you recommend to have the keenest attraction?

(1) Certainly. (2) Your question is vague. You do not say how the pull will be exerted—whether with one hand or two, whether with or without the use of leverage. A man's pulling power varies enormously according to the amount of purchase he can get. The following particulars are for a magnet to resist a pull of 600 lbs., which is the "average" pull of an "average" man lifting a weight from the floor with his feet firmly planted one on each side of the weight:—Cores, yoke, and keeper of 3·6 sq. ins. cross-sectional area; if of round iron, 2⅛ ins. to 2¼ ins. diameter; material, good wrought iron; bobbins, 1 in. length; winding, about ½ in. deep; wire required, No. 20 S.W.G., 45 yards or 9 ozs.; 204 turns altogether, half on each bobbin. Poles about 3 ins. distance apart (between centres). (3) The current required is 1 amp. We do not advise the use of a dynamo. A couple of medium-sized Bunsen cells would serve your purpose admirably. If you find coils getting hot put resistance in series with the magnet to reduce current. (4) No. Neither voltage nor amperage can resist a pull of any sort. The resistance which an electro-magnet presents to a pull depends upon the number of turns of wire it has upon it, and also upon the current flowing in those turns. So evidently one cannot determine the voltage or amperage required without knowing first the value of all the other factors that enter into the calculation. (5) Aluminium would be useless. Soft iron is the best material known for the purpose.

[18,122] **Alternating Current Motor.** E. C. (London) writes: I should be greatly obliged if you could favour me with a rough design for an alternate current electro-motor to fulfil the following requirements: (1) It must not take up a greater space than 6½ ins. square. (2) It must be self-starting. (3) To work at least at 3,000 r.p.m., more if possible. (4) To give about 1-10th h.-p. on 100-volt circuit (*i.e.*, to run off the Electric Supply Company's mains). (5) The motor to be fairly simple to construct so as to keep the cost of same at a low figure. I have THE MODEL ENGINEER by me—from Vol. III to date, but am unable to find anything suitable, as those shown work too slow and are rather too large for my purpose. Can an ordinary direct-current motor be wound so that it can run on either a direct or alternating current if the voltages are the same in each case, and would the output be the same (*i.e.*, power and speed)? I am experimenting with a centrifuge (medical), electrically driven, and have built one for direct current, but am unable to obtain either a design for the alternating current motor that is suitable or to buy one at anything like a reasonable price, as to make the thing a success it must not cost more than about 30s. to make the motors.

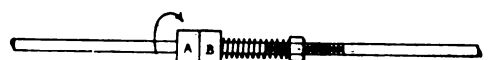
We regret that we cannot comply with your request. It is doubtful if the motor can be made to go in the space you mention or at the price. The only design likely to serve the purpose would be similar to a continuous current motor, series wound, but with field-magnet of laminated wrought iron; in fact, built up with sheet-iron stampings, as well as the armature core. An ordinary direct current motor is practically useless, no matter what winding is used, unless it has a laminated wrought-iron field-magnet and armature; even then the same winding would not do for either current. The power output would also be less with alternating current for equal speeds. We could give you a design through our Expert Service Department for a fee, but you would require to do some experimenting. Different windings would be required also for different voltages and frequencies; the frequency of alternation is not the same for all circuits.

[20,045] **Gas Engine—Valves, Ignition, and Power.** B. F. (Peckham) writes: I bought a small gas engine through your paper, but cannot get it to run satisfactorily. The bore is 3 ins. by 4-in. stroke, ignition by tube. The inlet is simply two holes drilled in the thickness of the cover—one, I suppose, should be for air, and the other gas; but the gas blows right through till it is running quickly. Could I fit a separate air valve? I should like to fit electric ignition. Can I do this with a motor cycle trembler coil? The space for compression is now 1½ ins. Would it be better to put another ⅜ in. on the end of the piston? Should an engine of this size be powerful enough to drive a 200-watt "Crypto" dynamo?

In our issue of March 1st, 1906, we published valve details which we think will give you just the information you require. Yes, motor cycle coil will suit. The volume of combustion chamber should be about one-third volume of whole cylinder. The volume swept by your piston is about 28 cub. ins. So combustion chamber should have volume of about 14 cub. ins., which requires a length of about 2 ins. Give another ½ in. of length to the cylinder. If of good design, the engine should develop 2 b.h.-p. at 450 r.p.m., so that it would drive a dynamo of 1 h.-p. output (746 watts). Have you seen our handbook, "Gas and Oil Engines," by Runciman, 7d. post free? You would probably find it of service.

[20,102*] **Model Airship.** D. C. M. (Rugby) writes: (1) In constructing a small model airship, of the heavier-than-air type, what do you consider the best (lightest in proportion to strength) material for making the framework, and how do you propose fastening the joints, corners, and angles of that material? (2) Supposing I made up my mind to make this framework of wood, what would be the best kind to use, and how could I make the corners and angles? (there would not be room in a small model to fasten them satisfactorily by a mortise and tenon). (3) What would be the best kind of wire to use, and of what thickness do you think it ought to be, for some parts of the mechanism must necessarily be of wire, whatever the rest of the framework is? (4) What do you think would be the most powerful and lightest means of propulsion for driving the propellers? If I use twisted elastic (which I have found fairly serviceable before), can you suggest a light regulating device which would regulate the speed of propellers (whether worked by elastic or other means), for I want to get over the difficulty of the inequality of speed (caused by the motor expending most of its power too rapidly at first) and make the power more lasting. (5) Can you suggest a really good method for coupling two or more propeller shafts, for it is absolutely necessary that one propeller should not work faster than another?

(1 and 2) Some kind of cane is most in favour for frames. For a small machine joints might be tied with waxed cobbler's thread. If special strength is required jointing pieces of light metal may be used. (3) This is a matter for experiment. Use the finest and lightest wire that will bear the necessary strain. (4) Elastic seems about the favourite driving means. Springs are sometimes used, also compressed air. To get a good regulation device is a matter upon which you must exercise your ingenuity. We suggest that you do it by means of a brake, which (by suitable device) is made to bear on the driving spindle at first when the speed tends to be highest, and is gradually withdrawn as the power decreases. You could do it in the manner illustrated below. A and B are hardwood sleeves, A being keyed to the spindle and



QUERY N° 20102.

B loose, an easy sliding fit on the spindle. A steel spiral spring has its one end fastened to B and its other to a nut which runs easily on a thread cut in the spindle. Now matters are so arranged that when the machine is wound up to the full extent of the elastic the nut is at the inner end of its thread, and the spring at full compression. So the brake power is highest at the start of flight when it is wanted. But as the spindle turns, the nut which runs in a groove to prevent its turning works back from the sleeves, gradually releasing the spring. The thread, of course, must be extremely fine, and the whole device must, by trial, be carefully adjusted. (5) Friction wheels gearing would provide a light and efficient means of coupling.

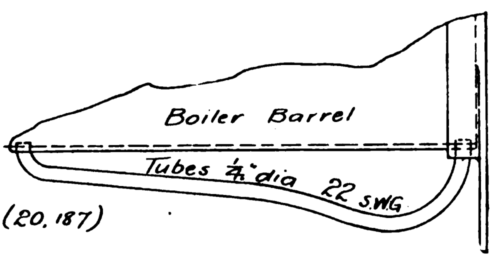
[20,192] **Wimshurst Machine.** E. W. E. (Charlton) writes: (1) I am making a large two-plate Wimshurst machine, plates 18 ins. diameter. I want to experiment with *X*-rays. Will this machine be powerful enough for same? (2) What number of segments should be put on each plate, and size? Should they be of copper or tinfoil? (3) Will it make any difference if the two plates are not of the same thickness? (4) For *X*-rays is it best to design the machine to give a long thin spark or a short fat one? (5) What should be the size of the Leyden jars for this size machine? (6) What handbook can you recommend on the making of Wimshurst machines?

(1) Yes. (2) Thirty-two on each plate is a convenient number, 3 ins. long, ¾ in. wide at one end, and ½ in. wide at other. They should be of tinfoil. (3) No. (4) Length of spark is the important factor. (5) Height, 10 ins.; diameter at bottom, about 24 ins. (6) You will probably be able to do the work satisfactorily by referring to our handbook "The Wimshurst Machine," 7d. post free. But we can recommend Mr. Bottone's book, "Radiography," which can be had from our office for 3s. 9d., post free. This work deals very thoroughly with *X*-ray practice, and gives details of construction for a machine of just the size you intend to make.

[20,187] **Model Locomotive Failure.** C. V. B. (Hull) writes: May I take the liberty to ask you the following questions regarding a MODEL ENGINEER locomotive I have been building? I have finished the engine itself and am able to blow it round in either direction. Starting from any point with a small cycle pump, and with a long flexible connection it will travel along the track. My boiler is of the Smithies type, the barrel being 14 ins. long and 2½ ins. diameter, and is made of No. 22 gauge copper sheet, double riveted. I have tried the 6-wick lamp, flat trays of several designs, but cannot get the engine to run continuously for longer than 10 minutes. The engine refuses altogether to run on the track. Not having a pressure gauge, I do not know what steam I get. Would a blowlamp as enclosed (sketch not reproduced) improve matters? What do you think will be stopping the engine?

As many models to this design have been made, and we have seen several working well when fired by a plain spirit lamp, we do not think that you will obtain success by simply fitting a blow-lamp. It would appear that the piston packing is faulty, and possibly there is some slight leak in the boiler or connections which is preventing the boiler from steaming freely. You will be well advised to fit a cheap pressure gauge (they can be obtained from 4s. 6d. each) and to make another test, not attempting to run the engine until the pressure reaches 50 lbs. or 60 lbs. The blowlamp shown in your sketch is quite unsuitable for the purpose. Presuming that the boiler is well-made and quite steamtight, and that the workmanship of the engine is up to standard, the only thing remaining is to "tune up" engine by seeing that the valves are correctly set, the faces ground steamtight, the pistons packed properly, and exhaust arrangements perfect. You can soon test the engine for faults of this kind by raising steam and, after warming up, turning on steam full and holding engine from moving. If there is any sign of steam coming from the exhaust pipe, then either the valves or pistons are not tight and there is more or less waste of live steam. The engine should stand the test without a whimper. You can, of course, use a paraffin or petrol burner. A No. 1 Primus burner ought to give fairly good results. We presume the joints of the boiler are brazed or silver-soldered throughout.

[20,185] **Further Query.** I have your reply to hand, for which I thank you very much. Since writing you I have found a small hole in one of the cylinders. It has evidently been done during the operation of drilling port holes. I have plugged this up, re-faced valves, and re-packed pistons. I thank for you the remark you made *re* brazed boiler. My boiler, as it happens, is sweated together with soft solder. I think I shall do better if I build another boiler and have it brazed, and should be glad if you will answer the following questions regarding it :—Would a brazed seam stand 60 lbs. pressure (in the barrel) ? Is it necessary to have a downcomer ? Could the water tubes be simply bent up to meet the barrel at both ends ? If barrel could be made from sheet metal with a brazed seam, what would be thinnest sheet to use ?



(20,187)

In reply to your further query, we at first supposed you intended to use a piece of brazed copper tube instead of solid-drawn tube. We do not think the saving in cost makes it worth while. There is no means of estimating the strength of a brazed joint without submitting a test piece off the actual tube to be used to scientific test. However, we think that a piece of 20-gauge brazed tube would stand a working pressure of 60 lbs. easily. It savours of prehistoric model making to build up the tube out of a sheet stuff. The tube would cost you only a little more than the plate and would fit turned ends much more neatly. There is no real necessity for a downcomer on a small boiler ; indeed, it is a debatable point whether a heavy downcomer is not a drawback. It certainly makes more work in brazing (*i.e.*, silver soldering) the joints of the boiler. Combined backplates and ends in cast gun-metal (as shown in our copy of your sketch) can be obtained.

[18,867] **Wind-power Electric Light Plant.** E. C. H. (Carlow) writes : I intend to erect an electric plant to light part of a dwelling-house, using a windmill to work same. My idea is to have a ½ h.-p. windmill, a 25-volt by 5 or 6-amp. dynamo, a battery of accumulators (20 amp.-hour), and Osram lamps. I would like to use a dynamo with eight poles on the armature and eight on the field, and which could be coupled direct to the windmill. The mill will be 10 ft. in diameter ; six sails. The speed of the dynamo to be the same as the windmill (which will have regulators on it). What size and how much wire will be necessary for armature and field? How many segments should there be in the commutator? If the charging current varies from 1 to 5 amps. will it affect the battery? I understand windmill regulators, cut-ins and cut-outs, and resistances.

Presuming that you will get a ½ h.-p. from your windmill, we should advise you to use one of the four-pole machines described in our handbook, "Small Electric Motors," or, better still, a 60-watt machine from "Small Dynamos and Motors," Manchester type, as Fig. 12. It is quite out of the question to attempt to couple your dynamo direct to the windmill, as the speed of the latter will be far too low under the circumstances. You will have to arrange a suitable form of gear, so as to run your dynamo at about 2,800 revoutions per minute. You can charge your accumulators from the dynamo, using, of course, an automatic cut-in and out, as the speed of the dynamo will greatly fluctuate ; provided the charging current does not exceed the maximum allowance for the accumulators, it will do no harm even if it does vary. You can charge accumulators slowly, as you choose ; there is no minimum charge-rate, but the maximum charge-rate must never be exceeded. You may reckon 5 amps. per sq. ft. of positive plate surface as the maximum charging rate.

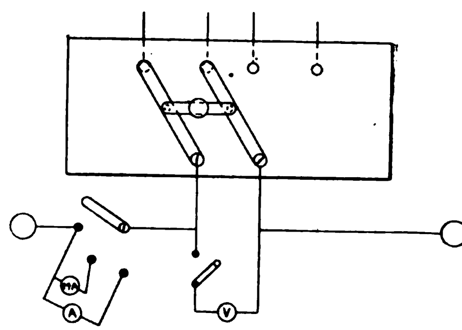
[19,425] **Winding Ring Armature Motor for Generating.** J. H. W. (Newcastle, Staffs.) writes : I have a "Crompton" motor, ½ b.h.-p., 1,650 r.p.m., which I want to rewind as a dynamo suitable for 30 volts 20 amps. Will you please give me the gauge and weight of wire to wind the field coils and armature with, also size of wire to put on for compounding? Sizes of dynamo are : diameter of armature slot holes, 5-16ths in., 24 ; diameter of armature, outside 5 7-16ths ins., inside 3 7-16ths ins. ; length of armature, 4½ ins. Field-magnet cores, 3½ ins. wide, 3 ins. thick, 4 ins. deep, 1 in. space all round for wire.

The output you require is rather too much for this machine unless the armature is run at an excessive speed. Wind the armature with No. 17 gauge D.C.C. copper wire ; get as many turns on the slots as you can ; about 2½ lbs. will be the weight. For field-magnet shunt winding use No. 20 gauge S.C.C. copper wire, about 5 lbs. on each core, making 10 lbs. in all. For a compound winding try No. 12 gauge D.C.C. wound over the shunt coils, a single layer on each core, and the two layers connected in parallel with each other ; the weight will be about 4 lbs. But the compound coils would be better determined by a trial method, such as described in The Model Engineer for August 31st, 1905, page 200. You must not expect so small a machine to be perfectly self-regulating. We advise you to run the armature at about 2,000 r.p.m., and make a trial with full load current ; if you do not obtain 30 volts, increase the speed, and if too high a voltage, decrease the speed. You will probably get the voltage, but may have to be satisfied with less current.

[20,086] **Magneto for Ignition.** W. S. (Asniers) writes : I should be extremely obliged if you could inform me on the following subjects : (1) Could I make a magneto (low-tension, with separate coil) to spark a small petrol engine, with a telephone magneto having three magnets of the following dimensions—¾-in. by ⅜-in. steel, poles 1½ ins. apart, length from back of bend to pole-tips 4½ ins. ; or, would four of the same size be better ? (2) Should the armature be solid or laminated, and what wire and how much ? (3) How are the armature wires connected up ? I presume one is earthed to the shaft. Where does the other go ?

(1) We doubt if three magnets could be made to answer your purpose—you should use four. As they will be of hardened steel, you will need to soften them in order to drill the holes for pole-piece screws, and afterwards re-magnetise them. They should be magnetised to a degree sufficient to enable them to lift nearly 30 lbs. suspended from an iron plate across their poles. (2) Laminated armature is preferable. Wind with nearly ½ lb. of No. 26 D.C.C. (3) One wire goes to shaft, and the other is led out (carefully insulated) through the spindle, or is connected to an insulated ring on spindle, from which current is taken by a brush. See S. R. Bottone's "Magnetos for Automobilists," price 2s. 3d. post free.

[20,050] **Switchboard Connections.** C. B. (Clapham Junction) writes : I have a medical coil and a De Watteville switch mounted on a board. I want to connect up one voltmeter, one amperemeter, one milli-amperemeter and a switch to each. I cannot get the connections right.



Query No. 20050

The above diagram will show you the connections for the instruments. The two ammeters are switched into the main circuit, the whole current passing through them. The voltmeter is put in as a shunt between the handle terminals.

[20,189] **Design for a Boiler.** W. F. M. (Highbury) writes : I am thinking of making a boiler from the design on page 549, Vol. XVIII. I cannot use rivets, on account of the noise. (1) Can I fix ends by stays as in sketch, Fig. 1, as I want them

emovable? How many stays, and what diameter, shall I want? (2) Will the boiler stand 70 lbs. working pressure, with a 4-in.-diameter boiler, 3-64ths in. thick? (3) Will one Primus burner be enough for firing? (4) What should be water-level and size of steam pipe? (5) Must the boiler be emptied after use, and can this be done without moving it?

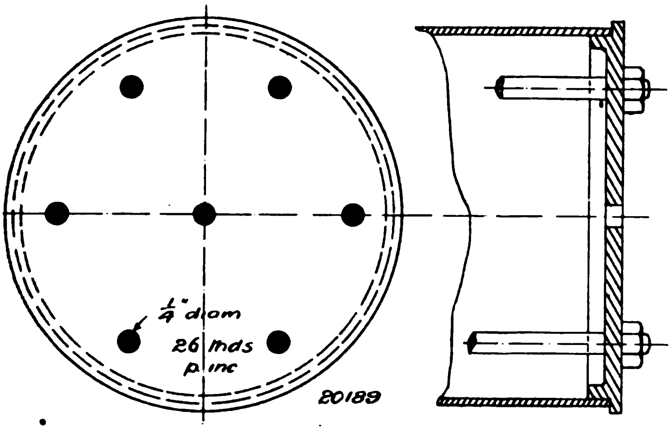


Fig. 1.—Securing Boiler Ends by Bolts only.

(1) We do not favour trusting to the stays and solder only; however, if the stays are well spaced and are amply strong for the pressure on the ends you may adopt this method of fixing. The edges of the tubes should be faced in the lathe. We should advise 4-in. tube, 1-16th in. thick. At 70 lbs. per square inch the pressure on the ends will be 840 lbs. (⅜ of a ton), and allowing not more than 4,000 lbs. per square inch on the stays, you will require, if 5-32nds-in. diameter stays are used :—

$$\text{No.} \times \text{Area at bottom of thread} \times 4{,}000 = 840 \text{ lbs.}$$

$$\text{No.} = \frac{840}{\cdot 01 \times 4{,}000}$$

$$\text{No.} = 21 \text{ stays.}$$

If ¼-in. diameter stays (screwed 26 threads) are used, then the number may be reduced to :—

$$\text{No.} = \frac{840}{\cdot 03 \times 4{,}000}$$

$$\text{No.} = 7 \text{ stays.}$$

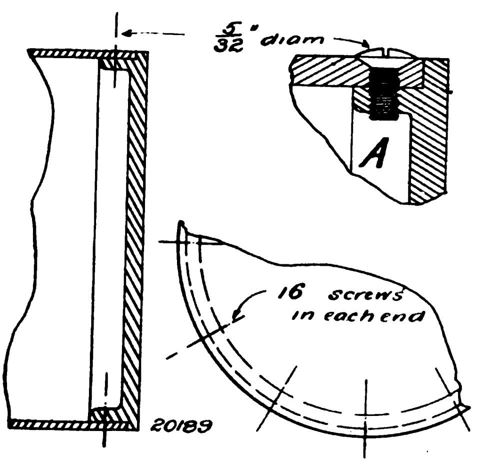


Fig. 2.—Securing Turned Flanged Cast Ends by Screws.

We do not see why you should want the ends to be removable. If you obtain finished castings for the ends (Messrs. Stuart Turner, Ltd., Henley-on-Thames, and W. J. Bassett-Lowke & Co., Northampton, stock this size), you can have them turned as shown in Fig. 2, and to lessen the number of stays partly fix the ends by, say, about 16 brass screws, 5-32nds in. diameter, as shown at A, Fig. 2, sweating the joint with ordinary soft solder. About three stays, 5-32nds for 3-16ths-in. diameter, may then be used to prevent the bulging of the ends. Another method would be to turn or file the ends of the tube to a feather edge as at B, Fig. 3. Then turn the ends to correspond (as at C), and finally bead over the tube and sweat the joint as shown at D, Fig. 3, using three stays ¼-in. diameter to secure the ends against possible accident. The beading-over may be done in the lathe or by hand with a hammer. (2) For 70 lbs. pressure use 1-16th-in. thick tube. (3) One "Primus" burner is not sufficient for 330 sq. ins. of heating surface, and if you do not require the power we would advise a slightly smaller boiler, say 3 ins. by 9 ins. fired by one burner. (4) The lowest water level should be one-third up the steam drum. The steam pipe should be ¼-in. or 5-16ths-in. copper pipe. (5) No, there is no need to empty it if it is kept in-doors.

[20,190] **Model Railway Curves.** A. C. (Warrington) writes: Will you please answer the following questions? What is the smallest diameter of circle a ⅜-in. scale locomotive would safely ride round? Also what weight (about) would engine and tender be in working order?

It depends largely on the type of engine employed on the line. In any case the minimum circle advisable is about 6 or 7 ft. diameter. The weight of the engine and tender of a simple type of locomotive built up from sheet material would not be more than 8 lbs. Why not adopt 7-16ths-in. scale and the standard gauge of 2 ins.? The minimum diameter of curve should be 8 ft. for 2-in. gauge locomotive. See articles in issues of October 3rd and 10th, 1907.

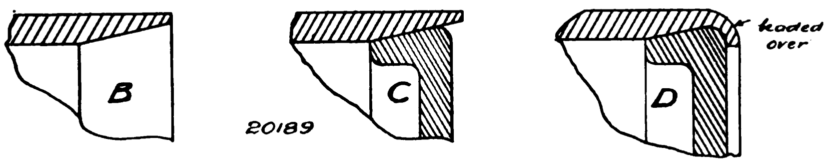


Fig. 3.—Fixing Boiler Ends.

New Catalogues and Lists.

Messrs. L. E. Wilson & Co., 20, Cross Street, Manchester.—We have received a leaflet from this firm giving particulars of Knowle's patent porcelain lampholder, which is specially designed to be of use in such situations as chemical works, accumulator rooms, stables, cellars, saline atmosphere, and damp places generally. Another leaflet gives prices and particulars of the Thomson Electric Gas lighter, which, it is claimed, fulfils the three requirements, namely, safety from fire, economy, and reliability. To this gas lighter may be attached the well-known Thomson lamp, which combination facilitates the use of the gas lighter and prevents an undue waste of gas when lighting up, as the operator can see exactly what he is doing. The combination which is now on the market is a substantial production and is extremely simple in construction and use. Parts for renewal can be had at a small cost. The lamp referred to can be used with or without the gas lighter; the latter, it may be mentioned, is found most useful in any places where a naked light is dangerous.

The Auto-Controller and Switch Co., Simplex Works, Vienna Road, Bermondsey, London, S.E.—We are informed that Fluxite Soldering Paste has recently been adopted by the Indian and Egyptian Governments, from whom the above Company have received large orders. This is another excellent testimonial to the merits of this preparation, which should now be very well known to model engineers.

The Ecco Battery and Electrical Co., Invicta Works, Bow Common Lane, Bow, London, E.—We are notified that owing to the growth of their business this firm have built and equipped a factory at the above address, where they are in a position to deliver goods at a short notice.

The Editor's Page.

On the subject of our Model Speed Boat Competition, we have received the following letter from Mr. T. F. Scott: "I was very pleased to read in August 6th issue of The Model Engineer that you were having speed trials again this year, and to read you invite suggestions as regards the alteration of rules. The way it is run at the present time does not meet my personal approval. The boats only have to run 300 yds.; in fact, they can run three 100-yd. trips, and from that the miles per hour are calculated. Hoping to be a competitor, I want to know what the objection is to boats 4 ft. 6 ins. and over running 1 mile. Then the engineers would have to make larger boilers, and so carry more weight; that would reduce speed, but I think it would be more satisfactory, more exciting, and more skill would be required to construct a craft to run this distance. This is only a suggestion, which I have been waiting to see in print in The Model Engineer for some time. I hope you will consider it and let me know your opinion on the subject. I can, of course, see it will meet an enormous opposition, as all model boat builders seem to me to make their boilers to carry their boats over the present racing course. I notice 500 yds. is the average. Of course, a lot of model makers will at once say—'Where are we to get a piece of water 1 mile long?' but no reader can be many miles from a lake, river, or canal. I should run my craft in the sea. Or, how would it be to run 880 yds.—that equals ½ mile. I hope you will put this before your readers and see what they have to say on the subject."

* * *

Mr. Scott is quite right in supposing that there are very strong objections to running the trials over a mile or even ½-mile course. Those who have had any experience in running model speed boats know full well the difficulties of keeping fast boats to a course, even over a short distance of 150 or 200 yds., to say nothing of the other troubles which would arise over such a long course as suggested. While we appreciate Mr. Scott's suggestion, we should be glad to know whether he holds the same views when he has had some actual experience in the running of fast model boats.

Answers to Correspondents.

J. T. (Siddick).—(1) Either water or wire would serve for the resistances. Your choice must be decided by the special circumstances of the case. (2) 250 volts.

E. H. P. (Ipswich).—We note your remarks and suggestions, and will do our best to satisfy your and your friends' wishes.

A. E. Kimber.—We have not been able to find any published drawings of the particular locomotive mentioned in your query. If we obtain any information on the subject, we will communicate with you. Most injectors will lift the water supply. *Re* Pump—These are made by Messrs. Whitney. We will, if possible, obtain drawing and publish same.

L. W. Taylor (Lancs.).—Our reply to your letter has been returned through the P.O. If you will send your address in legible form, we will post it on to you.

C. J. (Clifford).—We have no particulars of the engine you mention. For explanation of action see our handbook, "Gas and Oil Engines," by Runciman, price 7d. post free.

O. K. (Ronkonkoma).—We do not supply such goods, but any of the firms advertising in this journal would supply you. See "Electric Batteries," 7d. post free. The concluding portion of your letter is not clear.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

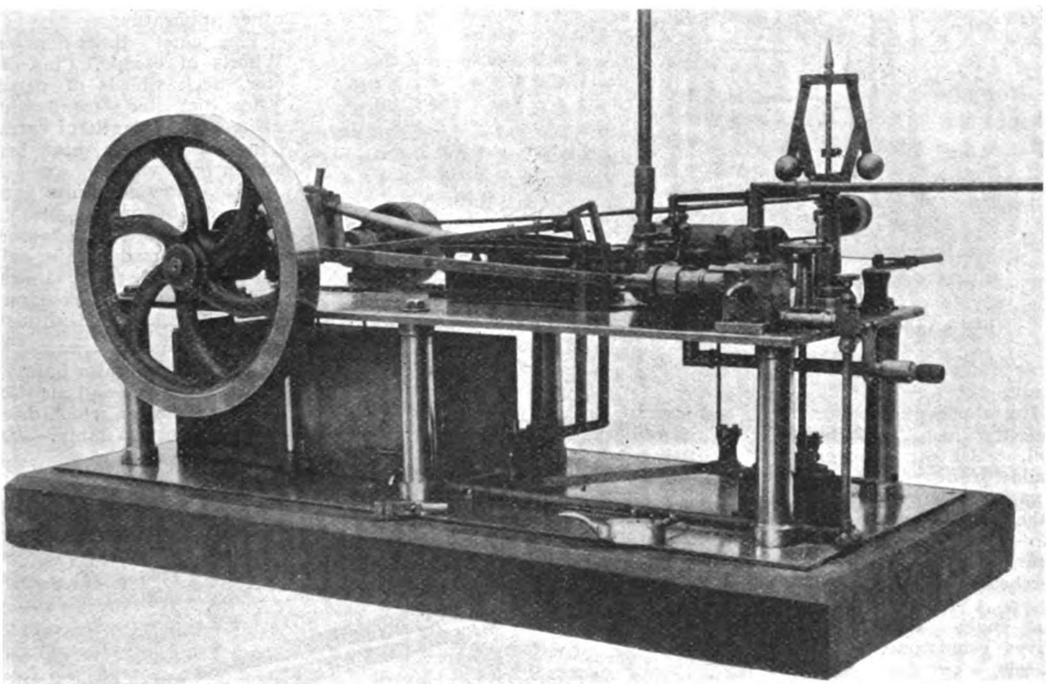
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 387. SEPTEMBER 24, 1908. PUBLISHED WEEKLY

A Horizontal Engine.

By STANLEY FRANCIS.



A MODEL HORIZONTAL ENGINE, BY STANLEY FRANCIS.

THE following illustrated description of a horizontal engine will, we think, interest model makers who have a liking for thoroughness.

Cylinder: Bore, 1¾ ins.; stroke, 3 ins. One ring. Two drain cocks worked by lever shown in photograph. Shaft diameter, ½ in. full. Link reversing motion worked by hand-wheel mounted on a turned steel pedestal through which passes a steel rod terminating in a pinion which engages a ratchet connected with a flat steel rod lifting the link by means of two flat steel vertical arms, the motion being kept in position by a setscrew pressing against rod in pedestal and worked outside bedplate. Flywheel: Diameter, 8¾ ins.; face, 1 in. Length of bedplate, 2 ft.; thickness, ¼ in. full; width, 9 ins. Pulley: Diameter, 2¾ ins.; face, 1¼ ins.

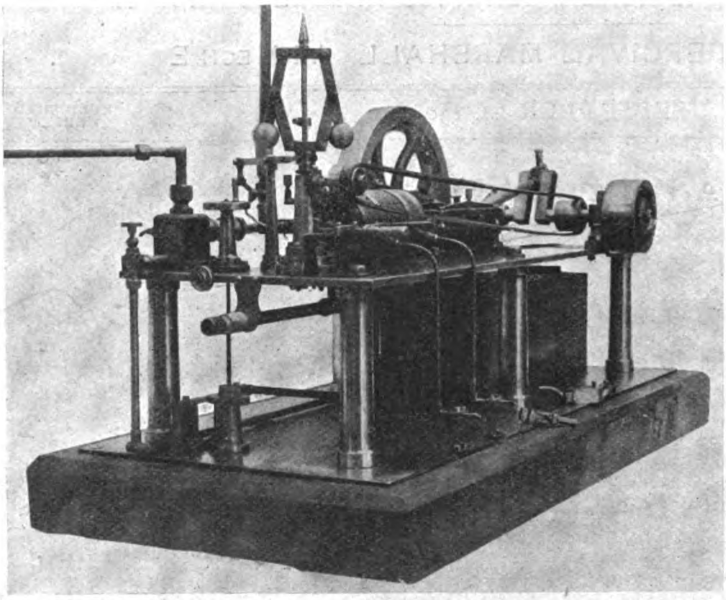
Water tank with two-tap gauge, is under bedplate, 10 ins. by 4 ins. by 5 ins., of brass sheeting

1-16th in. full, riveted, and is connected with pump on bedplate by a brass pipe ¼-in. bore; a screw-down valve close to pump regulates supply.

Working pressure, 20 lbs. Weight of engine in working order, 72 lbs. Total length, 2 ft. 4½ ins.; width, 14 ins.

Steam is supplied by a vertical boiler 14 ins. by 9 ins. of ⅛-in. copper sheet, riveted and brazed, having ten ½-in. tubes, gas or small coal being used. It can work up to 60 lbs., has one 3-tap water gauge, lever safety valve, and generates steam very freely.

The above engine was made from scrap metal, took four months to build, and runs remarkably well. All screws were made from round and hexagon steel rod. The lathe employed was a 4-in. gap-bed back-geared screw-cutting, having overhead motion, driven by a 3 h.-p. Crossley gas engine which also drives grindstone, emery wheels, circular saws, drills, etc.



Another View of Model Horizontal Engine, by Stanley Francis.

A Solder for Aluminium.—A solder for aluminium that has best stood practical tests, says the *Mechanical World*, consists of: Tin, 29 ozs.; zinc, 11 ozs.; aluminium, 1 oz.; 5 per cent. phosphor tin, 1 oz. It can be applied with the soldering iron or blowpipe.

Model Fire Escape and Hose Tender.

By G. Hindson.

The following is a description of a novel fire escape which I have made: She has one main ladder 16½ ins. long, and two extensions each 15¾ ins. long, reaching, when fully extended to a height of 3 ft. 8 ins. She also can be used as a water tower. (The branch is seen on the top of the ladder).

There are two separate winding gears—one for working the ladders, and the other to enable the wheel carriage to be moved to the centre of the ladder, so that it can be run by hand in a horizontal position, and will not interfere with overhead tramway or telephone wires.

The hose tender carries extra hose, also a jumping sheet and other apparatus.

The chief dimensions are: Wheels of escape, 4 ins. diameter, back wheels of carriage, 3 ins. diameter; front wheels, 2¼ ins. dia.; length of carriage, 8 ins.; breadth, 3¾ ins.; brakes act on back wheels.

I have now got quite a complete set of fire engines, *i.e.*, chemical engine, steamer, manual, and horsed escape—all of which are made to the same scale and have appeared in back numbers of The Model Engineer.

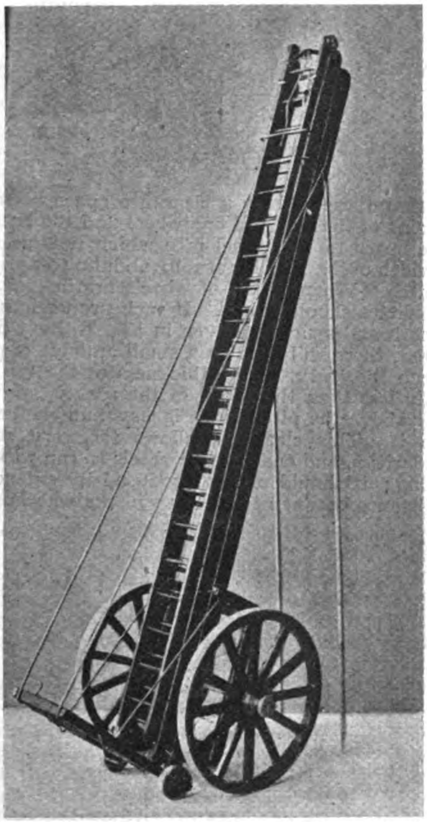
For filling cracks between commutator bars, a stiff putty made of the white of an egg and air-slacked lime is a better filling than shellac, which dries on the surface, leaving the lower portion damp.—*Power.*

A Model Fire Escape and Hose Tender, by G. Hindson.

A Model Sailing Yacht.

By James Campbell.

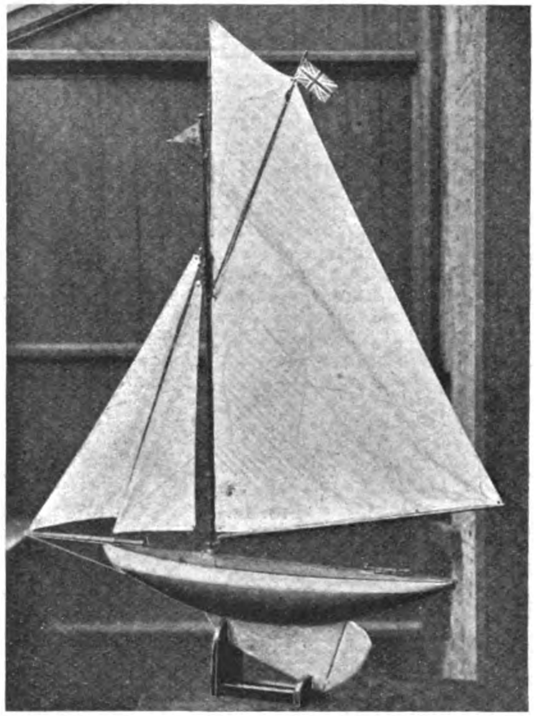
THE photograph of the model reproduced herewith represents the craft which I have just finished. What with living in the country, a blacksmith by trade, and having had no experience of boats or boat-making, I had to feel my way in this my first attempt, aided only by your book, "Model Sailing Yachts." The hull is cut out of



Model Fire Escape, by G. Hindson.

a solid block of red pine, which was first squared up and centres marked, and then divided into sections, as required. I then made templates, using the outside of the hull as a model, and then from these templates constructed another set similar to the first, but $\frac{3}{8}$ in. less, measuring from centre-line of hull to the respective points on the last-named templates. Using these as a gauge, I dug out the hull, as before mentioned. In the lead keel I cast two $\frac{1}{4}$-in. bolts with T-shape heads, and screwed the keel to two short cross-ribs left solid in the hull. The rudder is mahogany, fitted with screws to a copper sternpost, and steering gear is made of sheet brass. The mast and spars are lancewood. The sails were altered many times, until the best results were obtained. They are also carefully finished, and boot-eyes were used in each corner; whilst the mast stays are of four-ply brass wire, with brass lengths at the ends, so that all rigging may be removed when required. The rest of the rigging is American silk fishing-line. The small pulley blocks and cleats are cut from lancewood.

The principal dimensions are: Length of hull, 2 ft. 6 ins.; beam, 5 ins.; draught, 7 ins.; main boom, 23 ins., tapered $\frac{3}{8}$ in. to $\frac{1}{8}$ in.; mast, 30 ins., tapered from $\frac{1}{2}$ in. at deck to 3-16ths in. at gaff; length of gaff, 18 ins., tapered from 5-16ths in.



A Sailing Yacht, by James Campbell.

to $\frac{1}{8}$ in.; bowsprit, $11\frac{3}{4}$ ins. long, tapered from $\frac{3}{8}$ in. to $\frac{1}{8}$ in.; and the sail area, 624 sq. ins.

A convenient form of high resistance is made by spreading upon an insulating surface a mixture of lampblack and a transparent lacquer, an American commercial product called Zapon L. The conductivity of the films may be easily regulated either in mixing or in laying on the mixture, and the resistance may be made in forms varying from a few thousand ohms to many megohms. When the lacquer is dry, there is left a film of pyroxylin, which forms an elastic covering not subject to ordinary changes of temperature, which does not crack nor evaporate, and is a good insulator. Resistances made with this mixture diminish in value rapidly at first, but the variations grow much less with time. A process of baking might bring the films to a steady state at once. The resistances increase somewhat with increase of humidity, but this change can be avoided by keeping the films in sealed tubes.

Gear Wheels and Gearing Simply Explained.

By ALFRED W. MARSHALL, M.I.Mech.E., A.M.I.E.E.

(*Continued from page* 281.)

THE size of the teeth is determined according to the power which they have to transmit. They tend to break at the lowest portion—that is, at the root. If the wheels are well fitted, and the teeth make contact throughout the entire width, they will resist the strain much better than if they are inaccurately fitted. In the latter case they may make contact at some place near the edge so that the

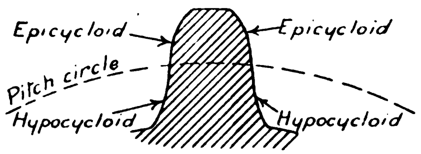


FIG. 11.

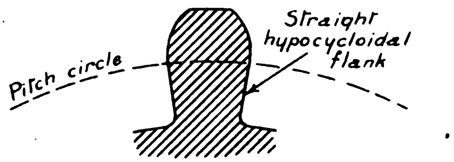


FIG. 12.

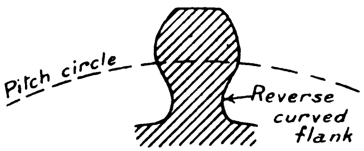


FIG. 13.

strain is concentrated mainly upon a small portion of the metal. The power which a gear wheel can transmit increases with the speed of the rotation. If a wheel has a slow speed of rotation, therefore its teeth must be larger than they need be if the speed is higher to transmit a given amount of power. Generally, there will be two pairs of teeth or more in contact simultaneously, so that you can reckon that the pressure is distributed upon two teeth. All the small classes of gearing likely to be used by amateurs will in all probability have sufficient strength when the teeth are made of recognised good proportions so that no calculations need be made for this. If the teeth are to be cut from the solid—and this is the best method for small wheels—the blanks can be sent to a gear-cutter who will select a suitable tool. It will only be necessary to state the sizes of the pitch circles and the number of teeth to be cut in each wheel. When deciding upon the numbers arrange to have as many teeth as possible consistent with strength and wear. It is not advisable to have less than seven teeth in any wheel.

The teeth are usually proportioned according to the length of the pitch. Different makers vary the dimensions to a small extent. The well-known authority, Professor Unwin, in his "Elements of Machine Design," gives the following (see Fig. 10), the unit being the pitch. These dimensions show that the thickness of a tooth measured on the pitch circle should be slightly less than the width of the interval between the teeth (called the space).

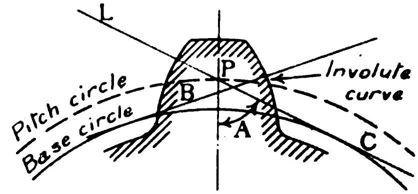


FIG. 14.

Also that there will be a clearance space between the point of the tooth of one wheel and the bottom of the space of the wheel into which it is geared. The width of the wheel is usually about 2 to 2½ times the pitch. When a pair of wheels are in gear, the pitch circles should touch. If such proportions for the teeth and spaces as given in Fig. 10 have been adopted, there will then be a small amount of play between the teeth, as the thickness of the teeth is slightly less than the width of the spaces, and the height above the pitch circle is less than the depth inside it. This clearance allows for very small irregularities, and enables the wheels to run without jambing; it should not be produced by extending the distance between the centres of the wheels.

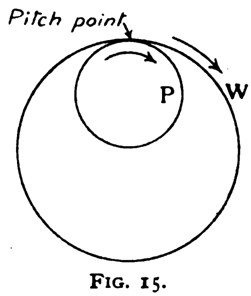


FIG. 15.

There is a kind of gearing used in mill work called mortise wheels. In this one wheel of a pair is fitted with wood teeth dovetailed into slots in the rim. When these are used the proportions of the teeth are altered, the wood teeth being made thicker than the metal teeth of the wheel with which it is geared. The object of the gear is to reduce noise. It would be scarcely used for small gearing except as a model of a large gear.

The teeth of cog-wheels require to be made of peculiar shape. It is not sufficient to make teeth of any pattern which will allow them to engage and disengage during rotation without binding. There is a further consideration: they must be of such a shape that the relative velocities of the pitch circles will not be disturbed as they roll one aganist the other. The pitch circles should continue to roll as if there were no teeth and no slip. Mathematicians have discovered that if the teeth are shaped according to certain well-known geometrical curves, this condition will be practically fulfilled. The three curves which are used in practice are the epicycloid, the hypocycloid, and the involute. When made on the cycloidal principle the contact surfaces of each tooth are composed of two curves. That part which is outside the pitch circle is curved to the epicycloid, and that part which is inside the pitch circle is curved to the hypocycloid (see Fig. 11).

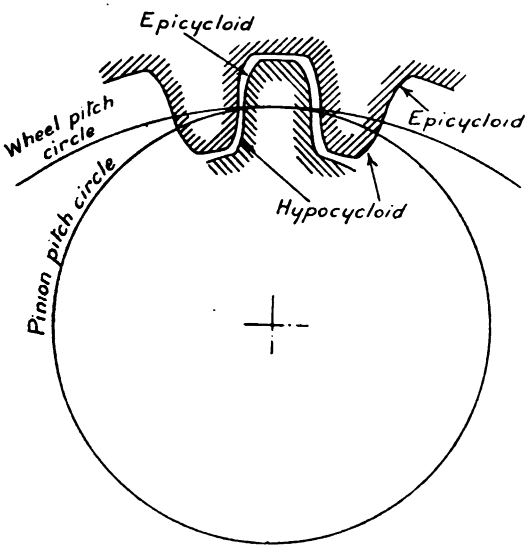


Fig. 16.

A cycloid is the curve which is described by a point fixed at the circumference of a circle when that circle is rolled in contact with a straight line. An epicycloid is the curve which would be described by the point if the circle was rolled upon the circumference of another circle. A hypocycloid is the curve which would be described if the circle was rolled in contact with, but inside, the circumference of another circle.

If the curves of the faces of the teeth on one wheel are formed by the same rolling circle which is used to form the flanks of the teeth on the wheel with which it is to gear, the relative velocities of the pitch circles will not be disturbed by the engagement of the respective teeth. This is actually done in practice. The curves are sometimes really produced by rolling a disc representing the curve-generating circle upon another disc or template representing the pitch circle, or are drawn by compasses to some geometrical construction which gives arcs of circles very closely approximating to the real curve. Constructions of this kind are given in text-books on machine construction; one can be found by reference to page 464 of The Model Engineer, of May 14th last, in Mr. Muncaster's article on engineering drawing. The same generating circle can be used to describe the curves for the faces and flanks of the teeth of each wheel; this is convenient and usual in practice, though two generating circles could be used—one for the flanks of the driver teeth and faces of the driven teeth, and the other for the faces of the driver and flanks of the driven teeth. If more than two wheels are in gear together, or if a number of wheels are required to gear indiscriminately with each other—as in the case of a set of change-wheels for a lathe or other machine—it is necessary to use one circle only to generate the curves for the faces and flanks of the teeth of all the wheels.

Many wheels are made with teeth which have straight instead of curved flanks, the lines being radial. This is quite correct, because a hypocycloid generated by a circle whose diameter is equal to the radius of the pitch circle inside which it rolls is a straight line (Fig. 12). The generating circle should not be made larger than this, as the straight line then becomes a reverse curve, producing a weak form of tooth at the root, as indicated by Fig. 13. For this reason the diameter of the generating circle to form the teeth of a set of wheels of different sizes is usually made equal to the radius of the pitch circle of the smallest wheel. The flanks of the teeth of that wheel will then be straight lines, and those of all the others will be curves. But all will be hypocycloids, and the teeth will not be weak at the root. According to Molesworth, the best diameter of the generating circle is given by 2·22 times the pitch, provided the number of teeth in any one of the wheels is not less than fourteen. If the number be less, the diameter of the generating circle should be equal to the number of teeth multiplied by the pitch and divided by 6·3.

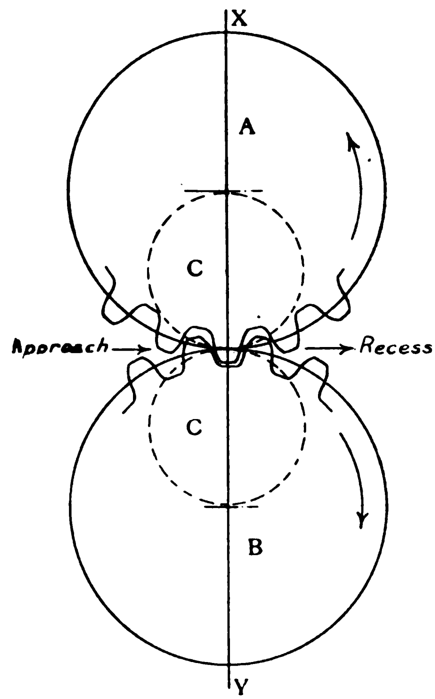


Fig. 17.

Teeth shaped upon the cycloidal principle preserve the relative velocities of the pitch circles only if the wheel centres are at the proper distance apart. If the centres are spread so that the pitch circles do not rotate in contact, the relative velocity is not maintained. If the teeth are shaped upon the involute principle, this condition need not be strictly observed; the relative velocities will not be disturbed if the centres are spread or brought more closely together to a small extent. Any normal wear of the bearings would thus not interfere with the proper action of the teeth. The involute is a geometrical curve produced by the end of a stretched cord which is being unwound off a cylinder or the circumference of a circle; it would also be produced by the end of a straight line which is being rocked upon the circumference of a circle. In either case the circle is called the base circle, and the curve produced is called the involute of that circle. Teeth shaped upon this principle do not have two curves for their contact surfaces; the face and flank at each side of a tooth is formed by one and the same involute curve (see Fig. 14). The curve is produced by the end of the line B, which represents the cord or straight line rocking upon the base circle. Such teeth are of strong shape, and all wheels with involute teeth will work correctly together if the teeth are of the same pitch and obliquity of line of contact. That is a line L C (Fig. 14) making contact with the base circle and passing through the pitch point P. For a set of wheels, any pair to work together, the radii of the base circles must bear the same proportion as the radii of the pitch circles. A curve consisting of an arc of a circle can be produced which is very near to the true involute curve; geometrical constructions for this are given in text-books on gearing and machine construction. According to some authorities, teeth shaped to the involute curve exert a thrust along the line joining the centres of the wheels (called the line of centres), thus exerting extra pressure upon the bearings; therefore the involute curve should not be adopted if the wheels have to transmit a considerable amount of force. Others do not agree with this. Hawkins, in his book on the teeth of wheels (largely translated from the work of the French mathematician Camus) describes an experiment made by him with a pair of wheels having involute teeth. The wheels were tried with the teeth engaging at various depths, and did not show any tendency to thrust the centres apart until they were placed with the teeth only engaged to a depth of ¼ in. out of a total depth of 1½ ins.; even then the tendency to separate the centres was very slight. Involute cutters are stocked by tool dealers, and the curve is favoured in American practice. If the angle A (Fig. 14) be made as large as practicable, involute teeth appear to give good results in working. The effect of increasing the angle A is to bring the circumference of the base circle close to that of the pitch circle, the result being short teeth.

Gearwheels can be made in the form of a ring with teeth inside the circumference instead of outside. Such wheels are called internal or annular gearwheels. Such a wheel can obviously only gear with another which has external teeth and is smaller in diameter, because the second wheel is placed inside the first. These wheels are calculated and set out according to the diameters of their pitch circles, as in the case of external toothed gears. The pitch circle of the pinion P being inside that of the wheel W (Fig. 15), and touching at the pitch point. If the diameter of the pitch circle of the wheel W is four times that of the pinion P, the latter will make four revolutions for one revolution of the wheel, and so on. The numbering and proportions of teeth apply as in the case of external gears. Cycloidal or involute curves can be used for the shape of the teeth. If cycloidal curves are used, they will be transposed in the case of the teeth of the wheel. The curve-generating circle for the faces of the teeth will roll inside the pitch circle, and therefore produce a hypocycloid, and that producing the flanks will roll outside the pitch circle and therefore produce an epicycloid (see Fig. 16). An internal gearwheel can engage with several pinions simultaneously. In such an instance the curve-generating circle for all the teeth should have a diameter equal to half that of the pitch circle of the smallest pinion. There is an important difference between the working of an internal and external pair of toothed wheels. If the wheels are external, they rotate in opposite directions, but if internal, they rotate in the same direction as indicated by the arrows (Fig. 15).

If the teeth are made as so far explained, with a part projecting beyond the pitch circle as well as a part inside it, any pair will come into contact as they approach the line of centres, and this contact will be maintained to some distance after they have passed the line of centres. For example, a pair of wheels A B (Fig. 17) are in gear. The teeth of wheel A come into contact with those of B to the left of the line of centres X Y, the wheels rotating in the direction indicated by the arrows. They are then said to be engaging. After passing the line of centres they are said to be disengaging. The contact is maintained for some distance, but finally ceases as each pair of teeth pass out of gear. The distance through which they make contact when engaging is called the arc or angle of approach, and that through which they move when disengaging is called the arc or angle of recess. The actual path followed by the contact point is a curve in the case of cycloidal teeth, which consists of arcs of the tooth-generating circles C C (Fig. 17), any particular tooth commencing to make contact at a point in one circle, and leaving contact at a point in the other circle, as indicated by the full lines. In the case of involute teeth the path of tooth contact is along a straight line, such as L C (Fig. 14), commencing inside one pitch circle and ceasing inside the other pitch circle.

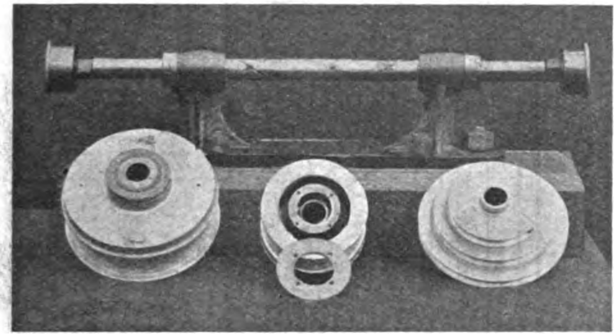
(*To be continued*).

An Electrically Operated "Clutch" Countershaft for a Small Lathe.

By Stanley H. Freeman.

THE following is a description of a magnetically operated clutch, forming the "countershaft," so to speak, for driving a small lathe. The chief point about it is the quickness with which the speed of the lathe may be changed from fast to slow, and *vice versa*, by the movement of a switch only.

There is only one casting used, which consists of the base, two bearings, and supports to same. The bearings were bored out by clipping the casting down to the saddle of lathe and using a boring-bar finishing the bearings to size with a standard ¾-in. reamer. The shaft was then turned up to size, drilled up for the "Stauffer" lubricators, and the grease channels cut with chisel and file. These are well shown in the photograph. The bearings are lubricated with oil held by two small lubricators with wick-feed. These can be seen just under the bearing. (When the clutch is in place over the lathe it is the reverse way up to that shown in the photograph, of course.) The holes through the webs of the casting were then drilled and insulated with fibre and the binding-screws fitted which take the current-supply wires and also the wire spring which conveys current to energise the pulley magnets. These two can easily be seen in the photograph.



View showing Parts of an Electric Clutch.

The two "magnet pulleys" were next made from solid mild-steel forgings, and there was a great deal of work attached to them. They were first mounted on the faceplate and the centre-hole bored and reamered to 1 in., to take the bearing bush. The forging was then mounted on a specially made mandrel chuck and the remainder of the turning done; cutting the groove to hold the wire which magnetises the pulley was the worst job, and took a long time. The two pulley magnets are identical as far as design goes, the only difference being in size.

The next thing was the two bearing bushes, made from gun-metal castings and driven tightly into the 1-in. holes in the magnet pulleys. On the end of each is fixed an insulated gun-metal ring, with a groove turned in its periphery to take the wire conveying current to the wire energising the magnet. The lathe-driving pulley proper is just a plain stepped cone pulley, made from a mild steel forging and fitted with a grub-screw to fix it on the shaft.

The magnet coils were made next on wood formers, and of such a size as to go into the grooves turned out for them when well insulated with silk and shellac. The two ends of the wire are brought through two insulated holes in the back of magnet and one end "earthed," *i.e.*, connected to the pulley itself, and the other taken to the insulated ring on bearing bush. The faces of the pulleys are recessed about 1-32nd in. for the brass covers screwed on with countersunk head screws to hold the magnet wire in position. The covers just grip the coil of wire, and so prevent any movement should the lathe be stopped suddenly from any cause.

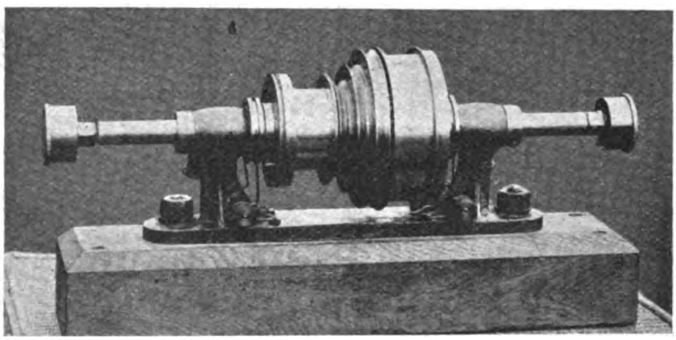
The whole was then assembled and found to behave quite satisfactorily. The action of the clutch is this: you have your two pulley magnets being revolved by two separate belts from the source of power. These pulleys run loose on the shaft, exactly as any other loose pulley, about ⅛ in. clear on each side from the centre cone pulley connected to the lathe by belt. Now, supposing one wants a fast speed: you simply move the arm of your two-way switch to the stud connected with the small pulley magnet. This allows current to pass, and the pulley becomes powerfully magnetic, and consequently pulls itself along the shaft until it reaches the cone pulley, which it grips and consequently drives, and, doing so, drives the lathe fast. Now you want a slow speed. Shift the switch from the fast stud. This cuts off the current from the small pulley on to the slow stud, which operates the larger pulley magnet in exactly the same way.

The pulleys were found to stick to the cone pulley after the current was cut off, so a springy disc of brass was cut out and given a slight bend, and put on each side of the cone pulley. This acts as a spring, and separates the pulleys from the cone pulley, and at the same time in no way interferes with the efficient working. It is arranged for a 110-volt supply, and drives a 3½-in. Drummond lathe. All the work was done on a 4½-in. lathe.

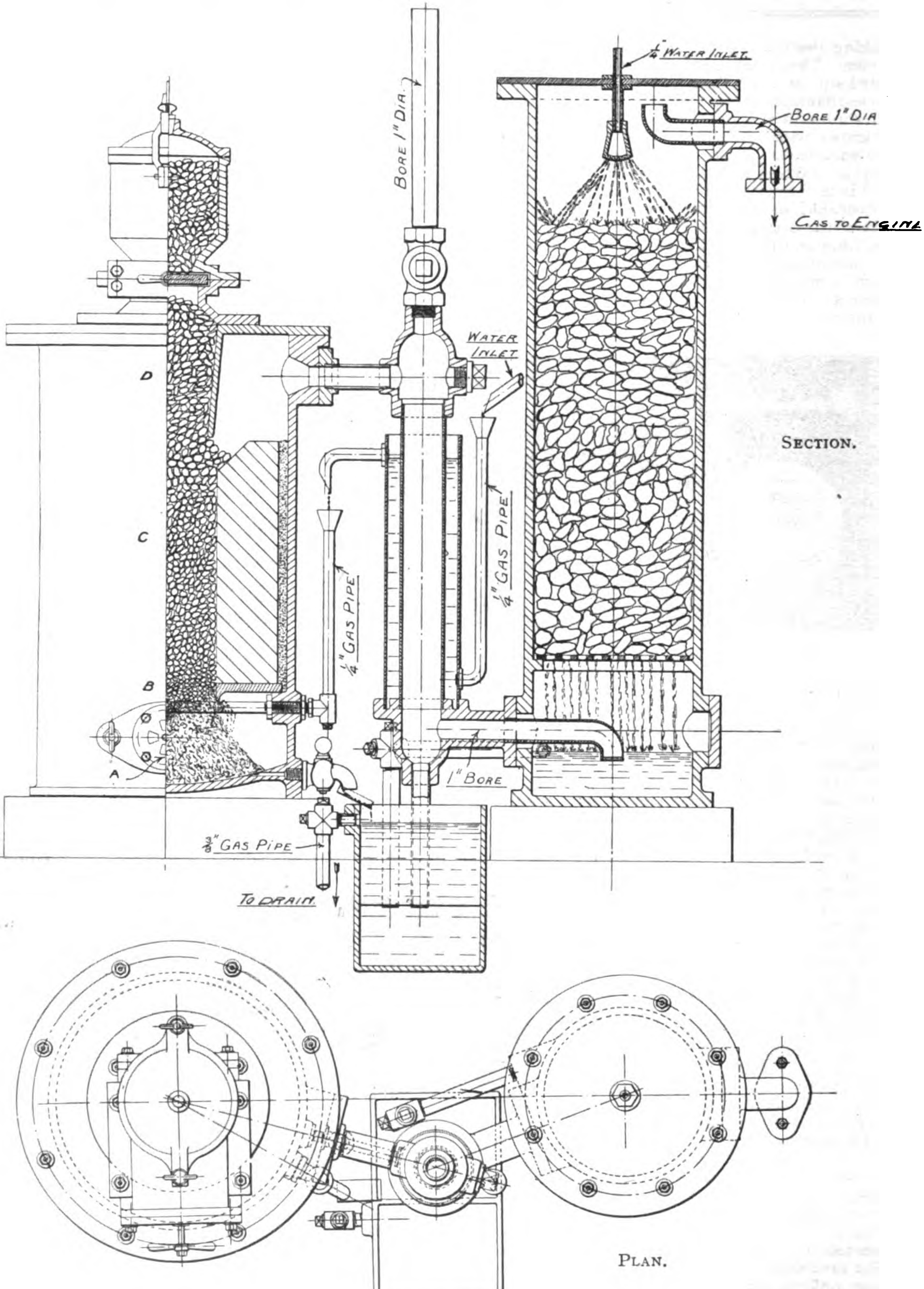
The leading dimensions are:—

Shaft, 12 ins. long.
Length between centres of bearings, 8 ins.
Length of bearings, 1½ ins.
Diameter large magnet pulley, 4½ ins.
Diameter small magnet pulley, 2½ ins.
Magnet coil spaces, 1½ ins. deep by ½ in. wide.

The Mersey Dock Board have decided to fit the North-West light-vessel and Bidstone lighthouse with Marconi wireless telegraph installations. The apparatus will he hired, the arrangement being for one year certain, with the option of determining the lease on a three-months notice afterwards.—*Mechanical World.*



General View of Electric Clutch.

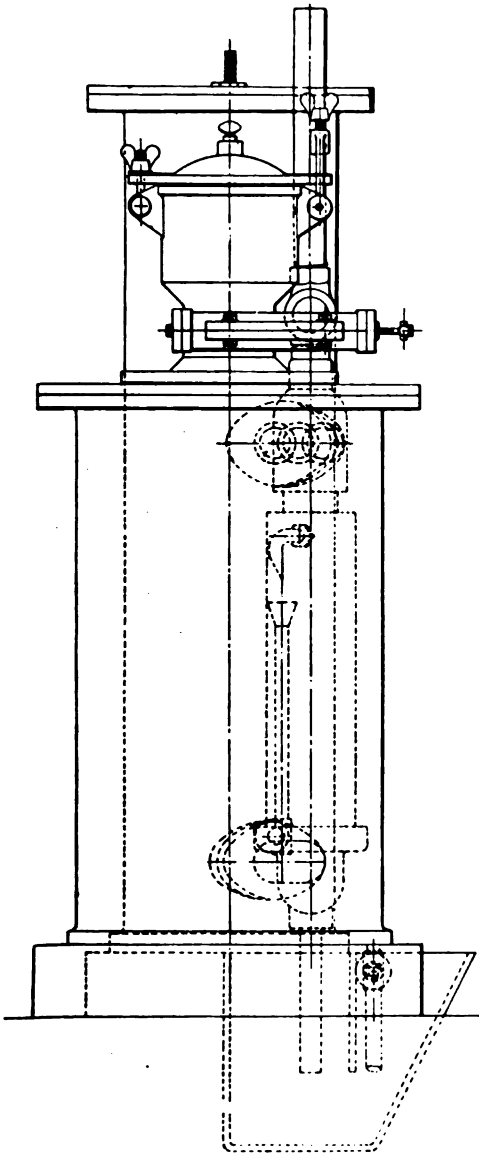


The "Model Engineer" Suction Gas Plant: General Arrangement.

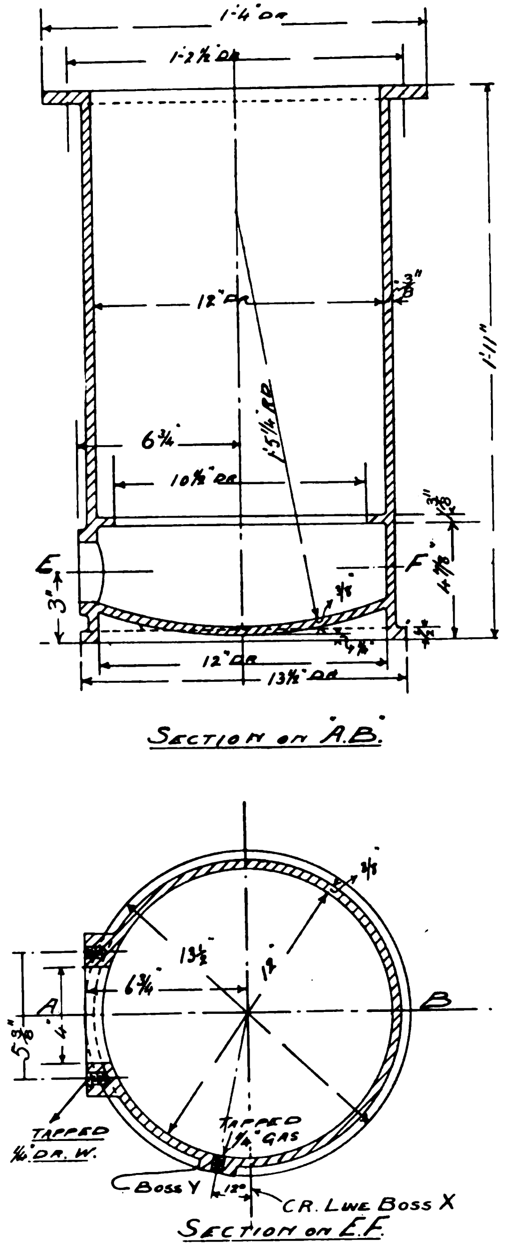
The "Model Engineer" Suction Gas Plant.

By W. A. Tookey.

(*Continued from page 274.*)



End Elevation of Generator.

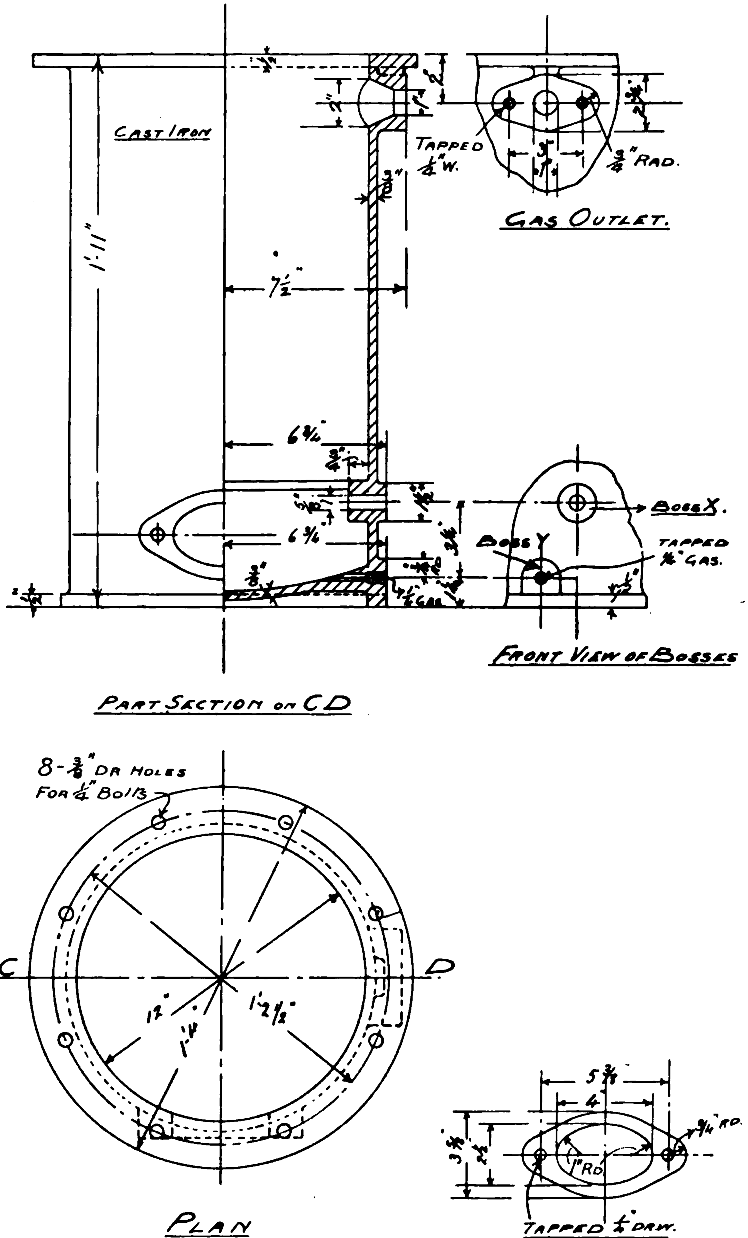


Generator Casting.

WE will now proceed to describe the details of the apparatus as shown on the accompanying drawings.

General Arrangement shown on pp. 296 and 297.—The general arrangement of The Model Engineer Suction Gas Producer shows the essential features and relative position of the detailed parts shown on separate drawings.

The generator is shown in half sectional elevation. It will be seen that no firebars are provided. Owing to the small diameter of the fuel bed it is important to arrange for the natural settlement of the fuel so that the coal or coke may not hang up and depreciate the quality of the gas consequent upon blowholes or "cores" being formed during work. The charging hopper is fitted with a sliding door just above the generator and a cover at the top,



Generator Casting

so that fresh fuel may be fed without risks of explosion. If the double shutter were not provided, the air, coming into contact with the gases formed within the generator would form an explosive mixture and be ignited by the fuel itself. The explosion would not be violent but the flames might injure the attendant.

It will be seen that a taper plug is fitted to the centre of the pivoted top cover by means of which the fuel may be poked and consolidated. At such times the sliding plate must also be drawn out, thus permitting the poker to enter the generator.

The gas is collected from the space between the distilling cone and the external shell, and is passed to a cooler. Water is heated by the gas passing down the internal pipe and overflows into a funnel, which conducts it to a circular ring at the base of the fire.

This circular ring is somewhat after the style of a gas "boiling ring," a number of small holes being drilled at the upper portion of the coil remote from the fire. The water falling upon the hot ashes is thus converted into steam.

The air supply to the fire is through the ashpit door, the latter being provided with a "louvre" regulator somewhat in the same style as is used for ventilation in railway carriages and elsewhere.

This regulator permits of proper control of the entering air.

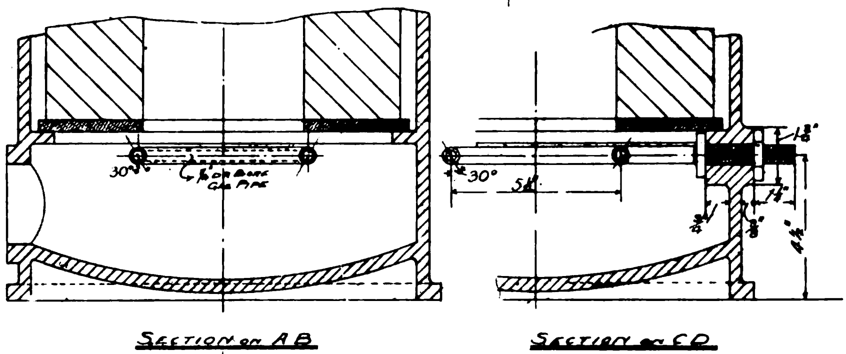
At the bottom of the cooler a pipe is led direct into a seal box filled with water, the gas passing through a side branch to the base of the scrubber.

Inside the scrubber it will be seen that the gas inlet pipe dips slightly below the water level, thus preventing any return of the gases from the scrubber to the generator. The water level in the scrubber is kept constant by means of an overflow pipe the end of which is also trapped in the same water seal box that is used for the cooler.

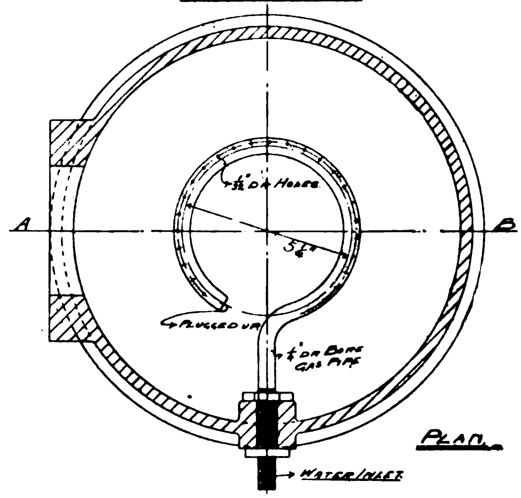
At the top of the cooler a plug cock opens or closes the generator to the waste pipe. This cock is open when the plant is being started up and closed as soon as the gas is of sufficient quality to burn steadily.

The scrubber is a plain cylinder of cast iron filled with coke, the latter resting on a wooden grid a few inches above the gas inlet pipe. Above the coke, at the top of the scrubber, a rose is fitted, by means of which water is continually sprinkled over the coke. Thus the gas is made to pass through the wet filtering material.

The base of the scrubber is fitted with a cleaning door so that any dust and sediment may be cleared out. From the top the gas passes to the engine through a right-angle bend. This bend inside the scrubber is shown looking upwards, the idea being to prevent the suction of the engine drawing water from the sprinkler into the connecting pipes.



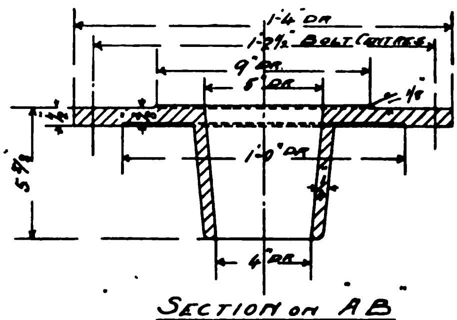
Detail of Ashpit and Water Vaporising Ring.

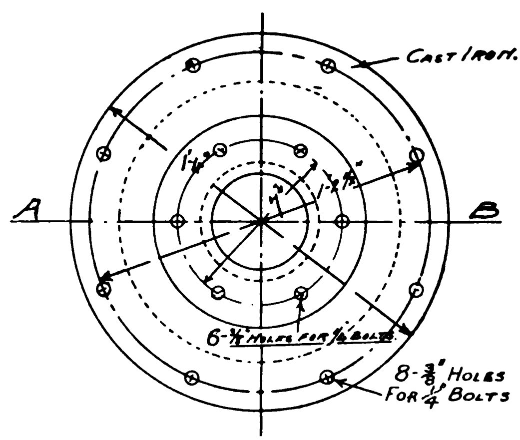


It will thus be seen that the whole equipment is of a very simple character and does not call for any intricate or delicate workmanship.

In the drawings the various details have been proportioned for cast iron which, all things considered, is the best material for such a small producer. There is no necessity, however, for the metal to be of any great thickness, and although the metal has been shown as ⅜ in. in thickness, it can. as a matter of fact, be even less than this. There is no essential difference between a suction gas producer and an ordinary slow combustion stove, and there is therefore no reason why the same thickness of metal as used in such stoves should not be used in The Model Engineer plant. It is not every ironfounder, however, that can do such fine work as is possible by those who specialise in stove castings, and in preparing the drawings it has been thought best to show the maximum thickness advisable rather than the minimum. Wrought iron is not so suitable for generators, as it does not equally well resist the corrosive action of the wet gases.

The drawings on pp. 297 and 298 show the cast-iron generator casing in detail. They are fully dimensioned and require no special description. The ashpit door requires to be faced to receive the cover and regulator shown upon a drawing given in a later issue. and is to be tapped and drilled for two ½-in. Whitworth bolts as shown. The top flange upon which the distilling cone is placed also requires facing and drilling for eight ½-in. bolts. The water pipe inlet, referred to on the drawing as boss X, requires no machine work except the clearing of the hole through which the perforated ring is secured, as shown in





Top Cover (Distilling Cone) of Generator Casting.

the general arrangement. Backnuts are placed on the internal and external faces and, in fitting up, a gas-tight joint should be made under the back-nuts, the ring being placed in position before the lining of the generator is built in.

The water overflow pipe, shown as boss Y in the drawing, is to be tapped for a ¼-in. bib cock. The gas outlet is to be faced for the reception of a flange. two holes being drilled and tapped to suit ¼-in. setscrew.

The drawings on page 279 give details for the water-vaporising ring and connection, and of the cast iron cover or distilling cone that bolts directly on to the top of the generating casing. Both sides of this require to be faced, the underside fitting to the generator, and the upper surface being prepared to receive the hopper casting shown on a separate drawing. It will be seen that two sets of bolt holes are required in the flange of this distilling cone, full particulars of which are given.

(To be continued.)

Engineering Works and Accessories for Model Railways.

By E. W. Twining.

(Continued from page 247.)

We now come to bridges of smaller dimensions than those we have been treating of, and, consequently, of lesser importance. They are of the class (termed "under-bridges") usually constructed for conducting the railway over roadways and small streams or rivulets. The example here given is of Gothic design, and is one of many built exactly similar on the Great Western Railway between Bristol and Bath. They for the most part span occupation roads, but several having somewhat larger arches are used for bridging public thoroughfares leading off the main road. As just indicated, they vary in their respective spans, the example here given and illustrated in Fig. 33 being one of the largest. It is situated about ¾ mile west of Keynsham Station. A photograph of another of these bridges, of smaller span, is shown in the issue of The Model Engineer for August 31st, 1905, where it was erroneously described as an "over-bridge."

Figs. 34 and 35 give respectively the measurements of the arch, with the radii for striking the curves, and a cross-section showing the mouldings with the buttresses in side elevation.

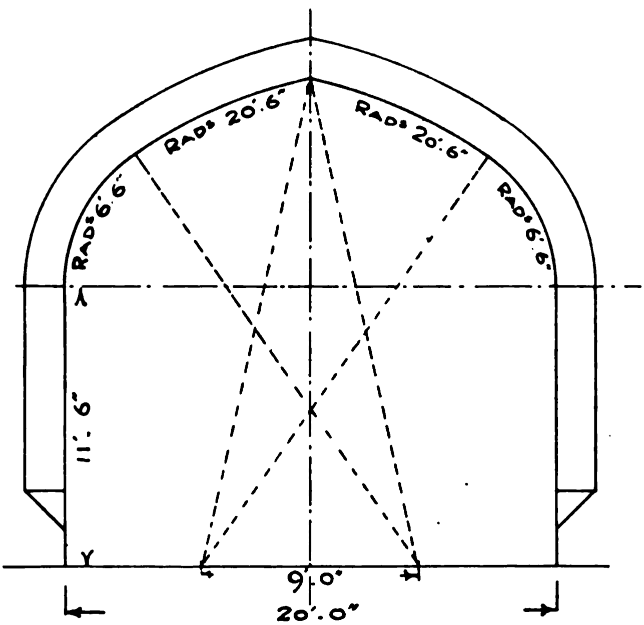


Fig. 34.—Radius Diagram, Gothic Bridge, G.W.R.

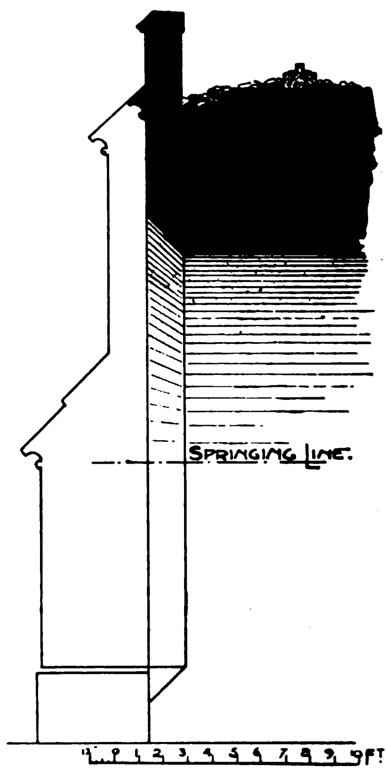


Fig. 35.—Section of Gothic Bridge near Keynsham, G.W.R.

The writer suggests that this would be very suitable for modelling on railways of limited length,—it can be made to scale without taking up too much space longitudinally, as would be done with the larger bridges previously given; besides this, the design is of such simplicity that little labour would be required to build it, as compared with the others. At the same time, these small bridges lack the beauty of form possessed by those of long span, particularly the large Gothic one given in Fig. 23 (August 13th issue).

The following are the principal measurements of the bridge near Keynsham: Total length, 101 ft.; span, 20 ft.; height of crown above road level, 20 ft.; versed sine or rise of crown above springing 8 ft. 6 ins. The width between parapets, which are 1 ft. 6 ins. thick each, is 30 ft., making the total width over the outer spandrel walls 33 ft.

THE James Watt memorial building at Greenock, Scotland is of red sandstone, with a base of rough-faced granite. It comprises two large classrooms, each 40 ft. by 24 ft., which are to be utilised for the teaching of navigation and marine engineering. In connection with these departments, a large number of donations have already been made, including models of ships and engines, and there is also a fully equipped library. The memorial has been erected on the site of Watt's birthplace, and the bronze statue is placed in a niche at the corner of the building. It bears the following inscription: "James Watt. Born 1736, died 1809. This memorial building is erected on the site of his birthplace."—*Power.*

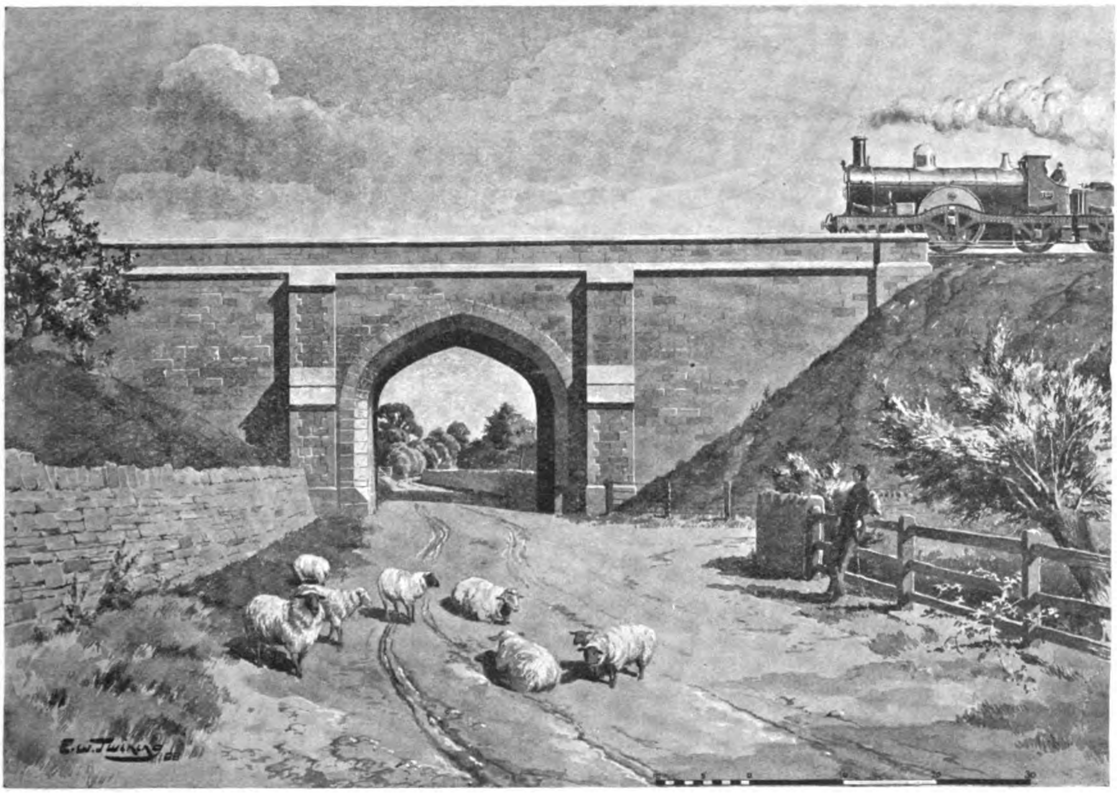


FIG. 33.—GOTHIC OVERBRIDGE NEAR KEYNSHAM, G.W.R.

How It Works.

XVI.—The Westinghouse Single-phase Railway System.

IT seems only a year or so since the application of electricity as a motive power on railways was being regarded in this country as a doubtful expedient, and certainly as something which belonged very much to the far and distant future, yet at the present time electric traction is a recognised and growing feature of railway operation, both here and abroad, although as yet confined, in most cases, to suburban and short distance traffic generally.

It only emphasises once again that the uncertainty of to-day becomes the established certainty of to-morrow, and also that time passes so rapidly that developments of the most important character ensue almost without our recognising the rapidity with which they have been accomplished.

The earliest electric railways were modelled on electric tramway practice, and involved the use of direct-current motors supplied at about 500 volts; and, owing to the gradually increasing weight of trains and the large currents necessitated by the use of this relatively low voltage, the supply of energy to the train was generally carried by means of an insulated rail laid parallel with the running lines, the latter forming the return conductor. This system is, indeed, at present the one most largely used, and it is giving excellent results on suburban lines with heavy traffic. Because of the low voltage, however, sub-stations must be provided at very frequent intervals in order to minimise the loss of pressure in the distributing system. Most of the larger direct-current railways now working derive their power from three-phase alternating-current power houses, the power being distributed through high-tension transmission lines to sub-stations placed at intervals of three or four miles along the railway. These sub-stations contain stepdown transformers and rotating machinery for converting the three-phase alternating current into direct current.

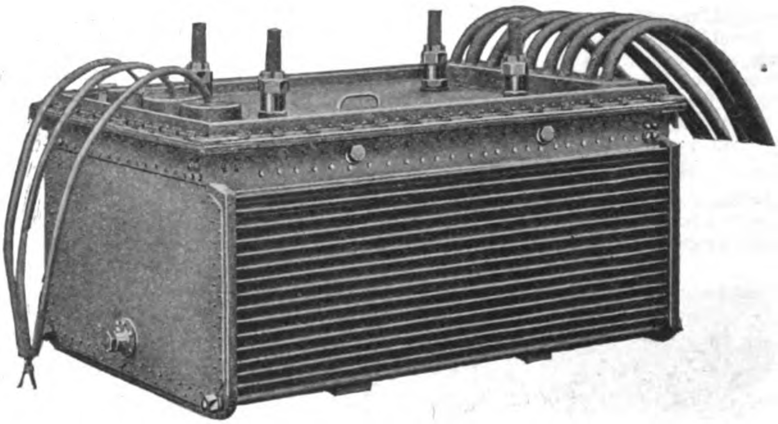


FIG. 1.—OIL INSULATED AUTO-TRANSFORMER FOR LOCOMOTIVE OR MOTOR CAR.

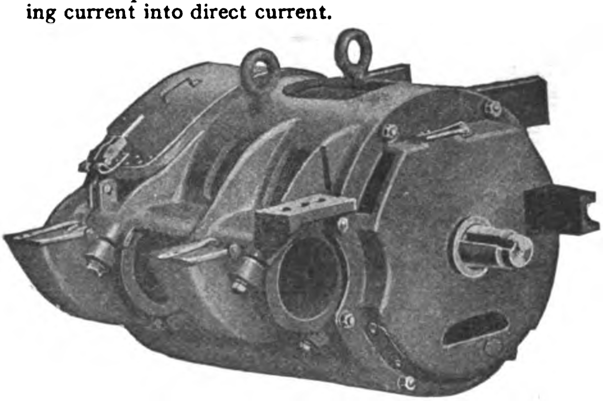


FIG. 2.—WESTINGHOUSE SINGLE-PHASE RAILWAY MOTOR.

It was recognised some years ago that, on the ground of economy, it was extremely desirable to do away with the use of rotating machinery in sub-stations and to use alternating current throughout from the power-house to the motors on the trains. At that time Continental practice tended to the use of three-phase motors, although it was well known that their characteristics rendered them somewhat unsuitable for traction purposes. For want of a better system, however, several three-phase lines were installed, and these have given comparatively good results under the conditions of light traffic and infrequent service. These examples have proved that, in spite of the great inconvenience of using two overhead wires for each track—as is necessary with the three-phase system—current can be conveniently conveyed to the trains at relatively high voltages, thus enabling the distributing system to be formed of overhead trolley wires instead of heavy insulated steel rails on the permanent way.

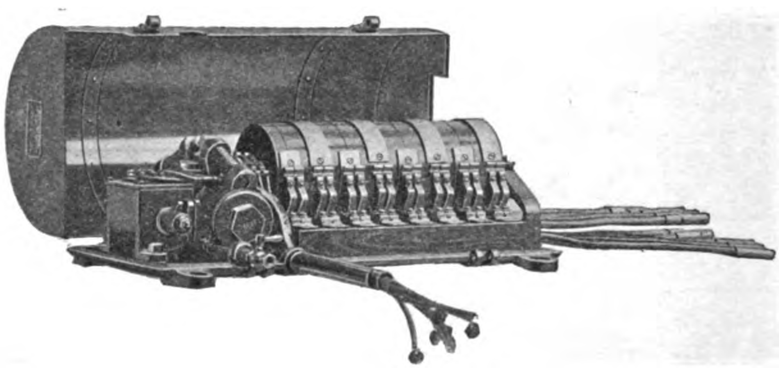


FIG. 3.—ELECTRIC PNEUMATIC REVERSER.

In view of the application now being made on the Midland and L.B. & S.C. Railways in this country, and several railways abroad, of what we may term for convenience the " overhead " system, it is interesting at this juncture to examine the construction and methods of working employed in this system.

Until some four or five years ago it was generally considered impossible to produce a single-phase alternating-current motor having the characteristics and large starting torque necessary for railway work, but, since then, advancement in this class of construction has been rapid, and seeing that apart from the motor all the other factors of the system—that is, the alternating-current power house, high-tension alternating-current transmission line, and high-tension overhead line—had previously been perfected, it only remained to produce a motor possessing the proper characteristics for railway work, and, when this motor had been perfected, it proved to be of very simple construction.

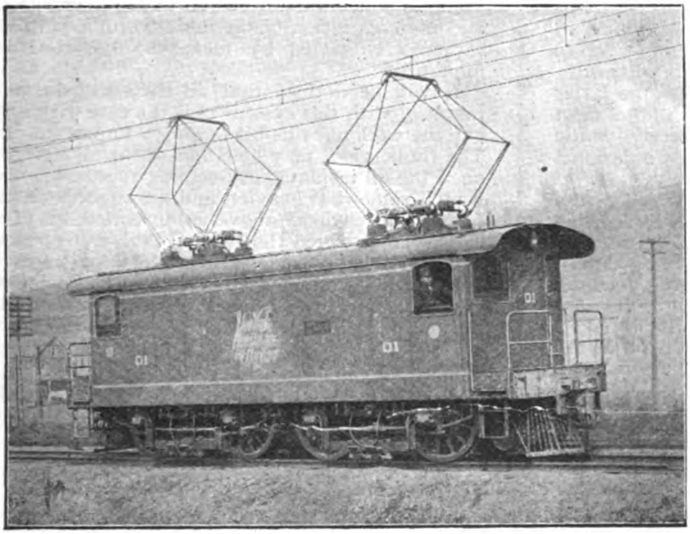


FIG. 4.—WESTINGHOUSE SINGLE-PHASE ELECTRIC LOCOMOTIVE: NEW YORK, NEW HAVEN, AND HARTFORD RAILROAD.

It is, in fact, nothing more than a highly-developed direct-current railway motor, in which the whole of the field circuit is laminated so as to reduce to a minimum the iron losses with alternating current excitation. The only other addition is a compensating winding for neutralising the effect of armature reaction. Such a motor not only works very well with alternating current at 25 cycles or less, but is also an admirable direct-current motor.

For the purposes of explanation and illustration we have selected the Westinghouse single-phase railway system, which in all respects is typical of the latest practice in this field. The system embodies a power house for generating single-phase alternating current at 25 cycles, or in some cases at 15 cycles. For short lines up to 20 or 30 miles it is usually sufficient to generate at 6,600 or 11,000 volts and to transmit the current at this pressure direct to

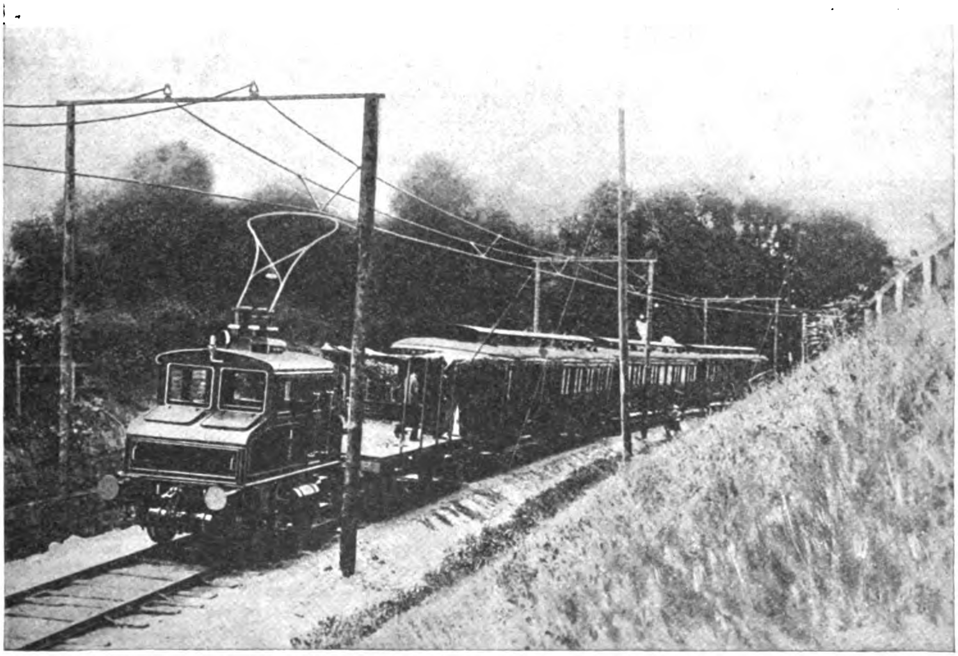


FIG. 5.—WESTINGHOUSE SINGLE-PHASE RAILWAY IN SWEDEN.

the overhead line and the trains. With longer lines it is usual to instal step-up transformers at the power-station and transmit the current at considerably higher pressures according to local conditions to step-down transformer sub-stations, which, in turn, feed the overhead line at, say, from 6,600 to 11,000 volts. Many cases may be dealt with without the use of sub-stations, but, where the latter are necessary, they need only be of the most simple construction and contain merely static transformers and switch gear requiring occasional inspection only.

The over-head trolley construction which distributes the power to the trains is usually carried out on the Westinghouse Catenary Suspension principle, in which the copper trolley wire is suspended at intervals of a few feet from high tensile steel suspension cables. The electrical equipment connected to the bow collector and the other to earth through the wheels and rails. The earthed end is provided with several tappings giving voltages which vary from 160 to 280 above ground, and the connection of the motor terminals to these tappings is varied by means of the controlling apparatus.

It will be noticed that no rheostatic losses are involved with this system as is the case with direct-current working, this being a very important point. The transformer may be either of the air blast type or of the oil insulated self-cooling type. The latter type is somewhat heavier, and a form of such fitted for suspension from above is illustrated in Fig. 1. This is so arranged that the oil tank can be readily lowered away from the transformer when necessary.

For small equipments ranging up to four motors of 50 h.-p. each hand, operated drum controllers

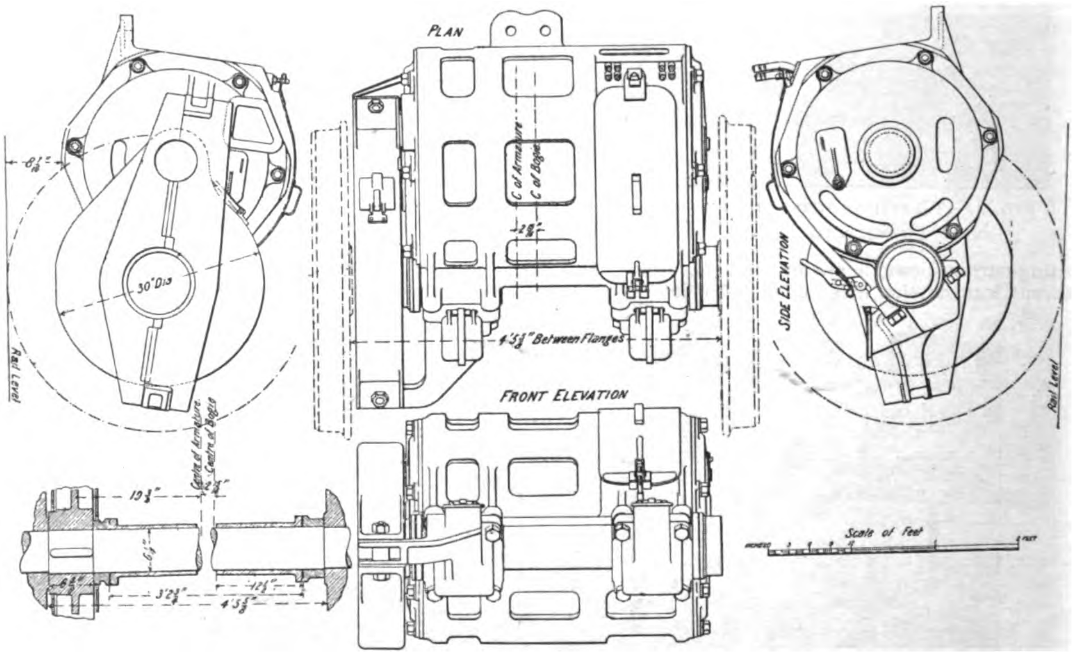


FIG. 6.—WESTINGHOUSE SINGLE-PHASE TRACTION MOTOR: MIDLAND RAILWAY.

of the locomotive or motor-car comprises the following parts, viz.:—

(1) The pantagraph bow-collector.
(2) The auto-transformer.
(3) The control apparatus.
(4) The motors.

The first of these, namely, the pantagraph bow-collector, in its usual form has a collecting surface consisting of a wide corrugated strip of metal which exposes a large area of contact to the overhead wire. It is held up against the latter by spring pressure acting on the pantagraph supporting frame, and is removed out of contact by the admission of air pressure to a cylinder forming the base of the apparatus. In this way the electrical equipment may be entirely isolated from the source of supply at any time. The auto-transformer is single-winding, one end of the winding being direct connected between the motors and the transformer are used. Such controllers are of extremely simple construction, and embody the usual reversing and controlling drums. For larger equipments on the Westinghouse system, an electric-pneumatic unit-switch type of control is employed, the principle of this being that the various circuits to the motors are closed by the action of air pressure on small pistons. The admission or release of air pressure to or from the pistons is effected by electric solenoid valves, and the supply of current to these valves in proper sequence is regulated by a small drum-type hand controller mounted in the driver's cab and usually known as the "master" controller. This master controller also actuates a separate electro-pneumatically operated reverser by means of which the direction of travel is changed. Fig. 3 shows the form of reverser used with the Westinghouse system.

The connections between the control apparatus and motors are so arranged that when the controller is in operation four of these unit switches are closed simultaneously, the circuits leading from them being connected to the terminals of preventive coils, which are practically very small single-coil transformers.

In moving the master controller from the first to the fifth notch over which it works, these preventive coils are progressively connected to increasing voltage tappings on the main transformer. The result is that the voltage applied to the motor terminals rises uniformly to its maximum, thus ensuring smooth and steady acceleration. The arrangement has the further advantage that the current carried by each switch is relatively small even for large equipments, and the controller is therefore of very compact and light design.

working with direct current, has an efficiency of about 5 per cent. higher.

The illustration on page 303 (Fig. 4) shows one of twenty-five electric locomotives equipped on the Westinghouse alternative single-phase and direct-current working system, as built for the New York, New Haven and Hartford Railway, for use between New York and Stamford, a distance of 33 miles. Between New York and Woodlawn the track belongs to the New York Central Railroad, and is electrically equipped on the direct-current third-rail system at 600 volts, while from Woodlawn to Stamford it is fitted with an overhead conductor, having double catenary suspension; this wire being supplied with single-phase current at 11,000 volts. The locomotives had consequently to be equipped for working with both single-phase alternating current at 11,000 volts and direct current at 600 volts. Each locomotive weighs 85 tons and is capable of hauling a 200-ton train in suburban service at a

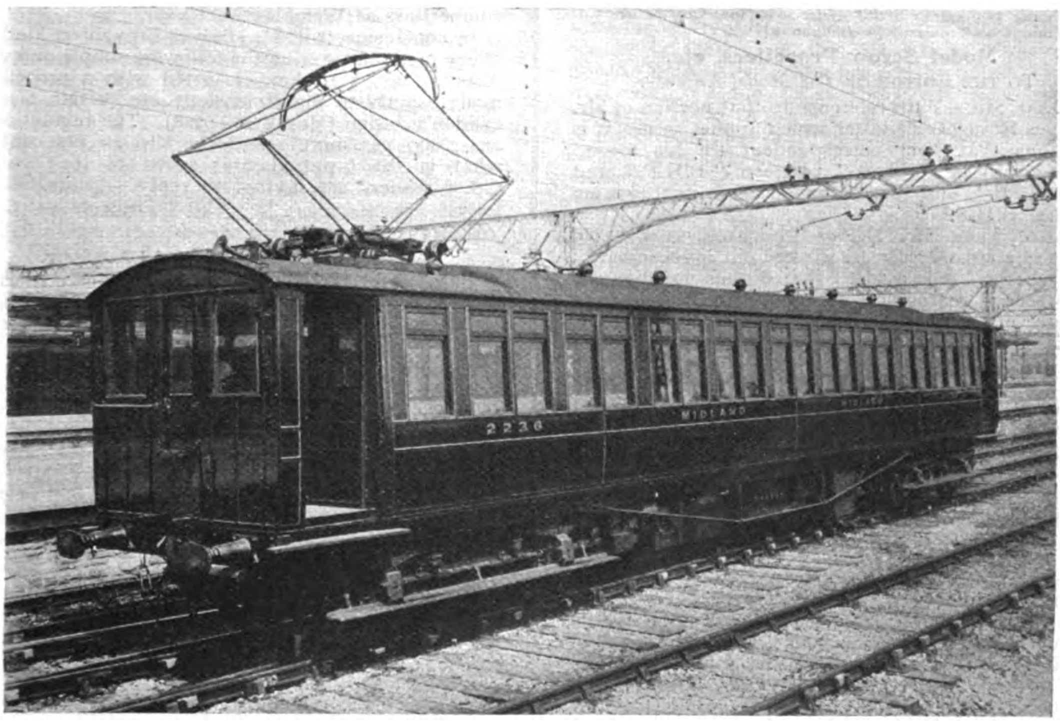


FIG. 7.—WESTINGHOUSE MOTOR CAR (MIDLAND RAILWAY), SHOWING BOW COLLECTOR.

The Westinghouse single-phase motor (Figs. 2 and 6) is of the series compensating type, the compensating or neutralising winding being in series with the armature, and therefore, electrically speaking, at right angles with the field winding. Motors of this class have characteristics similar to those of the series motors which are employed in direct-current traction work, that is to say, a heavy torque at starting, which is gradually reduced as the speed is increased. The efficiency of this motor is 83 per cent. when working with 25-cycle single-phase current at the mean load in service, the corresponding power factor being 90 per cent. The same motor, when

booked speed of 26 miles per hour, with stops about two miles apart. They are also designed to haul "through" trains of 250 tons at 60 miles per hour. Each locomotive is fitted with multiple unit control, which system allows of two or more locomotives being coupled together and operated by one driver, for the purpose of dealing with trains heavier than those mentioned above.

In Fig. 5 is seen a single-phase electric locomotive hauling a train of passenger cars on the Swedish State Railways. The locomotive in this case is equipped with two single-phase motors of 150 h.-p. each and Westinghouse electro-pneumatic unit switch control, and it weighs 24 tons. It was designed for hauling a train of 100 tons weight at an average speed of 25 miles per hour, but has been subjected to much more severe loads than this, having, in fact, worked loads of 300 tons without difficulty.

The successful development and perfecting of the single-phase system of traction opens up great possibilities in the immediate future. It is likely that before long it will be adopted on several branch lines of railway in various parts of the world.

The concluding illustration (Fig. 7) shows one of the Westinghouse motor cars used on the recently electrified Heysham branch of the Midland Railway.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Model Screw Propellers, etc.

To the Editor of *The Model Engineer.*

Dear Sir,—With reference to that portion of Mr. Delves-Broughton's letter which applies to me, it is obvious that your correspondent (in his second paragraph) is "at sea" between "B.H.P." and "T. J. P.", and further on he again confuses me with "B.H.P."

Also, when Mr. Delves-Broughton says, "No part of a steamer can be worked out independently of the rest," it is evident that he has not digested the second paragraph of my letter (page 113). There, my method of designing a boat is set out in its proper order, and no part independently of the rest.

Of course, I do not expect everyone to fall in with my particular views on designing; but I venture to assert that my method is more logical, from a practical standpoint, than that tabulated by your correspondent. The latter simply resolves itself into the prevalent and haphazard one of building a hull, putting into it what machinery, etc., it will comfortably float—and then trusting to luck!

As to there being comparatively little information available regarding *model* propellers, permit me to draw your correspondent's attention to the numerous designs, etc., which have appeared in The Model Engineer for the last few years. From these, by the aid of a little calculation, much valuable information waits to be assimilated. By adopting this course, and combining same with their practical experience and observation, a large portion of your readers should be able to evolve certain formulæ—empirical it is true—which would give them fairly accurate results.

It may be an easy thing to sit down and *sketch* a propeller on paper. But what about the knowledge, begotten of study and experience, which is necessary to determine the requisite data before such propeller can be committed to paper? It is like attempting to paint a picture before one has learned to draw.

There can be no gainsaying the fact that Mr. Delves-Broughton's ideas of propeller design (?) are somewhat crude, otherwise he would not have stated that he firmly believed "that a propeller twisted and cut to shape by eye, provided it is properly balanced, will often give better results than a propeller calculated and constructed with the greatest accuracy." Such a propeller, however excellently made, would not—except by luck in a few isolated cases—be so efficient as one whose diameter, pitch-ratio, etc., had been judiciously studied in connection with the engine power behind it.

With regard to the results derived from experiments in tanks, I should have thought these were generally known to be inaccurate, seeing that in actual running the conditions are different. I think it will be conceded that as soon as a boat gets away the engine picks up speed, with a consequent improvement in the speed of the boat.

As to "beating all records," this is, admittedly, a "tall" order, and, were I to attempt the design indicated by your correspondent, I should certainly avail myself of the extreme length which the present standard allows! On this particular subject, however, I trust your readers will pardon my reticence, as I intend (D.V.) to be one of the competitors at Wembley next year.

In conclusion, will Mr. Delves-Broughton kindly oblige me by answering the following simple query? A boat, say, 5 ft. long, is fitted with a propeller made exactly to the dimensions, etc., of Mr. Garscadden's design (May 21st, 1908). The revolutions are 2,000 per minute and the slip 40 per cent.; what is the (approximate) speed of the boat? Other readers are invited to reply.—Yours faithfully,

Thos. Dysart.

To the Editor of *The Model Engineer.*

Dear Sir,—With reference to the criticism which has been published in your paper these last few weeks on Mr. T. Dysart's 5-ft. speed boat design, may I be allowed to state that I do not think it is friendly criticism, but rather that it is prejudiced. How does Mr. V. W. Delves-Broughton know that Mr. Dysart's boat will not attain a speed of 10 miles per hour? What proof has he, when in the last speed boat competition the metre launch *Hermes*, designed and built by Mr. T. Dysart, attained on the first round a speed of 7·3 miles per hour, and that boat does not show much novelty in its design. It is, as a matter of fact, heavy and massive.

Then, again, does Mr. T. Dysart not state in the beginning of his article that simplicity of construction has been studied throughout, and I do not think that novelty of design and light construction is conducive to simplicity of construction.

In conclusion, I should like to thank Mr. T. Dysart for the open-hearted way in which he has given to us readers two designs for two substantial boats, and also say that criticism like that which has been published is not very encouraging.—Yours truly,

Herbert Carr.

Bolton.

To the Editor of *The Model Engineer.*

Dear Sir,—Mr. Delves-Broughton is evidently in error in assuming that his very small plant can give an output of 1-16th b.h.-p. It would be interesting to know how he has been led to so deceive himself in this way.

To the best of the writer's recollection, the machinery, as exhibited at Wembley Regatta, only proved capable of running for about ten or twelve seconds, and then became exhausted. It ran for so short a time that it was unable to complete a course of 77 yds. No one would be more pleased than the writer to see this clever contrivance run for, say, two minutes only, not less, showing a 4-lb. pull on a 2-in. flywheel at 1,000 or more r.p.m. Seeing, in that case, would be believing.

Mr. Delves-Broughton is also in error in assuming that the writer is classifying bad engines only, but includes even as good an engine as that gentleman himself can make. The whole thing is too spasmodic and squib-like in action to be reliable.—Yours truly, B.H.-P.

London, N.E.

To the Editor of *The Model Engineer*.

Dear Sir,—Mr. Delves-Broughton has evidently had little experience in designing high-speed models, otherwise he would not fall foul of Mr. T. Dysart's method of design, as he does. From practical experience of both the orthodox methods of design and the method adopted by Mr. Dysart, I have no hesitation in saying that the latter method gives the better results of the two.

Anyway, the method of design or the sequence thereof is not of *vital importance*, the *form of hull* being, in the writer's opinion, the first consideration. It is perfectly easy to design a boat in whatever sequence one fancies. If the machinery be designed first, it will be found much easier to design a hull of the necessary displacement than to design a hull and afterwards build the plant of a given weight. Often this latter method leads to disappointment. It is so easy to build the hull and machinery in excess of the specified weights, with the result that the boat floats on a false load water-line. If the other method be adopted, and the plant designed and built in its entirety, then, when the total weights are obtained, it will be a much easier task to build a hull of a sufficient displacement to carry the plant.

The fact that the orthodox method of design is that most in use for full-sized vessels does not necessarily prove it to be best adapted for model purposes, nor are the formulæ evolved by various experts of much assistance when dealing with models. As to information, plenty of it can be found in back numbers of The Model Engineer. Even then one must know how to apply the information when found. The design of a boat of any type, sailing or steam, must of necessity be a question of give-and-take, conflicting qualities or requirements so adjusted that a harmonious whole is produced.

The limit of speed of a model boat depends solely on the screw propeller. The propeller cannot be driven above a certain number of revolutions or cavitation will result, with great waste of power. Surely it is better to design a propeller with a definite diameter and pitch ratio to give a certain speed at a definite number of revolutions, allowing for a certain percentage of slip, and then to design a suitable plant capable of driving the screw at the speed required; then, finally designing the hull to carry the plant and sustain the reaction of the propeller, bearing in mind the fact before mentioned as to form of hull—than to trust to luck and experiments to get a screw to fit a boat.

I can here give Mr. Delves-Broughton a practical illustration as to the haphazard method of propeller design. A boat in the metre class was tried with two propellers, both of good design and build—one being 3 ins. diameter and 7-in. pitch; the other designed and built by Mr. T. Dysart, being 2¾ ins. diameter and 7½-in. pitch. When fitted with the second propeller, the engine speed was increased by about 300 r.p.m., and the speed of the boat by fully 1½ miles per hour. This serves to illustrate the importance of getting a propeller with a diameter and pitch ratio best adapted for the engine and boiler.—Yours truly, William J. E. Pike.

Dalston, N.E.

[Through lack of space some further correspondence on this subject is unavoidably held over until next week.—Ed., *M.E. & E.*]

A Featherweight Steamer.

To the Editor of *The Model Engineer*.

Dear Sir,—I notice in describing the above in a recent issue of The Model Engineer the "Carpenter's Mate" states that its speed is nearly the same as that of the *Morearad*, the Silver Medal winner in Class C of the last Model Engineer Speed Competition, while her weight tallies closely with same. I fail to see, however, how nearly the same speed is possible, as the heating surface of the boiler in the *Min*, according to the drawings, is only 34 sq. ins., the boiler of the *Morearad* having a heating surface of 60 sq. ins. and an evaporative power, according to speed of boat and size of cylinder, of 3 cub. ins. per min. The cylinder capacity of the *Morearad* is ·300 cub. ins., with a working pressure of 50 lbs.; that of the *Min* is ·191 cub. in., and as it would take nearly the same power as that of the original to drive a boat of the same size, weight, and approximate shape at nearly the same speed, this would mean a working pressure of about 75 lbs. on the cylinder of the *Min* and an evaporation in the boiler of at least 2·6 cub. ins. per minute. This the boiler described, with its 34 ins. of heating surface, would never do, even if the water tubes were efficient, which, from their shape, I very much doubt. As the power in the *Min* is only just over half that in the *Morearad*, the speed of the *Min* would not exceed 4½ miles per hour, and I do not know of any formulæ to prove 4½ nearly equals 7·3. This contention of mine is verified by the actual performances of the *Min*, as numerous witnesses can testify.

Putting the present case aside, I may refer to The Model Engineer for June 11th, wherein the calm assertion is made that an electrically driven boat 2 ft. 3 ins. long does 5 miles per hour. Cannot you devise some means, Mr. Editor, to have recorded speeds checked?—Yours faithfully,

Dalston, N.E. E. V. Pike.

Steam Canoe.

To the Editor of *The Model Engineer*.

Dear Sir,—May I be allowed to caution Mr. Bickford against carrying out his proposal to use a "locomobile" burner for his boiler?

I have read with great interest the description of his neat little canoe, more especially as it is a favourite hobby of my own, the more so, perhaps, as I am unable to practice it. I do not, however, speak without knowledge, as some few years since I was designing a steam carriage and in conversation with Mr. David J. Smith, the well-known metal engineer of Goswell Road, London, the subject of this type of burner was discussed. He told me then that for a "flash" type of boiler it was almost impossible to get too fierce a flame, and this the Primus burner well supplies, although I believe Mr. Smith at the time I was discussing the point considered the "Hecla" to be more suitable, as it is not quite so noisy.

The type of burner used on the "White" and "Miesse" steam cars are both excellent and all but noiseless, but these are, I believe, covered by patents. Both of these are, I believe, automatically controlled, the former by a thermostatic regulator.

The "locomobile" and similar types of burner are, of course, all very well for a tubular boiler, but the heat they give is useless for a flash boiler on account of the thickness of the tube of which it is usually constructed, or should be, as a thin tube is rapidly destroyed under these conditions. Thanking you for the insertion of this letter, I am, Sir, yours faithfully,

Cranbrook. SIDNEY RUSSELL.

Telegraph Connections.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to the letters of Mr. Harrison and Mr. Wilson on the above subject, I think that they have viewed this matter from a commercial point. When looked at in this way, I certainly agree with them that the systems they describe have a distinct advantage over my system. Before proceeding, I will admit that the system I suggested in my letter is of no use for commercial working. Telegraphy being a Government monopoly, I understand that an installation cannot be so worked—and how many of our readers require such an installation?

Excepting one which required two lines and earth return, all the systems described need a "spacing current"—a permanent current in the circuit when the apparatus is at rest.

It is plain that this permanent current, although it may be small, is a waste where a circuit is only occasionally used.

These methods are only an advantage where a large number of circuits are being continually worked.

I have several books on telegraphy, but for circuits of this kind I find no system mentioned that does not require this permanent current. The "calling battery" described in my letter does away with this "spacing current."

I have had a battery of the pocket lamp type in use about ten months for calling without giving any trouble whatever, and it does not yet show signs of exhaustion.

Owing to its small size and the little attention necessary, I think it renders the system very convenient. I remain, yours truly,

A. H. JOHNSON.

Lagging Steam Pipes and Boilers.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Noticing a few weeks ago a Query on "How to Lag a Small Boiler," I have found the following method very effective. Get a ball of ordinary or asbestos string, and wind this closely round boiler. Then obtain a tube of "Fortafix," which is a liquid cement, and can be obtained at any stationer's. This is then plastered over string on boiler. When this is dry it sets like porcelain, and is steam- and water-proof. It can be painted when dry, if desired. I enclose two samples of copper tube treated in this way for your inspection. A lagging like this has been on a 12-in. by 6-in. boiler which is used every day, and is as good as ever. Trusting this will be interesting to your readers, I remain, dear Sir, yours truly,

P. J. JAMES.

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.]*

London

FUTURE MEETING.—Friday, October 9th: Adjourned Locomotive Running Competition. The Secretary will be glad to have notice of any further entries.

VISIT.—On Saturday afternoon, October 3rd, a visit will be made to the Generating Station and Works of the Metropolitan Railway Company, at Neasden.—Full particulars of the Society and forms of application for membership may be obtained from HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green, S.E.

Liverpool and District Electrical Association.

ON Tuesday, September 15th, at the Common Hall (large room), an illustrated lantern lecture by Mr. Claude H. Verity, Seacombe, entitled, "The Construction of the Parsons Turbine Applied to Marine Propulsion," was given; and on Saturday, September 19th, a visit was paid to the Railway Signal Company, Ltd., Fazakerley, who are manufacturers of all kinds of signal and electrical appliances for railways and tramways.—S. FRITH, Hon. Sec. and Treasurer.

The Victoria Model Steamboat Club.

THE Club held a very enjoyable Gymkhana on Saturday afternoon, September 5th. Fine weather ruled and the sport was good. Although the events were few in number, the entries were so many and the fun so fast that it was impossible to complete the programme in one afternoon, so the "tug-of-wars" were arranged to take place on the following Saturday.

The first event—"Lancing the Ball"—started things humming at once. Coloured air-balls were moored in mid-ocean (?) about 15 yds. away, and the boats were provided with pins mounted on their noses in a horizontal direction, the object being to explode the air-balls on contact. Ship after ship bore down upon the monsters, only to shave them by a narrow margin. At last one hit a ball, but, alas! she had left her pin in the hand of a forgetful engineer when she got across on a previous trip, and the ball refused to pop. Still, others hit them without result, until at last Mr. H. Smith's fine model, *Victoria I*, touched one square, and the ball disappeared. Owing to the limited time, Mr. Smith was declared the winner and the next event proceeded with.

This consisted of steering trials, the object being to test the skill of boat-owners at hitting a mark. Flags were mounted adjacent to a central mark on the opposite side of the lake, and points were given for the various distances away from centre. Competition was very keen in this event, over a dozen entries being booked, and some real skill was displayed. Several boats repeatedly got within inches of the central flag, and this after a run of 39 yds.! Three boats scored the maximum number of points obtainable, short of actually striking the central stick, and these ran a final heat, as the result of which Mr. H. Smith's *Victoria I* again took premier honours.

In view of the importance of a carefully considered course (not necessarily a straight one) in point-to-point racing, these trials are splendid practice and make the members get to understand their boats.

Some fine speed trials were gone through meanwhile. Mr. E. Vanner's new boat, *Leda II*, creating a very favourable impression. Another boat which made a very good show was Mr. F. Field's T.B.D. *Firefly*. This model is very realistic in her mode of travelling, her wave-making being almost identical with the original, and she "hops."

But five o'clock arrived, the bathing bell rang, and the members swarmed into the enclosure, where some of their number had been preparing tea. Afternoon tea is now a regular feature on Saturdays while the weather permits, and the members do their own catering under the able supervision of Mr. E. Rose.

The best thanks of all are tendered to the several gentlemen who assisted, particularly to Mr. A. Davis, M.C., and to Mr. J. C. Crebbin, who generously insisted on providing the prize-list. Several distinguished model engineers attended, and expressed their pleasure in very definite terms.

THE world's total consumption of copper last year was 689,090 tons, or 17,370 tons below the year's production; but in 1906 the consumption reached 787,564 tons, or 34,664 tons more than was produced for the twelve months; while in 1905, 1904, and 1903 the excess of consumption over production was 48,441 tons, 29,627 tons, and 26,990 tons respectively. Of the total consumption last year (689,090 tons), nearly two-thirds, or 446,970 tons, were absorbed by Europe, North America taking only 24,120 tons, the rest of America 2,000 tons, China 14,000 tons (of which 4,611 tons went from America), Japan and the rest of Asia 10,000 tons, and Africa and Australia 2,000 tons. In Europe the largest consumer of copper was Germany (160,217 tons), England ranking second with 118,430 tons, and France taking the third place with 70,712 tons.—*Engineering.*

Queries and Replies.

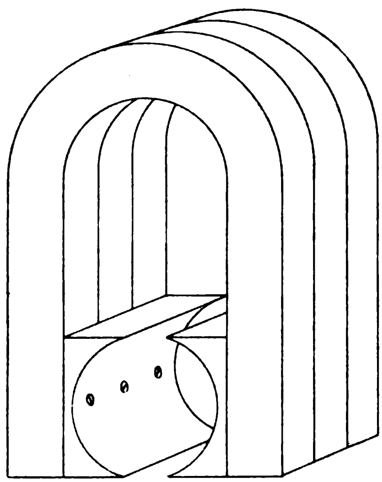
[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[20,245] **Magneto for 2½ H.P. Petrol Motor.** S. H. J. (Hull) writes: Would you kindly tell me, through the medium of THE MODEL ENGINEER, how I could make a "magneto" for a 2½ h.-p. petrol motor, and where I could get the magnets, and what size wire for the armature, and how much? I am sorry to say I know nothing whatever about a "magneto," and should be greatly obliged if you could give me a rough sketch and a few measurements.

A suitable size for magneto would be—total height, 6 ins.; width inside limbs, 2½ ins.; thickness of limb, ¾ in. Three such magnets would be suitable, each 1½ ins. wide, making a total width of 4½ ins., so that the armature length also would be 4½ ins. A suitable diameter for armature, if no shield is used, would be 2 ins. You would need about ½ lb. of No. 26 S.W.G. wire. The sketch herewith will give you a general idea of the construction.



Query N° 20245

The magnets could be obtained from one of the electrical manufacturers who advertise in our pages, such as Mr. A. H. Avery, Fulmen Works, Tunbridge Wells. An excellent book on this subject is Mr. Bottone's "Magnetos for Automobilists," price 2s. 3d. post free from the office of this journal.

[20,100] **Design for Boiler.** J. H. N. (Featherstone) writes: I am making a small horizontal slide-valve steam engine, fitted with a winding drum. I am working two cylinders, one at each side of the drum; the cylinders are ⅜-in. bore by ⅝-in. stroke, which were obtained from W. J. Bassett-Lowke & Co. a few weeks ago. The trouble is—what kind of a boiler shall I want to work this engine?

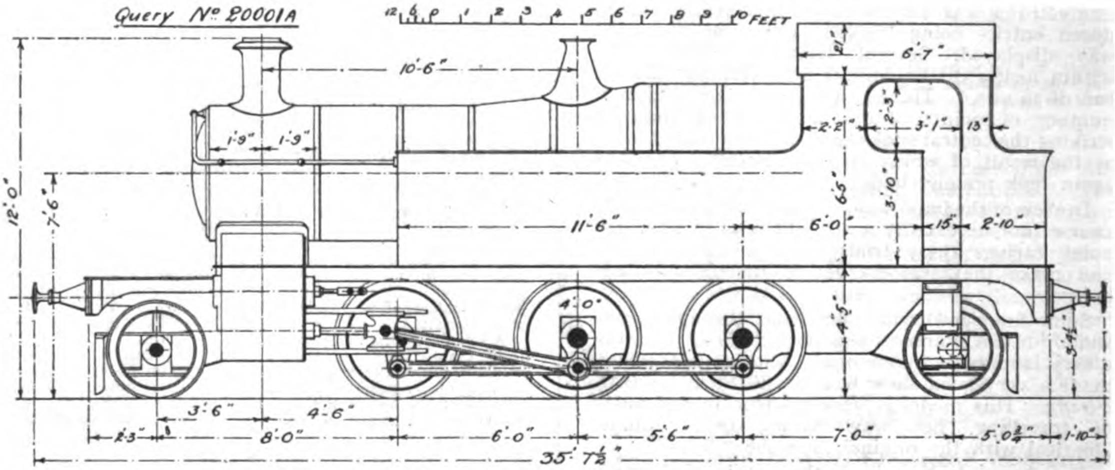
We advise you to make the multi-tubular vertical boiler described on pages 31 and 32 of our Handbook (No. 6), "Model Boiler Making", price 7d. post free.

[20,195] **Electro Deposition.** D. M. (Pendleton) writes: Could you please inform me how I could obtain an electro deposit of copper on non-conductive things, such as flowers, insects, etc.?

The articles must first be coated with black lead, bronze powder, or something else that will render them conductors of electricity. A copper wire must then be affixed and put in electrical connection with the conductive coating of the article to be plated, and then the process of electro deposition can be proceeded with.

[20,001A] **G.W.R. Tank Locomotive of the 2-6-2 Type.** N. R. (Shrewsbury) writes: I should be glad of a drawing of a G.W.R. tank locomotive of the 2—6—2 type. The drawing required is a 6-coupled, outside cylinder, pony truck, side tank of the G.W.R. with rather low wheels—side and front views.

We append a drawing giving the necessary particulars, but we cannot include side and end views. We would point out that you



G.W.R. 2-6-2 Type Goods Tank Locomotive: No. 115 Class.

reside on the G.W.R. system and can get sufficient information at the station to enable you to make end views from the drawing herewith. There are, it will be noticed, three classes of 2—6—2 type tank engines on the G.W.R.: the No. 115 class, with small 4-ft. wheels, and the 99 class with larger wheels (about 5 ft. 6 ins. diameter), both these engines having outside cylinders. The other engines (No. 3,902 class) have inside cylinders and are rebuilds of the old "Gloucester" tender goods engines. The driving wheels of this class are 5 ft. 2 ins. diameter. We do not send our readers drawings of locomotives, but if the enquiry is likely to interest other readers, we make arrangements to publish drawings, if the information required is readily obtainable. We can, however, make no general rule that drawings shall be inserted.

[19,315] **Dynamo Windings.** G. L. (Eltham) writes: I am making a dynamo. The armature is laminated, twelve slots and six segments to commutator. Can you give me the connections for same? What wire should I use for field-magnets? The dynamo consists of three pieces of mild steel bolted together by setscrews. Would it be better if I put these in the fire for a day or so?

Wind your armature with 2½ ozs. No. 24 S.W.G., and field-magnets with 10 ozs. No. 26 S.W.G., and connect in shunt. Particulars of windings and connections are given in "Small Dynamos and Motors," 7d. post free. The mild steel castings should be carefully annealed before using. Put them in the fire over-night and leave until the morning, when they should be perfectly soft.

[19,495] **Voltmeter; Model Electric Boat.** E. W. W. (London, S.E.) writes: I am about to make a voltmeter and I should be pleased if you would give me your advice on a few points. It is meant to show 10 volts when armature is fully deflected. Will the instrument do if made to sketch (not reproduced)? If not, can you suggest a better, giving a sketch if possible? What quantity and gauge wire will be required for instrument? Will copper wire do? Will tin from a milk can do for the armature? Will a darning needle do for the spindle, and need the bearings be jewelled? I thank you very much for your kind replies to my Query No. 19,330 about a model electric boat, and I regret I did not furnish you with enough particulars. I proposed to alter the boat described in Mr. Bottone's book, "The Amateur Electrician's Workshop," from 2 ft. to 3 ft. I also asked if I could make the motor described twice the size, as I want the boat to be fairly fast. The dimensions of the armature are 1¼ ins. diameter by 1½ ins. long. If the motor is made twice the size given, the dimensions will, of course, be 3 ins. diameter and 3 ins. long. Would you kindly give me the quantity and gauge (copper wire) for field-magnets and armature if made twice the size? What voltage and amperage will be required to drive the motor? Would six plates, 3 ins. by 1½ ins. (thirty-one positive and thirty-one negative in three celluloid cells) do to drive motor? Also what would be the best electrolyte to use? I take it that one cell gives 2 volts. Would the battery above be too heavy for the boat? Can you suggest a better method of making a battery for the boat? No doubt these questions seem simple to you and I may seem dense, but I am but a raw amateur. I shall feel greatly obliged if you will answer these questions.

You will have to find by trial exactly what quantity of wire is needed to give you a full scale reading when 10 volts are applied. We suggest winding bobbin of solenoid full of No. 28 S.W.G. You could then add a little extra high resistance wire if you find the instrument would work sufficiently well with less current. Use No. 36 S.W.G. German silver wire as a resistance if necessary in series with the coil of your solenoid. We should advise slightly thicker sheet iron for the armature of the machine. If the bearings are jewelled the machine will be much more sensitive, although hardened steel pivots answer very well for ordinary purposes. For further particulars of construction of these instruments, please consult our handbook, "Electrical Measuring Instruments," 7d. post free. We should be glad to have an account of your instrument when it is finished as we are always pleased to know what our readers have been doing. We might add that you would find it advisable to fix a counter-balance weight on the armature in order to increase the sensitiveness of the instrument; but our handbook will explain these points. *Re* model electric boat. For a 3-ft. boat a motor with 3-in. by 3-in. armature is far too large as it would take more current to drive it than you could possibly provide in the space available for the accumulators. A motor with 1½-in. by 1½-in. armature would be quite large enough and, as we believe we said in our previous reply, it would develop sufficient power provided it was supplied with ample current. You must find by trial what weight of accumulator the boat will carry and then instal an accumulator of the maximum size. To ascertain the weight she will carry you can load her up until she sinks to the correct water-line, then weigh the material you have used to load her with and that will be the weight of the accumulator which you can instal. You do not give particulars of windings, so we cannot say what voltage the motor is wound for, but you could try 4 or 6 volts and see what results you get. We trust these details will make matters clear to you.

[19,902] **Accumulator Charging.** H. T. (Cardiff) writes: I have got two small accumulators which I propose to charge with a Bunsen battery of four cells, 5½ by 4 ins. The first charge was for 40 hours, ½ amp. per accumulator (4 volts). I put them in parallel and regulated the current with a resistance wire. At the end of that time there was not much more than ½ amp. going through cells with all resistance cut out. Battery on short circuit gave about 1½ amps. The nitric acid in porous cells was green, and I presume it was that which was exhausted. But for future use I should be much obliged if you would tell me the quantities of nitric (strong) and sulphuric (dilute 1 : 10) acid which are, so to speak, equivalent to one another for the purposes of this battery, so that I may know which requires renewing. Also approximately how many amp.-hours I may expect to get from a given quantity

of either acid. Of course, you will assume that the zincs are well amalgamated and so forth.

The sulphuric acid should be diluted to 1 part acid to 7 parts water, by volume. For the porous pot concentrated nitric acid should be used. There are no proportions to be observed between the nitric and dilute sulphuric acids. We are unable to tell you the amp.-hours output. You will probably do better by charging the cells of the accumulator in series. Increase the voltage of the battery and take a smaller current from it accordingly. You will require six of the Bunsen cells in series to obtain sufficient voltage to charge a 4-cell accumulator; 2½ volts per cell is required as the voltage rises towards the end of the charge to that value.

[19,452] **Oil Engine Trouble.** H. B. (Workington) writes: Being a constant reader of your valuable paper, I should esteem it a favour if you would answer the following. A short time ago I purchased a set of 3-in. bore castings for oil engine. Having finished same, I have great difficulty in getting it to run more than a few minutes, and when it is running, it is very irregular. I enclose sketch (Fig. 1) showing clearance when piston is on back stroke, which, in my opinion, is enormous—viz., 3 ins. by 1⅜ ins. and 2¼ ins. by ⅝ in. Compression seems to be good, and I have also made inlet valve to work mechanically. Exhaust pipe is

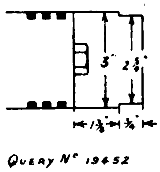


FIG. 1.

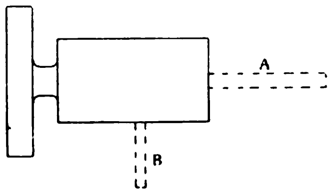


FIG. 2.

same size as inlet—viz., ¼-in. gas. I altered position of ignition tube as shown in Fig. 2. When fixed at A and tube ¼-in. gas, 5½ ins. long, as sent by makers, it would not run or explode, but when I placed it in position B, tube ⅛-in. gas (less size) and 2½ ins. long, I succeeded in getting it to run a few minutes at a time but very irregular in its running. Do you think it explodes too late, or what? What is your opinion as regards clearance in cylinder; do you think it excessive? Anything you can suggest I shall fully appreciate, as I am most anxious to get it working, and I intend driving a 3½-in. centre lathe when successful. Your answer to this query is eagerly awaited by several of your readers besides myself, who all intend building a similar oil engine if this is satisfactory. It may be of advantage for you to know that I have fitted an oil supply similar to those used by the Universal Company, Derby.

We regret to hear of your trouble with your small oil engine, but may say that the only satisfactory way to get good results is by the means you are adopting, namely, a series of trials and experiments. You have one consolation, however, that so long as you can get the engine to run well sometimes it is possible by proper adjustment and control to make it run well always. You should try the effect of various sized holes leading to the ignition tubes. The ignition passage could be bushed with a brass bush, the latter bored out to a small diameter to begin with, and the diameter gradually increased until you get the best effects. A defect in the design is, in our opinion, apparent, in the very small exhaust pipe and port: if you increase this to approximately half the diameter of the cylinder, you would probably get very much better results. The engine appears to be choking itself, and consequently causing it to miss-fire. We shall be glad to know how you get on with your engine, and should be pleased if you would write us if in further difficulties.

[19,880] **Dynamo for Dynamedical Machine.** G. L. T. (Bishop Auckland) writes: Will you please help me with the following? I am desirous of building a dynamedical machine, similar to the one described by Mr. Mortley in your issue of THE MODEL ENGINEER for October 29th, 1903. I have a 30-watt Avery-Lahmeyer dynamo and should like to use it if you think it is not too large. It is wound for 10 volts 3 amps. at 2,800, and has 8-cog laminated drum armature wound with about 3 ozs. of No. 24 S.S.C. copper wire in eight sections. Fields have 12 ozs. No. 22 D.C.C. copper wire. (1) Are the windings suitable to run as motor and for shocking? (2) Shall I have to connect in parallel for shocking and series for a motor? (3) How many 1-pint bichromate cells will be required to run it as a motor? (4) I haven't a piece of ebonite large enough for stud wheel, so can you suggest an alternative method for a contact-breaker, or could I just mount the brass ring on a piece of hardwood?

(1) The windings are suitable for use as a motor and you may be able to get shocks of sufficient strength to suit your purpose. If not, you can rewind the machine with wire of finer gauge. The machine is not too large. The field-magnet winding is more suitable for a voltage of about 6 volts than 10 volts. No. 23-gauge would be better for 10 volts. (2) No; use the coils in series with each other and connected in shunt to the brushes. (3) Three, connected in series. If the armature does not readily start, lift one of the brushes for an instant and let if fall again whilst current is on, or make a suitable shunt starting switch (see our handbook No. 14). (4) Hardwood will do, especially if coated with shellac varnish.

[20,204] **Motors Driven by Sun's Rays.** S. H. M. (Marylebone) writes: Will you please supply me with sketch plans, details, and approximate data for constructing a solar motor for running a fan of 2 ft. diameter, worked vertically, etc.?

On the subject of the use of the sun's rays as motive power there is, at present, no literature available, beyond a few jottings in the periodicals. We have heard of the sun's energy being utilised in America to the extent of driving 10 h.-p. motors. But we cannot supply particulars of the apparatus used, and to give you a complete design of solar motor plant is quite outside the scope of our Query Department. We can but advise you to attempt the construction of an experimental set of apparatus. We think you would have your task simplified by working with a steam engine, rather than a hot-air engine, as you suggest.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

** Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

*The "Fluvio" Submarine.

We have received from Messrs. Hamley Bros., High Holborn, London, W.C., a sample of an interesting water-sport novelty termed the "Fluvio." It consists of a flat board, coloured and shaped like a submarine boat, and weighted at the bottom so that, when in the water, it vertically floats at a proper water-line level. Two metal sockets are fixed to the upper part of the model, and two short sticks are inserted therein. By means of a long cord attached to these sticks the "Fluvio" sportsman can guide the model through the water in a highly diverting and interesting fashion. We have tried the sample sent with excellent results, and we can commend this novelty as providing plenty of amusement for the youngster. We believe that the same principle is also applied to model ducks.

*Model Gas Engine and Dynamo Castings.

We have received from the British Engineering and Electrical Company, of Leek, Staffs., a sample set of the gas engine and dynamo castings which they are offering to our readers. These include a complete set of castings and parts for making up a gas engine suitable for driving a dynamo or other light machinery, the cylinder being bored and machined, back cover turned, piston turned and fitted, and flywheels turned and bored. The bearing brasses are also bored and fitted to the bedplate with the caps. The dynamo has the armature wound and connected to commutator complete, the bearings bored and fitted to armature spindle and the field-magnet drilled for attaching to the foundation plate. The most difficult portions of the work are thus completed, and the amateur should experience no trouble in fitting the set up ready for running. The sets submitted for our inspection are of excellent quality as regards the castings and workmanship, and if all the goods sent out are up to the same standard, the purchasers will have good value for their money. The only criticism we feel inclined to make is that the exhaust valve in the gas engine might with advantage be made larger. We should not omit to mention that printed instruction sheets for fitting up the various parts are included with each set.

New Catalogues and Lists.

Messrs. W. J. Bassett-Lowke & Co., 20, Kingswell Street, Northampton, have sent us two new catalogues containing prices and particulars of a large assortment of electrical goods, comprising motors, dynamos, electric lighting plants, fans, traction motors, lamps, fittings, switches, spark coils, Wimshurst machines, wire, batteries, accumulators, and other accessories. The illustrations are good, and the descriptive matter to the point, and explains clearly what the various models and apparatus are suitable for, etc. The list, Section E, will be sent on receipt of two penny stamps to any reader making application for same.

The Editor's Page.

THE annual race for the Branger Cup will take place in Paris on October 8th, on the lower lake in the Bois de Boulogne. We understand from M. Branger, the donor of the trophy, that this year the event will be of an international character, for, in addition to the usual French competitors, entries are expected from England, Germany, and Switzerland. This makes it of special interest, for, although something is known of the capabilities of our French friends in the way of model motor boat building, we have not yet seen any craft of either Swiss or German origin. As mechanicians of a high order the Swiss have long been famous, while the success of the Germans in the world of motor-cars, to say nothing of other branches of engineering, is well known. How these two countries stand as regards the production of model speed boats remains to be seen. So far as England is concerned, we have good authority for believing that the petrol flier, *Moraima II*, belonging to Messrs. Arkell, is a certain starter, and we hope that others from the old country will do battle also. The course will be from one side of the lake to the other, a distance of about 300 metres, or, roughly, 325 yards. The boats will be divided into three classes: (1) Hydroplanes, not exceeding 1½ metres in length, with any type of motor; (2) electric boats in three sub-classes—(*a*) up to 60 cms., (*b*) up to 1 metre, (*c*) up to 1½ metres; (3) steam or petrol boats, divided into the same sub-classes. A prize will be given in each of the foregoing classes, and the first two boats in each class will be qualified to compete for the two Branger Cups, of which one will be given for electric models, and the other for models using any other power. There is an entrance fee of 5 francs, which with particulars of entry should be sent to M. Branger, 5 rue Cambon, Paris, as soon as possible before the day of racing. Judging from the popularity of the previous events organised by M. Branger, which our readers will remember have been reported in our pages, the gathering for this year will be well worth seeing.

* * *

The progress of the new Model Engineering Societies in Birmingham and Manchester has roused Sheffield into action. Mr. Joseph A. Wood, 133, Hill Street, Sheffield, offers his services in the matter and asks local enthusiasts to communicate with him with a view to forming a Society. We may say that several years ago quite a good Society existed in Sheffield, with some very capable members, but for some reason or other it was allowed to lapse. Sheffield, as a centre, is so strong in engineering talent that there should be no difficulty in running a very prosperous organisation. Mr. H. S. Phillips, of Solihull, Birmingham, reports the holding of a successful inaugural meeting, and asks us to say that particulars of ensuing meetings will be duly announced.

Answers to Correspondents.

J. W. B. (Helsby).—We are sorry we cannot help you with the financial side of your flying machine. Read our recent remarks on the development of inventions.

C. E. W. (Warrington).—Use shellac varnish, to be had from any oil and colour stores. Our "reading cases" are for containing loose numbers of THE MODEL ENGINEER, held in place by a length of cord passed between the pages. Binding cases are for binding up the issues into volumes, each containing twenty-six numbers of THE MODEL ENGINEER.

W. T.—(1) ½ lb. to ¾ lb. No. 26 S.W.G. (2) Yes, shellac varnish.

S. P. (Wednesbury).—Thanks for your letter; we shall be pleased to see the photos when they are ready.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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Contents.

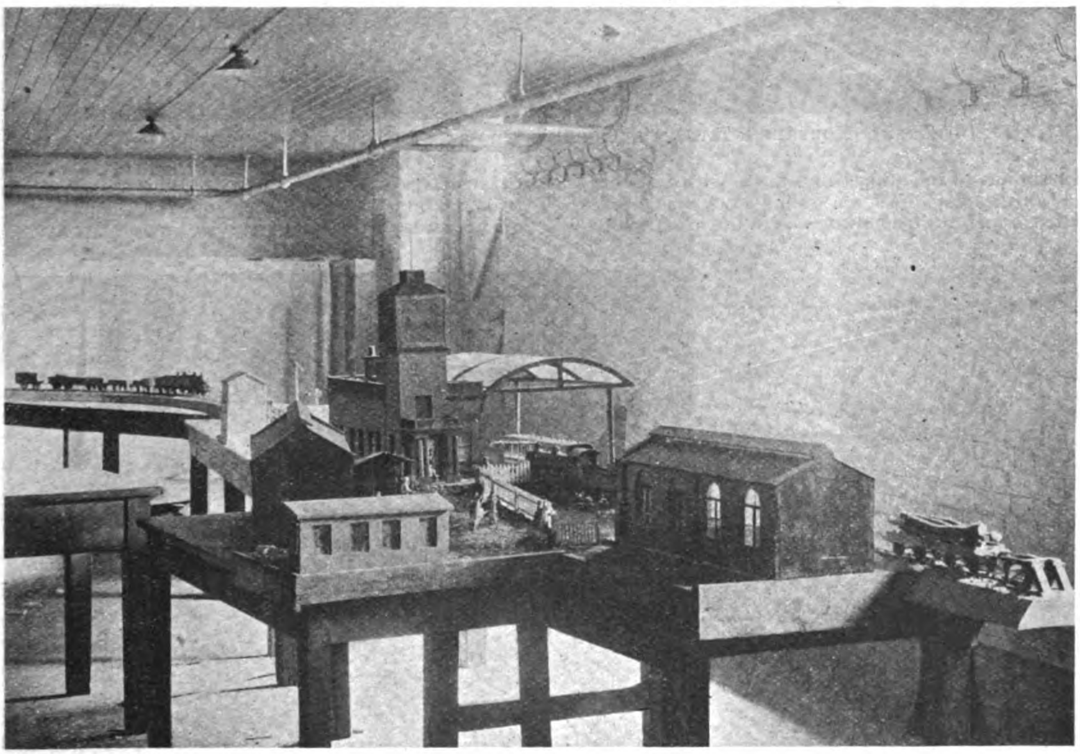
[*The asterisk (*) denotes that the subject is illustrated.*]

THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 388. OCTOBER 1, 1908. PUBLISHED WEEKLY.

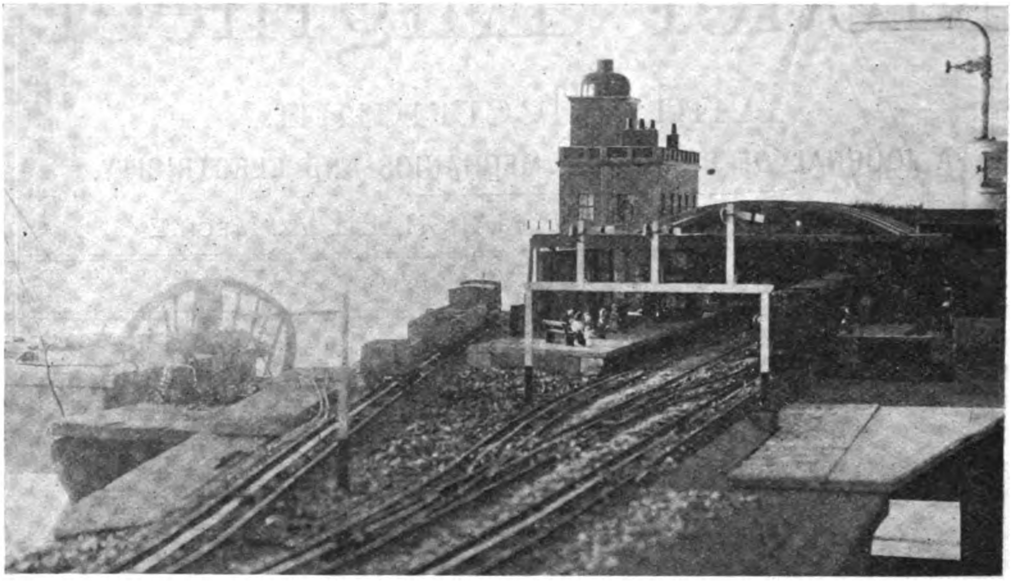
A Model Railway at Thetford Arts and Crafts Exhibition.



THE COUNTRY TERMINUS. (NOT QUITE FINISHED.)

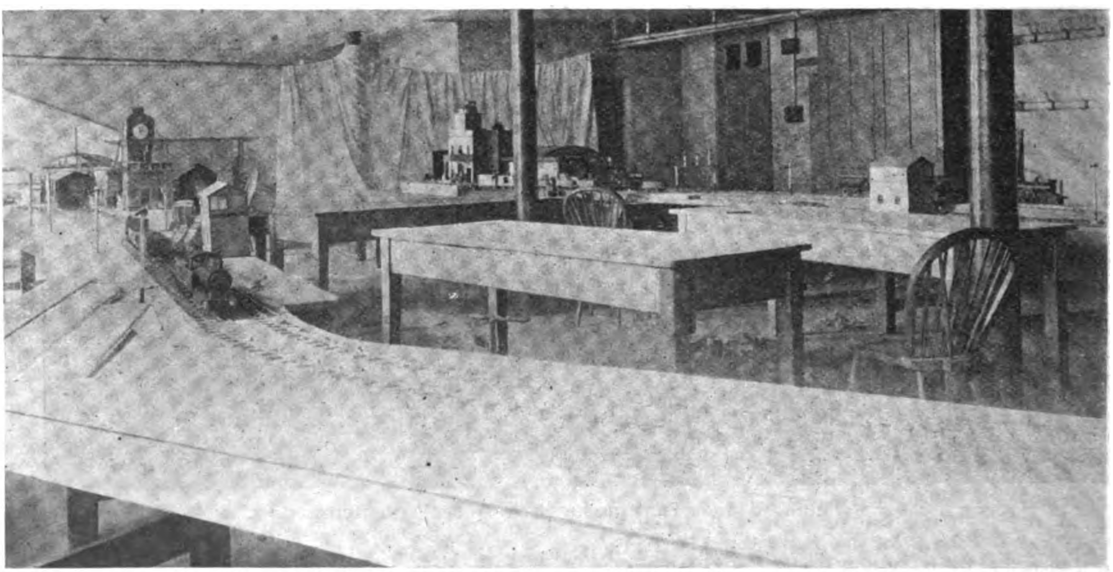
AN Arts and Crafts Exhibition was held recently in the little town of Thetford, in Norfolk, and there were several articles in the models section of interest to model engineers. Two very well made model traction engines were shown and also a road roller, these being made by employees at the engineering works of Messrs. Charles Burrell and Sons, the well-known makers of traction engines. The Great Eastern Railway Company also very kindly lent their magnificent model of the "Claud Hamilton," a description of which appeared in THE MODEL ENGINEER for September, 1900.

The chief exhibit was a model railway, which had been set up in the basement of the Town Hall, and was shown as an extra side show. The railway was roughly horseshoe in shape, the distance from trolling and reversing, coupling and uncoupling, were all done from the signal boxes at each terminus. Unfortunately, the time at the disposal of the



Grand Northern Railway, Queen's Cross: The London Terminus.

one terminus to the other being 74 ft., with a double track all the way. All the rolling-stock was Great Northern, and the locomotives were the electrically constructors was too limited to allow of any trial trips before the Exhibition opened. The consequence was "the train service was scarcely so



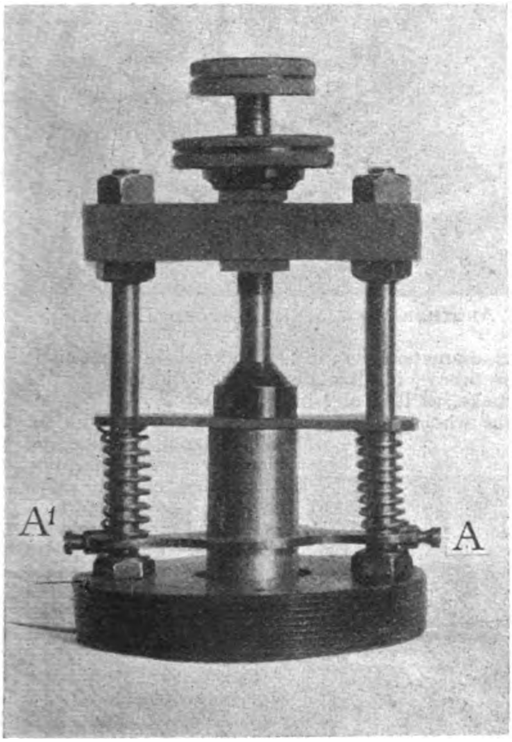
A General View of Railway.

controlled ones recently introduced by a Midland firm. The signals and points were all properly arranged on the interlocking system, and the con- satisfactory as could be desired," as the local newspaper remarked, yet the exhibit aroused much interest amongst the visitors.

A High-Frequency Break.

By C. S. Persichetti.

The photographs show a modification of the hammer break for induction coils. This was devised some time ago and the results obtained were very satisfactory, the chief being,



A High-Frequency Break for Induction Coil.

freedom from sticking of the break, and the production of a high-frequency and toned spark, well adapted for purposes of wireless telegraphy. It consists of two brass rods about 1½ ins. apart, screwed firmly into a piece of ebonite, of necessary thickness, at each end. Over each rod is a steel spiral spring, and at each end of the spirals a strip of brass from one rod to the other, but sliding loosely over them.

As the photograph shows, the hammer passes through a hole in the ebonite and the near strip of brass. The hammer contact of platinum is screwed through the second brass strip and into the hammer. Down the centre of the ebonite on the right of the photograph is also a strip of brass, through which is screwed the back contact of platinum. The two spirals allow the break to work very easily and rapidly, and may be quickly adjusted by screws in the brass strip marked A_1 A.

The terminals to be connected to the battery are as shown in Fig. 2. The break, as a whole, can be readily fixed to the core of the coil by means of the ebonite boss or plug, which is screwed. As before remarked, this break was found to work with high-frequency and to be free from troubles of adjustments noticeable in many other types.

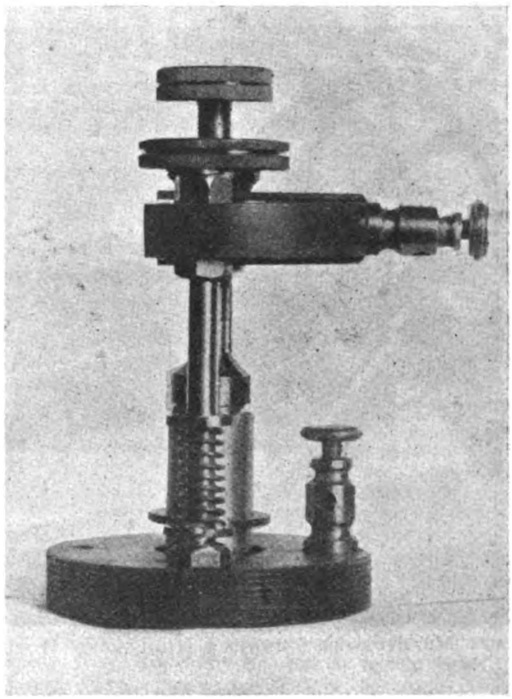
A High-speed Model Horizontal Steam Engine.

By Russell Skinner.

Being a constant and extremely interested reader of your very excellent and worthy paper, The Model Engineer, I thought perhaps a detailed description of a scale model high-speed high-pressure horizontal steam engine I have partly designed and built throughout might be of some interest to your readers.

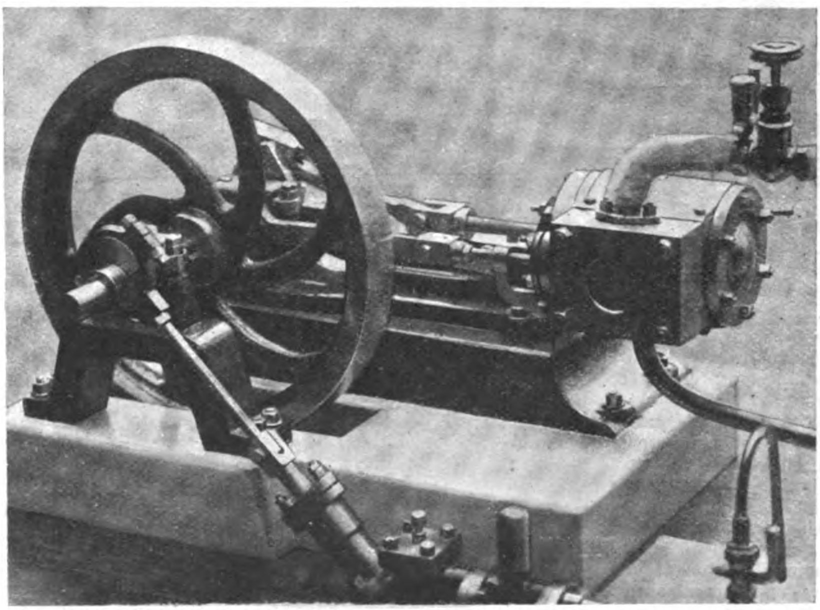
I bought the castings and design from one of the advertisers in your paper; but the design not being exactly what I required, I altered it to my own requirements, and had one or two castings made from my own drawings, making the model as perfect in the details and to scale as possible.

The cylinder, soleplate, bedplate, and flywheel are cast-iron; the split brasses, crosshead slide, and glands are of hard brass; the steam supply and exhaust flanges and slide-valve are of gun-metal. The motion-work throughout is of steel, with the exception of the crosshead, which is of



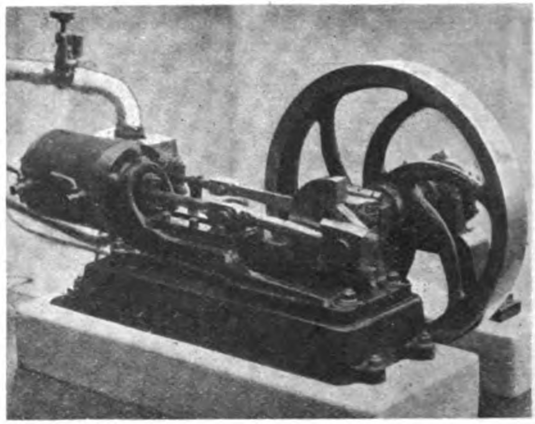
Side View of Break for Induction Coil.

wrought-iron and highly polished. The guides for the crosshead are marine pattern and made of steel; the caps for the plummer blocks of wrought-iron, also highly polished. The piston-rod is of steel turned in a 3½-in. Drummond lathe, coned each end, and keyed to the crosshead with a steel taper pin. The piston is of cast-iron, and made in two halves, as in larger engines, for the piston-ring to go on. The valve rod is steel, and passes through a gun-metal guide into the valve chest, and is fitted with two hexagon nuts on each side of the valve for adjusting same, as in the real engine. The eccentric rod is a piece of flat steel, and riveted to the eccentric strap, which is of gun-metal and split in two halves. The crankshaft is of silver steel, and the crank, which is made out of an odd piece of 3-16ths-in. mild steel sheet, is also cut with a hacksaw and filed up to shape. The crank is balanced with a piece of ⅛-in. mild steel, flat, shaped up and secured with three ⅛-in. Whitworth screws. The crank-pin is turned with a flange at one end, and shoulder at the other end riveted through crank. The crank is also riveted to the shaft in the same way. The eccentric sheave for the valve, and also that for the pump, was made out of odd pieces of round mild steel bar (1 in. diameter), turned down from the solid, as was also the connecting-rod. The crosshead and plummer-block caps were not forged, but cut with a hacksaw from a solid wrought iron bar ½ in. square, and filed up to shape and polished. The crosshead has a hard-brass slide screwed to the under-side; the slide can be renewed when much worn, as in the real engines. I did not trouble to fit double guides, the engine being designed to run in one direction only.



Mr. Russell Skinner's High-speed Horizontal Engine.

The cylinder is 1 in. diameter and the stroke 1¼ ins.; the working pressure is 60 lbs.; the cut-off is seven-eighths of the stroke. I did not deem it advisable to have it greater than this in so small a model, the angle of advance of eccentric sheave being about 30 degs. and the travel of the valve 17-64ths in. The ports are large (7-64ths in. by ⅜ in.), and the engine runs remarkably steadily and smoothly, and at very high speed, and absolutely silently—only the exhaust can be heard up the chimney. The boiler is a vertical multitubular



Another View of High-speed Engine.

6 ins. diameter by 13 ins., with smokebox and eight brass tubes ¾ in. diameter. This I did not attempt to make, as it is of ⅛-in. steel plate.

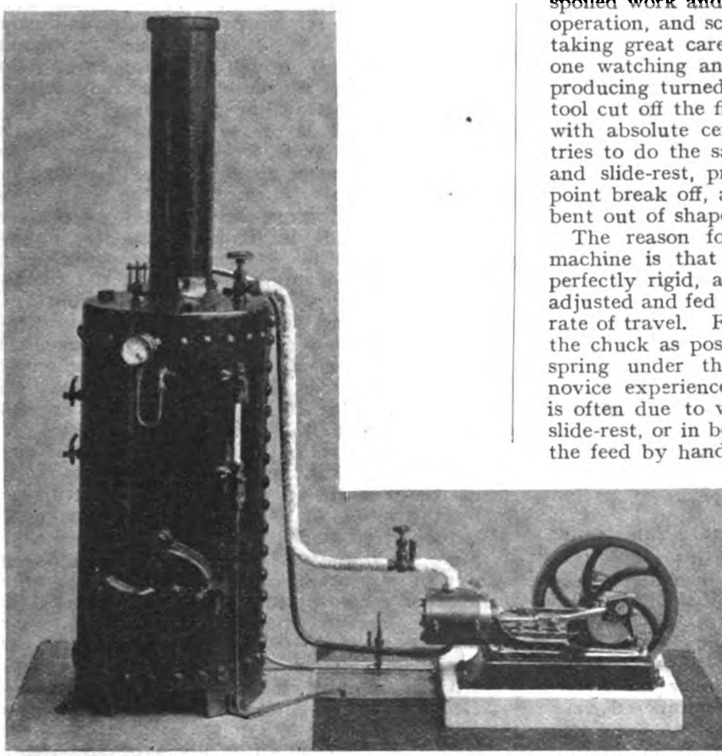
The whole engine was made without the aid of a surface-plate, scribing block, or planing machine. The faces of the valve chest and ports were filed as flat and true as possible, and when the ports were held together and I could not see the joints I was satisfied it would be true enough for a good steam joint.

The bed of the lathe was frequently used as a surface-plate, and this answered admirably. The pump has a ram ¼ in. diameter, and I made the eccentric for it with a ⅜-in. throw. When engine is running at about 500 r.p.m., it throws water into the boiler easily against the boiler pressure of 60 lbs., and this has proved remarkably successful, because it is not geared down in any way, and, as most model makers know, small pumps often refuse to work properly when run at a high speed direct from engine. In this case the reverse seems true—the higher the speed the better she pumps, and when pump is not required a by-pass is fitted, and the water is thus returned to the supply tank. This consists of a tin biscuit box reduced to the required size and placed out of sight underneath the engine base. The flywheel is 5 ins. diameter, with a heavy rim, 21-32nds on the face, which is slightly rounded to take a belt. Ninety-six small hexagon nuts have been used in the construction of this engine, including the pump, and it is fitted throughout with studs. The cylinder is lagged with asbestos and sheet blue steel. The steam supply pipe is also lagged with asbestos and fitted with a wheel valve and lubricator. All the joints of the steam and exhaust pipes, etc., are silver-soldered.

I originally fired the boiler with a No. 4 Primus oil burner, but I could not raise more than about 20 lbs. of steam with the engine running at a moderate speed only, and when the pump was required, this reduced the pressure so much that I discarded the oil stove and adopted a charcoal fire—(the boiler has water-space all round the firebox), and this has proved quite satisfactory, as it will maintain, with a good fire, about 60 lbs. pressure with the engine running at about 400 to 500 r.p.m., and when the pump is on the pressure is only reduced about 10 lbs., according to the speed pump is working.

The greatest difficulty experienced in building this little model was found in getting the guides for the slipper perfectly true, square, and flat, not having a surface-plate or scribing block to work with; or, rather, I should perhaps say the surface that the guides are screwed to, in getting it dead-square with the cylinder; but it has been overcome, and a highly successful working scale model is the result.

A general view of the whole plant—engine and boiler—is given above.



General View, showing Engine and Boiler.

How It Is Done.

[For insertion under this heading, the Editor invites readers to submit practical articles describing actual workshop practice. Accepted contributions will be paid for on publication, if desired, according to merit.]

Parting Off Work in a Lathe.

By A. W. M.

THIS seems an exceedingly easy and simple operation, perhaps the easiest one which the novice can imagine in the whole art of turning. He starts on it with confidence and a light heart, and his attempt usually ends in disaster. The latter part has certainly attended one of the readers of The Model Engineer, who confides his troubles in a letter to the Editor. Take courage, T. D. E., probably every professional turner has spoiled work and tools over this same easy-looking operation, and scarcely one will perform it without taking great care to guard against trouble. Anyone watching an automatic machine in operation producing turned articles from a rod will see the tool cut off the finished article as a final operation with absolute certainty and precision. But if he tries to do the same thing with an ordinary lathe and slide-rest, probably the tool will dig in, the point break off, and the finished piece, perhaps, be bent out of shape and spoilt.

The reason for the success of the automatic machine is that the mandrel and toolholder are perfectly rigid, and the tool properly shaped and adjusted and fed to the work at a suitable and even rate of travel. Further, the cut is made as near to the chuck as possible, if the bar is at all likely to spring under the strain. The trouble which a novice experiences when using an ordinary lathe is often due to want of rigidity in the mandrel or slide-rest, or in both; it is also difficult to regulate the feed by hand to such a nicety that the cut is not made too deep, especially if the tool is held in the hand, and not in the slide-rest.

The tool should be shaped as Figs. 24 or 27, in Mr. Percival Marshall's book, "Practical Lessons in Metal Turning"; it is of special importance to have clearance at the sides, as shown for a slide-rest tool, and advisable not to make the front cutting angle too keen; rather err on the side of having a somewhat blunt angle. It must be held in the slide-rest, so that its cutting edge is as near as possible at the height of the points of the centres. This is particularly important if the work is of small diameter; with comparatively large diameters the cutting edge may be slightly higher than the points of the centres. Do not try and take a heavy cut; feed the tool very carefully, and allow it to complete its cut before feeding again. It is very difficult to feed the tool with sufficient minuteness when the handle is operated by hand, unless the material being cut is soft, and running at a high speed. A self-acting feed does not always prove successful, as it goes on without regard to the way in which the work is taking the cut, and may cause a disaster for this reason. With an automatic machine, repeating the operation hundreds of times over again on given material, matters can be adjusted through a few preliminary failures, but the amateur is changing his conditions with almost every piece, and must not expect to be able to leave his lathe to deal with them. Feed the tool up to the work, and then tap the slide handle with a short piece of rod, a spanner, or anything handy, until you get a cut started; continue to take a series of cuts in a similar way, letting each one clear itself before starting the next. Watch the work to see if it shows signs of springing or riding on to the tool; if it starts to do this, look out for trouble. You may then be wise to cease the turning operation and complete the cutting off by means of a hacksaw.

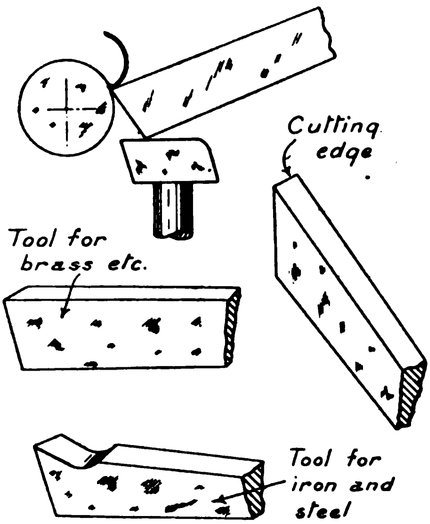


FIG. 1.—TOOLS FOR PARTING WORK IN THE LATHE.

Any work which projects much beyond the face of a chuck is very liable to spring if the cut is also to be made anywhere except very close to the chuck. If the work is being held between the centres, it will be very liable to spring unless the cut is quite near to one end. Under these conditions the parting operation may proceed very well for a time, but later the pressure of the tool causes the work to bend, though still rotating truly; it is trying, however, to rotate eccentrically; this puts extra pressure on the cutting edge of the tool, and it digs in, the work rides up on to the top face, and damage usually occurs to both tool and work. The cut should therefore be humoured to prevent this bending. A good plan is to make the parting surface wider than the cutting edge of the tool, allowing sufficient length in the piece to provide this margin. For example, if the tool is ⅛ in. wide, make the parting surface of the work 3-16ths in. or so wide. When cutting, move the tool sideways by means of the top slide at each cut, so that instead of making a groove exactly the width of the tool, you make one which is slightly wider. This will enable the tool to cut easily and prevent pressure from the sides of the groove. If you are using a hand tool, work to the same idea. Elevate the hand-rest so that the tool is well above the points of the centres, as indicated by sketch (Fig. 1), and make the cut with a see-saw motion to each side. This will produce a groove which is wider than the tool, and enable you to regulate the cutting action much better than if you attempt to make a purely front cut straight down into the work. A hand tool need not have its sides tapered from the cutting edge, but they should taper in a vertical direction, as indicated by the sketch.

When parting off by hand tool, run the lathe at high rather than low speed, and take light cuts. If the work or tool can give at all under the pressure of cutting, you are facing disaster, which can only be avoided by the use of persuasion in your methods. In theory a parting tool, whether hand- or slide-rest, has merely to be pushed straight into the work and the cut maintained until the piece drops off. In practice you will have to ease matters according to the circumstances of lathe and material. To be on the safe side, leave a certain amount of stock to be cut through by means of a hacksaw, and do not try and cut the piece right off by the tool. Even when the work is firm and the cut well supported, the piece is liable to make a considerable bend just at the last moment and catch against the tool or rest, very likely spoiling a nice finished shape or surface. In the example mentioned by our correspondent the work is given as a foot length of ¾ in. diameter mild steel; presumably, it was held between centres. Such a piece would tend to spring away from the tool when direct pressure was applied by the front cutting edge, unless the cut was made very close to one end. By giving a small sideways movement to the tool, and permitting each cut to complete before feeding again, the bending would relieve itself at each cut. Any slackness in the slides or mandrel would intensify the uneven cutting caused by the spring of the work. The centres should be screwed together, so that there is no end shake, as, if this exists, it contributes to an uneven cutting action by the tool. At the least sign of weakness the reduction of diameter should be stopped and the piece finally cut off by means of a saw. You must remember, in the instance of work supported between centres, that its strength to resist bending is being reduced with each cut, and that a stage may be reached at which it cannot stand against the pressure of the tool; it is well to avoid this critical stage by completing the cut with a saw. Bending can be prevented by means of a steady rest, such as Fig. 118 or 172 of the book referred to, or the kind shown by Fig. 119, placed directly over the parting groove.

To sum up, the precautions required are—tool cutting edge at or slightly above the points of centres; stiffness of work and lathe; persuasion in cutting by a small sideways movement of the tool; parting completed by hacksaw. It is quite possible for an amateur to part off pieces completely through by the tool if the work is held in a chuck when he has had some practice and realises the essential conditions; but I do not advise him to try and do so when the work is supported between centres.

Our correspondent found that the tool scraped at first when the parting was started, but that as soon as he applied more pressure it would dig in and take a deep cut. This is very likely to happen if the metal has a hard outer skin, as would be the case if it were the full-size bar, not turned down at all. The effect is due to spring somewhere; it might have been eased if the tool had been given a small sideways movement. At first the pressure is excessive, to enable the cutting edge to get a bite, but once it has done this the springing away of the bar or tool relieves itself by deepening the cut. If everything had been quite rigid, this would not have occurred. When parting off work, therefore, guard against any give in the work or lathe; if it occurs, ease matters by manipulation of the tool.

Workshop Notes and Notions.

(Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "Workshop" on the envelope.)

A Simple Boring Carriage.

By E. T.

Having made a small plain lathe some time ago, I was at a loss how to bore three cylinders of different diameters for engines in course of construction.

Having decided on making a boring carriage, I first got out the patterns, which were very simple, and sent them to the local foundry, where castings were obtained from them. The castings consist of the boring carriage proper and the two ends, which were obtained from the same pattern.

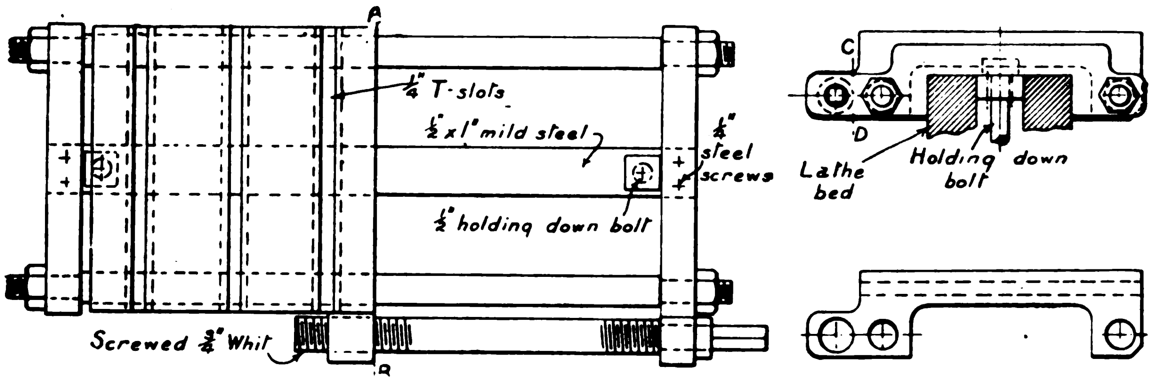
While waiting for castings, I got two pieces of silver steel ⅝ in. diameter. These were centred truly, and the ends reduced to ½ in. diameter for a length of 1½ ins., leaving 12¼ ins. between to act as guides for the carriage, untouched. The ends were next screwed for ½-in. Whitworth nuts, which hold the whole frame together. These guides were then put aside and the feed-screw taken in hand.

For the feed-screw a piece of ¾ in. diameter round tool steel was obtained. This was then screwed, after being centred truly, ¾-in. Whitworth for a length of 7½ ins. from one end. The unscrewed end was then reduced to ½ in. diameter for a length of 2½ ins., and 1 in. of this was squared to take the handle. A collar was next turned and bored ½ in. to fit on the reduced portion of feed-screw, and this was fixed on the screw by means of a taper pin driven through both the screw and collar. This screw was then case-hardened.

Having now obtained the castings, I first took the carriage. The lugs were first bored for the guides, viz., ⅝ in., and for the feed-screw, ¾-in. tapping. The holes for the guides must be very carefully bored, and must also be a very good fit for the guides. If these holes are a good fit, they help to strengthen the guides by bracing them together. The top of the carriage was then tackled, and this proved to be the worst job of the whole affair. The T-slots were filed clean, and then the top was filed as truly as it could be, being tested with an angle-plate and straight-edge.

The ends were next looked to and carefully filed where they touched the lathe bed, and where the strip of ½-in. by 1-in. steel was to be fastened to them, between the cheeks of the bed, by two ¼ in. diameter steel screws at each end. These were then clamped together and the holes bored for the guides through both at once, in order to get them exactly the same distance apart and at the same height. On taking the two apart, the hole for the feed-screw was bored in the right-hand end piece. As will be seen in the drawing, the ends differ the one from the other. The lug having in it the hole for the feed-screw is cut off the left-hand end piece, as indicated by dotted line C D in the end elevational drawing. The ends and carriage were then filed smooth all over and painted to prevent their going rusty.

The strip of ½-in. by 1-in. steel fastening the two ends together has two holes bored near the end to take the two square-headed ½ in. diameter bolts to hold the whole appliance in place. These holes are bored near to the ends, so that the heads of the bolts catch on the end castings and so are prevented from turning.



A Simple Boring Carriage.

The slots cored in the carriage will take ¼-in. bolts, which are used to hold the work being operated on.

To act as a handle, an old valve wheel of brass 3¼ ins. in diameter was fitted with a steel handle, and this is far better than an ordinary cranked handle, as it can be turned easily by the rim to give a careful feed for finishing work.

On viewing the finished piece of apparatus, I must confess that I felt very shaky as to the use of my new "contraption," as a friend called it. So by way of a test I began on the biggest and toughest of the three cylinders which I had to bore. This was to be bored to 2 ins. diameter and was cast in iron. The cylinder was bored as parallel as possible, not being any measurable amount out of truth throughout the bore, thus showing the "contraption" to be equal to the work.

Chats on Model Locomotives.

By H. Greenly.

(Continued from page 392, Vol. XVIII.)

Standard Inside Cylinders for 1-in. Scale Models.

As many readers are aware, I have for some time advocated, as far as possible, the use of standard parts for model locomotives, and so long as the persistent use of such parts is not detrimental to true progress, the benefits accruing therefrom are considerable. In pursuance of this idea, I submit designs for a pair of standard inside cylinders for 1-in. scale locomotive.

The cylinders are arranged on the plan of those first described in this journal for The Model Engineer steam locomotive (Jan., 1904—coloured plate). The bore may be either 1⅛ ins., 1 3-16ths ins., or 1¼ ins., according to the type and size of engine being modelled, and the stroke either 2 ins. or 2⅛ ins.

With regard to the latter dimension, even where the prototypes have 26-in. stroke, I always prefer to employ the scale equivalent of 2 ft. from the piston-stroke of a model locomotive—never more, as a thicker piston may often be used. In inside cylinder engines, perhaps, this is not such an important point, as the increased size of piston may be obtained by the simple expedient of lengthening the cylinder casting. With outside cylinders,

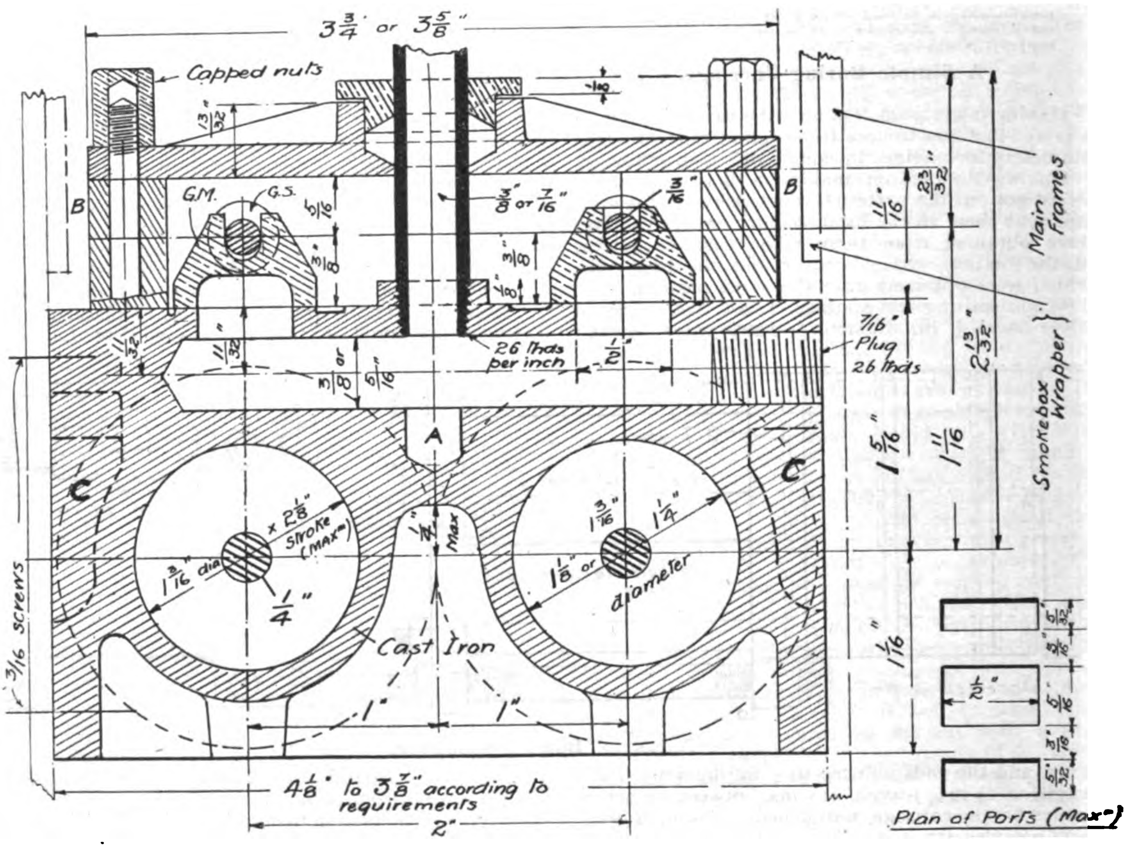


Fig. 1.—Cross-section of Standard Inside Cylinders for 1-in. Scale Model Locomotives.

(Scale of drawing, full size for model.)

One of the main reasons of my having prepared the drawings for cylinders of this size is the possession of a set of castings by a reader minus any further particulars of their construction. I have obtained dimensions of the castings, and although some differences in small details have been made (by way of improvement, I submit) in showing how they may be fitted up, the drawings herewith will be no less useful to this and other readers who may have castings for these cylinders.

the appearance of model and its external accuracy limits the over-all size of the casting, to say nothing of the near presence of the flanges of the bogie wheels of the engine.

The main casting of the cylinder is a simple affair. if extreme lightness is not desired. Personally, I rather fancy light castings for cylinders, as resulting in smaller heat losses, although from the point of view of the actual performances, I cannot point to any conclusive proof of the efficacy of cylinders containing a relatively small amount of metal. Certainly, the conduction of the heat to the frame and its subsequent dissipation is reduced by the lighter cylinders, and it takes less heat to raise the parts to the same temperature as the steam. However this may be, I have shown the lower portion of the cylinder casting cored away (no core is actually used) round the cylinder-boxes. The coring of the sides (see portions C, Fig. 1, enclosed by dotted lines) is optional. This involves a corebox, the print of which should stand well out, so that there is little likelihood of the core becoming displaced on running the mould. Really, sketch (Fig. 4). This is optional, and although it is more workmanlike does not make any appreciable difference to the weight of the casting. The screws required for fixing the cylinders to the frames are shown in Fig. 3. These may be ⅛ in. diameter, and, in addition, a couple of steady pins should be employed (*i.e.*, pins or screws) placed in holes drilled after the cylinders have been lined up and bolted to the main frames), so that the cylinders may at any time be taken out and replaced without interfering with their alignment.

With regard to the pistons, where iron cylinders are employed, rings may be used with advantage.

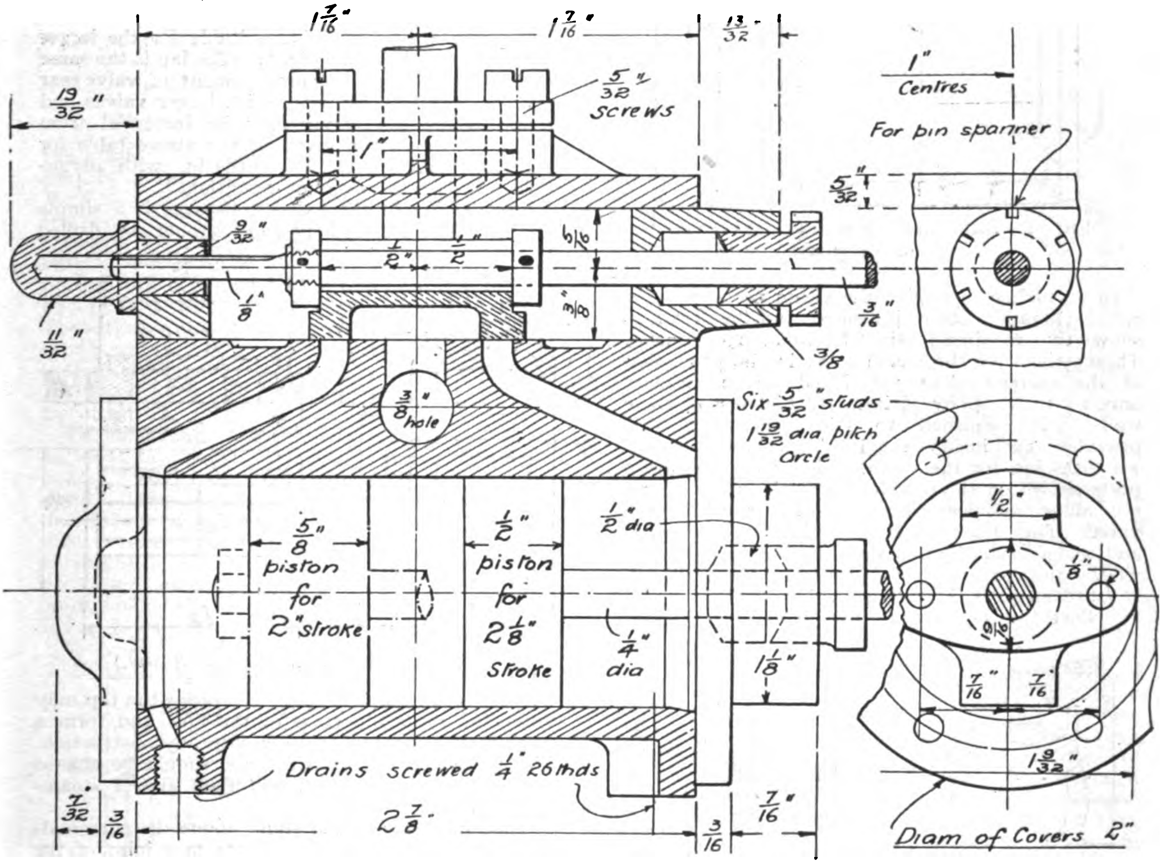


FIG. 2.—SECTIONAL ELEVATION OF INSIDE CYLINDERS. (*Full size for 1-in. scale model.*)

two core-boxes should be used to obtain the maximum lightness, or one core-box with loose pieces to produce the two different cores necessary, owing to the drilling of the horizontal exhaust passage from the outside of the casting. Loose pieces and other refinements of the pattern-maker's skill are, however, not always appreciated by the founder when it comes to model castings, and are liable to be lost. The side cores may therefore be identical and shaped in elevation as shown in the half-size drawing (Fig. 3) herewith.

A rather better cross-section for the coring of the sides and bottom is shown in the half-size

For general design I recommend the arrangement described for the L.-P. cylinders of the small under-type engine which formed the subject of a series of articles in THE MODEL ENGINEER last year. The cylinder covers are of standard design, the front cover being bossed out to clear the piston-rod nut. The rear cover is arranged to take a double bar top and bottom. Of course, only a single bar need be employed if the particular design of locomotive demands it, the lug being left remaining or cut off, as the builder desires. The facing for the cover nuts may be raised slightly in the pattern to provide for clean machining, and, of course, an allowance should be made on the top of the lugs for machining or filing to fit the slide-bars, and also on the gland face.

In the case of a four-bar engine the covers may be turned round the other way and the slide-bars fixed as shown in hand sketch (Fig. 5).

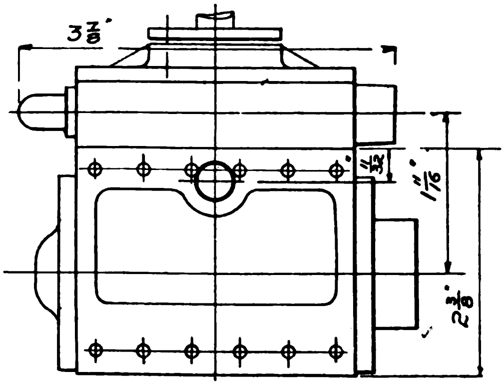


FIG. 3.—SIDE ELEVATION OF CYLINDER. (*Half size for model.*)

In an inch scale engine the steam ports (not the exhaust) may be cored, if desired, and the drawings show the maximum size I would recommend. The castings for the steam chest in the possession of the correspondent mentioned above measure only 2 5-16ths in. by 3⅝ ins., the thickness of these walls being finished to ⅛-in. thickness. This provides an inside longitudinal dimension of 1 9-16ths ins. for the valve, which, were the steam ports shown on the drawings herewith used, would not allow sufficient room for the travel of the valve. The steam ports are evidently not cored, and under such circumstances the ports and valve will be quite satisfactory if proportioned as follows:

Steam ports, ½ in. long by ⅛ in. wide.
Port bar, 5-32nds in. thick.

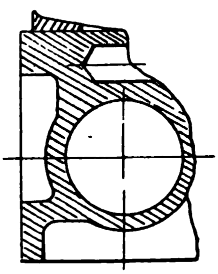


FIG. 4.

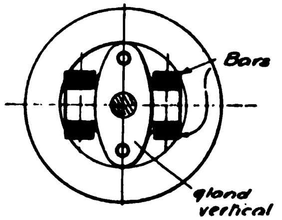


FIG. 5.

FIG. 4.—SKETCH SHOWING ALTERNATIVE METHOD OF CORING OUT THE SIDES AND BOTTOM OF CYLINDER CASTING.

FIG. 5.—BACK COVER ARRANGED FOR FOUR-BAR ENGINE.

Exhaust port, ½ in. long by ¼ in. wide.
Exhaust passage, 9-32nds in. or 5-16ths in. diameter.
Plug for exhaust passage, ⅜ in. diameter, 26 threads.
Exhaust pipe, ⅜ in. diameter (outside).
Lap of valve, 1-16th in.
Length of valve over cap, 15-16ths in.
Length of valve cavity, 17-32nds in.
Distance between V.S. collars, ⅞ in.
Valve travel, ⅜ in.
Length of valve face swept by the valve, 1 5-16ths in.

With these dimensions there will be at least 3-32nds in. clearance between the valve chest walls and the collars of the valve spindles, if the latter do not exceed ⅛ in. wide, and if the valve is filed away more so as to bring the collars closer together. With some forms of valve gear, notably the modified Joy's gear described by the writer in the issue of May 30th, 1907, a larger amount of clearance than normally required is essential.

The dimensions of valve suitable for the larger steam port is shown in Fig. 6. The lap is the same in both cases, and the arrangement of valve gear may be identical, although with larger valves and steam ports, the travel may be increased from ⅜ in., the dimension given in the above table for the ⅛-in. steam ports, to 7-16ths in., with advantage. It is, however, not essential.

The drilling of the exhaust passage is a simple matter. The vertical passage should be drilled

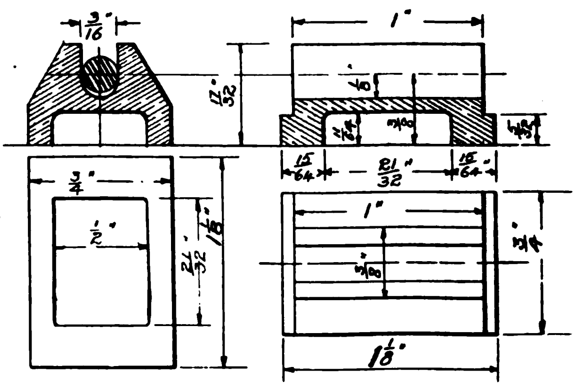


FIG. 6.—SLIDE-VALVE. (*Full size.*)

deeply, as shown at A (Fig. 1), so that the tap may enter the tapped portion of the hole and form a good thread without meeting with any obstruction. The thread on the exhaust pipe should be chased taper. A little red lead will then give a steam-tight joint.

The port faces should stand above the surrounding metal, but be level with the face joint of the steam chest, so that one machining faces the two portions. It would be very unwise to raise the port face, as is usual where the walls of the steam chest are cast solid with the cylinder. The facing may be done in the lathe, right to the central boss for the exhaust pipe, the recessing round the port faces being arranged for in the pattern, or chipped or milled out before or after the final machining.

The width of the cylinders may vary between 4⅛ ins. and 3⅞ ins., according to the type of locomotive being modelled. In the castings referred to the steam chest measures 3⅝ ins. wide. This is all right, but, as shown in Fig. 1, which is drawn to this dimension, there is not much room to spare at the sides of the valve if ½-in. steam ports are employed. The width should be 3¾ ins., if possible.

This drawing also shows the relative positions of the main frames and smokebox wrapper-plate. With the ordinary type of locomotive smokebox

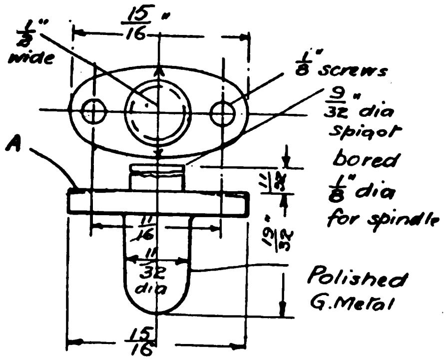


Fig. 7.—Dummy Gland. (*Full size.*)

the steam chest cover would form the bottom of the smokebox, and the space B (Fig. 1) between steam chest and the wrapper-plate should be packed with wet asbestos to make an airtight joint. If only a thin wrapper-plate is used, the bottom may be thickened up by riveting on a plate, as shown in the sketch (Fig. 9). The screws which secure smokebox to the frames will then be provided with a much better hold on to the plate, and the space B (Fig. 1) filled up in a more or less perfect manner.

The steam chest is a simple casting, with a stuffing-box and a gland for the exhaust pipe. Studs need not be used for this gland. The joint is not often broken, and the threads of the studs in a smokebox soon become clogged with dirt and the nuts difficult to remove. In actual practice capped nuts are always specified for inside smokebox fixings. These are shown in Fig. 1, and protect the top of the stud

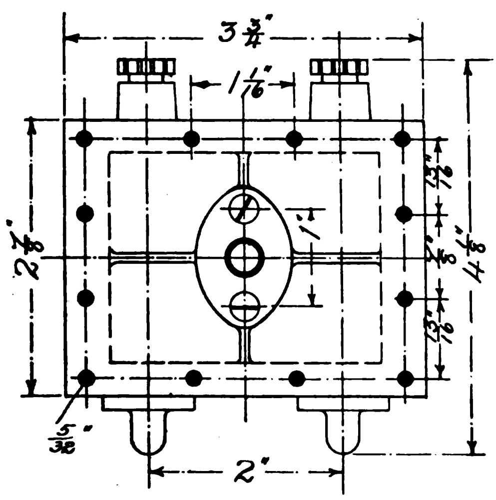


Fig. 8.—Plan of Cylinders, showing Arrangement of Steam Chest. (*Half full size.*)

from dirt and damage. In a model they may be made quite easily out of hexagonal brass or steel rod.

The positions of the steam chest studs and those of the cylinder covers are shown in the respective

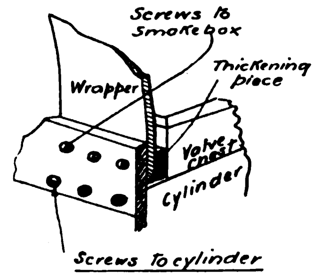


Fig. 9.—Fixing Smokebox Wrapper.

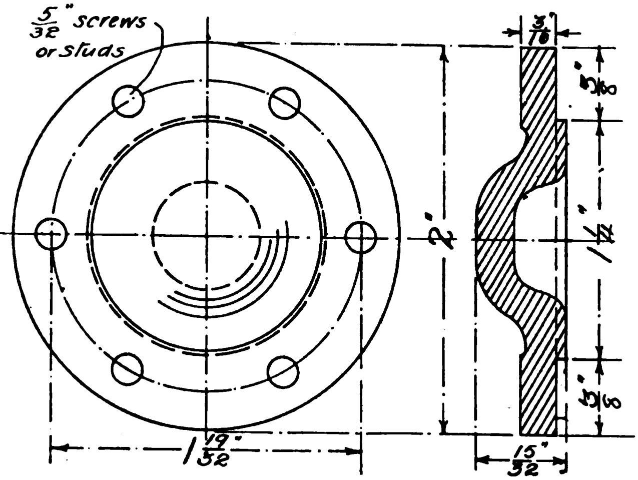


Fig. 10.—Front Cylinder Cover. (*Full size.*)

drawings: 5-32nds in. diameter is the standard size. Should any maker of the cylinders now under consideration wish to change the positions of the studs, he must take care to see that they clear adjacent moving parts, and in the case of cylinder covers to see that the studs miss the open ends of the steam ports and the draincock passages.

Having experienced the difficulty of packing small glands, I recommend the screw-in pattern for the valve spindles (as shown in Fig. 2), if not for both piston-rod and valve spindles. The flange of the gland may be slotted or provided with radial "tommy" holes.

The valve spindle is round, and fits in a slot in the valve, the collars being tight fits and pinned on to the rod, or screwed and pinned, according to the fancy of the builder of the model. I would prefer the arrangement shown, viz., a plain collar on the larger diameter, and the other being screwed and pinned. The extension of the valve spindle should be filed slightly flat on one side to allow of the escape of trapped water from the dummy gland.

This gland may be cast solid with the valve chest or loose, as shown. If the latter, it is advised that the flange be eased off, as shown in an exaggerated manner at A (Fig. 7), so that the gland bears hard on the centre when it is tightened up.

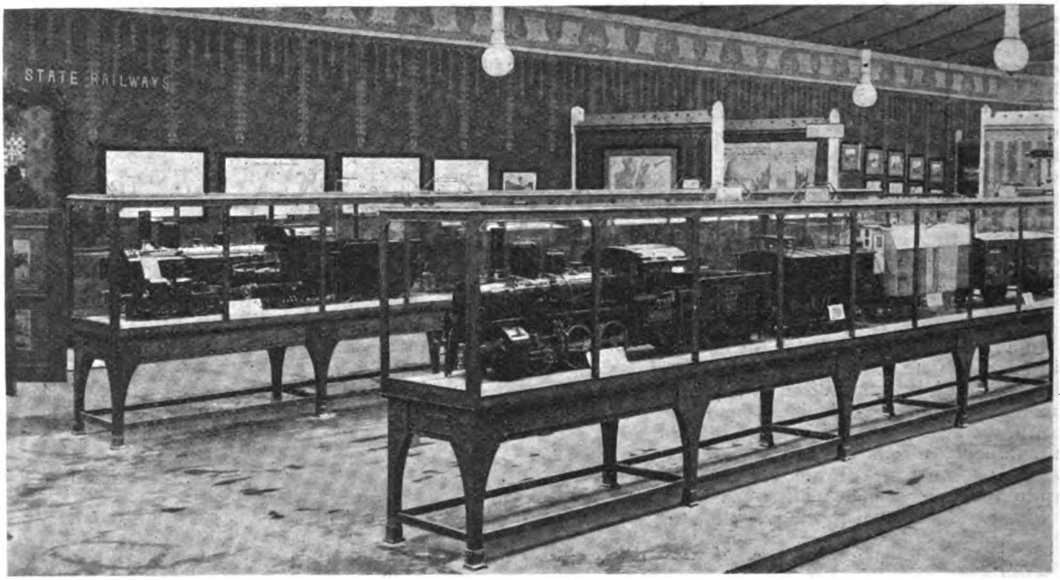
(*To be continued.*)

Models at the Hungarian Exhibition at Earl's Court.

THIS Exhibition, one of the series presented annually by the London Exhibitions, Ltd., shows that the Hungarians are a clever and artistic people, and that they possess a beautiful country. Exhibitions of this kind are very instructive and interesting to the thoughtful visitor. They practically bring one into actual contact with nations which, previously perhaps, had only been familiar as names on a map or from a knowledge of a few dry facts stated in a book on geography. Hungary may play a very important part in the near future in European politics, and there is evidence at this Exhibition that talent is not wanting in her race. Model engineers who think that they have seen all that there is in the way of locomotive practice from the examples in use on British railways, will be astonished and delighted at the magnificent models exhibited here by the Hungarian State Railways; they ought to be seen by every one of our model makers, as an education in this work. Those who are lovers of art and music will find additional pleasure in that direction.

Entering the Exhibition from Earl's Court Station, the visitor first reaches the educational section. There are appliances for teaching physics and mechanics, some electrical apparatus and models for teaching descriptive geometry, also a wood architectural model of the Francis Joseph Institute in section. Continuing through the corridors towards the grounds, we find a number of delightful examples of model-making in wood. A model of a seed riddling mill buildings, with rafts and slide for shooting firewood, also a sapling garden. A model of an ordinary forest water-driven saw, exhibited by the Royal Hungarian Woods and Forest Office; the saw is of vertical frame pattern, driven by gearing from a water wheel. A model of a tan breaker from the Royal Agricultural Museum, Buda-Pesth. All these are not only interesting as showing primitive machines used in forest industries, but are interesting and charming examples of clean, simple model work in wood.

Reaching the open air, across the water to the right is the pavilion in which the Hungarian State Railways' exhibit is situated. It includes four large model locomotives, which are not only interesting as designs, but are superb examples of workmanship and finish. At one end of the hall the model represents a tank engine—No. 4,281—for mixed trains; it is about 7 ft. in length, and is remarkable for working by adhesion to the rails, as usual, and in addition by an auxiliary cogged wheel and rack-drive (system Abt). The actual engine was constructed by the Vienna Locomotive Works, in Florisdorp, 1896; the model was made in the Miskolez Works of the Royal Hungarian State Railways, 1899. It has outside cylinders 500 mm. diameter by 500 mm. stroke for the adhesion driving wheels, which are eight-coupled, 1,050 diameter mm., with bogie. The geared drive is worked by two inside cylinders—420 mm. diameter by 450 mm. stroke; total weight of locomotive is 71·89 tons; working pressure, 12 atmospheres. The piston-rods are carried through the back covers. Wheelbase, 7,900 mm.; grate area, 2·4 sq. metres, firebox heating surface, 11 sq. metres; tubes—heating surface, 158·4 sq. metres.



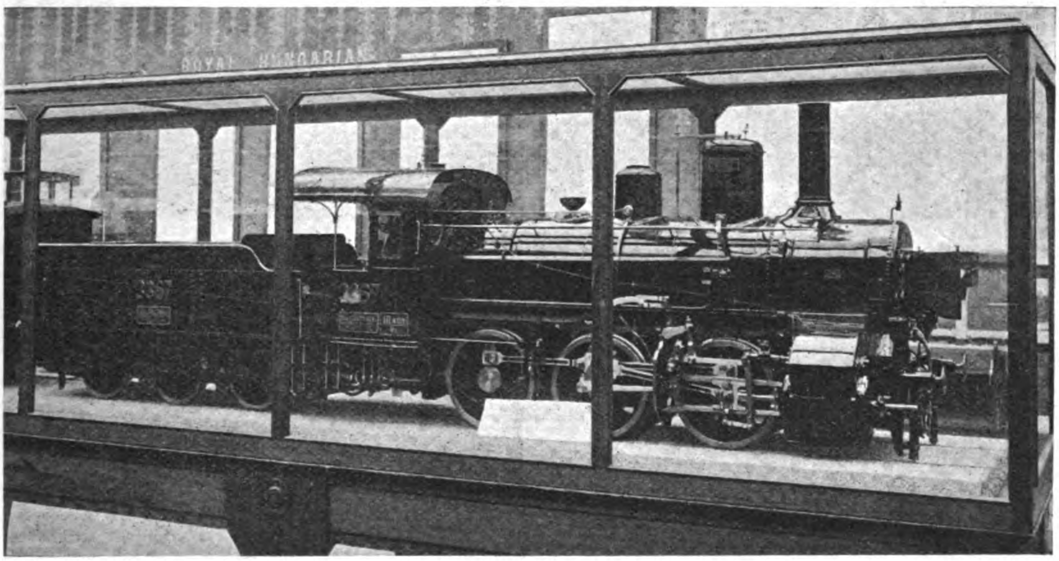
MODELS OF ACCELERATED GOODS TRAIN AND FAST PASSENGER TRAINS, R.H.S. RAILWAYS' EXHIBIT.

The geared drive is lifted up when not required, and lowered to gear with a rack placed in the centre of the track when the adhesion wheels are not able to haul the load by their grip on the rails. It is situated under the boiler, midway between the adhesion wheels. Separate starting levers are provided for the respective pairs of cylinders. The water gauge glasses are placed midway along the boiler in view of the driver; there are two, one being at each side; the object being to show an average level of water, as the locomotive is obviously intended for work on steep inclines. Gauges placed on the firebox would, therefore, be of little use owing to the inclination of the boiler.

At the other end of the hall is another model of exceptional interest. It is a Mallet system double-bogie compound freight locomotive. Each bogie has coupled wheels and is independently driven by a pair of cylinders and valve gear; the H.-P. cylinders (385 mm. diameter) are on the trailing bogie, and the L.-P. cylinders (580 mm. diameter) are on the leading bogie, with piston-rods carried through back covers. Total weight is 56·9 tons; grate area, 2·6 sq. metres, firebox, 12·3 sq. metres, heating surface—tubes, 154·6 sq. metres; working pressure, 13 atmospheres. The engine was constructed by the Hungarian State Railways, 1902, and the model made in the Northern Main Works, 1905. Diameter of driving wheels, 1,220 mm.; wheelbase, 5,800 mm.; tender wheels—diameter, 1,040 mm.; water capacity, 12·5 cub. metres; coal capacity, 8·8 cub. metres; weight (in working condition), 34 tons.

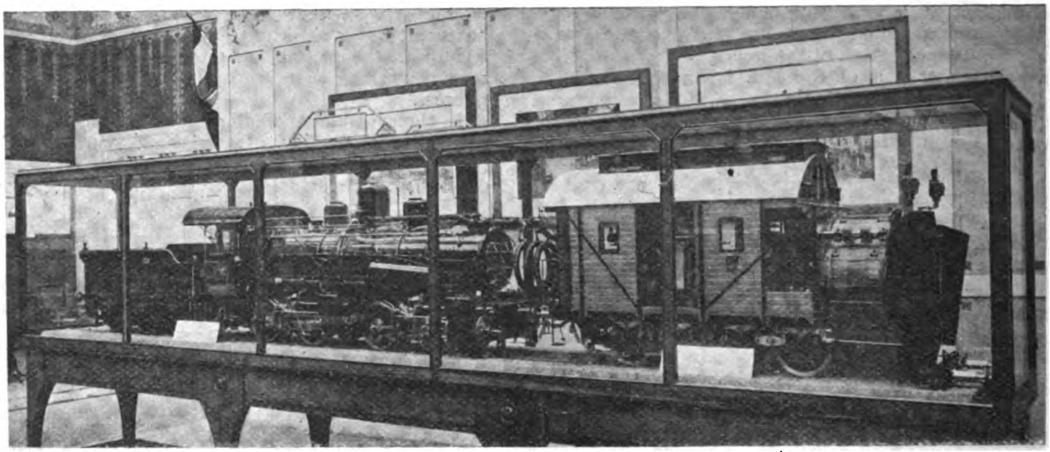
Coupled to this locomotive is a model of a rotary snow plough, which was made by the same works in 1894, the model being made in 1897. It consists of a strong covered wagon, in the front of which is placed a set of cutter blades similar to the arrangement of an air propeller fan. This forms the plough; it is mounted upon a shaft and rotated by means of a two-cylinder vertical steam engine placed inside the wagon. Steam is supplied from the boiler of the locomotive, and the exhaust is returned to the smokebox of the locomotive, in each instance through an armoured flexible pipe; these pipes are formed into large diameter coils, suspended over the couplings and buffer by springs. The rotary plough cutter is enclosed in a cylindrical steel case, which is entirely open at the front, but provided with doors at the side, through which the snow removed by the cutter is delivered to one or other side of the line, as desired. The steam engine drives direct on to the shaft of the plough cutter at 180 r.p.m. and develops 500 h.-p. Total weight of the plough, 44·4 tons; wheelbase, 3,550 mm.; working pressure of steam engine, 8 atmospheres.

In the centre of the hall are two models of express engines with trains. One is a locomotive—No. 3,367—for accelerated goods trains. The actual engine was constructed in the engineering works of the Royal Hungarian State Railways, in 1905, and the model—the engine part of which is about 6 ft. in length—was constructed in the Northern Main Works, Royal Hungarian State Railways, 1905, also. It is of six-coupled type, with six-wheeled tender; four-cylinder compound, high-pressure 485 and low-pressure 700 mm. diameter by 650 mm. stroke; the piston-rods project through the back covers. The starting lever is placed at the side of the firebox above the reversing gear handle. Driving wheels, 1,440 mm.; grate area, 2·1 sq. metres; firebox, 8·8; tubes, 113·6 sq. metres heating surface; wheelbase, 3,500 mm.; working pressure, 13 atmospheres, weight, 42·5 tons; capacity of tender, 12·5 cub. metres water; coal, 8·8 cub. metres; weight (in working condition), 34·0 tons; diameter of wheels, 1040 mm. The train presents some features peculiar to the conditions of the traffic, and consists of a guard's van (made by Messrs. Ganz & Co., Buda-Pesth),

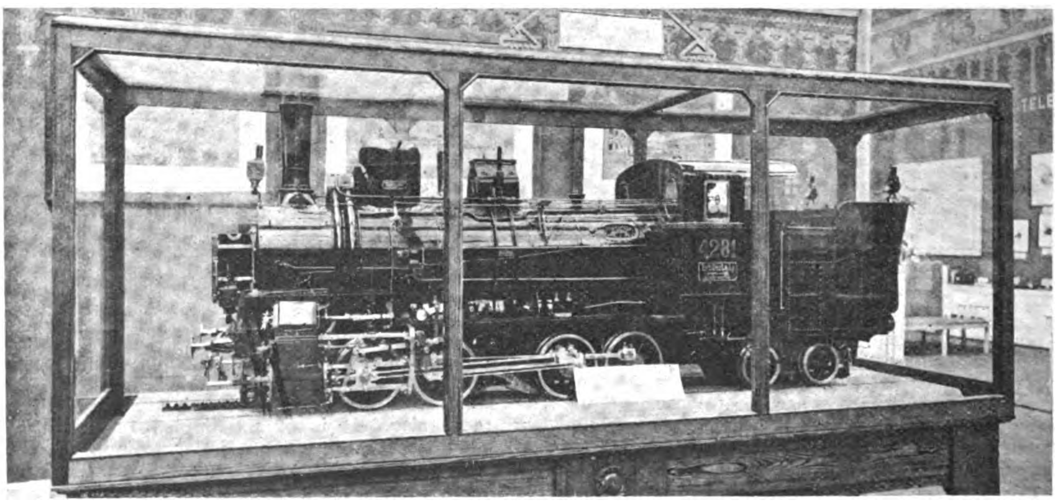


Model of Locomotive for Accelerated Goods Trains, R.H.S. Railways' Exhibit.

a meat van, and wagon for transport of fowl; the interior of the latter is fitted up with a number of small cages, in which the birds are placed. In addition, there is a van for the transport of pigs, in which a floor about halfway up the sides divides it into two spaces, one above the other, two layers of pigs being thus carried in the one van, and a 15-ton covered wagon. All the actual vans, except the last, were made by Messrs. Ganz & Co., who high- and one low-pressure being arranged tandem at each side, the low-pressure being in front; working pressure, 13 atmospheres. Diameter of driving wheels, 2,001 mm.; bogie wheels, 1,050 mm. Diameter of cylinders are—high-pressure, 320 mm.; low-pressure, 490 mm.; stroke, 650 mm.; working weight of engine, 54·7 tons; grate area, 2·98 sq. metres; firebox, 12·0 sq. metres; tubes 122·9 sq. metres heating surface. Diameter of tender wheels,



Model of Mallet System Compound Freight Locomotive and Snow Plough, R.H.S. Railways' Exhibit.



Model of Combined Adhesive Locomotive, R.H.S. Railways' Exhibit.

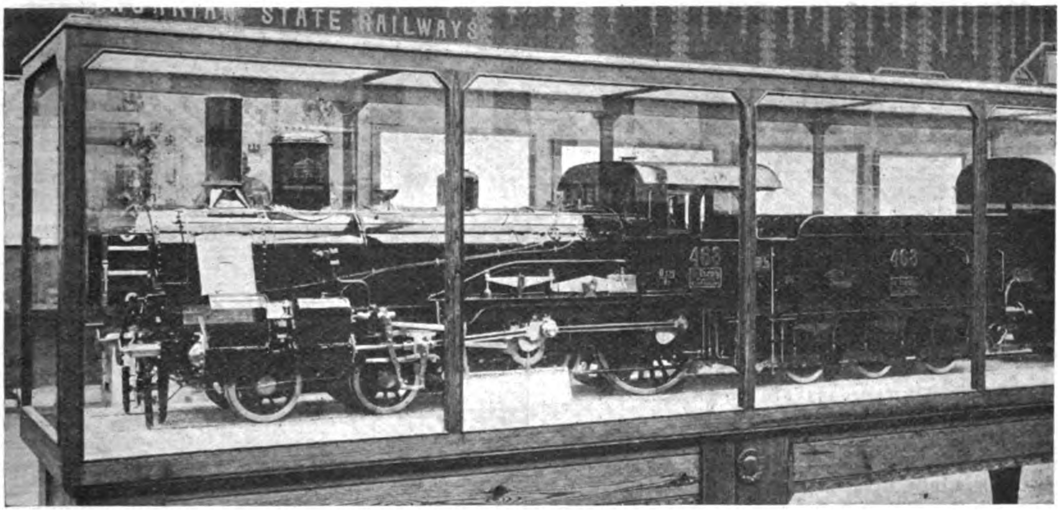
also made the models of the meat van and fowl and pig vans; the model of the guard's van was made by the Kolosvar Works, Royal Hungarian State Railways; the covered van and model are by Messrs. J. Weitzer's wagon works, Arad. The other locomotive is for fast passenger traffic, the length of the engine and tender being about 12 ft. It is of four-coupled type, four-cylinder compound. The cylinders are all outside, one 1,049 mm.; water capacity, 17·0 cub. metres; coal capacity, 8·8 cub. metres; weight, 40·54 tons. The valve gear is driven from an eccentric placed between the crank and axle-box. The engine was made in the engine works of the Royal Hungarian State Railways, in 1896, and the model in the Northern Main Works, in 1897. The train consists of a guard's van and first-class side corridor carriage, both models being made by Messrs. Ganz and Co., Buda-Pesth, and a first and second class side corridor carriage, the model being made by Messrs. J. Weitzer's wagon works, Arad, 1894.

All these locomotives are fitted with Walschaerts valve gear, that of the Mallet type engine being of special arrangement and worth particular study; it is driven from an outer crank-pin. Another feature is the rail brushes, which are placed in front of each of the guards; they consist of a simple bundle of birch or similar twigs placed in a cylindrical socket. The piston-rods are generally carried through the back cover of the cylinders, and in the instance of the adhesion and rack locomotive they are protected by tubular cases. Sand-boxes are placed on the top of the boilers at the back of the steam dome, the sand valve being operated through bevel gear by a lever and rod from the cab; the smoke-boxes have a pair of D-shaped doors opening from the centre line. In connection with these locomotives and trains there are some large albums of working drawings of engines and carriages and a fine collection of photographic views of the railways arranged in albums and frames. There is also some signal apparatus.

Bridge builders will be interested in the models of the Francis and Elizabeth bridges, Buda-Pesth. The first is a suspension bridge of three spans—78, 175, and 78 metres; it was built in 1894–6. The model is about 12 ft. in length to a scale of 1-125th; there is a large album of the detail working drawings. The Elizabeth Bridge is a suspension bridge of one span—290 metres, built 1898—1903; the model is about 24 ft. in length, scale 1-100th in., and shows the anchorage of the chains. There is also an enlarged sectional model showing the anchorage and an album of detail drawings.

Model ship-builders will also find something to please them in the various model steamers exhibited in this section. There are two models of the twin-screw, shallow-draught cable steamer *Vaskapu*, which is at work in the iron gate channel of the Danube, near Orsova. One model has the deck removed to show the propelling and winding gear. A model of the saloon passenger steamer *Ferencz Josef*, belonging to the Royal Hungarian River and Sea Navigation Company, Ltd., at Buda-Pesth. Very pretty little models, about 3 ft. in length, of the screw steamer *Cirkrenica* and the screw steamer *Elote*, about 2 ft. 3 ins. in length, both built at Fiume. Models of the screw tug *Légy*, about 20 ins. in length; the steamer *Volosca*, about 2 ft in length; and the Danube steam tug *Xenofon*, about 4 ft. in length, built by Messrs. Danubin's Shipbuilding Company, Ltd., Buda-Pesth and Fiume. There is a model of the Danube Navy monitor, *Koros*, shallow draught, twin-screw, two turrets, with one gun in each, built by the same firm. Also models of the Danube steam tugs—*Victoria*, twin-screw, and *Louis Dreyfus*, single-screw, built by the Danubins Company.

Amongst the side shows is one which is unusually good from an educational point of view, and which should be of special interest to engineers. It is a coal mine to real scale, with electrically driven winding gear and overhead wheels. Entering a lift cage, as at a real colliery, the visitor is lowered down into the earth at a slow rate, which gives an impression of scale depth. Reaching the bottom of the shaft, a genuine North-country miner conducts him through the galleries and explains the operations of coal mining. As a concession to visitors the passages are of sufficient height to enable them to walk upright, and are lit by electric lamps.



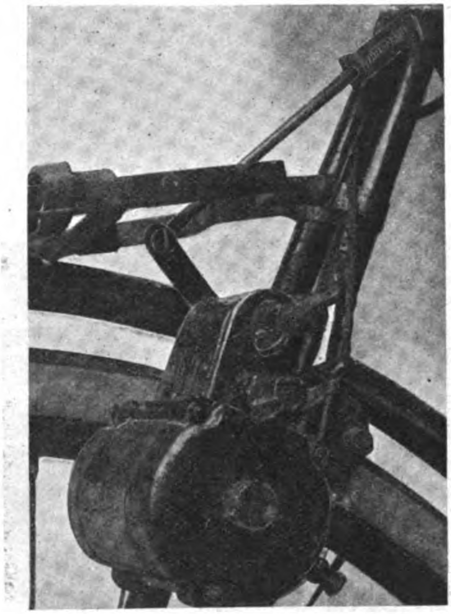
Model of Locomotive for Fast Passenger Trains, R.H.S. Railways' Exhibit.

We are much indebted to the directors of The London Exhibitions, Ltd., for permission to publish the illustrations of the locomotives and trains, through their very courteous Press manager, Mr. Henry J. Thompson, who specially interested himself in securing the best possible photographs for the benefit of our readers, and we must also thank Mr. C. Lowenrosen, in charge of the Hungarian State Railways exhibit, for assisting with explanations and suggestions.

A Dynamo-Electric Machine for a Cycle.

By D. P. Peel.

THE accompany drawings are of a dynamo-electric plant suitable for cycles, etc. I have had the arrangement on my cycle and working satisfactorily for a good while now.



The Dynamo fitted in Cycle.

The dynamo lights the lamp to a bright red when walking the machine, that is, at about 4 miles per hour, and is fully lit up at about 6 miles per hour. Owing to the construction of the dynamo, it is

The body of the dynamo consists of four horse-shoe-type permanent magnets, the lower portions of which are embedded in lead.

The armature is of the Siemens' H-type, wound

The Electric Lamp mounted on Cycle.

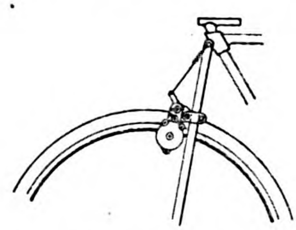
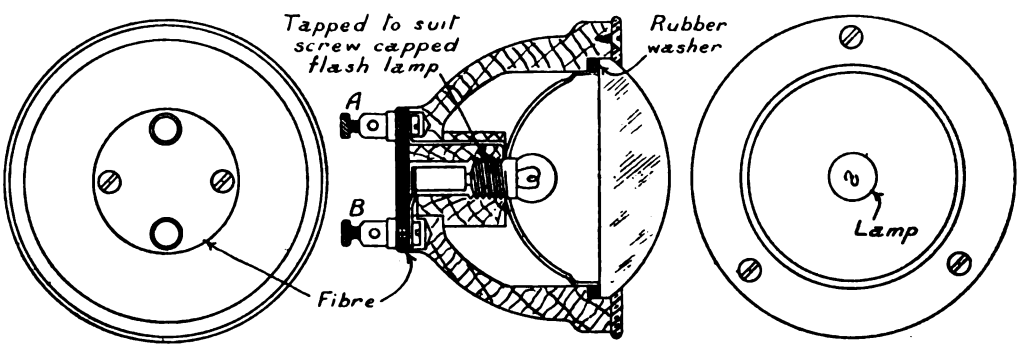


Diagram showing Dynamo fitted to Frame of Cycle.

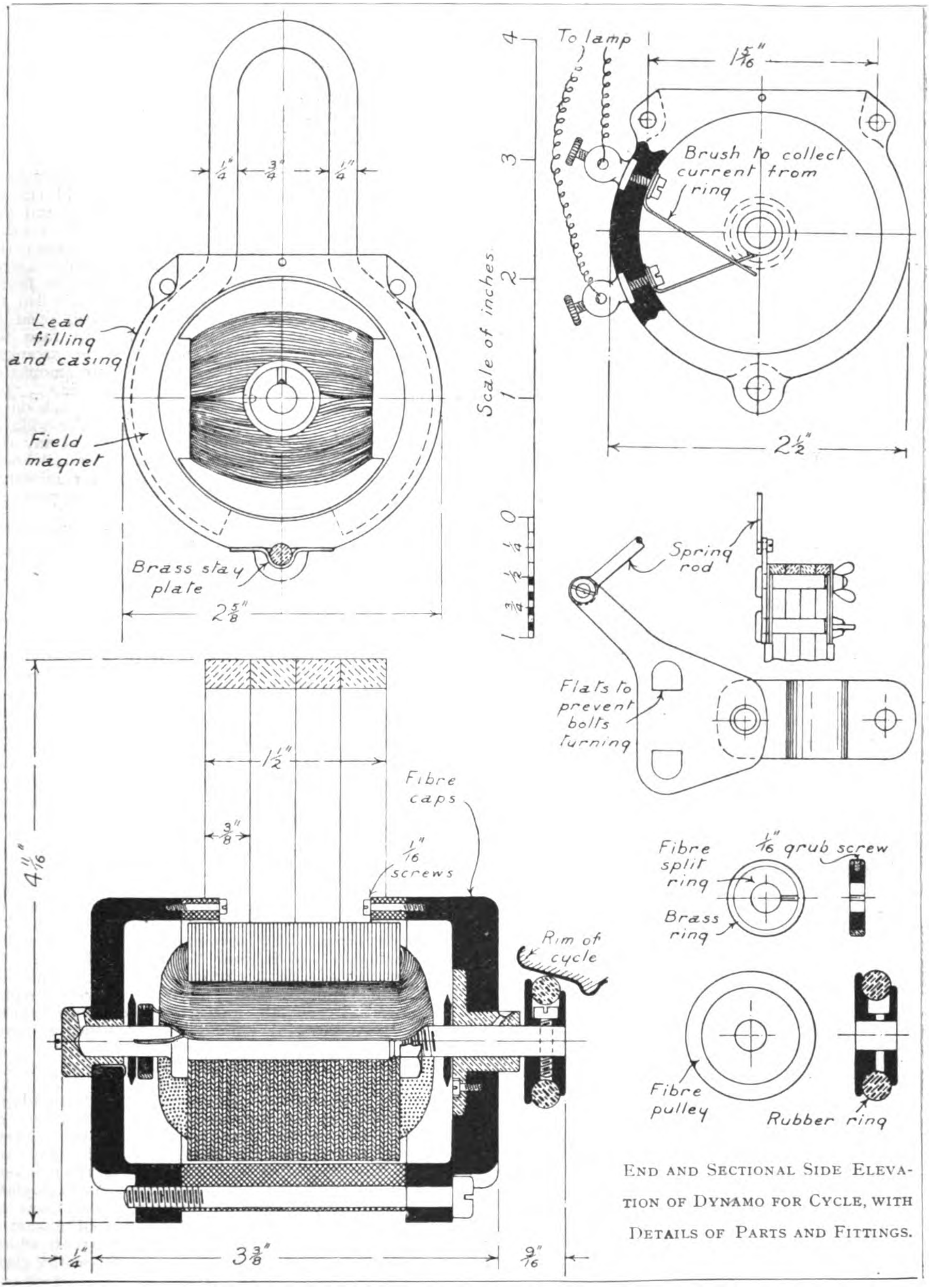


Showing Details of Lamp Arrangement.

impossible to burn out the lamp, no matter what speed you may travel at. I have run at about 24 miles per hour down a local bank, with no damage to either lamp or dynamo. The power required to drive the dynamo is almost imperceptible, and, being fitted with a rubber pulley, it is noiseless.

with about 3 ozs. of No. 28 silk-covered wire and mounted on a mild steel shaft.

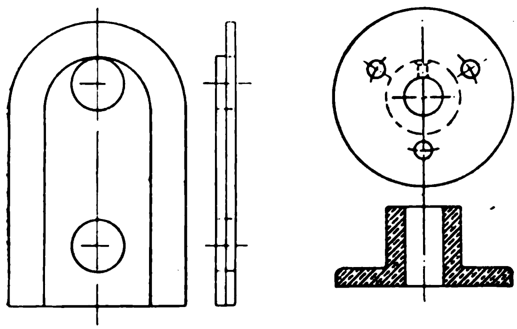
The end of the wire is soldered to the shaft before winding. After winding, the other end is soldered to a brass slip ring, which is insulated from the shaft by a red fibre split ring.



End and Sectional Side Elevation of Dynamo for Cycle, with Details of Parts and Fittings.

The current passes along the shaft into the end bearing, from which it is led by a wire soldered to the bush to one terminal.

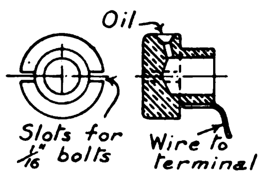
After passing through the lamp it returns to the other terminal, from which it is passed along a brush into the slip ring, then back into the armature, thus completing the circuit.



DETAILS OF SMALL CYCLE DYNAMO.

The body of the lamp was turned out of a block of beech wood. The reflector is an old stamped steel cycle bell top highly burnished.

A bull's-eye glass is held in by a brass ring fastened on with three countersunk screws, the ring being "tinned," so as to give an appearance of being plated.



Having obtained a screwed bush from a hand-flash lamp, I screwed it into the wood of the cycle lamp, thus making a holder to take a 4-volt screw-cap Osram lamp.

The plant is black cycle enamelled, so as to make it look as neat and inconspicuous as possible.

Model Yachting at Southwold.

THE sport of model yacht sailing receives considerable encouragement at this pleasant Suffolk seaside resort. Two ponds have been specially constructed for this purpose, one being situated at each end of the town. The owners are the Corporation of Southwold, whose pond is of rectangular shape, measuring about 200 ft. in length by 50 ft. wide, and Messrs. The Coast Development Corporation, Ltd. (owners of the well-known "Belle" steamers), whose pond, placed near to the pier, is of square shape, with sides about 140 ft. each, the corners being cut off; in each instance the depth is made just sufficient for the purpose, so that there is no danger. The first-mentioned pond is quite open to access and free to anyone; the other is enclosed by a fence and the very modest sum of one penny is charged for admission.

During the season regattas are frequently promoted by the owners of both ponds, and, judging by one which was witnessed by a member of our staff on Wednesday, September 2nd, provide an excellent entertainment to both young and old model yacht sailers, and to the onlookers as well. Prizes are given by the owners of the ponds, local tradesmen, and others.

This particular regatta was promoted by the Coast Development Corporation, and held on their pond, under the superintendence of Mr. F. R. Usher, the Piermaster, many of the competitors being children, the Mayor of Southwold (Eaton W. Moore, Esq.) heading the Committee, and the Mayoress (Mrs. E. W. Moore) graciously distributing the prizes, shows that the rivalry between the owners of the two ponds is of a very friendly character. The programme consisted of twelve races, one being for boats not exceeding 2 ft., sailed by girls. A consolation race was included, open to any non-winner, and a championship race for all winners. The racing seemed to be arranged with the object of giving the maximum amount of fun and chance to everybody competing; race No. 7, for example, was open to any schooners and yawls, whilst No. 10 was delightfully wide in its conditions, being open to any boat of any rig. The entrance-fee was 3d. for each race, all boats having to be entered and brought for measurement and classification to the Pier by the previous evening.

This fostering of a peculiarly and properly British sport, whether in miniature or on a full-size scale, is very commendable. A local model yacht club existed at one time, but has lapsed, owing to the migration of its members; this is unfortunate, and it is to be hoped that a new one may soon come into being. The ponds are not of a size to suit large models, but plenty of pleasure can be obtained in sailing small yachts of 18 ins. or so length, and there is nothing like the association of club membership to promote enthusiasm in designing and sailing. The yachts in the youngsters' care sailed very well in general; probably many of them had passed through the hands of the professional makers established on the beach there. Naturally, under the circumstances an easy course was set, but a local club might build really good design, such as many of our readers are familiar with, and sail to proper racing conditions for various directions of wind. Mr. Usher managed the racing in a most prompt and business-like way; no doubt a little tact was required to make everything go smoothly, but evidently a very enjoyable afternoon was experienced by everyone there, and the regatta terminated well in time before tea. Messrs. The Coast Development Corporation are certainly to be congratulated on the event, and everyone else concerned. Seaside model yachting is not new, but there should be more of it on lines such as these.

AN electrical device has been introduced in Philadelphia for the handling of large sheets of plate-glass for shop windows, etc. Heavy magnets are placed against the glass on one side, while on the other are flat plates of iron or steel, the magnets holding the plates through the glass. A heavy plate of glass can thus be handled with ease, using as many magnets as may be required; each magnet is connected with a source of electric current, which can be cut off when necessary to release the glass plate.

For the Bookshelf.

The Encyclopædia of Practical Engineering and Allied Trades. Edited by Joseph G. Horner. Vol. VIII. Price 7s. 6d; postage 5d.

Previous volumes of this encyclopædia will be already well-known to our readers, and it only remains to say that the present work is quite up to the standard of other volumes. Some matters of particular interest to model engineer readers will be found under the heading of Forms of Propellers. In this chapter both drawings and half-tone illustrations are given of various propellers, showing the construction and setting out and method of working same. Vol. VIII (dealing with subjects within the limits of R and S) treats of many other subjects appertaining to model work. The line drawings as well as the half-tones are well reproduced, and not only make the work more interesting in the reading, but emphasise many points which could not be adequately dealt with by mere descriptive matter.

The Principles of Alternating Currents for Students of Electrical Engineering. By Edgar T. Larner, A.I.E.E. London: Crosby, Lockwood & Son. Price 3s. 6d.; postage 4d.

As the literature on this subject is not so extensive as that dealing with continuous current electricity, we think the author of this volume has done right in placing such a useful contribution as this work before the public. He begins by dealing with the principles of, and laws relating to, electro-magnetic induction, and proceeds to explain, step by step, the properties of alternating currents, comparing them with those of continuous currents. Chapter II deals with simple harmonic motion and its applications, and Chapter III with Vectorial representation. Chapter IV is devoted to alternating current theory; Chapter V to circuits in series, and Chapter VI to circuits in parallel. Alternating current power is the subject of Chapter VII, and the work concludes with an appendix and index to the contents of the volume. The illustrations are chiefly diagrammatic and are well reproduced. As an introductory work to more advanced treatises on alternating currents it should be well received by the younger members of the engineering profession.

Electric Lighting and Power Distribution. By Perren Maycock, M.I.E.E. London: Whittaker & Co. Price 6s.; postage 4d.

The seventh edition of this well-known text-book hardly requires any recommendation to engineering students, for its usefulness in the past has been well demonstrated, and we think we may safely say it still holds its place amongst the valuable text-books on the subjects which come within its scope. The work has been thoroughly revised throughout and will be found quite up-to-date. Its size is increased to the extent of 167 pages, and more than 100 illustrations have been added since the publication of the last edition. It contains all the valuable and lucid explanations relating to plant and apparatus which is not now modern, and includes at the same time much that is quite new. We can strongly recommend it to our readers as a standard work for elementary electrical students.

Model Yachting Correspondence

National Model Yacht Racing Association.

To the Editor of *The Model Engineer*.

Dear Sir,—Every model yachtsman is, I suppose, more or less interested in the formation of a National Association, and at the request of some ardent model yachting friends, I took up the "cudgels" in September, 1906, on behalf of national model yachting. Side by side I have worked a local scheme, which is being brought to fruition (this winter) by our Corporation. Our friends will see, therefore, that I have been, to use a vulgar expression, "up to my eyes in model yachting," and having emerged at last from the ordeal (a pleasant one), I trust our little handbook, amongst other things, will be useful to all concerned. I do not want to waste valuable space, so what I have to say I must express in a few words. First, I have, I hope, done this quite unselfishly, without possible hope of reward; secondly, I recognise the claim of our boys, and have worked for their benefit; thirdly, I am sincere in wanting to see model yachtsmen combine into a great Association, without considerations of class or opinion.

I should propose that a postulate to the situation should be: "Model yachtsmen, members of a recognised club, do automatically become members of the National Association." If this be accepted, I think the clubs will have "crossed the line." (Messrs. Gamage, Ltd., of Holborn, have, I understand, already prepared a flag of the Association).

The next business will be to nominate officers, a President—a Commodore—a Secretary. A suggestion has been made that the commodore and secretary, and perhaps one other member of each club, form a National Committee, and we shall by this means have created the machinery required.

Whether a great Conference is immediately necessary or desirable, is open to considerations of expense only; but I should think that such a meeting would be feasible (if necessary) in London next March. Our Scottish friends would, perhaps, delegate representatives.

The business of such a conference would be to adjust a code of National Regulations for the proper carrying out of a National System, and the object would be to produce a "type," or, in other words, to produce a champion. This would be done by an eliminating process.

I am of opinion that model yachting is an invaluable asset in educating the minds of young lads; and, with others, I hope for the time when it will be admitted into our educational "Code." I should like to see each school keep its yacht.

We have the strong support of the best "brain" of the country, and if a National Association cannot be formed, the clubs alone are responsible.

With such gentlemen as the Earl of Dunraven, Marquis Ailsa, Major Scharbits, and a host of others in our ranks, it will not be difficult to find officers. The main question is the question of a Secretary. I am not at present disposed to undertake such a responsible position, as I fear my experience is quite inadequate to the exigencies of the position, but with such gentlemen as Mr. Whetstone, Mr. Talchett, Mr. Brittain, of the London (Alexandra), and Mr. Dunn, of Newport, already in the field, that should not be difficult.

It would be necessary for each club to make up its mind to an annual contribution of not less than 10s., certainly, otherwise I cannot see how any Secretary can possibly work the thing. Postage, circulars, and printing are a heavy item with any Secretary, and a National Secretary would require liberal treatment. Thanking you for valuable space, and hoping your readers will express their views, I remain, Sir, yours faithfully,

G. COLMAN GREEN,
Editor of the
"British Model Yacht Clubs' Guide."
15, Southwell Road, Norwich.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Modelling the Hydroplane.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I notice that one of your correspondents has discovered some further information with respect to the invention of the hydroplane by the Rev. Chas. Meade Ramus. Your correspondent has not stated where the information can be verified, and having regard to the random statements already made, this should have been given. However, presuming the information to be correct, it is the sort of information that we want, and should have been given before. The particulars given somewhat alter the aspect of my article on the subject, but not to any material degree. I should still advise the model engineer to repeat the experiments of Ramus by making a model to his (Ramus's) specifications, and even if he does not get 60 miles per hour, he will get a speed far in advance of an ordinary shaped hull similarly driven.

My object in writing the article was to induce amateurs to experiment with these machines, and I do not think such an interesting and valuable outlet for their energies need be checked by your correspondent's information. We must, of course, bow the knee to the great Froude, who was a genius for precision. But there is enough evidence in the few lines that your correspondent has presumably quoted from Mr. Froude's report to show that such great minds are only human after all, and the unnecessary sarcasm evidenced in those words bring to light once again the deplorable and unhealthy supercilious regard which *some* professionals hold for the amateur, especially is this deplorable when (as in this case) an amateur succeeds in discovering a principle which is destined to be of great value to the world, and the world has to wait thirty years before it learns the true value of an almost-forgotten name. It is impossible to suppose that the Rev. Ramus, having regard for his cloth, would intentionally make such misstatements, and I repeat my advice to the readers of THE MODEL ENGINEER: "Go, thou, and duplicate."

I must take exception to a statement that your correspondent makes in another part of his letter. He here states that he has "an intimate personal knowledge of my work." This, to put it mildly, is quite wrong, for your correspondent has only come in contact with the fringe of my model work. During the last few years my work has been largely experimental, and it has not been without results. I have achieved the *impossible* (?) on more than one occasion, and I really think the word should be removed from the English vocabulary. I shall hope to still retain the good fellowship of all model engineers. (I have never yet met a *real* model engineer who was not a good fellow). If my poor pen can assist amateurs to think on original things in original ways, it shall be at the disposal of THE MODEL ENGINEER, even though I suffer persecution. There is a germ of the sacred creative faculty (invention) in the brain of every human creature, and it should be fostered by every known means. One of the best agents to that end I know of is—original model engineering. If this discussion on the "Modelling of the Hydroplane" is to be continued, let all personal allusions be omitted.—Yours faithfully, W. L. BLANEY.

Stepney.

Perpetual Motion.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—As one who has spent the greater portion of his leisure time during the past few years in experimenting, with a view to the discovery of what is popularly known as "perpetual motion," I may, perhaps, be allowed to say a few words in support of "Pat's" statement that this subject is "not so utterly ridiculous as scientists would have us believe." It is true that if we are to depend upon a purely mechanical contrivance to attain the desired object, the task seems to be quite hopeless, for the reason that it is impossible to get more energy out of a machine than is put into it. Still, it must be acknowledged that our reliance on this, as on all other primary laws, is based on our ignorance of anything which might disprove it.

Again, many things which were, in the remote past, considered to be impossible, have been accomplished—but not, be it observed, by the people who dispensed gratuitous ridicule.

Now, in the humble opinion of the writer, "perpetual motion" will eventually be attained, either by a combination of mechanical and chemical factors, or by utilising one of those vast and inexhaustible sources of power as yet untapped, viz., the constant variation of the condition of the atmosphere, in the matter of temperature, pressure, etc., for it seems quite possible that the rising and falling of a column of mercury could be converted into continuous motion. We have only to find a means of storing the energy developed during the periods of movement to be used during the periods of rest.

That this and other similar sources of power can be relied on to provide a solution to the great problem the writer is convinced.

Friction (and its attribute, wear) has always to be reckoned with, but in a carefully constructed machine, running in an exhausted chamber, this factor could be reduced to a negligible quantity. Therefore, Sir, let those who have been working at this most interesting branch of science not be deterred by the ridicule and scepticism of inexperienced or unsuccessful critics, but rather work with increased concentration and energy to silence their detractors by producing a successful machine.—Yours truly, A. W. LUDLOW DORE.

London, W.

The Society of Model Engineers.

London.

AN ordinary meeting of the Society was held on Friday, September 18th, at the Cripplegate Institute, Golden Lane, E.C., Mr. A. M. H. Solomon taking the chair, and upwards of ninety members and visitors being present. The dates of visits and future meetings having been announced, and other formal business quickly disposed of, the Chairman called upon Mr. Percival Marshall for his paper on "Originality in Model Work." The lecture, which will be fully reported in another issue of this journal, was listened to with great attention. A very hearty vote of thanks was accorded to Mr. Marshall, on the motion of Mr. D. Corse Glen, who also opened a discussion on the paper, in which a large number of members participated. In replying, Mr. Marshall hoped that the Committee would allow him to offer a prize, to the value of £2 2s., for the best piece of original work done by a member of the Society during the present Winter Session.

FUTURE MEETINGS.—Friday, October 9th: Locomotive Running Competition (continued from August meeting). Wednesday, October 28th: Lecture by Mr. Henry Greenly on his recent Model Commissions, to be illustrated by a large number of original slides, diagrams, and exhibits. Any non-professional reader of this journal who has constructed a model to any of Mr. Greenly's designs that have appeared in this journal is invited to apply to the Secretary for a card of admission to this meeting, which will be given free, provided the model is exhibited at the meeting. Full particulars of the Society and forms of application may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

Queries and Replies.

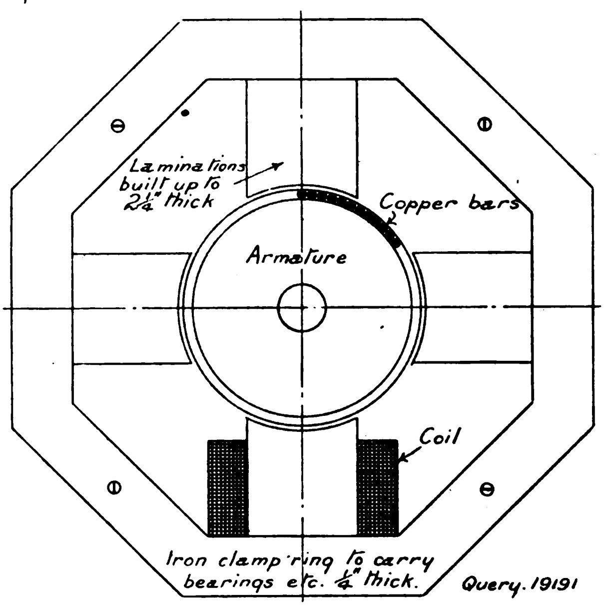
[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[19,191] **Small Experimental Induction Coil.** D. C. H. (Blackheath) writes: I enclose a sketch half size of an induction motor which I intend making. I would be much obliged if you could tell me if the iron section is about the right proportion, and also the size and quantity of wire to wind it with. The current is supplied here at 200 volts 50 ~ single phase. The motor is to be built up of iron stampings 2·25 ins. diameter with ·025 in. diameter copper bars laid across and short-circuited at the ends with a few turns of copper wire soldered on. I should like to know if the bars have to be insulated from the iron armature stampings. Could you tell me what power and speed I should obtain from this motor? I require it to drive a small dynamo of 3 amps, 10 volts. As these motors are not self-starting I intend using a strap wound round the shaft to bring it up to speed.

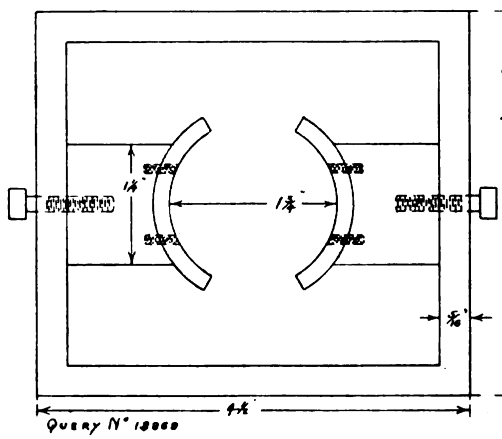
This design is not according to ordinary alternating current motor practice. You must regard it as an experiment. Wind the field-magnet with No. 20 gauge D.C.C. copper wire and connect all coils in series. About 1¼ lbs. will go on each pole, but there should be at least 200 turns on each pole. The copper bars on



Query. 19191

armature should be insulated from the iron core, but they ought to be sunk in slots or holes. The gap clearance between the armature iron and the pole-pieces ought to be exceedingly small, as small as you can possibly make it consistent with freedom of running. If the motor runs the speed should be about 1,200 revs. per min.

[18,869] **Windings for Small Dynamo.** H. K. (London) writes: Would you kindly answer the under-mentioned questions? What size and quantity of wire required for dynamo, as sketch, eight-section drum-wound armature 1¼ ins. long, field-magnet 3¼ ins. wide? How many volts and amperes could I get—8 or



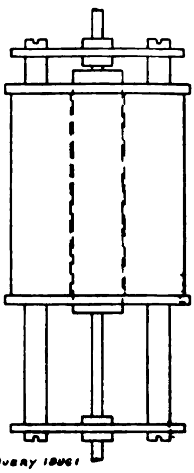
10 volts—5 amps. would do? When bought second-hand it had ¼ lb. of wire on each pole, the size of piece sent. Was it enough to excite at all?

Wind armature with 4 ozs. No. 22 S.W.G., and field-magnets with 1½ lbs. No. 23 S.W.G. The sample you enclose is barely No. 22 S.W.G. This could be used for the field-magnets. The winding which the field-magnet had when you got it was barely enough to give good results; if you wind as stated above, we think you should get machine to run very well.

[19,087] **Telephone Queries.** C. D. L. (Waddon) writes: I should be greatly obliged if you would give me the following information. I have made a telephone with a microphone (microphone hollow box with three carbons) and have fixed up all ready for working. I use two dry batteries, but somehow the instrument will not work. It is exactly the same upstairs, telephone and microphone. The telephone is carried out to the instructions of a book written by Bottone. The telephone is an instrument with a compound bar-magnet all ready wound, bobbin from Whitney. I have glued the microphone to the wall in the dining-room and upstairs in bedroom. I want to construct the microphone on to the telephone somehow, as my mother is an invalid and unable to walk. I should be much obliged if you would give your advice on this matter, also the reason of not working. Sometimes you can hear the diaphragms vibrate.

Your trouble seems to be that the speaking circuit is only complete when both the switches on the telephones are depressed. The circuit and type of switch shown in Fig. 30, page 78, of the 6th Edition of our handbook "Telephones and Microphones" should assist you. The construction of a hand combination instrument is out of the scope of these columns, and they can be bought very cheaply of any of our advertisers.

[19,961] **Electric Clock Solenoid.** J. F. (Bolton) writes: I am making an electric clock on similar lines to the one described in THE MODEL ENGINEER, November 15th, 1902. It states that two sealed batteries are concealed from view in the base of the clock, whose capacity is 10 amp.-hours, but does not say what voltage the batteries are. I enclose sketch half full size of my



Query 19961

solenoid filled with 22's s.c.c. wire to diameter shown. The core is made from soft iron tube with ends let in and the guide-rod driven in tight. The solenoid will suck the core in when in an horizontal position with 4 volts, but won't lift the weight when in a vertical position. Would the core be better solid? Is the wire correct size and sufficient used? What kind of batteries and how many volts to lift the weight shall I require?

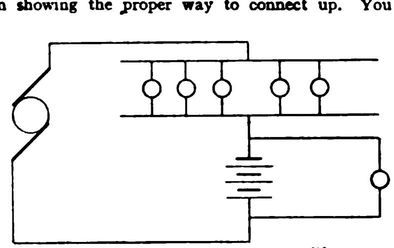
Your explanation and sketch are not clear. The battery referred to probably consists of two dry cells connected in series; the voltage would, therefore, be about 3 volts. Apparatus of this kind can only be adjusted by trial. You ought not to take a heavy flow of current from dry cells. According to the figures given in the article referred to, we should judge the resistance of the solenoid to be about 8 ohms. No. 24-gauge wire would probably be more suitable than 22. We advise you to try the solenoid with a solid plunger; it should slide very freely. We are unable to say if your coil is large enough, but the proportions are about correct. Try a winding of No. 24- or 26-gauge wire.

[19,938] **Small Motor Trouble.** C. G. S. (Wareham) writes: I shall be greatly obliged if you can explain to me the peculiar conduct of my electric motor which I have lately constructed. The field-magnet belongs to the 10 c.-p., 20-watt, 10-volt 2-amp. MODEL ENGINEER Dynamo. The armature is made of 8-pole cogged drum stampings, wound in eight sections with 2½ ozs. No. 22 s.s.c. wire, and the field-magnet with 14 ozs. No. 22 D.C.C. I feel sure the connections are correct and there is no leakage anywhere, either in the armature or field-magnet. Yet when worked from nine bichromate batteries (2-lb. jam jars) it will not work properly. (1) When armature and field are connected in parallel it works fairly well, but not at its proper speed, and does not seem powerful enough, nor is it always self-starting, but by lifting a brush (with current on) and then letting it down sharply, it will start itself. (2) When armature and field are in series it works very slowly for a few revolutions and then stops till it is pushed off again, when it will work another revolution or two. When turned by hand it is hard to push for a small fraction of a revolution, then it suddenly pulls for another revolution, and then hard again, and so on for a whole revolution regularly. The brushes are not made of gauze, but from pieces of copper pressed against the commutator by light springs. The commutator is very thin, about 3-32nds in., because there was not room for a wider one. I have your book, "Small Dynamos and Motors," but cannot find an explanation to the conduct of my motor. The armature (1½-in. by 1½-in.) is wound exactly as in Fig. 43, page 34, of "Small Dynamos and Motors," with the exception that instead of winding the first coils on the left-hand half of the slots they are on the right. I take it that this would only cause the armature to revolve the opposite way. Ought this motor, when in good working order, to drive a tram weighing 8 lbs. when complete, if driving through a countershaft (reduced 9 to 1) by a stout rubber belt on to the driving wheels 1½-in. by another belt?

(1) A shunt-wound motor is rarely self-starting unless the current is switched on to the field-winding first; or, if the field-winding and armature are receiving current simultaneously, there should be a starting resistance in series with the armature. This is cut out gradually as the armature gains speed (see our Handbook No. 14). When current is switched on to the armature and field, as you have been doing with your motor, the armature partly short-circuits the field-winding and it does not receive a proper flow of current. Matters are remedied when you lift one of the brushes for a moment. (2) The winding of field-magnet is not suitable for series connections. It is of too high a resistance and robs the armature of voltage. The motor ought to run your tram-car well. Probably you will get better results with a series-wound field. For this use No. 16-gauge D.C.C. wire. Arrange your battery with eight cells coupled two in parallel, or nine cells coupled three in parallel. The motor wants more current and less voltage.

[19,674] **Accumulator Failure Due to Improper Charging.** H. B. (Grange-over-Sands) writes: Thanks for answer to Query 19,577, but I am in the dark as to one or two points still. While the above query was in hand, I wound my dynamo and put it in working order, and commenced to charge again. I connected up and the odd lamp was run to house just to see that all was going on all right. The voltmeter read 60 and amperemeter 5. Now, what I am wanting to get at is: why should the paste be driven out of plates at this low current? I connected up as shown in your handbook, page 39, Fig. 20. Of course, I require no lamps in series to cut voltage down. Will the odd lamp do any harm running off the same circuit for lighting house? Ought the lamps in parallel to have lighted—as they did not? Any information on the above will be thankfully received. My dynamo will not generate 12 amps., only 8.

From the data you give we can see no apparent reason for the paste being driven out of the grids as you describe. We can only suggest, as we believe we said before, that in the process of pasting considerable pressure should be used, and the plates should be allowed ample time to dry thoroughly before being put into the acid and charging commenced. The odd lamp being connected across the cells will not be detrimental. If, however, your diagram shows how the cells were connected, it is not surprising that there was trouble with the paste coming out, as the cells are practically short-circuited across the dynamo brushes, thus the lamps, which in the ordinary way control or determine the current flowing through the cells, are getting no current at all. We append a diagram showing the proper way to connect up. You will see



Query No 19674

if you study your diagram carefully that the action would be just the same whether the lamps were there or not. If you put this matter right we think you should have no further trouble.

[19,974] **Overtype Dynamo Construction.** W. A. W. (Portsmouth) writes: (1) Could you tell me the number of volts and amperes I may expect from an overtype dynamo, fields wound with 2½ lbs. of No. 22-gauge wire on each limb, making 5 lbs. of wire on fields. The armature, cogged ring type, is wound with 1 lb. of No. 20-gauge wire. Speed, 2,000 r.p.m. (2) Can you tell me the size and shape of a former for a drum armature (12 slots,

$\frac{3}{4}$ in. by 5-16ths in.), 3 ins. by 3 ins. diameter, and an armature 5$\frac{1}{4}$ ins. by 4 ins., 24 slots, 5-16ths in. by 1$\frac{1}{4}$ ins. deep? Can you tell me if there is a book on former wound armatures at about 2s.? (3) Are there details of a lead burner in the "Practical Plumber's Work"?

(1) The field-magnet winding is suitable for a voltage of about 30 volts as a shunt winding, and the armature wire will carry an output of about 6 amps. The voltage which you will obtain depends upon the design of the machine and whether the armature runs close to the pole faces or not. If design is good and the armature clearance small, you may expect to obtain about 30 volts 6 amps. The voltage can be adjusted by running the armature at higher or lower speed. (2) You must work this out for yourself. We do not know of any book which deals exclusively with former winding. You will find information in the continuous current section of "Dynamo Electric Machinery," by S. P. Thompson. It is a standard book and expensive. See also THE MODEL ENGINEER for May 26th, 1904, in which there is a description of a two-pole dynamo with former wound armature. (3) Yes. See also query on page 502, May 21st, 1908 issue.

[20,286] **Model Condensing Gear.** D. M. S. (London) writes: I have a small marine type compound engine, cylinders 1$\frac{1}{8}$-in. by 2-in. bore by 1$\frac{1}{8}$-in. stroke. I would be much obliged if you would give a sketch or particulars of a suitable air pump to be worked off L.-P. crosshead to maintain a vacuum in a condenser which I want to fit to the engine. With reference to the condenser, I was thinking of a jet, water being supplied from the feed pump. Do you think this will prove successful?

Presuming, for the sake of argument, that the maximum capacity of the feed pump is about three times the consumption of water by the boiler and that the efficiency of the pump is 33 per cent. Only 2 units of water will be actually delivered, one for the boiler and one left for the jet condenser. If you examine the problem scientifically you will find that this unit, which is equal to the amount of water evaporated by the boiler and delivered in the form of steam to the engine, will be quite insufficient to condense the unit quantity of steam in the condenser, even if the heat losses owing to the comparatively large radiation surfaces in a model steam engine are taken into account. You not only have to reduce the temperature of the steam, but to absorb its latent heat, which requires, perhaps, ten times the amount of water. Of course, we cannot estimate the exact amount of the water required by the jet, but allowing largely for the help given by radiation of heat in the engine and condenser in liquifying the steam, we would not recommend less than five times the amount of water evaporated by the boiler. We roughly estimate this at 15 to 20 cub. ins. of water per minute. A circulating pump of the reciprocating type running at 300 r.p.m. with a plunger 9-16ths in. or $\frac{5}{8}$ in. diameter by $\frac{3}{4}$-in. stroke would do this. We would not recommend you to use this pump as a feed pump as well. It would then absorb nearly all the power of the engine. The jet does not require to be delivered at as high a pressure as the steam in the boiler. With regard to the air pump, this, if single-acting, should be $\frac{1}{8}$th the capacity of the H.-P. cylinder. You can save all the bother of making an air and circulating pump (if you use the engine as a stationary engine and not in a boat) by employing the house supply to work the jet condenser. If properly designed, no air pump will be required. Is this feasible in your case?

[19,312] **Accumulator Construction.** H. H. W. (Birmingham) writes: I am making two 4-volt accumulators from instructions given in your Handbook No. 1. The positive plates have turned out quite a success, but the negative ones I am in trouble with. I obtained the precipitated lead by lowering strips of zinc into lead acetate solution and kept it under water as advised, but instead of it forming a "soft fibrous and porous mass" it formed ordinary solid lead, before I had a chance of getting it pressed into shape in the grid. If took me an hour and a half to collect only half enough for one grid (4 ins. by 4 ins.), and as I have eight of these to do, it seems to me that the litharge and sulphuric acid method you mention would be simpler. I should esteem it a great favour if you could let me know where I am wrong, also give me the litharge and sulphuric acid method. I have taken in THE MODEL ENGINEER since November 23rd, 1903, and have all back numbers with few exceptions, so perhaps you could refer me to some of these.

We are aware that it is a difficult matter to correct and press crystals into the negative grids, and considerable force is required to accomplish the job successfully. You will be well advised to adopt the litharge and sulphuric acid method, which is exactly similar to the process of pasting the positive plates, only, of course, litharge is used in place of red lead.

[20,256] **Electrical Ignition for Motor Cycle.** J. G. L. (Daventry) writes: I wish to make a plain coil for 2$\frac{3}{4}$ h.-p. Minerva motor cycle engine (76 by 76), air-cooled. (1) I should be glad to know what size coil you would advise for the above, which I believe has a fairly high compression and runs at a rather high temperature? (2) Can you tell me what determines the rate at which a coil works (I have seen a certain coil advertised as being tested at 3,000 revolutions), as I want to get as high an engine speed as possible? (3) How are the connections made? (4) Is it best to fill in the space between the coil and condenser and its case with the usual mixture of paraffin and resin or whatever it is? Can you tell me how to make this?

(1) If you use a coil giving a good $\frac{1}{2}$-in. spark in air this should be suitable. (2) The rate at which a coil works is determined by the circuit-breaking mechanism. You need not be afraid of the break being too rapid for the coil. (3) You will find the coil connections described and illustrated in an article which appeared in our issue of November 15th, 1901. The issue may be had for 3d. post free. (4) The condenser case is filled in with paraffin wax. The wax is melted, poured in, and allowed to set.

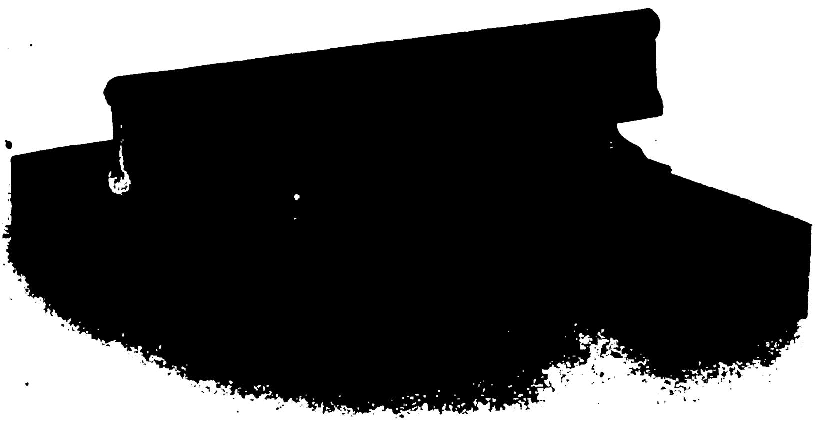
The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

** Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

Model Permanent Way.

We are now able to illustrate the new 1$\frac{1}{2}$-in. scale permanent way lately introduced by Messrs. Bassett-Lowke & Co., Northampton, to which we referred in a recent issue. It will be seen that a double-headed rail is used, keyed by wooden keys into cast-iron chairs. The latter, being machine moulded, have an exceptionally clean surface; they are fixed to the sleepers by japanned steel screws, with round heads. The rails are of the best Staffordshire wrought iron, specially straightened, and are supplied in 10- to 15-ft. lengths. The sleepers are of creosoted pine, and the keys of oak, machine cut to proper section. The fishplates are of plain steel, with holes punched in for standard $\frac{1}{4}$-in. black bolts and nuts. It may be mentioned that the rail is not exact to scale, but is a trifle heavier, and deeper in the web. This, however, is no disadvantage, for the section is a standard one, and therefore moderate in price, while the extra height provides greater vertical strength, and gives increased clearance to the wheel flanges. The track may be obtained complete in any quantity, or the separate details may be purchased, as desired. The increasing popularity of large scale model locomotives ought to produce a healthy demand for this new track.



NEW 1$\frac{1}{2}$-IN. SCALE PERMANENT WAY.

The Editor's Page.

On October 3rd the important Electrical Exhibition at Manchester will be opened to the public, and will continue till the end of the month. This will undoubtedly be one of the finest exhibitions of electrical machinery and appliances ever held, and none of our readers who can get an opportunity of going should neglect to take full advantage of this occasion to see the latest and best of things electrical. Our publishers will have a stand there, No. 144, at which all our handbooks and other publications will be on view. We hope that as many of our readers as possible will make a point of calling on us there.

* * *

We are just introducing a model-making novelty which we think will appeal to many of our readers, if not for their own amusement, at least for the edification of their younger friends. It is a set of coloured designs, printed on cardboard, for building a scale model of the Midland Railway's handsome locomotive "Princess of Wales." These coloured designs are put up in a strong box, together with a set of specially made fittings (chimney, dome, and safety valve), round wooden rods for axles, and drawn aluminium wire for handrail, etc. There is also a 16 pp. illustrated book of instructions giving complete information as to the method of building. The over-all length of the completed model is 14¾ ins., and it makes up into a beautifully realistic reproduction of the real engine. Many of us have in our younger days made up cardboard models from more or less crude and roughly printed sheets, but we may safely say that nothing so true to scale and so complete in detail has ever been offered to the public before. The set will be sold under the title of "The Young Model Maker" at the price of 1s. net, or post free 1s. 3d., and may be obtained through any of the agents for The Model Engineer, or direct from our offices if any difficulty in getting it locally is experienced. It will be ready a few days after this issue is published, and in view of the great demand which will undoubtedly ensue, we advise our readers to order early. We predict a great demand because of the enthusiastic opinions of the trade and others to whom advance proofs have been shown.

* * *

Another local Society has been formed under the title of the City of Bradford Society of Model Engineers, the next meeting of which will be held on Monday, October 5th, at 8 o'clock, at the Midland Dining Rooms. All model makers in Bradford and neighbourhood are invited, and will be heartily welcomed. The Hon. Sec. is Mr. Amos Barber, 15, Hartington Terrace, Lidget Green, Bradford, who will be pleased to give all particulars.

Answers to Correspondents.

J. K. (Leeds).—You will find all your difficulties cleared up in the new Model Engineer sixpenny handbook, "Alternating Currents Simply Explained." This will be ready in a few days.

F. P. (Bristol).—We should certainly advise you to spend at least three years, and preferably five, at practical work in the shops, with, say, two years in the drawing office to follow.

J. C. (Hastings).—Use a mixture of soap and water for producing a bright surface when turning wrought iron or mild steel. Turpentine is a good lubricant for turning cast steel. Brass requires no lubricant.

R. H. M. (Brook Green).—Geo. Adams, 144, High Holborn, would supply you with a clockwork motor. You must experiment with your car. No results can be forecast.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

How to Address Letters.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to The Advertisement Manager, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 389. OCTOBER 8, 1908. PUBLISHED WEEKLY

Model Trip Valve Engine and Water-tube Boiler.

By ARTHUR S. LANE.

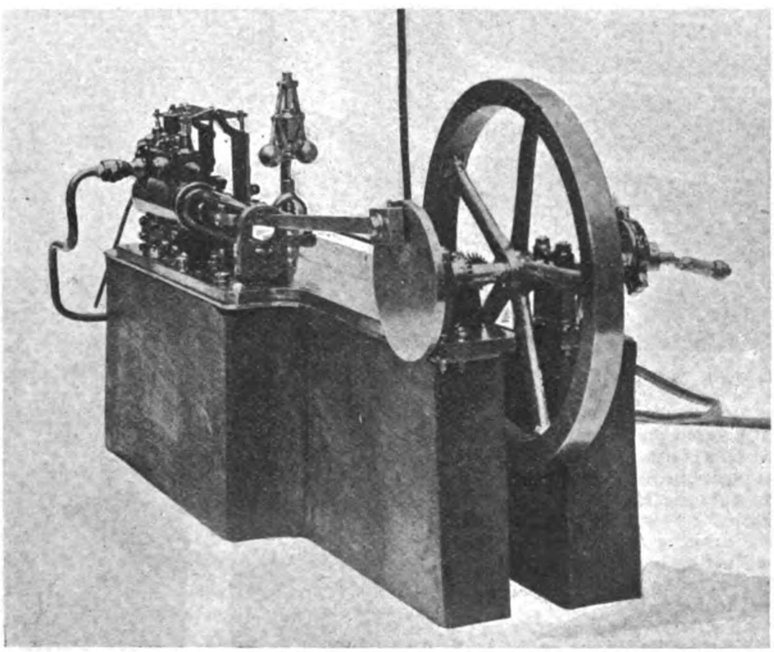


FIG. 1.—END VIEW OF MR. ARTHUR S. LANE'S TRIP VALVE ENGINE.

THE cylinder A (Fig. 2), which is 5/8-in. by 1 3/4-in. stroke, is mounted on brass plate Z, underneath which is fitted the exhaust chamber 1. The exhaust valves F pass underneath the cylinder A and are held in position by guides 2, and a spring is fitted on head of valve to keep same on seat. These valves F are 1/8-in. diameter across faces and are countersunk into seat. The valves F are actuated by eccentric cams R operating on lever O, which is screwed to bracket H. These cams R are set at right angles to cams J and are held in position on shaft D by small setscrews, which are threaded into shaft D. The shaft D is bevel driven and makes the same number of revolutions as crank, and is supported in bearings on bracket H. The valve box G is held in position by studs Q. The inlet valve guide E is screwed into valve box G and can be taken out complete with valve P should it require grinding in. Between the valve guide E and head of valve P is placed a moderately strong spring which keeps valve P firmly on seat. The valves P are actuated by levers B, which are pulled down by slide C, which is operated by cams J. The slide C only moves about 3-16ths of 1 in. and is brought underneath the cam J, thereby pulling

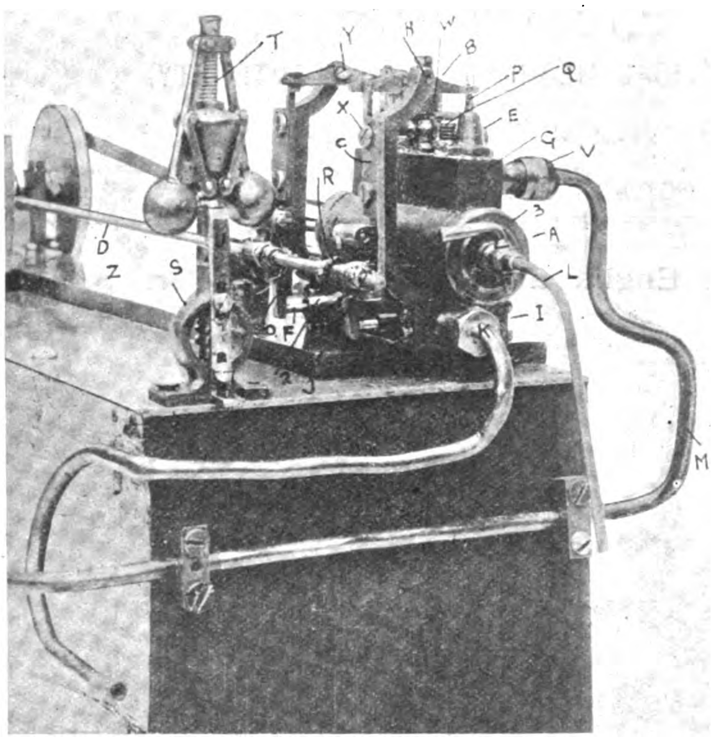


FIG. 2.—DETAIL VIEW OF CYLINDER AND VALVE GEAR.

the slide C in a downward direction. This slide is kept pressed on the cam J by spring on valve P as before explained, and is held in position by screws X running in slides cut on slide C. The levers B are pivoted by screw Y into bracket H. The drain cock L is also found useful for adjusting back pressure on cylinder. The cover (3) is screwed to cylinder A and makes a more effective joint than with screws. The copper pipe M, from boiler to cylinder is connected to valve box G by union tap V. The waste pipe K takes away also water and waste steam from cylinder A through exhaust valves F. W is a lubricator placed on top of valve box G for lubricating cylinder A. The piston is made of cast iron with phosphor-bronze rings and runs in tubular slide to connecting-rod. S is governor and contains a compression spring T which greatly steadies the governor when at work. The engine runs remarkably smooth and is much more powerful than an ordinary slide-valve engine of same dimensions. Working pressure is about 20 lbs. to the square inch, but engine will do about 600 r.p.m. at about 2 lbs. pressure, it taking very little steam when not under load.

The boiler generates steam very quickly, getting about 20 lbs. to the sq. in. in about four minutes from cold water. The top part of the boiler A (Fig. 3) is of solid-drawn copper tube, 2½ ins. by 10-gauge thick by 10 ins. long, into which are brazed tubes B and K, B being ¾ in. diameter and K 1¼ ins. diameter. The bottom box D, receives tubes B and A, also tubes C, which number thirty-two in all, and are ⅜ in. diameter by 18-gauge thick, solid-drawn copper tubes brazed and flanged into box D, which is cast in brazing metal. G is a stay rod bolted on to outside of cover plates F, giving a very firm support to boiler. H is also a stay rod used for same purpose. E is union tap from feed pump to boiler. J is steam tap to engine. The position of boiler is placed so that the top boiler A is parallel with ground line, the tubes C being in a slanting position. Underneath the boiler is placed a gas-ring to generate steam, it being found more efficient than a spirit lamp. Boiler has been tested to 200 lbs. per sq. in. under water and showed no signs of leaking.

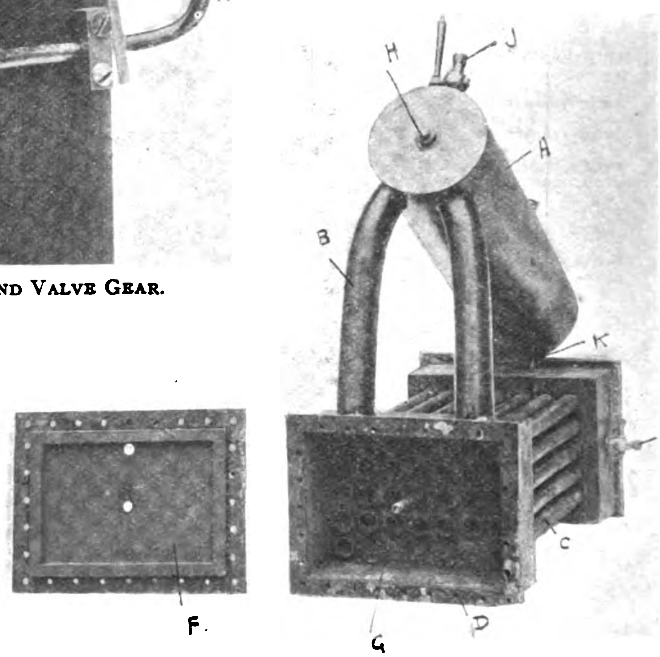


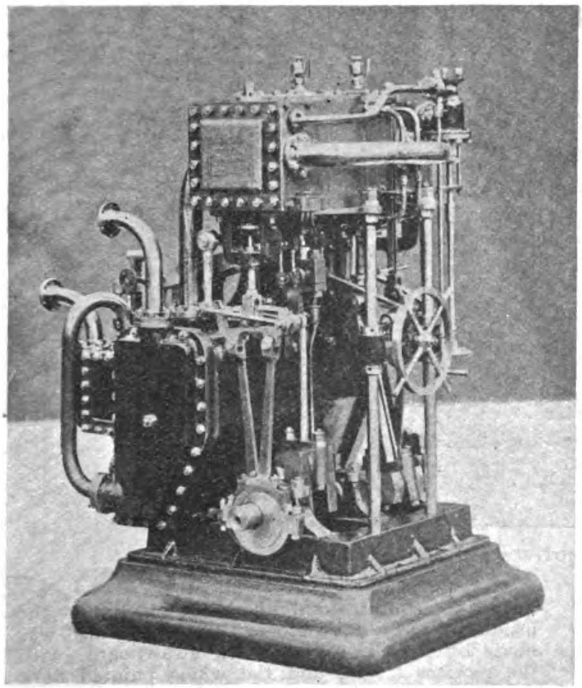
FIG. 3.—THE WATER-TUBE BOILER FOR MR. LANE'S TRIP VALVE ENGINE.

The photograph (Fig. 1) on the previous page gives a general view of complete engine.

A Prize Model Compound Condensing Marine Engine.

By Capt. Craigie Norwell.

THE accompanying photograph represents the winner of The Model Engineer Silver Medal, awarded at the recent Exhibition in Edinburgh, and is a scale model of the class of engine usually found on board steam drifters and similar boats. The H.-P. cylinder is 1¼ ins. diameter; the L.-P. 2 ins., with a stroke of 1¾ ins., the valves being the usual size. The condenser forms the main support for the cylinders, and contains thirty-eight ¼-in. tubes. The manner in which the tubes are fixed is as follows: Two gun-metal plates were fitted to the ends of condenser casting, the end covers of condenser being fitted to them and all



Capt. Craigie Norwell's Prize Model Engine.

securely screwed up with 3-32nds-in. studs and nuts. One end plate was screwed with a fine thread, and the other was first drilled ¼ in. and then reamered out with a taper of 2-deg. angle. Without altering the top slide of rest, a taper plug was turned to this angle and, after hardening, was used to expand the tube ends, each being first placed in a steel die reamered to same degree, thus ensuring a steam-tight joint when the tube was screwed home. As the amount of space between the tubes did not allow for any increase in the diameter of tube ends, a sawcut was made on expanded end to enable the tube to be drawn up to plate. The pumps, which are placed at the back of condenser and are worked by levers from L.-P. crosshead, consist of air-pump (⅞ in. diameter, and fitted with top, bottom, and bucket valves), circulating pump (½ in. diameter, double-acting, and having four valves); both pump pistons are fitted with metal rings, the air-pump having two and the circulating-pump three, each 1-16th in. in breadth. Although a lot of trouble to fit, the result has been most satisfactory, even in such a small size as ½ in. The boiler pump is worked off the same levers, and has a ⅛ in. diameter plunger and is fitted with ball valves.

The tube bending was perhaps the most troublesome business I experienced. I may mention a hint I got from a coppersmith in connection with tube bending, and that is to "tin" the inside of brass on copper tubes before filling with lead, as when bending sharp curves, especially near the end, the lead is apt to be forced out. The only portions purchased, with the exception of the castings, were the nuts, studs, and bolts, any special ones being home-made.

A Model C. & S.L.R. Electric Locomotive.

By H. Lee.

I HEREWITH give photographs and sketches of a model electric locomotive which I have made in my spare time during the last eighteen months. It is my first attempt at model making. The working drawings were made from sight of the real engine, and therefore it is not a scale model.

The frame is made of strip iron, ½-in. by 1-16th-in. section and shaped to form a rectangle 6⅞ ins. by 3 1-32nd ins. (outside), and is divided into two sections by a crosspiece 2¾ ins. from one end and 3¾ ins. from the other (inside measurement). In the latter section is a piece of ½-in. by 1-16th-in. brass, which joins the crosspiece to the end of the frame and supports the motor and collector, the latter being made of German silver sheet.

The former section contains a swinging truck (Fig. 4), which allows all wheels to be on the rails when on a rough road. This is made of two pieces of ½-in. by 1-16th-in. iron crossed and secured by two small rivets, and each piece is bent up at right angles at each end; holes were first drilled in these portions to receive the axle and pin. The pin is a piece of 12-gauge steel wire 3 3-16ths ins. long and soldered into coupler at one end and secured by a nut at the other. At the end by the coupler is a piece of tube, slipped on the pin to keep the truck in its proper position.

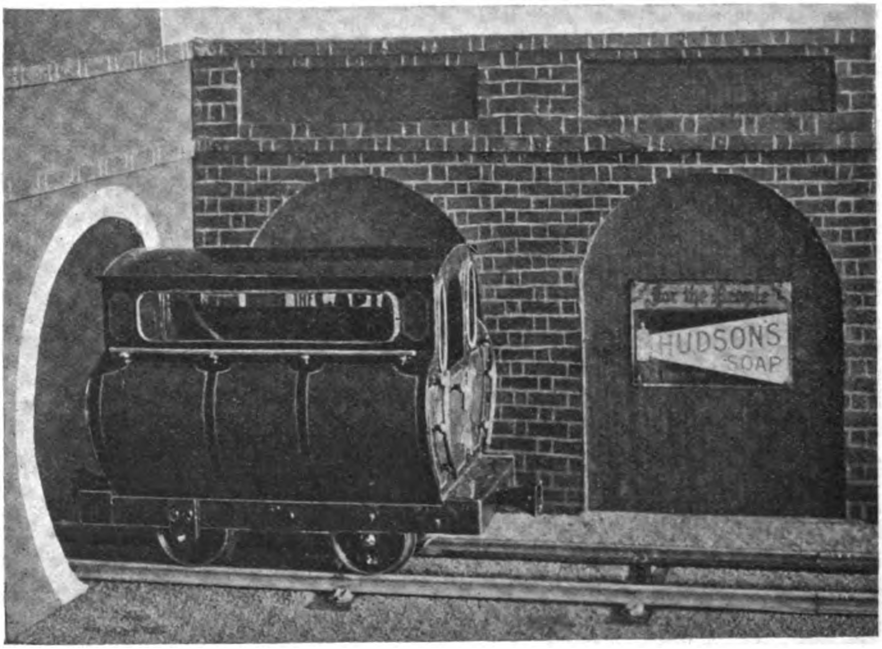
When I had constructed these parts I bought four brass wheel castings and turned them to 1¼ ins. diameter on the tread, on a small lathe fitted on a sewing machine stand. I then obtained a smallest size "Pet" boat motor and fitted on the brass support 1 13-16ths ins. from inside of the end of frame to centre of the motor, by two cheese-headed brass screws. On the outside of the frame two bearings are placed, one each side, 1⅞ ins. from the outside of the end of frame to centre of bearings, and are fixed by two cheese-headed brass screws each, which screw into the frame. In each bearing a hole was drilled ⅜ in. from top to receive the axle of the driving wheels, which are made of ¼-in. round steel rod 3⅜ ins. long.

The next job I took in hand was to obtain two cogwheels, 1⅞ ins. and 5-16ths in. diameter; the former has seventy-five teeth and the latter fifteen teeth; these give a ratio of gearing of 5 to 1. The small cog was sweated on to the armature spindle with soft solder, and the large one to the inside of one of the driving wheels.

When I had quite finished constructing the frame, etc., and the motor being properly fitted, I put it on the rails and tried it by standing a 4-volt 10-amp. accumulator on the frame and connecting it to the motor through a reversing switch, and when the current was switched on it ran along at a good speed; but as the track is only 8 ft. long, it could not get its proper speed. This test quite satisfied me, as the accumulator weighs 4½ lbs., and so I proceeded with the body thus: A sheet of stout tin was obtained and the ends, sides, roof, and windows marked out, and then I cut them out and drilled 1-16th-in. holes where they were necessary to take the hand-rail pillars, which are made from cheese-headed brass screws, and the hand-rails of No. 10 gauge brass wire. When the pieces were cut out and drilled, the sides were bent to shape on a lathe crank by means of clamping one long edge and bending the other round it; this method was easy and quick. I then soldered the pillars in, and soldered the rails along the top. The hand-rails on the ends were softened, and bent with my fingers. The ends are made with doors and footplates in one piece—there, of course, being two ends—and the sides had a piece allowed on the bottom to go inside the frame to secure the body to the latter.

The roof was bent on a large pipe 4 ins. diameter. As soon as all was quite ready, the parts were soldered together, starting by putting the ends on to the roof, and then the sides, and finally soldering all joints. The windows are edged with No. 16 gauge brass wire. The body is fixed to the frame by the two couplers (which are made of four pieces of tin each, each piece forming a side) and by a brass bolt each side of the frame.

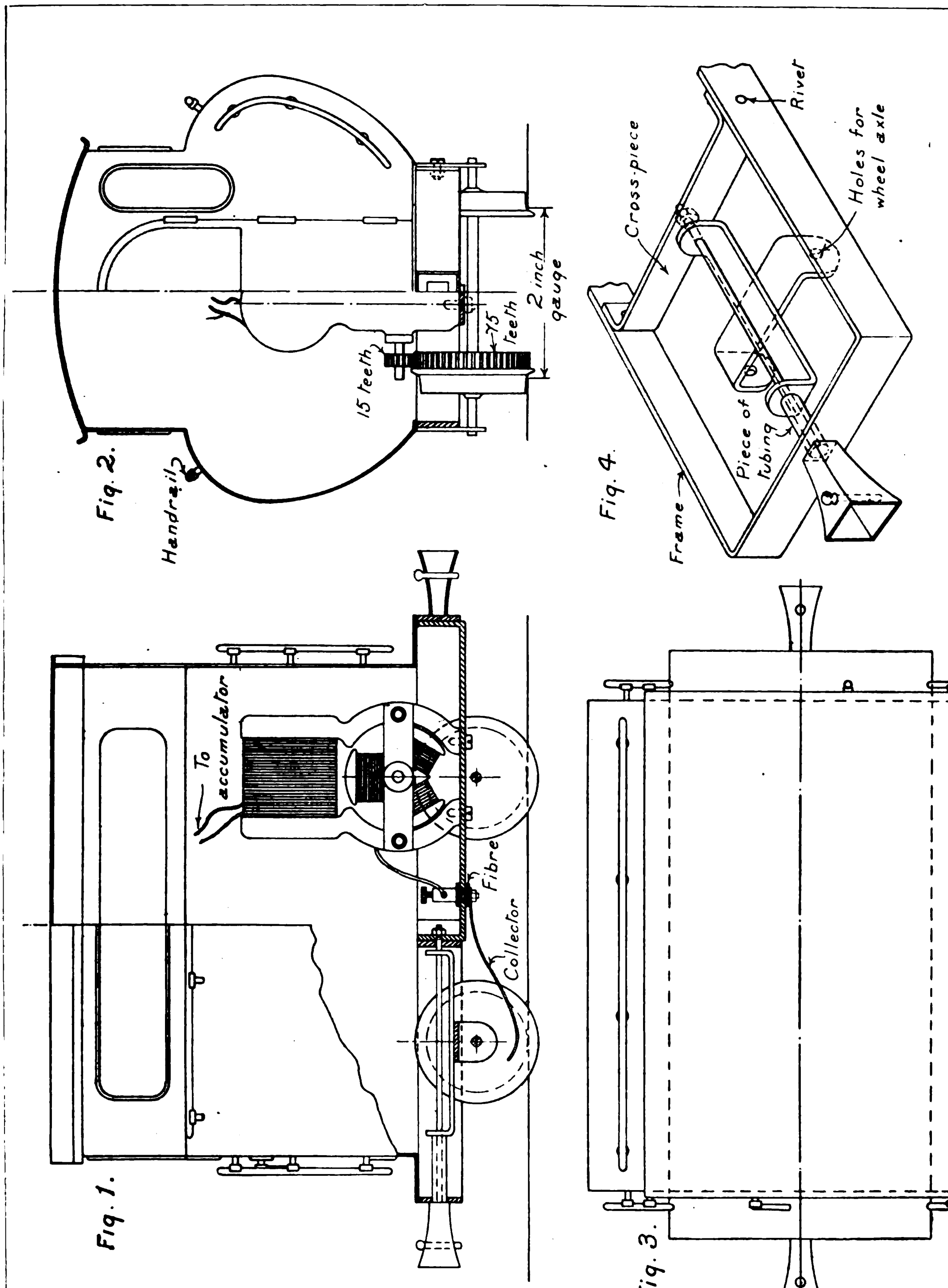
When the whole was completely finished, it was enamelled old gold and black and lined with yellow. At the left-hand side of the door ventilators are painted, but cannot be seen in photographs. The frame is enamelled mahogany outside and red inside, the couplers and wheels are black, and the inside of body dark stone. The stand also was made by myself out of thick strawboard, with the recesses let in, and the whole painted dark slate, with the bricks shown up by cement colour. The advertisements were obtained from one of your advertisers.



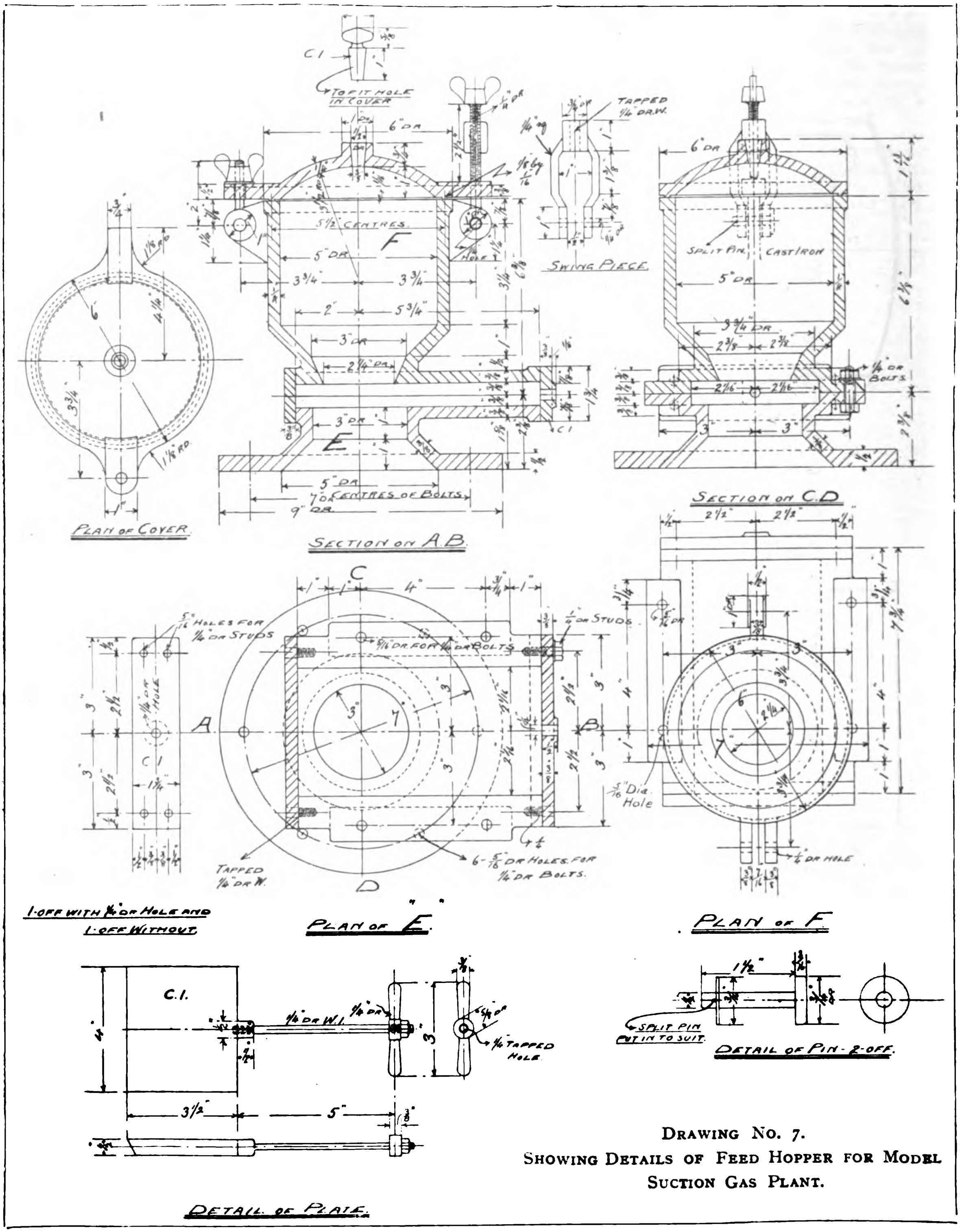
View of Electric Locomotive entering Tunnel.

I may say that engine is worked on the separately-excited principle to enable it to be reversed from the track, the field-coil being fed from an accumulator carried on a truck. The last time I tried it it pulled 9½ lbs. besides itself (3 lbs.). It may interest you to know that I was only 14 years of age when I started on the job, my experience being gained chiefly from The Model Engineer.

Wireless Telegraphy.—A station is now being erected in the grounds of the Vatican at Rome. The transmitting and receiving instruments will have a range of about 350 miles. A station has also been opened recently at Emden, in East Friesland, Germany, and operators desirous of entering the service on the large ocean liners will be examined there in future.—*Electrical Engineering*.



MR. H. LEE'S MODEL ELECTRIC LOCOMOTIVE.



Drawing No. 7.
Showing Details of Feed Hopper for Model Suction Gas Plant.

The "Model Engineer" Suction Gas Plant.

By W. A. Tookey.

(*Continued from page* 300).

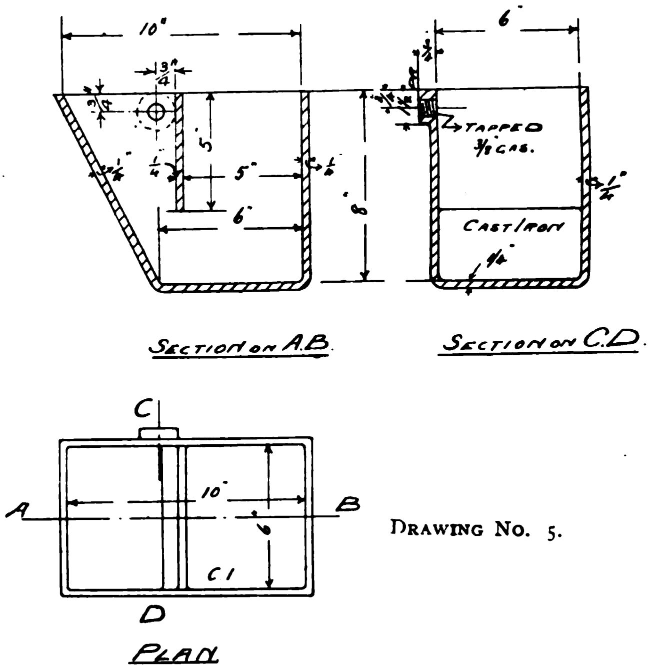
Drawing No. 5 shows particulars of the lute pot or seal box, and the only machine work required is the tapped hole for the overflow pipe.

Drawing No. 6 shows the details of the cleaning door bolting on to the ashpit, and also the air regulator. Full particulars of the work required in this portion are given on the drawing.

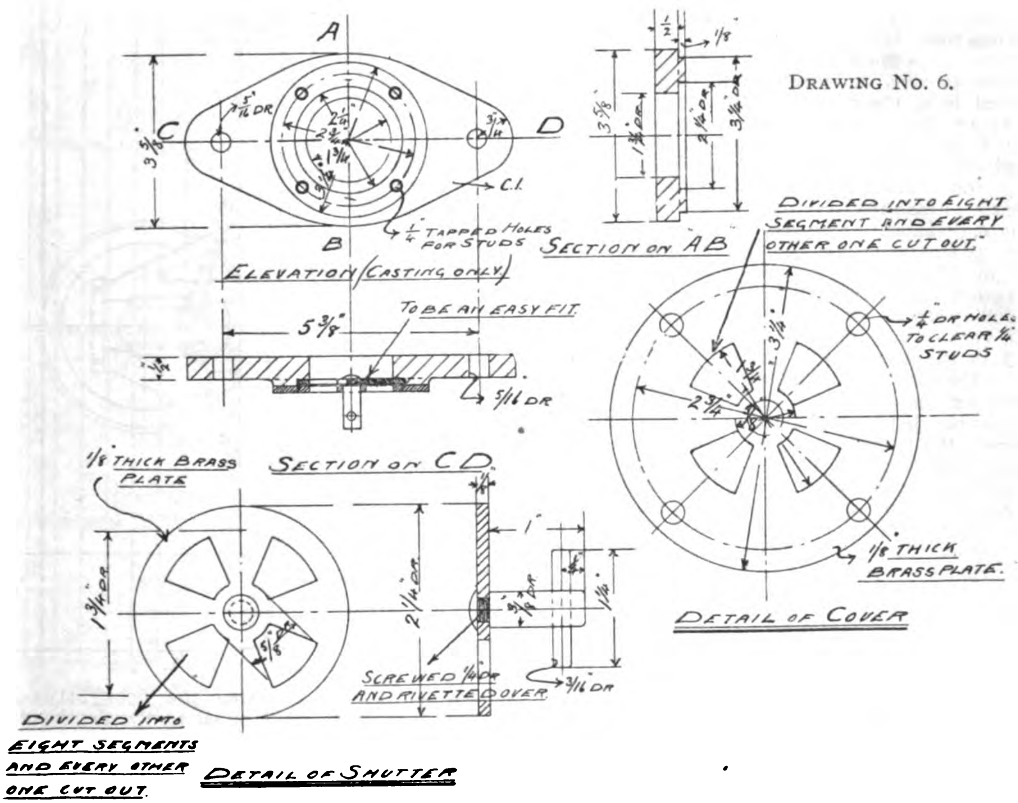
Drawing No. 7 shows the details of the feed hopper, and it will be seen that this requires by far the most attention in machine work. At the base is the sliding plate, carefully fitted to work in and out easily, but still to be gas-tight at all joints. Asbestos millboard, with surfaces covered with graphite, should be used between all metal surfaces at this portion of the work.

The top cover, which swings horizontally, is shown with a narrow facing strip, which must be machined to suit the surface of the flange at the top of the main casting, and thus to make a good joint preventing escape of gases when blowing up or leakage of air into the generator during work.

(*To be continued.*)



DRAWING No. 5.



DRAWING No. 6.

Model Rolling-stock Notes.

By H. Greenly.

FURTHER DESIGNS FOR OPEN WAGONS. MODELS FOR LARGE SCALE RAILWAYS.

(*Continued from page 272.*)

TO complete, for the time being, the series of diagrams of open wagons, I include herewith three more types common to English railway practice, viz., the L. & N.W.R. 7-ton open goods truck (Figs. 21 and 22) and the standard private owners' 15-ton and 20-ton wagons.

Although rated only at 1 ton more capacity, it will be seen, on reference to the drawing of the 6-ton wagon, on page 129 of August 6th issue, the L. & N.W.R. vehicle is nearly 3 ft. longer. In fact, it is 11 ins. longer than the Railway Clearing House standard 10-ton truck. For this reason, therefore, L. & N.W.R. trucks* are much to be preferred to ordinary private owners' wagons as passenger vehicles for large scale railways. The case of a 2-in. scale railway 7-ton or 10-ton L. & N.W.R. wagon would make an ideal truck for children to ride in. The length works out at 32 and 35½ ins. respectively, with a width of from 15½ to 16 ins. Either of these wagons will be found to provide sufficient room for two passengers (of the juvenile variety) sitting face to face, a well being provided for the feet in the manner to be described later.

In making a model truck in which it is intended to ride, the principal point to be observed is in the matter of the centre of gravity of the passenger when seated in the vehicle. Although I must admit the difficulties are not trifling, I have come across some absurdly designed trucks—of professional manufacture, too—in the course of my experience. Only recently I had to report on the whole construction of a 9½-in. gauge model railway, with a view to suggesting various improvements in both railway and rolling-stock. The passenger truck used was a very clumsy affair on two bogies, the length of the under-frame being about 6 or 7 ft. Except for the absence of bolster springs on the bogies (or anything equivalent) to provide for the inevitable "wind" in the road, the underframes were well made, from a joiner's point of view. The top of the solebars, on which a floor consisting of transverse slats of wood was fixed, was about 6 ins. above rail level. The seats were, however, higher than the ordinary dining-room chair, viz., 17½ ins. above floor level. This gave a total height above the rails of 23½ ins., and reckoning that the centre of gravity of an adult person sitting down is another 8 ins., the total height of the centre of gravity would not be less, with the light truck, than 29 or 30 ins. above rail level. In actual practice the centre of gravity of a railway carriage would be under 6 ft. above the rails, or slightly more than the base upon which the carriage rests.† No wonder then that the model truck was very unstable and that accidents occurred frequently. By lowering the floor between the bogies to an amount equal to the depth of these

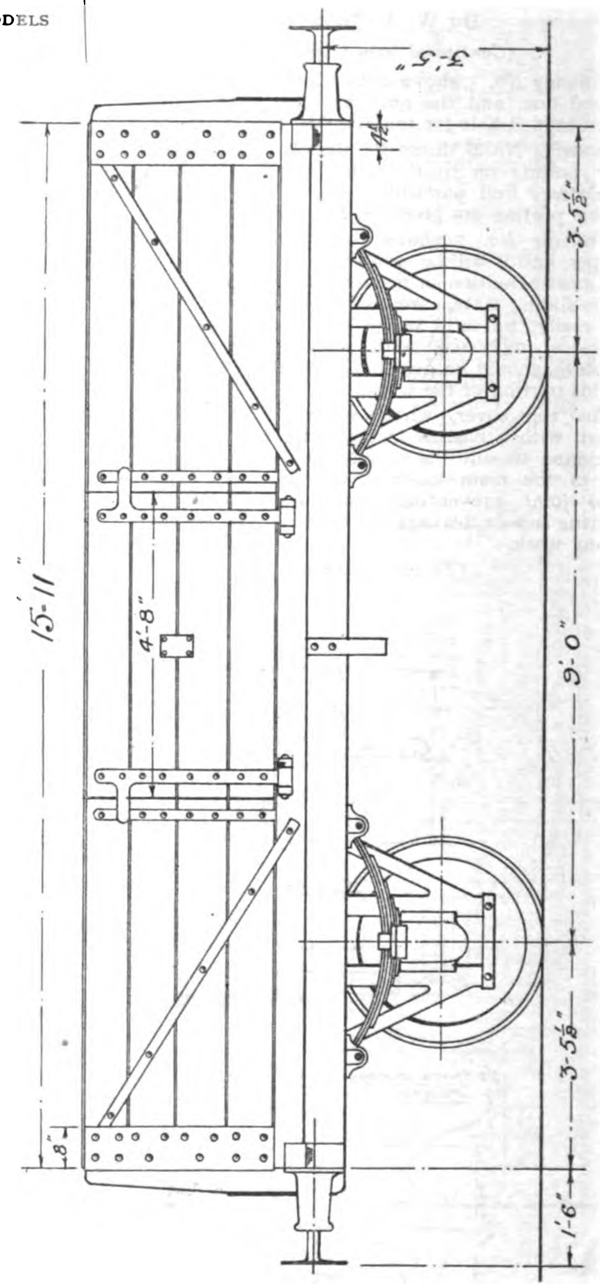


FIG. 21.—ELEVATION OF LONDON AND NORTH-WESTERN RAILWAY 7-TON OPEN WAGON.

* See also drawing of 10-ton L. & N.W.R. open wagon, page 510, issue of May 28th, 1908.

† Centre to centre of rails is, roughly, about 5 ft., with the 4-ft. 8½-in. gauge.

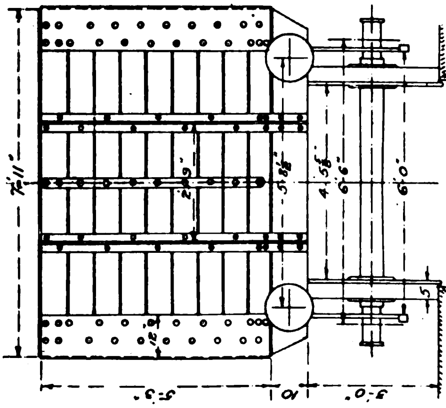


Fig. 27.—End Elevation of 20-ton Wagon.

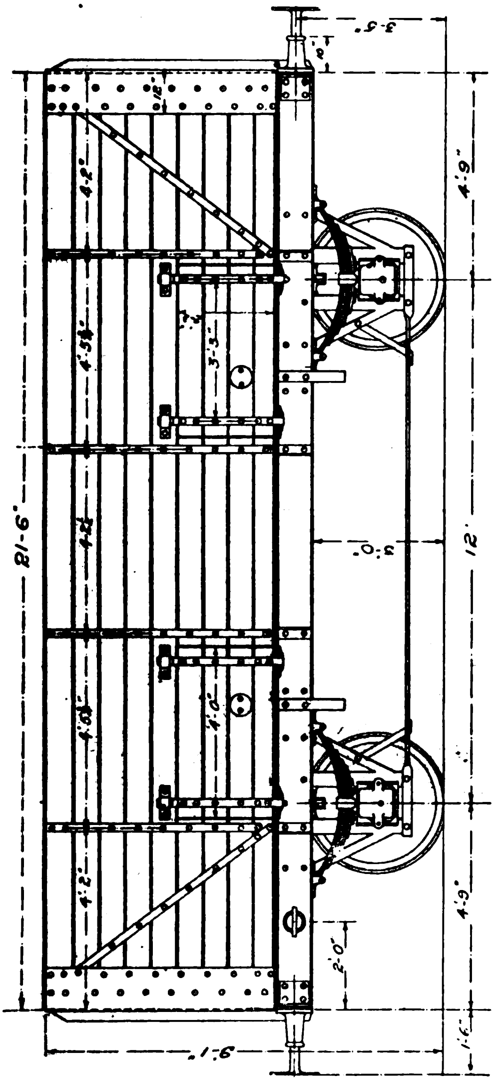


Fig 26.—Elevation of 20-ton Private Owners' Open Goods Wagon.

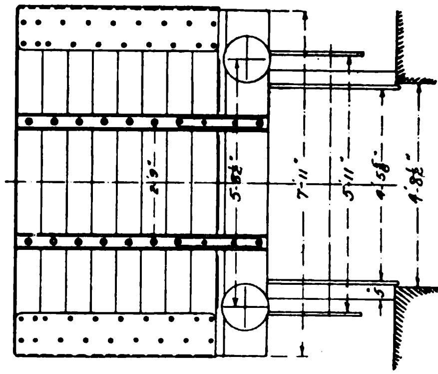


Fig. 25.—End View of Private Owners' 15-ton Wagon.

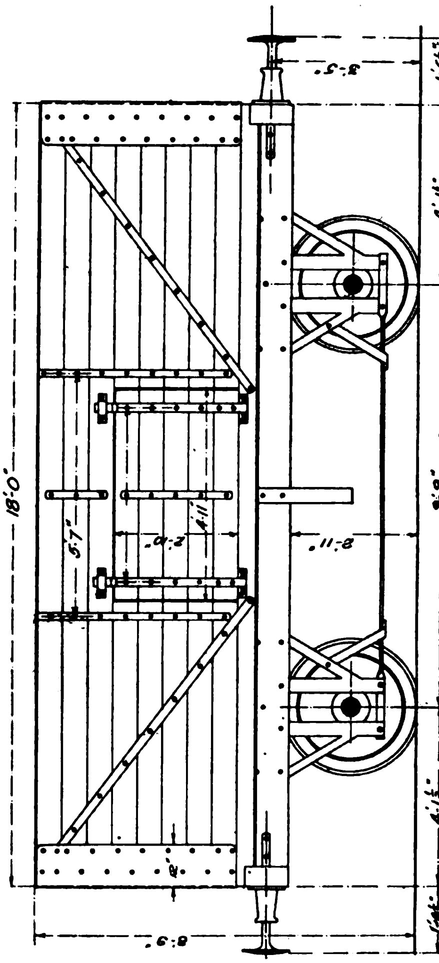


Fig. 24.—Elevation of Private Owners' 15-ton Wagon. (R.C.H. Specifications of Standard Wagons.)

solebars (the slats were fixed to the under-side, instead of the top, of the solebars), and cutting down the seats to 9 ins. high, a seat level

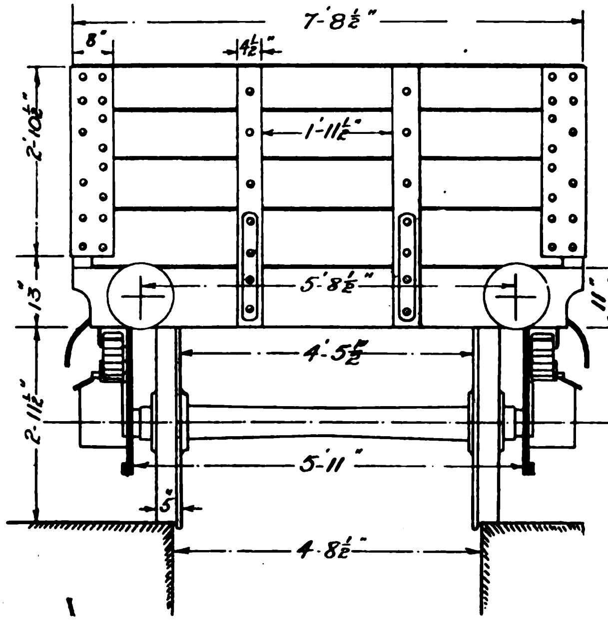


Fig. 22.—End View of L. & N.W.R. 7-ton Wagon.

of about 12 ins. was obtained. This height, although out of the question for ordinary purposes, does not feel uncomfortable when the short length of time the adult passenger is usually seated is considered, and is also quite a satisfactory seat level for children, who for the most part are the regular users of the railway. At the same time the height of the seat was reduced to 15 ins. above rail level, giving a total height of centre of gravity, when loaded, of not more than 20 ins. instead of 30 ins. The number of spills was reduced to a minimum, and when the laying of the line is improved, I think they will be non-existent.

For smaller passenger-carrying railways larger trucks must be employed, and instead of the L. & N.W.R. 7- or 10-ton trucks, I suggest that the general proportions of, say a 15- or 20-ton private owner's wagon be followed as far as is possible under the conditions in force.

A 15-ton wagon is shown in Figs. 24 and 25, and a model built to a scale of 1½ ins. to the foot would provide a truck with a body 27 ins. long and practically 12 ins. wide. This would be found a very good wagon for one passenger, even without a well, a seat about 4 to 6 ins. above the level of the floor being placed at one end of the truck for about one-third of the length. For driving the locomotive from the truck the seat may be used to kneel upon. If a greater fore-and-aft stability is desired, the truck may be elongated to the extent of 1 in. or so in the matter of wheelbase, and some iron weights fixed to the under-side of the frames.

The 20-ton wagon (Figs. 26 and 27) will be found very suitable as a two-seated vehicle, for children of course, and to make it more comfortable a well may be sunk between the wheels for the feet.

The general arrangement of such a model is shown in Fig. 28, and it will be seen by adopting the 20-ton wagon, with its 12-ft. wheelbase as a prototype, a more capacious well may be fitted than would otherwise be possible. By fixing the sides to the solebars the maximum width is also obtained.

So much for the particular application of the trucks illustrated herewith to large scale railways: makers of models pure and simple will require further particulars of the actual wagons, so that their models may be faithful replicas of the original.

The Railway Clearing House specifications say, in respect of the 15-ton vehicles, that no wagon shall exceed 18 ft. in length outside the body or exceed 8 ft. 3 ins. in width over all, up to a height of 5 ft. above rail level. Above 5 ft. the width may be increased to 8 ft. 6 ins. The height above the top of the rails not to exceed 10 ft. at the sides and 11 ft. 6 ins. in the middle. The latter, of course, determines the height of a salt or cement wagon, such as illustrated in the last article, this clause being the same in both the 8-, 12- and 15-ton specifications.

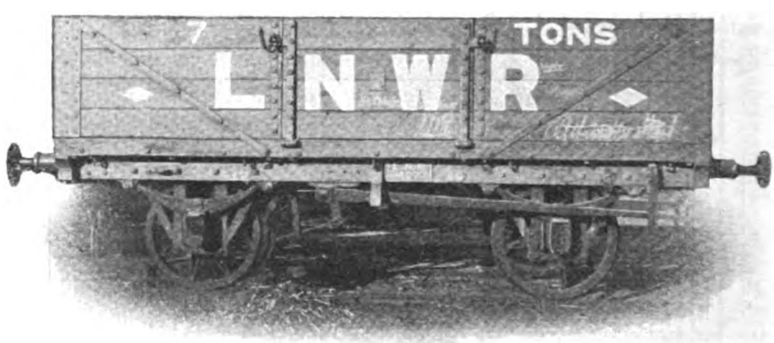


Fig. 23.—A Photograph of L. & N.W.R. 7-ton Open Goods Wagon.

The bodies and the under-frames of the 15-ton wagons may be of wood, iron, or steel. The solebars of wooden wagons must be 12 ins. by 5½ ins., or 12 ins. by 5 ins. if flitched with iron, instead of 5 ins. and 4 ins. respectively, in the case of the 8 to 10-ton vehicles.

The axle-guards or W-frames must be tied together, as shown in the drawings, and oil axle-boxes only to be used. The wheel tyres and axles have to be of slightly increased dimensions compared to the 10-ton vehicles. The doors may be in either the sides, bottom and end, in sides and bottom, sides only, or in sides and end; and the tare weight, that is, the weight of the wagon empty—the particulars of which are in all cases painted on the sides—may be respectively 7 tons 8 cwts., 7 tons 5 cwts., 7 tons 3 cwts., 7 tons 6 cwts.

The 20-ton wagons are usually provided with two side-doors, instead of the one used in the 15-ton truck. The dimensions of length given on the drawing are the maximum, other allowable body dimensions being stated above. The tare weight, with side-doors only, is given at 8 tons 8 cwts.

The under-frames of the 20-ton wagons are specified to be of steel or iron only; the bodies, however, may be of wood, as shown in the drawings. At some future time I will make it a point to get out the drawings of a steel-framed vehicle, as I understand that one or two of our readers, who do not care much about woodwork, are anxious to equip their railways with all-metal model wagons. In addition, I shall not forget to submit some drawings of a double bogie truck (as used for boilers, etc.), from which a model locomotive of small gauge (say 3½ or 1 in. scale) may be driven with comfort and safety.

In the design for the model well truck (Fig. 28) it will be noticed that the well is fixed to the cross-bearers (transverse beams) and to the solebars, and that the buffer beams (headstocks) are tied to the cross-bearers by means of longitudinal bolts, as advised in the last article.

(To be continued.)

Trial Trip of Large Cantilever Steamer.

ON Wednesday last, September 23rd, the fine steel screw cargo and passenger steamer, *Kohnkry*, built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyard, Middlesborough, with the cantilever frames on the patents of Harroway and Dixon, John Priestman and Livingston and Sanderson, to the order of Messrs. Elder, Dempster & Co., of Liverpool, proceeded to sea for her official trials.

Her leading characteristics are as follows: she is built to the highest class at British Corporation, with complete shelter-deck and topside water-ballast tanks under upper deck.

Her principal dimensions are 373 by 52 ft. 1 in. by 28 ft. 4 ins. moulded. She has four extraordinarily large hatchways, the largest of which is 35 ft. long and 30 ft. wide. The holds are absolutely free from all obstructions, such as beams, pillars, or webs.

She has been fitted with triple-expansion engines (placed aft) by the North-Eastern Marine Engineering Company, Ltd., Sunderland, having cylinders 26, 42, and 70 ins. diameter by 48-in. length of stroke, supplied with steam by three large single-ended boilers working at 180 lbs. pressure and fitted with Howden's system of forced draught.

The trials passed off most successfully.

The hull and engines have been constructed under the supervision of Captain W. P. Thompson, the owners marine superintendent, and Mr. James B. Wilkie, their superintendent engineer, with Mr. W. L. Roxburgh as resident superintendent.

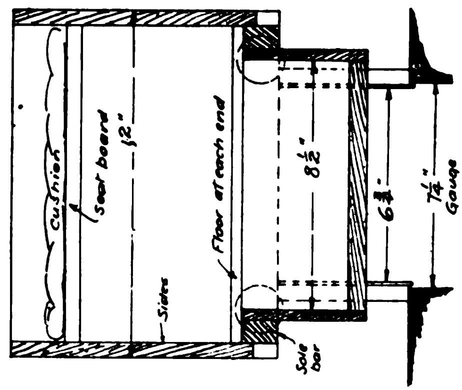
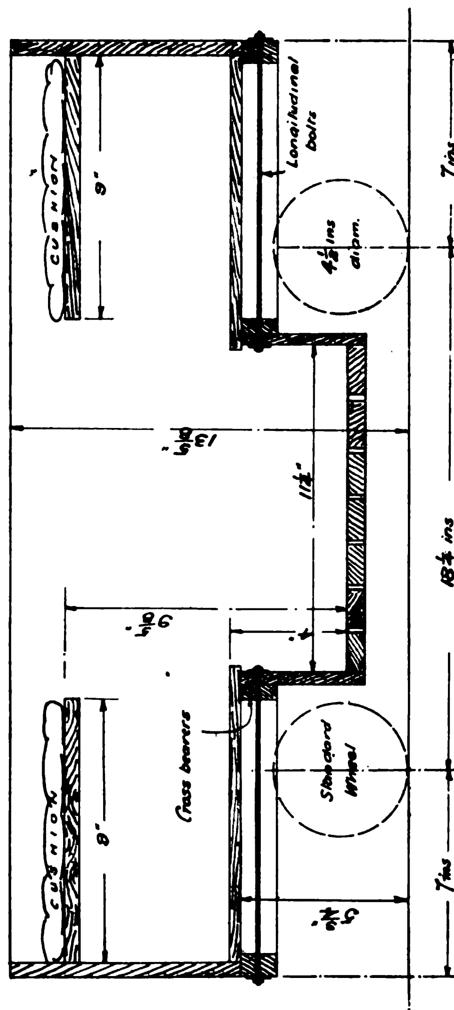


Fig. 29.—Cross-section of Model 1½-in. Scale Wagon.



Sectional Elevation.
Fig. 28.—Design for Model 1½-in. Scale Truck for Two Passengers (Children).

How It Is Done.

Turning a Locomotive Crank-Axle.

By Geo. V. Hutchinson.

In the following lines, and with the aid of a few sketches, the writer endeavours to describe the method employed to deal with one of the most important jobs on an inside cylinder locomotive—that of turning the crank-axle.

The forgings of the crank-axles are not made in the majority of works where locomotives are built.

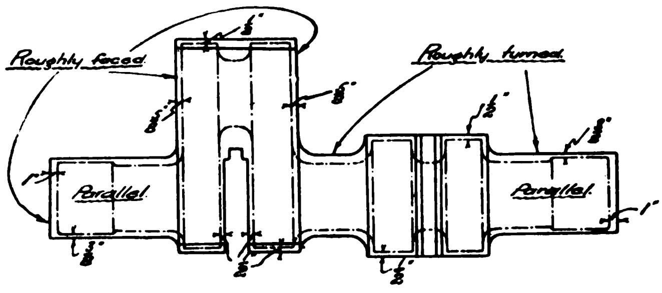


Fig. 1.—Forging for a Locomotive Crank-axle, showing the Amount of "Cleaning."

They are ordered from steel manufacturers who make a speciality of such forgings; consequently they reach the locomotive works in the form shown in Fig. 1. This sketch shows a finished axle dotted in the forging in order to give an idea of the amount of stuff to be removed.

In Fig. 2 a modern crank-axle is shown fully dimensioned,. so let us suppose that this is the drawing of the crank axle to be turned.

The first operation is to mark off on a lathe, about 4 ins. by ⅜ in., and about 6 ins. longer than the over-all length of the axle, the lengths and diameters of the wheel-seats, journals, etc., as between the lathe centres and placing the divided lath on it in such a position that the divisions on the lath show the same amount of "cleaning" on each crank. When the correct position of the lath is found a square is placed on the axle so as to touch the end mark on the lath and a "monkey" calliper is set, so that when the hooked leg is on the end of the axle the point of the straight leg is touching the heel of the square. All this arrangement is shown in Fig. 3. A line is then marked with the "monkey" callipers and "centre-popped." When the same process is gone through at the other end of the axle the carrier is placed in position and the balance weights are bolted on the lathe faceplate as shown in Fig. 4, which also shows the method of fixing the carrier and drivers. The balance weights shown are circular blocks of lead, but a cast-iron segment may be used instead, which is placed in the position shown by the dotted lines in the view of faceplate, Fig. 4. The axle is now ready to be cut to the correct over-all length, which is shown by the lines marked with the "monkey" callipers. When this is done the axle is removed from the lathe and the centres, which should be nicked round with a chisel, to prevent them breaking in, knocked off.

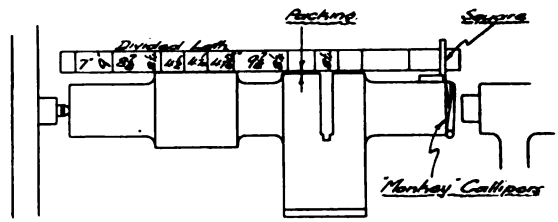


Fig. 3.—Marking the Over-all Length of Axle in the Lathe.

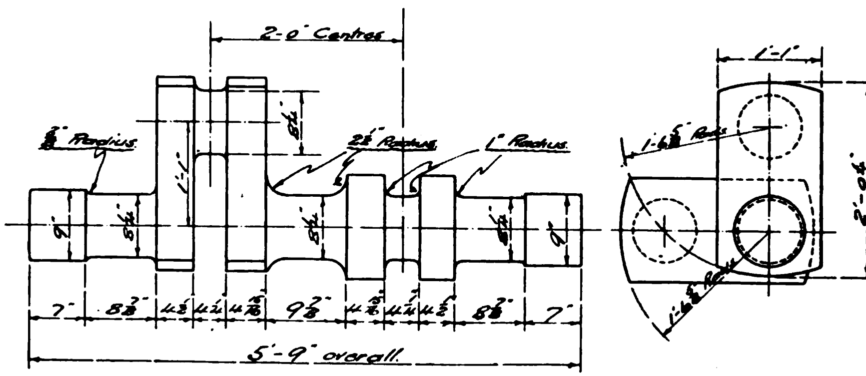


Fig. 2.—A Modern Locomotive Crank-axle.

shown in Fig. 3. The axle then requires centreing, if the makers have not left their centres after rough turning. This is done in the ordinary way by means of a "monkey" callipers. The centre-punch marks are deepened with a drill the same angle as the lathe centres. Marking the axle to the correct over-all length is next done by placing it

New centres must now be marked and drilled in the axle as before, and small grooves cut in them with a chisel so as to allow oil to get in for the purpose of lubrication

The forging is then returned to the lathe and the crank webs marked out in the following manner. For the purpose of marking out the webs two gauges are necessary. These are shown in Fig. 6, which, for convenience, may be called "A" gauge and "B" gauge. The axle is placed in the position shown in Fig. 4, the crank near the loose headstock being vertically downwards. The tool-rest saddles are brought together and a parallel piece placed across them under the crank to be marked. On this parallel piece a large square is placed. The "A" gauge, having been set the length of the end of the axle from the side of the web nearest to it, which in this case is 1 ft. 3⅞ ins., is placed so that the flat portion lies across the end of the axle and the round portion parallel to the centre line. A reference to Fig. 4 will make the above description clear. The edge of the square is brought up to the end of the "A" gauge, and a line is scribed along the web at the edge of the square. The crank should have been whitened previously, so as to show up the lines marked on it. The remaining three lines are spaced off the one just marked by means of a rule, and scribed from the square, as before.

In order to mark off the other crank, the axle is given a quarter of a turn so that the crank to be marked is vertically downwards, and the face of the crank which has been marked is uppermost. The tool rest saddles must now be shifted along till they are under the crank, which we might call No. 2 crank. The square is again rigged up in the same way as was done when marking off No. 1 crank. The "B" gauge, which is 2 ft. long for this crank axle, is placed, as shown in Fig. 5, with one end at the inside line of the outside web of No. 1 crank; the square is brought up to the other end and a line marked along the crank at the edge of the square, which touches the end of the "B" gauge. The remaining three lines on No. 2 crank are marked in the same way as was described for marking them on No. 1 crank.

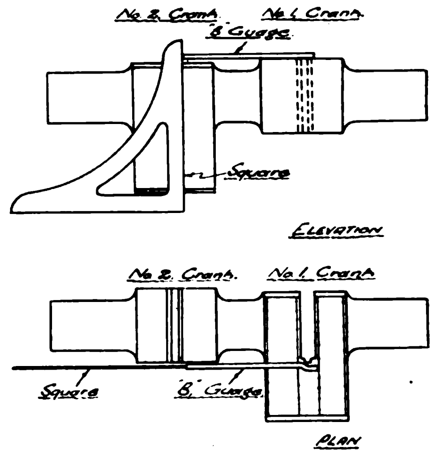


FIG. 5.—MARKING NO. 2 CRANK OFF NO. 1 CRANK.

The lathe, which should run at about 20 r.p.m., may now be set in motion, and the axle rough-turned. The middle of the axle and axle-box journals are left about ⅛ in. full of the finished size and the sides of the cranks are faced to within about ⅛ in. of the lines. These lines on the cranks should have a few centre-pops on them in case they get blotted out. The wheel-seats are left about ¼ in. full and water cut.

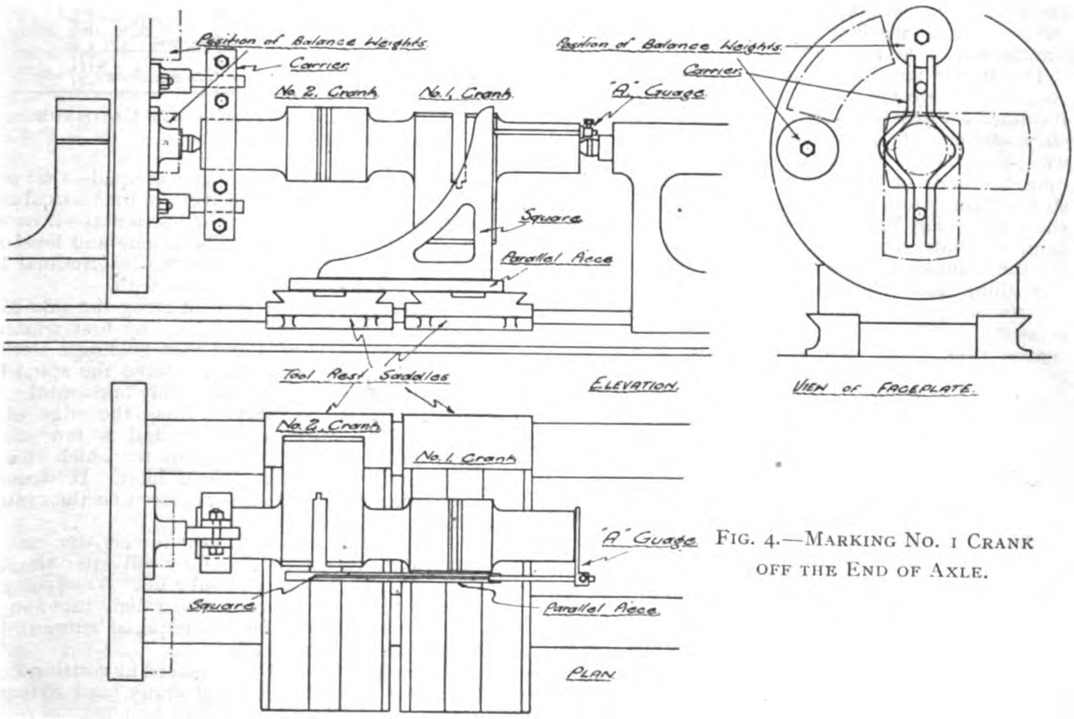


FIG. 4.—MARKING NO. 1 CRANK OFF THE END OF AXLE.

Before removing the axle from the lathe the ends of the cranks near the big-end journals must be finished to size, and to do this the cranks must be marked the correct length from the centre line. To mark the crank it must again be placed vertically

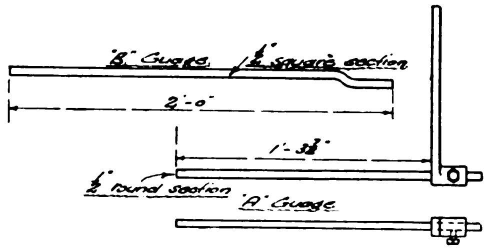


Fig. 6.—Gauges used for Marking off Cranks.

downwards. A scribing-block is set off the shears of the lathe to the lathe centre. This will, of course, be the same height as the centre line of the axle. A mark is then made with the scribing block at the corner of the crank, which is vertically downwards. The end of the crank is 1 ft. 6⅝ ins. from the centre line, therefore the scribing block must be set 1 ft. 6⅝ ins. down from the mark just made and a line scribed across the side of the crank. The other crank is marked in a similar way.

The turner may now proceed to remove the stuff till the lines are just cut away, when one end of each crank will be finished. When turning the ends of the cranks the lathe must be run slower than before—at perhaps half the speed—as the part being turned is a considerable distance from the centre and is not in contact with the tool for the complete revolution.

Nothing more can be done till the cast-iron centres are put on, and for this purpose the axle is sent to the "wheel gang." These cast-iron centres (Fig. 7) are used when turning the big-end

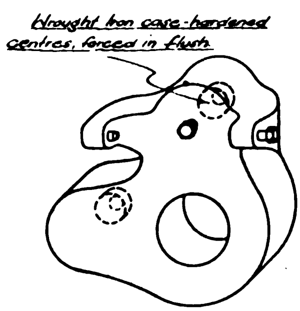


Fig. 7.—Cast-iron Centres used when Turning the Big-end Journals.

journals, and it is very important that the actual centres in them should be directly opposite one another, therefore great care must be taken in putting them on the axle. The actual centres in the cast-iron centres are made of wrought iron, case-hardened and forced in flush.

In order to receive the cast-iron centres the axle must be carefully levelled. A reference to Fig. 8 will explain how this is done.

The axle is placed on a trestle and wooden block, as shown, one crank—the horizontal one—is on the trestle, and the vertical one on the wooden block. A square is placed on the side of the vertical crank, and on it is placed a spirit level, as at A. This shows if the axle is level lengthwise, and, if not, it can be made so by adjusting the wedges placed between the vertical crank and the wooden block. The square and level are now placed as is shown at C, in order to get the crank truly vertical; this can be done by means of the wedges between the horizontal crank and the trestle.

When one crank is vertical, the other should be horizontal; but in practice this is not generally the case. By placing the spirit level on the horizontal crank, as at B, it will most likely be found that this crank is not level. The wedges on the trestle are therefore adjusted till the difference

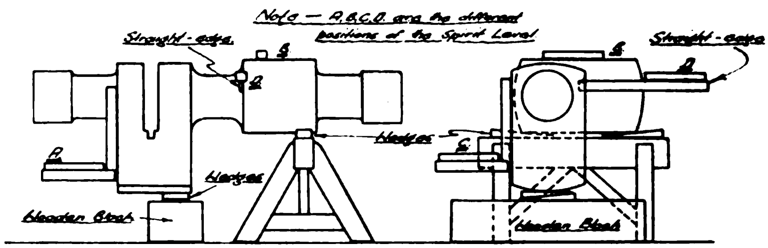


Fig. 8.—Method of Levelling Axle to Receive Cast-iron Centres.

of level between the two cranks is equal—that is, till the vertical crank is as much out of the vertical as the horizontal crank is out of the horizontal—if we may express it in that way. The square and level may again be placed at A in case the longitudinal level of the axle has been interfered with.

A line must now be scribed along the side of the horizontal crank. This is done by first whitening the part to be marked and then holding a straight-edge against it, on which is placed the spirit-level so as to get the straight-edge truly horizontal. The line may then be marked along the edge of the straight-edge with a scriber and a few centre-pops made on it. The purpose for which this line is marked will be explained later. It does not matter in what position it is placed on the crank so long as it is horizontal.

The wheel seats which now receive the cast-iron centres are turned so that they will enter the holes in the centres easily for about 2 ins. The remainder of the wheel-seat is turned with a slight taper so that the centre is forced on the required amount by a pressure of about 15 tons.

A cast-iron centre is now placed in position on the wheel-seat near the vertical crank, and driven on as far as it will go with a lead hammer; care must be taken not to shift the axle by the hammering. It will be noticed in Fig. 9 that there are two lines on each cast-iron centre which are at right angles to one another. Each line passes through a centre and the centre of the hole which takes the wheel-seat.

Along the horizontal line the straight-edge is placed and on the straight-edge the spirit level. If the level does not show the line truly horizontal, the cast-iron centre must be knocked round with a lead hammer till it is so. This arrangement is shown in Fig. 9.

All this operation of levelling up and putting on of the centres must be done in front of the hydraulic ram, so that it can be conveniently brought into position when required.

For the purpose of forcing on the centres an iron bar, sometimes called "the wasp," is used to hold the axle up to the ram. The wasp is of dimensions something near those given in Fig. 10. There is a hole at each end to take the bars which hold it up to the ram, and in the middle there is a ring for convenience of lifting.

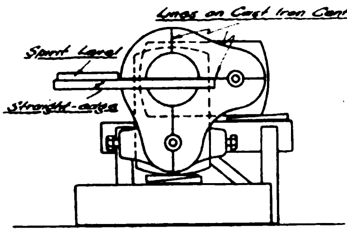


Fig. 9.—Method of Levelling Cast-iron Centres when being put on the Axle.

Fig. 11 shows how the wasp is placed in position between the webs of the vertical crank and connected up to the ram by the bars already mentioned, which have cotters placed in the holes shown. The hole in the cast-iron centre is bridged by means of an iron block against which the ram presses. The ram is now set in action and the centre forced on, centre as before, and if this is not horizontal the centre must be taken off and put on properly. If care is taken in the first instance the centre will be right the first time.

When everything is checked and found correct the other centre is put in position as was done with the first, the axle remaining the same as before. The wasp is then put at the back of the centre, which has been levelled with the straight-edge and spirit level as before, and connected up again to the ram with the bars and cotters, so that when the ram starts to work the centre will be pulled on to the axle. Everything is again checked over, and if correct the set screws in the centres may be tightened up and the whole job sent back to the lathe.

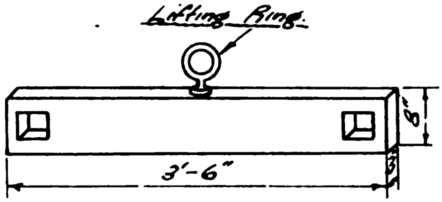


Fig. 10.—The Wasp.

It will be understood that although the cranks may not be exactly at right angles in the forging, they will be so when turned on the cast-iron centres, as the centres in these are truly at right angles.

When the axle is again put in the lathe it will revolve about the pair of centres which are opposite the big-end journal to be turned, so that practically the whole mass of the axle is out of centre.

This heavy weight must be properly balanced before the turning can be proceeded with, and to do this an iron casting of suitable weight and of a segmental shape, similar to that shown by the dotted lines in the view of faceplate, Fig. 4, is bolted on the faceplate, in such a position as to balance the axle.

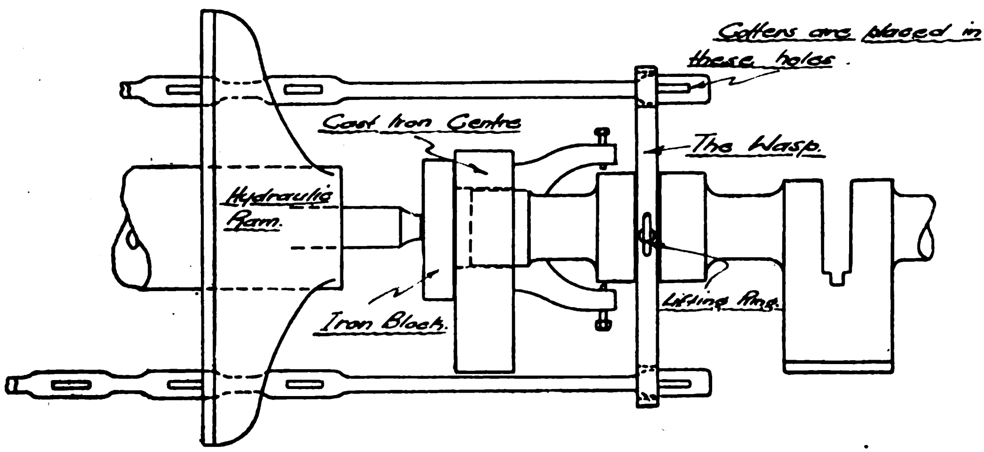


Fig. 11.—Plan of Arrangement of Tackle for Forcing the Cast-iron Centres on the Axle.

Before putting on the other centre the axle must be checked over to see if it is still level. This is done by placing the straight-edge and level as before along the line which was marked on the side of the crank. If it has altered, it must be levelled up again by means of the wedges. The straight-edge and level are then placed along the line on the

For the purpose of turning the big-end journals the lathe should be run at about 4 or 5 r.p.m. And to drive the job the drivers on the faceplate must be shifted till they are in a suitable position relative to the cast-iron centre near the faceplate; they should be tightened up to the job by having wooden wedges driven between them and the cast-iron centre.

(To be continued).

Locomotive Notes.

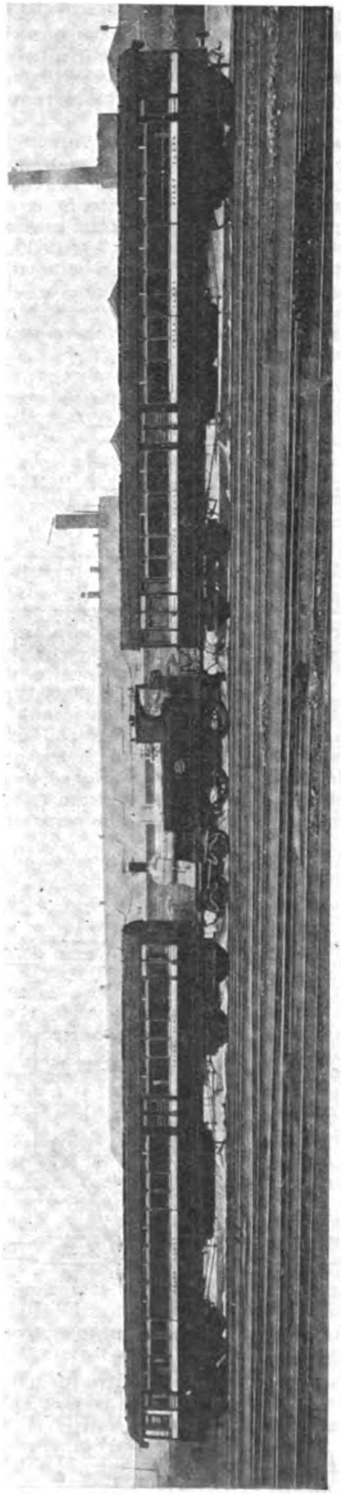
By Chas. S. Lake, A.M.I.Mech.E.

Correspondents and the Western of France "Pacific" Locomotive.

The offer made some time ago by the writer in these columns to lend the drawings of the Western of France Railway "Pacific" type locomotive for the purpose of modelling, brought quite a number of applications from those who felt they would like to take the engine as a prototype, and the drawings were duly despatched, to the first applicant, who, however, returned them, saying that they were altogether too complicated and presented too many difficulties to enable him to enter upon the task with any hope of completing it within the time at his disposal. The drawings have now been sent to India and the writer would, therefore, be obliged if any other model engineer who may be thinking of applying for the loan of them would kindly note that they are not now available, although at a later stage, perhaps, if anyone feels sufficiently interested, and would like to try their hands at the work, it will doubtless be possible to place them once again at their disposal. Meanwhile, if Mr. Hay-Sparkes, a model engineer, who, on being informed that the Western of France drawings had been sent elsewhere, intimated his desire to borrow a set of drawings of the new "Pacific" type locomotive recently introduced on the New York Central R.R., will kindly communicate with the writer again, the drawings shall be forwarded to him at once. The delay has been caused by his address getting mislaid.

A Correspondent Sends a "Poser."

A correspondent writing from Oswestry claims to have positive knowledge that a locomotive, while running on a down grade with steam shut off from the cylinders, has been known to slip the driving wheels, and that not only has this occurred on one railway and under one set of conditions, but that it frequently happens on most railways. Now, here—if we are to believe the gentleman referred to—there springs upon us a contingency which probably everyone has hitherto regarded as quite impossible. First of all, what is it that causes the driving wheels of a locomotive to "slip"? Surely it is nothing else than for the reason that, temporarily, the tractive power developed by the cylinders is too great to allow of the adhesion weight on the coupled wheels taking effect, or, in other words, the friction between the rail and the driving wheel is not sufficient to resist the power of the cylinders, which is being directed to revolving those wheels at a speed in excess of that which the load to be hauled permits of. Thus it is that engines "slip" so frequently when starting away with heavy trains or when they are passing over greasy rails with the steam applied on the pistons, because under these conditions the cylinders



New Short Motor Train on the Taff Vale Railway.

are developing more driving power than can be utilised between driving wheel and rail, but once the steam is shut off, the only thing which can keep the engine moving is the force of momentum, and especially when a locomotive is running down hill with steam shut off and the train pushing it forward is this force to be taken advantage of.

So that here we are confronted with the suggestion that without any direct power being applied to the driving wheels, that is to say, with steam cut off and the predisposing cause of the driving wheels slipping thereby removed, the same action may go on, and, indeed, does so. When a locomotive is running down a grade without steam, there must necessarily be set up in the cylinders a pumping action, caused by the pistons passing to and fro, and being, so to speak, driven instead of driving, and they must then act to some extent as air-compressors, and this must rather have the effect of retarding the motion of the engine than advancing it. Back-pressure takes place in the cylinders, and in no circumstances, so far as the writer is aware, can any action arise which would have the effect of producing the causes which lead, under other circumstances, viz., when steam is applied and the load is offering resistance, to slipping of the driving wheels.

If any reader can offer a suggestion, or can quote any instance when he believes the abnormal circumstance mentioned by the Oswestry correspondent to have taken place, something of interest might result; but the writer, after a long and varied footplate experience, has never yet witnessed or even heard previously of such an occurrence, and would require a good deal of convincing that it is possible unless steam be on the pistons at the time, and even then such a thing would be extremely unlikely on a down grade; at any rate, with a continuous steam supply.

New Motor Train for the Taff Vale Railway.

The rail motor-car system has been developed on the Taff Vale Railway to a stage which, taking into consideration the size of the line, is greatly in advance of anything yet attempted by any other railway. Indeed, so rapidly has the use of the cars thereon developed, that the number of journeys made in them at the present time is at the rate of nearly 2,000,000 a year, and the cars run about 360,000 miles per annum. The cars perform 198 separate journeys daily, running 1,166 miles per day and carrying 6,422 passengers, or an average of thirty-two passengers per car journey. At times of pressure it is necessary to attach a trailer coach to the motor-cars, and some special six-wheeled vehicles of the central corridor type have been constructed for this service. In order to cope satisfactorily with this motor traffic, it has now become necessary to provide cars of greater carrying capacity, and with this purpose in view, Mr. T. Hurry Riches, Pres.I.Mech.E., the locomotive carriage and wagon superintendent, decided to introduce a motor train consisting of two specially built corridor carriages, with a small tank engine in between them. By the courtesy of Mr. Hurry Riches, an illustration of the new equipment is given herewith.

The locomotive is one of the earlier standard tank engine types, having the 4—4—0 wheel arrangement, with outside cylinders. The latter are 16 ins. diameter by 24-in. stroke, and the coupled wheels are 5 ft. 3 ins. diameter. The engine weighs, in working order, 45 tons 8 cwts., and develops a tractive force taking 80 per cent. boiler pressure—which latter is 140 lbs. per sq. in.—of 14,155 lbs. The coaches are each 64 ft. in length and weigh 32 tons empty. The driver occupies a compartment at the end of the coach which at the time is leading, and from this position performs the whole operation of driving the train, with the exception of reversing, having full control of the regulator, brakes, and whistle. An electric gong communicates with the engine cab for signalling to the fireman. The trains run between Cardiff and Penarth and Cadoxton, residential towns near Cardiff, and also between Pontypridd and Aberthaw, another essentially passenger and light traffic branch. The length over all of each train is 162 ft. 5½ ins., and accommodation is provided for sixteen first-class passengers and 102 third-class passengers. The smoking compartments provide room for forty-eight passengers.

Heavy Passenger and Goods Locomotives on the Bengal-Nagpur Railway.

This important Indian railway has now in use some heavy and very powerful locomotives for passenger and goods service, and both are of distinctive design. The passenger engines are de Glehn system compounds, and the goods engines "Consolidation" type "simples," and in each case Walschaerts' valve gear is employed. The de Glehn locomotives, two in number, were built by the North British Locomotive Company, Ltd., and they have been supplied on the condition that if not successful, they are to be returned after a twelve-months' trial. Both classes will be illustrated and described in the next or following issue of these "Notes."

A New 12 h.-p. Hydroplane.

We are indebted to Messrs. J. W. Brooke and Co., Ltd., of Lowestoft, for the following particulars and illustrations (see page 355) of their new hydroplane, which was launched at the beginning of last month. The hull is 13 ft. long, with a beam of 5 ft. 6 ins., and is equipped with a 12 h.-p. three-cylinder "Brooke" motor. It was originally intended, we believe, to take this hydroplane down to Burnham, but Mr. Mawdesley Brooke felt it would hardly have been fair to enter a hydroplane in competition with ordinary motor boats. Some high speeds have been obtained, and Mr. Brooke hopes to do even better on some future trials. Not only has the speed obtained been satisfactory, but some valuable information has been acquired from his experiments, and, as a result, Messrs. Brooke are now designing a special engine of very high power and low weight, and a second hull of slightly modified form from the first is also being built. From this new combination Messrs. Brooke anticipate getting some remarkable results. The total weight of the hydroplane illustrated is under 4 cwts., and the speed about 20 knots.

Model Yachting.

THE "ASSOCIATION" MOVEMENT

By W. G. BRITTAIN.

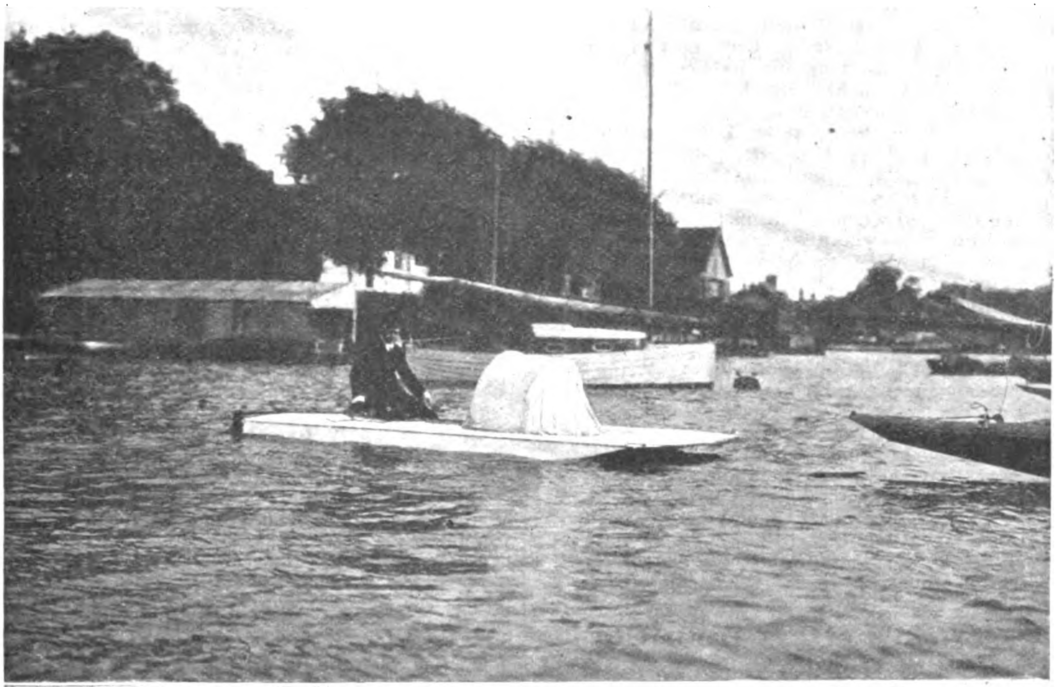
THE movement has grown out of the necessity for the establishment for model yachtsmen of a recognised authority. The sport is unorganised, and in some cases overlapping, and the want of some central body around which our numerous clubs may be grouped has long been felt. So long as their varied rules strike discordant notes, their loyalty to the sport demands severance from the old order. Union is only possible, obligatory, when those several divergent rules merge into a united and comprehensive formula. The partialisms and prejudices which cling like barnacles and check developments render it necessary that a means towards ultimate unity be established, when uniformity will become spontaneously inevitable, as it is absolutely necessary. More and more clearly has it become evident that model yachtsmen should be brought into more direct and close association. As if to make more emphatic this case for union, there is presented to us the example of a growing tendency in various districts to formulate local measurement rules; the movement which is embodied here, and which grows in proportion every week, is destined to command the allegiance and to herald the convictions of every single district, if the local clubs are not federated to a parent body. Once that day dawns, and their voice becomes the voice of a powerful association, a new era will open for model yachting, and an acceleration would ensue in the pace of those measures which make for the maintenance and prosperity of the sport.

In the very foreground of the objects I would place the "Measurement of the European Racing Union." I am content to accept the fact that most, if not all, of my colleagues in the country are of opinion that the thing is practicable, and we should prosecute, as far as we can to its completion, the task of maturing effectively the momentous and urgent reforms for which model yachtsmen have so long been waiting. It is, indeed, high time that all model yachtsmen should lend to this question their most serious and attentive consideration.

That I am a convinced opponent of a club-made formula does not imply that I am indifferent to a national formula, as instituted by a federated Association. An Association can never be more than, or other than, the sum of its units. You cannot get out of a bag more things, or different things, than it contains. If the clubs are given up to self-complacence and indifference, the organised corporate society will be the embodiment of their character. It is only when the parts are sound that the whole is sane. Model yachting *will be a sport* when its devotees are alive to the necessity of a ceaseless forward movement. It goes without saying that upon questions of detailed policy, on which there may be legitimate and frank difference of opinion, it would, at present, be as useless as it would be unjust to make pronouncements. The questions that confront us to-day—the main and foremost questions—are such as to demand the guidance of a central authority and the dissemination of what model yachting really means. The main obstacle in the way of the reforms necessary for the carrying out of this policy is, I fear, too often the apathy of model yachtsmen themselves. No other sport which has any title to the honourable epithet of being national is fettered as is model yachting, by the non-existence of a central body practically based upon direct representation. It is futile to expect reform until this anomalous position is abolished. We are to-day almost in the same backward condition as we were twenty years ago. *Almost, not quite.* In the first place, model yachtsmen have been educated largely in their opinion upon the question, and the minds of many are to-day occupied with the problem of "organisation." In the second place, the attention of the clubs has been drawn, with ever-accumulating force, to the anomalous condition of our sport, and anticipate the time when the barriers to unity and cohesion and other reforms will be removed. Thirdly, in spite of obstruction and deadly hostility in some quarters, a good start has been made in the right direction, which merits the generous support and hearty co-operation of all lovers of the sport. The present movement in the path of unification here embodied contains in itself factors that augur well for its future success.

When we consider that model yachting in the view of some of the "powers that be" is seriously regarded and suggested as of having no higher value than a boyish game of marbles or only a harmless and amusing pastime for old men in their dotage, it forces us to the conclusion that something is amiss, that some principle needs emphasising, and that the truth must be borne home to these sceptics that model yachting is *really* an educative and recreative sport, is a science intimately involved with the progress and development of technical education, and that the designing, building, and sailing of model yachts are attributes worthy the highest efforts of men in all stages and stations of life. It is only the inauguration of an Association that will give *éclat* to the sport and raise it to its just position as the national pastime of an eminently maritime people; other sports, less worthy, have usurped this honour. We are marking time when we should be up and doing, and it is seriously a subject of reproach that model yachtsmen are devoting their leisure and skill to the production of that which the wildest fantasy can hardly, even apologetically, call a "model yacht." For no yachts were ever built like them, and I pray never may be.

If the sport is to be synonymous with "racing" or "sailing" machines, or even representative of discarded and obsolete rules, then it will be discreet to cease prating of the value (in the abstract or real) of model yachting, for I am convinced that while this remains the "ideal," there is ample justification, *not without reason*, for the disparaging, veiled, and insidious innuendoes so frequently emanating from those whom it would be more prudent and profitable to convince as friends and supporters. Let us put to the test our vaunted belief in the intrinsic virtues of model yachting by a more generous exhibition of enthusiasm unfeigned, which will make us sincerer exemplars of that *esprit de corps* which pre-eminently pertains to yachtsmen. I cannot think of any more solemn or humiliating rebuke to our enthusiasm than the spectacle of the divergent and chaotic condition of the sport, caused by the narrow predilections



TWO PHOTOGRAPHS OF THE BROOKE HYDROPLANE.

(*For description see page 353.*)

of some of our *confrères.* The differences between the advocates of a forward policy and the recalcitrant ones may be serious, but they would seem to admit of accommodation.

The prejudicial attachment to obsolete and parochial formulæ is doing the true sport of model yachting *no good,* is demoting its best interests, and the mischief wrought, with the process of time, will inevitably be accentuated.

Those who love the sport, and who have any honour for the prestige of the sport, should concentrate their efforts to bring about its recognition as a national pastime. This will only be secured and acknowledged when it becomes a potent factor of national utility—whether material or intellectual—and proceeds along the clear and well-defined lines of progress as exemplified and embodied in the adoption of a universal rule and supervised by an elective body—cohesion and co-ordination its corner-stones—based upon direct representation. This, surely, is ample incentive to support the new movement, which (I do not minimise or disguise the fact) must necessarily entail *some,* and perchance *much,* sacrifice. The differences—and, I may add, the prevailing diffidence—are vaguely attributed to want of understanding; but this is not worthy of serious regard, and it is assumed in the usual helpless way that the difficulty is beyond elucidation, that it is best to leave things as they are, and that we should abrogate or surrender our rights to due recognition.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

"A Featherweight Steamer."

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Mr. E. V. Pike's letter of destructive criticism in the September 24th issue is a painful exposition of the old saying that—" a man convinced against his will, remaineth unconvinced still." I made no mention of the working pressure in my article, and Mr. E. V. Pike assumes too much when he says my boiler would never support a pressure of 75 lbs. on the engine. I must confess that my boiler has puzzled even me, for in actual working it supports a higher pressure better than a low one, which is somewhat paradoxical, and can only be accounted for by assuming that the pressure in the spirit container rises at a greater rate than the steam, which is very reasonable, considering its higher evaporative capacity. This is, indeed, the case, for the flame increases with terrifying vehemence when the steam pressure rises above 60 lbs. per sq. in. I do not pretend that the arrangement, in its present form, is a safe machine, and I have not pursued my experiments with it for that reason. I do not think Mr. E. V. Pike could do better, though, than make a copy of this boiler—since he has denied me the pleasure of demonstrating mine to him—for the purpose of his own study, constructing it of stronger material, of course. He would probably learn something about the possibilities of 34 ins. of heating surface plus an efficient superheater.

I regret that Mr. E. V. Pike's witnesses were not present when the *Min* travelled at the rate of close on 7 miles an hour; but, fortunately for me, several other witnesses were. I quite agree with Mr. E. V. Pike that recorded speeds should be checked, wherever possible. Nothing would better please—yours truly,

"THE CARPENTER'S MATE."

The Society of Model Engineers.

London.

FUTURE MEETINGS.—Friday, October 9th: Locomotive Running Competition (continued from August meeting). Wednesday, October 28th: Lecture by Mr. Henry Greenly on his recent Model Commissions, to be illustrated by a large number of original slides, diagrams, and exhibits. Any non-professional reader of this journal who has constructed a model to any of Mr. Greenly's designs that have appeared in this journal is invited to apply to the Secretary for a card of admission to this meeting, which will be given free, provided the model is exhibited at the meeting. Full particulars of the Society and forms of application may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

Birmingham.

The above Society held a most successful meeting on Friday, 11th ult., at Mr. E. Fearn's house. There was an attendance of fifteen gentlemen, and everyone was most enthusiastic in regard to the formation of this Society. The meeting was adjourned until Thursday, October 15th. The next meeting will be held at 6, High Street, Bull Ring, Birmingham, belonging to the Birmingham Breakfast Tables, Ltd., at 7 p.m., when I hope all who are at all interested in the formation of this Society will be present, and I am sure they will receive a hearty reception. I may add that there have also been several letters sent to both Mr. Fearn and Mr. Phillips, besides several callers at Mr. Fearn's house, all of whom have promised to become members, so that we shall have a very good start, and I hope to see an " overflow " meeting.—C. H. HAWKESFORD, Hon. Secretary, 3, Boscombe Road, Greet Hill, Birmingham.

Ashton-under-Lyne.—The secretarial duties of this Society are, *pro tem.*, in the hands of Mr. ARNOLD BARNES, 47, Trafalgar Street, Ashton-under-Lyne. He is anxious to see as many members as possible at future meetings, for the recent ones have been poorly attended.

Liverpool and District Electrical Association.

SATURDAY, October 10th: Visit to Mersey Dock and Harbour Board new offices, Pier Head, Liverpool, 3 p.m. Tuesday, October 13th: Presidential Address, by H. E. O'Brien, Esq., at the Common Hall, Hackins Hey, Dale Street, Liverpool, 8 p.m.—S. FRITH, Hon. Secretary and Treasurer, 77, St. John's Road, Bootle.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, 26–29, *Poppin's Court, Fleet Street, London, E.C.*]

The following are selected from the Queries which have been replied to recently:—

[20,049] **Horizontal Engine and Boiler.** A. S. (Camberwell) writes: I have a horizontal steam engine—cylinder ¾-in. bore, 2-in. stroke; 7-in. flywheel. Could I drive a small dynamo (8-volt 2-amp.), which requires the speed of 3,000 r.p.m.? What size boiler, and how many tubes, should I want to drive engine?

Yes, you should get pretty good results with your engine. Use a vertical boiler about 6 ins. by 13½ ins., with fifteen to twenty ½-in. tubes. You can get the right speed for dynamo by suitable belt gearing.

[20,261] **Electric Heating.** S. McD. (Standerton, South Africa) writes: What would, in your opinion, be the best illustrated text- or pocket-book to obtain, giving simple information *re* electric heating of metals, and the safe and proper insulation of same; also the best kind and construction of motors or accumulators of dynamos for working same? Would Whittaker's "Electrical Engineer's Pocket Book" be of any service? Given a length of copper wire, say, 10 or 12 size B.W.G., with loose handles, say at distance of 4 ft. apart, how can same be heated between the handles to a temperature above that of red-hot iron? What is the best method of safe and simple insulation to handle the wire, either held loosely in the hand or stretched at a tension on a metal frame? Say the make of switchboard to control current. I am stranded here on the "illimitable" veldt, with no public library to consult, and cannot work out a valuable invention which treats of above, without some assistance from your valuable text-books or correspondence column.

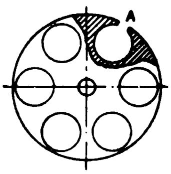
Whittaker's Pocket-book to which you refer is one of the best of these valuable little books of reference, but you would not get very much information on the particular subject in which you are interested. What literature there is on the subject deals only with electric heating in its ordinary commercial uses, for radiators, electric irons, etc. We fear you will find nothing published on working with metals made red-hot by the electric current. We advise you to get a good book on electrical engineering in general, such as Slingo & Brooker's "Electrical Engineering," published at 12s., or Sewell's "Elements of Electrical Engineering," published at 7s. 6d. Either of these will help you in dealing with electric current, wiring, dynamos, switchboards, accumulators, etc. For making insulating handles for holding hot wires we advise the use of porcelain. You could use tongs with porcelain insulated jaws. As for heating a length of copper wire—to a temperature above that of red-hot iron—this is impossible. For the wire would melt before it reached a temperature much greater than half that of red-hot iron. Iron wire is the best you can use for this purpose. A piece of iron wire, No. 12 S.W.G., will require a current of about 90 amps. to bring it to a red heat.

[20,236] **Horse-power, etc.** L. D. (Fishguard) asks: (1) How to find out the horse-power of an engine (locomotive). (2) How to find out the horse-power of a motor, 100 amps. 600 volts. (3) What is the difference between direct current and alternating current?

(1) See our issue of July 21st, 1904. (2) See issue of May 28th, 1908, for description of the brake method of testing the actual power of motor. You can tell approximately by calculation, if you know the electrical power the motor is taking, and also the efficiency of the motor. Thus, if a motor is taking 5 amps. at 50 volts, and its efficiency is 50 per cent. (*i.e.*, it gives out half the power supplied to it, the other half being wasted in heating, etc.) when as it is absorbing $5 \times 50 = 250$ watts, it will give out a power equal to $\frac{250}{2} = 125$ watts. A horse-power = 746 watts, so the power of the motor is $\frac{125}{746}$ h.-p.—about ⅙ h.-p. A motor taking the power you mention—100 amps. at 600 volts—is taking $\frac{100 \times 600}{746}$ h.-p. = a little over 80 h.-p. The efficiency of large motors is much greater than that of models. This would probably give about 76 h.-p. (3) A direct current is one which flows in one direction continuously. An alternating current is one which flows first in one direction and then in the opposite direction, these alternations taking place very rapidly, sometimes as often as 100 times in second.

[18,107] **Multipolar Dynamo Windings.** L. S. W. (Heaton) writes: I have a multipolar magnet casting as shown on the enclosed sketch. The tunnel has been bored out to 3¼ ins. diameter, 2½ ins. wide. I think the machine when finished will give about 120 watts. Will you please let me know the size and quantity of wire required for armature and field, in order that the E.M.F. may be 10 volts? Will the efficiency of the machine be increased by using tunnel type punchings having iron all round the wire instead of a slotted drum?

Wind armature with No. 22 D.C.C. copper wire; about ¼ lb. will be the weight. We advise you to use 16 slots, two coils to be wound into each, as diagram 49 of our handbook No. 10; there will thus be 16 coils. Commutator to have 16 sections and be cross connected as diagram for use with two brushes set at 90 degs., or without cross connections for use with four brushes, opposite brushes being connected together. Circular holes would increase the efficiency, but as the winding must then be threaded through, we advise you to cut a small slot ⅛ in. wide at the circumference so that the wire can be wound in as with open slots, as at A in your sketch: it will make practically no difference and save much trouble. Holes to be ⅜ in. diameter. Wind as many turns in as convenient. There should be at least eight per coil, that is, 16 per slot. Wind field-magnet with No. 21-gauge (or No. 20 if you cannot get this) s.c.c. copper wire: about 10 ozs. will probably



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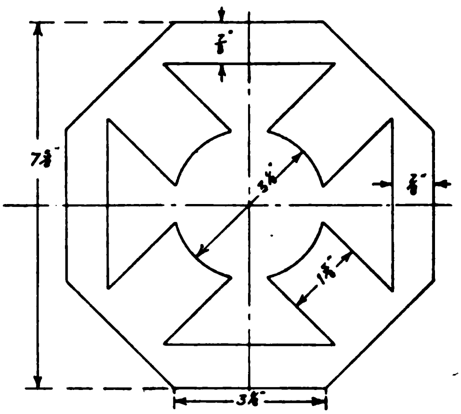


go on each pole. Connect as a shunt winding. Speed must be determined by trial, possibly 2,000 to 2,500 r.p.m.

[19,943] **Graduating Amperemeter and Volmeter.** G. S. T. (Dover) writes: (1) Can the dial of an amperemeter be graduated correctly from the main? If I put an amperemeter on the main wire which leads to a 25 c.-p. lamp (100 volts), would this give the correct reading for 1 amp.? If so, is it likely to be accurate or variable? Can the voltmeter be graduated from the main in any way? Have the lamps used on the main 100 volts a definite resistance per candle-power? If so, what would it be, say, for an 8 and 16 c.-p. lamp? (2) Could you give me a formula for frosting the surface of 9ct. gold previous to gilding, so as to give a nice dead finely frosted appearance to the surface?

(1) Yes, by means of resistances, if the voltage is steady and the resistance does not alter with temperature to an appreciable extent. If you use lamps you can only determine the current which they take if you know their particular efficiency. The best way would be to ask the maker to let you know exactly how much current a lamp of any particular candle-power will take at the given voltage. The resistance of an incandescent lamp is much less, if it has a carbon filament, when hot than when cold. You would have to enquire of the maker to find out the exact resistance unless you have an ammeter, when the resistance hot equals the voltage of the circuit divided by the amperes flowing through

the lamp. A voltmeter can be calibrated by passing a current of known value through a wire of uniform thickness and having a known resistance. The volts will then fall uniformly along the wire. If you connect the voltmeter at, say, points one-half the length of the wire apart it will indicate a voltage one-half that applied to the ends of the wire. For example, a wire 100 ins. in length and having a resistance of 100 ohms, will take a current of 1 amp. from a main having a pressure of 100 volts. There will be a drop of 1 volt each inch of the wire. A voltmeter connected to any places 10 ins. apart along the wire will, therefore, indicate 10 volts, and so on. A good kind of wire for these purposes is "Eureka" resistance wire made by the London Electric Wire Company, Playhouse Yard, Golden Lane, London, E.C. Read our Handbook No. 24 on "Small Electrical Measuring Instruments." (2) Consult a handbook on "Electro-plating." "The Practical Gold Worker," by Gee, may help you, which can be had from this office 3s. 3d. post free.

[20,198] **Shifted Steam Port Cores.** J. M. (Glasgow) writes: I should be much obliged if you would give me the sizes of ports and slide-valve for a 2-in. bore by 1¼-in. stroke vertical engine (1,500 revs. at 25 lbs. pressure). The ports were supposed to clean up to sketch (Fig. 1). Valve travel, ⅝ in.; eccentric, 123 degs. in advance of crank; diameter of steam pipe, ⅜ in.; diameter of exhaust pipe, ½ in. Unfortunately, the ports will not clean up to original working drawing (Fig. 1), and the nearest sizes they will clean up to are as Fig. 3.

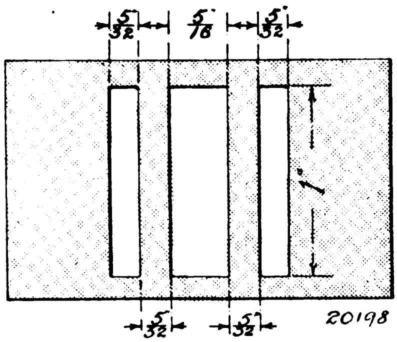


Fig. 1.—Ports according to Working Drawing.

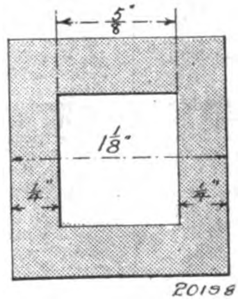


Fig. 2.—Valve according to Working Drawing.

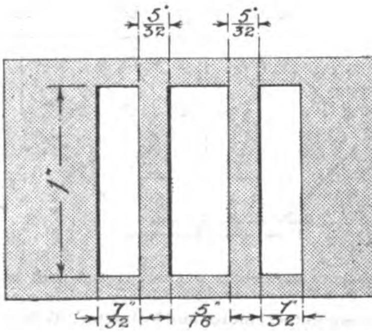


Fig. 3.—Ports as they will actually Finish.

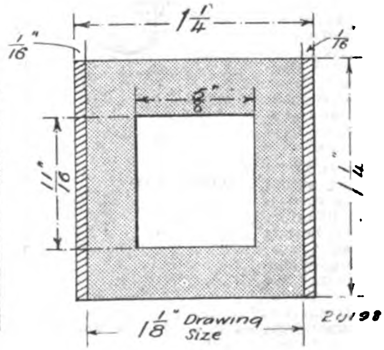


Fig. 4.—Valve altered to suit Ports (Fig. 3).

In reply to your query, this will not interfere with the speed of the engine, rather the reverse. There will, however, be slightly greater clearance losses, but these will not amount to anything appreciable. We would simply add the difference between the proposed and actual port widths (*i.e.*, 7-32nds − 5-32nds = 2-32nds = 1-16th in.) to the outside of the valve as shown in Fig. 4. No function of the steam distributing gear is then altered. The exhaust is simply so much freer, and the speed of the steam through the ports is decreased by the larger ports. We presume there is enough metal on the valve castings to allow of the above finished dimensions. If not, you will have to make a new pattern. The advance of the eccentric need not be interfered with.

[20,157] **Model Locomotive Construction.** E. P. K. (Derby) writes: (1) I intend making a ¾-in. scale model of a Midland locomotive. Would a boiler 12 ins. by 4 ins., with six ⅜-in. tubes fired by a 2½-in. or 3-in. Primus burner, supply enough steam for a pair of inside cylinders ⅞-in. bore by 1¼-in. stroke, or would two 2½-in. Primus burners be better? (2) What height should exhaust nozzle be in smokebox. Would 5-16ths in. below centre line of boiler be right? Also what diameter should hole in exhaust nozzle be? (3) Would a ¼-in. steam pipe be large enough? If not, what size should it be? (4) What pressure ought the boiler to be worked at. (5) Will the engine, if made well, pull 12 stone? It is a 4—4—0 type, No. 452. (6) What is the smallest curve the engine would turn on, with wheelbase as follows?—Distance between coupled wheel centres, 6⅞ ins. distance between first coupled wheel and last bogie wheel, 6 ins.; distance between bogie wheel centres, 4½ ins.

(1) You will find one 2½-in. diameter burner quite sufficient for all ordinary purposes. There is hardly room for two burners in the average ¾-in. scale model. (2) Rules for the position and size of the blast pipe orifice are given in the "Model Locomotive," by H. Greenly, pages 58, 59, 60, and 61. As you will see, the height of the nozzle in the smokebox depends upon the diameter of the chimney, and also on its length. There is, of course, a certain amount of latitude allowable in placing the blast pipe, but the diameter of the orifice cannot be varied very much. The proper diameter for a ⅞-in. bore cylinder is 5-32nds in. (3) ¼-in. copper tube may be used for all steam pipes. (4) A very high pressure is not desirable in any model locomotive. You will find a working pressure of 60 lbs. quite satisfactory. You are, of course, aware that the actual working pressure will be what the engine will maintain under working conditions, and this maintained pressure will depend upon the quality of the workmanship put into the model. You may, however, press the safety valve to 60 lbs., and arrange to stay the firebox for this pressure. (5) The engine should pull this load easily, *i.e.*, for short distances. No ¾-in. scale engine should be expected to haul such a load on a continuous track in a satisfactory manner. (6) Everything depends on the amount of lateral play allowed in the bogie, and for a full reply to this query we would refer you to the articles under heading "Chats on Model Locomotives" in the issues of The Model Engineer for October 3rd and 10th, 1907. These articles deal with the subject exhaustively.

[20,253] **Electrically Driven Model Boat.** W. S. (Kentish Town) writes: I am building a model boat, 3 ft. long, 6-in. beam, electrically driven. Would you kindly tell me the advantages of being geared, say, 3 to 1 over direct driven? Motor takes 3 amps. when running; will it take more current when driving propeller in water, or will the revolutions decrease and take less current?

Gearing wastes power besides adding to the bulk and weight of the machinery. So it is better to drive direct whenever possible. Have a motor of as slow a speed as you can get and use a propeller of not too great pitch. When the propeller is put into water more power will be required to drive it, so motor will run more slowly. With the decrease of speed there will be a decrease of back E.M.F., so that more current will flow through the motor.

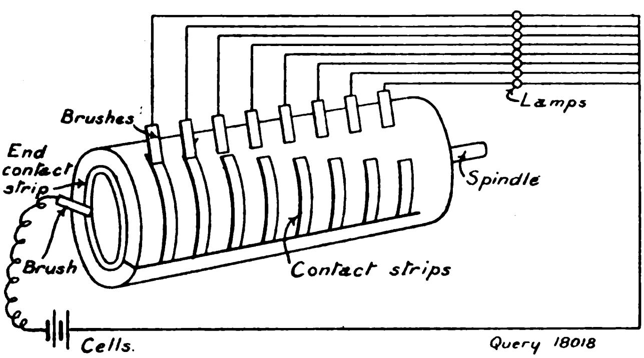
[20,241] **Daniell Cells.** L. S. D. (Wood Green) writes: (1) With reference to the description in The Model Engineer Handbook No. 5, page 49, as to construction of porous pot Daniell cell, I find a difficulty in making the solution of copper sulphate for the porous pot, and should be much obliged if you would kindly explain fully the operations necessary in preparing the solution. (2) I should also like to know if, in your opinion, chemicals obtained from Messrs. Boots, cash chemists, are suitable? (3) Also should the cells be connected in series or parallel for lighting a 4-volt lamp?

(1) A "saturated" solution of copper sulphate is one in which the water has taken up all the copper sulphate which it is capable of holding in solution. To make such a solution, all that is necessary is to pour the water upon the crystals and allow time for them to dissolve. It is best to put some crystals with the solution in the cell, so that when the solution becomes weakened by use it may be able to absorb more copper sulphate. (2) Yes. Always buy the purest chemicals. You will find them cheapest in the end. (3) If the resistance of your lamp is greater than 2 ohms, join in series; if less, join in parallel.

[18,018] **Automatic Switching Contrivance for Lighting and Extinguishing Lamps.** G. F. N. (Aldershot) writes: Many thanks for reply so prompt. I am sure I have found The

Model Engineer of quite valuable assistance this last three years. I go further by asking if you can tell me (or any reader of The Model Engineer) how I can make an apparatus to switch on twenty-one small electric lamps (as described in "Electric Lighting for Amateurs") one at a time until all have been lighted, and then to switch them off so that they all go out at once, and then to start off again on the first continuing to light up one lamp at a time? What would be the best power to work it by, clockwork or electro motor, and what resistance would be required? Would it want a resistance for each lamp? If you could give me a little idea of the above, I shall take it as a great favour.

A simple contrivance could be made on the following lines: On a vulcanite or wood (or other insulating material) cylinder mount a number of copper or brass strips as shown in sketch, all of these to be connected at their final extremity by another wire or strip, this in turn to be connected to a circular strip on the end of cylinder. The cylinder must be mounted so as it can revolve; the driving mechanism to be clockwork or other convenient type of motor, as you choose. George Adams would probably supply a suitable clockwork one. A number of small brushes corresponding to the number of lamps used must be arranged to engage these strips of various length, and each brush connected to one lamp as shown. The lamps will be run in parallel. If 4-volt ones are used, then the supply current will be 4 volts, and the cells must be of sufficient capacity to supply the total number of lamps in parallel. If each lamp takes, say, ½ amp., then a cell of 4 volts and capable of discharging at 10 amps. rate will be needed. You should therefore



Query 18018

have at least 1½ sq. ft. of positive plate surface in the cell, and two cells in series to give the 4 volts. The speed at which the cylinder is driven will determine the length of time the lamps are alight, and the length of the various strips, and the difference of these lengths one with another will give the period which will elapse between one lamp lighting up and the next. From these few hints you should be able to work out in detail a suitable contrivance for your special purpose.

[20,052] **Small Alternator Windings.** G. M. (Durham) writes: You kindly helped me some little time ago over a matter of some small alternator castings, but as I could not get exactly what I wanted, I prepared patterns, and have had castings made locally. I have now got these machined, and as this is intended for an experimental set, I would be greatly obliged if you will tell me what sizes and quantity of wire to use for fields and armature as an alternator, single-phase, 4 periods, to get best and probable results at 1,800 to 2,000 revs. As a direct-current dynamo with a slotted drum armature, how many slots do you advise? The alternator armature is built up from laminations, eight poles, each 2 3-16ths in. by ⅝ in. by ⅝ in., flange ¼ in. deep all round. The fields are 2 3-16ths ins. long, 1⅝ ins. deep, ⅝ in. thick, fitted with brass bobbins, ¼ in. flange all round. I have just completed a vertical 2 by 2 engine (steam) which I propose to couple direct; workmanship of top class throughout; pressure, say, 75 lbs. If I am not troubling too much, there is one other little point I should like to be clear on. Does the difference between a series and a shunt machine lie in the different thicknesses of the field windings, as well as the method of joining up? I have all your back numbers, and most of your books, but cannot quite satisfy myself as to whether the shunt machine has two sets of field windings like a compound.

Wind field-magnet with No. 23-gauge s.c.c. copper wire; about 6 ozs. will probably go on each pole. Get on as much as you can. Connect in shunt when using as continuous current machine. Continuous current armature to be slotted drum, 45 slots each, ⅛ in. wide by 5-16ths in. deep. Wind with No. 20-gauge d.s.c. copper wire, two coils per slot, each coil to have as many turns as you can get in the space. Wind from slot 1 to slot 6 as the winding span and connect as a two-circuit series (wave) winding, the step forward being eleven conductors—that is, you connect end No. 1 to end No. 12, then end No. 23 to end No. 34, and so on, until you reach end No. 1 again. The method is shown by diagram, page 303, of Model Engineer for March 26th, 1903. About ¾ lb. of wire should be ample. Commutator to have forty-five sections, one pair of brushes is sufficient, placed at a distance equal to the span from one pole centre to the next pole, but you can have eight brushes if you fancy, four positive and four negative, placed at equal distances apart, the positive brushes being all connected together and the negative ones likewise. Alternate current armature to be wound with No. 20 d.c.c. copper wire. Get on as much as you can. About ½ lb. total will be probably the quantity. The output may be about 30 volts and 5 amps., perhaps more. When working as an alternator you must excite the field-magnet from a battery or other source of continuous current. The alternating volts will, therefore, depend upon the exciting current. The field winding will stand 30 volts 1 amp. A series wound field winding must necessarily be of thicker gauge than a shunt winding, as the whole of the current generated by the armature passes through a series winding, but a shunt winding only receives a small fraction of the armature current. A compound machine has two field windings, a series or shunt machine one field winding only.

[20,057] **60-watt Avery Motor Windings.** D. B. (Horsham) writes: Kindly supply information respecting a 60-watt Avery-Lahmeyer motor, armature 8-cogged, 1⅝ ins. diameter, tunnel 2½ ins. long, slots 5-16ths in. wide by 5-16ths in. deep. Motor to be run off 220-volt mains. (1) If series wound, would starting rheostat be needed as in shunt wound motor, or switch and fuses be ample? (2) Would efficiency be impaired by winding for series machine; the motor is to be used for propelling a fan for blowing purposes? (3) Would welcome information respecting quantities for winding armature and fields for both series and shunt wound machines. (4) Kindly give method of fixing a piece of thin platinum foil to iron or brass. I have vainly tried the method I have always found successful on copper—viz., by heating both to white heat and striking with a hammer—but it is not successful when tried on iron, steel, or brass.

(1) Yes; a starting rheostat should be used for either series or shunt motors on 220-volt circuit. (2) The reason shunt motors are commonly used for fan purposes is because the latter are usually run at a constant load. A series wound or compound machine is more suitable when the load is variable, because they adjust themselves more readily to such conditions of work. You could, however, use a series motor just as well for a small fan. (3) You do not give particulars of the field-magnet dimensions. Presuming that it is of normal proportions and of cast iron, we advise you to wind the fields with about 8½ ozs. No. 38 d.c.c., S.W.G., and wind armature with about 3½ ozs. No. 36 d.c.c., 16,000 turns in all, shunt wound. For a series wound put about 2⅝ ozs., 2,000 turns in all, No. 38 d.c.c. on armature, and 10½ ozs. No. 34 on the fields. (4) You could fix platinum foil to iron by soldering in the ordinary way.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

* *Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

* Lathe Accessories.

We have received from Mr. Arthur Firth, Cleckheaton, Yorks, a sample set of castings and parts for building a 4-jaw dog chuck for an amateur's lathe. Both the jaws and the key are made in drop forged steel from special dies, and are particularly clean and sound pieces of work. The casting for the body of the chuck is also well-designed and cleanly produced. A full-sized drawing is furnished with each set, and also lengths of steel for the screws, so that the purchasers will have no difficulty in completing a satisfactory and always useful chuck. These chuck sets are supplied in four sizes, 5, 6, 7, and 8 ins. diameter. Mr. Firth has also sent us a sample of a neat little slotted angle-plate, 3 by 2 by 1½ ins., suitable for faceplate work in small lathes. These angle-plates are made in five sizes altogether. Full particulars of these and many other lathe and workshop appliances are given in Mr. Firth's list, which is sent post free for 6d., this sum being allowed off the first order of 5s. and upwards.

The Editor's Page.

IN the opening pages of this issue we give some particulars, by courtesy of Mr. Arthur S. Lane, of a novel type of horizontal engine. Trip valve gears are, of course, common enough on engines of large powers, but we do not remember having seen a valve gear of this kind in active operation on a model. The engine depicted in our photographs was shown running at the last conversazione of the Society of Model Engineers, and elicited high commendation from the visitors and members for the smoothness with which it worked. We are sure Mr. Lane's description of his model will be read with interest by many of our readers, and we shall look to seeing some other trip valve models forthcoming in the near future.

* * *

As the result of some further inquiries into the entries for the Branger Cup, which is being raced for to-day, in Paris, we have found that the crack English boats are precluded from competing, owing to the length being restricted to $1\frac{1}{2}$ metres. Mr. G. F. Young, the energetic Secretary of the Clapham Steam and Sailing Club, has done his best to get the rules relaxed so that a really representative international race might have been run, but without avail. M. Branger has, however, very kindly promised to see that next year the measurement limit shall be altered so as to enable the English boats to compete. We do not know if any of the smaller English boats are going over for this year's race, but in any case the old country must make sure of being well represented in 1909.

* * *

A movement is being set on foot for the construction of a lake on Blackheath. We do not quite know what the present facilities are in that district for the sailing of model boats of various kinds, but we believe the proposal in question is one which would be very generally approved. In order that the controlling authorities, the London County Council, may be justified in moving in the matter, it is essential that they should be satisfied that a *bonâ fide* demand for the improvement exists. Will those readers, therefore, who would be glad to see the work put in hand kindly communicate with the Rev. Charles E. Few, 41, Lee Park, Blackheath, S.E. Mr. Few, himself an enthusiastic model-maker, is taking up the proposal on behalf of the working men of the surrounding district.

* * *

Probably many of our readers in the South-West of London know that the model boat pond on Tooting Common has lately been very much improved. Not only has it been cleaned out, but a suitable depth of water is now available all round the banks, and it is forbidden to use the pond for dogs. Under these circumstances there is every prospect of an increased interest in model boat sailing being taken in this neighbourhood, and the formation of a local club has been proposed. Mr. J. R. Jack, 8, Rose Villas, Romberg Road, Upper Tooting, S.W., will be glad to hear from all model boat owners interested in this suggestion. Mr. Jack is the owner of a very fine model electric yacht, which is frequently to be seen on the pond in question, and has several more craft coming along.

Answers to Correspondents.

R. T. B. (Sunderland).—We do not see any objection to the title Sunderland Model Steamer Club. This is quite distinct from the Model Yacht Club title, and would not cause confusion. As an alternative you might use Sunderland Model Motor Boat Club. Shall be pleased to hear further when your models are completed.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

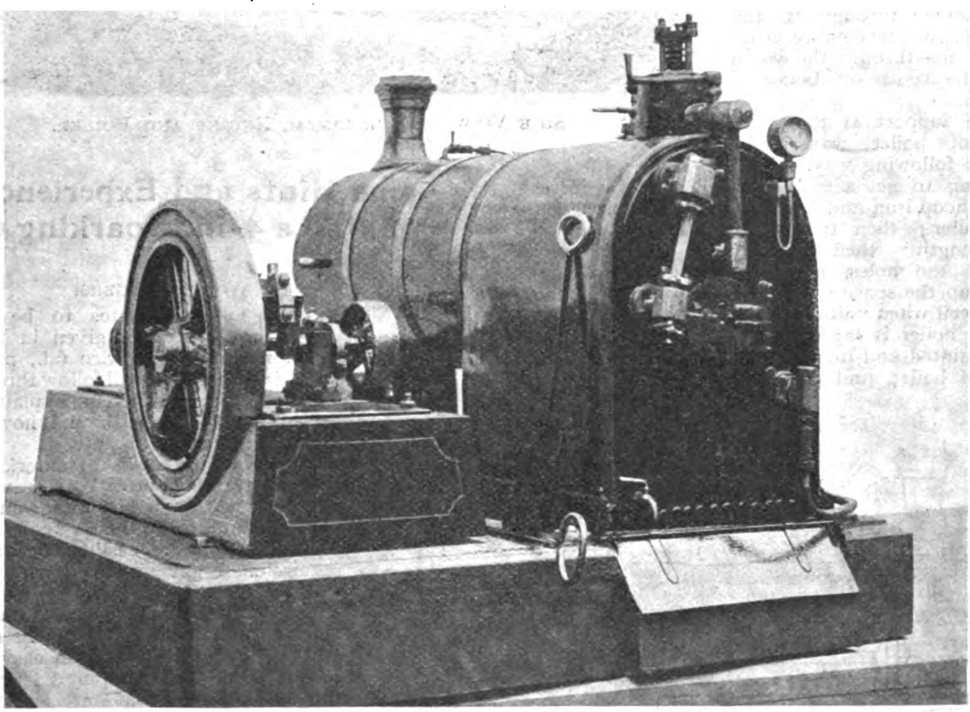
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 390. OCTOBER 15, 1908. PUBLISHED WEEKLY.

A Horizontal Engine and Boiler.

By F. G. FUTCHER.



GENERAL VIEW OF MR. FUTCHER'S HORIZONTAL ENGINE AND BOILER.

BEING a reader of THE MODEL ENGINEER, and seeing that a good many readers send photographs and descriptions of their work, I thought I would send mine, as it might be of interest to some. I may say to start with that I had no drawings, so I had to work things out as I went along, and, as readers will guess, I had to make some parts two or three times.

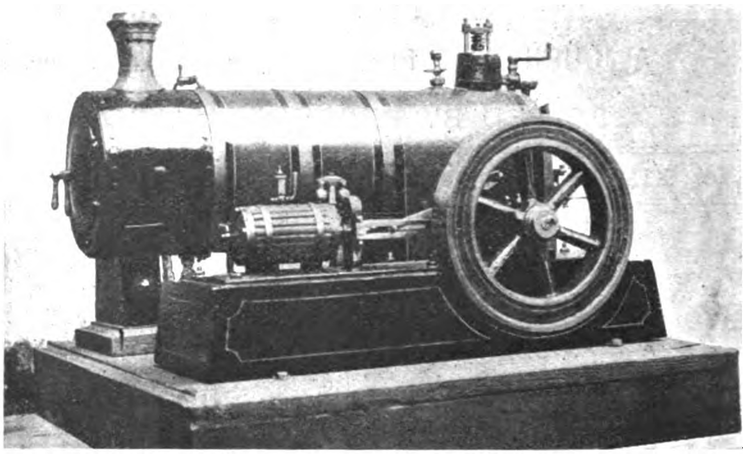
Anyhow, to begin with I fitted up the engine on an oak board, and got her to run fairly well. Then I bought a piece of ¼-in. steel plate 15½ ins. by 4 ins., and drilled the holes to correspond with those in the oak board, and filed out the crank-pit and six holes to bolt it down to the plinth, which is a teak block, with a hollow cut for the flywheel. Then I built up the engine on the steel plate, and, with a little adjusting, I found it went fairly easy.

I then lagged the cylinder, which is of gun-metal, with strips of a cigar-box, and bound it with brass strips. The governors I made and fitted to the valve spindle guide. The chief dimensions are: Cylinder, 2½-in. stroke, 1¼-in. bore; crankshaft, 7-16ths in. diameter; flywheel, 7½ ins. diameter, 1 in. on face. She runs at about 400 or 500 revolutions with 25 lbs. pressure steam, valve three-quarters cut-off, and superheated steam used.

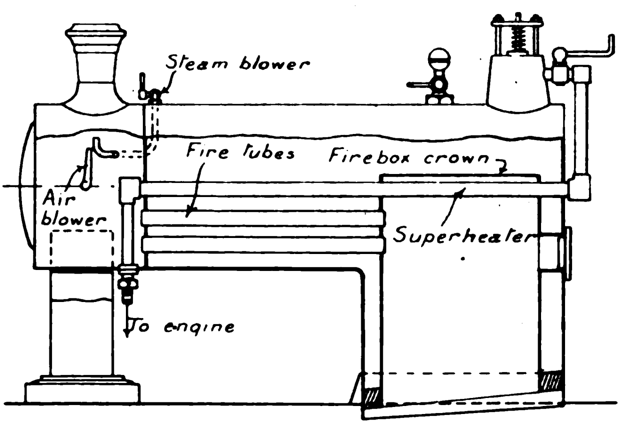
The boiler, which is perhaps a trifle small for the engine, is 22 ins. long and 6 ins. diameter copper tubing (⅛ in. thick), riveted, and the firebox is well stayed. It is fitted with two blowers — one for steam, and the other for air — water filler and whistle, combined safety valve (on top of dome), steam valve, water gauge, pressure gauge, drain cock, check valve, etc., as will be seen in the photograph. There are fourteen ⅜-in. tubes, one of which is used for a superheater and runs through the firebox to the smokebox, then down through to the engine, steam coming from the dome through the valve and the centre of boiler to engine.

The support at the front end of boiler was made in the following way. Not wanting to get a casting for it, I got a piece of stout hoop-iron and bent it to the required shape for boiler; then turned down the ends and got the length; then turned them again inwards; drilled the holes, and screwed them down and filled up the space with a block of wood. It looks very well when painted.

The boiler is lagged with tin and brass bands, and painted and lined. The pump is on the other side of boiler, and is made of small gas fittings, and is worked by eccentric and handle to turn by hand. I can use coal or gas-ring for firing, if the firebars be taken out for the gas-ring. I can raise steam from cold water in about half-an-hour, and it will steam well with exhaust up the funnel. The general appearance, etc., will be seen by the two photographs.



Side View of Horizontal Engine and Boiler.



Part Sectional Diagram of Boiler.

Some Hints and Experiences in Making a 4-in. Sparking Coil.

By Woodis Rogers.

I INTEND the following notes to be supplementary to the instructions given in "Induction Coils for Amateurs," price 6d., published by The Model Engineer. I will follow through the instructions given therein, explaining the difficulties I met with and how I surmounted them.

Firstly, taking the list of materials at the beginning of Chapter V, I advise you not to get the ebonite tube until you have wound the primary coil, because you can then more easily judge the size required. I got soft iron wire for the core ready straightened in lengths of about 20 ins. from W. A. C. Smith, 53, Dundas Street, Glasgow. This saves a great deal of time, as it is an easy matter to cut them to the required length, and the short pieces that are wasted are suitable for the core of a small medical coil. I also got circular filter papers of the required external diameter, from James Wooley and Co., Victoria Bridge, Manchester; they only require to have a hole cut in the centre: I made a cardboard template and cut through a wad of about twenty at a time with a sharp gouge. The baseboard and coil ends present no special difficulties. I made the baseboard a little larger, as my commutator occupies rather a lot of room. I found the primary wire rather stiff to wind neatly, as it springs back and uncoils as soon as the strain is removed. The best method is to tie the wire to a staple in a wall and then, starting from the opposite side of the room, wind the wire, gradually approaching the point where the wire is fixed. When the three layers are wound the loose end can be bound down temporarily until the ebonite tube is on. The tube I got was rather too tight for the coil, and

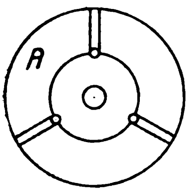


FIG. 1.

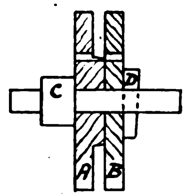


FIG. 2.

when I got it half on it stuck and would neither come off nor go on. I warmed the tube over a gas burner along its whole length, but for only half its diameter; this left one half stiff for pushing it on and one half soft enough to expand circumferentially.

I made a winder for the sections of the secondary coil, somewhat similar to the one described, but found that the sections would not set sufficiently to allow them to be removed without uncoiling. Perhaps this was because I used shellac varnish instead of paraffin wax.

Referring to Fig. 2, the centre piece which divides A from B is solid with A instead of being a separate disc; C is a wooden spindle with a slot in it. D is a small wooden wedge which fits in the slot, keeping the two discs together instead of the screwed spindle described in the book. I then added a contrivance for tieing the sections before removing them. In Fig. 1 three radial grooves are shown cut in the face of the discs A, deep enough to hold

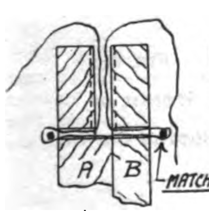


FIG. 3.

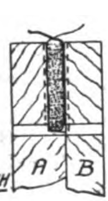


FIG. 4.

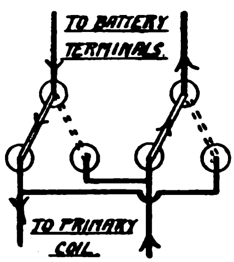


FIG. 5.

a single thread below the flush; they each terminate in a hole bored through the disc at the edge of the raised portion, cutting a groove in it vertical to the face of the disc. B is grooved in a similar manner, the holes coming exactly opposite the holes in A.

Fig. 3 shows the method of tieing. The thin line represents the thread before it is drawn tight; put half a wooden match through the loop which comes through the hole, then pull the loose ends until the matches are drawn up against the outside of the discs, secure the loose ends by a turn under the matches. This keeps the thread below the flush in the grooves and out of the way of the wire, which is then wound. Wind a few layers dry and then soak well with a small brush dipped in shellac varnish, then wind again until the wire shows dry, then put on more varnish, and so on, until the section is fully wound. Before taking out the wedge, pull out the matches and pull the loose ends tight and tie as shown in Fig. 4. Then take out the wedge D and remove the disc B, and carefully lift off the section with a flat knife. Then take the section on a flat sheet of copper over a spirit lamp or Bunsen; keep the section from sticking to the copper by letting it rest on three wire nails placed radially; give it another good coat of varnish on each side while drying; when cold, cut off the tieing threads and the section will not unwind. In building up the secondary I used a very small soldering bolt, the copper on it being about ¾ in. by ⅜ in.; it is handier than a large bolt, because it will easily keep warm in a Bunsen or spirit lamp flame. For connecting two sections together bare about ½ in. of the two ends which are to be joined, clean them well, and twist together; see that the

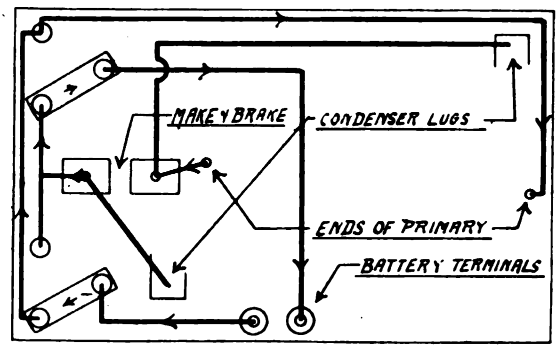


FIG. 6.

bolt is well tinned with a small blob of solder on it; give the joint a touch of soldering flux, and then a touch of the bolt will secure it. Have a small dish handy with little pieces of silk floating in melted wax in it; wrap one of these round the joint to insulate it before tucking it in place.

The condenser presented no special difficulties. I will only add a word of warning not to make it too soon and leave it lying about where the lugs can get torn off.

For a commutator I made two double-pole switches which can be moved together by means of an ebonite connecting link. Fig. 5 shows the principle on which they work and explains itself. The switches are quite simple—a strip of 3-32nds-in. brass 2½ ins. by ¾ in. I mounted them each on an ebonite quadrant cut from an old gramophone record; the contacts were cheese-headed brass screws which passed through the ebonite mount and the top of the baseboard for connections underneath.

Fig. 6 shows a general plan of the connections. If any of your readers find further difficulties, I shall be very glad to explain them to the best of my ability.

A SOLDER for aluminium, says the *Mechanical World*, consists of: Tin, 29 ozs.; zinc, 11 ozs.; aluminium, 1 oz.; 5 per cent. phosphor tin, 1 oz. Apply with soldering iron or blowpipe.

The "Model Engineer" Suction Gas Plant.

By W. A. Tookey.

(*Concluded from page* 343.)

THE general arrangement of the gas cooler is shown in Fig. 8*a*, on page 365. The casting (8*b*) is that forming the junction piece for gas-pipe connection to the scrubber and lute pot. The piece of 2-in. tube shown in 8*c* connects the top (8*d*) and bottom (8*b*) castings of the cooler and the piece of 3½-in. tube forms a water jacket round the smaller barrel. The top casting (8*d*) forms the junction piece for the tube connecting with the generator and waste pipe, a third screwed aperture receiving a plug, which may be withdrawn to facilitate cleaning operations. The details of the coke scrubber are shown in Fig. 9*a*. The water sprinkler is clearly drawn out in No. 9*b*, and the cover plate for the base of the scrubber in 9*c*. The latter cover permits the clearing away of accumulated dust, etc., from the scrubber when necessary.

Drawing No. 10 shows the firebrick lining. This can be procured by special order from any of the well-known Stourbridge firms, or built up in fireclay and gradually dried and as gradually heated when first gas is to be made.

Expansion Box.—In most industrial installations an expansion box is a necessity, and especially for engines of large size, where a comparatively large volume of gas is drawn from the apparatus in a short interval of time; but in a small plant, such as now described, where a very small cylinder is taking gas several times a second, there is not so much need and there is no doubt that successful working will be obtained without this appliance.

However, expansion boxes have another use in that they provide a receptacle within which condensed water, carried over as moisture from the scrubber, is collected and, by means of a drain cock, removed at intervals. It will, therefore, be seen that it will be advisable to provide some fitting which will enable the gas and water to be separated in a similar manner. This can be very readily arranged for by providing an ordinary screwed tee for about 2½-in. pipe, fitted with nipples and reducing sockets to accommodate the proper size connections, as shown on the drawings. The tee must be placed at the lowest portion of the system of pipes so that it can receive all moisture. It must be placed so that the inlet is at top, outlet at the side, and drain pipe at the bottom.

Starting Fan.—The drawings give no details of a starting fan suitable for this producer, as this would probably be preferred to be bought out if found to be necessary. It is quite possible, however, that if a sufficiently long vent pipe is arranged for, the fire will draw up with natural draught. If any of our readers would prefer to make their

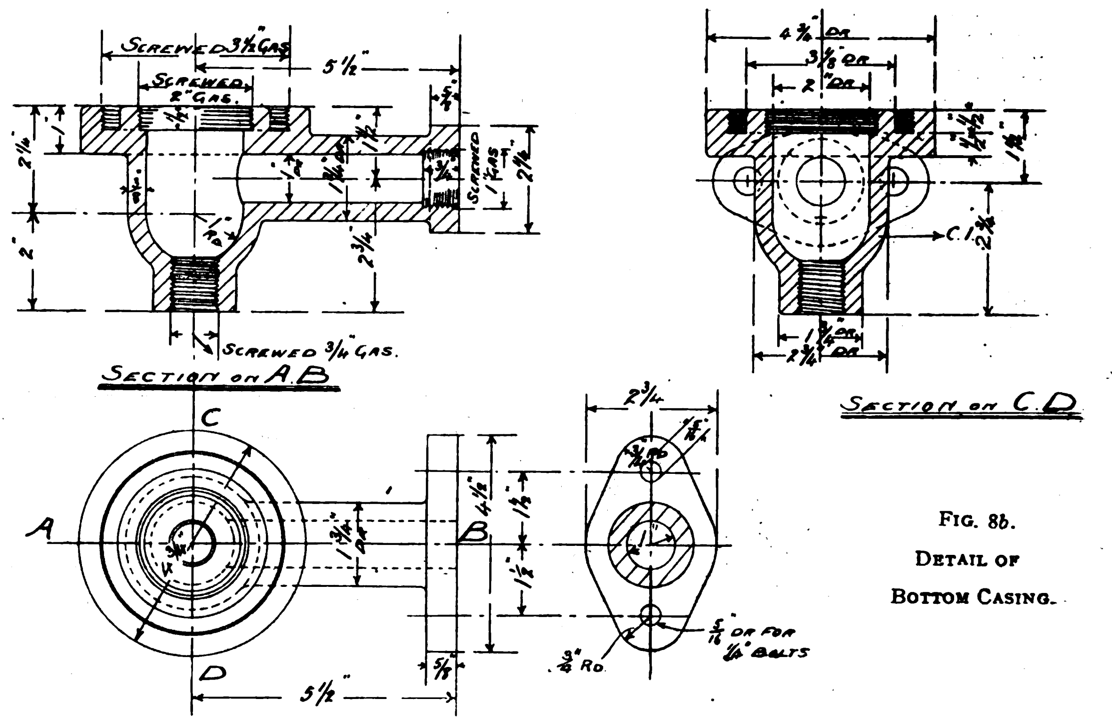


Fig. 8*b*. Detail of Bottom Casing.

own starting fans we will supplement the present drawings at some future time.

Fuel.—The most suitable fuel for The Model Engineer suction gas producer will be found to be anthracite of the size known as peas. With this fuel very little attention is necessary, the fire retaining its compactness for a long time and very little ash requiring to be removed.

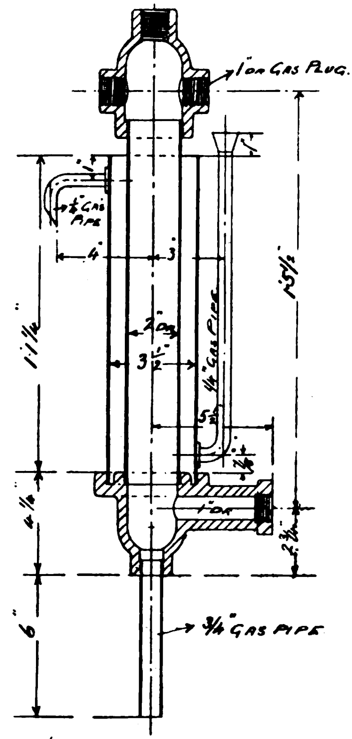


Fig. 8a.—Gas Cooler.

If anthracite be unobtainable, gasworks coke can be brought into service, but this should be broken up small and be free from dust. Coke does not contain so great a percentage of carbon in its composition as does anthracite, and, therefore, not

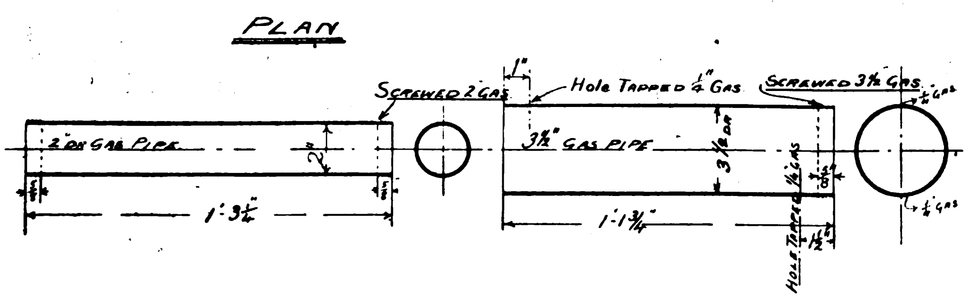


Fig. 8c.

only is a larger quantity required for a given power—a matter of no importance in a small plant—but it also means that a greater quantity of incombustible matter interferes with a long continued operation of the apparatus. Not only so, but there is a larger amount of tarry matters given off with the gas which, condensing in the scrubber and connecting pipes, in time affects the working of the engine by causing undue restriction and sticky valves. It is usual to pass the producer gas made from tarry coke through a tray of sawdust contained in an iron vessel.

A sawdust purifier can readily be made by using two lengths of different size gas tubing, say 3 ins. and 2 ins., arranged so that the gas enters a connection on the 3-in. and leaves by a connection on

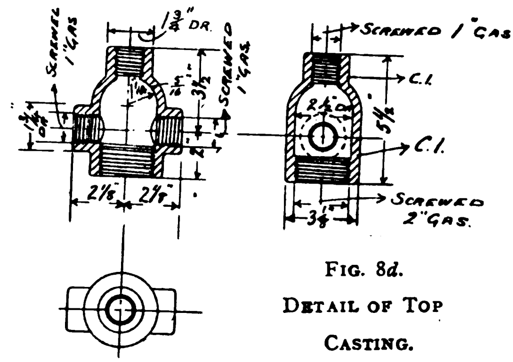


Fig. 8d.

Detail of Top Casting.

the 2-in. pipe, the latter being perforated and filled with coarse sawdust.

A simpler method, obtaining the same result, would be by fitting flanges to either end of a 12-in. piece of 3-in. tubing to suit similar flanges being placed conveniently upon the gas pipe between the scrubber and expansion box. In the inside of this length of 3-in. pipe a cylinder made from wire gauze may be used to enclose the coarse sawdust, and a new charge could be put very readily in this when it is desired to renew it.

Starting.—Having erected the producer and connected it to the engine, it will be necessary to provide two test cocks—one on the vent pipe between the generator and the scrubber, and the second near to the engine inlet valve. That in the first position will enable the quantity of gas to be determined during the process of blowing up, while that by the engine will enable the quality of the gas at the engine to be noted before setting the engine to work, thus making sure that all air and bad gas from previous working has been expelled before the fresh start is made.

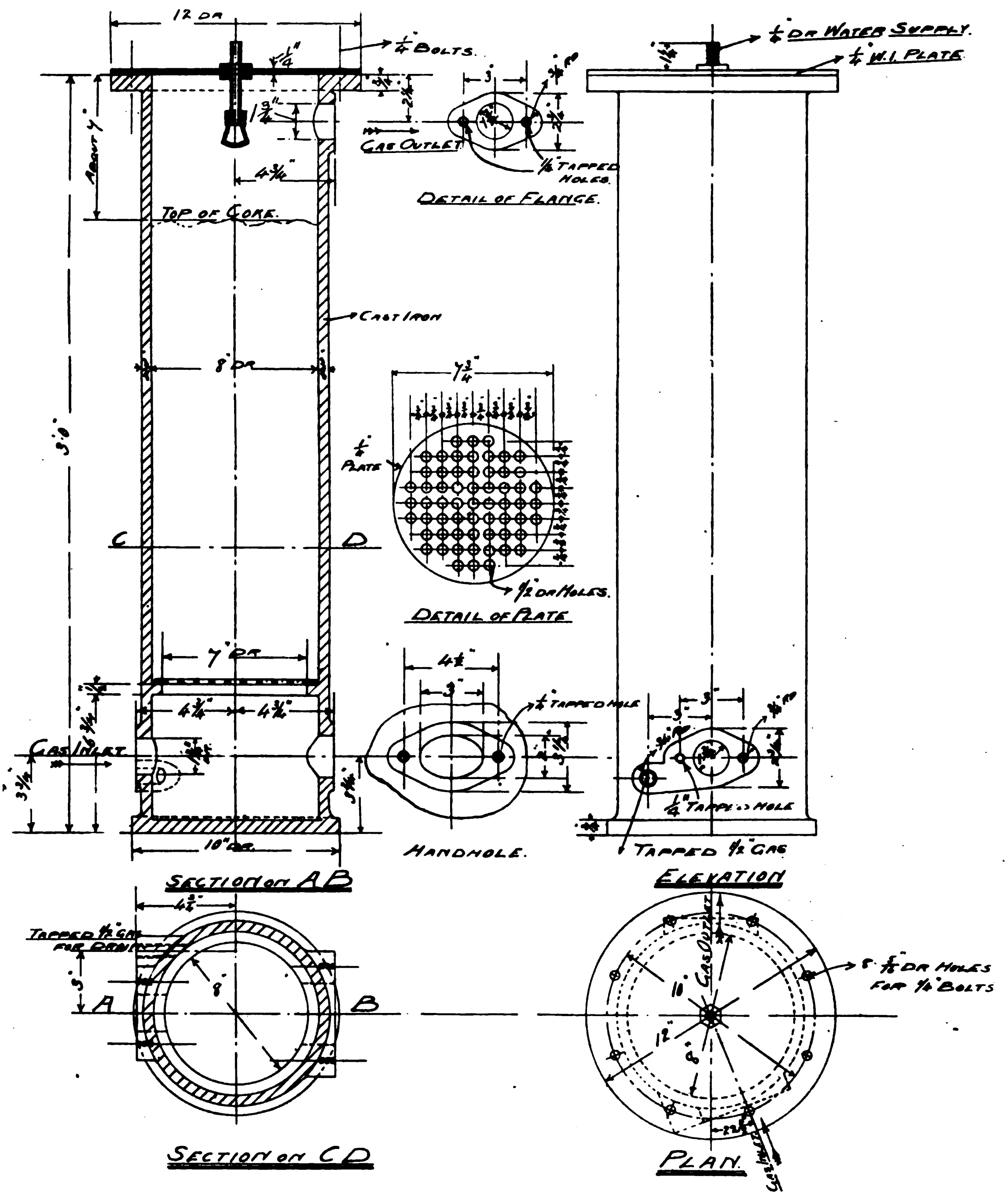


FIG. 9a.—DETAILS OF THE COKE SCRUBBER.

To start the fire within the generator, it is necessary at the very first time of lighting to let the fireclay or firebrick lining gradually warm up, and for this purpose a wood fire is best. About two hours should be allotted to this warming up.

When ready to first make gas, the generator should be properly cleaned and the base of the fire should be formed of fairly large pieces of coal to act as supports between the floor of the producer and the firebrick lining. An oily rag should be

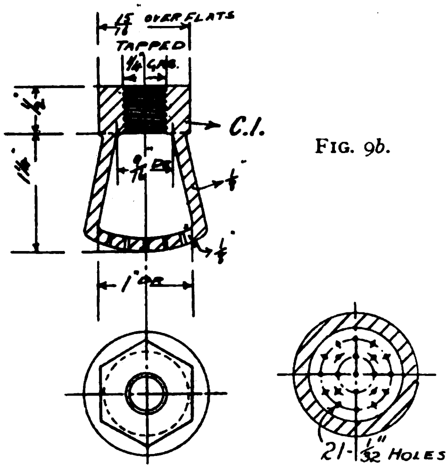


FIG. 9*b*.

placed above this and then alternate layers of small chunks of wood and anthracite or coke. A match then applied through the firedoor will set the whole alight, the top valves at the feeding hopper should be closed, and the cock on the vent

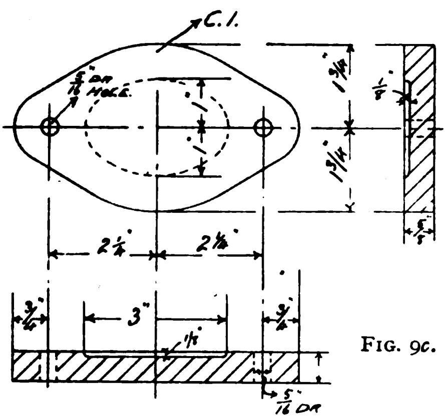


FIG. 9*c*.

pipe wide open. The fire will then begin to draw up and little by little the coals should be fed in until the sliding plate will pass no more.

Care should be taken while starting up that the base of the fire be not disturbed, otherwise the superimposing fuel will fall down and quite possibly as a result a fresh fire will have to be made.

When trusting to natural draught it will be necessary to keep the bottom door of the generator open so as to allow as much air to pass through the fire as possible. After several minutes the gas should light at the vent pipe or at the test cock connected therewith, and if found to burn steadily without going out, the gas should then be passed through to the engine by partially closing the vent pipe near the generator and opening that near the engine. Of course, it will be necessary to draw the water away from the seal to the bottom of the scrubber for this to be done. Within a short time gas will burn at the test cock near the engine and the engine can immediately be set to work, the vent pipes immediately afterwards being closed, the firedoor being placed on the generator and the amount of air regulated by the "louvres" provided.

With a starting fan a quicker start can usually be effected, while there would then be no necessity to make arrangements for destroying the water seal at the base of the scrubber. Another advantage in favour of the fan is that, when first starting up, any leaky joints or connections can be easily distinguished by the smoke arising therefrom, whereas in the natural draught air would be leaking in connections similar to the condition of affairs when the engine is at work.

Irregularities During Work.—If it be found that the gas produced is of very poor quality, the most likely thing to account for this would be that air is leaking in at some portion of the generator, either halfway up the fuel bed, thus restricting the areas of the different zones, as already referred to, or at the top of the fire where the oxygen thus admitted would burn off a portion of the carbon monoxide, leaving an excessive amount of carbon dioxide. Care must, therefore, be taken that all joints shall be so made that no air can pass through the fire except from the ashpit.

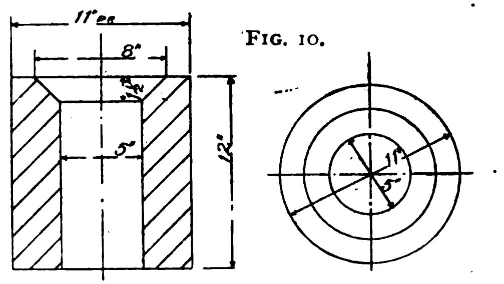


FIG. 10.

As has been before mentioned, it is necessary for continuous operation that excessive working temperatures are to be prevented, and means are provided in THE MODEL ENGINEER suction gas producer for the introduction of water vapour in the manner before described.

Irregularities may also be set up by an excessive quantity of steam being allowed to come into contact with the fuel and the proper working temperatures may not be maintained. Only sufficient steam should be admitted that will prevent the formation of clinker, and care must be taken to avoid any excess which will so reduce the temperature of the fire as to render good gas impossible to manufacture.

Other irregularities that will occur from time to time will be due to the clogging of pipes, of coke in the scrubber and sawdust in the purifiers. In case of difficulty, therefore, all these matters should be looked to.

The whole apparatus is so simple that there should be no difficulty in obtaining good results.

Locomotive Notes.

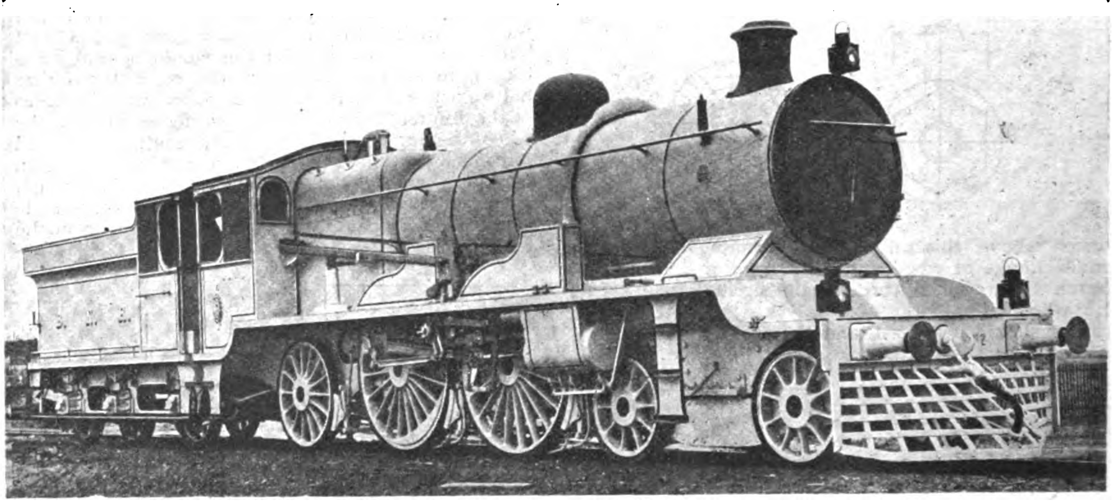
By Chas. S. Lake, A.M.I.Mech.E.

Is the Four-cylinder Balanced Locomotive a Modern Idea?

If the above question were put to the average student of locomotive practice, the answer in nearly every case would probably be in the affirmative, and, so far as the application in actual working of the type of locomotive which has four cylinders convertible in use from compound to simple working and *vice versa*, and operated on the "balanced" principle is concerned, the answer would be substantially a correct one.

Yet, if we take the trouble to carry out a little research for the purpose of ascertaining how far in the past the four-cylinder balanced motion has been anticipated, it comes as a surprise to find that upwards of thirty years ago drawings were prepared for a locomotive of this description, and Letters Patent were granted in respect of an invention which to all intents and purposes fulfilled, apart from the matter of dimensions, all the characteristics of what is, in these later days, considered to represent one of the most up-to-date developments of locomotive design and construction.

The inventor—a Mr. Reid, of London—purposed to secure economy in steam and fuel consumption by employing compound working on level and evenly graded sections of the railway, and then, when steep inclines had to be negotiated, to have at command a means of changing the large cylinder capacity provided instantaneously from compound to simple working. The drawings accompanying the patent specification show the idea adapted to a six-wheeled locomotive of the 2—4—0 type, the four cylinders being placed in line across the front of the engine in advance of the leading wheels. They all drive the first pair of coupled wheels, the inside or high-pressure cylinders actuating the crank axle and the outside low-pressure cylinders driving on the wheels themselves in the usual direct manner. The two cranks on each side of the engine were set 180 degs. apart and at 90 degs. to the cranks on the opposite side, precisely in accordance with the crank arrangement in modern four-cylinder engines; and another feature wherein this early proposition closely resembled some of the latest locomotive creations of the present day was that the four slide-valves were to be worked by means of only two valve gears, these gears being of the link-motion pattern, driven by eccentrics on the crank axle, "the valves being worked by two suitably arranged rocking bars having connection between the outside and inside valve spindles and the reversing link die blocks." The single valve motion and reversing gear was thus arranged to work a double set of valves.



Experimental de Glehn System Compound Locomotive: Bengal-Nagpur Railway.

What were termed "exhaust division valves" were employed for changing the system of working from compound to simple. These valves were placed inside the "exhaust steam pipe," and were to be operated from the footplate in accordance with the requirements of the time being. One of the valves caused the high-pressure cylinder to exhaust into the low-pressure one for compound working, while the other valve was for the purpose of allowing the high-pressure exhaust steam to pass directly into the atmosphere, while the boiler steam was admitted to the low-pressure cylinders, when the engine would, of course, work on the single-expansion principle in all four cylinders.

The inventor foresaw that a larger boiler capacity than was usual in those days would be required, for he proposed the boiler should have a diameter of not less than 5 ft. to provide ample steam-producing powers when the engine was working simple. The high-pressure cylinders were to be 14 ins. diameter by 17 ins. stroke, and the low-pressure ones 18 ins. diameter by 22-in. stroke.

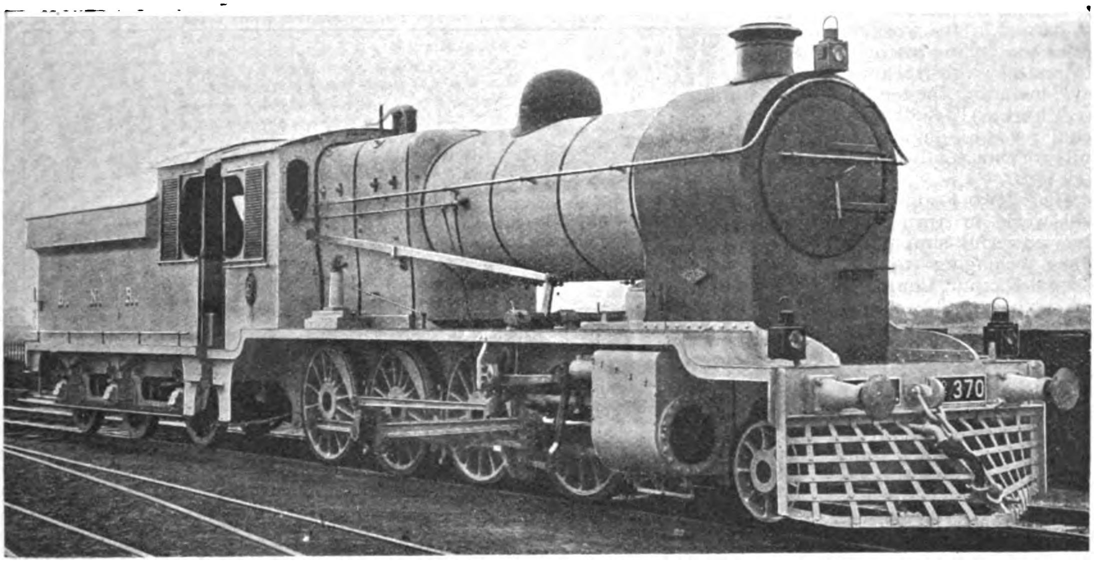
Four-cylinder locomotives were tried in actual practice at perhaps an even earlier period than that which marked the projection of this one, but there does not appear to have been any examples that embodied the features which in the present year of grace are identified with the latest ideas in locomotive design.

Why There was No Need for Alarm.

The correspondence columns of the daily newspapers often provide amusing reading on a variety of subjects, and, when railway matters are touched upon, it is almost certain that something at least of an entertaining character, will be found among the contributions. Recently, in the course of a letter which appeared in one of the morning journals, a pen-picture of an alarming character—to those of limited knowledge on the subject—was drawn by the correspondent who wrote it, of the case of an express train approaching a terminal station at a high rate of speed, when, "to the intense alarm of the driver and fireman," it was discovered that the regulator had in some way or other got fixed, with steam full open, and the combined efforts of both men were insufficient to close it. "Imagine," goes on the correspondent, "the terrible feelings experienced by the occupants of the footplate, who knew that unless they succeeded in getting the steam shut off, nothing could avert a fearful catastrophe; but, providentially, and at the last available moment almost, they managed, by a superhuman effort, to release the jambed regulator, and with much difficulty brought the train to rest by applying the brakes with full force"

Now it is these kind of things finding publication in the open columns of the lay Press which create among a large section of the travelling public a feeling of great uneasiness which is wholly and entirely uncalled for. In the very unlikely event of a locomotive regulator getting fixed in the open position so that it could not be closed, or through the dislocation or breakage of the rod or other part, all that the driver would have to do would be to place his reversing gear in mid-position and apply the brakes in the ordinary way, when he would be able to bring the engine to a state of rest with almost, if not quite, the same precision and certainty as though the regulator was closed.

Years ago the writer had some experience with an old L. & N.W.R. engine, on which the regulator on two occasions could not be closed, but the driver worked the train over a considerable distance both times and stopped in due course at several stations, steam being "on" the whole time, and the movement of the engine controlled entirely by means of the reversing lever and the brakes



20-in. by 26-in. Consolidation Type Mineral Engine: Bengal-Nagpur Railway.

New Types of Locomotives on the Bengal-Nagpur Railway.

Reference was made in the last issue of these "Notes" to the new heavy types of passenger and goods locomotives placed in service on the Bengal-Nagpur Railway, and, through the courtesy of Mr. A. R. Bailey, chief mechanical engineer of that line, it is now possible to illustrate and briefly describe each type. As previously mentioned, the passenger engines are de Glehn compounds of the "Atlantic" persuasion, while the goods engines are "Consolidation" type simples. The de Glehn locomotives—two in number—were sent out from the works of the North British Locomotive Company, Ltd., Glasgow, and are at present serving a probationary period of twelve months, at the expiration of which they will—if results obtained with them, after taking everything into consideration, justify the course—be taken over by the railway company, while in the opposite and most unlikely event it will be open to the Bengal-Nagpur people to return them from whence they came. The illustration shows that the design conforms in all its important respects to the usual features which characterise this type of engine, and the dimensions also closely follow those adopted on European railways under the same conditions. Therefore, except for the fact that they are built for the 5-ft. 6-in. instead of the 4-ft. 8½-in. gauge, there is not much which can be said about them that has not already been said many times over about similar locomotives nearer home. The outside high-pressure cylinders are 13 ins. diameter by 26-in. stroke, and the inside low-pressure ones 21½ ins. by 26 ins. The coupled wheels have a diameter on tread of 6 ft. 6 ins., and are spaced at 7 ft. between centres. The total engine wheelbase is 28 ft. The boiler has the Belpaire type of firebox and an extended smokebox. Its total heating surface is 1,899 sq. ft., and the grate area 31·7 sq. ft., while a working boiler pressure of 220 lbs. is carried. In working order the engine (without its tender) weighs 72¼ tons, and, including the tender, 112½ tons. The adhesion load, with engine in full working condition, is 34½ tons.

These two locomotives will work in turn with the powerful simple engines belonging to the Bengal-Nagpur Company on the mail express through services between Calcutta and Bombay and Calcutta and Madras. Already it is said that the enginemen speak in high terms of the two locomotives, which are giving very uniform results with the principal trains, showing a general capacity for good all-round work.

The "Consolidation" locomotives are employed in working mineral trains of upwards of 1,000 tons weight, and these also are among the most successful engines employed on the railway. They have outside cylinders and Walschaerts' valve gear, and the design throughout is a modern one in all respects. It is principally in accordance with the recommendations of the Engineering Standards Locomotive Committee, and the engines belong to what is known as the "H class Modified" series. The cylinders are 20 ins. by 26 ins., coupled wheels 4 ft. 8 ins. diameter, rigid wheelbase 16 ft., and total engine wheelbase 24 ft. 2 ins.

The boiler contains, with firebox, a total heating surface of 1,605 sq. ft.; the grate area is 32 sq. ft., and working pressure 180 lbs. In working order the engine weighs 62 tons 13½ cwts., with 56 tons adhesion.

THE experiment to eliminate noise on the elevated railway lines in Chicago by the use of a gravel road-bed on the structure has recently been abandoned, the gravel not only failing to reduce the noise, but also holding water, with injurious results to the structure.—*Mechanical World.*

Balancing Railway Carriage Wheels.

BY the courtesy of the *Great Western Railway Magazine* we are permitted to reproduce this illustrated article, which, we think, will prove of considerable interest to our readers:—

It is doubtless well known that the wheel now generally employed for passenger stock in the United Kingdom is the "Mansell" wood centre wheel. The features of this type of wheel are so familiar that a detailed description of the construction, even if space permitted, would be superfluous. Suffice it, therefore, to say that the body of the wheel consists of sixteen wood segments 3½ ins. thick, firmly fastened to the cast steel boss by bolts passing through a steel washer or disc. The steel tyre is shrunk on to the wood body and then secured by means of two retaining rings having "lips," or projections, engaging with suitable recesses in the tyre. The axle is forced into the cast steel boss at a pressure of 60 tons, which suffices to secure it without the use of a "key."

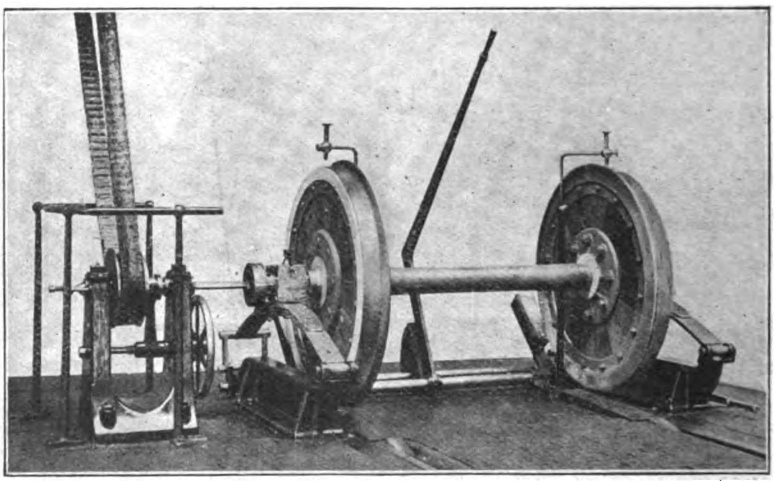


FIG. 1.—TESTING RAILWAY CARRIAGE WHEELS FOR BALANCE AT SWINDON WORKS.

The advantages of this class of wheel are: (1) Freedom from noise; (2) the fanning up of dust is not nearly so much as in the case of spoked wheels; (3) the method of tyre fastening prevents the tyre leaving the wheel in case of fracture; and (4) adaptability to balancing, ensuring smooth running.

Except by those acquainted more or less closely with railway workshop practice, it is perhaps not known that every pair of carriage wheels is most carefully tested for balance before being put into service, and the object of these notes is to explain the method of testing and balancing followed in the Company's carriage works at Swindon. The reason for balancing wheels of passenger stock will be readily understood when it is realised that a 3-ft. 6-in. wheel revolving at 60 miles per hour makes 480 r.p.m. If accurate balancing were not ensured, the tendency of the unbalanced wheel would be to revolve about its centre of gravity instead of the centre of the axle, producing an uneven movement of the carriage and a hammering action on the rail, due to the upward centrifugal force at each revolution ; and it would be found that wheels which are much out of balance would very soon develop flat places on the tread of the tyres.

The method of balancing is as follows : For the body of the wheel, well-seasoned teak blocks are selected. Each block is divided into two segments—care, by the way, being taken that the grain of the wood runs from the centre to the circumference. These segments are then weighed and marked with their respective weights, and with a view to initially ensure balance, such as are of equal or practically equal weight are placed in circular form on a flat-surfaced table. After this the segments are secured temporarily within a steel ring, known as a "jig," provided with a number of setscrews, which are tightened up so that

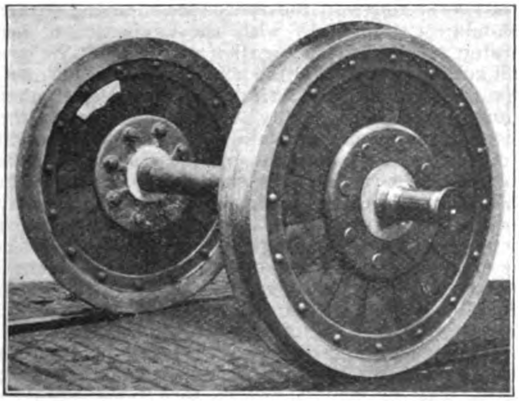


FIG. 2.—SHOWING BALANCE WEIGHT SECURED TO WHEEL.

the segments are forced firmly and evenly together at the joints. The segments and jig are then submitted to a specially designed multiple boring machine, which bores simultaneously the holes for the bolts securing the boss and those for the retaining ring, after which the hole for the cast steel boss is bored by another machine. Then follow the operations of tyring, etc.

The wheels, now being complete with the axle, are placed on the balancing machine, as shown by Fig. 1. This machine consists of two bearings on leaf springs, the wheels being revolved by a belt-driven pulley. The wheels are started and the speed gradually increased, and any inequality in the balancing produces oscillation. This causes the unbalanced portion or portions to be indicated on the tyre by chalk, which is held on the marker by hand. The markers, it will be observed, are fixed immediately over the top of the tyre.

As a rule, the wheels are revolved for three minutes. They are then slowed down by means of the brake, the tyre is carefully examined, and the operator, from experience and observation is able to arrive—from the appearance of the chalk marks—at a remarkably close judgment of the amount of balance required. This balance is given by the affixing of small cast-iron plates varying in weight. The operator has by him a stock of these plates, which are numbered to indicate their weight, *e.g.*, No. 1 = $1\frac{1}{2}$ lbs., and so on. A plate of the required weight is then affixed by means of screws to the inside of the wood centre near the tyre fastening (opposite, of course, the unbalanced portion), as indicated by Fig. 2. The wheels are revolved for further observation and the balancing operation repeated, if necessary. It may be remarked, however, that so accurately is the building up of the wheels performed that the test reveals that 90 per cent. do not require to be balanced.

Originality in Model Making.*

By PERCIVAL MARSHALL, A.I.Mech.E.

WHEN I had the pleasure of assisting in judging the models in the Competition at the last Conversazione of this Society, I ventured to make a few remarks on the subject of originality in model making, which aroused some discussion amongst those who were present. I suggested that at the public displays of the leading body of model engineering enthusiasts work of an original character might reasonably be expected, and it was due to the reputation which the Society had obtained that the members should show models which, in addition to high-class workmanship, should possess some merit in point of novelty ; they should, in fact, mix brains with their handicraft. In view of this pronouncement on my part, one or two members of the Society found it rather difficult to understand why the first prize should have gone to a model which was an exact copy of an existing engine, and which therefore apparently possessed no originality whatever—I refer to Mr. Chadwick Taylor's beautiful model of the old locomotive "Agenoria." Other members said that if original work were required in competitions, it would be useless to model existing types of engines, but that competitors would require to be inventors as well as model makers. The knowledge of the existence of these feelings amongst the members led me to offer to read a short paper on the subject of originality in model work, and the Committee have very kindly permitted me to occupy your time this evening with a fuller exposition of my views. Let me say at once, however, that what I have to say is in no way intended as a reflection on the work shown at the last or any previous Society Competition. I believe it has been my privilege to take some part in the judging at all the important competitions organised by the Society since its foundation ten years ago; and I should like to express my high appreciation of the really admirable mechanical craftsmanship by which these Competitions have been marked. But, as most of you know, I have the welfare of the Society very deeply at heart, and I hope my remarks of this evening will be regarded, not as a criticism, but as an effort to encourage the members to better things. I want the public to feel that when they go to a Conversazione, or even to an ordinary meeting of the Society of Model Engineers, they will see work the like of which cannot

* Abstract of paper read before the Society of Model Engineers, Friday, September 17th, 1908.

be seen elsewhere; that they will not only see the perfection of model workmanship, but that they will see new models and new ideas.

Now, what is originality, as applied to model making? Perhaps I can best answer this by saying what it is not. It is not fitting up a purchased set of castings. Purchased sets of castings are excellent things in their way and fill the requirements of thousands of model makers exceedingly well. Neither is it very original to make a model from a design for a model published in the pages of THE MODEL ENGINEER or in any other journal. These published designs are very useful and helpful to many makers of models, but it should be the aim of the members of this Society, or at least of the more skilled amongst the members, to strike out a line for themselves.

There is, of course, a kind of originality which is not to be encouraged—I mean, that which is merely original and nothing else. For instance, the man who built an engine with a square flywheel might be regarded as original, but he could not be congratulated on the form of his originality. To be good, originality must be on well-directed lines, and must not be mere eccentricity. It need not reach the degree of being an invention, and it is quite possible for members to be original in their work without becoming inventors.

Perhaps the most famous example on record of original thought in connection with model making is the invention of the separate condenser by James Watt, which was the outcome of his experiments with a model Newcomen engine he was repairing for the Glasgow College.

Another noteworthy example of the conception of an engineering invention is to be found in the biography of James Nasmyth, to whom the idea of the steam-hammer is due. Although this invention did not spring from a model, as in the case of the invention of the separate condenser, its history is of much interest, as showing how such things are thought out, particularly in the use by Nasmyth of a "Scheme Book," on the pages of which he thought out, with pen and pencil, his various mechanical ideas. How many model engineers possess a "Scheme Book," or even an ordinary note or sketch book, in which they can note new ideas for use in their model-making work? The scheming out of new designs on paper is fascinating work, even if the design should never get so far as the constructive stage; and who knows but what the thought bestowed on such paper schemes may lead one on to some new and profitable track? (See "Centenary of Nasmyth," in *The Engineer*, Sept. 17.)

An interesting practical illustration of the result of mixing brains with craftsmanship may be found in the history of the Model Steamer Speed Competition organised through THE MODEL ENGINEER. In 1902, when this competition first started, a speed of 5 miles per hour was sufficient to establish a record for the whole of the United Kingdom, and was considered a fine performance. In 1903 the record rose to 7·13 miles per hour, in 1906 to 8·76 miles per hour, while last year it again jumped to 9·58 miles per hour for model steamers. If the winning steamboats of 1902 were placed beside the winning steamboats of 1907, it would probably be difficult to detect much difference at first glance; certainly, there would not be sufficient divergence of design apparent to account for a doubling of the speed. A closer examination, however, would reveal certain points about the later boats which the earlier vessels lacked. There would be an improvement in the lines of the hull, a departure in the design of the boiler, perhaps a better type of blowlamp, and something different about the engine and the propeller. The model speed boat builders of the country have, in fact, been doing original work. They have been studying the proper methods of designing hulls for speed, and they have been developing the most suitable types of engines and boilers for the work. There is still room for brainwork in this branch of model engineering, and those who have a fancy for marine modelling will find ample scope for their powers of originality and for their experimental capacity. Special attention may be directed to the subject of model propellers as an excellent opening for experimental research. Recently, the construction of hydroplanes has commenced to attract serious attention, not only in regard to models, but for larger craft also, and it is quite within the bounds of possibility that the model engineers of this country may show the world the way the speed boats of the future should be built. As with the navigation of the water, so with the navigation of the air. We are all keenly interested in the achievements of Farman, Santos Dumont, the Wright Brothers, and other famous aeronauts. Why should not some of the honour of the experimental work, which has still to be done to ensure the conquest of the air, be placed to the credit of model engineers. Sir Hiram Maxim did not disdain the use of models in many of his earlier researches, and he obtained much valuable information by their aid. The field of aeronautics is one which offers endless experimental scope, and the class of mechanical work for which it calls is well within the range of every model engineering workshop.

Those model engineers who are possessed of scientific tastes in addition to a nice mechanical skill, may be commended to turn their attention to what I may term optical engineering. The optical lantern, with its many fascinating and entertaining uses—for there is much to be done with a good lantern beyond the mere projection of ordinary lantern slides—is worthy of consideration. The telescope and the microscope, which bring one into such close touch with the hidden mysteries of Nature, form excellent subjects for the exercise of constructive talent, and have the advantage of being of most interesting and instructive service when completed. It is rather curious to note how attractive the telescope seems to be for men of a highly developed mechanical turn of mind. Both James Nasmyth and Sir Henry Bessemer, when they had weathered the stormy times of a busy life, devoted their leisure moments to the work of constructing astronomical telescopes, and Mr. W. H. Maw, recently President of the Institution of Mechanical Engineers, is similarly noted for this tendency. I should like to quote the following observations of James Nasmyth on his hobby of telescope construction:—

"I may mention that I know of no mechanical pursuit in connection with science that offers such an opportunity for practising the technical arts as that of constructing, from first to last, a complete Newtonian or Gregorian reflecting telescope. Such an enterprise brings before the amateur a succession of the most interesting and instructive mechanical arts, and obliges the experimenter to exercise the faculty of delicate manipulation. If I were asked what course of practice was the best to instil a true taste for refined mechanical work, I should say—set to and make for yourself, from first to last, a reflecting telescope with a metallic speculum. Buy nothing but the raw material, and work your way to the possession of a telescope by means of your own individual labour and skill. If you do your work with the care, intelligence, and patience that is necessary, you will find a glorious reward in the enhanced enjoyment of a night with the heavens—all the result of your own ingenuity and handiwork. It will prove a source of abundant pleasure and of infinite enjoyment for the rest of your life."

Apart from the specific branches of applied science already mentioned, there are endless pieces of physical and scientific apparatus which are within the capacity of the smallest workshop and the most moderate degree of mechanical skill. The perusal of any book on experimental science will, in fact, open up a new world of work for the model maker who is seeking a change from his stationary engines, his locomotives, and his dynamos. While, to start with, he may construct such apparatus on the usual and well-defined lines, the very fact that he is engaged in experimental work will tend to set him thinking for himself, and will probably result in his ultimately making something really original and new.

Referring again to the "Agenoria," I venture to describe this as one of the most original models yet exhibited before the Society, in spite of the fact that it is an exact copy of an existing engine. Paradoxical as this may seem, it is perfectly true in the light of the meaning I wish to attach to the word "original." In the first place, it has struck out a new line in model making amongst the members. Mr. Taylor made up his mind to do something different from his other work, different from other people's work. No one else had thought of modelling such an engine—in fact, he was original. Secondly, the model was a new creation in so far as the drawings, the patterns, and the information necessary for its construction were concerned. There were no sets of parts or castings to be obtained ready made; there were even no published drawings sufficient for Mr. Taylor to build from. He had to make numerous visits to South Kensington to inspect the original engine, to take photographs and measurements, and to fathom the mystery of working of this ancient railway relic. Lastly, he had to exercise considerable thought and ingenuity in reproducing the out-of-date methods of boiler construction and of making the various working details. In fact, he had to mix a considerable quantity of brains with his careful handicraft, and thereby produced an original piece of work in the best sense of the term. For those who have a fancy for old types of engines, there are plenty of others which are fit subjects for the exercise of their skill, not only as regards locomotives, but in other branches of engineering as well. Old pumping engines and early marine engines, in particular, are well worth attention for this purpose. Let me utter one little word of warning, however, at this stage. Do not choose a prototype for your model merely because it is old. Select something which has a special interest either by reason of its being an epoch-marking invention; of its having some interesting gear or mechanism; or of its having some record or historical association of special note. Your model will then have this special point of interest also, which will render it all the more attractive to yourself and to your friends. Another model of an original character is well known to you all—I mean Messrs. Arkell's model petrol motor boat, the *Moraima*. It is true that this is merely a boat with a petrol motor placed inside, but it has two claims to originality. It is, I believe, the first model petrol boat to be built, and the petrol motor was specially designed and constructed by Messrs. Arkell for the purpose. Some of you may remember the steam engines previously used by Messrs. Arkell in their boat. These, again, were marked by several original features—notably, in the valve gear adopted. Going back still farther in the history of the Society, the water-tube locomotive boiler of Mr. Smithies, and the four-cylinder compound locomotive built by Mr. J. C. Crebbin, may be quoted as distinctly interesting pieces of original work. Several other instances of originality will doubtless occur to the minds of those who have followed the work of various members, but those I have mentioned are sufficient to serve as typical illustrations of what, I think, should be encouraged. The fact that a good deal of creditable original work has already been accomplished within the ranks of the Society shows that I am not advocating any impracticable ideas, and it should also show that what can be done by some, can at least be attempted by others. I am quite confident that if the opinions of those who had done original work were taken, they would unanimously agree that the personal pleasure in carrying out their own ideas far exceeded the pleasure derived from merely following the well-beaten track.

Let me now make a few other suggestions of subjects for modelling, which are of much interest, but which have received scant attention from followers of the craft—large steam pumps of the Worthington and other types, direct-driven centrifugal pumps, hydraulic lifts and hoists, hydraulic engines—(one member, Mr. Clayton, has already shown a very pretty little model of a hydraulic capstan)—large vertical mill and electric light engines, tandem compound horizontal engines, overhead travelling cranes operated either mechanically or electrically, machine tools, industrial machinery of various kinds for printing, textile, and other trades, small refrigerating plants, railway turntables, mountain railways, artillery, flying machines, turbines, and, indeed, in almost every branch of mechanical work one can see scope for something fresh in the way of model making. To make a choice, one must naturally consult one's own particular tastes and interests; but on whatever subject the choice finally falls, it should not be difficult to obtain the information necessary to construct an instructive and interesting model. Such work as this, of course, involves much preliminary labour in the way of preparing drawings and making patterns, but the thought of breaking fresh ground and of making a model different from that of any one else's should prove its own reward.

While I have made the foregoing suggestions for new departures in model making, I do not wish to entirely advocate the copying of some existing type of engine or machine. This is undoubtedly a very interesting branch of model making, and one which possesses much educational value.

There are, however, many members of the Society who are capable of originating their own designs, and although, in principle, such designs may involve no points of novelty, they are much to be commended. There is considerable pleasure to be derived from scheming out the proportions and the working details of a boiler, engine, or dynamo, or other piece of work, and to see the creation of one's own brain growing in one's hands is perhaps the most satisfactory of all kinds of mechanical work. To those who are blessed with powers of invention the interest is increased. The anxiety to know whether the engine or machine will work, or whether it will not, the plotting and planning to obtain this particular power or that particular movement is most absorbing, and the delight at the final result, when satisfactory, must be felt to be appreciated. The fact that many model engineers are practical inventors is to be seen from the numerous original cute little kinks and devices they employ in their workshop practice, and the exhibition of original tools and workshop notions is one which might well be encouraged, not only at competition times, but at ordinary meetings as well.

I am afraid my observations on the subject of originality have been somewhat in the nature of a sermon, but if they cause the members of this Society to think whether they cannot tackle something new, they will not have been made in vain. I do not think I am depriving Mr. Taylor of any of the credit for originality when I mention that he was first led to think of building the "Agenoria" after reading a suggestion of mine in THE MODEL ENGINEER, to the effect that attention might be given to the modelling of historical examples of engineering. The knowledge that that suggestion has borne such good fruit has encouraged me in pleading the cause of originality to-night, and I look forward with every hope to the Society of Model Engineers being regarded, not only as the centre of good workmanship, but as the recognised centre of the new ideas in the world of model engineering.

A DUTY has been imposed on winding engines for mining purposes driven by hydraulic power. (including bedplates, foundation bolts and friction clutches, when imported with the engines), on importation into the Dominion of New Zealand, at the following rates :—If the manufacture of some parts of the British Dominions, 5 per cent. *ad valorem*; otherwise, 15 per cent. *ad valorem*. Similar duties on winding engines driven by other kinds of power exist already.

THE ten new torpedo-boat destroyers are to be equipped for burning oil only. They will be fitted with turbine machinery, with the expectation that the speed will be at least 30 knots, which, it is believed, may be easily attained and maintained with the new characteristics of fuel and motive power. It has not yet been ascertained what will be the radius of a destroyer so equipped, but it has been estimated by the experts that a boat using oil instead of coal will have a radius of one and a half times that of a similar ship burning coal. It has been practically decided that no burner which requires steam or compressed air for atomisation of the fuel will be permitted. The oil will be put under pressure and heated before passing through the burners.—*The Engineer.*

How It Is Done.

[For insertion under this heading, the Editor invites readers to submit practical articles describing actual workshop practice. Accepted contributions will be paid for on publication, if desired, according to merit.]

Turning a Locomotive Crank-Axle.

By GEO. V. HUTCHINSON.

(*Continued from page* 351.)

THE turning may now be started and the big-end journals roughed out to within about ⅛ in. of the correct diameter, and the stuff removed from between the webs till they are faced to within ⅛ in. of the lines already marked on the crank.

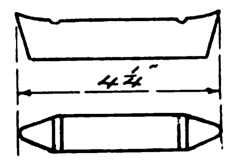


FIG. 12.—DOUBLE-ENDED TOOL, USED WHEN FINISHING BETWEEN THE CRANK WEBS.

It will be remembered that we finished one end of each crank whilst the axle was turning on its own centres. Now, we are able to finish the crank being dealt with to the correct over-all length. By reference to drawing Fig. 2, it will be seen that the length of the crank web is 2 ft. 0¼ in., therefore a gauge will be required, such as shown in Fig. 13. By applying this gauge to the crank it will be seen when it is turned to the correct length.

The job is then taken from between the lathe centres and turned round end for end and again placed in the lathe; but this time it is on the other pair of centres of the cast-iron centres, so that the other big-end journal is in the correct position for turning. It is roughed out as was done with the first and the webs faced inside and cut to the correct over-all length. It will be understood that

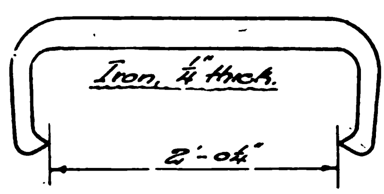


FIG. 13.—GAUGE FOR THE OVER-ALL LENGTH OF CRANK.

the job must be turned round before being put on the centres for the second big-end journal; because if it were simply shifted on to those centres without being turned round, the whole faceplate would have to be shifted—that is, the balance-weight and drivers would have to be placed in different positions. But by turning the job round, the face-place remains the same.

The whole axle is now roughed out, and before going any further it should be checked over with the divided lath which was used when marking the over-all length.

In Fig. 12 is shown a double-ended tool 4¼ ins.

over the cutting edges. It will be seen that the distance between the crank webs is 4¼ ins., and it is for the purpose of finishing the crank webs to this figure that this double-ended tool is used. It is placed in a tool-holder, as shown in Fig. 14, and the tool-holder placed in the tool-rest. The tool-rest is then adjusted till the tool is in the correct position to finish between the webs to the lines. To finish this crank the tool-holder with its double-ended tool is removed and ordinary lathe tools used in their turn. A light cut is taken over the big-end journal to bring it within about 1-32nd in. of the finished diameter; and the finishing cut is taken in the ordinary way with spring tools and water, as it is generally called, but in reality it is some patent preparation for the purpose of water-cutting. There will, of course, be three tools necessary both for roughing and water-cutting—one straight tool, one right-hand side tool, and one left-hand side tool. The right- and left-hand spring tools for finishing the fillets are ground to the same radius as the fillets. A gauge for the fillets, made of thin sheet iron, is also used when finishing them. The tools used for turning a crank axle are generally made from about 1½-in. square section steel.

In order to finish the crank which was roughed out first, the job is again turned round and put on the pair of centres it was on first, which correspond to the big-end journal about to be finished. The double-ended tool and tool-holder are again put into the tool-rest. This time the tool-rest is set by means of the "B" gauge. It will be noticed that there is a set in this gauge; it is to allow the end of the gauge to butt up against the finished face of the web. When in position the double-ended tool is brought up to touch the other end, as shown in Fig. 14. The finishing cut may now be taken with the double-ended tool as before, and, if the marking of the cranks was properly done, the webs will finish up to the lines. It is evident that since the "B" gauge is of a length equal to the distance between the centres of the cranks, these centres will be correct when the double-ended tool is set as described. To finish this crank the same process is gone through as when finishing the other.

The cast-iron centres are next removed, and the axle set up on its own centres. The outsides of the crank webs are finished to size with the side tools. No further notice need be taken of the marks on the cranks, but, as the insides are finished, the correct thickness of the webs may be got by applying a rule or by setting a calipers to the required size. The axle-box journals are finished in the same way as the big-end journals were finished. A gauge should be made of thin sheet iron the correct length of the journal, having the corners rounded to the correct radii of the fillets; this will enable the journals to be turned an accurate length. The journal near the loose headstock must be done first, and then the corresponding wheel-seat. Before finishing the other journal and wheel-seat a circle must be made on the end of the axle with a sharp-pointed tool. This circle need not be of any particular diameter. The axle must now be turned round in order to finish the other journal and wheel-seat and to make a similar circle on the other end of the axle. These circles are used when the wheels are being put on the axle. They ensure that the crank-pins in the wheel bosses will be directly opposite their big-end journals—that is, if the engine is a coupled one. The middle portion of the axle is also finished with a smooth cut to the correct size, but need not be water-cut. It is, however, advisable to water-cut the fillets on this middle portion, as they are parts where the axle might fail, and any roughness in the way of tool marks might increase the possibility of a crack starting. The black parts shown in Fig. 15 are the parts of the axle which must be water-cut. When finishing the wheel-seats the turner must make them such that the wheels will go on easily for about 1 in. and be forced on the whole way by a pressure of about 100 tons. This can only be done by experience. It might, however, be roughly stated that a taper is allowed of about

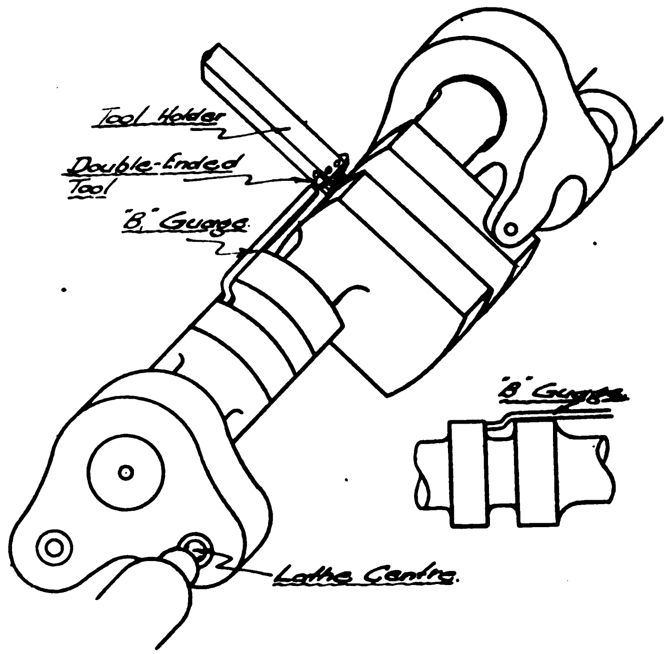


Fig. 14.—Method of Setting the Double-ended Tool off the Finished Crank with the "B" Gauge.

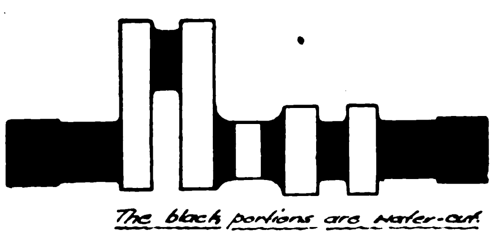


Fig. 15.—Crank-axle showing the Portions which are Water-cut.

3-64ths in. in 8 ins., the smallest diameter being a close fit for the wheel.

The lathe work is now complete, and all that is required to finish the axle is the machining of the web faces, which could not be done in the lathe. This may be done on a planing or milling machine.

Although not in accordance with the title of this article, the writer may be permitted to give a brief description of the method employed to set up the axle on the table of a machine for the purpose of planing. Two cast-iron standards are used to support the axle at the axle-box journals; they are of sufficient height to keep either crank, when in a vertical downward position, clear of the table. These supports are V-shaped at the top where they take the axle, and are exactly the same height, so that when the axle is in position on them it will be parallel to the table of the machine. A thin piece of copper should be placed between the journals and the supports so as to prevent the former from being injured. The crank to be planed must be horizontal, and since the big-end journal and axle-box journal are the same diameter they must be the same height off the table.

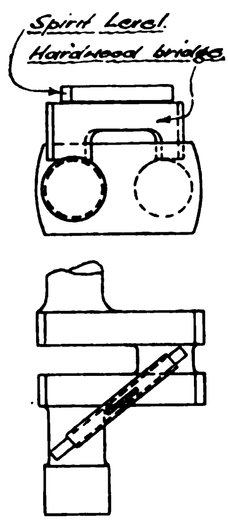


Fig. 16.—Method of Levelling Crank on the Planing Machine.

To get these heights the same, a surface-gauge may be used in the ordinary way; that is, set it off the table to the top of the axle-box journal and then pack up the big-end journal to it. This method, however, may not be found convenient, as the axle takes up a considerable amount of room on the machine, and, besides, a large surface gauge may not be to hand. But the crank can be levelled just as well by adopting the means shown in Fig. 16. A bridge made of well-seasoned hardwood about 1 in. thick is placed on the journals as shown, and on it is placed the spirit level; the end of the crank at the big-end journal can then be packed up till the crank is level. When the axle is secured in this position the planing may be begun. The faces of the webs being planed are, in this case, 2⅜ ins. off the journal; therefore the stuff must be removed till this figure is arrived at. A parallel piece placed across the webs directly over the big-end journal will show the amount the faces are off the journal if an inside calipers is placed between so as to touch the parallel piece and the journal. In this way the webs can be planed down the correct amount. The other faces are, in turn, brought into position for planing similar to the first, and when all the faces are finished the axle may have the key-ways cut in the wheel-seats. They are directly opposite the big-end journals. The key-ways may be cut whilst the axle is still on the planing machine. When the rough edges are taken off the webs with a file the axle is finished and ready for the wheels.

In conclusion, it may be remarked that a crank-axle turned as above is a good job, and although some slight difference of method exists in different shops, the general principle as described is the same in most cases. Some crank lathes are made so as to dispense with the cast-iron centres when turning the big-end journals, but by the use of the cast-iron centres a higher degree of accuracy is attainable.

A Bazaar Shocking Coil.

By R. Tharratt.

The following is a description of a bazaar shocking coil which I have made during my spare time. Being all fitted within a box made of satin walnut, it makes the whole thing very compact, and it can be carried about with ease, this being a decided advantage.

The coil is of the usual construction. It is 4½ ins. long, having four layers of No. 22 S.W.G. for the primary coil and fourteen layers of No. 36 S.W.G. for the secondary, each layer being insulated with a turn of good writing paper. The finished coil is covered with dark blue velvet, which greatly adds to the appearance. The core is made of a bundle of iron wires 22 S.W.G., ½ in. diameter, and covered with a piece of smooth paper to allow brass draw-tube to slide easily over it. The divi-

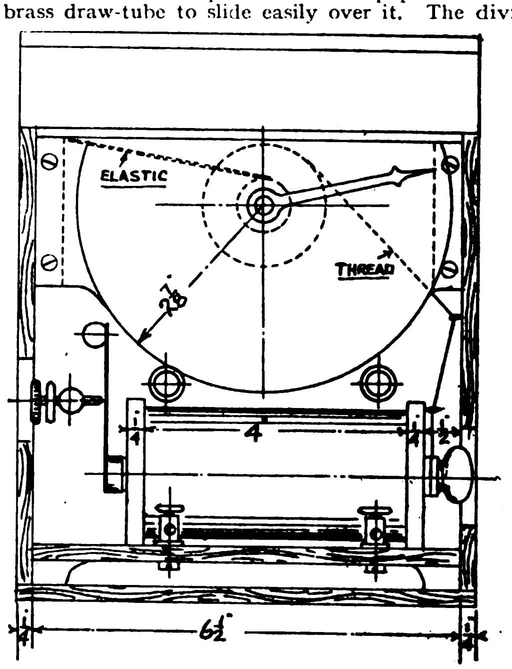
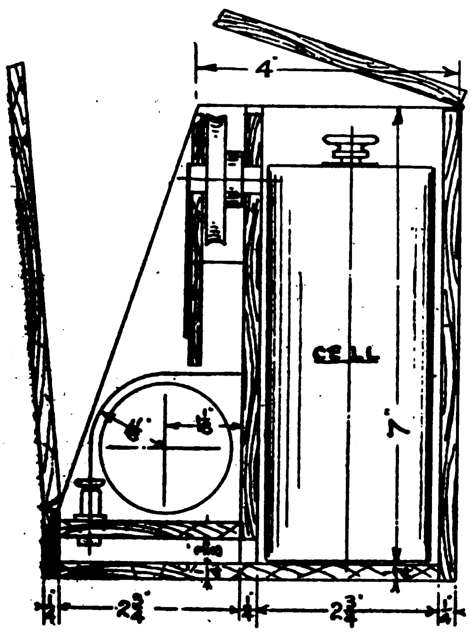


Diagram showing General Arrangement of Coil in Box.

sion-piece in the box has the coil, contact-breaker, terminals, and dial all fixed to it, so that all may be removed to be examined without anything having to be disconnected except a couple of screws holding the division-piece in place. The pointer on the dial is operated by a thread fixed to the drawtube and passed round a roller having a piece of elastic band to bring the pointer back to its original position when the drawtube is replaced. The dial improves the coil, and it seems to excite a competitive spirit among those who use it. The dial registers no particular power, but is just divided into 100 parts. The cell is one of Whitney's "Imperial," and sends a very powerful current through the coil.

The sketches show a front view and a sectional view giving the chief dimensions. I have been unable to obtain a photograph, but I think the



END VIEW OF COIL AND BATTERY IN BOX.

sketches will give my readers a fair idea of the construction. The cost of such a coil is not great if the reader is able to make some of the articles himself, and it will be found as powerful a shocking coil as anyone would care to have.

Death of Mr. Charles L. Palmer.

WE much regret to record the death of Mr. Charles L. Palmer, the news of which sad event has just reached us from New York. Mr. Palmer died suddenly on September 9th, at Keene Valley, after having returned from his summer holiday at the seaside. His name will be known to many of our readers through his contributions to the pages of our earlier volumes, particularly in connection with his model cruiser *Tigress* (August, 1899) and his notes on liquid fuel burners for model locomotives and marine boilers (October and December, 1899). Mr. Palmer was as skilful in the art of building models as he was enthusiastic, and was rightly regarded as one of the foremost amateur mechanics in America. We have very pleasant recollections of the kindly and hospitable reception he extended towards us when we visited Albany in 1904, and of the many interesting things he showed us in his own workshop and in the neighbourhood. Photography, cycling, and motoring were other hobbies to which he was keenly devoted, and his loss will be greatly felt by the many friends to whom his knowledge and his charming disposition so much appealed.

Mr. Palmer, of late years, had constructed a magnificent scale model of a New York Central locomotive, to a scale of 1 in. to the foot, a model English Great Western locomotive to the same scale, and had partly completed a model of one of the later types of the New York Central engines. He left his models to the Sheffield Scientific School of Yale University.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Propellers, etc.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I hope I have not hurt Mr. Dysart's feelings by my criticisms, as one of your correspondents hints. Nothing was further from my intentions, and after our long friendship and the valuable assistance that he has rendered me, I should be sorry if he did not take my remarks in good part.

I must, however, still maintain that the information available concerning model propellers is most meagre—at any rate, to the general public, and, as far as I can hear, the power of the engines and the number of revolutions at which they run has never been tested.

Even such a simple question as whether the engine gathers speed when released cannot, so far, be answered, as no one seems to have taken the trouble to find out. Then, again, the question of cavitation—everyone seems to fear this to an unreasonable extent. I have before me a letter from Mr. Dysart, in which he states that it would be impossible to run a propeller at more than 2,500 r.p.m. without setting up cavitation. I have been trying a propeller with a greater pitch than the propeller discussed in the above letter, and failed to obtain any trace of cavitation at a speed of 3,500 revolutions!

Then, again, what is the greatest pitch allowable in a propeller, what is the best form of blade, and what power will it take to drive it at a given number of revolutions? Can Mr. Dysart answer these questions?

To continue, what proportion of the power developed by the engine is transmitted to the propeller? I am *told* that the amount is negligible—I *know* that it can amount to a very large item in the balance-sheet!

I am now working out a scheme for testing most of these problems, and as soon as I have succeeded in completing my trials, I propose sending you a description of the very simple apparatus used to make these tests.

I have had a personal explanation with Mr. "B.H.P.," and I think that I have convinced him that the power developed by the plant in the

Folly is much above his estimated maximum power. I must abstain from answering Mr. Dysart's conundrum, as I have no experience in propeller design.

It appears to me that it would be ridiculous for anyone to build a boat from the designs published by Mr. Dysart with a view to competing in the Speed Boat Competition, especially when he tells us that he has a much better design up his sleeve, and unless it were built with this view, it would be much too fast and cumbersome for anyone who wants to enjoy running a boat.

My experiences with the *Folly* have taught me that speed boats are a great nuisance, and that much more enjoyment is to be obtained by running a boat at not more than 5 miles per hour—3 miles, for preference. Then, again, unless you happen to live within easy reach of a steamer club, with an available boathouse, or have a lake in your back-garden, a 5-ft. 6-in. boat is altogether too difficult to cart about. Even a metre boat is too large and too fast for thorough enjoyment, and I think that if you, Sir, would initiate a smaller class, say 2 ft. or ½ metre, it would do a lot to promote the sport.

Not only would a boat of that size be much handier to manage, but it would cost much less to construct, and thus allow men and boys with limited pocket-money to take part in a most interesting pastime.

I should like to see the present classes still kept up, but I think there is room for a smaller class, and with a view to keeping this class within the reach of all, a limit on the cost of the materials might be imposed, say 10s. or 12s., with an allowance of the price of a pressure gauge or any special fitting, if required; but, of course, these details would have to be thoroughly discussed before any decision could be arrived at.

I did not reply to your correspondents before as I gathered from your footnote that there was more to come, and I wished to know the whole of the fire that was to be heaped on my head before answering.—Yours faithfully,

Norwood. V. W. DELVES-BROUGHTON.

Modelling the Hydroplane.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Replying to Mr. W. L. Blaney, the only random statements I am aware of are those which he himself has put forward.

The further particulars which I gave regarding Mr. Ramus's claims (page 235) were taken and quoted from Mr. W. Froude's report to the Admiralty, and can be easily verified. If my reading upon this particular subject is in advance of your correspondent's, that is no reason why he should attempt to discredit the accuracy of my statements.

Mr. Blaney says that the particulars I gave do not alter the aspect of his article to any material degree. I beg to differ. Mr. Ramus admitted that the (utterly impracticable) results which he described were *deduced* from his small-scale experiments by Mr. Froude's "Theory of Comparison"; to which Mr. Froude replied that Mr. Ramus did not evidently in the least comprehend his "theory," and said that it was "altogether irrational to think of applying to the movements of bodies actuated by accelerating forces equal to many times their own weight, and experiencing resistances which are comparatively trivial, a rule which belongs *solely* to the relations of steady speed, involving resistances which exactly balance the propulsive forces."

Mr. Blaney is somewhat inconsistent. After admitting that Mr. Froude was a genius for precision, he immediately goes on to decry that gentleman because the results of his experiments are not to your correspondent's liking.

Mr. Ramus was not the inventor of the hydroplane. Patents had been applied for, and vessels built on the inclined plane principle, years before Mr. Ramus's time. This is distinctly admitted by Mr. Ramus in his booklet.

I strongly urge your readers to proceed with the hydroplane, or any similar type of hull, as, if my calculations are correct, I have every reason to think that at least 16 miles per hour can be attained by a suitable metre hull, steam-propelled. Of course, the design and construction of the propelling plant, etc., will be the chief desideratum.

I still maintain that I have "an intimate personal knowledge" of Mr. Blaney's work, and very few who know both of us will dispute this statement. True, I have only come into contact with the "fringe"—your correspondent's work having hitherto been confined to the "condensed-milk-tin" stage (page 236).

It is no use whatever Mr. Blaney talking at random, and letting readers of these columns infer what they chose from his "experimental results." Your correspondent is studiously reticent upon this point, but fellow-clubmen have never seen any of these results in a concrete form, and a diligent perusal of back numbers of THE MODEL ENGINEER will fail to elicit that he has ever put on the water anything of a creditable and mechanical success. "Honour to whom honour is due," and if Mr. Blaney will mention only *one* instance of a practical success—not a paper result—I shall be pleased to award him whatever merit he deserves.

Your correspondent states that he has "achieved the *impossible* on more than one occasion."

But has Mr. Blaney achieved what he states? I wish he had mentioned those successes (?). Ah, stay! I think I know *one*. He alludes, I presume, to his latest creation—the *Min* (page 229). The best speed this boat has done—and can do—is about an average of 4 to 4½ miles per hour, as numerous witnesses can testify. This is not *nearly* 7·3 miles per hour. I claim to know more about the *Min* than anyone else—excepting its owner—seeing that, as the "fellow-clubman" referred to, I discussed its entire data with Mr. Blaney. I also supplied the cylinder for the engine, and certain data for the propeller.

Mr. Blaney desires all personal allusions to be omitted. I appreciate his change of front, but would point out that his letters on this particular subject (pages 141 and 332) are replete with personal allusions and innuendoes. By all means, Sir, let us have honest and sincere criticism, however hard-hitting. But no hitting below the belt; no reckless, untruthful, or uncorroborated assertions—remembering, at the same time, that "abuse is no argument."—Yours faithfully,

South Hackney, N.E. THOS. DYSART.

5-ft. Speed Boat Design.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to the correspondence in THE MODEL ENGINEER on Mr. Dysart's 5-ft. speed boat design. I have been a reader of THE

MODEL ENGINEER for about two years and an engineer by trade all my working life, and I have never read a more concise or interesting series than the above contribution. In fact, it has taken my fancy so much that I have already made a start on one. Although it is the first model that I have attempted, Mr. Dysart's articles are so plain that I have every confidence of success.

There is only one point in the whole series that I am at all uncertain about, and that is in the description of the hull building, where he describes the fixing of the tin strakes. He says these should be fixed on the three-cross plan. I should be much obliged if he would say what this means, as I am sure there will be other tyros like myself who will not understand the above quotation. I should like to say that if all model makers who publish descriptions of their models in THE MODEL ENGINEER were to go into details as clearly and thoroughly as Mr. Dysart has done, there would be a great many more MODEL ENGINEER readers become model engine makers.—I am, yours faithfully, "TYRO."

The Fowler Traction Model.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In reply to "Road Loco" in your issue of August 7th last, I have no doubt that some model firm will provide castings for this engine and prepare the patterns, as the drawings are published.

In discussing this model with an amateur friend of mine, who thought the model entailed rather more work than he was prepared to undertake, I suggested that he need only purchase a portion of the castings, say, for the cylinder and motion, this winter, and if he completed the work, he could mount it temporarily on a piece of turned wood the same diameter as the boiler shell, the crankshaft bearings being supported by a suitable plate screwed to the side of the wooden base. In this form it would be worth showing at any Society meeting, and would be preserved in a respectable condition until the boiler, wheels, etc., are made ready to receive it.

With reference to the design of the boiler, I have not yet quite decided, but think at the moment that a coal-fired boiler, with the hornplates attached to, and not forming part of, the firebox will be the best arrangement to suggest.

The boiler could be worked by "Primus" burners, but this would not be an economical method. I would prefer a spray burner. However, I will deal with all these matters to the best of my ability as the articles proceed.—Thanking your correspondent for his letter, I am, yours faithfully,

Watford, Herts. HENRY GREENLY.

Re Hot-water Supply.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I beg to point out that "Plumber" is right in saying that Mr. Cummings could not have read my letter carefully, as my intention was to uphold "Plumber's" letter, which Mr. Cummings will see by the advice given at the end of my letter as regards "W. C." taking "Plumber's" advice. I myself have never seen the cold supply pipe put in the bottom of boiler of any domestic hot-water apparatus, and if I were on a job that speci, fied the cold supply to enter the bottom of boiler and could not induce the responsible person to have it altered (whether hard or soft water were to be used), I should leave the job to be done—probably, by someone without a conscience.

The boilers I mentioned being cleaned every three months were in 5-ft. 6-in. ranges, with two ovens, at a large drapery establishment, and the fires were going strong for about eighteen hours out of the twenty-four hours. They were fitted with the cylinder system, which was copper, as was the boiler flow and return and expansion pipe. The cold supply was lead, and connected to bottom side of cylinder. When I first went so see them there was no sign of an arch inside boiler, one being nearly half full of scale; the flow and return went into top of boiler, with a short stump on return inside.

What would have been the result if cold supply had gone in the bottom of these boilers? I agree with "Plumber" in his remarks about continued expansion and contraction as being detrimental to same, and I, like "Plumber," cannot see why the cylinder should collapse more in summer than in winter, providing the expansion pipe is clear.—Yours, "HOT WATER."

Belts for Milling Spindles.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I notice that Mr. J. Aird, in Sept. 10th and 17th's MODEL ENGINEER, recommends the use of twisted cord for driving small milling spindles. Having used both "gut" and cord, I find that, although by using the latter the unpleasant "click" is avoided, a far greater evil is developed, viz., a "jump" in the spindle, caused by the knot in the cord passing over the pulley. In my own experience, the result of this has usually been a broken cutter, as most of my work has been done with very small D-bits milling slots.

I now use round section leather belting, with a butt joint held by a common double-ended hook, as will be found in use on most "sewing" machines, or, better still, a spliced joint sewn with cobbler's waxed thread.

If the hook joint is adopted, the holes in the leather must be cut, not burned through with a hot wire, as this latter method seems to "perish" the material surrounding the hole and causes it to break away. Trusting other readers will find this hint useful, I am, Sir, yours faithfully,

A. W. LUDLOW DORÉ.

Perpetual Motion.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The recent letters on "Perpetual Motion" are interesting, but very likely to mislead some of our younger readers. In the first place, what is really understood by scientists as a perpetual motion machine is one that will give off power without cost, *i.e.*, without using fuel of any sort. Everyone with the least theoretical knowledge knows this to be impossible, as is pointed out by the great Kelvin's Law of the Conservation of Energy, and it is obviously foolish for anyone to waste their energy, time, or money on such ideas. Power obtained from chemicals, the sun's heat, the waves, etc., through a machine would not be perpetual motion at all—such a machine would be a chemical motor, sun motor, or tide motor, and would get its power from the energy of the chemical, sun, or tide. Let our inventors try to make such a machine by all means. What is badly wanted in the electrical world are the following: (1) A direct-current dynamo or motor without a commutator; (2) a light, efficient cheap storage battery, without lead or acid; (3) a means of getting electricity from coal without using a boiler, engine, and dynamo, *i.e.*, an efficient carbon-consuming cell or thermo-pile.

It is not much use for a novice to try his hand at such things—he will have ninety-nine times' more chance of success if he reads all the available matter and good text-books first, to see what has been already done; in fact, he needs several years' study (and even then he will find he needs years more!).

All scientists know well (as I know Mr. Edison does, too) that "perpetual motion" never will be attained; let us then try to invent (or improve on) something we know can or may be accomplished, and not waste our time and energy trying to butt head-first through a relentless stone wall!—Yours truly, R. F. M. WOODFORDE.

82, Aspen Grove, Liverpool.

TO THE EDITOR OF *The Model Engineer.*

SIR,—Would it not be well to avoid use of the term Perpetual Motion in connection with the utilisation of power from natural sources? There is nothing scientifically wrong in the search for a machine that need never stop because it can be renewed whilst it runs, and because it derives its power from a source in Nature that demands no intervention of human control.

But this is not what Perpetual Motion men—to employ the term in its usual significance—are after. What they seek, to put the matter in homely guise, is eighteen-pennyworth of energy for, say a shilling's worth of heat. W. J. T.

111, Hatton Garden, E.C.

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.]*

London.

A PARTY of the members visited, on Saturday, October 3rd, the Neasden Power Station of the Metropolitan Railway Company, and, under the guidance of Mr. Dobson, the assistant electrical engineer, spent a very pleasant and instructive afternoon amidst machinery of a rather novel nature to most of the members. The plant consists, primarily, of 5 units each of 3,500 kw. capacity, the machines being British Westinghouse alternators direct-coupled to Parsons' turbines, running at 1,000 r.p.m., and generating alternating current at a pressure of 11,000 volts, this being afterwards transformed to 600 volts continuous current for feeding the line. The members were fortunate in being able to see the interior of one of the huge turbines, which are a combination of the De Laval and Parsons types; one being dismantled for repair and the rotor and shaft taken out of the casing, the action was clearly explained to the party. The method of accurately balancing these huge masses, each weighing about four tons, was explained and the apparatus for effecting it inspected. Visits to the boiler-house and subsidiary engines of many varieties were made, and after an inspection of the running sheds, where several electric engines were closely inspected, acknowledgments were made to Mr. Dobson for his courteous explanations, and the party returned to town.

FUTURE MEETINGS.—Wednesday, October 28th: Mr. Henry Greenly's lecture on his recent model commissions. Wednesday, November 25th: Annual General Meeting. Any member wishing to move an amendment of or addition to the rules of the the Society is requested to send particulars of such amendment or addition to the Secretary at least seven days before November 25th.—Full particulars of the Society and forms of application may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

The Glasgow Model Steamer Club.

THE above Club closed the season by sailing their race for the Championship of Scotland, and colours, on Monday afternoon, Autumn Holiday, on Springburn Park Lake, with a large attendance of interested spectators.

The Aberdeen Model Steamer Club were represented by three electric-driven models and one steamboat. The Glasgow Model Steamer Club had four steamers flying their colours.

The race for the Championship was sailed in four heats—once up and down lake. Results as follows:—

First Heat: Mr. A. C. Gaffikin's *Rocket* (G.M.S.C.) beat Mr. Wm. Bunting's *Viper I* (A.M.Y.C.).

Second Heat: Mr. T. H. Cattell's steamer *Viper II* beat Mr. W. Clarke's *Swift* (electric—A.M.S.C.) and Mr. Samuel Russell's *Veda* (steamer—G.M.S.C.).

Third Heat: Mr. R. M. Baird's *Iris* (steamer—G.M.S.C.) beat Mr. R. Smith's electric model *Thrush* (A.M.S.C.) and Mr. Wm. Phillips's *Jeanie* (electric—A.M.S.C.).

The following steamboats crossed the line for the final heat—*Viper II*, *Rocket*, and *Iris*. The *Rocket*, taking fire, dropped out of the race, leaving the *Viper II* and the *Iris* to divide the honours. A closely contested race ensued between these two swift models, and resulted in Mr. R. M. Baird's *Iris* (G.M.S.C.)—steam) beating Mr. T. H. Cattell's *Viper II* (steam twin-screw) by 15 seconds and winning for the Glasgow Club the Championship of Scotland.—A. C. GAFFIKIN, Hon. Secretary, 725, Hawthorn Street, Springburn Road, Glasgow.

London Model Yacht Club (Kensington Gardens, Kensington, W.)

A COMPETITION for models of 12 rating to I.Y.R.U. rule (scale 1 in. = 1 ft.), for prizes presented by the London Model Yacht Club, will be held on the Round Pond, Kensington Gardens, on October 31st, at 11 a.m.

Entries close October 17th, and should be made to the Hon. Secretary, L.M.Y.C., Kensington Gardens, Kensington, W., accompanied by a certificate of rating certified by a club official measurer.

The Committee reservé the right to refuse an entry.—P. TATCHELL, Hon. Secretary L.M.Y.C.

Queries and Replies.

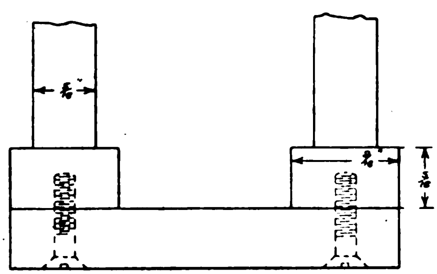
[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[20,059] **Field - Magnet Construction and Winding.** B. G. M. (Hackney) writes: I am making a small electric motor to drive a 4-in. fan direct. The field-magnet consists of two similar halves, and the armature of tripolar stampings 1¼ ins. diameter and ¾ in. long. Is it necessary to connect the halves of field-magnet at bottom with a piece of iron bar; and, if so, what is the best joint? What amount of wire, and what gauge and covering to wind field-magnets and armature?

Yes, certainly, you must connect the two halves of your field-magnet. And if your machine is to be as efficient as possible, you must do this very carefully, making sure that the two faces



Query N° 20059

of the joint coincide perfectly, having no air-space to speak of. A small air-space in the crack will do a great deal to spoil the efficiency of your machine. You will get the best joint by fixing a soft piece of wrought iron underneath the two poles, as sketch. Join by two small steel screws into each pole. Wind armature with about 10 yds, No. 23 D.C.C., and field-magnets with about 20 yds. No. 21 D.C.C. The motor should run well with 4-volt pressure.

[20,283] **Tesla Transformer.** G. S. (Crook) writes: I should be greatly obliged if you would kindly give me some particulars for the construction of a Tesla transformer, capable of being used in conjunction with a 10-in. spark induction coil. I may say that I have had some little experience in the matter before, and all I really want is the dimensions and rough diagram. Would it be possible to make the transformer without oil insulation? I should much prefer it, if possible. I wish to get as large a spark as possible from one of the secondary terminals—*i.e.*, when the other is connected to the primary coil of the transformer. If you cannot help me in the matter, would you kindly refer me to a book on the construction of same.

For account, with dimensioned drawings, of a Tesla coil such as you require, see Mr. Howgrave-Graham's articles of February 4th, March 3rd, May 19th, August 4th and 25th, October 27th, 1904. We cannot too highly recommend the use of oil insulation whatever form of transformer you adopt. If your coil is to be used with an ordinary "make-and-break," you may find a transformer of about half the dimensions given quite adequate, but where a very heavy coil secondary discharge is used to charge a large Leyden jar battery, the sizes given are very suitable. You doubtless have a good reason for connecting one end of the secondary to one end of the primary, but the practice is open to serious objections, and you would probably have serious trouble of various kinds with the insulation.

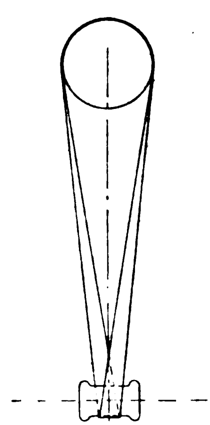
[18,118] **Daniell Cells.** J. G. (Glasgow) writes: I intend making a small standard Daniell cell, and I would be obliged if you would answer the following questions. (1) What will be the exact E.M.F. when both the copper sulphate and the zinc sulphate solutions are saturated? (2) Would it be a good plan to use a glass tube about ¾ in. diameter, bent into the form of a U, with a piece of cotton wool to separate the solutions, or would it be better to use a larger straight tube as a gravity cell? (3) If I use lamps as a high resistance, what current can I pass through them so that I may not change their resistance by heating? Also what will be the probable resistance of a 16 c.-p. 250-volt lamp when cold? (4) In using a water resistance, does the kathode polarise; and, if so, will the change in the current passing through a glass tube 5-16ths in. diameter and 8 ins. long, under a pressure of 2 volts, be worth taking into account? Also what would be the probable resistance of such a tube when filled with pure water?

(1 and 2) You will find information in the Appendix, page 478, of "Elementary Practical Physics," by Stewart & Gee. Dr. Fleming has made a thorough examination of the best conditions of constancy in a Daniell's cell and has devised a form described in the above-mentioned book. It consists of a vertical U tube, with stop-cock at bottom of one limb for the purpose of adjusting the level of the liquids. Zinc and copper rods pass through india-rubber corks into the solutions, the density of which does not matter provided they are the same. Temperature co-efficient negligible for small ranges, E.M.F. 1·1 true volt. Materials should be purest procurable. (3) The resistance of a lamp filament decreases with rise of temperature. Unless you keep the temperature absolutely constant any current will alter the resistance. Enquire of the maker of the lamps you intend to try. (4) Yes, the kathode polarises; try the experiment. You will probably find it necessary to add some acid to the water.

[20,429] **Weight of Propellers for Model Boats.** H. O (East Sheen) writes: I have completed a model boat about 6 ft. long, 7-in. beam, and about 3-in. draught. She has two propellers 2 ins. diameter, of brass, driven by an electric motor through worm and bevel wheels, the motor revolving three times the speed of propellers. In order to reduce weight, I propose replacing the two brass propellers by similar ones of aluminium or magnesium, by which I shall gain several ounces, as the bosses of propellers are rather long and large diameter, which shape it is important to keep to. I would like your opinion as to whether the running of the propellers and motor will be badly affected by having very light propellers. There is no flywheel, and the bevel wheels are very small. Will having light propellers be detrimental to their running and that of the remainder of gear and motor?

The propellers on model high-speed engines undoubtedly do act as flywheels, but exactly to what extent the lighter propellers would be detrimental to good running is a matter which would have to be found by trial. You could always arrange to have a flywheel mounted on either the motor or the propeller shafts, if you found it desirable after having made a trial with the lighter propellers.

[20,251] **Belt Driving.** F. N. (Redhill) writes: I shall be obliged if you will kindly give me the correct way to line up pulleys for a half-twist drive, that is, when the shafts are at right angles to each other, as per sketch. Also, is there any rule to determine the distance between the shafts, in relation to the size of the pulleys used? I take it there must be a fair distance between the shafts for a drive of this description to be successfully used.

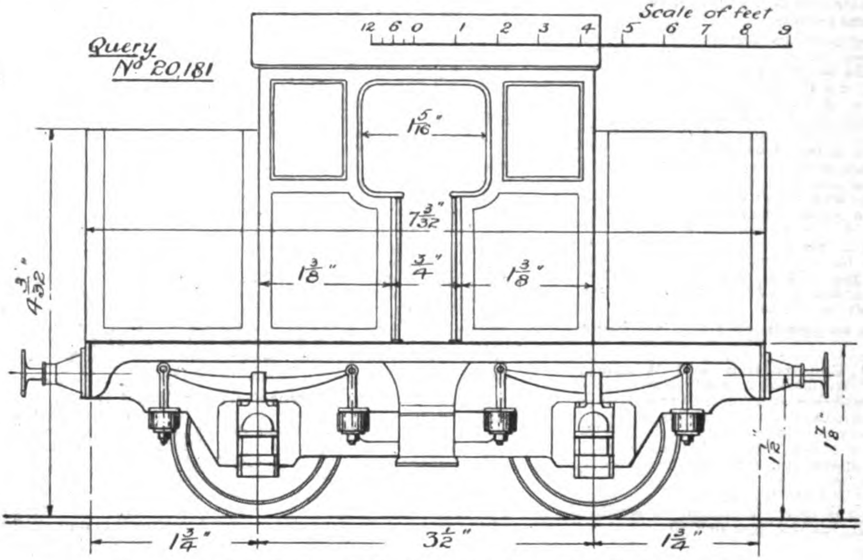


Query N° 20251

The line joining the centre of the driving pulley to the centre of the driven pulley should be at right angles to both shafts. Pulleys having diameters in the ratio 2 to 1 should be not less than 8 ft. part; if 3 to 1, 10 ft.; if 4 to 1, 12 ft.; if 5 to 1, 15 ft. These distances are measured between centres of pulleys.

[20,181] **Four-wheeled Model Electric Locomotive.** K. M. F. H. (Godalming) writes: Can you give me a design for a cab for a four-wheeled electric locomotive, 2-in. gauge outside frames? The frame is 7¼ ins. by 2½ ins.

We presume that you require a drawing of the whole superstructure above footplate level. If so, to enable us to make a proportionate design you should have sent us a dimensioned sketch



SIDE VIEW OF FOUR-WHEELED MODEL ELECTRIC LOCOMOTIVE.

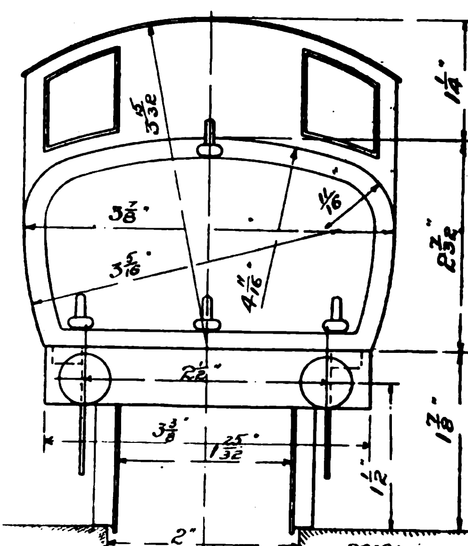
of the frames you have made. However, so that you can proceed without delay, we append a design which you may be able to adapt. The frame length is fixed at 7 ins., but may be 7¼ ins. long inside the buffer planks, the wheelbase and length of cab being extended ¼ in. to suit. The body is shown with the sides shaped in the same way as a passenger coach. The resistance covers at each end of the cab are curved and moulded into the sides of the cab. There is no projecting footplate except at the cab opening. The wheels are of a standard size, viz., 1¼ ins. diameter, and may be spoked cast-iron wheels having 10 spokes. The buffer heights and centres are standard. As you are doubtless aware, there is difficulty in modelling the C. & S.L. Railway locomotives to suit ordinary rolling-stock, on account of the buffer height not being standard.

[20,246] **Dynamotor Windings: Shellac Varnish.** B. E. W. (Harrow) writes: I shall be extremely obliged if you will kindly advise me on the following. I propose to build a 220-volt 10-amp. dynamotor for battery charging, using a similar machine to No. 12 in your No. 10 handbook, with a double winding on the armature, armature coils to be formed and taped. (1) Would a 150-watt machine be large enough to get 10 volts 6 amps. from the low voltage side? I have a 3½-in. Drummond lathe which will not take a larger machine. (2) What is the approximate proportion of the input watts to the output watts? (3) The armature dimensions are 3 ins. diameter by 3 ins. long, 16 slots ⅜ in. by 5-16ths in. What gauge wire for the primary (high voltage) and the secondary (low voltage) coils would be suitable, also how much? (4) How much wire would be required for the field coils and what gauge? (5) Could you give me a recipe for making a suitable varnish for this machine's windings?

(1) Yes, 150-watt size will be sufficient. (2) The watts given out by the machine would not be more than a quarter of the watts supplied. (3) For the high-voltage winding put on sixteen coils, two per slot, of 150 turns No. 32 S.W.G. s.s.c. wire. You will require about 14 ozs. Use a 16-segment commutator. For the low-voltage winding, put on eight coils, one per slot, of sixteen turns No. 20 S.W.G. D.C.C. wire. For this about ½ lb. will be required. Use an 8-segment commutator. We think you will require to enlarge the slots of your core. Before starting to wind, cut a number of short lengths of wire and try to fit into the end of one slot the correct number of wires of both gauges with insulation. In this way you will find out just how large your slots must be. (4) For field-magnets use about 3 lbs. No. 32 S.W.G. s.c.c. wire on each coil, the two coils to be joined in series with each other and in shunt to the high-voltage brushes. (5) Good shellac varnish which can be obtained very easily and cheaply is the best for this purpose. If you wish to make it yourself, dissolve shellac in methylated spirit, or, preferably, spirit of wine. The proportions are: ¼ lb. of shellac to 1 pint of spirit.

[20,265] **Magnetic Fish-pond.** W. C. D. (Belfast) writes: Please can you tell me how to make an electrical fishing-pond? What I mean is, an area of water enclosed in a 3-ft. diameter vessel; the fishermen drop their line in water with a magnet at the end of line. When the operator has turned the current on, then the magnetised tin fish begin to rotate about in bowl or vesse which is half full of coloured water. Then when the magnet at end of fishing-rod touches a fish it is drawn out of water. Please could you give me a working idea?

We do not know of any literature dealing with the subject of magnetic fish-ponds. We can give you a general idea of how one could be made, but the determination of details must be a matter of experiment unless you can obtain particulars of one actually working. Below your circular glass tank a wheel of diameter somewhat larger than the tank must be made to rotate. The rotating could be done by clockwork or by an electric motor. From the wheel rim you must have a certain number of vertical supports which carry magnets — either permanent or electro-magnets—at their upper ends. The magnets are directed to send their influence across the bowl, and as they rotate the fish, which must have iron or some other magnetic material in their construction, are kept in continual motion. The water could be clear, the anglers using simple steel



END VIEW OF MODEL ELECTRIC LOCOMOTIVE.

hooks which could catch in a hole or ring in the fish. Or, if preferred, obscured water could be used and the fish angled for by small permanent magnets dropped into the water. The magnets rotating outside the bowl should, of course, be protected. This could be accomplished by enclosing them in a wooden casing.

[19,541] **Leyden Jars: Wireless Telegraph Relay.** W. B. (Ayrshire) writes: (1) I am experimenting with a Wimshurst machine, having two ebonite plates, 7 ins. in diameter. I have

made a Leyden jar out of a glass jar fully 1-16th in. thick, and having 28 sq. ins. of tinfoil on the outside, and about the same on the inside. When I connect both coatings, one to each pole of the Wimshurst, the size of the spark on discharging the jar is about ½ in. long, perhaps a little less. Is this as it should be, or about what length should it be on discharge? I expected to obtain more. Is the jar too large for the Wimshurst? The Wimshurst machine is the same as that sold by electrical dealers, and is listed as giving 2-in. spark. I have given the jar a coat of shellac-varnish both outside and inside. I don't think the jar

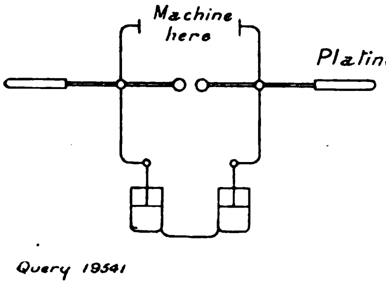


FIG. 1.

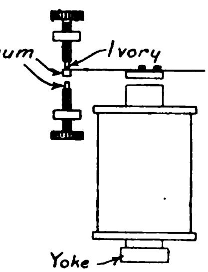
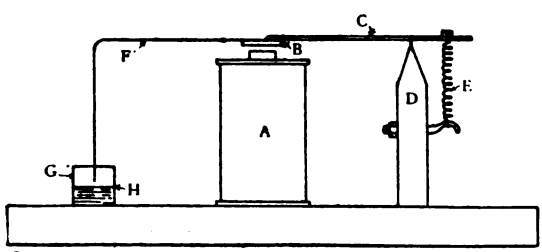


FIG. 2.

is pierced, as I can see no spark between the coatings. If you can give me any information as to where I have gone wrong in the construction, I shall be obliged. Any other particulars with regard to Leyden jars will be welcomed. (2) Below you will find a sketch of a relay I intend to make for telegraphic purposes (wireless) for short distances. A are two bobbins filled with No. 36 single cotton-covered copper wire; B is a light iron armature soldered to the light brass strip C, which rests on the knife edge on D, and is drawn back to normal position by adjustable spring E; F is a copper wire also soldered to armature; G is a small cup of mercury, the level of which is indicated by H. The action is this: On the attraction of the armature B to the pole-pieces, the copper wire F dips into the mercury cup and thus completes circuit. Can you tell me if this will work well; and, if not, can you give me a sketch of any better arrangement? I have left out connections, terminals, and other small details in the sketch.

(1) The Leyden jar will take time to charge to the required potential, but should not reduce the spark length so much if the necessary time is given. The jar is, perhaps, a little large and, moreover, there are usually two such jars in series, one on each discharge rod (as Fig. 1). We can only suggest that your jar may be made of unsuitable glass, as different kinds of glass behave very differently. To test this, charge the jar to the utmost possible potential difference and let it stand well away from conducting objects. It should retain its charge for several hours, or, if a very good one, for a day or two. Perhaps the tinfoil approaches



too near to the edge of the jar. There should be a very considerable depth from the rim to the coatings. Have you tried very slow and gentle baking to ensure absolute drying out? (2) We would recommend pivots instead of knife-edge, and would advise that the whole moving portion should be greatly shortened. Also you will certainly do well to avoid mercury cups and substitute two adjustable screws by means of which the travel of the pivoted arm can be finely adjusted. The top screw should be tipped with ebonite or ivory, and the bottom one should have a platinum contact in the end (as Fig. 2). You must provide a fairly substantial yoke of iron connecting the bottom ends of the cores. We would recommend No. 40 or 42 wire rather than 36. However, we would not advise the use of this type at all, but a polarised relay of the type described in Mr. Howgrave-Graham's book on "Wireless Telegraphy" (Percival Marshall & Co.).

[20,237] **Signalling by Earth Currents.** R. A. W. (Sutton) writes: I wish to fix up some means of communication (by Morse or some other code) with a friend 1½ miles distant. Unfortunately, we are unable to see each other's houses owing to houses and trees intervening. Is there any other system besides wireless telegraphy? It will not be necessary to "ring up," but merely to send signals. It would cost too much to run wires between the two houses. Is there not some method of employing earth currents? I once read an account somewhere of a field wireless telephone which was put in connection by two spikes driven in the ground. Supposing wireless is the only practical method, what size coils should I need to work in conjunction with telephone receivers? Type of coherer; or would a magnetic detector be better? If so, where can I get particulars as to windings, proportions, etc.? I do not think I could make a Lodge-Muirhead. Is there any charge for licenses for wireless telegraphy, and, if so, how much? At present the only coils I possess are two 3-16ths in. spark coils. Could I not increase the range of my coils in a given direction by means of bent aerials, as on page 320, Vol. XVIII of THE MODEL ENGINEER?

We have no experience of the use of earth currents, but we believe that the base lines—that is, the lines running between the two stakes at each station, must be long for long distance work. In other words, you would have to place your stakes far apart at each station. A coherer is not used in earth current signalling, neither is a magnetic detector so used. You could try a single point coherer of the carbon steel type with a telephone and the ordinary spark system of wireless telegraphy as described in our handbook. You will probably want far larger spark coils. We would not recommend bent aerials for such a station as you describe.

[20,257] **Stencil Making.** R. J. H. (Camborne) writes: Having made some stencils from plain post-cards, I find them a little thin. Is there any way of making them stiff and hard? I covered both sides with black enamel, making them better but not hard and stiff.

Try shellac varnish.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

* *Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

Cycle Dynamo Parts and Lamp Fittings.

We are informed by the Universal Electric Supply Co., 60, Brook Street, C.-on-M., Manchester, that they are able to supply parts for making up the dynamo-electric machine and cycle lamps similar to those described and illustrated in our issue of October 1st. The principal parts they keep are those which are most difficult for the amateur to obtain and make—namely, the steel magnets and the armature stampings. In addition to this, the above firm can supply special 4-volt metal filament lamps taking a very small current. Readers who were interested in the description above referred to will be glad to avail themselves of this offer, and can obtain full particulars and prices from this firm.

A New Model Engineering Business.

A new business devoted to model engineering has been recently opened at the address below, which will specialise in model railways and fittings, launches, steamers and fittings, electrical apparatus, &c., but particularly the building and repairing of high-class scale models. It may interest model engineers to know that the head of The Oxford Model Engineering Co., of 75, Iffley Road, Oxford, is himself an enthusiastic model engineer, which alone should be sufficient testimony to the character and management of the business.

A New 4-6-0 G.C. Railway Locomotive.

Messrs. W. J. Bassett-Lowke & Co., of Northampton, have been building several 1½-in. scale engines lately, and have a G.C.R. 4—6—0 type bogie express locomotive nearing completion. This engine is one of the best and most complete they have yet constructed, and should mark a new era in locomotive building. They expect to have same under test towards the end of October, and would be pleased to hear from any readers of THE MODEL ENGINEER who are interested in 1½-in. scale work, as to whether they would like to be present at their works during the steam trials. A convenient date could then no doubt be arranged.

The Editor's Page.

THERE is a certain class of user of our small advertisement columns who is anxious to avail himself of the well-known result-bringing qualities of our paper for the purpose of making profit, but who objects to paying trade rates for his announcements. He usually argues that because his daily occupation is not of an engineering or model-making kind, he has a right to run a spare-time profit-making business in models, tools, or similar goods as a private advertiser at private rates. We need hardly say that this argument is quite unsound. The specially low rates at which we accept private advertisements for our Sale Column are intended to benefit the ordinary reader of the journal who merely wishes to sell or exchange something for which he has no further use, but who is not advertising with the idea of making a profit on the transaction. As soon as a reader commences to sell models or other goods, new or secondhand, on a profit-making basis, he becomes a trader, especially if he is repeatedly advertising with the same purpose in view, and he is entering into competition with our regular trade advertisers. It would be obviously unfair to other traders if we accepted the announcements of their spare-time competitors on preferential terms, and it is for this reason that we scrutinise so closely the advertisements we receive. One advertiser recently protested against our charging him trade rates, on the ground that he was a schoolmaster by profession and a model engineer only in his spare time. When we pointed out to him that in his correspondence he was using a printed trade letter heading, he calmly replied that he did this because it enabled him to buy tools at a cheaper rate than he could as a private purchaser! Anyone who poses as a trader for his own purposes can hardly grumble if we take him at his word and ask him for trade rates for his advertisements.

* * *

We are informed that the Lloyd's Register Scholarship, value £50 per annum, tenable for two years, in connection with the Institute of Marine Engineers, has been gained in competitive examination by Mr. James Richmond Thomson, of Clydebank. The scholarship is intended to provide an opportunity for young engineers to follow up a technical course at the day classes in addition to what they have been able to take at evening classes during their apprenticeship. The examinations are held at various centres annually, the subjects of examination being algebra (including quadratics), elements of statics, dynamics, thermodynamics, and hydrostatics; Euclid, Books I, II, III and IV; general knowledge, English grammar and composition; language, French or German; plane trigonometry, including logarithms; practical engineering and workshop practice. Candidates must be graduates or associates of the Institute of Marine Engineers, and particulars of the necessary qualifications for these grades of membership may be obtained on application to the Hon. Secretary, James Adamson, Esq., 58, Romford Road, Stratford, London, E.

* * *

A letter to hand from Mr. F. W. Simpson, Customs Engineering Works, Key Street, Ipswich, notifies us that he has been asked by several readers of THE MODEL ENGINEER to endeavour to form a Society of Model Engineers at Ipswich. Mr. Simpson would be glad to hear from any prospective members in his district, with a view to starting a Society.

Answers to Correspondents.

H. MEYRICK-OSBORN.—We have a letter at our office for you, if you will kindly send present address.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26-29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

[The asterisk (*) denotes that the subject is illustrated.]

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

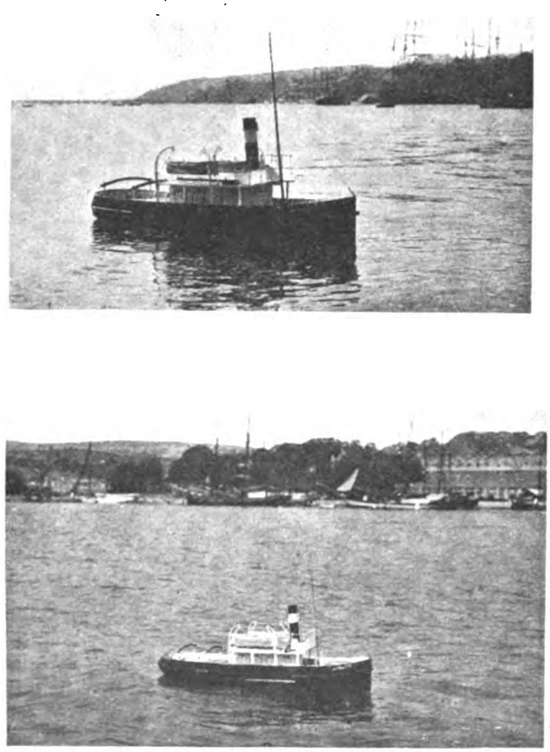
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 391. OCTOBER 22, 1908. PUBLISHED WEEKLY

A Model Tugboat.

By G. L. HEAD.

THE accompanying photographs illustrate a model tug which I have made in my spare time. The hull is 3 ft. 3 ins. long, 9-in. beam,



TWO VIEWS OF A MODEL TUGBOAT.

By MR. G. L. HEAD.

and 4 ins. in average draught. It is built of yellow pine on the "bread-and-butter" plan, and the layers are held together by glue and copper wire, as described in No. 4 of your Practical Manuals. In order to sink her deeper in the water, I fitted her with two water ballast tanks with a total capacity of about 1½ pints. I did this in preference to lead weights because it makes the boat lighter to carry.

The motive power is electricity, which I adopted in preference to steam, as being cleaner and less trouble to start. There is one hatch over the motor for oiling purposes, and one on the upper deck over the accumulators for the starting and reversing switch. The motor I made from a set of castings, some of which I had to discard, and it takes a current of 3 amps. at 8 volts.

The propeller is a two-bladed one, 2 ins. diameter and 4-in. pitch. It is driven at about 600 r.p.m. when in the water.

The accumulators are a 4-volt 25-amp. C.A.V., and a 4-volt 10-amp. one bought at Gamage's.

The telegraph and steering wheel are dummies, the steering being accomplished by means of a tiller on the deck.

On her trial trip she travelled about 3 miles per hour, and rode waves as high as her upper deck (the wash from a motor launch) without shipping a single drop. As seaworthiness is a necessity in a tug rather than speed, I think she is quite satisfactory for a first attempt at a self-propelled boat.

A 10-Rater Model Yacht.

By Charles Hastings.

My 10-rater model yacht, *Patience*, was built entirely from diagrams and plans obtained from "Model Sailing Yachts." Her chief dimensions are: Deck, length over-all, 3 ft. 9 ins.; length L.W.L., 3 ft. 1 in.; main boom, 2 ft. 10 ins.; gaff, 1 ft. 6½ ins.; bowsprit (outside), 9 ins.; beam, 11½ ins.; mast from deck, 4 ft. 1 in.; depth of keel from middle of hull, 5 ins.; length of keel, 1 ft. 7½ ins.

Fig 2

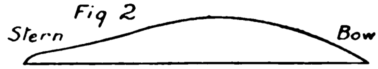


Fig. 1

She is built throughout with maple wood, 1-16th in. thick, with a good straight grain and no blemishes. The keel which the boat is constructed on is of ¾-in. English oak, straight grain, with the sap down. The deck is of American whitewood, 3-16ths in. thick. The reason of this thickness is

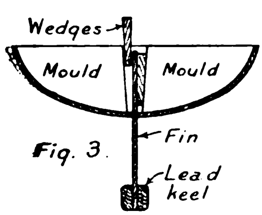


Fig. 3

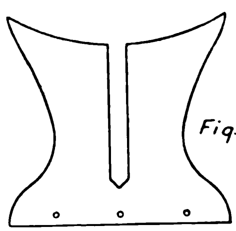
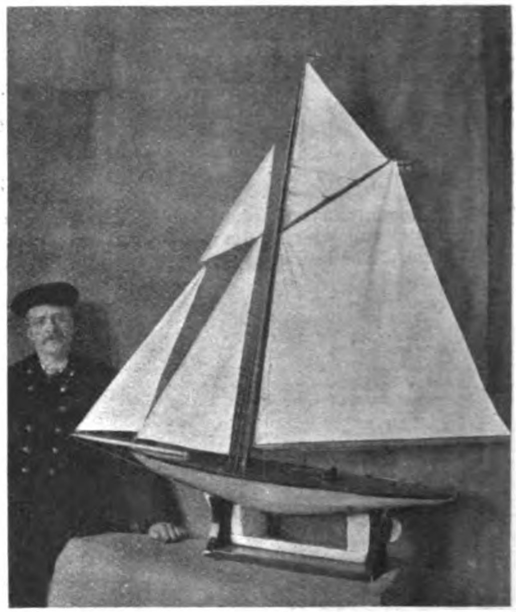


Fig. 4.

apparent when it is explained that there are no ribs in the construction of this boat. In fact, the only cross section left in are the two moulds, which are in two half sections, as shown in Fig. 1, the space A being left after the removal of the fore and aft frame which it was built on, that being as shown in Fig. 2, a perfectly straight piece of seasoned wood, ¾ in. thick. When the planking is completed, this is removed, the oak keel and the series of moulds being unscrewed from it, they in their turn being delicately removed from the hull. I may mention that these half sections are left in for a good purpose, that is, to act as supports for the inboard ends of the fins, wedging them and keeping them perfectly rigid—a pair forward and a pair aft (see Fig. 3). It is built on mahogany battens running fore and aft, ¾ in. wide, and the planks are brass riveted to them their entire length.



Mr. Hastings' Model 10-Rater.

The fins are of zinc, which I think is in itself an experiment, and I have every hope of them standing any strain which may be put on them by fair sailing. The keel is cast in one piece and is of lead, being slotted to take the fins, and weighs 8½ lbs. The rudder is of the swing pattern, made of brass with adjustable lead strips, the advantages of which are ably described in the above volume. The hull of the rightly named *Patience* is of a dark green, a good serviceable colour, with a polished mahogany strip beading, and a nice lined deck, which has had two coats of linseed oil and a coat of varnish.

The hatch is of cedar wood (cigar box), with a thumb-piece to remove same in the shape of a companion hatch, making a neat finish. I have also furnished the deck with a few cleats and fairleads bow and stern, because they are of no weight, add finish, and are no trouble to make. It is also standing on a polished and stained stand, which is of 1-in. American whitewood and is worth copying (see Fig. 4).

The masts and spars are of white pine dressed with linseed oil and varnished. The brass work throughout was made by myself, also the sails, of which there are two suits—for fair and foul weather. The estimated total cost of everything was not more than £1, and took six months to build in spare time.

Experiments on Electric Oscillations and Waves.

By R. P. Howgrave-Graham, A.M.I.E.E.

(*Continued from page* 198.)

In a previous article a photograph was published showing brush discharges and streamers issuing from the finger-tips and branching out towards a metal plate. To produce this effect the experimenter placed himself in connection with one terminal of the Tesla coil and gradually brought his hand towards a plate connected with the other terminal until the discharge was as much as he could stand. Figs. 69 and 70 show the effects obtained by approaching the face instead of the hand towards the plate; the discharges pass from nose, eyebrows, and chin, but particularly from the rims of spectacles, and the sensation is sufficiently unpleasant to make the experimenter limit the vigour of the discharge to a degree which makes it impossible to obtain a very good photograph.

Fig. 69 is an unaltered photograph which had an exposure of about a second; in reality, however, the effect is more nearly like that shown in Fig. 70, which is the same photograph worked up to look as much like the actual appearance as possible.

The pricking and tingling sensations which accompany these discharges are somewhat aggravated by the pungent smell of the ozone which is generated close to the nostrils.

Brush Discharges from Wire.

A very pretty effect can be obtained by making a thin wire form one conducting surface of a condenser with a very thick di-electric. The surface occupied by the wire is small compared with the large area of the tinfoil on the opposite side of the insulating material, and this causes brush discharges to leave the wire and run outwards over the surface of the di-electric, so as to make the effective area greater than that of the mere wire itself.

The effect is similar to that described in a previous article, which contained a photograph showing a

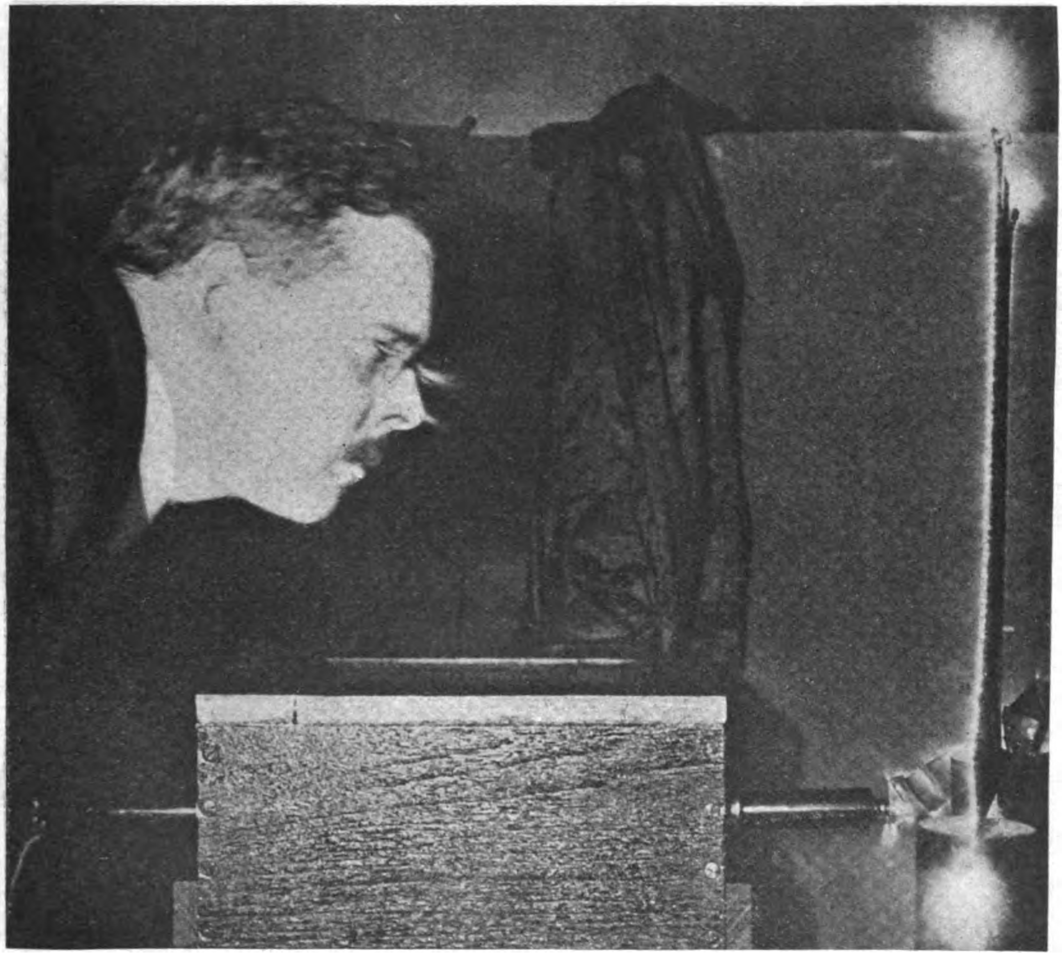


Fig. 69.—Untouched Photograph of Brush Discharges from the Face. (*Exposure about* 1 *second.*)

small circular plate emitting brush discharges at its edges on one side of a micanite plate in such a way as to convey energy over a square area, corresponding to a sheet of tinfoil pasted on the other side.

In the present arrangement the wire is laid so as to form a pair of words or names—one on each of two large sheets of glass varnished with shellac. The two words chosen should be of nearly the same length.

The wire—about No. 36 or 40—may be secured by very small dabs of melted shellac, where necessary, the whole being shellac-varnished uniformly afterwards to fix it permanently to the surface. A short length of wire is left projecting from the outer termination of both words—that is, from the commencement of the first word and the end of the second.

A pair of small terminals is procured and the shanks are cut off, the bases being filed smooth and soldered to discs of brass or tinned iron, not more than ⅜ in. in diameter. If the discs cover too large an area, their capacity will interfere with the working of the experiment. Each of the free ends of wire alluded to above is soldered to one of the terminals, and the discs on which the latter are mounted are secured to the varnished surface of the plates by hot shellac.

In this way the outer extremities of the pair of words are provided with terminals which must be well within the margins of the plates. On the back of each plate a sheet of tinfoil is spread so as to leave a good margin, the best adhesive being thin glue, thinly spread after the glass has been gently warmed; when the latter has had several days to dry, the margin is shellac-varnished so that the coating overlaps the edge of the tinfoil. The sheets are each provided with a terminal mounted as described above, except that the disc may be 1 in. or 2 ins. in diameter, and should only be secured with shellac round the edge.

Each plate is supported in a vertical position by being dropped into a deep groove in a block of wood, and accordingly the bottom margin—that

FIG. 70.—TREATED PHOTOGRAPH OF BRUSH DISCHARGES FROM FACE. (*Exposure about 1 second.*)

is the one under the word—should be wider than the others.

The apparatus is set up and connected with the Tesla coil in the following way :—

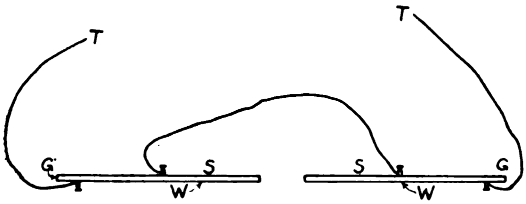


Fig 71.—Plan showing Method of Connecting for obtaining Brushes from Fine Wires.

G. Glass plate.
W. Word or name in wire.
S. Tinfoil sheet.
T. To Tesla secondary.

small, as the most effective results are obtained at rather specially high frequencies.

If a battery of jars or other variable condenser is available, it is worth while to make a series of experiments with widely differing capacities, but if the primary supply is an alternating current or an extremely rapid succession of impulses, considerable adjustment is required to prevent very troublef some arcing, with attendant excessive heating o- the induction coil secondary and the sparking appliances. It is curious to note how the brushes occur at fixed points along the wire, probably where the shellac happens to be particularly thinly laid on.

Mr. Tesla speaks of obtaining extremely fine white streamers when using a very small capacity. Fig. 72 is a photograph of one of the plates, and Fig. 73 is a photograph of the effect obtained.

In Fig. 72—which shows the first of the pair of names—it will be observed that the terminal has been wrongly attached at the end of the name instead of at the beginning. As will be seen, the

Fig. 72.—Photograph of one of a Pair of Names made by Laying Fine Wire on a Sheet of Glass.

The plates are placed in a vertical plane a short distance apart, so that the pair of words reads correctly, and the two terminals connected to the

eminent name chosen was particularly suitable being naturally divided into two parts of the same length.

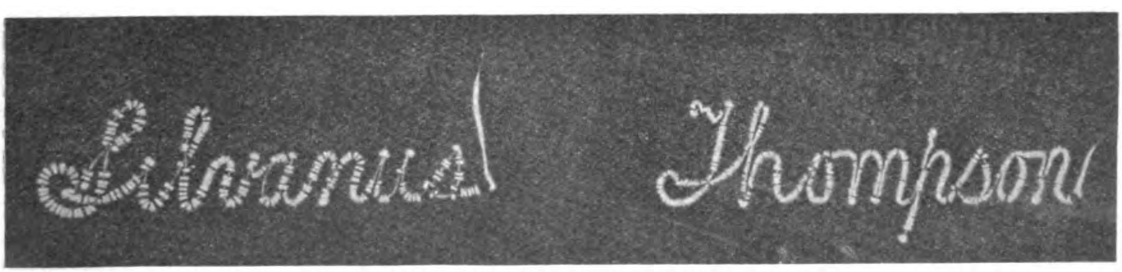


Fig. 73.—Brush Discharge from Wire Names on Glass Sheets. (*Exposure about ½ second.*)

words are joined by thin wire, preferably heavily insulated, to the secondary terminals of the coil.

The terminals of the sheets of tinfoil at the back are simply connected together. These connections are shown diagrammatically in Fig. 71.

The capacity required for this experiment is

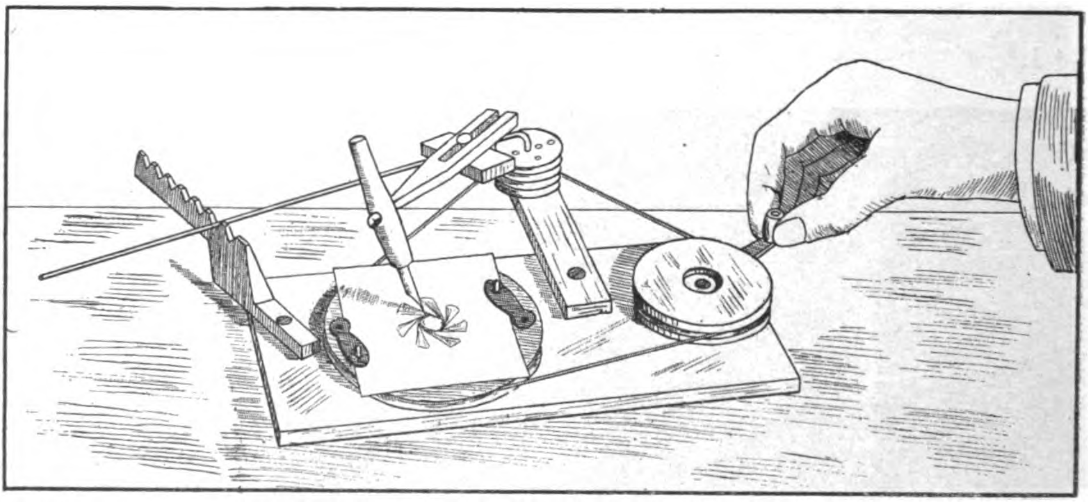
The plates were 24 ins. by 11½ ins., the tinfoil at the back being 20 ins. by 7 ins.; the thickness of the glass was about 3-16ths in., but might well have been slightly greater; the length of each name was 18 ins., and the height of the smaller letters about 1¾ ins.

The Lepine Exhibition in Paris.

SEVERAL years ago M. Lepine, the chief of the Paris Police, conceived the idea of holding an exhibition of mechanical and other toys and of novel inventions, the intention being to give the small manufacturer and the poor inventor an opportunity of bringing his ingenuity before the notice of the public. So successful was the first exhibition, that the Concours Lepine, as it is termed, has now become an annual affair, and the eighth exhibition of the kind has just terminated. A very large number of the exhibits are purely of the toy order, but the French inventor of mechanical and other playthings is a highly ingenious and prolific person, and some very clever notions are on view. That he is up-to-date may be gathered from the fact that the "Flip-Flap" of the Shepherd's Bush Exhibition was represented in miniature on at least one of the stands. A curiously national characteristic of many of the games is their appeal to the gambling instinct, and quite a number of exhibitors were showing miniature outfits such as are, or were, to be found in the gambling saloons of the casinos of the various pleasure resorts in France.

One of the cleverest notions on view was a cheap and simple harmonograph, sold at the price of about 3s. 6d., and producing harmonic curves as pretty and as varied in their characteristics as an apparatus costing ten or twenty times the money. We show an illustration of this device (Fig. 1), which we believe is patented in this country as well as in France, and will shortly be put on the market. It is made throughout in wood, except the sliding rod of the penholder, which is in metal. An ordinary pen nib is used in the holder, which slopes so that the paper is always moving away from the pen. The apparatus is named "The Wondergraph."

Another novelty which, in view of recent correspondence in our pages, may be of interest to some of our readers, was a perpetual motion device, which, sad to relate, was in a state of suspended animation at the moment of our first inspection. At a later visit it was in a better frame of mind, and was slowly turning round. It consisted of a glass disc mounted in a series of threads, the threads forming a double cone with the glass disc as a common base. This will be seen on reference to our sketch. The ends of the threads were secured to discs carried on a spindle which was mounted on light running pivot bearings. These bearings were affixed one to each end of a bath of water in which the glass disc was immersed to about one-third of its depth. A hole was pierced through the centre of the glass plate large enough to fully clear the axle. Although no explanation was attached to the device, we gathered that the threads tighten slightly as they enter the water and slacken again when they leave the water and pass through the air. One side of the cone is therefore always under greater tension than the other, and this produces a slow revolution of the glass disc. A pulley mounted on the axle conveys the impression that the device is capable of driving something, but the bare thought of the size of such an appliance to develop, say, 1 h.-p. is appalling.

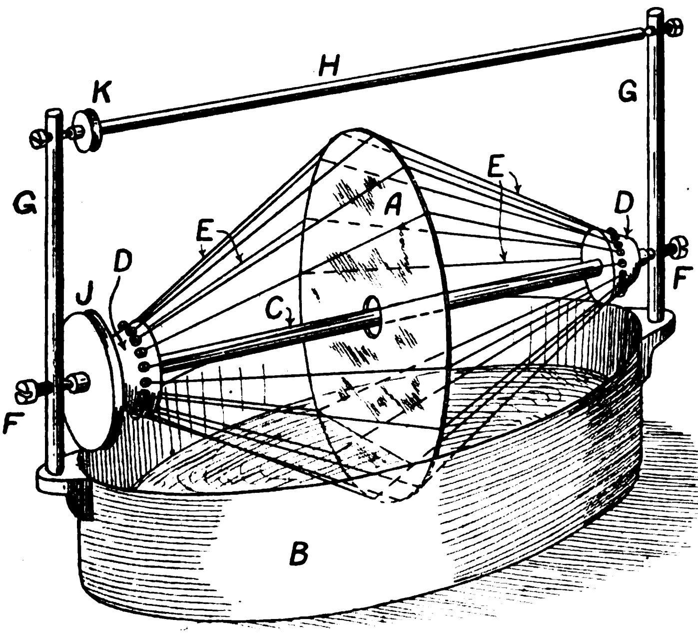


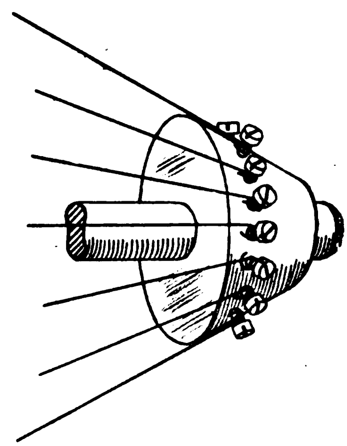
"The Wondergraph" at the Lepine Exhibition.

In the cycling section two novelties are shown—one a bicycle bearing a sunshade mounted on a rod attached to the steering pillar; and the other a machine carrying a chime of bells in lieu of the ordinary horn or single-action bell. We could not ascertain whether the bells produced any tune which was particularly effective in clearing the road.

For the propulsion of boats, another inventor had hit upon the idea of utilising the principle of the Archimedean drill; a spirally-grooved shaft corresponding to the drill spindle being fixed along the bottom of the boat, which carried the propeller at its extreme end. The sliding nut which turned the spindle was operated by a hand-lever which the navigator of the craft moved backwards and forwards. A free-wheel clutch provided for the uni-direction of the propeller.

Models of flying machines, kites, balloons, were shown in great variety, as well as a thousand and one other *jouets* dear to the juvenile heart. Altogether M. Lepine has provided an exhibition of intense interest both to toy makers and toy users, as well as giving the opportunity of publicity to dozens of inventors—some with good ideas and some otherwise, but all enthusiastic and anxious to demonstrate the value of their notions. It was, however, lacking in any serious efforts at model engineering, with the exception of two models of locomotives of the Nord Railway. One of these was built up from a set of castings and the other made up in wood. These, however, were so crude as compared with what is accomplished in our own country that they did not call for detailed notice.





Method of Fixing the Ends of the Cords.

A Perpetual Motion Machine at the Lepine Exhibition.

Obviously the French have not yet reached a sufficient stage of model development to make a display at all comparable with The Model Engineer Exhibition of 1907, but there are signs that they are moving in that direction. We wish M. Lepine all success in his efforts to promote interest in the subject.

Engineering.—An additional course of lectures on tools and modern workshop practice is being given at the temporary Castle branch of the Merchant Venturers' Technical College, Bristol, on Thursday evenings by Professor John Munro, M.I.Mech.E. The course will deal with the various kinds of tools and machinery used in engineering shops. Further particulars are obtainable from the Secretary.

Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "Workshop" on the envelope.]

Method of Removing Agglomerate.

By C. J. T.

Agglomerate block Leclanché cells that have run down should have new agglomerate blocks in place of the old ones, which is nearly always the cause of failure. If the following method be applied, the old blocks will do again and give better results. Take the carbon plate or rod, with the agglomerate blocks attached, and immerse almost up to terminal in a porcelain trough filled with sulphuric acid and water (1 part acid, 100 parts water). Opposite the carbon plate, and about 18 ins. distant, have an iron plate. The number of plates that can be done at one time depends on the size of trough.

Connect the carbon plate to the positive pole of a dynamo or other source of current, and the iron plate to the negative pole. On passing a current through (about 2 amps. per plate) the following action takes place. Oxygen is generated at the carbon plate, and is absorbed by the peroxide of manganese in the agglomerate blocks. Hydrogen is generated at the iron plate and allowed to pass off; an important cleaning action is also undergone by the carbon plate during the process. The time occupied in doing one plate and blocks is about two hours (or any number joined in parallel). It will be found that cells done in this manner will be better than when new, and will keep good. The use of sulphuric acid in the bath is merely to lower the electrical resistance of the water. The pressure of current (E.M.F.) does not materially matter, as long as the quantity of current is sufficient.

An Anti-friction Thrust-plate for Lathe Headstock.

By N. E. N.

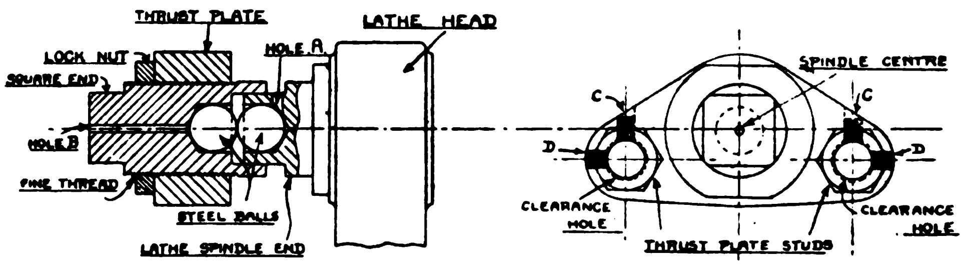
In most amateurs' lathes the thrust of the fast headstock mandrel is generally taken by a screw, and a pad of soft material, such as brass or vulcanised fibre; this arrangement wears out very quickly, and is hardly as frictionless as might be desired. The annexed sketch shows a design which is not difficult to make, and is applicable to any lathe that is not of the hollow mandrel type; those, however, who do possess hollow mandrel lathes have generally a proper ball thrust bearing and hardened races, etc.

This design is for those who have just the ordinary type of lathe and would like to fit an anti-friction thrust of simple design. As will be seen from the drawings, the whole of the thrust is taken by two hardened steel balls, such as are used in motor-car work, etc. The end of the lathe spindle is drilled up to receive one ball, and the thrust-screw drilled up to receive the other. Here is just the point where care must be exercised, the holes in each case being just large enough to allow the balls to be driven in fairly easily, but held firmly enough to prevent rotation, so that when the spindle rotates, the spindle ball is driven round and the ball in the thrust-screw is held stationary, causing the whole of the friction to come on the two balls at the point of contact, the friction being practically a minimum. It will be seen from the drawings that the spindle end is turned down and runs inside the end of thrust-screw, which is suitably recessed for same; this ensures that the two balls will come exactly opposite one another, and will not tend to run off one side. A small space is allowed in the thrust-screw for the spindle end to move further up as wear takes place, but, considering the perfection of hardened steel balls, it will be some time before any appreciable flat appears on either ball. However, when a flat has worn on the balls, knock them out from their seatings, and do not throw them away, but just simply turn them round a little way, so that a new surface is presented at the point of contact. This is a very useful feature from an economical point of view.

The hole A in spindle end, and the hole B drilled up the end of thrust-screw, are provided for the purpose of knocking out the balls from their seats when required. The thrust-screw is screwed with a fine thread, and the end is provided with a square for turning screw when making adjustments; this thrust-screw is locked in position by means of a thin lock-nut, as shown.

The thrust-plate can be made out of cast iron, but is better made of steel, then it need not be so large; the thrust-screw is, of course, made also of steel. Let me again point out that the balls must fit nice and tight in their seats.

In lathes which have conical bearings, as wear takes place, the spindle centre does not drop; but in lathes having ordinary parallel bearings the spindle centre is bound to drop slightly, and would cause spindle end to bind where it runs inside the thrust-screw, and then, again, the balls would not be exactly in line. To accommodate this, the holes in thrust-plate for the studs are drilled a little larger than the size of stud, and two small grubscrews C C are placed as shown, and bear down on to the thrust-plate studs; also, two more grubscrews are provided at D D, for setting thrust-screw dead in line with lathe spindle. These adjusting screws relieve the amateur of very accurate working, and allow of the thrust-plate being adjusted and tightened up afterwards without any fear of it moving or slipping out of place. The space in between the balls can be filled with grease when fitting up the thrust-plate.

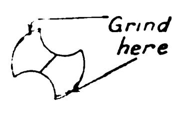


SECTION AND END VIEW OF THRUST PLATE FOR LATHE HEADSTOCK.

To Make Small Drills.

By T. ROBSON.

A cheap and simple method of making a small drill is to procure a sewing machine needle (fluted type) and break off the point at the eye: then grind the same as an ordinary drill, and fit in a brass stock. It may be advisable to grind one side of the needle to make a clearance for cutting, as shown in sketch.



A Prize Competition for Small Gas Engines.

We note from a recent issue of *The Journal of Gas Lighting* that a Prize Competition for small power gas engines is being organised by the Société Technique du Gaz, 105, Rue Saint Lazare, Paris. Full particulars may be obtained on application to this address, but we may say that the engines must be sent in by March 1st next, and will be divided into three classes: (*a*) Under 2 h.-p.; (*b*) between 2 and 5 h.-p.; and (*c*) above 5 h.-p. The tests will commence on May 1st, and successful competitors will receive an honorary award and diploma, in addition to which the value of the prizes may be any sum up to 10,000 francs, or £400. The idea of the competition is to encourage the output of first-class engines of small dimensions.

Gear Wheels and Gearing Simply Explained.

By ALFRED W. MARSHALL, M.I.Mech.E., A.M.I.E.E.

(*Continued from page* 294.)

THE teeth of gear wheels rub together whilst in motion, causing friction and wear of the surfaces. It is reduced by designing the teeth so that the path of contact is as short as possible. The friction which takes place during engagement in the arc of approach—this would be to the left of X Y (Fig. 17)—is considered to be more detrimental than that which takes place during engagement in the arc of recess—this would be to the right of X Y (Fig. 17). The teeth rub to greater disadvantage when coming into contact than when disengaging. On this account designers of wheel gear in which it is of

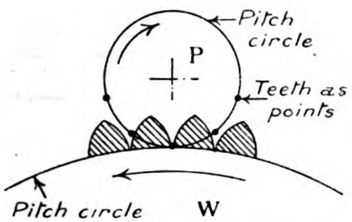


FIG. 18.

great importance that friction and wear should be eliminated as much as possible, such as watch and clock gearing, have favoured teeth which only make contact when they have reached the line of centres. Engaging friction is thus reduced to a minimum. This action will be accomplished if the driven-wheel teeth are made without points—that is, they would not have a part which projects beyond the pitch circle. For example, wheels having complete teeth, such as Fig. 17, come into engagement before the line

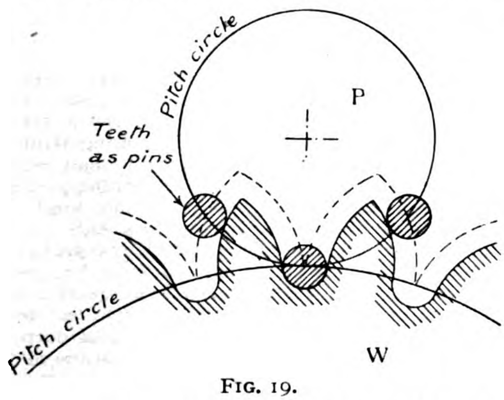
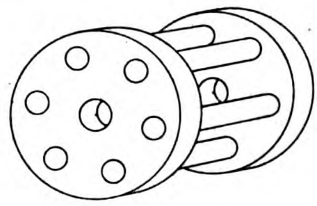


FIG. 19.

of centres X Y. At this stage the flanks of teeth on wheel B make contact with the faces of the teeth on wheel A, assuming B is the driver. After passing the line of centres the faces of teeth on wheel B make contact with the flanks of the teeth on wheel A. Therefore, if we desire that contact shall only be made after the line of centres, the points of the teeth on A should be removed. It follows from this that the roots of the teeth on B will not be required, and as the engagement is only to take place at, or after, the line of centres, B must be the driver. If A be the driver, the engagement will take place only after the line of centres, which is the condition in this instance to be avoided. The teeth having points are therefore to be put on the driver, and those having no points are to be upon the follower. If cycloidal teeth are used (they should be used), the curve of those upon the driver

FIG. 20.



will be an epicycloid, and that of the teeth upon the driven wheel a hypocycloid. This leads to two distinct forms of teeth for the driven wheel. If the curve-generating circle is made to have a diameter equal to the radius of the pitch circle of the driven wheel, the hypocycloid becomes a straight line (as previously explained), and the teeth have merely straight radial lines for the shape of their flanks. In the second case the curve-generating circle is made to have a diameter equal

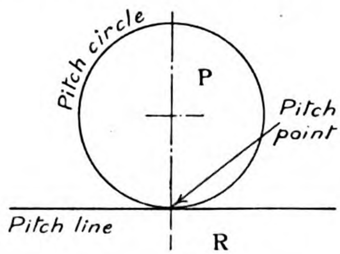


FIG. 21.

to that of the pitch circle of the driven wheel; the hypocycloid then becomes a point and the teeth may be pins projecting at a right angle to the side of the wheel. This is the only instance in which the hypocycloid formed by a generating circle of such a proportion to the pitch circle is used for wheel teeth.

When the curve-generating circle is made of a diameter equal to that of the pitch circle in which it rolls, and the hypocycloid becomes a point, some practical modification is necessary, because the teeth are, theoretically, merely points, which, according to Euclid's definition, have no parts nor magnitude. Obviously the teeth must have some thickness, and they become pins as a practical construction. Fig. 18 is a diagram showing the teeth of a pinion (P) as points, being the hypocycloid we have produced by using a curve generating circle having a diameter equal to that of P. The teeth on the wheel W are entirely outside the pitch circle, and the faces are epicycloids produced by rolling the circle which has generated the point teeth of P upon the pitch circle of W. To make a practical working construction we fit cylindrical pins to P to form teeth. This is quite justifiable, as a circle is the equivalent of a point, and therefore in the particular instance is logically a hypocycloid. The teeth on W as originally formed to engage with points are represented by dotted lines, Fig. 19. If we enlarge the points and give them a sensible diameter so that they become pins, it will be necessary to cut away some portion of the teeth of W to provide room for the pins to engage between the teeth; as already explained, we may not alter the distance between

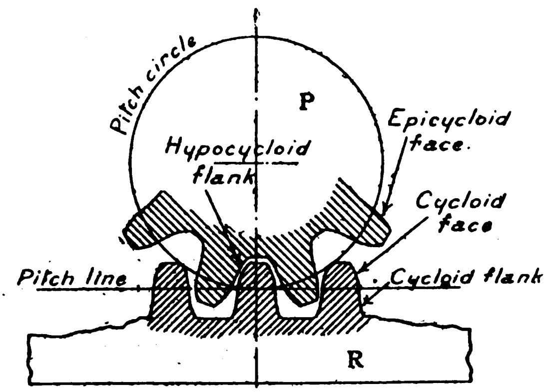


FIG. 22.

the centres of the wheels. Space for the pins is provided by cutting away a portion equal to half the diameter of one of the pins from each face of a tooth along a line parallel to the original curve of the face. This will leave the teeth with the size and shape as indicated by the full lines, Fig. 19, the curves still being epicycloids. To complete the clearance space a semi-circular space is cut away below the pitch line of W between each pair of teeth. This procedure may be understood by imagining the pin to be a milling cutter moving with its centre coinciding with the original lines of the teeth, and thus cutting away the amount of metal

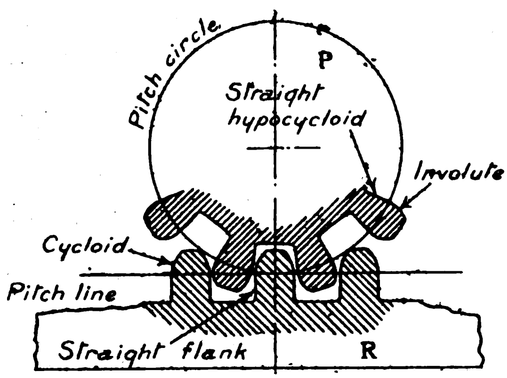


FIG. 23.

necessary to allow the pins to engage. In such a gear, if W is the driver, the engagement of the teeth of the pair of wheels will take place almost entirely after the line of centres. As this is really the object for which the peculiar arrangement is designed, whenever it is used the wheel having the projecting teeth is always made to drive the one which is provided with pins. If the pins are made to drive the teeth, the engagement takes place before the line of centres, and the object of the design is lost. Gears of this kind may also be made in the form of a rack and pinion. The arrangement is much used in clockwork, the wheels with the pins appearing in the familiar form shown by Fig. 20: it is called a lantern pinion. In the main train of wheels of a clock the driving force passes through the gearing from the great wheel, which is driven by the spring or weight to the escapement. The wheels, therefore, drive the pinions, and the latter can be provided with pins as teeth, hence the extensive use of lantern pinions for clockwork. They have incidentally the advantage of being very strong and durable.

It is possible to design a pinion, also, to engage after the line of centres, with teeth having radial flanks. The number of teeth must be at least ten, and it may be necessary to cut the spaces between the teeth of the pinion with extra width. There would thus be a certain amount of play between the wheels, which would be permissible in clock-gearing where the teeth move slowly, and are kept in contact by a steady constant pressure. Though the teeth of such pinions need not project beyond the pitch circle, they are usually made with

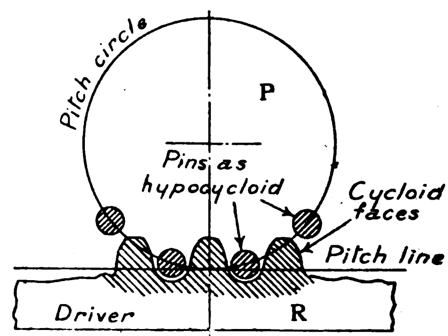


FIG. 24.

a round end projecting beyond the pitch circle by an amount equal to half the thickness of the tooth, to ensure smooth engagement as the teeth come into action. Clock and watch gearing require large wheels driving very small pinions, and work under special conditions. Anybody contemplating the construction of time-keeping or similar mechanism should consult a treatise on clock and watch gearing. The principles upon which the teeth of the wheels are constructed are, however, precisely those which govern the design of wheel-gearing for machinery in general. Smooth action is very important, therefore the teeth must be of correct design to preserve the relative velocities of the pitch circles. Practical modifications would be introduced to meet the peculiar conditions of clock gearings. For example, the spaces at the roots of the teeth of W, Fig. 19, would probably be cut somewhat deeper than indicated, and rectangular instead of semicircular, the sides being radial lines. The teeth of W would be of less width than the spaces between the pins on P, this amount of play permitting engagement to take place at or very near to the line of centres. The best length for the teeth of W would probably be found by experiment.

A rack and pinion gear may be considered as a pair of toothed wheels, one of which, the rack, has a pitch circle of infinite radius—that is, it is a straight line. The teeth can, therefore, be shaped according to the principles already explained. Provided the rack is made of sufficient length, the pinion can be made to give any desired number of revolutions for one stroke of the rack or the rack to move any desired length of stroke for one revolution of the pinion. The gear is to be planned according to the principle used for designing a pair of toothed wheels. The pinion P is represented by its pitch circle, and the rack R by a pitch line, Fig. 21, which is really the pitch circle of a second wheel stretched out to form a straight line. They touch one another at pitch point x. The pinion may drive the rack, or, conversely, the rack may drive the pinion. As with a pair of wheels, the teeth should be of such a shape that the relative velocities of the pitch circle and line are maintained. The length of stroke which the rack will make for one revolution will depend upon the diameter of the pitch circle of the pinion. When planning a rack and pinion, therefore, the positions of the pitch circle of the pinion and pitch line of the rack should be determined first without regard to the teeth of either. The distance which the rack will move for one revolution of the pinion will be equal to the circumference of the pitch circle of the pinion. Thus, if the diameter of the pitch circle of the pinion be 4 ins., the rack will move 12½ ins. for each revolution of the pinion. Conversely, if the rack drives the pinion, the latter will be rotated one complete revolution if the rack be moved through a stroke of 12½ ins., and so on.

If the rack or pinion are to be indiscriminately driver or follower, the teeth should be partly formed outside the pitch lines and partly inside, as in the case of a pair of wheels. The curves of the teeth of the pinion will be as follows—the faces epicycloid and the flanks hypocycloid. The curves of the teeth of the rack will be as follows—the faces cycloid, and the flanks cycloid also, because in each instance the curve generating circle is rolled upon a straight line (see Fig. 22): the diameter of this generating circle may be anything not exceeding the radius of the pitch circle of the pinion, and the same generating circle can be used to form the whole of the curves. If a set of wheels is required of different diameters and numbers of teeth, any one to work with the rack, the generating circle should be equal to the radius of the pitch circle of the smallest wheel. The pitch of the teeth is measured on the circumference of the pitch circle of the pinion and along the pitch line of the rack. It may be expressed as diametrical pitch in terms per inch of the pitch circle diameter of the pinion, as previously explained; it will thus also apply as pitch in number of teeth per inch length of the rack. When the curve generating circle has a diameter equal to the radius of the pinion pitch circle the teeth of the pinion will have straight radial lines for the flanks, as previously explained, and the rack teeth will have curved lines for both faces and flanks, the curves being a cycloid. The teeth of the rack may, however, be made to have straight radial flanks. As the radius of a straight line is of infinite length, the flanks of such teeth will be straight lines perpendicular to the pitch line. The faces will be a cycloid formed by the generating circle, which produces the straight radial flanks of the pinion. The faces of the pinion teeth, however, should not be an epicycloid curve, because they should be produced by the generating circle which has produced the so-called radial flanks of the rack. But this circle is one of infinite radius—in fact, it is a straight line. Therefore, the faces of the pinion teeth should be curves produced by rolling a straight line upon the circumference of the pitch circle; the curve should thus be an involute of the pitch circle of the pinion (see Fig. 23).

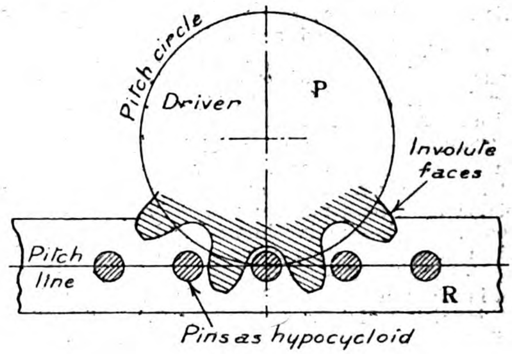


FIG. 25.

The rack of the pinion may be fitted with teeth in the form of pins on the principle explained with reference to Figs. 18 to 20. As in the case of a wheel and pinion, the pin teeth should be on the follower and not on the driver. If they are placed upon the pinion, the rack should therefore be the driver; if they are placed upon the rack, the pinion should be the driver. The pins represent a hypocycloid produced by a curve generating circle having a diameter equal to that of the pitch circle of the wheel upon which they are placed. Therefore, if they are placed upon the pinion, the teeth of the rack will be formed by a cycloid curve produced by a point on the pitch circle of the pinion when it is rolled upon the pitch line of the rack.

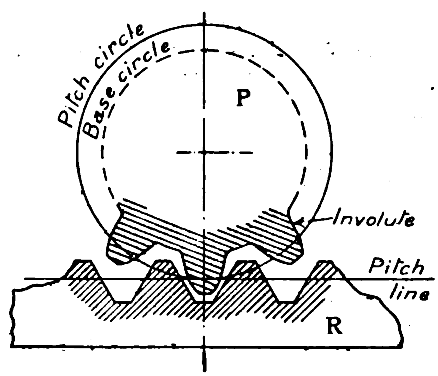


FIG. 26.

The rack teeth will be composed of the part which projects above the pitch line, so that they will have faces only and no flanks (see Fig. 24). If the pin teeth are placed upon the rack, they represent, as before, a hypocycloid produced by a curve generating circle having a diameter equal to the pitch circle upon which they are placed. In this case the pitch circle is a straight line, therefore the curves of the teeth of the pinion should be produced by rolling a straight line upon its pitch circle. The curve thus produced will be an involute of that pitch circle. The teeth of the pinion are, therefore, shaped to an involute curve, and consist of the part which projects beyond the pitch circle, no flanks being required (see Fig. 25). Gears on this principle should work very smoothly if properly made, as the friction between the teeth takes place almost entirely after they have passed the line of centres. Theoretically, the pin teeth are points, as in Fig. 18; the spur teeth of the driver are cut away to allow for the thickness of the pins, as previously explained with reference to Fig. 19.

The teeth of both rack and pinion may be formed on the involute principle, either to be indiscriminately the driver. In this instance the teeth of the pinion have both faces and flanks formed by one curve, namely—an involute formed by rolling the pitch line of the rack upon a suitable base circle (see Fig. 26). The teeth of the rack must also be an involute in theory. But the involute of a circle of infinite radius is a straight line. The teeth will therefore be formed of a straight line for both faces and flanks, and the line should be inclined so that it is a tangent to the curve of the teeth of the pinion. As in the case of a pair of wheels, the pitch circle of the pinion and pitch line of the rack must be in contact, or the relative velocity will not be kept constant except when the teeth are formed upon the involute principle.

(*To be continued.*)

Chats on Model Locomotives.

By H. Greenly.

(*Continued from page* 324.)

The L.S.W.R. No. 580 as a Prototype.

A correspondent of The Model Engineer recently requested the publication of an outline drawing of the 580 Class of express engines which were built by Mr. Adams about 1892 for the London & South Western Railway. In supplying the same it has occurred to me that a few notes, from a model-maker's standpoint, on the possibilities of these engines as prototypes would not come amiss to a certain section of the readers who have a fancy for this type of locomotive.

From the time I became acquainted with these locomotives, I have viewed them with mixed feelings and regret. I am forced to admit that they rank among the finest outside cylinder 4—4—0 type engines within the shores of this island; but, if Mr. Adams could only have looked 10 or 15 years ahead, to the time when the traffic department of his railway would require him to provide locomotives with 50 per cent. more power, what fine engines they would have made with larger and higher pitched boilers. However this may be, the L.S.W.R. 4—4—0's were in their day extremely efficient machines, and when tested against a "Webb" compound, held their own without difficulty both in time-keeping and consumption of fuel.*

As models, I can number more than one successful engine built exactly to the original proportions—Mr. S. L. Thompstone's excellently made model, which was illustrated in the issues of May 25th, 1905, and March 12th, 1908, for example. In a private letter Mr. Thompstone sends me a few particulars of the performances, and he claims an i.h.-p. of ·22, or nearly ¼ h.-p., from a ¾-in. scale model of No. 580. This would mean an evaporation of at least 5 cubic inches of water per minute, which is large for a ¾-in. scale boiler, even when forced. However, he writes saying that the engine maintained 50 lbs. pressure at over 750 r.p.m., under load.

Presuming a similar measure of success with a model of No. 580 as originally designed can be obtained by a model-maker less skilful than Mr. Thompstone, the desire for a larger boiler is, I think, still defensible. In the case of a smaller model of ½-in. or 7-16ths-in. scale, No. 580 does not allow much room for the inner barrel and water tube. The outer shell of a 2½-in. gauge engine would not be more than 2 5-16ths ins. This gives, with a ⅜-in. flue space under the barrel, a diameter of inner tube of not more than 1½ ins., which is manifestly insufficient, if any length of run without replenishing the water is required. In 2-in. gauge an inner barrel of only 1¼ ins. diameter is possible.

This being the case, in addition to the outline drawing of the engine as designed and built by the late Mr. Adams, I have made a forecast of what the designer might have done had be been confronted with the problems of locomotive engineering of to-day. Except in the matter of length, the outline Fig. 2 shows a boiler of the same general proportions and pitch as those built for the Caledonian and L.N.W.R. latest 4—4—0 type engines. The use of the circular extended smokebox is optional, of course. In my opinion, it suits the particular design, and consolidates the appearance of the engine at the front end. The wheelbase of the bogie used in the 580 Class is exceptionally long, and with the ample amount of frame projecting above footplate level and in front of the leading bogie wheels, creates, in conjunction with the very narrow smokebox, a rather displeasing appearance at the front end of the engine. The footplate being also raised above the normal height right to the front buffer plank also makes the boiler look somewhat smaller than it really is.

In the sketch Fig. 2 I have modified these points. The extension of the main frames beyond the leading wheel of the bogie is reduced to the more normal dimensions of 2 ft. 5½ ins., *i.e.*, 1¼ ins. for ½-in. scale engines, and 1 11-16ths ins. in the case of a 3½-in. gauge model. A guard iron of more graceful shape is also substituted for the style of thing used in the actual L.S.W.R. engines.

With reference to the raised portion of the footplates, builders of small models especially will find the work rather closer than they would wish

* The actual engines in these trials were slightly smaller than No. 580. Their fuel-consumption was only 27 lbs. per mile. The 580 Class in the tests described by Mr. Pettigrew were more powerful and averaged 31 lbs. per mile. I understand that even this was much lower than that of the compound.

at the splashers, and while the drawing Fig. 2 shows the footplates from the cylinders to the trailing wheel at the same height as in Fig. 1, an alternative and larger dimension is suggested. This, with the reduction of the stroke to the scale equivalent of 24 ins.,* will provide additional clearance between the 4—4—0 and 4—2—2 type will have experienced the difficulty of providing sufficient lateral play for the trailing bogie wheels on curves, owing to the close proximity of the crosshead to the tyres. The placing of the coupling-rods inside the connecting-rods on the driving crank-pin, as is

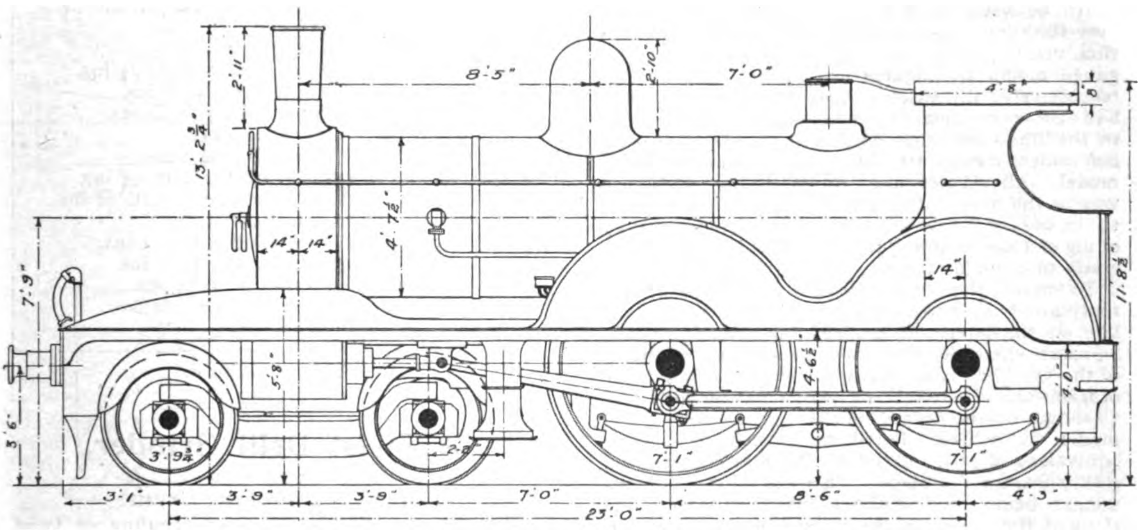


Fig. 1.—Mr. Adams' L.S.W.R. 4—4—0 Type Outside Cylinder Express Engine, No. 580 Class.

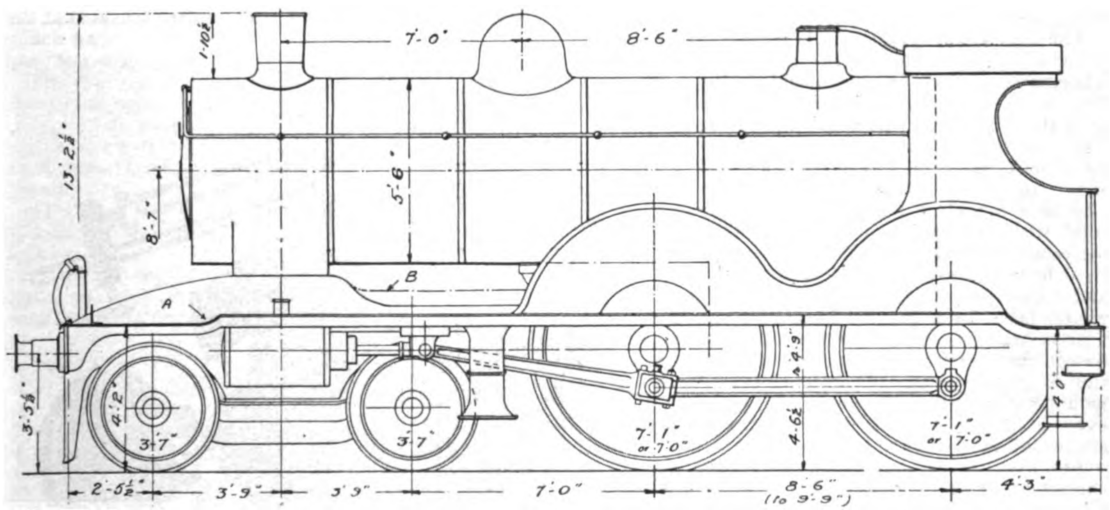


Fig. 2.—Design for a Model L.S.W.R. 4—4—0 Type Engine, with Larger Boiler.
(Dimensions as for actual locomotive.)

the footplate, angle edging, splashers, and the outside motion. The importance of this will be noticed in 2½-in. gauge engines, especially where the suggestion for placing the connecting-rods outside the coupling-rods (see Fig. 2) is adopted.

Those who have built outside cylinder engines of

* In most model locomotives it is advisable to do this for the sake of obtaining a thicker piston and more efficient packing.

usual in the case of "Atlantic" type locomotives, increases this side play to the extent of the width of the coupling-rod brass on each side. With the L.S.W.R. engine 580, the connecting-rod is housed on the top portion of its stroke by the main splasher (actual width over splashers and cab, 7 ft. 3 ins.), but where the centres apart of the cylinders are increased to make room for the movement of the bogie, the connecting-rod would most likely foul the footplates, and the raising of the footplates to the scale equivalent of 4 ft. 9 ins. (as suggested) rendered necessary. I cannot give dimensions which will work out correctly in every scale. As all those who have had to deal with various sizes of models are aware, the differences in the character of various portions of the model are considerable. For instance, in an inch scale working model the width between tyres is 4 7-16ths ins., and width over the tyres twice the tyre width (½ in.) in addition, viz., 5 7-16ths ins. In a half-inch scale 2½-in. gauge model the figures are 2¼ ins. and 2¾ ins. respectively, dimensions noticeably greater than half those common to 1-in. scale. This is due to the standard gauge employed and the necessity for wider treads to the tyres in smaller scale model. Allowances must therefore be made one way or the other in the amount of projection given to the boss of the wheel, splasher widths, dimensions of big end and coupling-rod brasses, and the distance apart of cylinder centres, to suit circumstances.

To make the engine look more massive, the footplate is shown dropped to normal level at A, like on the later 7-ft. engines, viz., No. 682 Class. In cases where the work to the frames of an engine of the 580 Class is not already completed, the depth of frame over the rear bogie wheels may be increased, as shown by the dotted line B, Fig. 2. In a small model the wheels should be turned to a scale equivalent of 7 ft. for the driving and coupled and 3 ft. 7 ins. for the bogie. This will allow of deeper flanges being used without interfering with the sizes of the wheel splashers and other parts, and will also provide for the proportionately thicker material which must be employed in models of small scale.

The only other point which concerns the general design of the engine is the coupled wheelbase. For an ordinary ½-in. or 7-16ths-in. scale model the scale equivalent of 8 ft. 6 ins., the wheelbase of the actual No. 580 may be adhered to, as the firebox back-plate may be placed in the position shown by the dotted line in Fig. 2. In the case of a model of larger proportions using solid fuel best results will be obtained by increasing the length of the coupling-rod to at least the scale equivalent of 9 ft. 9 ins., and using a deep firebox. For a ¾-in. scale model fired by a Primus burner, a shallow firebox with the back portion of the foundation-ring directly over the rear axle and the original wheelbase will suffice. There would not be sufficient room for two burners, even if the wheelbase were lengthened as suggested on the drawing.

For very sharp curves the bogie wheels should be reduced to 3 ft. (*i.e.*, 1½ ins. for ½-in. scale, and 2 1-16th ins. diameter for 3½-in. gauge).

Readers who may go to some point on the South-Western system to view these engines should take care not to confuse the No. 580 Class with the No. 561 engines. The latter are much the same in general appearance, but have 6 ft. 7 ins. driving wheels, and 3 ft. 7 ins. bogie wheels. The firebox and coupled wheelbase is also 6 ins. longer. I believe the 682 Class have also the extended coupled wheelbase, and no splashers over the wheels of the bogie.

Drawings of the tender, by Mr. S. L. Thompstone, appear in The Model Engineer for March 12th last, to which issue all readers interested are referred. I append a few dimensions of No. 580, which may be useful to makers of models.

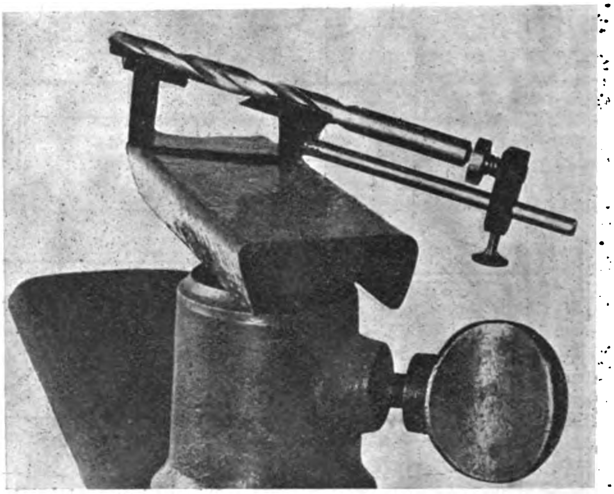
Leading Dimensions of No. 580 L.S.W.R., not given on the drawings.
Width between frames (straight throughout), 3 ft. 11½ ins.
Thickness of frames, 1 in.
Distance between cylinders, 6 ft. 2½ ins.
Centres of valve spindles, 2 ft. 6 ins.
Length of eccentric-rods, 5 ft. 4 ins.
Centres of buffers, 5 ft. 9 ins.
Width of cab (outside), 7 ft. 3 ins.
Diameter of cylinder covers, 2 ft. 0¾ ins.
Width of leading buffer beam, 7 ft. 11 ins.
Width over footplates, 8 ft.
Length of firebox (outside), 6 ft. 4 ins.
Length of connecting-rod 6 ft. 8 ins.
Total length of frame, 30 ft. 4 ins.
Cylinders, 19 ins. by 26 ins. stroke.
Driving wheels, 22 spokes.

(*To be continued.*)

A Twist Drill Grinder.

By T. Goldsworthy Crump.

The subject of the proper grinding of twist drills seems—to judge by correspondence—a matter on which there appears considerable doubt and difficulty, and the writer trusts that this contribution may prove acceptable to those desiring a cheap, easily-constructed guide for holding drills during grinding. A simple guide-block embodying the angles given has been in use for many years, and the one herewith illustrated is the outcome of improvements suggested from time to time.



Twist Drill Grinder in Position.

On reference to the drawings — which are to scale, so that enlargement or reduction can easily be made to suit individual requirements—

Figs. 1, 2, and 3 show respectively plan, side, and end elevations of sliding portion. Figs. 4, 5, and 6 give similar views of base, which is carried in the socket of the hand-rest or otherwise. Fig. 7 shows the block for adjusting the exact length of drill being operated upon. Fig. 8 illustrates brass block carrying-arm, and Figs. 9 and 10 the angles which have to be carefully observed in the setting-out of the drill carrier.

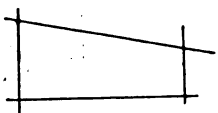


Fig 11.

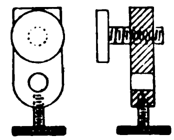


Fig 7.

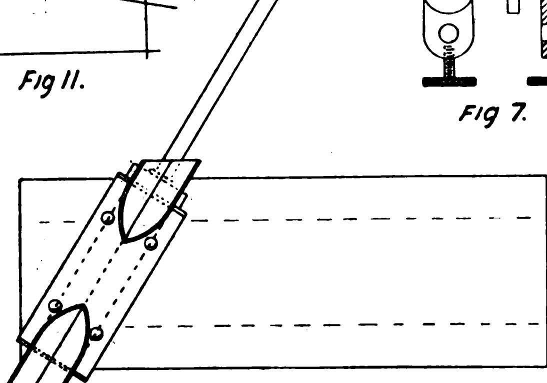


Fig 1.

The first portion to take in hand is the top slide, shown in section in Fig. 2. For this a piece of brass or copper plate, 5½ ins. in length by 4 ins. in width and 1-16th in. thick is required, and is bent as shown, care being taken to keep the sides quite parallel.

The top of support, shown in section in Fig. 4, is made out of hard wood, and should be quite an easy fit in the top slide, although the angles must be true and the sides parallel. Two strips of brass are now fastened to the bevelled faces, as shown, with countersunk screws. This block must now be adjusted to the top slide. If too tight, the brass strips must be unscrewed and the wood reduced; if, on the other hand, the block is slightly slack, the brass strips can be packed up with tin or paper. The slide should be a nice push-fit, without shake or slackness.

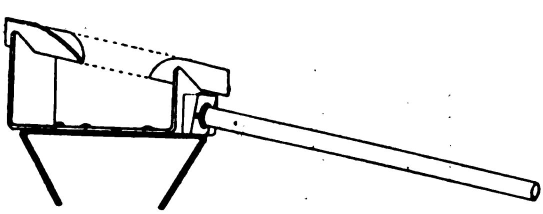


Fig 2.

The pillar may be of hard wood or metal, and does not require description, except that it must be at right angles to the block.

The next portion to claim attention is the ⊔-shaped support. A length of brass is taken (3¾ ins. long by ⅞ in. width), and a line is scribed exactly in the centre on both sides. The piece is now bent as shown in Figs. 1, 2, and 3, care being taken that the sides are parallel throughout. A full-size diagram of the angle should be set out on a piece of cardboard or tin, as shown in Fig. 11, and the base of the ⊔-piece adjusted exactly over the lower line. The intersection of the top line can now be scratched on edge of strip on each leg, and with a square carried across to intersect the line previously scribed through the centre of the piece; the points of intersection being the bottom of the two vees. From these points the right-angled vees are set out at 45 degs. with the base. These can now be sawn out and carefully filed up to the scribed lines. For the trough a piece of brass 3 ins. by ¾ in. is bent lengthwise in the centre, so that the sides are at right angles. The brass block (Fig. 8) is filed up to the angle and dimensions shown, and tapped to receive rod, and drilled for small rivets. This can now be attached to outside of the shorter leg, being riveted exactly central, and later sweated with solder.

The support can now be fixed to the top slide at an angle of 59 degs. A template should be prepared, as before, giving this angle, with which it is an easy matter to transfer it exactly to the top slide, when the line should be scribed. The support is now carefully adjusted to this line and secured by rivets, and soldered. The trough can now be soldered in position and the centre portion sawn out with a fretsaw—so that the fingers can hold and revolve the drill—and the ends nicely filed up.

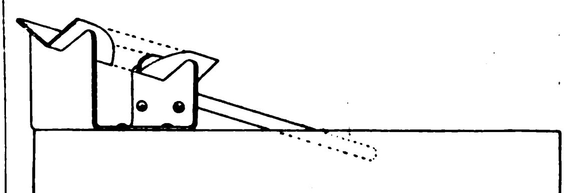


Fig 3.

The rod to carry the adjusting-screw block does not require explanation, and Fig. 7 will show the construction of the block and screws.

In use, the base is set exactly at right angles to the spindle carrying the emery wheel. The height is adjusted so that the drill to be ground is about level with spindle, and the side of the wheel is employed, not the edge.

The drill to be ground is laid in the trough, with one cutting edge horizontal and in contact with the wheel. The adjusting block is brought up and secured. The emery wheel is now put in motion, and the drill advanced by means of adjusting screw until sufficiently ground at edge. The drill is now turned half round and the other edge ground without altering adjustment, thus ensuring both lips being identical. Then the drill should be slightly revolved by the finger and thumb to give relief to the cutting edge, this being repeated for the other lip. The extreme heel of drill can be removed by holding the drill by hand at a greater angle or altering angle of base. While grinding, the slide should

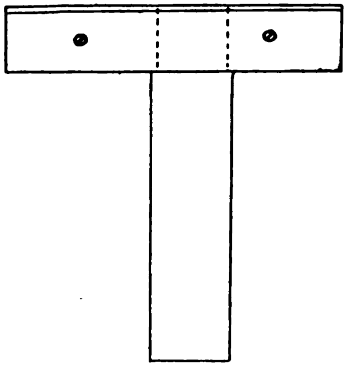


Fig 5.

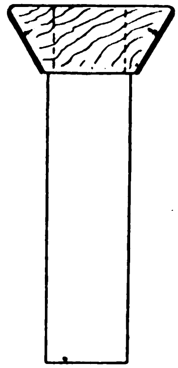


Fig 4.

be moved backwards and forwards, so that a perfectly straight edge shall result.

With a very little practice drills can be set with this holder that will drill perfectly true holes and

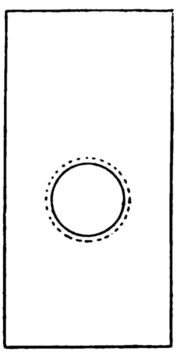


Fig 6.

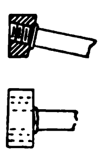


Fig 8.

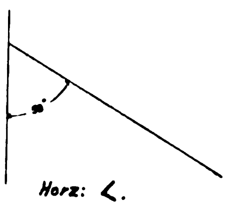


Fig 9.

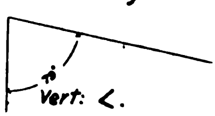


Fig 10.

to exact diameter, the shavings from each lip coming off in equal quantities, and the drill doing its work without undue pressure or excessive power.

Correspondence Tuition.—A syllabus of correspondence courses in electrical engineering has been received from the University Engineering College, Stanstead Road, Forest Hill, London, S.E. Instruction is given in the following subjects: A, Elementary Electrical Engineering; B, Electric Light and Power; C, Central Station Practice; D, Design of D.C. and A.C. Generators; E, Electric Wiring; F, Electric Power Distribution; G, Complete Electrical Engineering; and H, Electric Traction. Further particulars may be had from the Secretary, who will be pleased to forward a syllabus on application.

The Colouring of Various Metals by Lacquering, Bronzing, etc.

By C. A. G. Standage.

Lacquers differ from varnishes in the matter of the solid constituent, which, in the case of lacquers, is shellac, whereas in varnishes it is resins of various kinds; moreover, the fluid solvent is always alcohol or methylated spirit, but in varnishes it may be either spirit, oil, or turpentine.

A solution of shellac in spirit forms a fluid which dries quickly and with a gloss, and can be heated or baked on a surface (Japan).

The following recipes are typical for lacquers used for metals:—

The First Operations in Lacquering Brass.

Be sure there is no grease or oil on the brass. Do not touch the work with the fingers, but hold it with tongs or by a tapered stick in some of the holes that may be in the piece of work. Always handle with a piece of clean cloth. Heat the brass so hot that the brush will smoke when applied, but avoid overheating, as it burns the lacquer. It is well to fasten a small line across the lacquer cup from side to side to scrape away any surplus lacquer. The brush should have the ends of the hairs all exactly equal and even. If not so, trim the ends with sharp scissors. Scrape the brush as dry as possible on the wire, making a flat smooth point at the same time. Use the very tip of the brush to lacquer with, and carry it with a steady hand. Put on at least two coats. It is well (in order to make a durable coating) to blaze off each coat with a spirit lamp or Bunsen burner, taking care not to overheat and burn the lacquer. If the lacquer is too thick it will look gummy on the work; if too thin, it will show prismatic colours. In the first case, add a little alcohol; in the latter case, set the cup on the stove and evaporate some of the lacquer to make it thicker.

A good deal of cheap work, like lamp burners, is dipped thus: use a bath of nitric and sulphuric acids, equal parts, dip the work, hang on wire into the acid for a moment, remove, rinse in cold water, thoroughly dip in hot water, remove, put into alcohol, rinse round, shaking vigorously on removing to throw off extra lacquer, and lay on a warm metal plate till dry; let cool and it is done. Avoid handling lacquered work until it is cold.

Lacquers for Brass.

No. 1.—Ingredients:

1 oz. seed lac.
1 oz. dragon's blood.
1 oz. annotta.
1 oz. gamboge.
¼ oz. saffron.
2½ pts. alcohol.

Method of Preparation.—Dissolve the colouring matters in a little of the alcohol separately; then mix altogether in the dissolved resin and shake well to thoroughly incorporate.

No. 2.—Ingredients:

3 ozs. shellac.
3 ozs. gum juniper.
4 ozs. turmeric.
½ oz. annotta.
3 ozs. alcohol.

Method of Preparation.—Same as No. 1.

No. 3.—Ingredients :

3 ozs. seed lac.
1 oz. amber (powdered).
1 oz. copal (powdered).
20 grains dragon's blood.
¼ drachm extract red sanders wood.
18 grains oriental saffron.
2 ozs. coarsely powdered glass.
20 ozs. absolute alcohol.

Method of Preparation.—Same as No. 1. The product is most excellent.

No. 4.—Ingredients :

3 ozs. seed lac.
1 oz. turmeric.
¼ oz. annotta.
¼ oz. saffron.
1 pt. alcohol.

Method of Preparation.—Digest the colouring matters in the spirit for a week, then filter into a clean bottle and add the lac, and give two weeks' digestion with frequent shakings.

Lacquer for Dipped Brass.

Ingredients :

4 ozs. seed lac.
½ oz. copal.
½ oz. English saffron.
¾ oz. annotta.
2 pts. alcohol (95 per cent.)

Gold Coloured Lacquer for Brass not Dipped.

Ingredients :

1½ lbs. sandain.
6 ozs. shellac.
12 ozs. turmeric.
¾ oz. gamboge.
1 gallon alcohol.
1 gill turpentine varnish.

Bronze Lacquers.

Ingredients :

12 ozs. shellac.
8 ozs. sandarac.
3 qrts. alcohol.
Dragon's blood and turmeric to produce tone required.

No. 2.—For ornaments bronzed with gold-coloured bronze, paint the articles, of cast iron, with white paint, which is white lead and oil. When dry and hard, varnish with copal varnish. When sticky dry, dust the bronze powder over it, and when hard dry, brush off all the superfluous bronze with a camel's-hair brush. To protect it from the dust and soiling, coat the bronze surface, when thoroughly dry, with spirit copal varnish.

The practical tests of the German locomotives imported for the Chilian State Railways have had the effect of sending the latest order for sixty new engines to British builders, says the *Mechanical World*. The German engines are said to have good machinery, but their steel tubes and smoke-boxes stood the tests badly. The new British engines are also to be fitted with steel tubes and smokeboxes, but it is thought that these will prove of a more durable quality.

Originality in Model Making.

By Percival Marshall, A.I.Mech.E.

(*Continued from page 374.*)

DISCUSSION.

Opening the discussion on Mr. Marshall's paper, Mr. D. Gorse Glen made some interesting remarks upon the nature of the paper that had just been read. Referring to the author's reference to Nasmyth's practice of keeping a "scheme book" in constant use for the purpose of making notes of mechanical thoughts passing through his mind in the course of his work, and which he exhibited when occasion required to anyone interested, and with whom he came in business contact, Mr. Glen recalled the incident of Nasmyth's surprise on the occasion of his visit to France in April, 1842, when he discovered that a steam hammer, identical in design and construction with his own, had already been built and was then working. It had in fact been the means of forging a large wrought-iron marine engine single crank, which Nasmyth had just seen, with a remarkable degree of exactness in its general form. It transpired that whilst Nasmyth was away from home two French engineers called at his office at Patricroft, to whom his partner exhibited Nasmyth's drawings of his steam hammer. He regarded this as too ordinary an incident to be worth mentioning specially to Nasmyth on his return. However, the French engineers had evidently made careful note of what they had seen, and the result was that a steam hammer was built upon their return to their own country.

Mr. A. W. Marshall said: It does not seem to me that all those present have appreciated the author's real meaning. The object of Mr. Percival Marshall's paper appears to me to be to urge us to think and use our brains when planning and constructing our work. Before coming to the meeting this evening I was thinking over the subject, and some doubt occurred to me as to the meaning of the term "model engineer." I consulted a dictionary and discovered that the word "model" means "a pattern of anything, a mould, example: *v.a.*, to form or plan. "Modeller: a planner or contriver." The word "pattern" is defined as "an original or model." Clearly, then, we are wrong if we regard our title of model as meaning a copy of anything: the model is the original and not the copy. We have been under quite a wrong impression, and are making copies, not models. Then the word "engineer" does not mean anyone who merely makes a steam or gas engine, or drives or manages an engine: it comes from the French verb *s'ingénier*, which means to work with or use one's brains; or, as the dictionary quaintly expresses it, "to bend one's wits to intuition." A "model engineer" is, therefore, someone who is ingenious and uses his brains, who thinks and makes, not mere copies of things, but originals. If the Society is really to live up to its title, it must be original, and the members show originality in their work. It is the law of all things in a community that they must progress or decay; whether in the individual or a society, you cannot stand still—as the saying is, you must go on or go under. If our Society is to exist it must be continually making progress, or it will die out. Mr. Percival

Marshall's remarks are advising us to progress and not remain in an old groove. But we should remember to apply originality of the right kind. We should not follow the example of the eminent scientist who cut a large hole in his door to allow his cat to enter through and a small hole for the kitten also. When arranging to do a piece of work, we need not follow some previously conceived plan. There are various ways of accomplishing the same end. For example, the Maudslay collection of engine models which is in the Museum at South Kensington. They are all marine steam engines, but one is on the oscillating principle, another the side lever type; there is the annular engine, the steeple engine, the return crank engine, and the modern vertical marine type, as used in Atlantic and other liners. They are typical of thought and originality in carrying out the simple idea of marine steam propulsion. Sir Henry Bessemer used to exhibit charming examples of flowers and ferns cast in bronze and perfect to nature in all their complexity. It was a puzzle to guess how they were moulded. The famous inventor explained to me that he buried the plant in plaster-of-Paris, which was allowed to set, and then made hot, thus burning out the plant and leaving a mould into which the molten brass could be poured; the plaster was finally broken away, leaving a perfect reproduction of the specimen. Here was originality applied to a hobby. Elias Howe, the inventor of the sewing machine, used a vibrating shuttle to pass the second thread which formed the lock-stitch through the loop formed by the first. Wilson also invented a sewing machine, he sewed by machine and also by lock-stitch, but in a different way; he passed the second thread through the loop, not by a shuttle, but by the now celebrated rotating hook which seized the loop and passed the thread from a spool contained within the hook. He did not merely copy Howe's machine, he exercised originality. The invention of the gunstock lathe is another example of originality. When this machine was evolved, lathes and the operation of turning were well known. Blanchard, the inventor, designed a lathe; it performed the operation of turning but in another way. He devised the principle of turning from a model, the tool copying the shape of the model upon the work. Look at one of Stanley's compasses and compare it with one of the old patterns which are made and sold even now. You will find an improvement in the way of clamping the needle point; the pencil-holder takes a piece of solid lead, instead of the clumsy wood-cased pencil, the upper part of the legs is spread out so that you can easily place your thumb and finger between them to open the instruments. Here again is originality and thought. But we must take care to be on safe ground and understand the theory of our work. I recollect the late Mr. Henry Perigal—a gentleman who made a hobby of drawing geometric curves by means of the geometric chuck—telling me how he gave himself a great deal of trouble through want of theoretical knowledge. He added a straight line movement to his chuck and for the purpose used a crank and connecting-rod. He sat up all one night trying the mechanism, puzzled to find out why the chuck refused to produce true ellipses—they were all ovals. He did not learn for a long time that the cause of the error was due to his having used the wrong kind of mechanism. He was not aware of the true nature of the movement produced by a crank and connecting-rod; he ought to have used a cam. There is also plenty of scope in experimental models. That very clever engineer, Mr. Lanchester, this week states in *The Engineer* that the problem of aerial flight can be almost entirely solved by means of models. Even in making copies of existing engines there is plenty of scope for originality. In my opinion, Dr. Bradbury Winter has been very original and used his brains when making his wonderful model of the "Como." As an example, the pressure-gauge card is an exact copy of that on the real engine. We should probably have been satisfied to draw a few small markings on a card for the purpose of showing a gauge scale. But Dr. Bradbury Winter had set himself to make an exact reproduction of the "Como" to small scale, accurate in every detail. To carry out this purpose with respect to the gauge cards, he actually photographed the originals down to the required dimensions. This is only one item in which he used his brain to do something out of the ordinary in model-making as a hobby. You may say why take so much trouble? Such a question applies to many things. Let us remember the story of the Japanese artist who produced exquisite articles of lacquer work, which were in great demand because of their artistic beauty and quality. It was urged upon him by various friends that he could make a great deal more money by hiring a factory and employing workmen to do the work; but he replied that the work might not then be so good, and he preferred to remain poor and do only the very best, which might be admired and give pleasure to others after he was dead. If we take Mr. Percival Marshall's remarks to heart and use our brains to think and originate when we do our model work—and that is what I think he is really urging us to do—the Society will progress, and perhaps, like the Japanese artist, we may produce something which will be admired and give pleasure to others when we have passed away.

Mr. Wratten said the paper had appealed to him strongly as a model engineer. He had found that even in constructing simple models originality was constantly necessary in the formation of special tools and methods, but he was fully conscious that one often fell short of originality in the selection of materials used. He thought that many others like himself had too strongly conservative ideas as to the invariable necessity of the use of metals. He thought that sometimes the use of glass, cardboard, wood, or celluloid, would be superior for the purpose in view, but the fear of being unorthodox prevented their use, and therefore the more usual practice of using metals was generally adhered to.

Mr. Solomon concurred in Mr. Marshall's advice, and counselled the members to exercise originality both in design and in copying—*i.e.*, to copy, when they could not invent, models, pieces of apparatus and prototypes not usually copied, and so evolve original work. To slavishly copy he thought was to be deprecated, and in doing so the only thing exercised is one's aptitude to use tools. He therefore strongly advised original design and work, as the labour entailed in scheming out the design in the first place formed a great part of one's pleasure in amateur work, and, besides, formed good exercise for one's inventive genius. He also referred to the excellent selection of models to be found at the South Kensington Museum, from which much could be learnt and much benefit derived by model makers in general.

Mr. H. H. Harrison mentioned an amusing incident illustrating in a high degree misplaced originality. He told us that as he was coming to the meeting that evening he heard a street piano-organ playing a well-known thing from Wagner's "Tannhauser" called "Star of Eve," but the mechanician or musician who had constructed the barrel had inserted many things that were not to be found in Wagner's score—things which Louie Frear would call "twiddley bits." Further, he thought the author's remarks were thoroughly disinterested, as, if all **Model Engineer** readers took his advice, he would either end his days in the workhouse or have to submit to an old age pension. He instanced numerous cases of want of thought on the part of model makers, and illustrated his remarks by several cases which had been brought to his notice recently. He concluded by asking all to take the author's advice to heart.

Mr. Riddle was in entire accordance with Mr. Marshall, and contended that in the production of models necessitating the employment of both brains and constructive skill, the amount of real pleasure derived by the maker is far greater than that derived from putting together a set of ready-made castings, or working to hard-and-fast published designs.

Mr. Gentry, after complimenting the Society on the thoroughly practical nature of the paper and discussion, and commenting on the absence of anything to cavil at in either, referred to his first impression of the paper as perhaps limiting the scope of work to strictly model work, as understood generally, but found later that Mr. Marshall had ambitions for model engineering quite on a par with those of Mr. A. W. Marshall, who had placed the position of amateur mechanics on the broadest basis, and one in which Mr. Gentry cordially agreed. In adding his quota to the list of suggestions, Mr. Gentry referred more especially to tool work as being a branch both for the exercise of such enthusiasm as members of a Society of Model Engineers must necessarily possess. In addition, it saved expense to make one's own tools; and possible improvements, and addition of attachments, to second-hand and old high-class foot lathes and other light machine tools which might perhaps be bought cheaply, must also not be lost sight of. A writer in the *English Mechanic* of July 10th, 1908, described the process of attaching back gear and screw-cutting gear to a plain lathe, which had been carried out by a friend of his who had done also much useful work in experimenting with small power motors in light boats, such as up-river craft. Mr. Gentry said that old clocks were a source of enterprise in restoration and readjustment, especially English "Grandfathers." He suggested working models of agricultural machinery, such as steam ploughing tackle, and called attention to some excellent models of the same in the French Agricultural building at the Franco-British Exhibition. In conclusion, he stated that he thought model work carried on on such lines as Mr. Marshall had placed before them would make for both improvement and progress, and might even be a very real aid in mechanical research.

[**Note.—We hope to give the observations of some** further members next week, and, meanwhile, invite opinions from any of our readers who are **interested.—Ed.,** *M.E.*]

Practical Letters from our Readers.

Slipping Driving Wheels.

To the Editor of *The Model Engineer.*

Dear Sir,—I have read to-day in Mr. Chas. S. Lake's always interesting "Locomotive Notes" the poser concerning the slipping of driving wheels when a locomotive is running downhill with *steam off*. I have heard of this rather weird phenomenon before, although, like ghost stories, no definite particulars were forthcoming.

What was interesting, however, was a suggested explanation from a good authority, and this, if I am not mistaken, is what Mr. Lake asks for. It is that (presupposing the train to be running fast downhill) the locomotive runs over a piece of faulty track and for a fraction of a second the rails under the driving wheels sink whilst those immediately under the leading and trailing wheels stand firm. Thus, the theory states, the driving wheels are momentarily jacked up from the line and do not possess their normal adhesion. What then happens is that the latent flywheel tendency of the drivers immediately comes into play (the normal adhesion being removed, as explained), and they at once fly round *faster* than the trailing wheels until brought to a standstill by perfect track. Personally, I think this explanation—in other words, a flywheel with the brake suddenly removed—a good one, and hope it may be of interest to you.—Meantime I remain, yours faithfully,

10, Farringdon Avenue, H. N. Coombs.
Farringdon Street, London, E.C.

To the Editor of *The Model Engineer.*

Dear Sir,—As one who has had thirty-five years practical locomotive experience and travelled many hundreds of miles on engines when coursing down long grades, the locomotive poser brought to notice in your issue of October 8th by such an experienced authority on locomotives as Mr. Chas. S. Lake—that the driving wheels of an engine are supposed to slip on a down grade with steam shut off—would not be worth notice were it not for the fact that the statement emanates from a driver of a locomotive. Experienced drivers can at once detect when any slip takes place; it is this fact which, to me, makes the question such a mysterious one. Personally, I do not for one moment believe that slip (certainly not in the forward direction) does take place. What, then, can occur to lead the driver to suppose the wheels slip? Can it be that in some cases the engines have been allowed to run with the lever in an incorrect position with steam shut off and the pumping action of the piston causing the wheels to slip backwards? The slipping of locomotive wheels can only be brought about by the tractive force being in excess of the adhesion, any slip once started accelerating until steam is shut off.

Let us now assume, for the sake of argument, that it is practicable for the momentum of the driving wheels to bring about slip; it appears obvious that this slip would also tend to accelerate and cause the drivers to apply the brake to stop it. Will drivers interested say if such is the case?

I should like to hear what Mr. E. Clement

Stretton has to say on the subject. His wide experience and connection with driving of many years standing should enable him to set at rest not what causes the supposed slip, but what leads drivers to believe that forward slip takes place.—Yours truly, JOHN RIEKIE.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—With regard to the poser sent by the Oswestry correspondent, I should like to say, as a fireman on the G.W.R. with a number of years experience, that I can affirm his statement *re* slipping of locomotives running down declines with steam shut off, I have a case in point. It was while I was stationed at C——, one of our first-class drivers complained of the same thing taking place while running down the decline in Severn Tunnel on more than one occasion, and not a little either, but downright hard slipping, as though she (the engine) would throw her rods. This has often been discussed among ourselves as one of the inexplicable and mysterious things we could not fathom, but there the thing remains a fact, affirmed by more than one railwayman from actual experience.—Yours sincerely, "ONE WHO KNOWS."

Perpetual Motion.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have read with considerable interest the letters on the above subject in THE MODEL ENGINEER, and I agree with "Pat" and Mr. A. W. Ludlow Doré that the subject is not "utterly ridiculous." As Mr. Doré states, if the subject is ever brought to a successful issue, it will not be by those who ridicule it. Years ago people may have ridiculed the idea of transmitting messages without wires, and yet it has now been accomplished.

Quite recently I had the pleasure of hearing a lecture on Radium, and the lecturer, after saying that radium created heat and light, added "An ounce of radium would be sufficient to drive a 30 h.-p. motor for the next two thousand years."

Now, I do not know if the lecturer was stretching the point at all, but I certainly do think that radium could be made to drive a machine, and if its energy is inexhaustible, as we are told it is, would not this constitute perpetual motion? The discovery of radium has turned many of our ideas of chemistry upside down; might it not also alter our hitherto idea of perpetual motion being impossible.—Yours truly,

Sheerness. R. VINCENT BORNER.

Model Corliss Valve Engines.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I was very much interested indeed to see, in THE MODEL ENGINEER for October 8th, a horizontal engine with Corliss valve gear. This gear is so complicated in a full-sized engine that in a model it must need to be considerably modified to admit of easy working. And although a (somewhat meagre) explanation *was* given in the article referred to, I am sure that a diagram and full description would be interesting to many readers, o whom the rather indistinct photograph published does not clearly explain the working of this extremely interesting and uncommon model. The ordinary slide-valve gear is so universally used in model making that when a really original model, such as this one, *does* turn up, one is very anxious to understand the exact method used in making.

Besides this, I am sure many readers do not know how a trip gear works, and to these a theoretical article (under, may I suggest, the "How It Works" column), would no doubt be interesting.

One thing I should like to ask Mr. Lane is, does this engine reverse? If not, does this gear permit of reversing at all? Hoping Mr. Lane will, with the Editor's kind permission, give us the pleasure of seeing a fuller description of his model.—Yours faithfully, W. S. FARREN.

A Featherweight Steamer.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I notice in the issue of THE MODEL ENGINEER for October 8th that the "Carpenter's Mate" states I assumed too much when I stated in my letter *re* the above that the boiler would never maintain a pressure of 75 lbs. on the engine. I suppose he means to assert that it does maintain that pressure and to have an evaporative efficiency higher than any other model boiler ever made. I beg to remind him that I am not a novice at engineering and know all about the possibilities of 34 sq. ins. of heating surface, and I also know that his boiler will never evaporate 2·6 cub. ins of water per minute, no matter how fired. I may also beg to remind him that he has demonstrated his boiler to me much to its disadvantage, and can certainly say I have nothing to learn from it, much less copy. I should very much like to know the date (?) when the *Min* travelled at the rate of close on 7 miles per hour, and who timed same. As he says nothing would better please him than to have recorded speeds checked, I make him the following challenge:—I challenge him in the sum of one guinea to run the *Min* over a 100-yards course, under the conditions of THE MODEL ENGINEER Speed contests, same to be timed by a reliable timekeeper. The stakes to be deposited with the Editor of THE MODEL ENGINEER and to be forfeited by me if the speed anywhere approaches 7 miles per hour, and by him if the speed falls short of this. Same to go to any charitable institution the Editor may mention.—Yours faithfully,

53, Cranwich Road, Stamford Hill, N. E. V. PIKE.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I was more than surprised at reading Mr. Blaney's reply—I cannot call it an answer—to Mr. Pike in this week's issue. Surely, in view of the well-known and obvious facts regarding the *Min*, your contributor could not expect any criticism of the alleged performance of this boat and its plant to be other than destructive?

Mr. Blaney's letter, like his quotation, is a travesty of certain facts. He tells his critic that he assumes too much when the latter says that the boiler in question would never maintain a working pressure of 75 lbs. Now, let us analyse. The propeller used had a pitch of 5 ins. Assuming the revolutions per minute to be 2,000 and the slip 30 per cent. (a low computation), the speed of the boat would be 6·8 miles per hour. *But*, to drive the said propeller at the above number of revolutions, the engine would require, approximately, a working pressure of 75 lbs. Your contributor would, therefore, have us believe—at any rate, by inference—that the boiler with its 34 sq. ins. of heating surface is capable of maintaining this pressure;

equal to an evaporative capacity of about 7½ cub. ins. per minute per 100 sq. ins. of heating surface! This, I cannot credit.

As Mr. Blaney, when he built this boiler with its attendant lamp, had the working drawings, etc., of the *Morearad* before him—and his plant is simply a replica, with the exception that he has followed Mr. Scott's design by using a circular section for the steam drum, instead of the rhombic one employed by Mr. Midler—he cannot even fall back on the contention that his type of boiler is different from the two just mentioned. The evaporative capacity of Mr. Scott's boiler works out at 4 cub. ins. per minute; the *Morearad's* at 5 cub. ins., and the *Min's* at 7½ cub. ins. per minute each per 100 sq. ins. of heating surface. How, then, does your contributor attempt to account for the vastly superior results which he must have had in order to attain the alleged speed?

Again, why did not the *Min* compete at Wembley? She was entered and taken down for that event. If her recorded speed be correct, she would have been an easy winner in her class, as the *Una* (which took first prize) did only 6·3 miles per hour. Besides, owing to her much shorter L.W.L. she would have received from the *Una* the very handsome handicap allowance of 1⅜ miles per hour. The *Una* is 3 ft. 9 ins. on L.W.L.; not 3 ft. 3 ins.

Speaking from personal knowledge, Mr. Pike has no need—nor does he intend—to copy this type of boiler. He is at present engaged upon a much better design of an infinitely more powerful type.—Yours faithfully, THOS. DYSART.

5, Fremont Street,
South Hackney, N.E.

Dynamedical Machine.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In reference to Query No. 19,880, *re* dynamedical machine, may I be permitted to suggest that if "G. L. T." decides to use the 30-watt dynamo as generator, he will do well to make the driving gear of rather more substantial proportions than those given in the working drawings in THE MODEL ENGINEER Nos. 131 and 132.

When using the interrupter at the highest frequency, the F.M. are demagnetised and remagnetised twice during each revolution of the armature, and, in consequence of this, the heavier gauge of wire, viz., 22 S.W.G. may be found an advantage, as larger machines, of course, take a greater length of time to build up in field strength.

Tunbridge Wells. GEO. E. MORTLEY.

Model Yachting Correspondence

National Yacht Racing Association.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Referring to the remarks which have appeared in your last two issues on the subject of a proposed Model Yacht Racing Association, this is a matter which should closely engage the attention of model yachtsmen all over the country, and the sport undoubtedly owes a debt of gratitude to Messrs. G. Colman Green and W. G. Brittain for bringing this important subject to the front.

In a scheme of this kind, however, individual effort, unfortunately, has its limits; and I think, if any good is to come from the preliminary work which has already been accomplished, it is high time we heard some expression of opinion from the various Model Yacht Clubs themselves.

In his letter published in THE MODEL ENGINEER for October 1st, Mr. G. Colman Green says: "Whether a great conference is necessary or desirable is open to consideration of expense only." I beg to suggest that a meeting of the Clubs or their accredited representatives is not only desirable, but absolutely necessary. If success is to crown the efforts that have already been made, I think a meeting should be convened at the earliest possible opportunity, so that the seal of popular approval can be set upon the movement and its success assured.

I do not suppose for one moment that every Club will be in favour of the Association, but I am sure a very strong nucleus can be formed; the other Clubs will then probably fall into line naturally, as they see the advantages which accrue from sailing under a standard set of rules and being affiliated to a central governing body.

Referring again to Mr. Colman Green's letter, I notice that "a flag of the Association has already been prepared." This seems to my mind a little too previous. I would suggest that the question of a flag, together with the division of the country for the purpose of Inter-Club racing, are matters best left to the consideration of the Association when formed.

As regards the question of expense involved in calling a meeting such as that proposed, I think that if the Clubs are convinced that a determined effort is to be made to form an Association they will loyally give their support to the movement.

Before I close this letter, I should like to say something in reference to the type of boat to be encouraged. We are continually having the new metre boats thrust upon us as possessing advantages of such a character that it behoves all self-respecting Model Yacht Clubs to take them up without delay. In the first place, the chief considerations which weighed with the promoters of the present International Rule do not exist so far as model yachts are concerned.

The sole object of the model yachtsman is racing, and to that end he wants the speediest boat possible. The Rule mostly in use at present, viz., $\frac{L. \times S.A.}{6000}$ fulfils this condition admirably; it may be argued that boats built under this Rule lack stability, but, speaking of the majority, this is not so. Speed itself imposes a certain standard of stability, as no yacht can sail with half her deck awash and at the same time be a fast boat. Again, the increased weight of the new boats is an important factor to be considered where much Inter-Club sailing is done, carrying a boat of 25 lbs. to 30 lbs. weight even a short distance being no light task.

Undoubtedly improvements might be made in the $\frac{L. \times S.A.}{6000}$ Rule so as to eliminate the freaks which are put forward as an interpretation of it, but I do not think any good can come from the substitution of a cruiser for a racing yacht. Apologising for trespassing so largely on your valuable space.—I remain, dear Sir, yours faithfully,

"Woodville," R. W. BOTTOMLEY.
Belmont Road, Ilford.

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before the usual date of publication.]*

London.

AN ordinary meeting of the Society was held on Friday, October 9th, at the Cripplegate Institute, Golden Lane, Mr. A. M. H. Solomon taking the chair, and upwards of eighty members and visitors being present.

The minutes of the last meeting having been read, eight new members elected, and other formal business disposed of, the remainder of the evening was occupied in watching the locomotive running competition, in which Mr. Barrett's six-coupled "Brighton" engine and Mr. Denvil's "Atlantic" type engine showed to great advantage. Other exhibits shown under steam were Mr. Lane's horizontal engines with trip valve gear, both running at great speed and developing remarkable power for their size. Mr. Barrett also exhibited a double-throw crankshaft; Mr. Allman a small motor and oil-spray burner; and Mr. H. Nield a motor armature in course of construction.

The piece of mechanism selected for the next meeting's competition is valve gear, with eccentrics where such used. These competitions are open to country members, who should send their exhibits to the Secretary two or three days before October 28th.

FUTURE MEETINGS.—Wednesday, October 28th: Lecture by Mr. Henry Greenly on his recent model commissions, illustrated by slides, diagrams, and apparatus. Wednesday, November 25th: Annual General Meeting.

Full particulars of the Society and forms of application for membership may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

The Victoria Model Steamboat Club.

INTER-CLUB VISIT.

ON Saturday, October 3rd, by invitation of the Victoria Model Steamboat Club, several prominent members of the Clapham Steam and Sailing Club paid a visit to Victoria Park and participated in one of the popular Gymkhanas instituted by the V.M.S.C.

[We regret space compels us to hold over a full account of this interesting event until our next issue.—ED., *M.E. & E.*]

FILES clogged with tin or lead should be cleaned with strong nitric acid. For iron filings blue vitriol should be used first, then the file should be rinsed in water and dipped in nitric acid. Dip the file several times in nitric acid for copper or brass. Diluted sulphuric acid should be used to cleanse a file clogged with zinc. After cleansing, the files should be rinsed in water, thoroughly brushed and dried in sawdust or by burning alcohol on them.

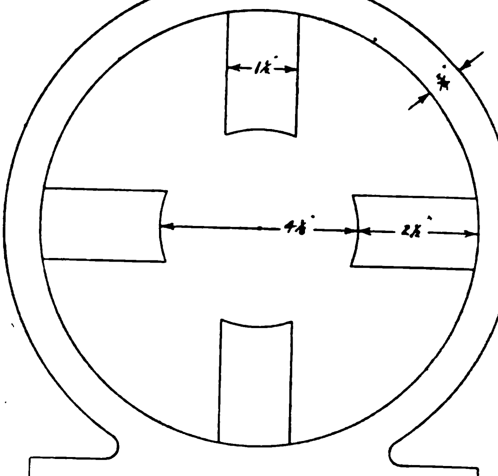
Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

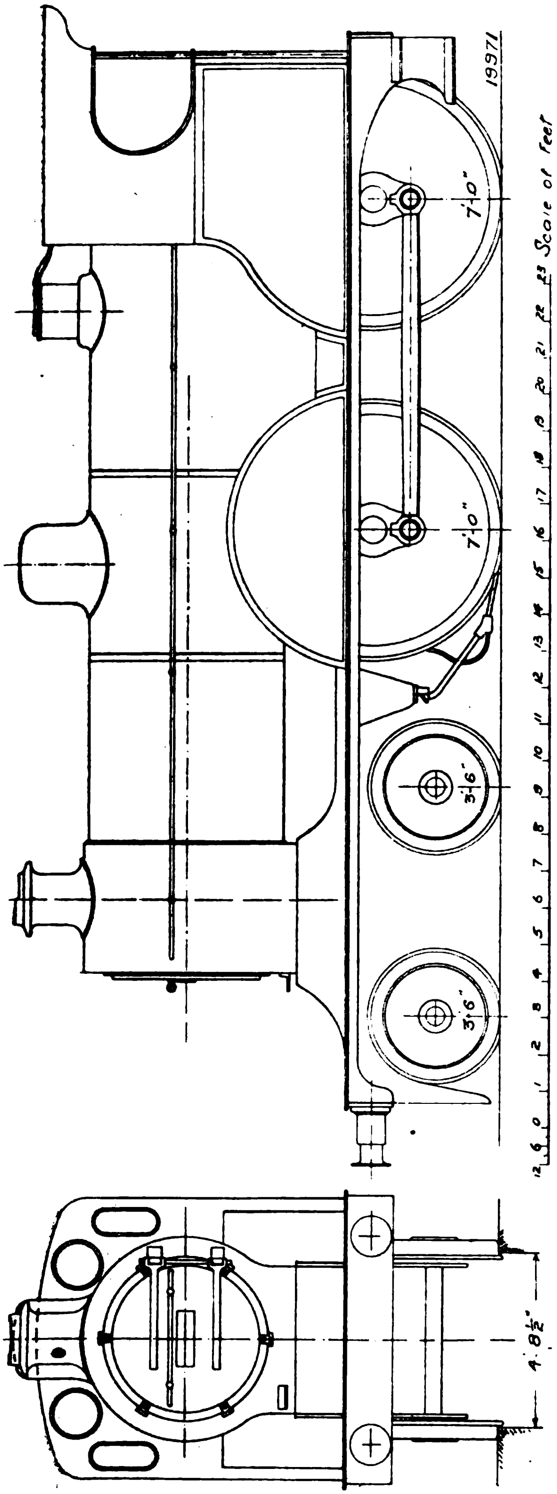
The following are selected from the Queries which have been replied to recently:—

[19,167] **Four-Pole Dynamo Windings.** R. S. (Salop) writes: I should much esteem a reply to the following query. I have multipolar dynamo castings, as rough sketch enclosed. Kindly say what windings would be required to give 15 amps. and as high voltage as possible. The armature is 4-in. drum, with sixteen slots 7-16ths in. by 7-16ths in.; commutator, 2 ins. diameter, sixteen sections; brushes set at 90 degs.; carcase is 6 ins. wide; armature 4 ins. long; pole-pieces 4 ins. wide. Is the design all right? I am getting your book—No. 10. Will there be a suitable diagram for winding armature?



Query No 19167

Wind armature with No. 20-gauge D.C.C. copper wire; get in as many turns as you can (about 1 lb. of wire will probably be the weight). Wind field-magnet with about 3 lbs. of No. 22-gauge S.C.C. copper wire for a shunt winding; all coils to be connected in series with each other, as diagram 4 of our Handbook (No. 10). You will find Fig. 49 suitable for an armature winding diagram. The commutator sections can be cross-connected, as shown, so that two brushes only, placed at 90 degs., can be used, or you can omit these cross-connections and use four brushes, connecting opposite brushes together instead of connecting the commutator sections. The field-magnet winding is arranged on the assumption that the machine will give about 50 to 60 volts. You can adjust the voltage to some extent by running at higher or lower speed; try 1,800 r.p.m. Your poles are somewhat narrow: if you do not obtain satisfactory results, try some pole-shoes having a spread of about 2½ ins. With this exception, the design is satisfactory.



MIDLAND 4—4—0 REBUILT LOCOMOTIVE.

[19,971] **Midland 4—4—0 Rebuilt Locomotives.** G. E. B. (Barnsley) writes: I shall be very glad if you will please publish in your valuable paper, as early as convenient, a fully scaled and dimensioned outline drawing of one of the Midland 520 Class of express engines, as I am about to commence a model of same. These engines are a rebuild of an older type, and are much admired.

Owing to the fact that we can only trace very meagre dimensions of the original Johnson engines, and to the slight differences in leading dimensions which are present in the various batches of 4—4—0 type of engines which Mr. Johnson designed for the Midland Railway between 1876 and 1900, we are unable to say that the drawing we include herewith is an exact representation of No. 520 or any other particular engine. It is, however, sufficiently accurate for the purposes of model making, and the details of construction which are not shown may be added from a photograph or sketches on the spot. As most readers know, owing to the renumbering of the Midland locomotives, many of the old engines have lost their identity, and not having the run of the Derby drawing-offices and official books, we cannot make any authoritative statements concerning these now very fine locomotives. Like the G.W.R., in the matter of types, naming, etc., the Midland locomotive department do not appear to have settled opinions as to the leading features of their locomotives, and there are several types of chimneys, domes, and safety valves in common use.

[20,389] **Wood for Model Boats.** N. B. R. (Crewe) writes: I require a block of yellow pine, 5 ft. 6 ins. long by 9 ins. by 6 ins. I had a piece up from a yard at Swansea near where I live, and although I stipulated for no knots, sap wood, shakes, etc., the block came in four weeks and contained the heart of the tree and was half sap wood and perfectly useless for a gate post, let alone a model steamer. Would you oblige with the address of a reliable firm who would supply me? Should I give finished sizes of block or allowance for squaring up?

To use the words of a timber merchant when conversing with us on the subject of timber suitable for model boats: "Yellow pine is only less valuable than gold." Probably you did not receive yellow pine, or, if you did, it was of very inferior quality. We can recommend you to Messrs. Stuart Turner, Ltd., Shiplake Works, Henley-on-Thames, who are sure to have some suitable blocks for making 5-ft. 6-in. hulls, as we understand that they are machine-carving this size. We would also recommend you to consider the claims of American whitewood, which is free from knots, has a short grain, and can be obtained in large blocks at a reasonable price. You should make all the allowances, stipulate the net size you require in the rough. The steamer should, of course, be designed with an eye to the probable sizes of wood obtainable, and 6 ins. (net size 5 15-16ths) is a common thickness in the rough. Other firms are Cobbetts, Ltd., Virginia Road Bethnal Green, London, E.; The Young Firm, 1, 3, and 5, Virginia Road, Bethnal Green, London, E.

[20,430] **Blueing Steel; Painting Models.** B. R. (Bristol) writes: Being a reader of THE MODEL ENGINEER, I should be very glad if you would send me the name of the acid for blueing iron or steel the same as gun-barrels are blued over—a steel blue; also a recipe for a paint that will stand heat without blistering.

You will find an account of how to brown gun-barrels, etc., on page 210, February 27th (1908) issue. Some further methods were described in later issues in the "Practical Letters" columns. For blueing steel the article to be blued is immersed in saltpetre which has been melted in an iron pot. After this the article is cooled down in paraffin oil and allowed to dry in sawdust. *Re* paint, you could not do better than use any of the enamels which are advertised to withstand high temperatures. Messrs. Cotton and Johnson would supply you. An article on painting and enamelling models appeared in our journal a short time ago.

[20,415] **Cleaning Burners.** H. H. S. (Howden) writes: Will you kindly tell me in your "Queries and Replies" if there is anything to be obtained to clean out blowlamps on an oil engine?

Prickers are supplied with the burners for clearing the nipple holes, when blocked; they can be obtained from the tool-makers advertising in our pages. For thoroughly cleaning the burners, an excellent method is to pickle them in dilute sulphuric acid. See Mr. Greenly's article, "Renovating Primus Oil Burners," in our issue of October 1st, 1903. This issue can be had from our publishing office, price 3d. post free.

[20,203] **Electro-plating.** C. E. H. (Plaistow) writes: Would you oblige me by stating the best method of silver and brass plating, and what strength of current or what cells are required?

Electro-plating in silver has been very fully described in our pages. See issues of August 16th, 23rd, September 20th, October 4th and 25th (1906). You will find particulars of the bath mixture, etc., for brass plating in our issue of April 9th of this year.

[20,428] **Converting Sewing Machine to Lathe.** L. P. (Neath) writes: Will you kindly let me know at your earliest convenience if it is *possible* to make a lathe out of an old sewing machine (Singer); if so, I will be very pleased if you will give me full particulars?

It would be *possible* to turn the sewing machine into a primitive kind of lathe for very small work, but we do not think you would be justified in spending much time or labour on such a job when well made and properly designed lathes can be obtained at such moderate prices now-a-days.

The Editor's Page.

WE should like to call the attention of secretaries of the Model Engineer Societies and Yacht Clubs to the necessity of sending promptly any reports or notices they wish inserted in our pages. Owing to the exigencies of our large circulation we are obliged to close most of our editorial pages for press quite early in the week previous to the week of publication, and we are unable to guarantee insertion of any notices reaching us after the Monday morning of the previous week.

* * *

Owing to the above cause we have been unable to utilise a report received from the recently formed Bradford Society, but we may say that a successful meeting was held on October 5th, at which several interesting exhibits were made. Another meeting was arranged for October 19th, and already some seventeen members are on the books. The Hon. Sec. is Mr. A. Barber, 15, Hartington Terrace, Lidget Green, Bradford, who will be pleased to give information to others who are thinking of joining.

* * *

The proposed Tooting Yacht Club has now taken definite shape, a number of members having already given in their names and a preliminary meeting for the drafting of rules has been held. A Sailing Meeting of the members will be held at the pond on Tooting Common on Saturday afternoon, November 7th, after which a general meeting will be held at 8, Rose Villas, Romberg Road, Upper Tooting, for the purpose of electing officers, and confirming rules. It is hoped that a full attendance will be made, prospective members with their boats —sail, steam, or electric—being specially invited.

* * *

"Cyclist" (Birmingham) propounds the following curious problem:—"I was interested to read your note on locomotive driving wheels slipping when running down hill with throttle closed. I do not pretend to understand it at all, but I can put another 'poser,' viz.: why should the front wheel of a bicycle momentarily stop revolving when going fast down hill on a perfectly dry road. I am acquainted with a gentleman whose machine has done this for some time. The wheel runs perfectly freely and there is no friction at any point. I have heard him say that at such times he has felt the rear wheel jump off the ground with the sudden braking effect of the phenomenon. Thinking it might be due to his brake or mud guard stays he removed both, but with no effect." Our correpondent does not say whether he felt a pull at his leg at the same time, but obviously his friend has a machine with some very bad habits. During a fairly long experience of cycles and their peculiarities we have never met a machine which misbehaved itself in this truly curious fashion, and we think that some actual demonstrations of this little trick would arouse a good deal of interest.

* * *

The huge demand for our novelty, "The Young Model Maker," rather embarrased our printers for the first week or ten days and some unavoidable delays in delivery occurred. By the time these lines appear in print, however, we think the trouble will be got over and that we shall be able to supply as fast as the demand requires. We shall be glad to hear the experiences of our readers in building up this model. It is the first of its kind, and any suggestions which may make for improvement without increasing the cost will be much appreciated.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26-29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

[The asterisk (*) denotes that the subject is illustrated.]

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A I.MECH.E

VOL. XIX. No. 392. OCTOBER 29, 1908. PUBLISHED WEEKLY.

The Race for the Branger Cup.

A HYDROPLANE ON A TRIAL TRIP.

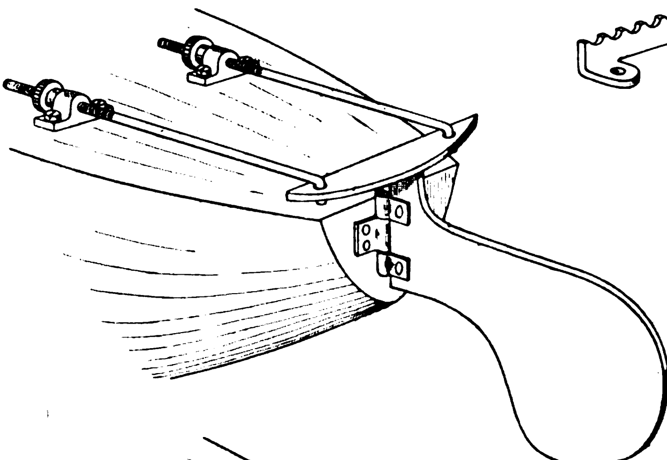
FOR some five years past M. Branger has promoted a model motor boat regatta in Paris, and has given a handsome cup or trophy to be raced for. In the earlier years of this event the competing boats were mostly of the toy shop order, but with the increasing attention devoted to the subject much improved craft have been forthcoming, until this year some really fast and high-class models have been run. Indeed, so keen an interest in model yachting is now taken across the Channel that quite a number of flourishing model clubs are in existence.

This year's regatta was held on the 8th inst., on the lower lake of the far-famed Bois de Boulogne, in perfect summer weather, amidst surroundings of the most delightful kind. Unfortunately, the trees which bordered the bank of the lake, much as they added to the beauty of the scene, introduced one very serious drawback, for the water was badly littered with floating leaves and tiny twigs, which brought trouble to many of the competing boats. In our own event at Wembley Park, much annoyance was caused by floating weed, but we can safely say that on that occasion the water was in much better condition than the lake of the Bois de Boulogne at the time of the Branger race. Another trouble from which the Branger competitors suffered was the insufficient arrangements made for controlling the crowd of two or three thousand spectators who thronged the banks of the lake. The interested multitude not only covered the lawn on which competitors were endeavouring to get their boats into running trim, but at the start of every race they flocked to the water's edge and all but pushed the competitors, the officials, and some of themselves in. True, Mr. Branger had taken the precaution of staking off a portion of the lawn, engaging two park-keepers to preserve order, and issuing special entry tickets; but for all the attention paid to these restraining influences, they might never have been provided. We took unto ourselves, as we noted these facts, some little congratulation that things were better at Wembley Park.

Altogether nearly thirty boats competed in the various events, these ranging from tiny little sailing boats fitted with electric motors—a curious combination, by the way—up to 1½ metre steam and petrol and electric boats, and hydroplanes. Mr. Branger had offered two trophies this year—one for electric boats and one for steam and petrol boats, while a whole array of other prizes by various interested parties were added to the list. The racing was across the lake, a distance of 165 metres, and the first boat to reach the opposite bank was to be adjudged the winner. From this it may be gathered that the boats in each class were all started together, as was the case, the start being by pistol-fire. This method of group racing is however very difficult to carry out successfully, and time after time the races, as races, proved a failure. Four or five boats would start at the crack of the pistol and would go all right for a few yards. Then one would go off her course in one direction, and another would diverge elsewhere; here would be a collision, and there a boat would stop altogether. In fact, only in the actual meeting of the two competitors for the Branger Cup, one a steamer and the other a petrol boat, did anything like a real race take place. In some of the other events not a boat found its way across the lake at the first attempt, and more than one turned completely round and came back to its point of departure. Some of these cases of misbehaviour were due to defective steering, others to deflection of course through collisions, and others to the influence of weeds or leaves.

As regards the adjustment of the steering an ingenious plan was adopted by several competitors in their trial spins. They attached one end of a long cord to the stop valve, or the switch of their engine or motor, and let the boat start on a trip; as soon as she got off her course the cord was pulled, the engine stopped, and the boat gently drawn back to the bank. The position of the rudder was then altered, and a further trial made, and so with comparatively little trouble the true position of the rudder for a straight course was found in one or two preliminary runs. Another idea adopted by many of the competitors, and also used on our side of the Channel, was to fit

FIG. 1.—THE STEERING GEAR OF THE "GIRARD VII."



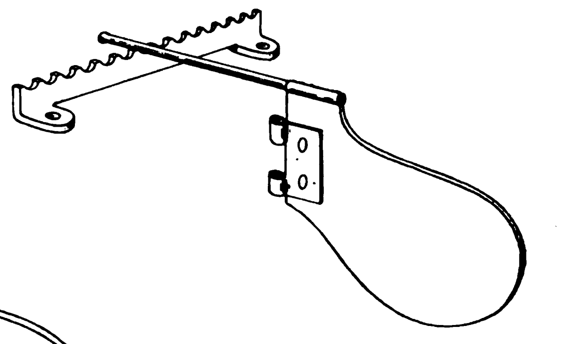


FIG. 3.—THE STEERING GEAR OR THE "BURDIGALA."

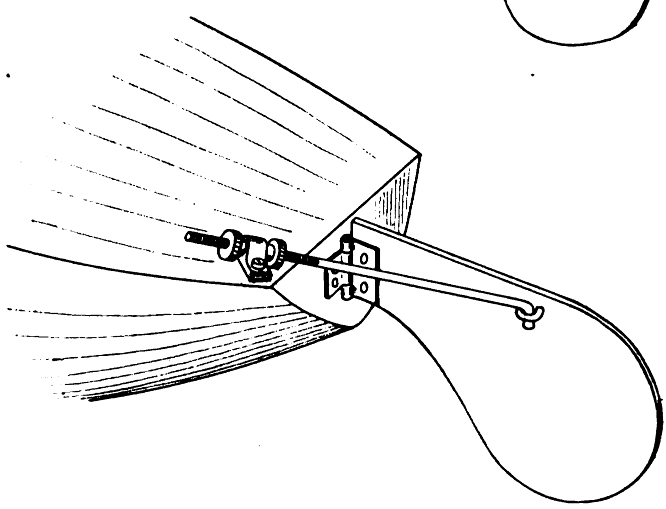
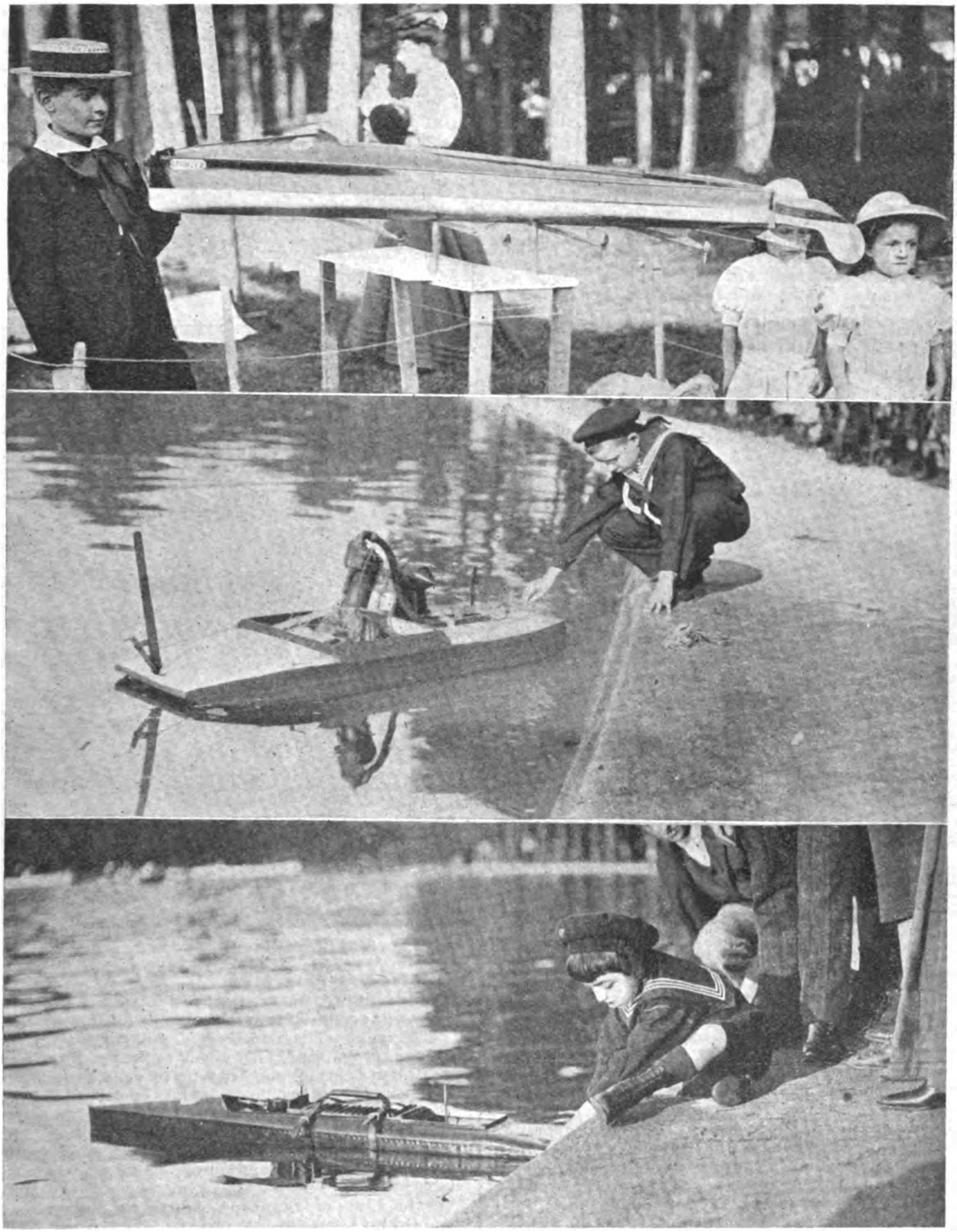


FIG. 2.—THE STEERING GEAR OF THE "MARSOIN."



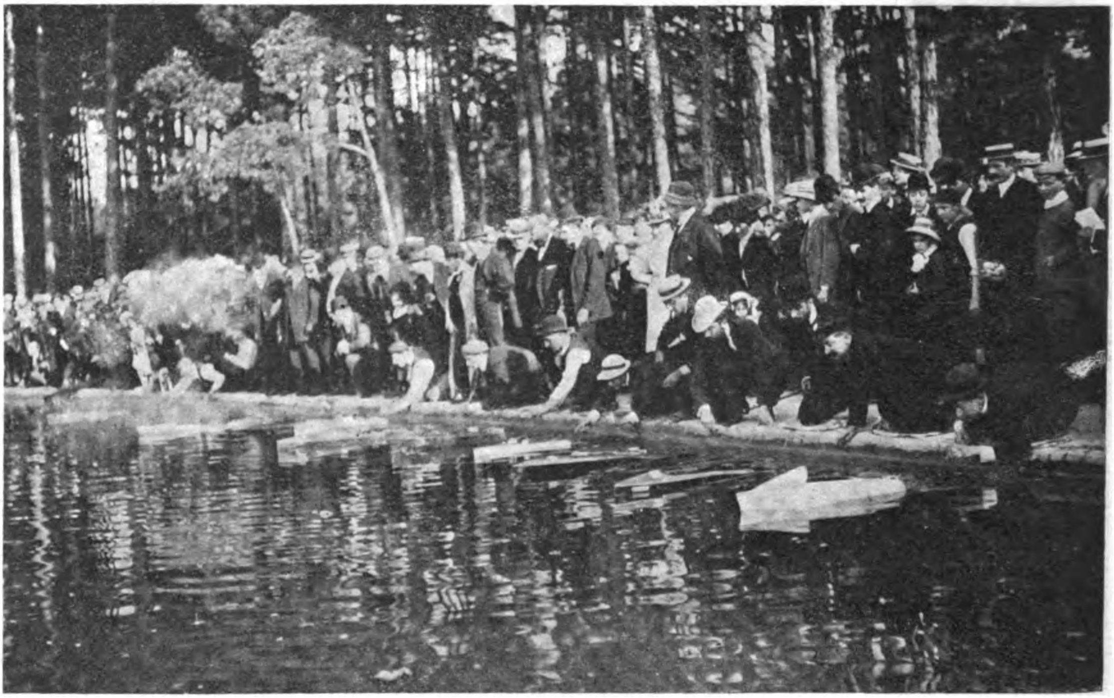
SOME OF THE COMPETITORS IN THE BRANGER RACES.

THE "DESVAUX II" WITH ITS FIVE PROPELLERS—A HYDROPLANE—THE STEAMER "BURDIGALA" WHICH WON THE BRANGER CUP.

a light float to their boats by means of a length of cord coiled up on the deck. Thus in the event of sinking through collision or other trouble, the float would rise to the surface of the water and mark the position of the submerged craft. The necessity for some such indicator as this was demonstrated during the afternoon by the disaster to the *Fanlo II*, a 1½ metre petrol motor boat, which, after a vigorous start in one of the races suddenly turned turtle, then stood up in the water stern downwards, and slowly sank from sight. She carried no float, and for the remainder of the day two salvage crews sorrowfully raked and poked and scraped the bottom of the lake, trying to find the whereabouts of the vanished craft.

each side. The three boats entered under the names of *Fanlo I*, *Fanlo II*, and *Fanlo III* had another peculiarity in that their rudders were placed about an inch or more or one side of the centre line of the hull. In the matter of propellers too, several peculiarities were noticed, particularly in the case of the *Desvaux II*, shown in one of our photographs, which had no less than five propellers arranged tandem fashion along the keel of the boat, each on its own separate shaft, and driven by its own electric motor.

In one of the preliminary races the ***Burdigala*** and the *Girard VII* had a fine fight, the latter only just gaining the verdict by a few feet in the time of 47 secs. In the actual race for the cup, however,



The Start for the Metre Electric Boat Race.

The steering gears on the various competing boats were very varied in character. The *Girard VII*, the cup winner in 1907, had two screwed rods, each attached at one end to the rudder yoke, the other passing through an eyelet on the deck, the adjustment being made by a milled nut on each. This is shown in Fig. 1. Another method, adopted in the *Marsoin*, was to use one rod only, attached at an angle to the rudder, and passing through an eyelet on the deck, two milled nuts being necessary in this case, one on each side of the eyelet, as shown in Fig. 2. The actual cup winner, the ***Burdigala***, had merely a notched cross-bar, in which the tiller rested, as shown in Fig. 3. Both this boat and the *Girard VII* made splendidly straight courses in their two runs. Other competitors held their rudders in position by means of string passing round the tiller and tied to eyelets in the deck, one at

this result was reversed, the ***Burdigala*** gaining an easy victory in spite of the time being increased to 53 seconds. The *Girard VII* got rather off her course, probably due to weeds or leaves interfering with her steering, and took 64 seconds to complete the trip. These two boats, by far the best of the day, were of very different types. The ***Burdigala*** is a steamer with metal hull and very fine lines. She has a flash boiler, and a 4-cylinder single-acting engine with a novel and simple valve arrangement. She belongs to M. Picard, a member of the Model Yacht Club of Bordeaux, where she has already gained no less than five prizes. The *Girard VII* is a petrol boat of great beam and draught for her length, with a flat counter. She is propelled by a single cylinder vertical petrol motor, with spray carburettor, magneto ignition, and three-bladed propeller. It was instructive to see these two boats start. The long narrow steamer shot away at once, and accelerating rapidly gained a considerable lead. The *Girard VII*, much slower in getting up speed, seemed to maintain it better when once acquired, and would probably be an easy winner on a longer course. So marked was the difference in speed in the first thirty yards or so, that the *Burdigala*, in the preliminary race actually crossed the bows of the *Girard VII* without getting touched, but was ultimately overhauled and beaten. It will be noticed that the speed of the *Girard VII* in the first race worked out at 7·79 miles per hour, and in the second race—that for the cup—the *Burdigala* did 6·67 miles per hour. We should imagine that under more favourable conditions both these boats are capable of better times. A good idea of the *Burdigala* may be obtained from the accompanying photograph, which, however, shows her with the hand straps by which her owner carries her about.

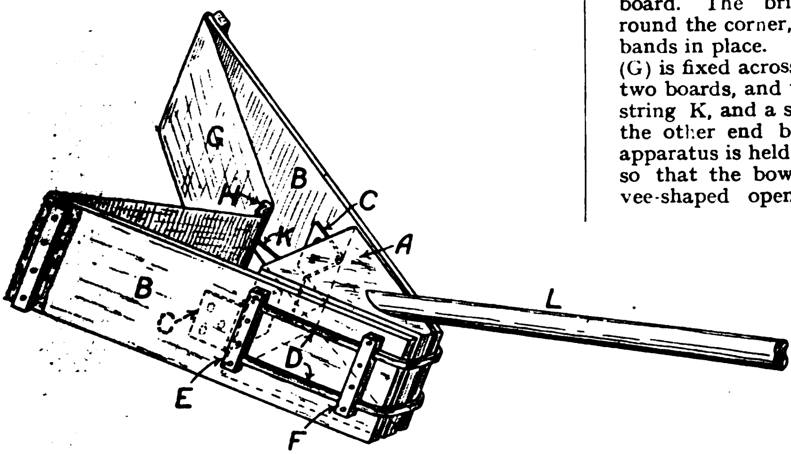


Fig. 4.—M. Girard's Device for Stopping his Boat.

A special class was arranged for hydroplanes, but although several put in an appearance only two actually attempted to run, and of these only one succeeded in achieving a successful trip. This was the *Reste-Là* of M. Caillez, which put up a really fine performance, easily beating the times of all boats of the ordinary type. She did in fact cross the lake in 36 seconds, which gives her the excellent speed of 10·15 miles per hour. This craft is fitted with a 2 h.-p. Bozier petrol motor which drives the propeller shaft through a leather-faced cone clutch. The propeller is of the two-bladed type, and the ignition is by accumulator and coil. The clutch is operated by a lever placed at the stern, which can be locked in gear. The hull is entirely flat, except where it slopes up slightly in front and behind, and has a single rudder which can be fixed in position when once set for a straight course.

The following is a brief summary of the results of the various other races: the explosion motor class, including steam boats as well.

Electric Motor Driven Boats, one metre in length.—M. Breton's *L'Eclair* 1. One and a half metre boats: M. Mercier's the *Je Vais Doux*, 1.

Explosion Motor Boats, one metre in length.—M. Mercier's *Le Marsouin*, 1. One and a half metre boats: M. Desvaux's *Le Desvaux II*, 1.

Explosion Motor Boats, second series, one metre in length.—M. Mercier's *Le Marsouin*, 1. One and a half metre boats: M. Girard's *Girard VII*, 1.

Hydroplanes.—M. Caillez' *The Reste-Là*, 1.

One item of note, in which we think our readers will be interested was the use of a special stopping device by M. Girard for catching his boats at the end of the trip. This is illustrated in Fig. 4, and is constructed as follows: A wedge-shaped block of wood (A) is fitted at a convenient angle to the end of a light pole (L), the latter being about 6 or 7 ft. long. To the sides of the block A are hinged two light boards (B, B), the hinges being fixed as shown at CC, allowing the boards to close inwards. The movement of these boards is regulated by two stout rubber bands shown at D. These bands are of rubber about 3-16ths square, and are fixed by the cross strap E and a corresponding strap on the other board. The bridge piece F, and a similar piece round the corner, serve as guides to keep the rubber bands in place. A band of stout canvas webbing (G) is fixed across the front of the V formed by the two boards, and this is held in place by a piece of string K, and a short strip of wood H, the starting the other end being fixed to the block A. The apparatus is held down at the surface of the water, so that the bow of the incoming boat enters the vee-shaped opening, the hinged boards closing in under the pressure until they lightly grip the sides of the boat. It will be seen from the foregoing notes that, although the gathering was not without its troubles, there was much of interest to be observed, and we should have greatly liked to have seen some of the best English boats amongst the competitors. The condition of the water was such, however, that the success of the best was by no means a certainty, and it would have been very disheartening to have taken over boats specially for the event, and have them beaten through fouling of the propeller, as would have been quite within the bounds of possibility. We hope that Mr. Branger will bear this important point in mind for the next year's event, and if he can promise a clean run for the boats he will, no doubt, have an even more exciting and more successful competition than the one which has just been held.

Inflammability of Coal Dust.—Some interesting experiments are now being carried on at Altafts, to ascertain to what extent coal dust, in the absence of fire-damp, is inflammable. These experiments are being carried out under the direction of Mr. W. E. Garforth, who has long urged his theory that coal dust is in itself an explosive. So far as the experiments have gone, they have proved conclusively that coal dust without any admixture of gas has great explosive power, heavy steel plates having been shattered by it and one boiler plate hurled a distance of over 400 ft., the detonation being heard many miles away.—*Vulcan.*

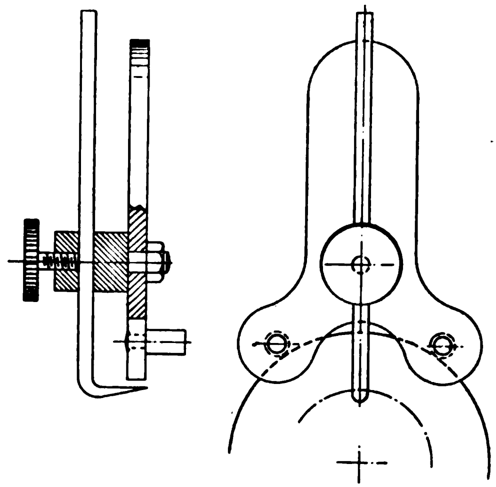
Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "WORKSHOP" on the envelope.]

A Marking Gauge.

By T. LEWIS.

The sketch shows a gauge which is very useful for marking the bolt circles on cylinder covers, etc. It will work equally well on straight work. Little need be said concerning the construction,

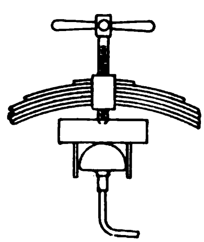


except that it is made of steel, and the pins and lips that come in contact with the work are hardened. One view shows the tool in position to scribe.

Method of Drilling Holes in Metal with an Ordinary Brace.

By W. F. MILNER.

The following is a method which I use of drilling holes in metal with an ordinary brace. A piece of wood, with four pegs or nails on one side to hold the head of the brace and a hole about ½-in. deep in the other, is required. The rollers and spring are then taken from a mangle (a very simple matter) and a board placed across the wooden tray or in the slots provided, according to the size of the brace. The piece of metal is placed on the board and the brace fixed with the drill in the required position and the hole in the wood under the screw which tightens the spring. The screw is then tightened and the drill arranged square with the work by means of a square. The hole can then be drilled in much less time than by hand, and a much better hole is the result. It is well worth the trouble of rigging up for a job such as I had, namely, drilling thirty-one ⅜-in. holes in two

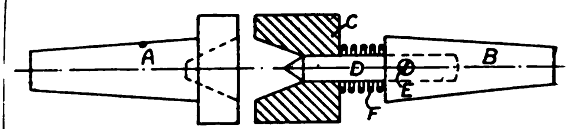


boiler ends. I find it very useful in another way, as, being only 15, and therefore always short of pocket money, I cannot afford a bench drill.

A Centreing Device for the Lathe.

By W. H. ISLIP.

This centreing device will be found useful as a time-saver when there are a good number of pieces to be centred. Most lathe-users have centred work up by means of a bell chuck and square centre, so that this device will be easily understood. A is a bell chuck to be fixed in the headstock of a lathe, B is a taper to be fixed in the tailstock (and should be bored to receive a piece of silver steel), D—one end of which is squared to form a square centre,



CENTREING ATTACHMENT FOR LATHE.

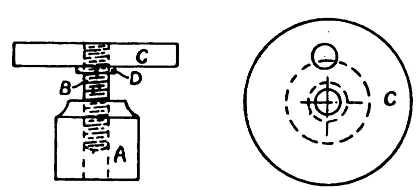
the other end being fixed in B by a grub screw E. C is a cone piece which should be a running fit on D; F is a close coil spring, and rather strong. Now, if we put a piece of steel between the two cones and feed up the tailstock, the steel will revolve the spring F, giving sufficient pressure to drive same, and, if we continue to feed tailstock, the centre D will come up and centre the revolving work.

If desired, instead of square centre D, a Slocomb centreing drill may be used, which gives a much better result. This device, properly made, will be found to be as quick as most expensive centreing machines.

An Adjustable Table.

By W. H. ISLIP.

When marking off irregular-shaped pieces of work, a great deal of packing has often to be done, and the adjustable table shown will be found a



AN ADJUSTABLE MARKING-OFF TABLE.

great help in such cases. A is a bicycle cone faced up true, B is a piece of a bicycle spindle, and C is a plate faced up true and screwed to suit the spindle B. A nut D should be fitted to the spindle, and the plate C screwed up to it to keep it tight.

To Make Brazed-Seam Tubes.

By E. R. CARROLL.

All that is necessary is to cut a strip of metal to, say, twice the width of one required for the for the finished tube.

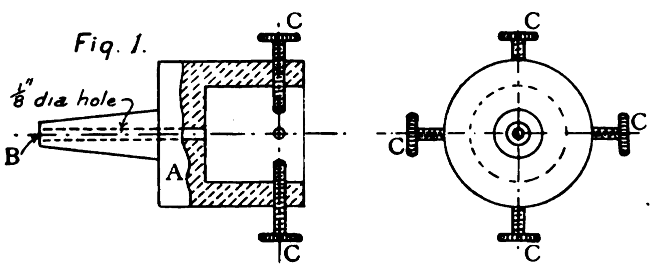
Suppose we want to make ⅛-in. tube. Cut a strip wide enough to make ⅜-in. tube, taper one end and enter in drawplate; press metal down by driving in a taper punch gently to channel metal, remove taper punch, and draw with draw-tongs right through hole, so on to the next couple of holes, and repeat until edges meet silver-solder, or braze from the inside neatly, and continue drawing until proper size is reached.

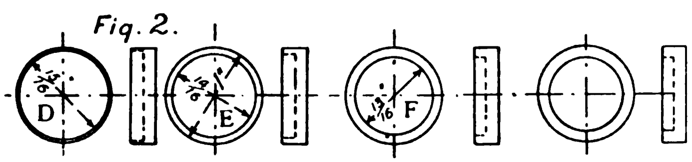
A Useful Chuck.

By M. T. Reilly.

Most model engineers experience the difficulty of holding small work in the lathe without going to the expense of a self-centreing chuck.

I have designed a chuck which is practically self-centreing, and which costs very little, a description of which may benefit some readers of The Model Engineer. A short length of steel rod 1½ ins. diameter is turned up, as shown at A (Fig. 1), and a ⅛-in. hole bored through, as at B. Four holes are drilled at right angles to each other round the mouth of the chuck, as shown at C; these holes should be drilled 3-32nds in. diameter and tapped for ⅛-in. diameter screws. When this part is finished





a number of washers have to be turned. From 1 in. diameter rod (brass or iron) turn out fifteen plates ⅛ in. thick, and recess each ⅛ in. deep to different diameters (see Fig. 2), going down by 1-16ths, as shown at D E F.

To fix work in the chuck is but a simple matter. Say your rod is 11-16ths in. diameter, then you fix on the end the washer recessed to 11-16ths in. diameter; then run this to the end of the chuck (the other end of the rod should have been centred); the centre in the tailstock should be brought up to the centred end of rod, so that it is now mounted between the centres. The screws C C C C are now screwed down against the work firmly, when the tailstock may be taken away. To remove the washers, a short length of steel rod made to fit easily is then pushed through the hole (Fig. 1), when a tap or two will knock the washer out.

Workshop Conversations.—I.

Characters.

Jones: an enthusiastic, but rather inexperienced model engineer.

Brown: a friend, who takes a passing interest in Jones' work.

Scene I.—*Jones' Workshop.*

Brown (opening the door): "Hullo, old chap, can I come in?"

Jones: "Come along, you're just in time to see me make a screw."

Brown: "Didn't know you made screws—thought you bought 'em ready made."

Jones: "Not much, since I bought a screw-cutting lathe. Saves me no end of money—at least, it will do, for I haven't made any screws yet."

Brown: "Fire away, then, and show me how it's done. What sort of screw is it?"

Jones: "Oh! just an ordinary ⅛-in. cheese-head screw. See here, I am going to make it out of this bit of brass rod in the chuck. First I turn it down to size on the head, so. (He turns.) A couple of cuts along, and there it is. Then we turn the body down—so."

Brown: "What about the size?"

Jones: "Oh! that's easy enough. I try it with these calipers, which I set to a ⅛ in. on the rule—I'll show you. Oh! bother! I've turned it down too much, and it won't do."

Brown (facetiously): "Can't you put a bit on again—a clever chap like you ought to be able to do that."

Jones (rather huffy): "Do talk sense—I must cut it off and start again."

Brown: "Right oh! here's the saw."

Jones: "That shows how much you know about lathe work. We do this job with a parting tool."

Brown (apologetically): "Sorry, old man; we live and learn."

Jones: "Parting-off, my boy, beats sawing into fits—besides, it's the correct thing, as you'll see in a minute. Here's the tool that does the trick. You just fix it in the slide-rest and feed it straight into the work. It walks through it like butter—watch it." (He proceeds to feed in the parting-off tool.) "See the lovely shavings—that's lathe work!" (Br—r—r—r——bang! The tool digs in; the work bends up and rides over the tool; the tool breaks, and the lathe stops.)

Jones: "—— —— —— ——"

Brown (seizing his hat): "Awfully sorry, old chap—I must part-off, too. Thanks for the lesson—good-night." (He goes—suppressed chuckles heard as he descends the stairs.)

Scene II.—*Jones' Study.*

Jones seizes a post-card, addresses it to Messrs. ——, and writes: "Please send me your price-list of cheese-head screws, especially of ⅛ in."

Chats on Model Locomotives.

By H. Greenly.

(*Continued from page* 398.)

Steam Whistles, and How to Make Them.

Several readers of The Model Engineer have desired me to describe the construction of a model steam whistle, and although I have held certain opinions on the best way to make one of these interesting accessories to a working model locomotive (especially to a large model, upon which the driver rides), I deferred the matter until the opportunity arose for making and fitting one to a 1½-in. scale engine under my charge.

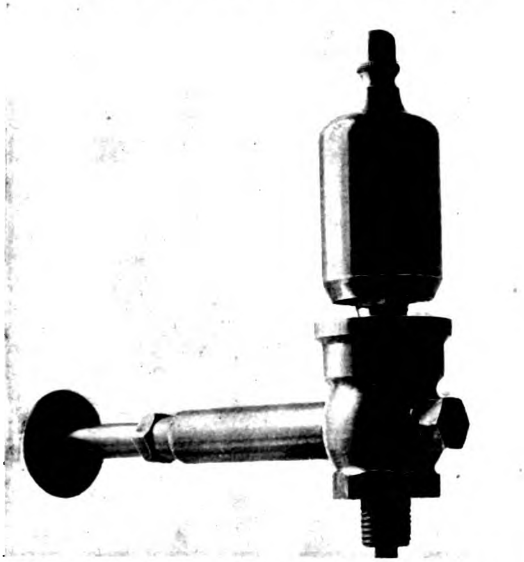


Fig. 1.—A Steam Whistle for Model 1½-in. Scale Locomotive.
(*Photo about three-quarters full size.*)

Some months ago I was consulted by a gentleman with a view to suggesting certain improvements to this engine, and after the main portion of the work of rebuilding was completed, I turned my attention to the whistle. The one already fitted was of the standard model type, with a plain plug cock, and although it would blow if you could turn the handle, a pair of pliers had to be carried by the driver to perform this operation. This was decidedly awkward, especially in cases of emergency.

The new whistle has since been completed and fitted to the locomotive. It is shown nearly full size in the photograph (Fig. 1) herewith, and is the work of Mr. C. Butcher, of Watford, a skilled mechanic, who very often assists me in producing new things, and does for me some of the experimenting which is necessary before one can write on model subjects in an authoritative manner. The whistle works exceedingly well, and gives great pleasure to the youthful users of the engine, only slight adjustments being necessary to make it blow properly after it was fitted. As to these adjustments, I will deal with them in detail later on.

At first I thought of altering a standard whistle by drilling out the plug hole and fitting a valve-seat of the type shown in the sketch (Fig. 3). This, however, was ruled out of court, as the metal available was not quite sufficient for the purpose, and, further, I did not want any trouble, owing to steam leaking from the "live" steam side of the

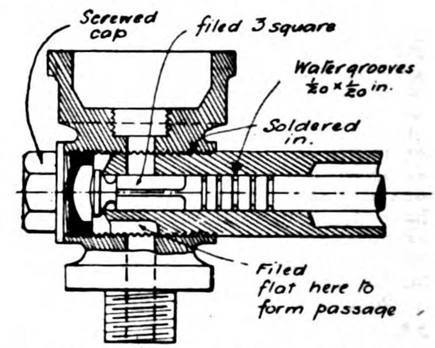


Fig. 3.—Alternative Arrangement of Valve Seating and Plunger Spindle.

valve past the seating and the body of the whistle (*i.e.*, through the joint) to the whistle side. This would happen if the joint did not fill the hole properly. Of course, solder might be used to caulk the joint, but this would have to be used somewhat sparingly and might not make a perfect joint.

The advantage of the separate seating is, of course the fact that the seating and the plunger sleeve, being in one piece, perfect alignment is assured, whereas if the method shown in the main drawing is employed, with inferior fitting, the valve seating may not be square with the plunger or spring sleeve.

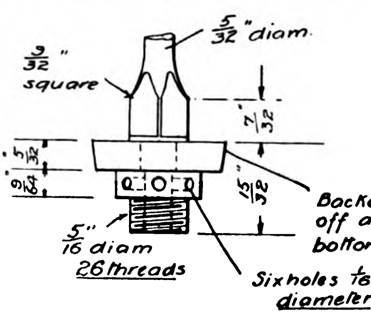


Fig. 4.—Detail of Plug which forms Annular Orifice.

Of course, after the spring sleeve has been fitted, the seating may be trued by a pin cutter or in the lathe, the spring sleeve being held in the self-centreing chuck.

One improvement I have introduced in the design of the whistle (the drawing herewith was made after the whistle in the photograph) is in the shape of the body, which may be hexagonal instead of round where the spring sleeve and cap fits on. This provides a better seating for both fittings. The valve body of the whistle is made out of 1-in.

brass rod, the hexagonal portions being milled with a drilling spindle in the vertical slide.

In the whistle shown in the photograph the valve and plunger stem are formed out of one piece of metal (brass rod), the stem being run down to size from a thicker piece of stuff or the valve head being silver soldered on to a piece of 3-16ths-in. rod.

The valve is turned to shape, and the stem for about ⅛ in. up filed to triangular shape to allow the steam to pass to the vertical passage above the valve. The seating should be knife-edged, so that the valve beds on easily, and also to prevent dirt lodging on the seat. The spring should be hard brass, if possible. A japanned steel spring may be used and will last a fair time. The tension nut, which also supports the plunger, should be arranged so that the movement "B" of the plunger (and therefore the valve) should be restricted to 3-32nds or 5-64ths in. This nut is locked in place by the plunger knob, as indicated. An improvement over the arrangement shown in the drawing would be to mill the flange of the nut to hexagonal shape and similarly treat a portion of the plunger knob, so that spanners may be used to lock the screws.

The screw into the boiler should be as large as possible—not less, in the case of a whistle of the size shown in the photograph and drawing, than ⅜ in. diameter and 26 threads per in.; 7-16ths diameter, 26 threads, would be better, and a base ⅞ in. diameter instead of ⅞ in.

The bell of the whistle is a matter of simple turning, the diameter of the sounding edge being the same as the annular orifice A (in Fig. 2). This orifice is formed by the centre plug, which fits in the body. This plug may be solid with the bell stem, or the latter may be screwed in, as shown. Another way would be to silver solder a boss of metal on to a length of 5-16ths-in. brass rod, finishing the whole in the lathe, and thus ensuring perfect alignment. The stem should be left full length and trimmed off afterwards.

To conduct the steam from the centre passage to the annular space, six holes 1-16th-in. diameter should be drilled to meet the centre passage, as shown at H in the drawing.

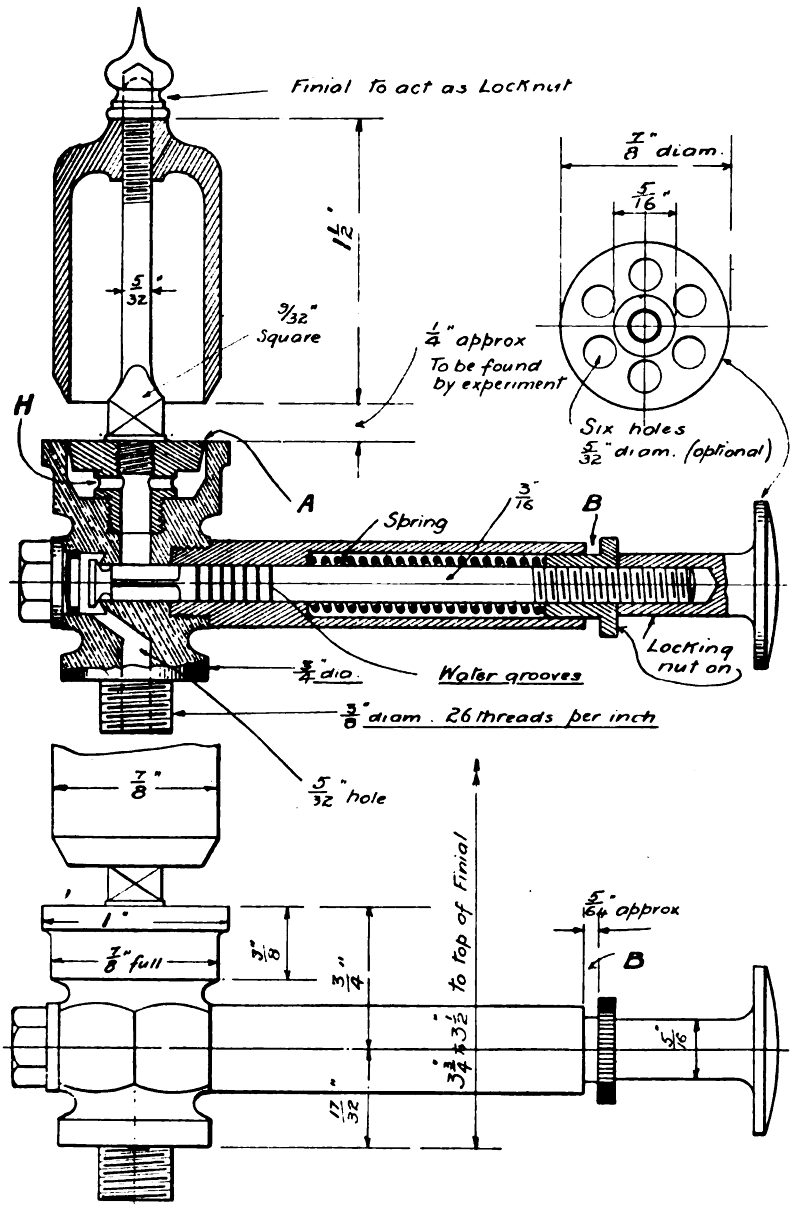


Fig. 2.—A Design for a Steam Whistle for a 1½-in. Scale Model Locomotive. (*Scale: Full size.*)

The annular orifice should be very small—a mere crack at the outset, and the plug backed off at the lower portion so that the steam is not subjected to undue resistance. The final size of the orifice may be settled when the whistle is tested under steam at the required working pressure, the bell also being screwed up or down until the correct distance away from the lower portion is found. The orifice should, I find, be slightly larger than at which the whistle will just blow the proper note, to allow for the accumulation of deposit in the narrow space forming the annular jet, depending on the water in the district in which it is used.

After the whistle shown in the photograph had been at work a day it refused to pass steam, and the orifice had to be made a little larger in consequence. To prevent the handle becoming unduly hot, holes may be drilled in the knob, as shown in the separate view in Fig. 2.

The shape of the finial is, of course, optional. Its only other purpose besides that of an ornament is to lock the bell in position, as indicated on the drawing.

(To be continued.)

Gear Wheels and Gearing Simply Explained.

By Alfred W. Marshall M.I.Mech.E., A.M.I.E.E.

(Continued from page 396.)

When the shafts between which the rotation is to be transmitted are not parallel to one another, conical toothed wheels, called bevel wheels, may be used. They have peculiarities,

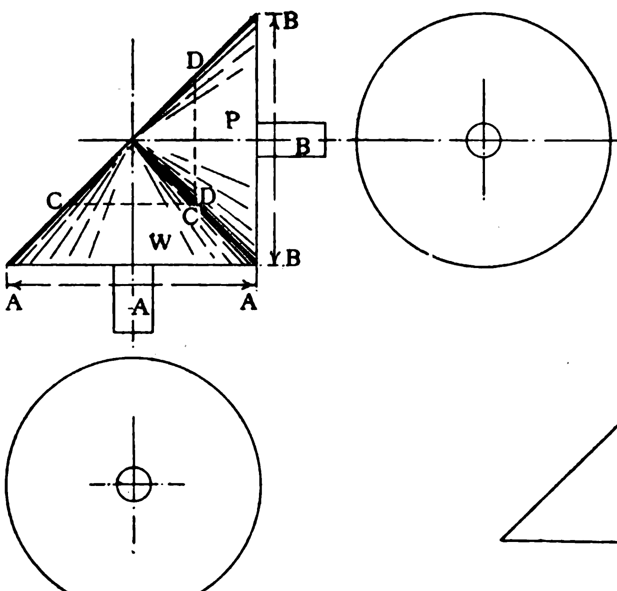


Fig. 27.

and are difficult to construct so that they will work properly together, maintaining the relative velocities of the shafts. If the shafts are at right angles and the wheels are of equal size, they are then often called mitre wheels. When planning a pair or train of bevel wheels the first step is to imagine them as cones with smooth surfaces rolling against each other and transmitting the motion by frictional contact (Fig. 27). The relative

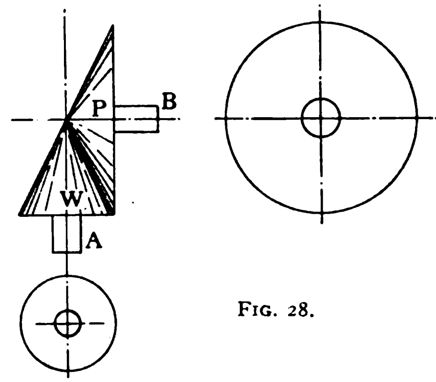


Fig. 28.

velocity of cone W to cone P will depend upon the diameter A A of cone W to the diameter B B of cone P. If these diameters are equal, cone P will make one revolution for each revolution of cone W. If any other diameters which are in contact, such as C C, D D, are selected, they will be in the same proportion to one another as the large diameter A A is to B B. We can imagine a series of such pairs of diameters between the bases and points of the cones, and each pair will bear the same proportion to one another. The entire surfaces, therefore, of the two cones, roll together with the proportional velocity of the large circles A A, B B, and the entire surface of each cone forms a pitch

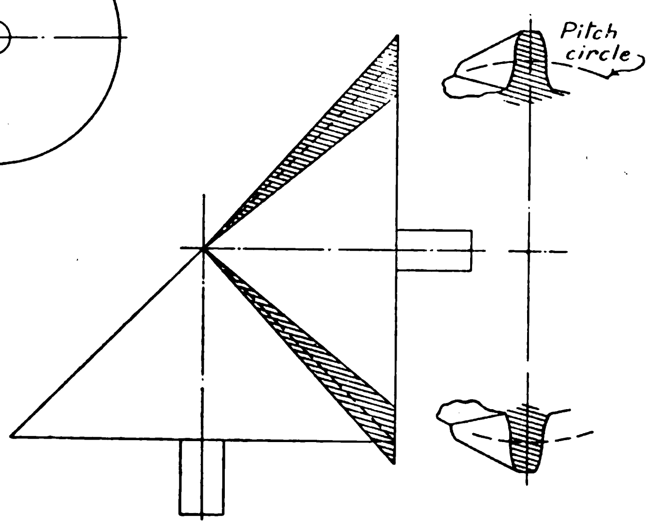


Fig. 29.

surface of that cone. We could thus correctly select any pair of diameters upon which to form the pitch circles of the cones. In practice, the circles formed upon the largest diameters A A and B B are selected as the pitch circles. To drive one shaft by the other at any relative number of revolutions you should thus make the sizes of the circles forming the bases of the cones in proportion to the desired relation between the revolutions of the shafts. Thus, if shaft B is to make one complete revolution whilst shaft A makes one revolution, you should design the base A A of cone W so that it has a diameter equal to the base B B of cone P; if shaft B is to make one revolution whilst shaft A

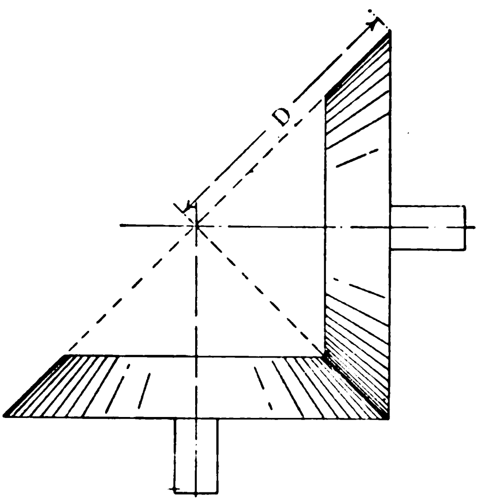


FIG. 30.

makes two revolutions, the base of cone P should be designed with a diameter twice as large as the diameter of the base of cone W, Fig. 28; and so on. The bases of the cones are equivalent to the pitch circles of flat gear wheels, and the shafts which they connect will rotate with relative velocities proportional to the diameters of the bases of the cones. In these explanations it is assumed that the axes of the shafts intersect. This is the condition usually met with in practice.

Such a pair of cones, made of wood, metal, or other material, will transmit the motion of one shaft to the other by contact friction between the surfaces. If they are large in proportion to the amount of power to be transmitted and conditions of working are favourable, the friction may be sufficient and no slipping occur. To prevent slip, teeth may be provided as in the case of flat gear-wheels. This introduces a difficulty, as the teeth and spaces must be conical and follow the shape of the pitch surfaces of the cones. For example, if we construct teeth of similar shape and character to those used for flat wheels, they must be made to taper from the base to the point of the cone, as indicated by the shaded surfaces, Fig. 29. If they are made of uniform height and thickness, or of less angle of taper than would terminate in the point of intersection of the pitch cones, they could not work together, but would foul and break off if sufficient power was applied to drive the shafts. Every part of the surface of each tooth—the faces and flanks as well as the tops—must be conical, the taper coming to a point at the intersection point of the pitch cones. The teeth, if properly made, will, therefore, become very thin at the parts which are near to the points of the pitch cones, finally vanishing away. Only a portion of the length is of practical use, and bevel wheels are never made to the complete theoretical extent of the pitch cones, the breadth is usually made equal to one-third the distance D, Fig. 30. Each wheel thus becomes a truncated cone, but is actually part of a complete cone, as indicated by the dotted lines, Fig. 30.

This principle of rolling cones permits considerable latitude in selecting the size of the wheels, and in this respect the problem differs from that of connecting two parallel shafts by flat spur wheels. In the latter case the size of the wheels is limited by the distance between the shafts, but when the shafts are at an angle the wheels may be of any size within the limits of the space of the machine or the surroundings of the shafts. For example, in Fig. 31 the shafts A and B are to be connected by the wheels so that they rotate with equal velocities. Wheels of size C C may be used, or of size D D, or any intermediate size, without affecting the relative speed of the shafts. Both pairs of wheels could be used simultaneously because all bevel wheels on either shaft having pitch surfaces meeting on the line of the two cones indicated by the dotted lines are really a portion of one large conical wheel the teeth and pitch surfaces of which extend from the point to the base of the largest wheel. The principle is not affected if the shafts rotate at different relative velocities. For example, in Fig. 32 shaft A makes two revolutions to one revolution of B. The wheels may be of size C C or D D, or any other size, provided their pitch surfaces form part of the

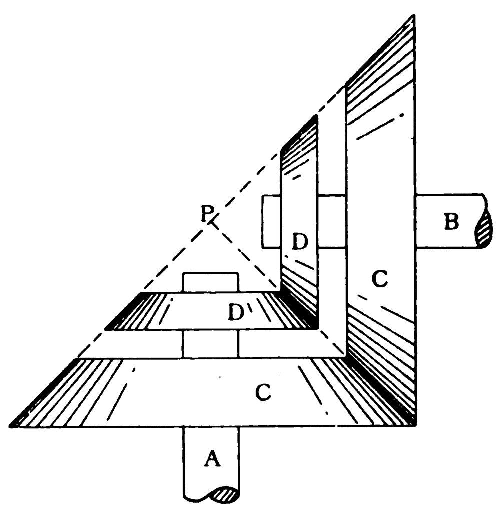
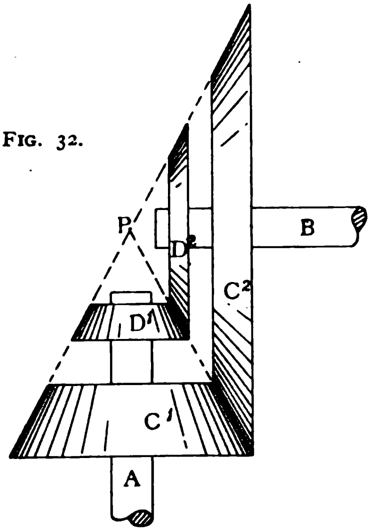


FIG. 31.

cones indicated by the dotted lines. The relative numbers of teeth must remain the same or be in the same ratio. If C1 has 30 teeth and C2 60 teeth, D1 must have 30 teeth, and D2 60 teeth, or numbers of teeth having a ratio of 1 to 2; thus D1 could have 15 and D2 30 teeth, and so on. The sizes of the wheels to connect a pair of shafts whose axes are at an angle can therefore be determined by matters of convenience and strength required to transmit the power. Obviously a large pair of wheels can have teeth of greater size than a smaller pair. If the shafts are not at a right angle to one another the principle of rolling cones is still applicable, if the axes of the shafts intersect. Fig. 33 is a diagram showing two shafts intersecting at an angle of less than 90 degs., and Fig. 34 shows the

FIG. 32.



shafts intersecting at an angle greater than 90 degs. in each instance the cones have equal diameters, so that the two shafts will rotate at equal speeds. The shafts may be made to rotate at different speeds by designing the cones so that their diameters are of corresponding proportions to the speeds, as in the case of shafts at a right angle. Fig. 35 shows the principle of rolling cones applied to an internal gear connecting two shafts S S,

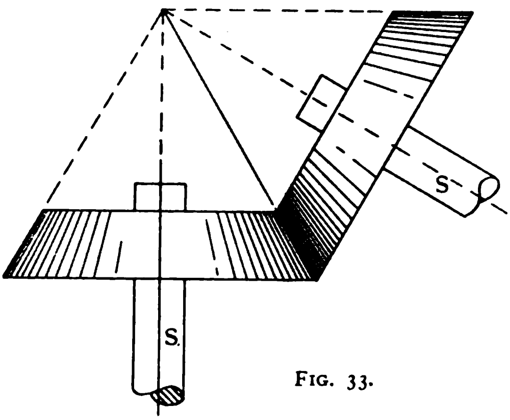
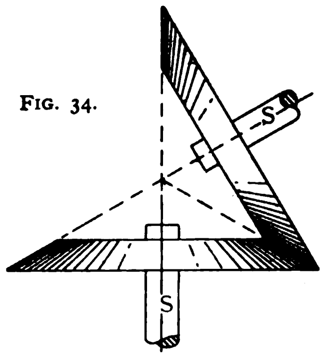


FIG. 33.

which are at an angle. In this arrangement the wheel P must be smaller than the other, as it is a pinion working inside an annular wheel.

The term crown wheel and pinion is sometimes given to the gear shown in Fig. 36. Correctly speaking crown wheel is another name for bevel wheel, and the gear shown in Fig. 36 should be formed on the principle of rolling cones. If the wheel W is made with straight teeth and a cylindrical pinion P is used to gear with it, the arrangement will not work correctly. The wheel may be represented by a flat disc W, Fig. 37. In fact, its pitch surface would be a part of such a disc. The pinion would be represented by a cylinder P, rotating in contact with the disc; such a cylinder would form the pitch surface of the pinion. Obviously all parts of the circumference of P must move with the same velocity. But all parts of the surface of the disc will not move with the same velocity. That part represented by the dotted circle C will have a much greater surface speed than the part represented by the dotted circle D. As both parts are in contact with the circumference of P, the circle D will be trying to drive P at a slower speed than it is being driven by P. Every part of the surface between C and D will, therefore, be trying to rotate P at a different rate of speed. As P can only rotate at one speed at any instant, a slipping and grinding action must take place between the surfaces. If the surface of the disc is cut away so that only a circular ridge is left in

FIG. 34.



contact with P, such as would be represented by the circle C, this action would be reduced to a minimum. The gear shown in Fig. 36 can be, therefore, made to work if the teeth on W have very small breadth, as indicated by the sketch, so that they make very narrow contact with P. Such a wheel can then only transmit or receive a very small amount of power or its teeth will soon wear away. When the diameter of the wheel is great compared to that of the pinion, the error in the shape of the teeth as regards taper is small, as indicated by the dotted sketch Fig. 36, but it still exists.

The teeth of bevel wheels are formed on the same principle as the teeth of flat wheels, but the shapes of the faces and flanks are not developed upon the actual pitch circles. A section through a tooth which would show its actual shape would not be in a plane parallel to the base of the pitch cone as indicated by the teeth shown by Fig. 29, but would be in a plane perpendicular to the conical pitch surface. The teeth are placed so that they are perpendicular to this pitch surface; therefore, it would not be correct to develop their shape by curves generated on the circumferences of the pitch circles. They are developed upon circles C C of larger diameter, as indicated by Fig. 38, the centres and radii being found by drawing lines B at a right angle to the pitch surfaces, and meeting the centres of the shafts at D D. The circles upon which the curves of the teeth are formed are then found by radii equal to the distance from D to the edge of the pitch circle. The numbers of the teeth are calculated with reference to the pitch circles P P, and not with reference to the circles C C. The pitch is merely applied to the circles C C and the teeth shaped by rolling curves as in the

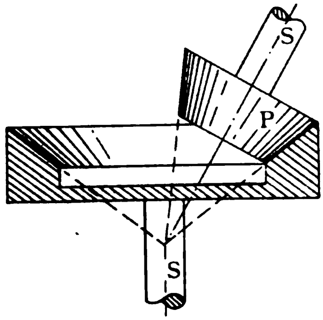


FIG. 35.

case of flat wheels, as if C C were the true pitch circles, but it is kept the same as found by dividing the circumference of the true pitch circles P P by the required numbers of teeth. Only a part of the circumferences C C is therefore required, in fact, sufficient only for the motion of the curve generating circles. This question of shaping the teeth need not concern you if you are merely preparing a blank to send to a wheel cutter; it only concerns

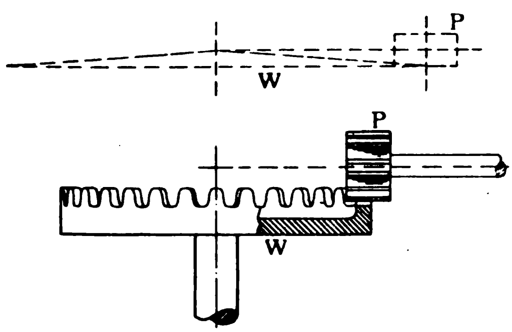


FIG. 36.

anyone who is actually shaping the teeth. The necessary thing is to make the blank of sufficient size and suitable shape to be cut. Sufficient margin must be allowed above the conical pitch surface to form the part of the teeth which projects beyond the pitch circle. The amount necessary for this is found by adding a part T projecting above the pitch surface, and the dimensions S is the depth to which the spaces will be cut below the pitch surface. The small ends of the teeth are terminated parallel to the lines B. The inner face of the wheel is, therefore, recessed as indicated at R. The lines of the sketch indicate the manner in which the teeth taper towards the point O, where the axes of the two shafts intersect. This is also indicated at V, where the small ends of the teeth are shown developed upon a circle W, concentric with C, and having a radius Y Z, found by drawing a line from Z to Y perpendicular to the conical pitch surface of the wheel. A complete blank ready for cutting the teeth would have an appearance as indicated by the sketch Fig. 39, which is partly in section. The dotted lines S S indicate the depth to which the teeth will be cut.

It is usual to make the thickness of the wheel

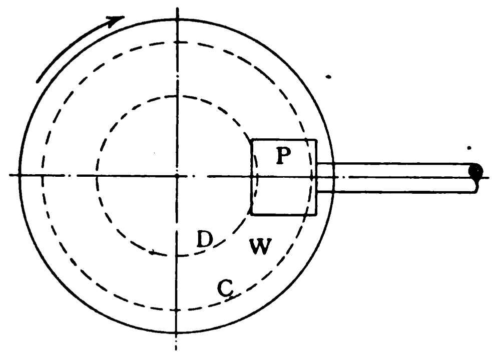


FIG. 37.

somewhat greater as indicated by the dotted line A, to avoid a weak edge at the bottom of the spaces between the teeth. If a pattern is being made and the teeth cut out by hand, the curves for the faces and flanks must be applied to the surfaces

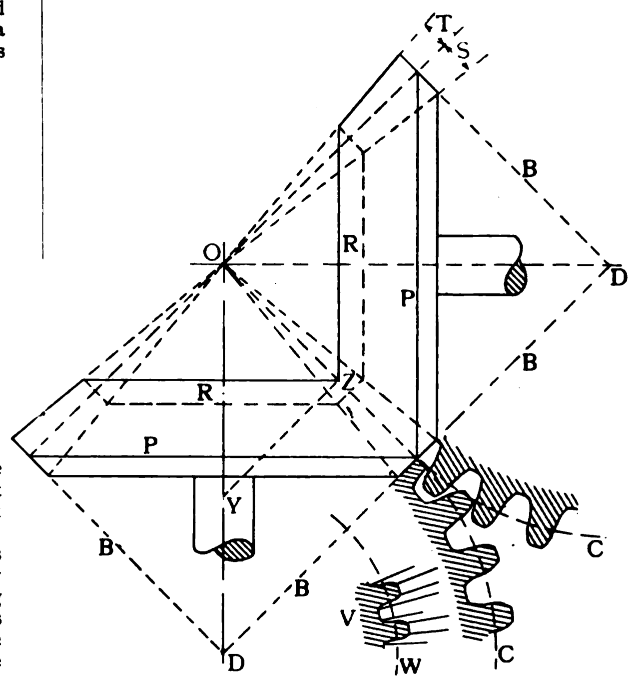


FIG. 38.

T T, either by a template or by setting out with compasses, having been found by construction or development on the circles C and W, Fig. 38. A consideration of the tapered form of the teeth will show the difficulty of shaping them by cutters in a machine. In fact, when cut by milling cutters, they usually only approximate to the correct form, and some methods of cutting leave a certain amount of shaping to be done afterwards by filing. The general idea being to produce the teeth as correctly as possible by the cutter at the large end.

The general rules for shapes of teeth of flat wheels also apply to the teeth of bevel wheels; they may be on the cycloidal or involute systems. One wheel may be of the lantern pattern, as Fig. 20, and have pins for teeth; such a pair of wheels have their teeth shaped precisely upon the same principles

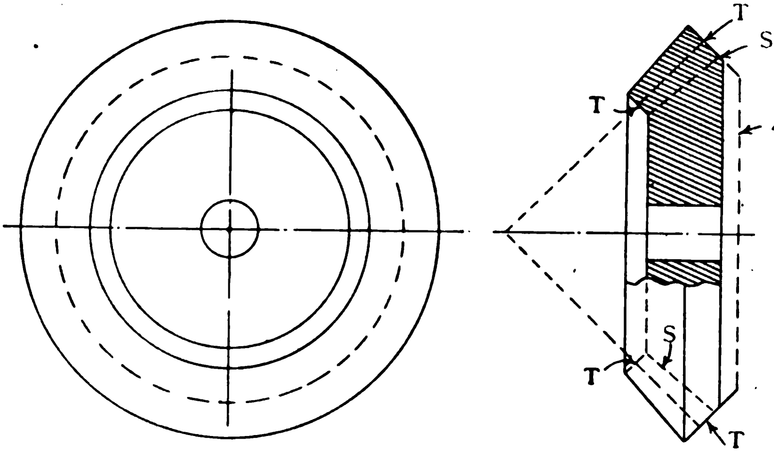


Fig. 39.

as the teeth of a flat wheel, and lantern pinion. When the teeth are produced by a circular milling cutter they should be of involute form, as the cycloidal shape is extremely difficult if not practically impossible to obtain by this method.

(*To be continued.*)

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

An Anglo-American-Japanese Locomotive.

It is not often that a locomotive can be said to have originated in one country, been built in a second, and used in a third; but such is the case where the engine illustrated in Fig. 1 is concerned. The drawings were prepared, and the design wholly worked out, in the North of England; the engine, with others of the same type, built in America; while the work for which they were constructed, and on which they are now engaged, is the hauling of passenger trains on the Imperial Railways of Japan.

The international character thus imparted to the locomotives may be regarded as unique, and the explanation of the circumstances seems to be that the order was divided between an English locomotive-building firm and one in the United States, on account of the fact that the consignment was a rather heavy one and the engines required as quickly as possible. There were probably other reasons, but this one, at least, is the most likely and reasonable. The design is not remarkable in its general features, although it is interesting to note that the firebox is fitted with the Drummond water-tube arrangement and that the engine is equipped with the vacuum brake appliances. The cylinders (16 ins. diameter by 24-in. stroke) are placed outside the frames, and they drive the leading pair of coupled wheels, which are 5 ft. in diameter. The wheel arrangement is 4—4—0 and the gauge 3 ft. 6 ins. The engine has a coupled wheelbase of 8 ft. 4 ins., and a total wheelbase of 21 ft. 7 ins., while the total wheelbase, including tender, is 38 ft. 7½ ins.

The boiler is 3 ft. 8 ins. diameter by 10 ft. 9 ins. long, and contains 163 tubes of 1¾ ins. diameter, giving a heating surface of 801·15 sq. ft. of heating surface. The firebox is 5 ft. 11 ins. in length outside and 2 ft. 4 ins. wide, and contains a heating surface of 84 sq. ft., or a total heating surface, including 72·2 sq. ft. in the water tubes, of 957·35 sq. ft. The grate area is 14·25 sq. ft., and the boiler pressure 160 lbs. per sq. in.

The locomotive, which presents a very English appearance, weighs, in working order, with its six-wheeled tender, 55 tons, of which 20½ tons is employed for adhesion. The maximum tractive power developed is 13,926 lbs., and the adhesive factor 3·3.

Another American-European Locomotive.

The locomotive shown in the second illustration is one of several recently supplied by the American Locomotive Company—who, it may be added, also built the Japanese locomotive illustrated and described above—to the Paris-Orleans Railway. This is another instance where the design was prepared in one country and the construction effected in another, for the drawings were sent out to New York direct from Paris, and no departure from them in any shape or form was made. These new "Pacific" type engines are substantially the same in all respects to those built last year by the Société Alsacienne for the P.O. Railway, being de Glehn system compounds, with 15½-in. by 25½-in. high-pressure cylinders and 25½-in. by 25½-in. low-pressure cylinders, coupled wheels 6 ft. 1 in. in diameter, and total engine wheelbase of 34 ft. 5½ ins. The total heating surface is greater in these new engines than in the French-built earlier series, the figures being 3048·2 sq. ft. in the present, and 2769·06 sq. ft. in the former instance. The grate area and boiler pressure remain as before, being, respectively, 46 sq. ft. and 227 lbs. per sq. in. In working order, the engine weighs 87 tons, with 53 tons of adhesion.

Great Northern Tank Engines to Carry More Coal.

One, at least, of the ten-wheeled, 4—4—2 type tank locomotives of the "1,500" class, viz. No. 1509

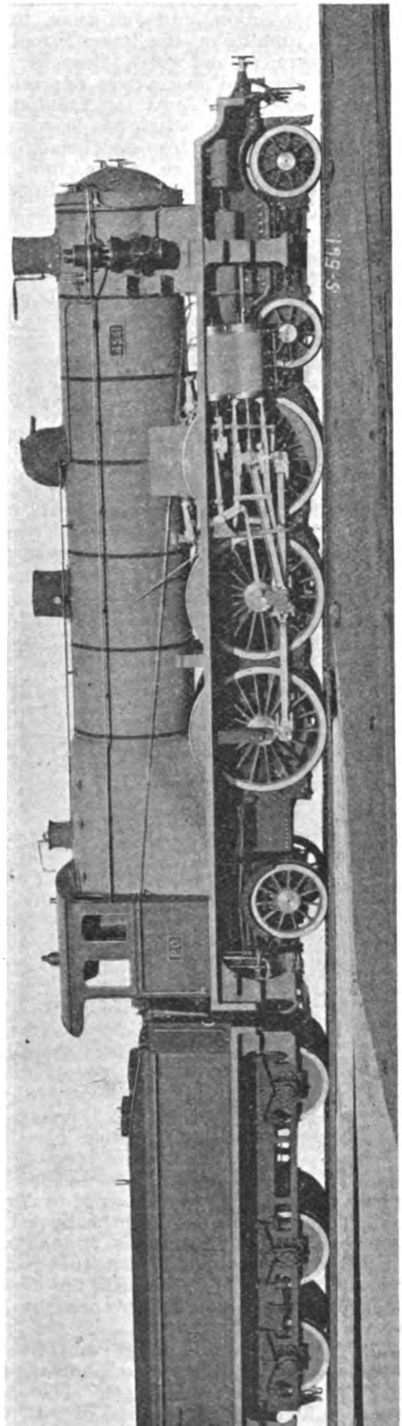


FIG. 2.—AMERICAN BUILT PACIFIC TYPE COMPOUND LOCOMOTIVE: PARIS-ORLEANS RAILWAY.

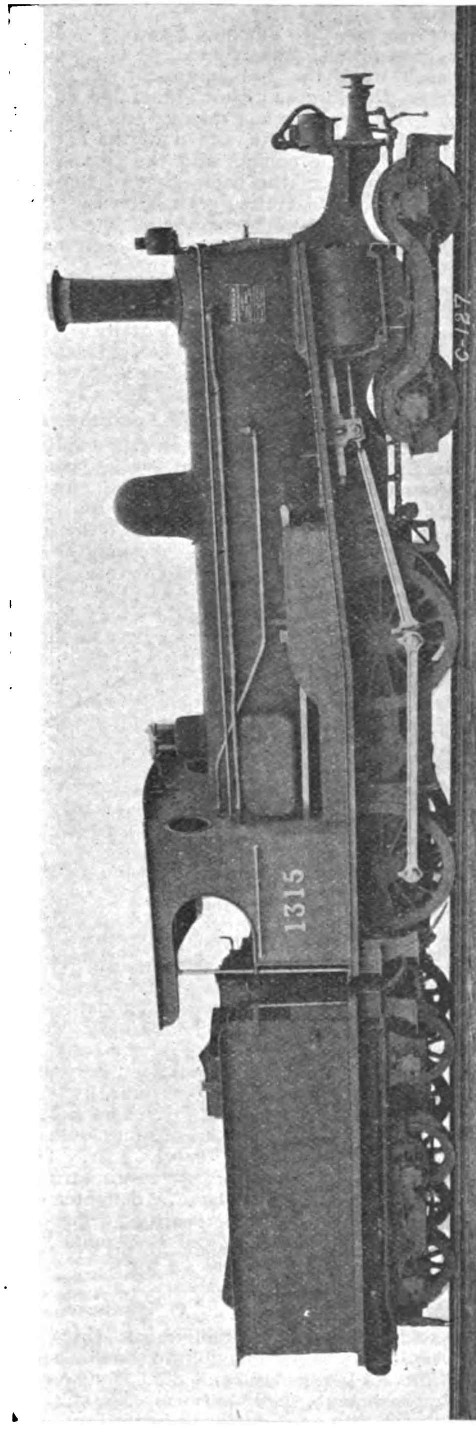


FIG. 1.—DESIGNED IN ENGLAND, BUILT IN AMERICA, AND USED IN JAPAN.

on the Great Northern Railway has recently been adapted for carrying an increased supply of coal. This engine has latterly been working the shuttle service on the Finchley-Edgware branch line, on Saturdays and Sundays, on which days in each week the rail motor-car is taken off, owing to the large amount of traffic to be dealt with. The tank engine referred to has had an inverted V-shaped plate added at the rear of the bunker above the coping, and the coal space between this plate and the back sheet of the cab has been railed in with slanting grids, after the style of the latest 4—4—2 tank engines on the Great Central Railway. By this means it has been made possible for the engine to carry a supply of coal larger by about 25 per cent. than formerly, and, in the writer's opinion, the appearance of the locomotive has also been improved incidentally by the change. The grids are hinged at the bottom and can be thrown back outwards when coaling is going on.

An Inquiry *re* Great Western Locomotives.

Mr. H. A. Dalton, a model engineer with a special interest in locomotive construction, writes asking to be informed as to why some of the outside cylinder locomotives on the Great Western Railway, on which line he is a daily traveller to and from Southall, have "circular big ends to the connecting-rods similar in shape to the coupling-rod ends, whereas on every other line, so far as he has seen, the connecting-rods have rectangular big ends. Is there any advantage in the Great Western method, and if so, what is it?"

Practically all the modern Great Western locomotives with outside cylinders are fitted with the type of connecting-rod referred to by Mr. Dalton. It is what is termed the "solid-bushed" pattern big end, and the advantages attending its use are that, owing to its more simple construction, it is cheaper and easier to produce than the rectangular or "marine" type of big end. The end of the crank-pin has a fine thread cut on it, and the cap is screwed on and afterwards secured by a taper pin running through it.

A Record in Locomotive Building.

What constitutes, within certain defined limits, a record in locomotive building has just been achieved by the Avonside Engine Company, of Bristol, this firm having despatched, to the order of an important Australian colliery company, a ten-wheeled tank engine, which ranks as the largest and most powerful locomotive yet built by any private firm in the West of England. The engine has the 0—8—2 wheel arrangement, and outside cylinders with Walschaerts' valve gear. The cylinders are 20 ins. diameter by 24-in. stroke, and the eight coupled wheels have a diameter on tread of 3 ft. 11½ ins. A total heating surface of over 1,300 sq. ft. is provided, and the engine (in full working order) weighs about 64 tons.

Changing the Locomotives at Harrow.

The recently completed re-building at Harrow-on-the-Hill Station, Metropolitan and Great Central Joint Railways, have effected some very striking improvements, not only in the station itself, which now has four platforms instead of only two, but also in the methods available for working the traffic.

The system employed for changing from steam to electric traction, and *vice versa*, in respect of the trains running on the Baker Street and Aylesbury line services, and which takes effect at Harrow, has been rendered more easy of accomplishment by the improvement. At the London end of the station a new engine siding has been put in on the "up" side of the line, this siding being equipped with the necessary coal stage, water crane, and engine pit, and, on the arrival of a train from Aylesbury, the steam locomotive is at once detached and runs off on to this siding, while the electric locomotive is held ready to be attached to the train the moment the other engine has cleared the points. The whole operation is accomplished in about 1½ minutes, and, after the steam locomotive has been coaled and watered, it runs through to the other end of the station and takes up its stand on a special siding near the "down" Aylesbury platform, in readiness for the next train brought by an electric locomotive from Baker Street.

The "Slipping" of Locomotive Driving Wheels.

Quite a number of correspondents have written on the subject of locomotive driving wheels slipping when the steam is shut off; a matter which, it will be remembered, was referred to in a recent issue of these notes. Various suggestions are offered in the endeavour to clear up the point and the correspondence forms very interesting reading. The matter will be reopened in a forthcoming issue, when these letters will be discussed.

The Victoria Model Steamboat Club.

INTER-CLUB VISIT.*

On Saturday, October 3rd, by invitation of the Victoria Model Steamboat Club, several prominent members of the Clapham Steam and Sailing Club paid a visit to Victoria Park and participated in one of the popular Gymkhanas instituted by the V.M.S.C. The weather was all that could be desired, although the water was perhaps not quite so, owing to the "fall o' the leaf," but in spite of floating vegetation, etc., some fine sport resulted. The proceedings opened with the Lancing the Ball event, in which the usual and best practice of "go-as-you-please" was again adopted. It was some time before a burst was reported, but the steering was very good, several boats of both Clubs providing exciting moments by shaving the balls by hair's breadths. It fell to the lot of the *Dart*, owned by Mr. S. Parker, to make the best practice, as this boat, by a curious coincidence, burst two balls on one voyage. It was necessary to run a final in this event, and Mr. Parker and Mr. Dobson with the *Iris* competed alone to decide the winner, when the *Iris* proved the victor.

The next event, Point-to-Point Steering Competition, proved exceedingly popular, the visitors showing to great advantage. The points were arranged with a central space of 1 ft. in width, a

* This account of an interesting event was unavoidably held over from last week.—Ed., *M.E. and E.*

middle outer space of 4 ft., and an outer space of 6 ft. each side of the central mark, the points being indicated by flags fixed in position. Each boat was allowed three trials, and very few failed to get within the scoring zone. Mr. G. F. Young's (C.S. and S.C.). new electric launch, *Sonny*, set an example on her second voyage by scoring the maximum number of points obtainable in one trip, and would undoubtedly have repeated the feat had it not been for " flotsam " altering her course. The *Myra*, owned by Mr. Howe (C.S. & S.C.), also put on a fine score, making two middle outers and one outer. Mr. S. Parker was fortunate enough to beat these scores by one point, thereby taking first prize; the second prize in this event falling to Mr. G. F. Young.

The visitors' boats were much admired, the workmanship being of a very high order. Particularly must be noted the 3-ft. T.B.D. by Mr. J. Riggs; the paddle steamer *Vaporiser*, by Mr. A. J. Upton (complete down to the oilskins of the officers on the bridge), and the electric launch *Stella*, by Mr. Whitmore. The most novel point about this last-named boat is the ingenious manner in which her electric installation is disguised to look like a steam set; even a dummy engine being fitted under the engine-room skylight. As dusk drew on, Mr. Whitmore switched on the port, starboard, and saloon lights, and the *Stella* then looked her very best.

At the subsequent *al fresco* " tea," the visitors unanimously praised the arrangements, and Mr. G. F. Young, in a few well-chosen words, officially expressed their thanks. Genuine regret is felt on all sides that the Clapham entries for the Branger Cup were disqualified. Mr. Young explaining that their boats were about an inch too long for the rules. Altogether the visit was thoroughly enjoyable and did much to improve the little maxim, " that the foundation of successful model engineering is good fellowship." Special thanks are tendered to Mr. H. W. Greenfield for providing the prizes, which took the sensible form of useful tools.

A Group of Members at Victoria Park.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Propellers, etc.

To the Editor of *The Model Engineer.*

Dear Sir,—I was pleased to read Mr. Delves-Broughton's reply, and can assure him that his criticisms were received in a proper spirit.

With reference to his remarks regarding cavitation, I am still inclined to think that this occurs at high speeds—say from 2,000 r.p.m. up, although I believe its effects are over-estimated in model work.

I am interested to learn that Mr. Delves-Broughton has failed to obtain any trace of cavitation at 3,500 r.p.m. It is possible he is correct, especially as one authority says cavitation does not usually begin at a thrust of less than 11 lbs. per sq. in. This being admitted, and assuming the test was made with the propeller which the *Folly* had when at Wembley—approximately, 4 ins. diameter and

10-in. pitch—then I must congratulate your correspondent upon having the fastest model boat so far recorded.

Assessing the slip at 40 per cent., which is rather high, the speed of the *Folly* should be—

$$\frac{\cdot 833 \times 3{,}500 \times 60 \times 60}{5{,}280 \times 100} = 19\cdot 8 \text{ m.p.h.}$$

I hardly think that the propeller in question, with its meagre blade-area, would give such results, especially remembering that blade-area, amongst other things, prevents cavitation to a considerable extent.

Mr. Delves-Broughton asks if I can answer certain questions. Given the necessary governing factors, it is not impossible that I could give fairly approximate results. But to discuss the points raised in a satisfactory manner would necessitate using more space than you, Sir, would perhaps grant me. Besides, I have certain cogent reasons for being reticent upon such vital questions as these.

As to the proportion of the engine power actually transmitted to the propeller—this will depend chiefly on the workmanship. The efficiency may range from 70 per cent. to 30 per cent., but a good average in better-class work will probably be about 60 per cent.

In view of the remarkable speeds which will be attained before long, and the consequent personal risk attendant upon stopping boats at such speeds, I am at one with Mr. Delves-Broughton when he advocates a reduction in the size of boats. It would be interesting to have the views of other readers upon this point.

Replying to "Tyro," the strakes are intended to be of three-cross tinplate—that is, tinplate of that gauge or thickness. Two-cross would be lighter, of course, but unless "Tyro" has had some experience in sheet-metal work, he had better use the thicker material.—Yours faithfully,

THOS. DYSART.

Perpetual Motion.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—It appears to me that your correspondents—Messrs. Woodforde and "W. J. T.," in THE MODEL ENGINEER of 15th inst.—are themselves placing a misinterpretation upon the term, "Perpetual Motion."

Especially is this the case with "W. J. T.," for he suggests that the majority of our fellow-enthusiasts are striving to obtain "eighteenpenny-worth of energy for a shilling's worth of heat." Surely it is rather unreasonable to expect 150 per cent. efficiency, for we cannot create energy any more than we can destroy it.

I take it that he is really aiming at the more efficient employment of the sources of power over which we already have some control; or, in other words, economy is his object. However, I think if we could—to adopt his "homely guise"—get something for nothing, it would be economy *par excellence.* Mr. Woodforde seems to have a more accurate conception of the term, although he imposes what may be considered an unnecessary condition, for if we can design and construct a machine to develop useful power from the sun's heat or the motion of the tides, it would cost nothing for fuel, and as these sources of energy are, as far as they are likely to concern us, inexhaustible the above-mentioned machine could well be considered a solution to the problem.

With regard to what I have referred to as an unnecessary condition, viz., that "no fuel of any sort must be used"—I presume Mr. Woodforde means that no energy in any form must be supplied it is hardly possible that any intelligent being can be found now-a-days seeking success in this direction, as most of the would-be paradoxes of the past could be made to show, on paper, equal promise to work in opposite directions of rotation, and should never have arrived at the constructive stage; so Mr. Woodforde's "stone-wall" is, indeed, relentless, however powerful the head that is brought to bear upon it.

To sum up, a machine which would cost nothing to run, and with no attention beyond occasional lubrication and replacement of worn members, would literally give perpetual motion, whether we called it a "sun motor," "tide motor," or anything else, and would be a sufficiently noteworthy and useful achievement to justify a continuance of our efforts in its direction.

It has been suggested to me by engineering friends that we can never hope to obtain *useful* power from the above-mentioned sources. I would recommend all who hold this view to bear in mind the proverb—"Ce n'est que le premier pas qui coûte," for I believe that once we hit upon the right principle, interest in the subject will be stimulated, and its development must naturally follow.—Thanking your correspondents for expressing their views, and you, Sir, in anticipation, I remain, yours faithfully,

London, W. A. W. LUDLOW DORE.

Parting Work in the Lathe.

TO THE EDITOR OF *The Model Engineer.*

SIR,—Referring to the article in October 1st issue, by "A. W. M.," on the use of the parting tool in the lathe, it may be useful to state that a very important point to observe is that the parting tool shall be very narrow. Most of the tools, as sold in the shops, are a great deal too broad on the cutting edge, and a small lathe will not stand such a broad cut taken "end-on." If the tool be ground down to not more than 3-32nds in. wide, with clearance both downwards and backwards, and care be taken to see that mandrel and work and tool are all as firm and rigid as possible, then cutting off becomes easy, and the feed can be fairly rapid, taking quite a decent shaving. Use plenty of lubricant for steel, and have edge of tool just at centre-height, and you can cut down to 3-16ths in. thick or less; if the work be held in a chuck, it can be cut right through.

If the correspondent who sought your advice has been trying to cut off a 12-in. bar in the middle or anywhere near it, he has been asking for trouble, unless he used a very firm steady-rest close to the cut, for no amount of tightness in the adjustments of the lathe and care in cutting will prevent a comparatively long and thin bar from springing unless it is supported firmly near the cut.

I trust this note, especially as regards the narrowness of the tool, may be of service to some who have found difficulty in this undoubtedly "tricky" operation.—Yours faithfully,

ALFRED WATERHOUSE.

Castings for "M.E." Suction Gas Plant.

To the Editor of *The Model Engineer*.

Dear Sir,—Seeing the article on "Suction Gas Plant," and that a cast-iron cylinder is required, and that I found that it is difficult to make a good pattern in wood that will be perfectly round and true, I made one several years ago in cardboard, and had several castings from it, of which I enclose a few particulars. Get several sheets of cardboard and cut one the size of inside of cylinder; put the two edges together and glue a piece of tape down the outside of joint. Place the cylinder on table with the joint downwards, and place a piece of wood, about 3 ins. wide, inside cylinder over the joint, with weights on it, till it is well set; then take another piece of cardboard, soak it in water, take it out, drain it, spread it with glue, and place it outside the first piece; take the piece of wood and place it over the second joint, as before, till the joint is well set and will not give. When it is dry enough, lay another thickness, and keep on until the required thickness is obtained, and lay one or more thicknesses of brown paper outside to give it a smooth surface. When it is thoroughly dry, finish up the ends by sawing them level, as though they were wood, and with a coat or two of paint or varnish it makes a splendid pattern.

At first you think it is going to be a failure, as it is anything but round, but as it dries it will gradually go into shape. Let each layer dry before the next is put on, and distribute the joints round the pattern, and see you do not break the cardboard. When the joints are set, stand the pattern on its edges, and if you have the outside flanges cut, you can place them on during drying, as it all assists to get it into shape; and do not hurry it.—Yours truly, F. M. S.

Modelling the Hydroplane.

Editorial Note.—Since our issue of the 22nd inst. closed for press we have received a further letter from Mr. W. L. Blaney, replying to Mr. Dysart's letter of the 15th inst. The previous correspondence on this subject has been characterised by so many evidences of a personal disagreement, which cannot be of interest to our readers in general, that we are reluctant to devote any further space to the matter. We, however, reproduce the concluding portion of Mr. Blaney's letter, which will serve also as a reply to Mr. Pike's challenge of last week, and in the hope that the parties to this correspondence may now see their way to reconcile their differences, we must put the closure on the discussion so far as our columns are concerned. Mr. Blaney writes:—"The speed of the *Min* has been properly accredited by numerous witnesses who were present; but if Mr. T. Dysart wishes to have her performance repeated, I am perfectly willing to demonstrate before him, on condition that he handles the boat himself while I superintend from a safe distance. I have risked blowing off my head once in the cause of honour, and I submit once is enough in this case. It is rather unfair for Mr. Dysart to call upon me to mention my successes, since, apart from the immodesty of the proceeding, he must know that much of my orthodox model work has been assisting others to complete their work; but cannot Mr. Dysart turn back the pages of his memory to the old *Phœnix*, the boat that first attracted him to Victoria Park. She was the first model I know of to be fitted with a horizontal engine minus a flywheel, and the first boat of her size to do 3½ miles an hour. Can he not remember the pleasant hours we spent together running this old crock, and cannot those memories induce him to reconsider what is, after all, and obvious to all, a personal disagreement?"

The Size of Model Speed Boats.

To the Editor of *The Model Engineer*.

Dear Sir,—In reply to Mr. Delves-Broughton *re* the size of boats, I may say, with confidence, that for ordinary every day use, a 2-ft. boat is much preferable to a 5-ft. racer. My experience with my own launch, which is 2 ft. in length, has also taught me that steam is much cheaper than electricity. I first tried my boat with the latter, but could not obtain any satisfactory results, chiefly owing to accumulator troubles, I think. I bought two 5s. 6d. 4-volt motor boat accumulators, one of which has since been pronounced useless, as it will not retain its charge for more than four hours. When one of these accumulators was in use with a 9s. 6d. motor, I could never get the boat to go more than 50 yds. at the most, and then the motor stopped. On being tested by a voltmeter, the accumulator still gave 4 volts, and would work the motor perfectly when out of water. This defect, however, may be partly owing to the size of the propeller, which is 1½ ins. in diameter. I have subsequently purchased a 15s. 6d. marine engine, with a propeller ¾ in. in diameter, and with this I hope to obtain more practicable results.

I spent quite £3 10s. in fitting the boat, of which 15s. went in charging accumulators, whereas with a marine engine there is no such expenditure. Trusting that this letter will not offend lovers of electricity.—Yours faithfully, W. L.

Ashampstead, Eastbourne.

For the Bookshelf.

[Any book reviewed under this heading may be obtained from The Model Engineer *Book Department, 26–29, Poppin's Court, Fleet Street, London, E.C., by remitting the published price and the cost of postage.]*

Practical Metallurgy. By Thos. Turner, M.Sc., A.R.S.M., F.I.C. London: Chas. Griffin and Co., Ltd. Price 3s. net.

In the volume before us the author covers practically two years of laboratory work and supplies a general introduction to the subject such as all students are expected to require, whatever branch of the work their future may necessitate them taking up. The contents include sampling and weighing; metals and alloys; oxidation and reduction; the examination of fire-clay and fuel; the determination of muffle temperatures; silver and silver assay; the assay of silver ores, and gold assay; the properties of mercury; the microstruction of metals; and a chapter on iron and steel. The last chapter is devoted to electrometallurgy. As a testimony to the value of the work, it is only necessary to say that it is compiled from the MS. which has been in successful practical use for a large number of years.

The Society of Model Engineers.

London.

ON Saturday, November 21st, at three o'clock, a visit will be made to the extensive works of the Gas Light and Coke Company, at Beckton, E. Members wishing to be present are requested to send in their names to the Secretary as early as possible.

The tenth Annual General Meeting of the Society will be held at the Cripplegate Institute, on Wednesday, November 25th, at 7 p.m., when it is hoped all members will attend. Any member desiring to move an alteration or addition to the existing rules of the Society at this meeting is requested to send particulars to the Secretary at least five clear days before the date of the meeting, so that they may be inserted in the agenda.—Full particulars of the Society and forms of application may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

Manchester.

On September 3rd an informal meeting of the above Society was held. About thirty members and friends were present, and there being no official business to transact, the meeting partook entirely of a social nature. Several models were exhibited, and great admiration was expressed by all at the beautiful workmanship and finish of a hydraulic press, made and shown by Mr. Mitchell, a visitor. In order to prevent rusting, oil was used in place of water, but this in no way interfered with the efficiency of the machine. A well-made 30-watt dynamo, by Mr. L. Stant; lathe tools, by Mr. A. Barnes; some model rolling-stock, two marine engines of novel design, and a spark coil were among the other exhibits. Thirteen new members were enrolled at the close of the meeting.

On October 1st, the first official General Meeting of the above Society was held in the Smoke Room of the Manchester Social Club, Lower Mosley Street. About nineteen members were present, and Mr. A. Barnes took the chair. After some little difficulty, occasioned by the excessive modesty of the members present, the following gentlemen were elected on the Committee: Mr. L. Stant, Mr. A. Barnes, Mr. Graham, Mr. Johnson, and Mr. N. Procopides. The question of electing a president, or, as an alternative, a permanent chairman, was, after some discussion, adjourned until a later date. Two or three new members were enrolled, bringing the present total membership of the Society to thirty-two. Subscriptions (which are now due) were also collected at the close of the meeting. Those members who were unable to attend are requested to note that from this date meetings will be held fortnightly at the above-mentioned premises, until further notice.—BASIL H. REYNOLDS (Hon. Secretary).

Birmingham.

A most successful meeting was held on Thursday, October 15th, and was well attended. The subscription was fixed at 5s. per annum and the entrance-fee 6d. A set of rules was compiled, but as all the officers have not as yet been elected, the rules will not be printed until after the next meeting. All meetings will be held on the first Wednesday in the month, the next being on November 4th, at 6, High Street, Birmingham, 7.30 p.m. Information concerning the Society can be obtained from the Hon. Secretary, C. H. HAWKESFORD, 3, Boscombe Road, Greet Hill, Birmingham.

Bradford.

A meeting of the newly-formed branch—the City of Bradford Model Engineers' Society—was held on the 19th inst. at the Midland Dining Rooms, Foster Square. Three new members were enrolled, which now brings the number to thirteen. We have decided to become affiliated with the London Society. The meeting commenced at 8.15, and after the business was finished the Secretary was called upon to describe his model traction engine, which he recently rebuilt. All the members seemed highly satisfied with the same, and, after a very enjoyable evening, the meeting closed at 10.30.

Mr. T. Wilson has consented to bring a model for the next meeting, which will be held on Monday night, Nov. 2nd, at 8, when we shall be pleased to see a few more intending members.—All particulars can be obtained from the Hon. Sec., AMOS BARBER, 15, Hartington Terrace, Lidget Green.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor, THE MODEL ENGINEER, 26-29, Poppin's Court, Fleet Street, London, E.C.]

The following are selected from the Queries which have been replied to recently:—

[19,947] **Manchester Type Dynamo Winding.** J. M. B. (Glasgow) writes: I am making a Manchester type dynamo, capacity 150 watts, from your book, "Small Dynamos and Motors," No. 12, on page 20. (1) I want to wind this dynamo for 10 amps, at 15 volts. What size S.W.G. and weight of wire will be required for the armature and field-magnets? (2) Would an 8-slotted armature wound in eight sections do for the above? If I wound this armature in four sections, would it do as well; and if not, why? (3) What size of wire (S.W.G.) will be necessary for the leads from the dynamo to the switchboard, and what size of wire (S.W.G.) to the lamps? (4) Would it be possible to run this dynamo at a slower speed than, say, 1,500 r.p.m.; and, if so, what size of wire (S.W.G.) will be required for armature and field-magnets?

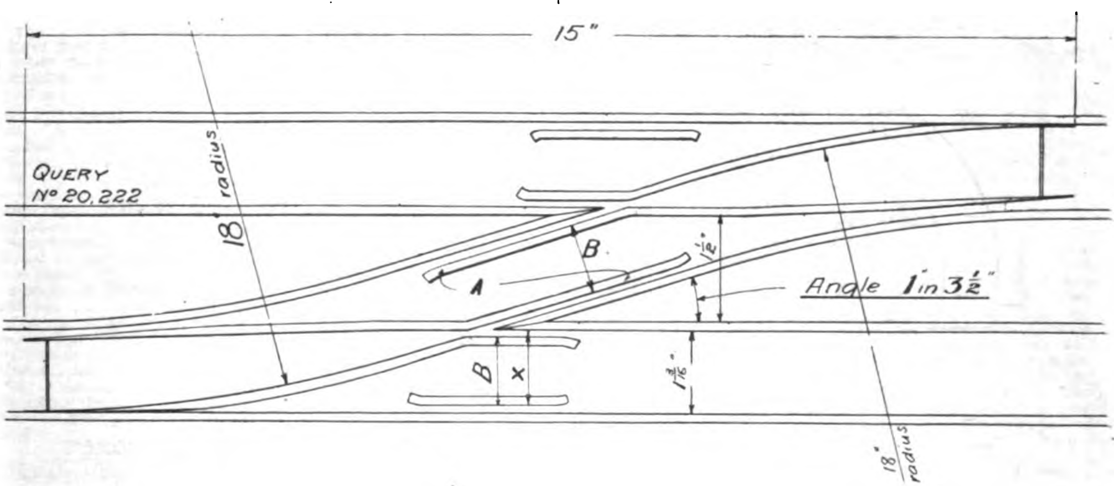
(1) Wind armature with No. 18-gauge D.C.C. copper wire; about 1¼ lbs. will be required. For field-magnet use No. 19-gauge S.C.C. copper wire, 3 lbs. on each coil, connect in shunt to the brushes. (2) Yes, eight sections would do. We do not advise four sections. It would work, but there will be more liability to spark and the voltage and current will not be so steady as with eight sections. (3) No. 14-gauge to switchboard; to lamps depends upon the arrangement of your lighting. If the current is to be distributed by ten circuits, each feeding one lamp, use No. 18-gauge. (4) If you run dynamo at slower speed you will decrease the output accordingly. For the speed you mention the field-magnet wire should be as given above, but armature wound with No. 20-gauge D.C.C. wire. Output will be then about 5 amps. The exact speed can be found by trial.

[19,917] **150-watt Dynamo Trouble.** E. W. T. (Sunderland) writes: In THE MODEL ENGINEER for August 29th, 1907, I noticed your reply to Query 17,977 *re* above, and as I was busy with the same size dynamo from the same people I made a note of it, as I too was only supplied with the same quantity as your querist. I bought extra wire to make up the 4½ lbs. for field-magnets as you suggested, but I find that in my case No. 20 wire was supplied with castings, so wound armature (as much as I could get on) and field-magnets all No. 20 D.C.C.—eight slots in armature, 4½ ins. long, 50 conductors in each, equals 50 yds. active wire No. 20. I have run dynamo to 4,000 revolutions by counter, but get nothing beyond blue flickering at brushes. It ran at fair speed from four bichromate batteries, as motor. I have run opposite way, also reversed connections. Is the quantity of wire suitable for No. 20. I would be pleased to receive a suggestion from you.

You do not give particulars as to how you tested your dynamo. Did you put some lamps in circuit or what did you do? If it runs as a motor the winding and connections are probably in order. A shunt wound dynamo runs in the same direction when used as a motor to that in which it should be driven as a dynamo, no connections being altered. No. 20 gauge wire on the armature is suitable to give an output of about 8 amps., and 4½ lbs. of this gauge on the field-magnet is suitable for a voltage of about 15 volts as a shunt winding. Therefore, try your dynamo with some 15-volt lamps connected to it. If flickering at the commutator is of a decided character, it shows that the dynamo has excited and presumably will work successfully under proper conditions of outer circuit. If you require 30 volts, rewind the machine with No. 22 gauge wire. See THE MODEL ENGINEER for December 27th, 1906, page 612, "How a Dynamo Works."

[20,222] **Points and Crossings.** W. P. (Shepherd's Bush) writes: Will you kindly inform me the correct way in which to set out (*i.e.*, how to obtain centres, radii, etc.) cross-overs for my railway, 1 3-16ths in. gauge, 1½-in. six-foot way, ordinary section tin rails? Length of cross-overs to be 12 ins. and 15 ins. from toe to toe at various points along line. If you could give me actual measurements for these I would be much obliged. I am converting my 2-in. gauge road to this (1 3-16ths in.) and am "stuck" pending your reply, as my cross-overs on the 2-in. roads, although satisfactory, were not mathematically obtained, and as the new road is fairly elaborate I want them to be correct.

We append a drawing showing setting-out of points. We do not usually care for less than 1 in 4 crossings, but with a total length of crossing of 15 ins. the most suitable angle works out at 1 in 3½, as indicated in the drawing. We do not advise the 12-in. crossings if you can possibly avoid them. However, if they must be used, set out on the basis of 16-in. radius curves instead of 18 ins. with a piece of straight tangential to the curves in between. In laying out the points the dimension B must be settled at the outset, from the tyres of the vehicle. We presume that you will adopt a standard of 1 in. between tyres, and very thin, almost straight-sided, deep flanges. Dimension B should, therefore, be slightly less than the distance between tyres. Dimension X should be slightly more than the distance between tyre plus the flange thickness, so that the guard rail keeps the flange quite clear of the frog of the crossing. As the angle of the crossings is so sharp, we suggest that the wing rail of the frog be extended to form the guard rail, as at A. The centres of the radii should, of course, be exactly opposite the toe of the point—*i.e.*, 15 ins. apart on each side.



LAY-OUT FOR MODEL 1 3-16THS-IN. GAUGE, 1 IN 3½ CROSS-OVER ROAD.

[20,421] **Facing Slide-valves.** J. A. W. (Sheffield) writes I am making some cylinders for a locomotive from a solid block of forged steel. I had several cylinders cast in iron, but they were all faulty. What I want to know is—(1) Do you think steel cylinders are likely to be a success? (The steel is of the finest quality mild; the pistons and rings are of best iron.) (2) Of what material should the slide-valves be made for the above—in iron or gun-metal? (Steam pressure, 125 lbs. superheated.) (3) What is the really correct method of grinding slide-valves in? Should it be given a rotary motion or simply rubbed backwards and forwards? Definite information *re* the above will oblige, also any hints, as I have experienced considerable difficulty before getting valves thoroughly steam tight at high pressures (100–150 lbs.). How am I to know when it is properly ground in?

(1) There is no objection to steel cylinders, except the work involved. (2) Either will do. You fail to give us the size of the cylinders, but above 2 ins. by 3 ins. we would recommend cast-iron valves, facing them by scraping to bed on a surface plate. This, of course, is not altogether practicable for a very small valve, and, therefore, they are usually ground in on a piece of plate-glass with grindstone dust and water. The two parts may be finally faced by rubbing together with the above abrasive. It does not matter much how the surfaces are rubbed together, so long as the valve is not tilted and the edges chamfered off. You would do well to look up the method devised by Mr. Rompler, described in our issue of July 30th, 1903. The use of emery should be avoided where valves are of gun-metal. (3) Test the valve on a faceplate or on a piece of plate-glass with red lead and oil paste. If the valve or port face does not bear all over, and there are any patches left on the faces after they have been pressed on the plate-glass (smeared with a thin film of red-lead paste), then they are not flat. In a large job the high places must be scraped down by hand. A steam test for a small valve is perhaps the most satisfactory, and you will be able to tell where it has not been bearing by the appearance. Of course, there should be no "blow" up the exhaust when the valve covers the ports and steam is turned on. Every small engine is better after it has had a few runs and the valves have faced themselves; the surfaces, however, must be reasonably true to commence with.

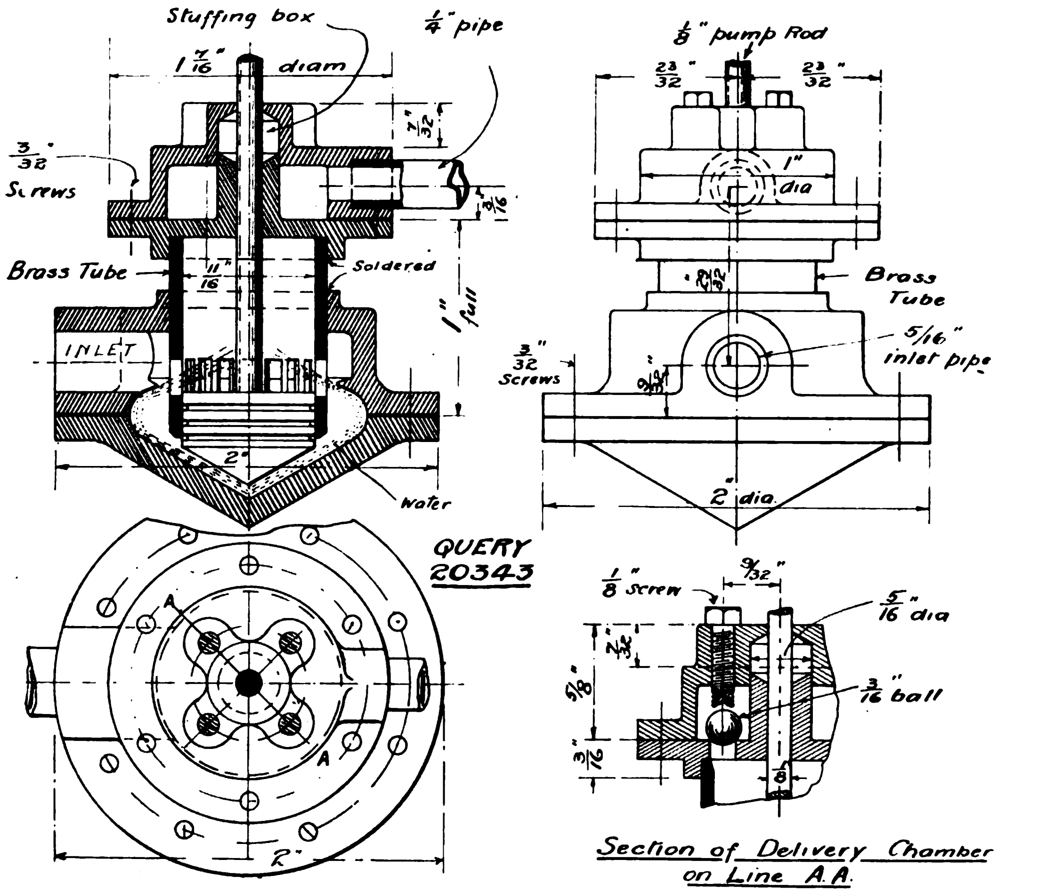
[20,282] **Vaporiser for Gas Engine.** F. J. S. (Catford writes: I have a gas engine, 2-in. bore, 3-in. stroke, flywheel 9 ins. diameter, and weight 8 lbs. (1) Is this flywheel heavy enough? If not, please state size and weight. (2) Should there not be sufficient power in the engine to drive a 60-watt Avery dynamo? (3) Is it safe to drive engine by petrol and thereby increase power and speed? (4) What sort of vaporiser shall I use? How shall I make it? What size and design (the simplest possible)? Is the type as per enclosed sketch (not reproduced) of any use?

(1) Hardly; 10 lbs. would be suitable; say, 10 ins. diameter, 1-in. face. (2) Yes, it should drive 60-watt easily. (3) Not every engine can be converted to oil; better write the makers and inquire. (4) A "Practical Letter" in our issue of March 2nd, 1905, described and illustrated a vaporiser very similar to the one you sketch. Yours is rather too small. Make one 6 ins. high by 4 ins. diameter.

[20,343] **Condensing Gear and Air-Pump for Model Marine Engine.** D. M. S. (London) writes: Many thanks for your Reply (No. 20,286) to my Query *re* jet condenser for small compound engine. As I want to fit the engine into a model battle-

ship, I shall give up the idea of a jet condenser. Do you think a surface condenser consisting of two lengths of copper tube, each 2 ft. long by ½ in. diameter, carried along the outside of the hull, would provide sufficient area to condense all the steam from the engine? An arrangement of this sort would do away with the necessity for any circulating pump, but an air-pump would still be necessary, as without it I do not think any sort of vacuum could be maintained, and maintenance of a vacuum (thereby increasing power of engine) is the whole object of condensing in my case, the condensed water being a relatively unimportant item. You say that a single-acting air-pump should be 1-6th capacity of H.-P. cylinder; this works out to about 11-16ths in. diameter by ⅞-in. stroke. Would these dimensions be suitable, and could you oblige me with a sketch or description of type and arrangement of valves and plunger? Would it be possible to use a steam ejector instead of an air-pump for maintaining a vacuum, arranged in the funnel to act as a blower also, or would this have to be of a size which would consume a quantity of steam greatly in excess of that required by an ordinary jet blower?

In further reply to your queries, we may say that the outside condenser is a tried method, and should be quite successful in your case. You will only have to provide the air-pump in addition to the condenser, no circulating system being required. We would still recommend the size of air-pump mentioned in our last reply (20,286) and which you work out at 11-16ths-in. bore by ⅞-in. stroke. To save the trouble of making valves in the pump bucket, you might try a pump of the "Edwards" type, as shown in the accompanying full-size diagram. You would require four simple patterns and castings in gun-metal—one off each pattern. The basis of the pump is a piece of brass tube about 11-16ths-in. bore. The pump bucket may be solid, and have three water grooves turned in it, as shown. The bottom of the pump is separate, to save corebox making and to render the work of turning the inside of the base castings less difficult. The bottom cover must accurately fit the base casting, so that the curve is continued without a ridge or other obstruction. If any trouble in this direction is anticipated, then the bottom cover may be spigoted into the base casting, and alignment assured. The packing of the pump-rod is obtained by means of a spigot on top casting, the top cover having a suitable recess bored in it to take this spigot and leave space for packing. This packing is compressed by the flange screws. The packing need not be very tight. We do not think it would be wise to use a combined steam ejector and blower, owing to the presence of water in the condenser. We also do not think it would be so efficient or so interesting as the mechanical solution of the problem.



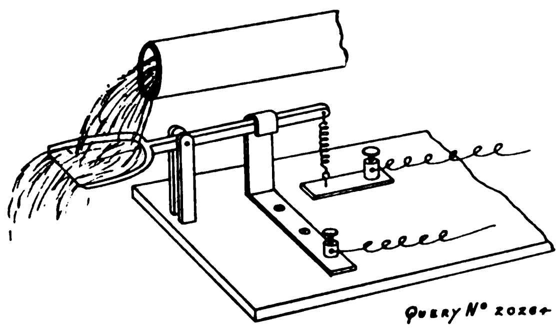
"EDWARDS" TYPE AIR PUMP FOR MODEL MARINE ENGINE.

[20,381] **Model Locomotive.** A. W. H. (London) writes: (1) Is there any objection to feeding a small ½-in. scale model boiler, with water-space all round firebox, by means of a back-pressure valve fitted on backplate of firebox shell in cab of engine and connected with a small hand-pump instead of the usual method of the valve being fixed to the boiler shell? (2) In the event of this being a satisfactory arrangement, is it advisable to connect the inlet of the back-pressure valve with a length of tubing, so that the water enters the boiler away from firebox? (3) I presume the correct height for the inlet hole from pump should be slightly below the lowest water level. (4) Could you give me a sketch of an oil spray burner for model locomotive?

(1) We have not had any trouble where this has been done. (2) You can do this. It is the common practice in modern locomotive construction. (3) Yes, well below the lowest water level. (4) You will find a drawing of the spray burner in Greenly's book, "The Model Locomotive: Its Design and Construction," see page 243 (Fig. 347). Such a burner would prove a little too large for a ½-in. scale engine.

[20,264] **Gas Engine Queries.** G. E. (Kingston) writes, (1) I have purchased a ½ h.-p. Crossley gas engine (horizontal):

type H, of late design, and do not want the tank in workshop. Shall I be safe in running water supply off main direct, constant supply? If so, can you give me a rough sketch as to how I can cut off electric current to engine automatically should the water at any time be shut off? (2) Which is the best place to fix the silencer—close up to engine, or the other end? My exhaust pipe will be about 20 ft. long. I want the engine to run as silent as possible. (3) Shall I be able to convert ½ h.-p. Crossley gas engine to electric ignition by placing sparking plug in the centre of box at back of cylinder where the porcelain tube goes in? I suppose I shall get as much power? Shall I fit it with a wipe contact and trembler coil? I thoroughly understand the way to fit it, as I have a two-cylinder car, but wondered whether it would work with this type of engine, and did not want to start on it till I am sure of same being satisfactory. (4) What class of dynamo shall



I use for charging? I shall require to charge eight 2-volt cells at once. I want one of good substantial build and bearings. (5) Shall I be safe in trying one of Holmes' twist drill grinders, and are they suitable for self-hardening steel? (6) Shall I have to notify the Insurance Company about the gas engine? It will be mounted on a concrete bed, etc., and will they rate me extra for same?

(1) You should be able to work satisfactorily with water from main. The accompanying sketch shows an idea for breaking the electrical circuit should the water supply fail. The water, as it is discharged from the waste pipe of engine, is made to fall upon a scoop with pivoted handle. The weight of the water bears down the scoop, raising the handle against the action of a spring. The handle on rising slides into a spring contact-piece completing the ignition circuit. Should the water supply be cut off or fall below a pre-determined quantity, the amount emitted by the waste pipe will not be sufficient to counteract the pull of the spring, so the spark circuit will be automatically broken. (2) Have the silencer as near the engine as convenient, but a distance of 20 ft. would make no appreciable difference in the noise of the exhaust. A box of coke is as effective a silencer as anything. (3) Yes; try the effect of putting sparking plug where tube has been. The only chance of trouble is that if the plug is in a recess at top of cylinder it may get surrounded by dead gas and so be ineffective. If this is the case, you must find a way of advancing the sparking point into the cylinder. Yes. Yes. (4) You cannot improve upon the Avery-Lahmeyer type. (5) Yes. Yes. (6) Yes. Yes, slightly.

[20,407] **The 5-ft. Speed Boat.** L. N. G. (Peckham) writes: I have read with interest the article on "A 5-ft. Speed Boat," and have set out the engine, etc., with a view to making, during the ensuing winter. I find, however, on setting out the body plan twice the size of the print you gave, that this gives a beam of 8¼ ins. only—which is ⅜ in. less than Mr. Dysart specifies. Will it, in your opinion, make any appreciable difference in the action of the boat?

Mr. Dysart tells us that in designing the boat he purposely allowed a certain margin in the displacement for eventualities, so that you need not fear failure with the boat through making the beam only 8¼ ins., providing that you do not allow the total weights to much exceed the figures given in Mr. Dysart's Specification.

[20,434] **Magneto-Bell Conversion.** A. B. (South Yardley) writes: I want to claim the assistance of your Query Column on the following. I bought the other day, second-hand, an electric bell — the pattern as used as extension bells on telephone installations. I was disappointed to find on examination that it was only intended to ring from a telephone magneto, and would not work from a battery. Can I convert it in any simple manner to work by battery?

The bell will require to be completely re-made, as the two types of bell work upon different principles. See our handbook, "Electric Bells and Alarms" (price 7d. post free), which fully describes the construction of battery-worked bells, and would enable you to make the necessary alterations.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

** Reviews distinguished by an asterisk have been based on actual Editorial inspection of the goods noticed.*

Motors for Locomotives and Boats; Electrical Accessories.*

We have received several leaflets from Mr. Herbert C. H. Smyth, of 37, Ravenscourt Gardens, London, W., giving particulars of several types of dynamos and motors he is placing on the market. One motor of very neat design and of such size as enables it to be fitted between the wheels of an O gauge locomotive, its dimensions being 1⅜ ins. high, 1 in. wide, 3½ ins. long, self-starting, runs on a 4-volt supply, and weighs 12 ozs. Other sizes of the same motor are to be had and also various parts of complete sets, as required.

Another type of motor is his boat motor. An efficient dynamo for charging, lighting, and railway work is also described. A sample of a very near reversing switch for fitting into the cab of a locomotive or other position where space is limited, has been sent to us. It is simple in design and construction, and should meet with a ready sale. Another speciality is his worm-gear, suitable for reduction gear in small locomotives, etc.

The Latest in Model Locomotives.

A new supplementary list, just issued by Messrs. James Carson and Co., Ltd., 51, Summer Row, Birmingham, describes several new points of interest in connection with their well-known model railway specialities. For instance, the pretty 7-16ths-in. scale "Precursor" model is now fitted with two cylinders instead of one, giving much better results, especially in starting on load. A complete set of parts and material for building this model is now listed, all the turning being done. A new type of boiler case is being fitted to all the firm's locomotives, which are enamelled in colour, the purpose being to prevent the colour being disfigured by the fire. The celebrated G.W.R. "Pacific," "The Great Bear," is now modelled in 7-16ths-in. scale, 2 in. gauge, and has, even in this small scale, all the powerful appearance of its prototype. By the way, a "Geat Bear" model was shown at the Franco-British Exhibition, where it attracted great attention. We note several reductions in prices in this list, particularly in regard to the clever model injector invented by Mr. Henry Lea, M.I.C.B. These are now made on the interchangeable system by a special plant, and may be strongly recommended to our readers. They will lift as well as force, and can be relied on to "pick up" without trouble. On a recent test a No. 3 injector lifted 9 in. of mercury (equal to 18 ft. of water) with 75 lbs. of steam, and gave with the same steam pressure a pressure of 100 lbs. on the delivery. Another new item Messrs. Carson, Ltd., are introducing is a flat-bottom brass rail, suitable for either 1 in. or 1½ in. scale models. No chairs are required in laying this rail, and the cost comes out at a very moderate figure.

Surface Plates and Drill Chucks.

We are notified that Messrs. Collinson, 117, Horton Grange Road, Bradford, are placing on the market surface plates and drill chucks. The latter is similar to the one described in No. 277 of The Model Engineer, and will hold from ⅛ in. to ⅜ in. stuff. The surface plates are 12 ins. by 10 ins., and weigh 34 lbs. The plate is ⅝ in. thick, stiffened by means of ribs 1¼ in. deep. A guarantee is also given to the effect that the plate is accurate to 1,000th part of an inch. Small tools, patterns and castings to customers' own drawings are also matters in which this firm specialises.

The Editor's Page.

"PAT" (Cardiff) sends us the following further note on the subject of perpetual motion :—

"Perpetual motion will be perpetual motion from whatever source the e ergy be obtained if it is perpetual. There is only one primary source from which to get it, and this is illimitable, infinite, inexhaustible, and eternal. I have yet to learn what engine, motor, or machine of any kind is otherwise driven than by one or more of Nature's forces. Why, then, the objection ? There is no absurdity in seeking it ; the absurdity lies in denying the possibility of that which is an accomplished fact, a law of Nature, and an absolute necessity for our very existence. Would it not be well when discussing this or any subject to confine ourselves to the subject and use only debateable arguments, omitting wild, unsupported suppositions, cheap sneers, and foolish prophecies. Mr. Woodforde is decidedly irrelevant in his allusion to electrical requirements I can suggest with equal relevancy that a study of boot laces would be profitable, as their supercession would earn for him the everlasting gratitude of all humanity, male and female, of fifteen stone and upwards. 'W. J. T.' also, with his big gun 'In homely guise' (which, by the way, has missed fire), does not bring the subject into such ridicule as he intended. There are many things costing a shilling to-day which a few years ago cost much more than eighteenpence, and this by tapping fresh sources of Nature's stores of energy. There are many known sources of untapped energy which would undoubtedly give energy practically without cost. One instance—the difference in potential between the electrical conditions in the higher atmosphere and the earth. Now, Mr. Editor, put on your best chest protector, for I have hob-nailed boots. In your last remarks on this subject a few weeks ago, you stated that a regenerative series of chemical actions was impossible, because all chemical action must be in the nature of a change from a higher to a lower state. I challenge the word 'must,' Sir. This implies devolution, and also a loss of something. Nature continually carries on regenerative chemical action and reaction, and recognises no such word as 'lost,' and I think, Sir, our geologists, botanists, zoologists, and all other scientists teach us that the whole universe is in a state of evolution, not devolution. Any apparent devolution is but a small step in the evolution of something greater. For the sake of brevity, I will merely say that the application of this principle to the matter in hand is obvious, since it is the secret of Nature's success in accomplishing it. A more intimate study of organic chemistry would lay bare a great many of the details of Nature's methods of accomplishing perpetual motion, all available for our use. A small patch of earth represents but a very few chemical elements. The atmosphere and water only add three gases, yet from these few elements may be produced good food, deadly poison, rubber, oils, tars, turps, gums, etc., in endless variety. The distinctive characteristics of each being retained and controlled by the battery contained within the limits sometimes of a microscopic seed. Further, they reproduce themselves in greater number, and their decay rejuvenates the earth."

* * *

While we are interested in our correspondent's further enunciation of his views, we may say that we have no quarrel with those who are seeking to adapt the forces of Nature to the service of man, and we see no reason whatever why they should discontinue their search for a method of deriving continuous power from some natural source. Our other correspondent, "W. J. T.," in his letter in our issue of October 15th, put the matter in a nutshell. From the various correspondence we have published it is obvious that there are two classes of inventors who are seeking to solve the perpetual motion problem—one class who are endeavouring to tap some new source of natural energy, or to secure an increasing supply from a known source; and another who are endeavouring to circumvent Nature by a combination of mechanical devices. It is the latter class who are generally indicated when perpetual motion inventors are referred to, and it is they who are foredoomed to failure, for the reasons we have already given in our issue of May 28th. We do not think that anything is to be gained by prolonging the discussion, but we shall be glad to hear again from "Pat," or any other of our correspondents, if they have any progress to report.

Notices.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 393. NOVEMBER 5, 1908. PUBLISHED WEEKLY.

Photographs of Electric Sparks.

By WILLIAM L. BEMROSE.

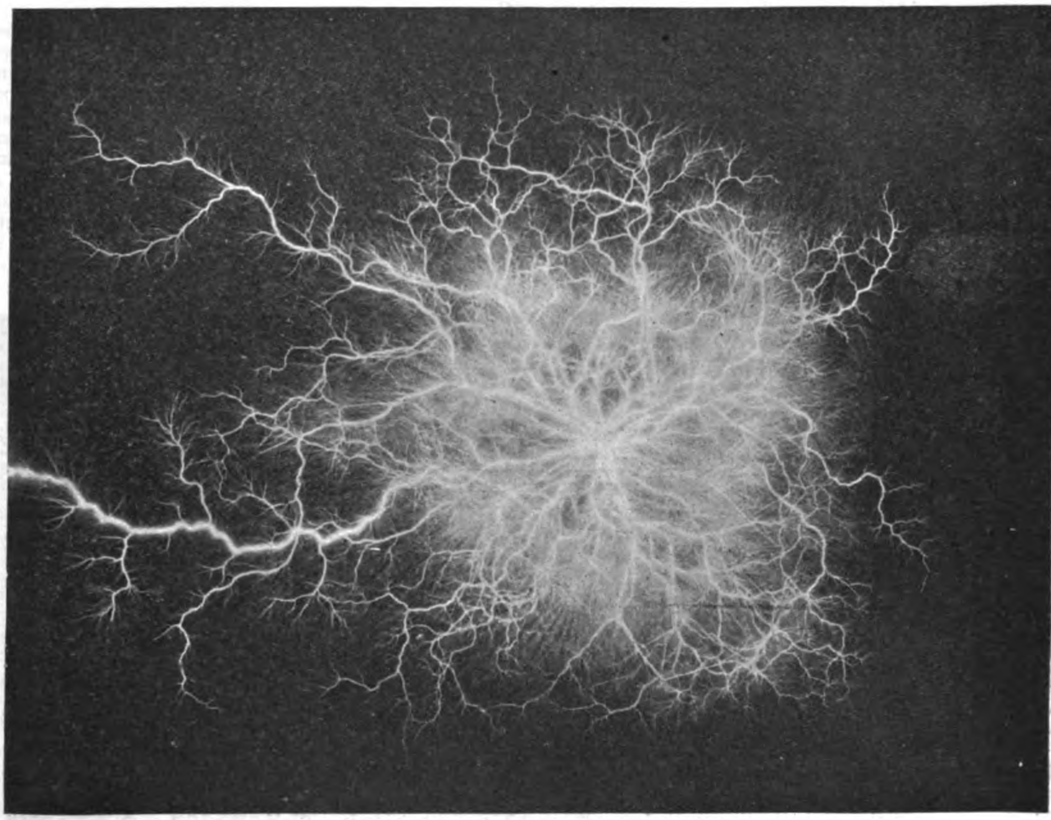


FIG. 1.—PHOTOGRAPH OF POSITIVE DISCHARGE.

THE accompanying photographs and short description are of some sparks which I recently took by means of an amateur-made Rhumkorf coil giving a 3-in. spark in air. Fig. 1 is a photograph of a positive discharge.

The method of taking was as follows: The photographic plate used was a very slow one, half-plate size, and was placed upon metal plate about 4 ins. by 2½ ins., with the film side uppermost. The metal plate was connected to the negative terminal of the secondary circuit of the coil and a pointed piece of metal rod was placed in the centre of the plate, just touching it; this point was connected to the positive of the secondary of the coil. The exposure, or the duration of the discharge, was between 1-5th and 2-5ths of a second. It will be noticed that the discharge has passed over the edge of the photographic plate at one point only; that, I think, was caused by the wire connecting the metal plate to the coil passing near this place. It will also be noticed that the sparks or brush-like discharges have formed themselves into a well-defined shape, in some places. This, I take it, corresponds with the shape of the metal plate beneath.

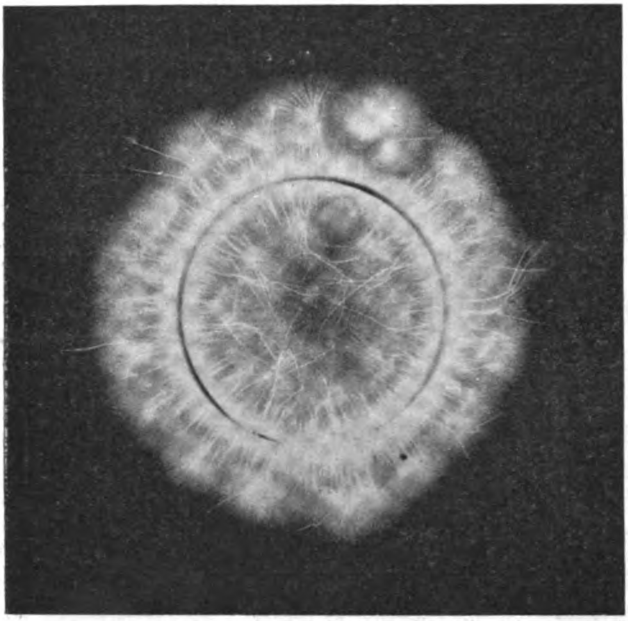


Fig. 3.—Photo of Discharge between Brass Ring and Metal Plate.

Fig. 2 is a photograph of a negative discharge, and was taken in the same way and with the same apparatus and kind of photographic plate as Fig. 1, the only difference being that the metal plate was connected to the positive and the point to the negative of the secondary of the coil, instead of *vice versa*. The exposure was also about the same as that given to Fig. 1. In this photograph it will be noticed that there is a peculiar fan-like formation on the extremity of each spark or brush discharge, and also that some of the discharges have gone together for a short distance and then branched off, as will be seen. This has happened in two directions, and so forming a broad white line through the central point.

Fig. 3 is a photograph of a discharge passing between a brass ring and a metal plate. The ring was about 1¾ ins. in diameter, and the plate was the same as that used in taking the first and second photographs, and was covered with black cloth in order to prevent the light from the sparks being reflected by it back on the photographic pate. The photographic plate used was of the same size, but a little faster than those used previously, and was placed film side uppermost on the metal plate, and the brass ring was placed upon the centre of the photographic plate. The discharges or sparks seem to have passed fairly equally from the ring in all directions, and also towards the centre. The shape of the photographic plate does not seem to have caused the discharges to go towards the sides more than to the ends, as might have been expected.

An old project to connect Leghorn by a direct line with Modena, in Italy, and the hemp country has been revived since the opening of the Simplon Tunnel. Another project is a direct line, avoiding Pisa, to the busy agricultural and industrial district of Pontedera. Both lines, states the British Consul, should considerably cheapen certain inland freights. The railway works which are to put Leghorn on the main line to Rome proceed apace. The new main line station is half completed, and the line should be in full working order in less than two years.—*The Engineer.*

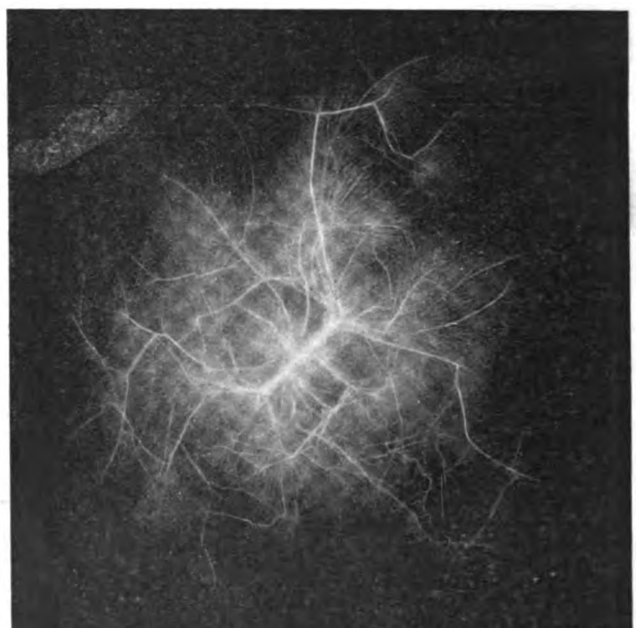


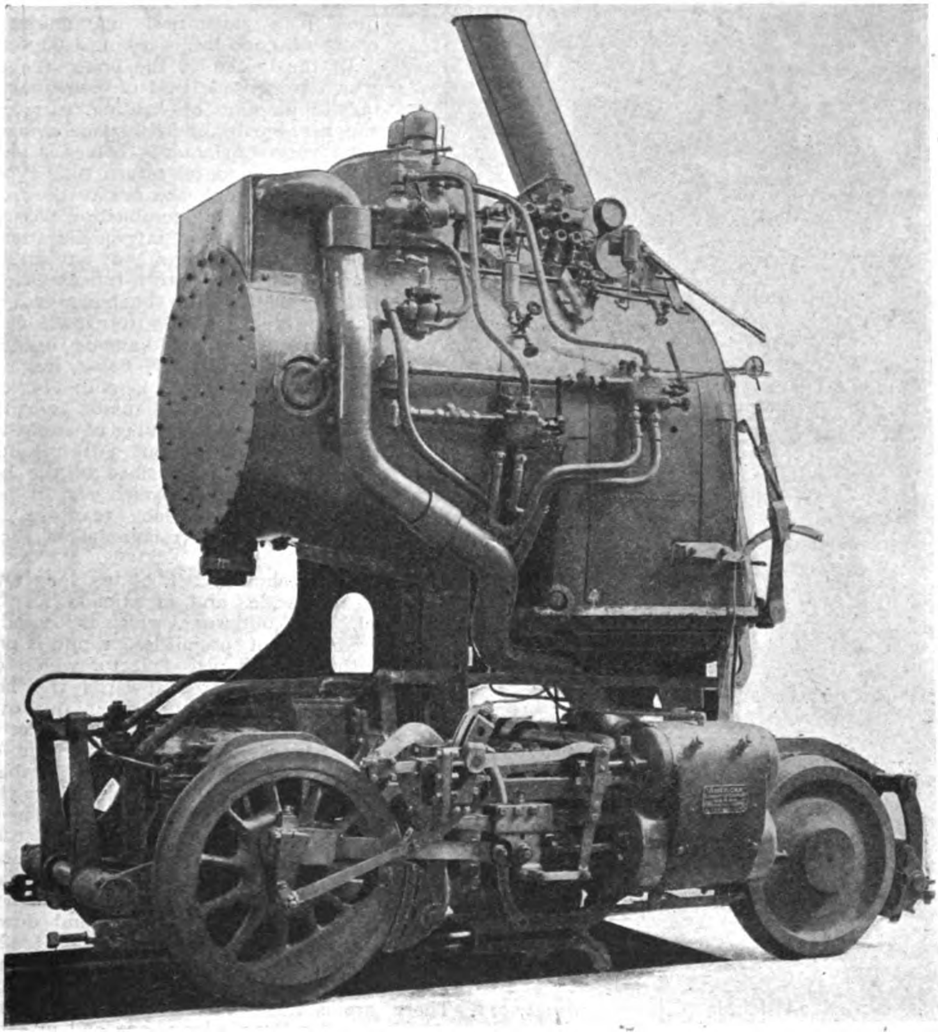
Fig. 2.—Photograph of Negative Discharge.

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

The S.E. & C. Railway "Exhibition" Locomotive.

A correspondent, who, as a result of visiting the Machinery Hall at the Franco-British Exhibition, has conceived a desire to model the locomotive mounted by the South-Eastern & Chatham Railway there, writes asking for the publication of particulars of this engine, and, if possible, a line diagram which he may take as the basis of operations. It will be remembered that a photographic reproduction of the engine appeared on page 35 of The Model Engineer issue of July 9th, 1908, and by the courtesy of Mr. H. S. Wainwright, chief mechanical engineer, it is possible to reproduce on page 437 an outline dimensioned drawing, giving many of the leading particulars. A recent issue of either the *Engineer* or *Engineering* contained, as a two-page supplement, a sectional elevation and plan drawing of the engine, and these would doubtless be of value to anyone desirous of reproducing the design in model form. As regards the style of painting and finish, the best plan would be to endeavour to inspect one of the large S.E. and C. locos. and make necessary notes on the spot.

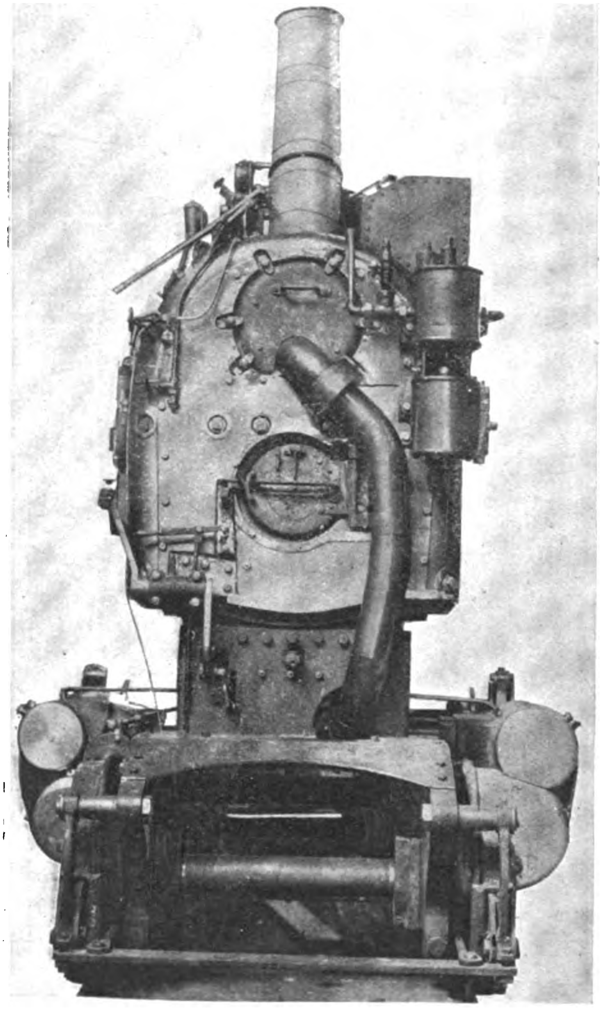


Engine of Steam Rail Motor Car: Chicago, Rock Island, and Pacific R.R.

Steam Rail Motor-car: Chicago, Rock Island, and Pacific R.R.

Particulars and photographs of the new steam rail motor-car placed in service on the above railway have reached the writer from the American Locomotive Company, who built the car at their Schenectady workshops. Four illustrations are given herewith.

The motor truck is of the four-wheeled swinging bolster type, with side frames of cast steel, the bolster being carried on double elliptical springs, and the weight on the rear or driving journal by a semi-elliptical spring suspended between two cross-equalisers, the ends of which rest on the tops of the journal-boxes, while the weight on the forward journals is carried by coil springs, one on top of each journal-box, thus obtaining a three-point suspension truck. The trailing truck is of the four-wheeled two-bar equaliser type, with wrought-iron top frames. The wheels are 2 ft. 10 ins. diameter and the journals 4½ ins. by 8 ins.



FRONT VIEW OF ENGINE.

The engine is of the two-cylinder cross-compound type, with single driving wheels, the H.-P. cylinder being 9¼ ins. diameter by 12-in. stroke, and the L.-P. cylinder 14½ ins. diameter by the same stroke. The Mellin system of compounding is employed, the intercepting valve being located in the H.-P. cylinder casting. Both cylinders are equipped with piston valves actuated by Walschaerts' valve gear. The cylinders are in separate castings, and are rigidly bolted to the side frames of the motor truck. They drive on the rear wheels of the truck, which have a diameter on tread of 3 ft. 2 ins. With a boiler pressure of 250 lbs. the engine will develop a theoretical maximum tractive effort of 4,300 lbs., working compound.

In the design of the boiler the problem which presented itself of providing the requisite amount of heating surface within the necessarily limited space available has been very satisfactorily solved. The boiler is of the horizontal return tube type. The firebox and smokebox are at the front end, and the gases of combustion pass through the firetubes to an intermediate smokebox chamber at the rear end, and thence forward through the return-tubes to the smokebox. The barrel of the boiler is formed in one continuous plate 5 ft. 1 ins. long, and it measures 4 ft. 1 in. diameter inside at the firebox end, and 3 ft. 8 ins. inside at the intermediate smokebox end. It contains 214 fire-tubes 1¼ ins. diameter and 3 ft. 9 ins. long, and an equal number of return-tubes of the same diameter, but 3 ft. 11½ ins. long. The total heating surface of the boiler is 624·4 sq. ft., which gives 2·5 sq. ft. per h.-p. Of this heating surface, 521·8 sq. ft. is in the tubes and the remainder in the superheater.

The firebox is 2 ft. 9¼ ins. long and 3 ft. 7¼ ins. wide, and is bricked for burning oil. The oilburner, which is located in the firedoor, is of special design, and is provided with a fan-shaped deflector which deflects the oil downwards towards the hot firebricks, and also spreads it out over the firebox, thereby tending to produce perfect combustion. The superheater is of the smokebox type, and is located in the intermediate smokebox chamber, where the temperature of the gases is high. The superheater tee-head is bolted to a cast-steel box saddle casting, which in turn is bolted to the top of the boiler, and covers the opening cut in the sheet through which the superheater tubes extend down into the smokebox chamber. The tee-head divided transversely into a front and rear compartment by means of a vertical partition. There are sixteen superheater tubes, bent into the shape of a double loop, one end of each loop being connected with the front or saturated steam compartment, and the other with the rear or superheated steam compartment. Steam flows from the dome through a short, dry pipe into the saturated steam compartment, and from thence into the steam pipe to the H.-P. steam chest. The boiler is rigidly connected to the motor trucks.

The car body is of steel construction throughout, with the exception of the exterior finish, and it is divided into three compartments, namely—an

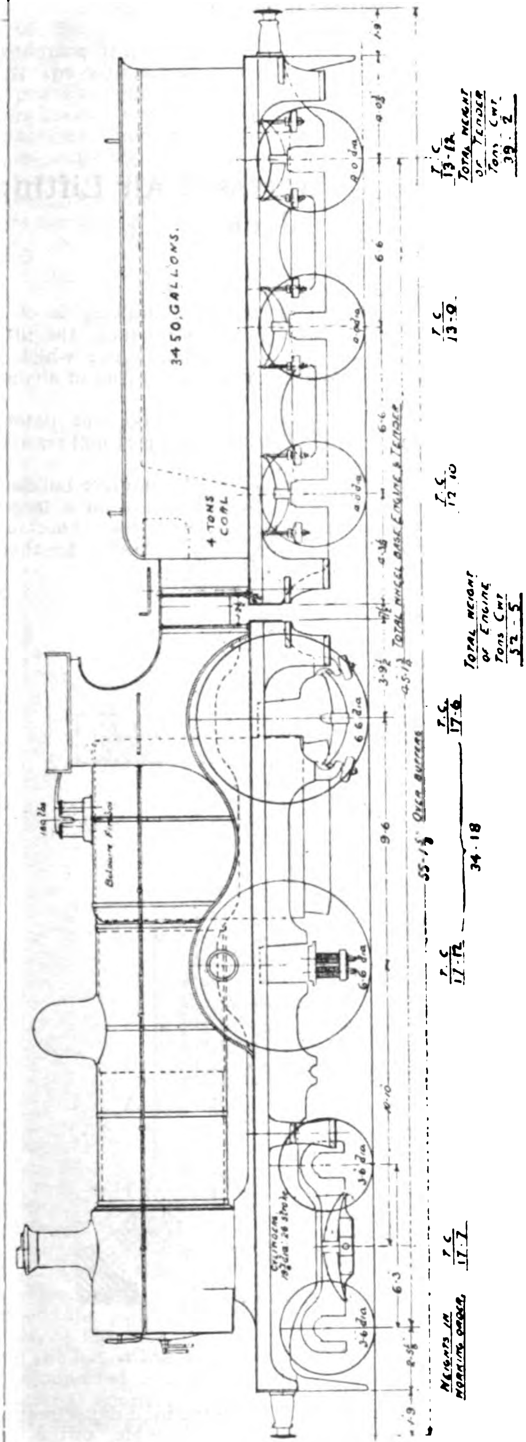
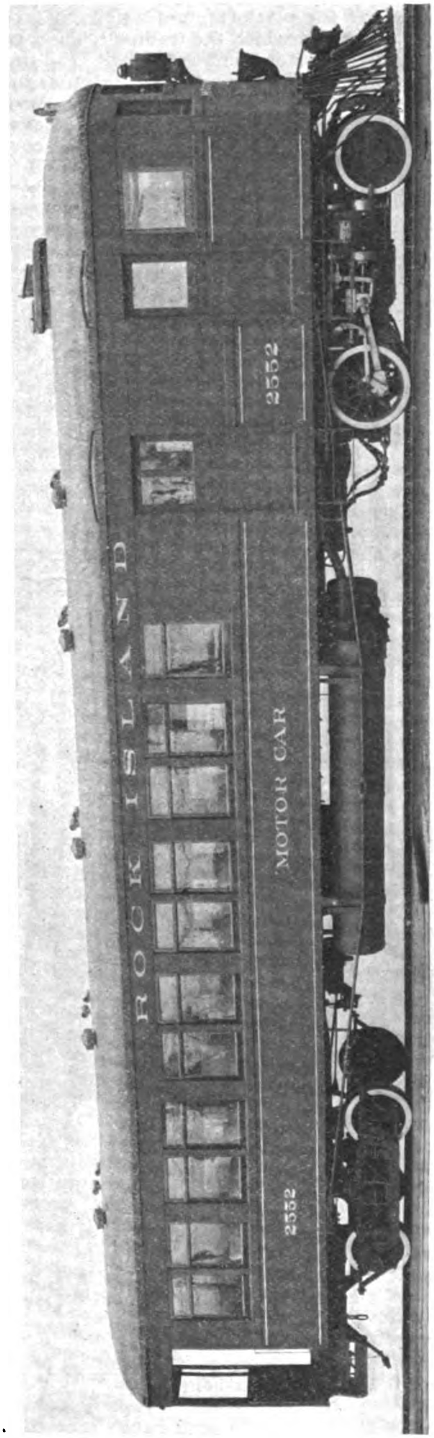
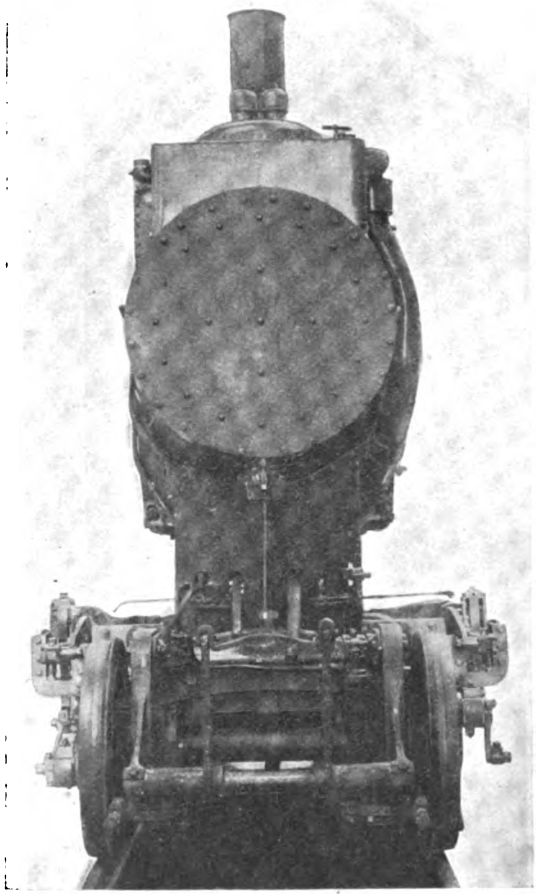


DIAGRAM OF EXPRESS LOCOMOTIVE: SOUTH-EASTERN AND CHATHAM RAILWAYS.



COMPOUND STEAM RAIL MOTOR CAR: CHICAGO, ROCK ISLAND, AND PACIFIC RAILROAD.

engine-room, luggage compartment, and passenger compartment, the latter containing seating accommodation for forty passengers. The car is 55 ft. 9 ins. long over the platform, and weighs, in working order, 45 tons, of which the trailing truck carries 17½ tons and the motor truck 27½ tons. The single pair of driving wheels have a load of 14½ tons upon them. Before being placed in regular service, the car was tested on the experimental tracks of the New York Central Railroad, and in the course



REAR VIEW OF ENGINE.

of several runs it developed a maximum speed of 60 miles per hour.

The leading particulars are as follows:

Total weight, 45 tons.
Weight: On leading (motor) truck, 27½ tons; on trailing truck, 17½ tons; on single driving wheels, 14½ tons.
Total wheelbase, 45 ft. 10 ins.
Distance between truck centres, 38 ft. 3 ins.
Wheelbase of driving truck, 8 ft.
Diameter of cylinders: High-pressure, 9¼ ins.; low-pressure, 14½ ins.; stroke of pistons, 12 ins.
Diameter of driving wheels, 3 ft. 2 ins.
Rear truck wheels (diameter), 2 ft. 10 ins.
Boiler, horizontal return tube type.
Working pressure, 250 lbs.
Heating surface: Tubes, 527·8 sq. ft.; firebox, 37·6 sq. ft.; superheater, 59 sq. ft.: total, 624·4 sq. ft.

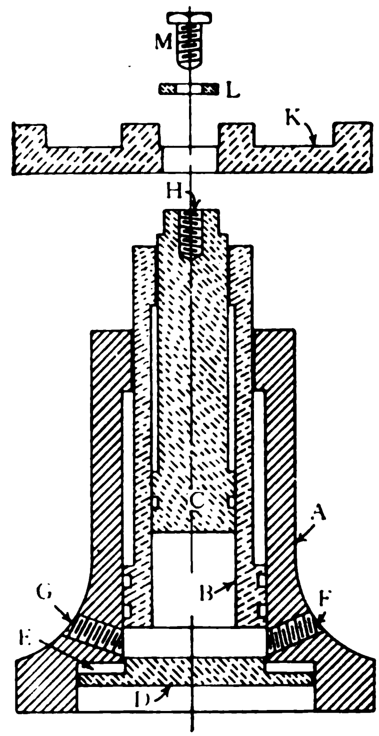
A Model Compressed Air Lifting Jack.

By FRED WILSON.

THE accompanying sectional drawing is of a model compressed air lifting jack, the idea for which crossed my mind, and which I made, a short time ago, during the laying of a compressed air plant at our works.

My original intention was to take out patent rights, thereby protecting the idea, personal reasons alone preventing this.

The works spoken of being a locomotive building and repairing shop, the above (made on a larger scale of course) appealed to me as just the thing required for lifting the heavy portions to their



SECTION OF LIFTING JACK.

respective places in the erecting department, the jack being particularly adaptable, owing to the fact that on this class of work it is very difficult to lift the different sections on account of there not being much space.

Returning to the sketch (which is full size of the model), a brief description only will be required.

The base A, it will be seen, is cast iron, the two pistons being of mild steel. The larger piston B is bored to take the smaller one C, and it will be noticed that they have two rings and one ring, respectively, which are of brass. D the bottom cover is fastened on with set-bolts, the joint E being made with india-rubber. The tapped hole F is for the inlet cock, and G for the outlet one.

FIG. 2.

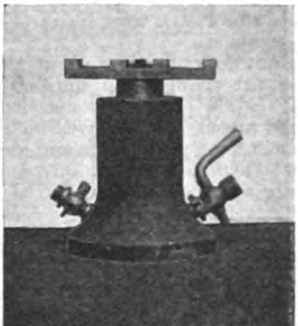
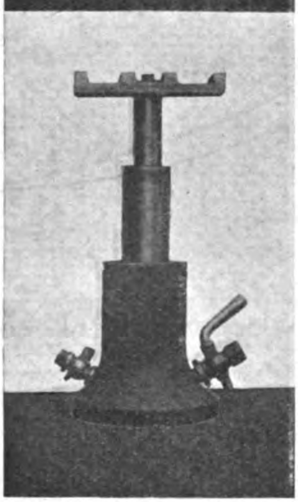


FIG. 3.



TWO VIEWS OF COMPRESSED AIR LIFTING JACK.

K is a sectional view of the top. This can be removed very easily and replaced by others of different shapes to suit various loads, by simply removing the setscrew M, the washer L being a square one.

The photographic illustrations (Figs. 2 and 3) show the jack at its lowest point, and extended fully. The cock on the right is the inlet one, and on the left is the outlet one.

Connected to the model by means of 3-16ths-in. external copper piping, it will lift 14 lbs. to the full height with an air pressure of 80 lbs. to the sq. in.; this, for such a small thing, being no mean performance.

Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "WORKSHOP" on the envelope.]

Centreing Rods in Lathe.

By "AMATEUR."

Everyone who has a lathe knows how much more work is caused by not centreing the work to be turned, truly. Having a home-made lathe of 3-in. centres, I found this to be the case, and so, after thinking for a little, hit upon the plan which I will endeavour to explain.

As will be seen, the arrangement is really a modification of a lathe carrier; but instead of having several sizes of dies, there is but one, bored with a taper hole to steady the rod, and a parallel hole to hold the drill. The mode of construction and usage is:

The main part, as will be seen, is a casting, which is bolted to the lathe bed and also carries the die. The casting is in iron, and was obtained at a local foundry, from a pattern which was made by myself. On receiving this casting, I filed the base

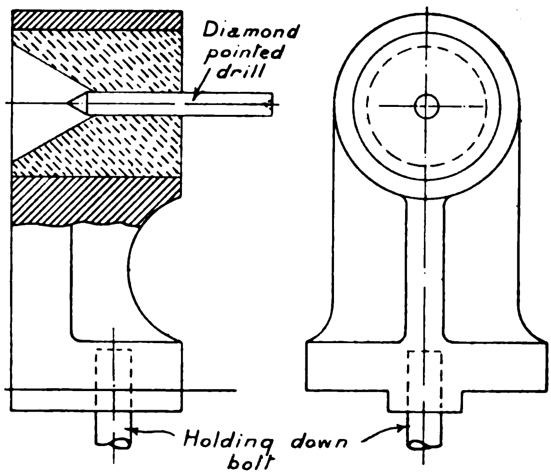


FIG. 1. FIG. 2.

to fit the bed of the lathe, and then marked off the place for the holding-down bolt. This is a 3/8-in. bolt screwed into the casting. The head of the bolt was then cut off and a thread (Whitworth) was made on the stud thus formed. The bolt was left long enough to allow a washer to be placed between the nut and the bed of the lathe. The hole to take the die was cored out, and, of course, had to be bored out at the correct height. This was done in the following manner. The casting was fastened to the bed fairly tightly, so as not to shake, and well oiled where it came in contact with the lathe bed (which is an iron one). A boring-bar was fixed between the centres and an arrangement rigged up as shown in Fig. 3. This consisted of a bolt and nut (½ in. in this case by 5 ins. long) and a piece of gas pipe (¾ in. in diameter inside), which was slipped over the bolt and the *nut unscrewed* until the *bolt-head touched the tailstock* of lathe and the end of *tube touched the casting*. The lathe was then set in motion and the bolt held from turning by means of a carrier, as indicated, while the cut was started by turning the nut, and so pushing the casting from the tailstock.

The die was then taken in hand. It was turned from a piece of mild steel and bored while in the chuck. A hole ½ in. in diameter was first drilled through it, and then this was enlarged by means of an inch drill, taking a very light cut. The drill was only sent in until it began to cut parallel. The hole thus roughed out to shape was next turned to the proper size at the tapered end of the bore. A lap was then made from a piece of scrap brass turned conical, and the hole was lapped out with emery-powder and oil, and finally cleaned free from all traces of the powder.

There then remained the fixing of this die securely to the casting, and this was done by means of three ¼-in. diameter screws, with the heads cut off and a slot cut in the end for a screwdriver to fit. These screws were driven home and filed flush with the casting. They were put in at ¾ in. from the face (Fig. 1), and spaced equally round the head of the casting. (These are not shown in drawings.)

All was now made with the exception of a drill to drill the centre with. For this I took a short length (about 3 ins. long) of tool steel ½ in. diameter. This was first of all softened and then fixed in the chuck, and the end turned taper, the same as the lathe carrier—in this case 60 degs. Four flats were filed on this tapered portion, care being taken not to file any more than just to give a keen edge where each pair of faces met. The drill was next hardened and polished, and the cutting edges rubbed up on an oilstone. It was found to slide easily, but not too easily, in the ½-in. hole bored to the die. Before being hardened, however, the end, which had not been sharpened had been truly centred by placing it in the die, bringing up the back-centre, and, having chalked the end, marking the centre by the lathe centre. This was then bored to suit the lathe centres.

Having finished the description, I will say a word or so about the *modus operandi*. The rod to be centred is held in the chuck and the other end is supported by the die. The whole apparatus is then fixed to the lathe bed, the drill is inserted in the die, the back-centre is brought to bear on the rear end of the drill, and the lathe is started. The drill is fed to the work by the back-centre, and in half a turn of the tailstock wheel you have as respectable and true a centre as one could wish to see. The drill must be prevented from revolving. (I use a pair of pliers.)

I may say that the original of this short article has quite repaid me for the trouble of making; it has now been in use for over two years, and is none the worse for wear. Only the drill has been re-ground once in the whole of the time since it was made. The pattern, I may say, is quite sound, and I am quite willing to lend it to anyone who cares to make such a thing as is here described.

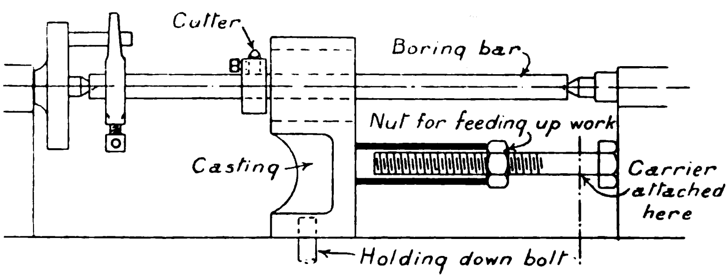


FIG. 3.—SHOWING ARRANGEMENT OF CENTREING DEVICE.

To Make Seamless Tubes from Cuttings of Sheet Metal.

By E. R. CARROLL.

Short lengths of tubes of small diameters may easily be made from scraps of sheet copper, brass, aluminium, or other metals by hammering a circular disc of same into a solid block of lead with suitable pearl punches.

Cut out a circular disc of metal gauge, depending on the size required for finished tube. Now take punch, *i.e.*, a piece of round iron or steel nicely rounded at one end and well polished in the lathe; place metal on lead block and drive it right down into it, when it will form into a nice little cap on the end of punch, and can be easily removed from lead block by giving punch a few light taps on the side. The metal must be well annealed after each drive.

Now take a slightly smaller punch and proceed to drive as before, but into a fresh part of lead block; but this time you may drive right through the block, in order to remove, and at the same time the metal is stretching. It is better to have all the punches slightly tapered, or there will be the greatest difficulty in removing tube. Continue annealing and driving with a smaller punch each time, until you obtain a length equal to two diameters; then the end must be knocked out with a suitable punch that will have a projection to get a grip of the draw tongs on. Having finished our punching, which requires a great deal of care and patience, we now take the drawplate, *i.e.*, a steel plate with tapering holes of suitable size. Enter tube in the first hole; if you cannot pass it through without the tongs, use a little oil or grease, and pull. The first few holes will be jerky, but in the fourth or fifth it will just draw through, as if you were stitching a piece of elastic. Follow up the holes until the required size is arrived at.

I have made many lengths of tubing, from ⅜-in. bore down to 1-100th-in. bore in this way. The bore will not be absolutely true, but by drawing over a steel bore the first few times, this can be remedied, and if the bore is Stubbs's steel, and not damaged, a little heating will expand the tube sufficiently to withdraw core.

Some Further Notes on Models at the New Zealand Exhibition.

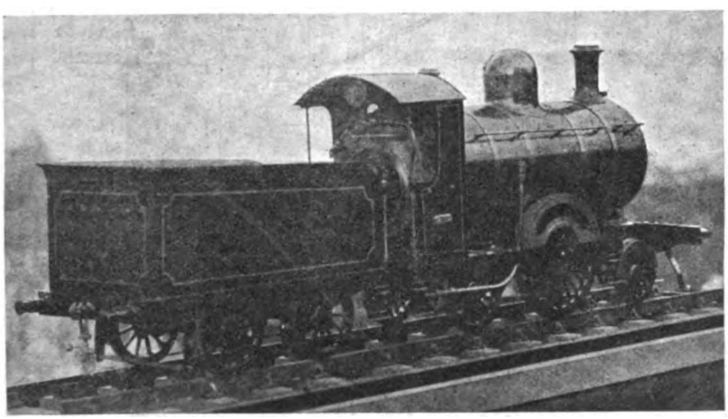
By Edward F. Roberts, Dunedin, N.Z.

FOLLOWING the notes which appeared at the latter end of Vol. XVII on the model engineering at this Exhibition, we have received the following particulars from one of our readers in the Colony. Although the illustrations do not show the work of the respective model makers to the best advantage, we have no doubt that, as an instance of model-making in New Zealand, many readers will be glad to see the descriptions and illustrations.

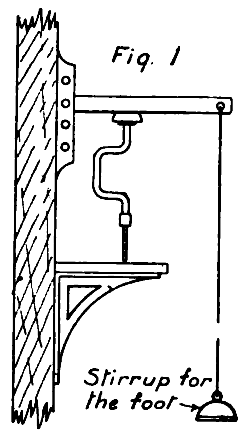
Model Locomotives.

Designed and Built by Edward T. Roberts, Dunedin, N.Z.

The general design for this locomotive (No. 1) was made when the writer was at school, but the whole of the details were not completed until he had been some while at the engineering trade. Construction was begun as soon as the general design was got out, the first job tackled being the drilling out of the main frames from the unshaped plate, this being accomplished in the arrangement shown in Fig. 1. Six $\frac{3}{8}$-in. holes through $\frac{1}{4}$-in. of steel plate in 15 minutes was about the average, but after this a spell was necessary.



No. 1.



After about a year of struggles of this sort, the writer obtained a $5\frac{1}{2}$-in. Barnes lathe, which greatly accelerated all operations; for example, compare the above figures with the time taken to drill out the tender frames in the lathe, which was only about an hour-and-a-half, although these frames involved fully three-quarters as much drilling as the main frames.

The big mistake of the design is the large size of the driving wheels, which makes the engine a slow starter, and gives a low tractive effort. If the writer had been able to benefit by the experience of others, as a reader of The Model Engineer undoubtedly is, he would not have made the error. Also, in the writer's opinion, inside cylinders constitute a mistake in any model, for not only are all the most attractive parts of the model hidden, but the working parts, which are in most frequent need of repair, are inaccessible unless the engine be completely turned over on its back so to speak, which in an engine of this size is no small matter.

The writer intends to call attention to the special features of the design and to describe some of the methods employed in its construction. A few of the leading dimensions are appended. The photograph herewith shows the working parts of the engine, and some leading dimensions are given on page 444.

As the cylinders came from the foundry they were two blocks of cast-iron with a square pap on each, as shown in Fig. 2. The first operation was to face the two ends opposite the paps and to bore out the recesses shown dotted, and to fit into them a steady pin as shown in Fig. 3. Clumps to hold the two halves together were fitted on, as shown, and then the pair was machined on all four faces, using the paps to clamp up to the faceplate. Great care

Fig. 2.

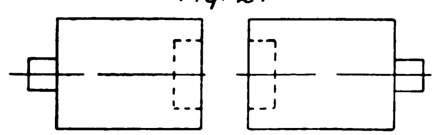
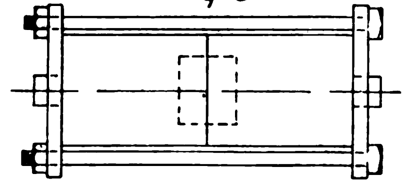
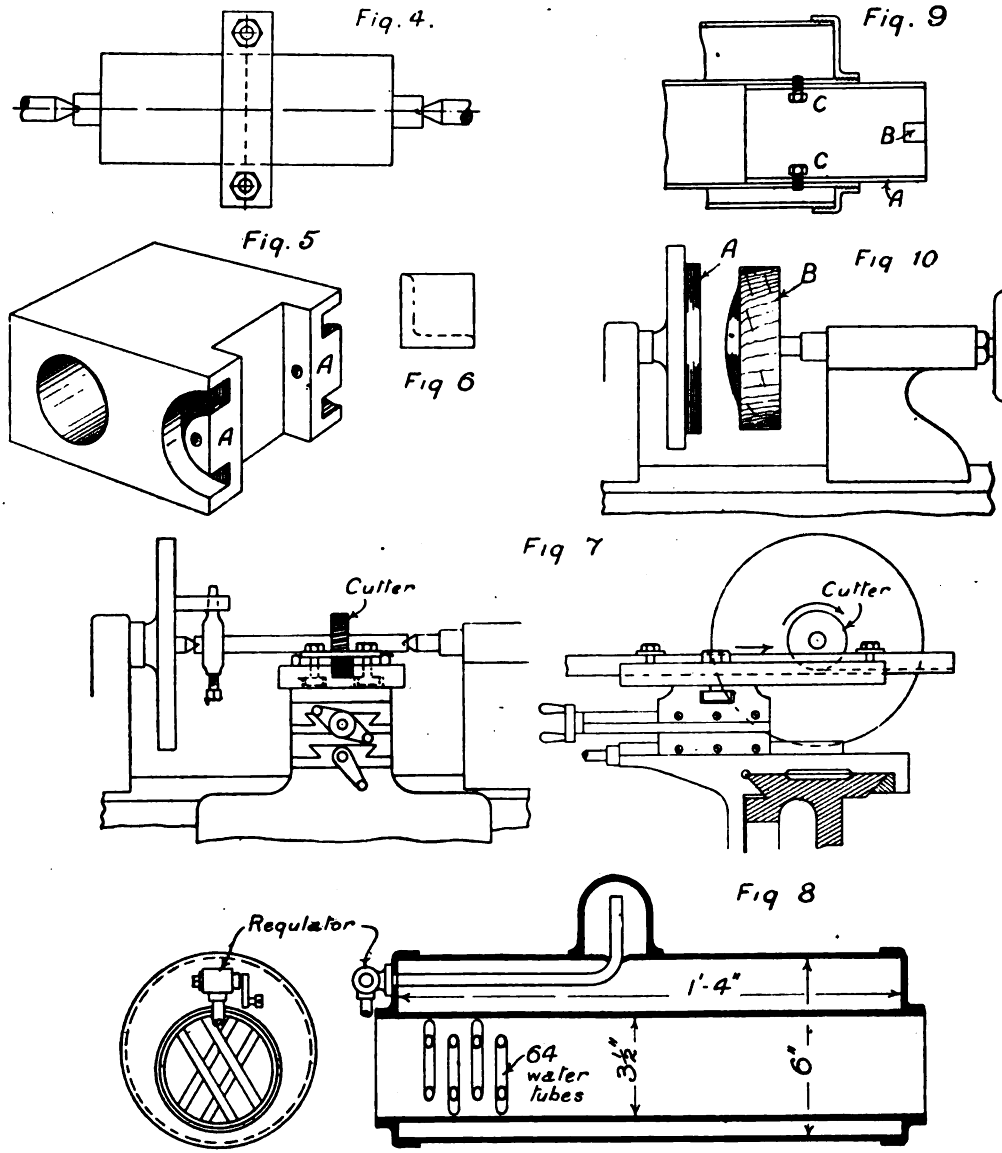


Fig. 3



was exercised to keep the faces symmetrical as regards the bored recess, and to maintain the four faces perfectly square. The block was then marked off for the cylinder bores and valve spindle glands, which were then machined. A steel ring, shrunk in, was employed, the purpose of which is to hold the two halves together when finished. The grooves for these rings having been turned, the block was finally swung between the centres by the paps, and the

and scraping up the valve faces, brown paper joints were made for A, A Fig. 5, and the rings shrunk into place. The writer may add that this design wholly obviates coring, and pattern-making almost entirely ensures absolute accuracy when due care and circumspection are exercised, and has not given the slightest trouble in practice.



GROUP OF PARTS FOR LOCOMOTIVE NO. 1.

ends faced up and the paps cut off. During this operation the two halves were prevented from slipping relatively to each other by temporary clips as in Fig. 4, the clamps shown in Fig. 3 being taken off. The blocks were next separated, and the circular recesses squared out, as in Fig. 5, to form the valve chamber. After drilling the steam ports

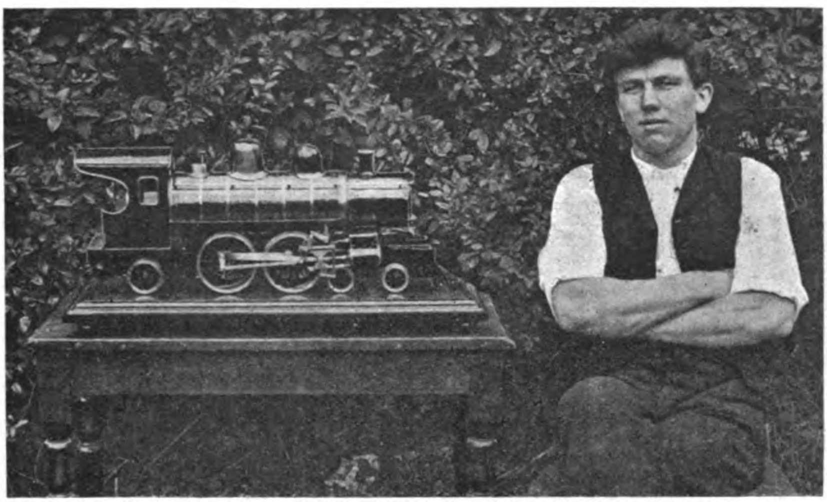
The cylindrical guides were turned from solid cast-iron bar, and the sides cut away as shown. The crankshaft was machined from 2½-in. round cold-rolled steel, and occupied 33 hours turning time. The eccentrics were made in one piece from spring steel forgings and then split. They had to be sprung out rather widely to get into place, but closed up again without trouble and have never been off since first put on.

The wheels formed one of the heaviest parts of the job to make. Following his usual practice in those days, the writer avoided pattern-making, and determined to cut the wheels from solid mild steel. There were ten in all. For the leading, trailing, and tender wheels square plates were obtained, and from these discs were parted out and the wheels roughed to shape on the faceplate, being finally trued up on the axles. For driving wheels, discs were obtained, and a similar procedure followed. The wheels remained without spokes for some years, but eventually the spaces between the spokes were drilled out, and the spokes filed to shape. The drilling and filing of one of the smaller wheels occupied on the average about 4½ hours.

About 10 ft. of ⅜-in. angle iron was built into the engine. This was formed from ⅜-in. square iron by milling out to the dotted lines as in Fig. 6.

The flanges were left about 1-16th in. thick. The rig-up employed is shown in Fig. 7. A whole bar was gradually fed through under the cutter and out through a window. The lathe was run on the slowest speed, and the feed was as heavy as could be pulled round against. A heavy stream of soapy water was delivered on the cutter. One foot was several times put through in 25 minutes.

The design adopted for the boiler was the outcome of the writer's distrust in solder and brazing, and of his low estimate of his own powers as a boiler-maker by the orthodox methods. A certain amount of available material which could be worked in also exercised considerable influence. Fig. 8 gives a general idea of the boiler's construction. For the outer shell a piece of black iron pipe was used, 6 ins. inside diameter, and threaded in the lathe at both ends. The boiler ends were turned from inch steel plate, the bulk of the material being removed in a 10-in. lathe The flue hole in the foot-plate end was screwed to suit the outside of a 3½-in. boiler tube, and in the smokebox end to suit the same size of pipe, but slightly reduced, so that the flue could be introduced and screwed home with a few turns. With the exception of the half-inch of big thread on the firebox end of the flue, the whole length of the flue had to be reduced to the diameter of the bottom of the big thread, but the flue was amply thick to allow of this. Care was necessary to ensure that the distance from top of thread to top of thread on the flue was identical with that in the flue holes when the boiler ends were screwed home on the shell. Into the flue were expanded 64 brass water-tubes of ¼-in. bore. The dome is a brass casting, and was riveted on before the boiler was assembled. The seams were all well caulked, and after a few trials under steam were absolutely tight. The chief objection to the boiler is its weight and the slightly longer period required to warm up; but it makes plenty of steam when fired with a blow-lamp, giving a flame 10 ins. long and about 2 ins. diameter. The whole boiler could be taken apart if desired. It is lagged with a layer of asbestos board, over which is a covering of Russian iron secured with brass bands.



No. 2.—Narrow Gauge 4—4—2 Type Locomotive.

The method adopted of screwing in the flue is perhaps worthy of note. It is shown in Fig. 9. *A* is a piece of pipe to fit the flue easily, and tapped into it are the two setscrews *C C*. These were screwed out into the previously drilled holes in the flue and a bar was used in the notches *B* to screw the flue home. The screws *C C* were afterwards withdrawn, and the tube *A* removed. The holes in the flue were subsequently tapped and plugged with taper brass plugs.

The dished front of the smokebox was produced by the arrangement shown in Fig. 10. *A* is an iron ring bolted to the faceplate, and *B* a wooden block turned to the desired shape and mounted on the tailstock. The piece of iron plate was made a bright red and held up to *A* while *B* was run up. A little charring of the wood occurred, but the plate took the desired shape.

The engine was exhibited at the recent New Zealand International Exhibition, and was awarded a silver medal.

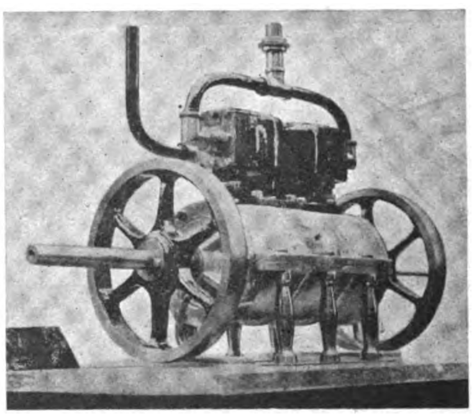
The following are some of the leading dimensions :—Gauge, 6 ins. ; cylinders, 1 in. by 1½ ins. ; diameter of drivers, 6 7-16ths ins. ; diameter of trailers and tender wheels, 4 ins. ; leading wheels, 3¼ ins. ; total length, 3 ft. 10 ins. ; length of engine, 2 ft. 3 ins. ; length of boiler barrel, 1 ft. 4 ins.

By H. W. Dallisen, Christchurch, N.Z.

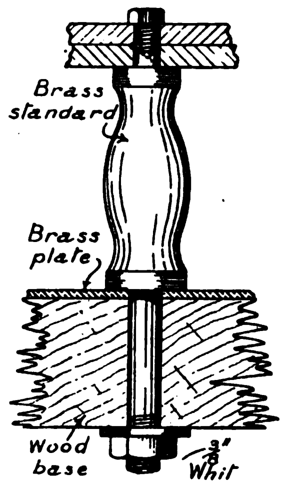
The design and patterns for the narrow-gauge 4—4—2 type locomotive, No. 2, were the sole work of a youth of 19 years of age, and occupied six months' spare time to bring the model into working order. The maker has just furnished me with a few details which he hopes may be of use to readers of The Model Engineer. The frame is of ⅛-in. steel plate with 1-16th-in. angle irons and ⅛-in. rivets. The boiler is of ⅛-in. solid drawn copper tube, 17 ins. long by 4 ins. diameter, fitted with 2-in. steam dome. Firebox 4 ins. by 4½ ins. with 14 ⅜-in. solid-drawn copper flue tubes, the whole boiler stayed with 3-16ths in. copper stays. Boiler saddle of cast brass bolted to frame. Complete leaf spring gear with a compensating and equalising beam. Double bogie in front end with saddle and springs with deaf springs on each side. Diameter of driving wheels 4½ ins., leading bogie wheels 2 ins., trailing wheels 2⅝ ins.—all of cast brass. The axles were all turned and the wheels forced on and keyed. Cylinders, 1-in. bore by 1½-in. stroke (cast brass), fitted with Walchaerts' motion and reversing gear, all motion in mild steel. The engine is fired with a kerosene blow-lamp. Length of engine and tender, 3 ft. Width, 6 ins. Rail gauge, 3½ ins. Boiler tested to 120 lbs. per sq. in. ; working pressure, 90 lbs. per sq. in. Took first prize at New Zealand International Exhibition, £10 and silver medal.

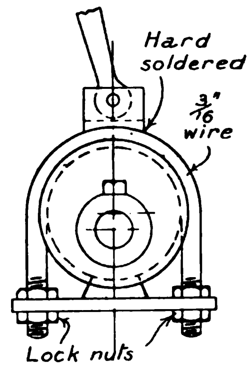
By G. U. Judkins, Christchurch, N.Z.

The design of engine No. 3 first entered into the head of a youth 17 years of age who, whilst perusing a copy of The Model Engineer (August 27th, 1903), was struck with the desire to "do something good," as all engines he had made before were of scrap brass and solder. The engine which caught his eye was made by Mr. H. R. Ricardo, and illustrated in The Model Engineer of aforesaid date. Photo No. 3 shows the engine on its stand in the recent Exhibition. The writer was a real amateur, never having before made an engine worthy of the name. The first thing tackled was the pattern-making. This necessitated a great deal of enquiry as to how to do it, also a large amount of patience and time. The time taken over drawing plans and making patterns was about two months. The only lathe to hand was a 3½-in. centre gap bed Holmes lathe. This lathe is also illustrated in the aforesaid Model Engineer. I might mention here that all the turning was not done on this lathe. After the patterns were made and passed the scrutiny of the iron founder, they were put in their respective moulds and all turned out splendid castings. The cylinders, steam chests, flywheels, eccentrics, and slide valves are cast-iron. The crankshaft is a forging of mild steel. The crank chamber is an aluminium casting. The engine is mounted on six brass standards, which also screw the two halves of crank chamber together. Not having a screw-cutting lathe, I had to get the cylinders bored and piston turned to fit, and also the crankshaft turned. The cylinders are 1¼-in. bore, 1¼-in. stroke, single-acting slide valves. The steam ports are 3-32nds in. by ⅞ in., and exhaust ports 5-32nds in. by ⅞ in. Steam chests covers are gun-metal, ⅛-in. thick, with a projection cast on, which is threaded ⅜-in. (brass) and fitted with a polished brass elbow. The way these covers were turned might be of interest to readers. A piece of wood 1 in. thick with a hole drilled in it was screwed on the headstock and turned up flat to act as a faceplate. Next the covers were drilled, having eight ⅛-in. holes for studs to screw down covers and steam chests at one setting. The cover was then put in the centre and secured by driving 1-in. lath nails in the holes. The lathe was then set in motion and a rough file held up against the cover. When it was trued up a burnisher was used ; this method was found to act faithfully. The cylinders are fitted with cast-iron trunk pistons with two rings and wrought-iron connecting rods. These rods have a split end



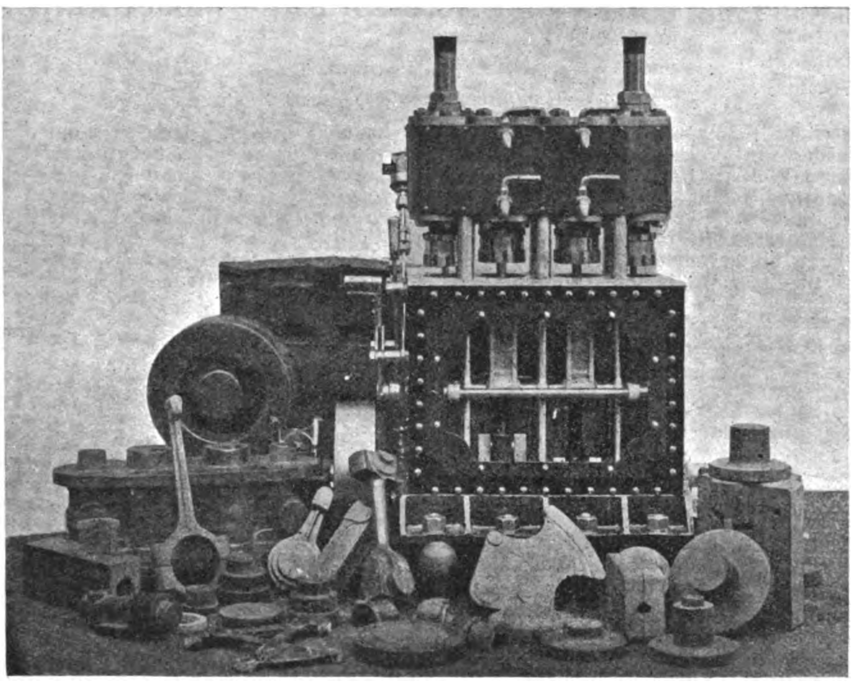
No. 3.





fitted with brasses of gun-metal. The piston-end is the full width of the piston's interior, and is ⅜-in. square, with a 3-16ths-in. hole drilled through it for the gudgeon pin, which is riveted each end. The slide-valves are cast-iron, with a pin cast on top. This pin fits a slot on the end of the eccentric rod. The eccentrics form another interesting feature of the engine. These were turned half-round on the outside edge, so as to fit a piece of 3-16ths-in. brass wire. The wire was then threaded and bent half-circle. Next a swivel was hard-soldered on the outside top edge for the eccentric rod. A piece of brass was then got ready with a small piece hard-soldered in the middle and shaped to fit in the groove. This piece of brass was then slipped over the two ends and set to the required tension by lock nuts. (See Fig. 11.) Wear can be taken up by shifting the lock nuts. I have proved this style of eccentric sheave and found it act well.

chamber has all the projecting parts polished. This was done by chucking a piece of thick felt on a piece of pipe in my 17s. 6d. lathe, and then glueing a piece of worn-out emery cloth round it. Having the lathe going at top speed the aluminium casting was held against it and was polished to my satisfaction. A finishing touch with benzine and whiting was all that was wanting to make a brilliant polish. The two bearings in the ends are gun-metal bushes pushed in from the inside. The crankshaft at these bearings is ½-in., but at the crank is ⅝ in. The crank has a diagonal centre piece, as in Mr. Ricardo's engine. This crank-chamber has a man-hole in the top centre cavity which enables you to see the working parts, but of course is closed with a polished brass door when the engine is working. This chamber is kept about one-quarter full of oil when engine is working, thus lubricating all internal parts freely. As will be noticed in the photograph,



No. 4.

Never having made a slide-valve engine before, I naturally found great difficulty in making the slide-valves fit steam-tight. I first faced the cylinders and valves with a file, and to my amateur eye they looked perfectly steam-tight; but after getting all the engine together I found my mistake, for they leaked like a sieve. This is the method I adopted to make them true, and now they work splendidly: I first got a scrap of good plate-glass and made a mixture of oil and Wellington knife powder, manufactured by John Oakey & Sons, Ltd., London. This mixture was thin, and kept thin by the continued addition of oil. The valves were then placed on the glass and rubbed to and fro in one direction, the mixture making a fine surface on the valves and cylinders, not showing a scratch. The crank

there are two 3-16ths-in. brass tubes as outlets for waste oil coming out of the ends and emptying themselves into little tin dishes. The six standards that hold this chamber together might also be of interest to readers. They pass through the bottom half and screw into the top. These are also drilled and tapped, and have small hexagon-headed screws screwed into them at top to act as lock-nuts, also putting a good finish to the end of the standards (see Fig. 12).

The two flywheels weigh 2½ lbs. each, and are 7 ins. in diameter, with 6 spokes. These are keyed on to the shaft by keys made from horseshoe nails. There is one pulley not shown in photograph. This is 2½ ins. diameter, having a ⅞-in. rim for belt. The steam pipe is ⅜-in. solid-drawn copper tube, whilst the exhaust pipe is ⅜-in. thin brass pipe allowing a good exhaust. The engine is 17 ins. long and 10 ins. high. I have tested it and found it goes 800 r.p.m. (without a load) with 30 lbs. steam. It was exhibited in the New Zealand International Exhibition and was awarded fourth prize (bronze medal and £2). and took six months to complete.

With regard to vertical engine, No. 4, the maker of this having left the Colony, comparatively few particulars are forthcoming regarding his work. The engine was commenced at about the age of 17 and was taken from designs by Mr. Hyler White, of a 12 to 14 b.h.-p. engine, working at 200 lbs. pressure, at 700 r.p.m. With a small lathe and a few other tools he started to make the required patterns for the castings. The latter were cast at a local foundry in brass and steel, and all the small turning was done in his workshop at home, whilst the larger work was carried out by him in an engineering shop close by after working hours, with the kind permission of the chief engineer. After a few failures the engine gradually grew into shape, after many months of hard work (as it was all done in the evenings and any spare time he could devote to it). It took over two years to bring it to its present state. The engine has subsequently been utilised for driving a dynamo, and has proved itself a very serviceable power generator. The photograph, No. 4, shows the engine, together with a group of patterns used for its castings. It was awarded the gold medal and a special prize of £3.

Engineering Works and Accessories for Model Railways.

By E. W. Twining.

(*Continued from page* 301.)

THE subject of this contribution is a small underbridge near Colwich, on the London and North-Western Railway. In point of size of the span and height of the arch it is the smallest bridge I have yet given; at the same time, it is the most elaborate, with more fine detail than any of the large bridges illustrated in foregoing chapters. For this reason it is not at all suitable for modelling on a large scale out of doors; but it would make a most beautiful little work for an indoor railway of about ¼ in. or 7-16ths-in. scale, where all the intricate mouldings and cornices can be quite easily modelled in hard cardboard. With this method of modelling I have already promised to deal later.

Fig. 36 represents one of the faces of the bridge.

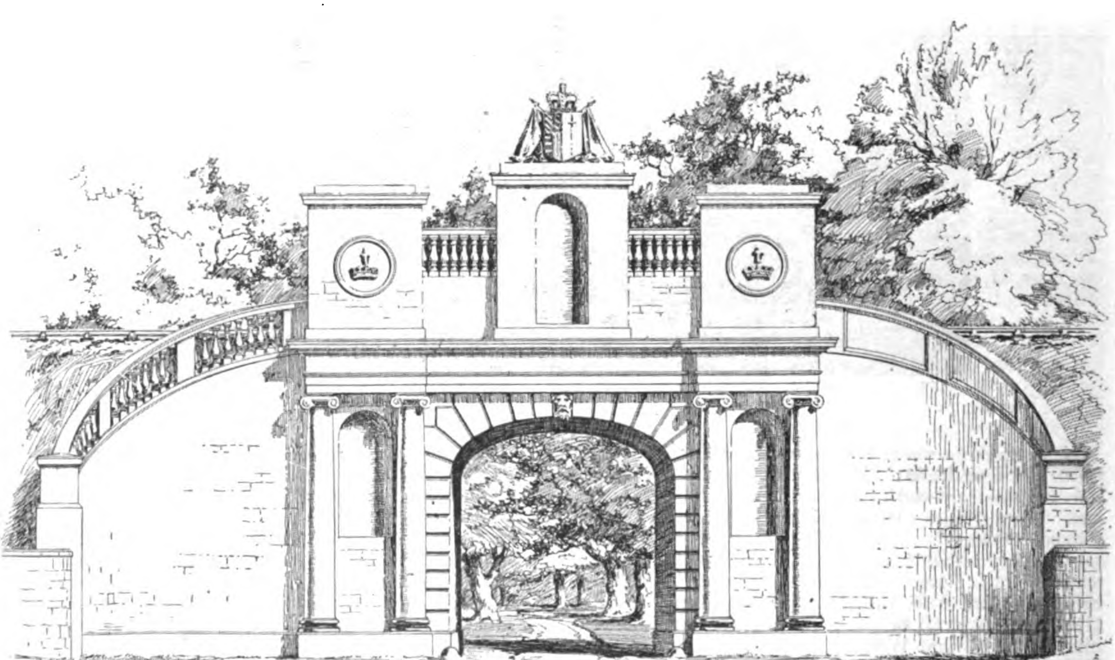


Fig. 36.—Small Underbridge near Colwich, L.N.W.R.

I regret that I can give no very accurate measurements, but if the scale at the foot of the drawing is followed, sufficient accuracy will be obtained for the purposes of a model of small dimensions. The span is about 15 ft., and the height from the road level to the soffit of the arch approximately 16 ft. Each side of the opening is flanked by a projecting entablature and cornice supported by two columns, the whole being in the Roman Ionic order.

FIG. 38.

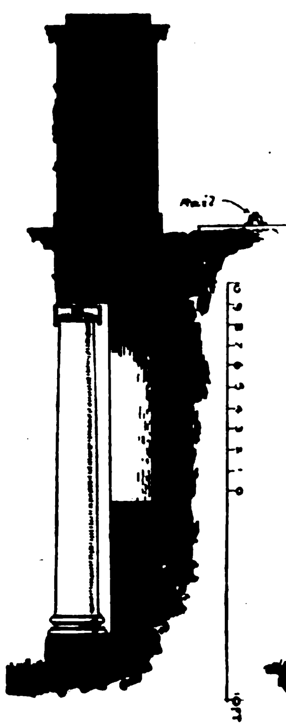
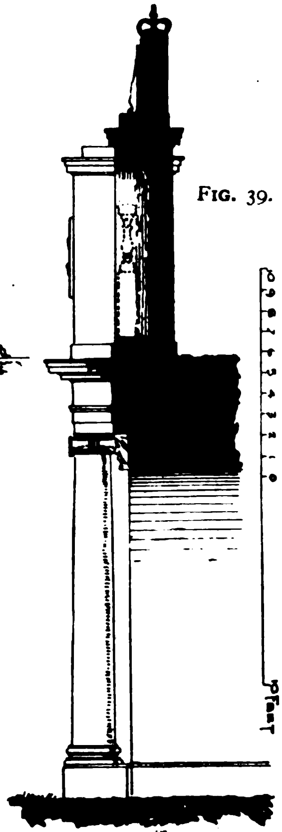


FIG. 39.



SECTION THROUGH ONE OF THE SIDE NICHES BETWEEN THE COLUMNS.

SECTION THROUGH THE ARCH AND CENTRE NICHE.

An open balustrade surmounts the wing walls and also the bridge itself. This balustrade I have shown on the left-hand wing wall only in the drawing, although both sides are in reality alike. On the right-hand wall is indicated an alternative form of balustrade, introduced to minimise the work in modelling. Of course, both sides must, as in the original, be made to correspond—either plain with panels, or open with turned balusters. The short balustrades on the top should be retained; they are much more easily modelled and fitted than those on the sloping wing walls. This is the only deviation permissible.

Fig. 37 is a radius diagram for the elliptic curve of the arch, and Figs. 38 and 39 are cross-sections, the latter showing the position of the balustrade, indicated by dotted line, and also the amount which

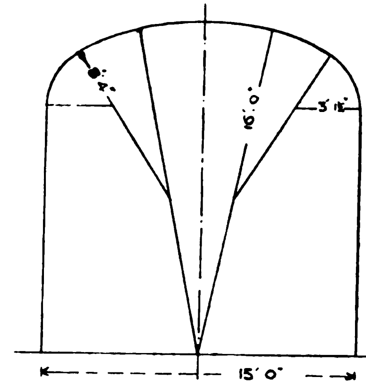


FIG. 37.—RADIUS DIAGRAM OF THE ARCH: CLASSIC BRIDGE, COLWICH, L.N.W.R.

the flanking columns and entablature project beyond the face of the work.

(To be continued.)

Gear Wheels and Gearing Simply Explained.

By ALFRED W. MARSHALL, M.I.Mech.E., A.M.I.E.E.

(Concluded from page 422.)

A KIND of gear which is frequently adopted when the driven wheel is required to give a much lower number of revolutions in a given interval of time than the driver is shown by the sketch (Fig. 40). The arrangement is called worm gear. The driving wheel is a screw S, and is called the worm. The driven wheel W is provided with teeth, and is called a worm wheel. Imagine the wheel W to be fixed so that it cannot rotate. If the worm S is rotated, and can move also in a direction along the line of its axis, it will act as if W was a nut through which it was being screwed, because the thread of the worm is engaging with the teeth of the wheel. It will therefore move in a forward or backward direction, depending upon the direction in which it was being rotated. If, on the contrary, the shaft of the worm is held between thrust bearings so that it cannot move in an end direction, and the wheel W is free to rotate, it will do so if the worm is rotated. As the worm is unable to screw itself past the wheel, the latter will rotate due to the sliding action of the worm thread upon the wheel teeth. The rotation of the shaft S will be thus transmitted to the shaft upon which W is fixed.

This kind of gearing, though equivalent to a pair of spur wheels in its action, differs to some extent. Either wheel of a pair of spur wheels may be made to drive the other, but though the worm can always be made to be the driver, the wheel cannot be made to drive the worm under all circumstances of design. As in the case of spur wheels, the gear is planned by pitch lines and surfaces. There is this difference however—the pitch surfaces of spur wheels roll together, and, as already explained, one would drive the other by contact friction if the load upon the driven wheel is not in excess of the grip obtained between the surfaces. The pitch surface of the worm gear (Fig. 40) is represented by the sketch (Fig. 41); obviously, if S is rotated, its effort will be expended entirely in a line parallel to the

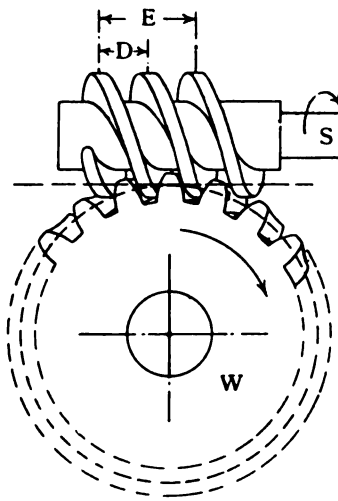


FIG. 40.

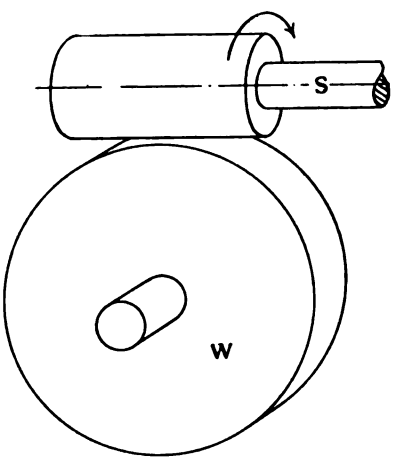


FIG. 41.

shaft of W, and will not produce any rotating effects at all on W. The surfaces will merely grind together without producing any turning effort upon W. Similarly, if W is rotated, the effort will be expended entirely in a line with the shaft of S, and no rotating effect will be produced. Any rotary effort can therefore only be produced by providing S and W with teeth which are placed at an angle to the axes of the shafts and can slide against one another. This is effected in practice by means of a screw thread upon S and teeth upon W, which are placed at an angle to correspond with the inclination of the screw, so that the two will engage in gear. The amount of rotation which will be given to W for each complete revolution of S will therefore depend upon the pitch of the screw thread. This pitch divided into the circumference of the pitch circle of the worm wheel gives the number of revolutions which the worm will make to produce one complete revolution of the wheel.

The relative number of revolutions made by S and W is therefore quite independent of the diameter of the pitch surface of S. It is, also in a sense, independent of the number of teeth upon W. For example, suppose the screw S to have a single thread of 1-in. pitch and the pitch circle of the wheel W to have a circumference of 20 ins. The wheel should then have twenty teeth of 1-in. circular pitch. As the pitch of a screw is the distance through which the thread advances whilst making one complete turn round its axis, S must make twenty complete revolutions to drive W through one complete revolution. If the screw

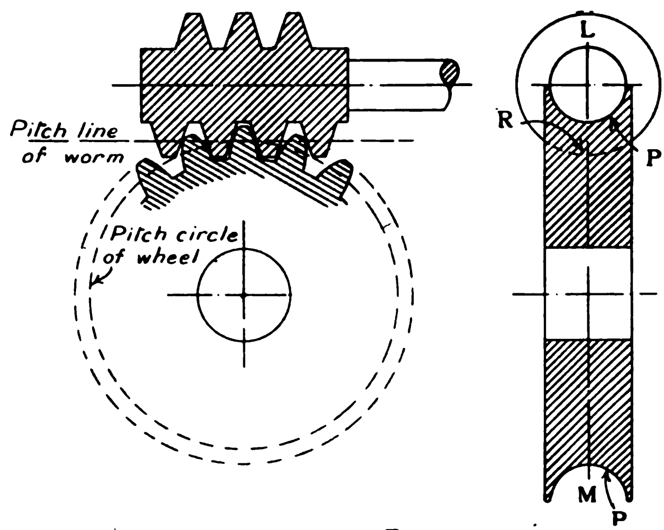


FIG. 42.

thread is made to have a pitch of 2 ins., the wheel W would then be made to have ten teeth of 2-in. circular pitch. The screw would now make ten revolutions to drive W through one complete revolution. So far, the number of teeth on W has been made proportional to the ratio of the gear, that is, we have halved the number of teeth whilst obtaining half the number of revolutions of S required to obtain one complete revolution of W. But we need not have reduced the number of teeth on W. We could have allowed the screw to gear into alternate teeth, half of the number of teeth thus being unused. The arrangement would effect the desired result, as the screw would move the circumference of W through twice the distance each revolution which it made, than when its pitch was 1 in. It would thus give one revolution to W when its own shaft had made ten instead of twenty turns. But it would not be a good arrangement to permit half of the number of teeth to be idle. The whole twenty teeth can be utilised by providing a second thread upon S, interspaced with the first thread, so that it gears with the idle teeth. Each thread will then take a share in driving the wheel, and the pressure and wear will be distributed over double the amount of contact surface. It would be necessary to re-shape the teeth, so they properly gear with the altered curve of the screw due to increasing the pitch. The wheel W thus retains its previous number of teeth, namely, twenty, and yet makes one revolution for ten instead of twenty revolutions of the screw. Simi-

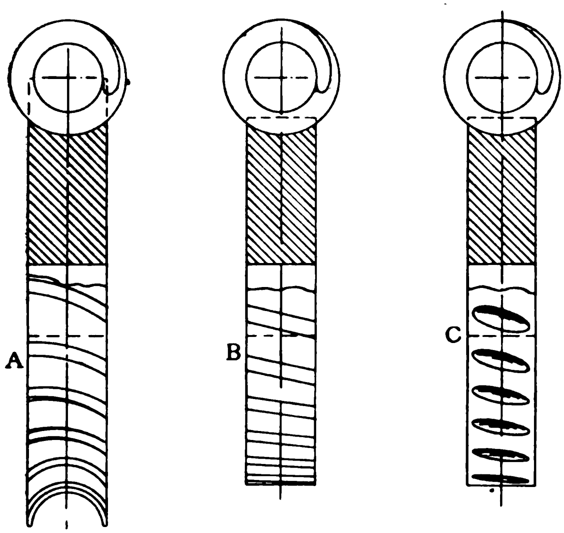


FIG. 43.

larly, the screw may be made to have three or more threads. The number of teeth upon the wheel therefore does not determine the ratio of the gear which, as already stated, is determined by the pitch of the worm.

When dealing with worm gear it is on this account advisable to call the pitch of the worm the lead, as it will be different to the circular pitch of the teeth on the wheel, if the worm has more than one thread. The term "lead" also more suitably expresses the property of the worm thread in its action with the wheel. Referring to Fig. 40, if the worm has a single thread, its pitch will be the distance D, and this will be equal to the circular pitch of the teeth on W. But if the worm has a double thread its pitch will be the distance E; this will be twice the length of the circular pitch of the teeth on W.

When preparing the worm blank and wheel blank for cutting, allowance must be made for the distance beyond the pitch line by which both the thread of the worm and teeth of the wheel will project. If a section be taken through the centre-line of the worm, the teeth of the wheel and thread of the worm can be regarded as a pinion and rack at that line, the screw thread representing the rack, and may be designed upon the method used for determining the shapes of the teeth of a pinion and rack. They may be curved upon the cycloidal or involute principle. If the former method be used, the teeth and screw thread will both have curved sides; if the involute method be adopted, the sides of the screw thread will be straight lines, as explained in an earlier part of these articles. The involute principle is usually adopted, because it is easier to cut the worm thread if it has straight sides. Fig. 62 is a sketch showing such a section of a worm gear through the centre line L M.

If the teeth of the wheel accurately fit the spaces between the thread of the worm throughout the entire breadth of the wheel following the true curve of the screw, the shape will alter in section, according as the distance from the centre line L M is increased. A section of any tooth taken on any line but L M will show a different shape to that taken on line L M. In addition to this, the circumference of the wheel must be hollowed to fit the worm at the points of the teeth and bottoms of the spaces between the teeth, the curves being arcs of circles of two different radii, as indicated by P R (Fig. 42). On this account shaping and cutting the teeth of a worm wheel correctly is a difficult matter. The method adopted in practice, especially for wheels of small or comparatively small sizes, is to shape them by means of a cutter which is a fac-simile of the screw intended to gear with the wheel. This cutter is called a "hob," and consists of a steel worm of exact shape to the worm which is to gear with the wheel; it is provided

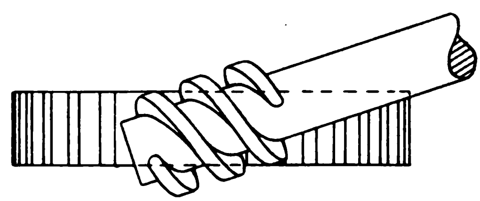


FIG. 44.

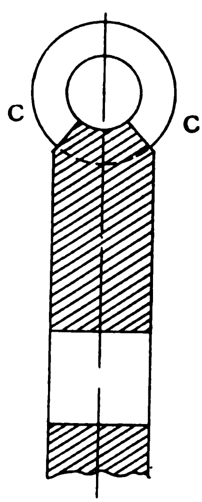


FIG. 45.

with cutting edges and hardened. The teeth of the wheel are first cut nearly to size by means of an ordinary circular cutter; the hob is then geared with the wheel, and the two are run together until the hob has cut the teeth to the true shape. Obviously, if the hob is a correct representation of the worm it will remove all irregular places from the teeth and leave them a perfect fit to the actual worm. It is sufficient therefore to plan the thread and teeth upon a single section L M through the centre line of the worm and wheel.

A correctly shaped worm wheel will then have the appearance of A (Fig. 43). On account of the expense of making a hob, worm gears are frequently made to a compromise. The circumference of the wheel is not hollowed at all, but straight, as in the case of an ordinary flat spur wheel. The teeth are cut upon the slant, as indicated by B (Fig. 43), at an angle to correspond to the inclination of the worm thread. Another method is to make the circumference of the wheel straight and cut teeth by causing the edge of a circular milling cutter to dip down into it, as indicated by C (Fig. 43), technically called "gashing" it. If the axis of the worm need not be at a right angle to that of the wheel, an ordinary flat spur wheel can be used by slanting the worm until its thread meshes with the teeth of the wheel, as indicated by Fig. 44. Any one of these methods (Figs. 43 and 44) may be used successfully, and for transmission of very small amount of power or purposes of mechanical adjustment only the worm can be an ordinary Whitworth or similar screw thread. In practice the edges of the wheel are usually bevelled off, as indicated at C (Fig. 45), except in the case of wheels like C (Fig. 43). This diminishes the inaccurate portion of the teeth and removes the weak corners. A blank worm and wheel ready for cutting a gear such as Fig. 40 would have the appearance indicated by Fig. 46 if the teeth were to be of perfect form and shaped by means of a hob. The dotted lines show the pitch lines and the allowance of metal to give the part of teeth and worm which project beyond the pitch line. The part P is called the "throat," and should be curved to a circle equal to the diameter which the worm will be at at the bottom of its thread. As a small amount of clearance ought to exist between the worm and wheel at the tops of the teeth and bottom of the spaces, the hob should be made slightly larger in diameter than the worm, so that it will produce this clearance. Fig. 47 shows a blank wheel similar to Fig. 46, but which is to be cut

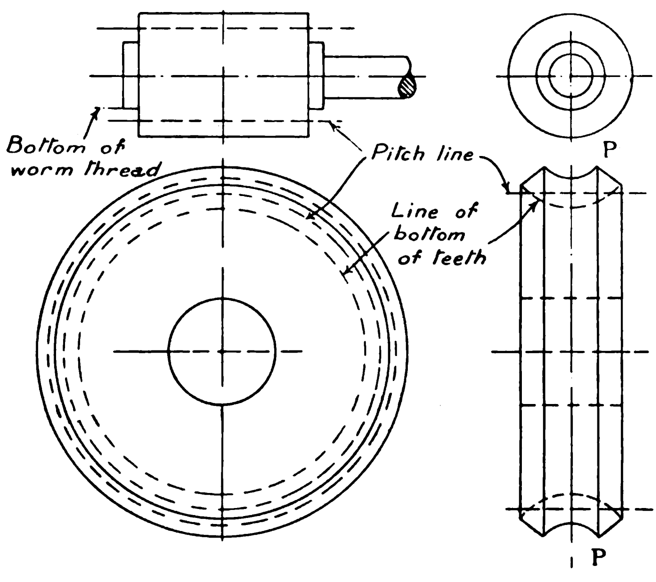


FIG. 46.

with straight-through teeth, as B (Fig. 43). The throat P is now made straight, and not curved, as in Fig. 46.

The diameter of the worm has no influence upon the ratio of the gear. As already explained, this is determined by the lead of the worm thread, and the circumference (and therefore the diameter) of the wheel. If the distance between the shaft centres of worm and wheel is fixed, you must select a lead for the worm thread which will give you the ratio desired. The diameter of the worm can be made greater or less, to accommodate the size of wheel found to be suitable in the particular instance. For example, suppose the distance between the centres will admit a wheel having a circumference of 10 ins.; the pitch circle for this will have a diameter of 3 3-16ths ins. If the worm thread is made with a lead of one turn in ½ in. (½-in. pitch), the ratio of the gear will be 1 to 20, because each revolution of the worm will rotate the wheel by ½ in. As there are twenty half inches in the circumference of the wheel, twenty revolutions of

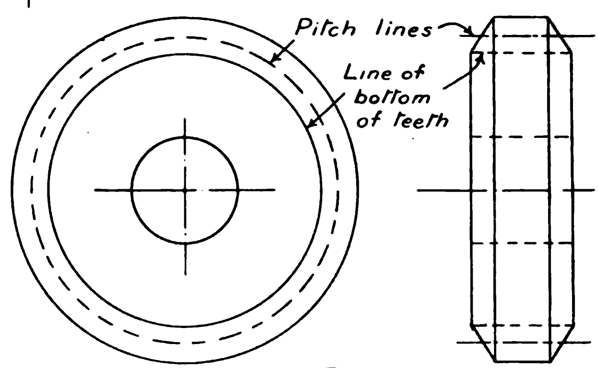
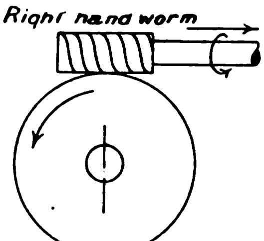


FIG. 47.

the worm will be required to rotate the wheel through a distance of 10 ins. If a ratio of 1 to 10 be required, it can be obtained by making the worm thread with a lead of one turn in 1 in. Ten revolutions of the worm will then produce one revolution of the wheel. If a greater ratio than 1 to 20 be required, it can be obtained by decreasing the lead of the worm thread. For example, if the lead is one turn in ¼ in., the ratio of the above gear will be 1 to 40, as there are forty quarter inches in a circumference of 10 ins.; therefore, forty revolutions of the worm will be required to produce one revolution of the wheel, and so on. If the worm thread is made to have a lead of 1-10th in., the ratio of the gear will be 1 to 100. The lead may be one turn in 2 ins.; the ratio will then be 1 to 5. As the lead of the worm thread is increased, the thickness and height of the wheel teeth must be increased also. It may, therefore, be necessary to cut several threads upon the worm to enable the teeth to be made of reasonable proportions, as previously explained. In the instance given above, where the worm thread has a lead of 2 ins., it may be advisable to cut four or five threads. The wheel would then have twenty or twenty-five teeth respectively. Should the circumference of the wheel pitch circle, as first determined, prove to be inconvenient to the number of teeth, it may be increased or decreased to a limited extent and the diameter of the worm altered to accommodate the difference. When the centres are not fixed, the wheel size is only limited by convenience of construction. It is advisable to have at least thirty teeth in the wheel, if convenient. When a smaller number must be used, the top edges of the worm thread do not properly clear the wheel teeth.

FIG. 48.



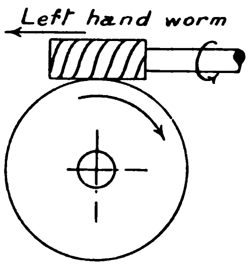


FIG. 49.

This interference can be avoided by a slight rounding off towards the tops of the thread or by increasing the diameter of the wheel so that the teeth project almost entirely outside the pitch circle. Messrs. Brown and Sharpe, in their treatise on gearing, give the following rule for this increase of diameter. The pitch diameters to be multiplied by ·937; add to the product four times the addendum, that is, the part which in the ordinary way would be outside the pitch circle. The sum gives the diameter of the blank at the throat P (Fig. 46). The whole diameter of the wheel is obtained by making a drawing to this rule and measuring off the dimension. They say, however, that it is not practical to finish wheels sized by this rule with a hob when they have twelve to eighteen teeth, unless the wheel is driven by separate mechanism; the hob must not be relied upon to drive the wheel.

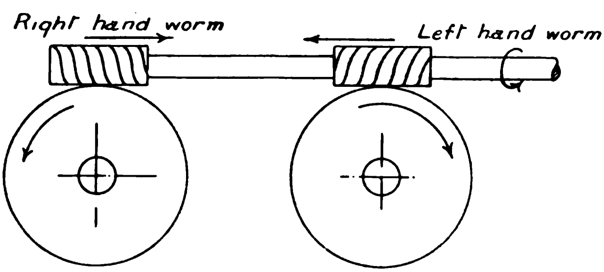


FIG. 50.

Professor Unwin gives the following proportions for worm gearing, P being the circumferential pitch of the wheel teeth. Thickness of tooth on pitch line, ·48 *p*; height outside pitch line, ·3 *p*; depth below pitch line, ·4 *p*; length of worm, 3 to 6 *p* (usually 4 *p*); width of wheel face, 1·5 to 2·5 *p*. The worm is frequently made of some different metal to that used for the wheel. For example, a steel worm and gun-metal wheel, a hardened steel worm and a phosphor-bronze wheel, give good results · a wrought-iron or steel worm and cast-iron wheel are also used; a cast-iron worm can be used with a cast-iron wheel. When the gear is used for continual running and transmitting power for driving purposes, the shape and materials used are of much greater importance than when the gear serves for adjustment purposes and occasional use. A hardened steel worm and phosphor-bronze wheel is a very good combination for transmitting power, but efficient lubrication of the surfaces in contact is the most important factor. The gear should run in an oil bath, if possible. Worm gear was at one time regarded as a very inefficient means of transmitting power, but during recent years it has come into extensive use for this purpose, and, if well designed and run in oil, is found to have high efficiency. The loss of power due to friction between the worm thread and wheel teeth decreases with increase of the inclination of the thread, that is, a coarse lead will give a higher effiefiency than a fine lead (pitch). Worms having multiple threads thus give a higher efficiency than single-threaded worms, and a small diameter worm gives a higher efficiency than one of corresponding lead, but larger diameter. In addition to the friction at the worm thread, there is friction set up by the end thread of the worm shaft. This is also of importance, and some form of thrust bearing is required if high efficiency is to be maintained; a ball thrust bearing is very good. As previously explained, the worm must be prevented from moving end-wise, if it is to exert pressure upon the wheel teeth and rotate the wheel; therefore, the wheel teeth will press against the worm thread with a force proportional to the load which the wheel has to drive. The teeth therefore thrust the worm shaft against the bearing in which it runs. The direction in which the wheel rotates for a given direction of rotation of the worm depends upon whether the worm thread is right or left hand. It is possible on this account to combine two worm gears so that the end thrusts of the worms oppose each other, and no thrust comes upon the bearings. Fig. 48 is a diagram of a worm and wheel, in which the thread is right-hand, and Fig. 49 is a similar design, in which the thread is left-hand. The arrows indicate the direction of rotation and thrust. The worm shaft rotates in the same direction in each instance, but the wheels rotate in opposite directions, and the direction of thrust exerted upon the thread of the worm, and therefore upon its bearings, is also opposite, as indicated by the straight arrows. In Fig. 50 the gears are combined, the two worms being cut upon one shaft. Each worm exerts a thrust in the opposite direction to that produced by the other; the bearings are thus relieved of end pressure, which is taken by the part of the shaft connecting the two worms. The driving force of the wheels can be combined and transmitted to a single shaft by means of spur wheels.

A distinctive feature of worm gearing is that it is not always reciprocal—that is, the worm will always drive the wheel, but the wheel may not drive the worm. If the lead of the worm is small, and therefore its angle small, the friction between the surfaces in contact will be so great that the worm cannot be rotated by the wheel. The critical lead of thread at which the wheel can drive the worm will depend upon the friction between the surfaces in any particular instance. Generally speaking, single-thread worms cannot be driven by the wheel, but if the lead required is sufficiently great to necessitate a multiple thread, the wheel may drive the worm; the greater the lead, the more likely is the gear to be reciprocal.

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.*]

Originality in Model Making.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have been greatly interested in the recent discussion upon Mr. Percival Marshall's able paper, "Originality in Model Making," which was published in your issue of October 15th. It seems a great pity that the average model maker is only original in his methods, and not in the character of the work he produces, for the adoption of unorthodox methods is often compulsory, much of his work being at times quite beyond the normal capacity of the tools at his disposal, and this must in many cases be conducive to "shirking" or "putting work out."

Evidence of this is to be seen in the demand which exists for partly machined sets of castings. It is, of course, impossible to compel originality of thought in the character of a man's work, but it might at least be deemed worthy of greater encouragement, as, for instance, by giving preference to original designs when awarding prizes, etc., at the various exhibitions; at the same time bearing in mind Mr. Marshall's remarks as to "mere eccentricity." I believe this system has been adopted in some cases, but its effects would be more apparent were it to become universal. Simply devoting a separate section to this class of work is, to say the least, only partially effective, as this gives only too obviously an opportunity for neglect.

I have long been of opinion that many of the model makers who so faithfully copy some modern design, do so with but a limited knowledge of the history of the machine they are constructing, but were they to devote their energies to a reproduction of its original or primitive form, their knowledge would be greatly increased, for they would observe many obsolete devices, and a natural "curiosity" should prompt them to discover precisely *why* these factors have been superseded.

Again, "prime movers," such as steam, gas, and oil engines, seem to have received more than their fair share of attention, and in consequence driven machines have been neglected. For example, we seldom see models of printing machines, although in this class we can find almost every possible degree of complication and difficulty, from the wonderful newspaper press to the simple "Cropper," in the construction of which the amateur would be sure to acquire fresh knowledge. Therefore, Sir, from a purely educational point of view, this form of originality has much to recommend it.

Now, with regard to absolute originality, viz., the invention of new appliances for various purposes, it seems that a great deal more could be done in this direction, for a large amount of what may be termed potential inventive talent undoubtedly exists, as was amply demonstrated by the many novel and ingenious solutions offered by competitors in your "Workshop Problems" Competition of some time ago. Can it be that they are deterred by a lack of confidence in themselves? In other words, do they consider that their labour would be wasted if the particular device failed to achieve the hoped-for result. Surely there is nothing to lose, for if no new principles were demonstrated, the old ones would be more firmly impressed and more thoroughly understood. It is true that great disappointments would be occasionally suffered, but the practical and comprehensive knowledge derived should be considered ample compensation.

It may be observed that plausible theories have in the past failed when put into practical form, and others, which were apparently unsound, have been successfully demonstrated; so there would appear to be ample scope for the ambitious enthusiast in experimenting with a view to reform or overthrow some of the generally accepted "laws," or to prove new causes for various effects. It should be noted, in this connection, that scientific deductions cannot by any means be conclusive, for the reason that, first principles being incapable of demonstration, the fundamental basis of our reasoning must necessarily be hypothetical.

It is essential that the tyro, in working out new ideas, should not allow his enthusiasm to outweigh his judgment, for I venture to think that if he can be induced to look for vices rather than virtues in his design, the finished machine will seldom fail to perform its particular functions.

In conclusion, I would recommend the practice of making wooden or cardboard models of the various simple mechanical actions, as not only will their peculiarities be more easily observed, but many new possibilities will probably be found to present themselves, and so provide the embryo inventor with at least something upon which to build his hopes.

Trusting that the importance of the subject will excuse this somewhat lengthy effusion, I am, Sir, yours faithfully,

A. W. LUDLOW DORÉ.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I quite agree that model making could be made much more interesting if model makers would be original; but to many, or at any rate to most, of those to whom I have spoken, they do not seem to know what to make to be original.

They have said—to be original in model making means to invent a new type of engine, motor, or dynamo, as the case may be. Now, to me, to be original seems to mean that one should model some type of machine which other people seem to leave alone; for example—models of bridges built on the cantilever system, models of dams, sluices, locks, and other appliances used in the control of water. Let any model maker go to the South Kensington Museum, and I think in an hour he would find several models of machines of all sorts which are original. Let me give a few more examples: I have the catalogue of the Museum before me on my desk at the present moment; now let us glance at Part I. Let our amateur make a model of Savery's engine—now this is original; or an engine fitted with the Sun and Planet gear; or a Newcomen engine; or, to go further into the catalogue, there are models of horse-gears, water-wheels; or, to go to pumps, why not model scoop wheels, or chain pumps? These seem to me to be out of the ordinary. Now, to go to Part II: there are machines for the cotton, the woollen, the weaving, and the silk industries;

or there are rope-making, paper-making, and printing machinery. Or, for those of a warlike nature, there are guns, large and small.

I own a laboratory in which I carry out experiments in mechanics, physics, and chemistry; also research of a medical nature, and I make a lot of my own apparatus. I have from time to time modified existing apparatus, and in one or two cases I have improved apparatus. I hope in a short time to send you for "Ours" an account of my latest improvement.

Now, surely this is original, and this may lead others who are making scientific apparatus to give us accounts of their apparatus.

Hoping that in the near future some original and interesting models may appear in "Ours," I remain, dear Sir, yours faithfully,

A London B.Sc.

To the Editor of *The Model Engineer*.

Dear Sir,—I wish to emphasise the fact that original work gives much greater pleasure than merely making things to drawings.

Firstly, there is the scheming of the model, not necessarily a complete engine, but some part of it; the thought that it may be made in a way differing from the usual practice—for example, the building up of a part by using sheet and tube metal and silver soldering together instead of making a pattern and obtaining a casting; or it may be modifying or simplifying the design of a prototype.

Secondly, there is always present the pleasant anticipation of whether it will work satisfactorily or not, and lastly, the pleasure of the actual trial, and, let us hope, the fulfilment of the original idea.

The making of the small injectors and pumps which I have shown at previous meetings were amongst the most agreeable and interesting jobs I ever undertook.

Making models of various valve gears in cardboard to study the functions of the various parts and see how far a divergence from actual practice may be made in a model without affecting the correct distribution of steam is also interesting and profitable work which I commend to the notice of the members of the Society.—Yours truly,

L. M. G. Ferreira.

Re Slipping Driving Wheels.

To the Editor of *The Model Engineer*.

Dear Sir,—Surely Mr. Coomb's theory in your issue of October 22nd is inadmissible. In no possible way can the speed of the driving wheels exceed that of the trailing wheels. By means of rail adhesion a very large amount of work is being done through the driving wheels in overcoming friction of the motion and inertia forces, necessarily very large at a high rate of speed. Therefore any diminution of the adhesion between the rails and the driving wheels, whether arising from imperfect track, as Mr. Coombs suggests, or from excessive grease on the rails, can only have the effect of immediately braking the driving wheels and so easing slip, or, more correctly, negative slip.—Yours truly,

N. B. Richards.

To the Editor of *The Model Engineer*.

Dear Sir,—I have read with interest the letter written by Mr. Farren, regarding my mechanical valve models, photographs of which you published in The Model Engineer of October 7th, 1908. With reference to Mr. Farren's remark "Does this engine reverse?"—yes, it does, by reversing the bevel which is on a sliding key on main shaft. Shall be most pleased to send in diagrams or drawings, together with a description of a fuller nature than heretofore at an early date.—Yours faithfully,

Arthur S. Lane.

To the Editor of *The Model Engineer*.

Dear Sir,—I see by this week's issue Mr. Chas. S. Lake's Oswestry correspondent has received an emphatic confirmation that locomotive driving wheels *do slip* when steam is completely throttled, and this confirming testimony is, of course, the letter from a writer stating he is a G.W.R. fireman.

Unfortunately, nobody comes forward with any details—only just statement founded on hearsay.

If our two friends (Oswestry correspondent and G.W.R. fireman) would kindly furnish details as to the type of locomotive with which the incomprehensible slip took place, I think it would at once prove or disprove finally the theory I suggested to you on the 14th inst. If the engines that misbehaved had trailing wheels as well as leading wheels, my suggestion looks probable. If the engines had either no leading wheels or no trailing wheels, then the driving wheels could not possibly have become jacked up momentarily and thus allowed to spin idly, and I am wrong.

I hope someone will settle this rather fascinating story, and remain, yours faithfully,

H. N. Coombs.

To the Editor of *The Model Engineer*.

Dear Sir,—We have heard a good deal lately of locomotive driving wheels slipping, so a case of driving wheels which could *not* be made to slip may be interesting.

The engine in question was attached to the Wolverhampton to Paddington express, leaving Oxford at 9.10 a.m. one day last week, and was one of the new G.W.R. 4—4—0 "Flower" class, built this summer. When signalled to start the driver opened throttle as usual to half and then three-quarters, but neither wheels nor engine moved. Closing the throttle, he reversed gear by means of the screw arrangement; when throttle was opened again, the engine gave one weak puff and moved about an inch or so. Reversing gear with throttle full open had a similar effect, and steam was now blowing off at 195 lbs. per square inch.

After finding out that the guard's brake was off all right, both driver and fireman tried again, but still that engine remained in a state of "masterly inactivity." The coupling behind the tender was then slacked off a little; this was effectual, and the rate the heavy train was accelerated proved there was very little the matter. Now, how can this be accounted for? An engine, with cranks at 90 degs. and with reversing gear, behaves as though both cranks were on the dead centres. Was it caused by the valve setting? It seemed something peculiar to this engine, as the next train was a long, well-filled excursion, and was started without difficulty by an old 2—4—0 engine.—Yours truly,

F. Rolph.

Manchester Society of Model Engineers.

A MEETING of the above Society was held on October 15th in the smoke-room of the Manchester Social Club. Eighteen members were present. The minutes of the previous meeting having been read by the Secretary, and the necessary business transacted, Mr. Edward McMellor was called upon to give his paper on "The Automatic Vacuum Brake." The subject was dealt with in a very clear and concise manner, and was illustrated by means of working drawings passed round for examination. The proceedings terminated with a hearty vote of thanks to the speaker for his interesting contribution.—BASIL H. REYNOLDS, Hon. Sec., 35, Torbay Road, Chorlton-cum-Hardy.

The Junior Institution of Engineers.

THE annual general meeting of this Institution was held at the Royal United Service Institution, Whitehall, on October 19th, the Chairman, Mr. Frank R. Durham, Assoc.M.Inst.C.E., presiding.

Salient features of the Council's report relating to the year 1907-8, which was presented and adopted, included reference to the increase in the membership roll, bringing the total to 1,042, the election of Mr. James Swinburne, F.R.S., as president, in succession to the late M. Gustave Canet, and as Vice-Presidents, Sir William Huggins, K.C.B., O.M., Sir Archibald Geikie, K.C.B., Sir Robert A. Hadfield, and Professor J. J. Thomson, F.R.S. Nine meetings for the reading and discussion of papers and thirty-eight visits to engineering works, etc., had taken place, with an average attendance respectively of 116 and 74. Mr. Durham had been awarded the Institution Medal for his paper on "The Design of a Sewer," and a bronze medal (the Junior Members' Award) went to Mr. Gilbert Whalley, for his paper on "Notes on the Testing of Gas Engines." The successful Summer Meeting in France, during which the well-known works of Messrs. Schneider & Co. had been visited; the twenty-fourth anniversary dinner; the conversazione; the establishment of the Building Fund; first local section of the Institution (at Birmingham); the Benevolent Fund; the library; the Monthly Journal and Record of Transactions, forming for the year a volume of 680 pages; were other matters dealt with in the report, and special reference was made to the foundation of the Durham Bursary, due to the kindness of Mrs. F. R. Durham. The award for the year 1908-9 had gone to Mr. L. M. Jockel, of Edinburgh, his thesis being on the subject of "Electricity in Mining." The finances of the Institution were reported as being in a healthy state.

The election of officers and members of Council resulted as follows:—Chairman, Mr. F. R. Durham; vice-chairman, Mr. G. T. Bullock and Mr. J. Wylie Nisbet; hon. librarian, Mr. C. H. Smith; hon. auditors, Mr. H. Norman Gray and Mr. Henry Cook; ordinary members of Council, Messrs. S. N. Bylander, L. M. G. Ferreira, B. E. Dunbar Kilburn, and John Weston; district members of Council, Messrs. C. T. Briggs, Ernest King, Geo. H. Hughes, Eustace W. Porter, A. Don Swan, W. E. Lilly, and H. F. Hunt.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26-29, Poppin's Court, Fleet Street, London, E.C.]*

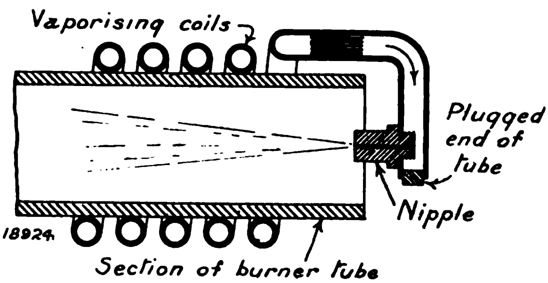
The following are selected from the Queries which have been replied to recently:—

[20,431] **Lead Burning.** F. W. E. (London, W.) writes: Will you kindly answer the following questions *re* lead burning for small accumulator plates. I have tried, as mentioned some time ago, with small iron, but find it unsatisfactory. Burning top plates to bridges, as per sketch (not reproduced); burning on broken terminal.

A method of lead burning will be found in our "Query" columns recently. Also please refer to "The Plumbers' Handbook," by Hasluck, price 2s. 2d. post free. We might add the job in question would be rather difficult to carry out unless you have had some experience in lead burning.

[18,924] **Burner for Model Boiler.** G. N. (Highgate) writes: I am making a burner same style as on page 26, "Machinery for Model Steamers," but the size of the container for spirit is 5½ ins. long by 4½ ins. wide. Would ⅛-in. copper tubing do for size of my container; if not, what size would you advise? Will this burner burn paraffin oil as well as benzine, or even methylated spirit? I prefer paraffin. If not, what alteration would have to be made? In your drawing (bottom one, page 29) I cannot see how the end of the tubing, after being coiled round the large tube, is finished off. Is it plugged at the end?

We are not clear upon the subject of your queries. Two types of burners are described on page 26—one the burner for methylated spirit, shown on page 27; and the other the benzoline or petrol burner, illustrated on page 29. They are, respectively, unsuitable for any other fuel than that stipulated in our handbook. You



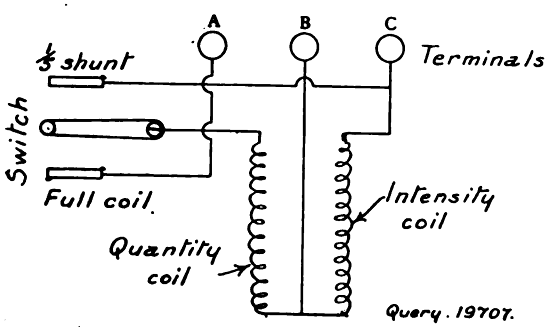
cannot use paraffin or benzoline in the spirit vapour burner shown on page 27, or methylated spirit or paraffin in the burner shown on page 29. In the latter burner the end of the tube is plugged up and a pinhole is drilled in it. What would be better would be to use a standard nipple (as sketch), as supplied for benzoline blowlamps. The use of the nipple will save a good deal of trouble in finding the exact diameter of the hole required. The proportions of the burner are a matter for experiment. Nipples only cost a few pence, and a tap must be made to suit the special thread used on these fittings.

[19,124] **Dynamo Windings; Running as Motor from Batteries.** W. F. B. (Bedford) writes: Thanking you for your past favours, I should be very much obliged to you if you would tell me how to wind a Kapp type dynamo, and show connections of field-magnets to brushes for shunt wound machine. I have been looking through THE MODEL ENGINEER, which I have taken for the past three years, but no one has asked this question, so I

thought I must trouble you. I also want to know the right way to wind and connect field-magnets of dynamo (shunt wound). I want the dynamo to give 20 volts 1 amp. Also size of wire for field-magnets and 8-slot drum armature. Would it make any difference to a dynamo if the right quantity of wire was on the armature and the slot not full? What power may I expect from dynamo if running it as a motor, and do you think a battery of twelve 1-pint Leclanché cells would drive it?

Wind your armature with 2 ozs. No. 26 S.W.G. and field-magnets with about 12 ozs. No. 27 S.W.G. This should give you approximately 20 volts and 1 amp. Particulars of methods for winding both armature and field-magnets are given in our Handbook, "Small Dynamos and Motors," 7d. post free, which we advise you to obtain. You will find the quantity specified for armature will just about fill the slots, but a good deal depends upon the way the wire is put on and whether the layers are packed tightly together, and also upon the thickness of the insulation, but a little difference one way or the other will make no appreciable difference in the results obtained. Leclanché cells would never be suitable for running this machine as a motor, as it will require at least 20 volts and take a current of fully 1 amp. Leclanché cells are only suitable for giving a very low current output.

[19,707] **G.P.O. Detector.** H. R. (Plumstead) writes: Having bought a G.P.O. detector, I find it has a 1-5th shunt. I understand that by using it on the intensity coil it greatly increases its utility. Can you kindly refer me to any article in THE MODEL ENGINEER by which this can be used, or, failing this, would you kindly give me a diagram of connections, and say what size and length would be required for the shunt? I got the Handbook No. 24 for small measuring instruments, but could not find find anything relating to it. I have tried manipulating the wires, but have utterly failed. Thick wire is about ·0265 in.—S.W.G. 22; thin wire is about ·0125 in.—S.W.G. 30.



Probably the shunt is obtained by connecting the quantity coil n shunt to the intensity coil; the gauges of wire seem to indicate that this is so, but without knowing the respective resistances, we cannot make any numerical calculations. The connections would be as diagram herewith. Connecting to B and C, you have the intensity coil alone in; or, to A and B, with switch on full coil, the quantity coil alone. With the switch on shunt stop and intensity coil in, this coil would be shunted by the quantity coil. The formula for calculating shunt is S $\frac{S}{S+G}$ — 1-5th; where S is shunt resistance and G the intensity coil resistance.

[20,457] **Model Flash Boiler.** J. W. (Glasgow) writes: I would be much obliged to you for answering the following questions. I have a double-cylinder slide-valve high-speed marine engine (⅝-in. by ⅝-in.), and was thinking of making a flash boiler for same. (1) What size and length of tube would be required? (2) Size of pump to keep boiler supplied, working off engine shaft. I intend using blowlamp for firing.

If you are requiring a reliable boiler without much trouble, then do not make a flash generator; but if you do not mind the experimenting, then we would not under any circumstances do anything which would tend to prevent you. (1) We would use a heavy tube—to hold the heat as much as possible. It may be of steel 5-16ths or ⅜ diameter outside, with about ⅛-in. hole in it. The length should provide about 100 sq. ins. of heating surface; therefore, use a length of about 100 to 120 ins. Copper is more or less unsuitable, as it is much weakened when subjected to a high temperature. (2) You will require a pump at least 5-16ths in. by ⅜ in., and an adjustable relief valve which will not leak. A hand-pump will also be required for starting. The engine force-pump should have an adjustable throw. And all valves should be perfect, and not liable to stick or leak. The engine should be of strong, simple design, and made with a cast-iron cylinder. It is by good regulating devices that a model flash boiler will be able to score over the ordinary type—and it is these devices that present the difficulty.

[20,273] **Coal for Oil Engine Ignition.** A. E. S. (Saltley) writes: I have an oil engine of about 1 h.-p. (3-in. by 6-in. stroke) at present fired by an oil blowlamp, which I wish to change to electric ignition. I should be glad if you would be kind enough to give me the rough dimensions of a suitable coil (of the non-trembler variety) to work with a 4-volt accumulator as I would prefer to construct one myself.

Please refer to our handbook, "Induction Coils for Amateurs," price 7d. post free, which gives full particulars for making spark coils. The ½-in. coil described in Chapter IV will be suitable for your engine.

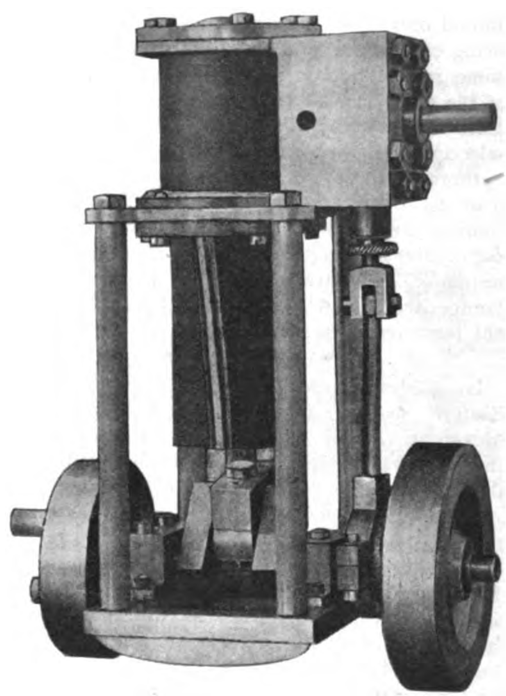
The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

** Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

*A Speed Boat Engine.

Those of our readers who have studied the design for an engine for a 5-ft. speed boat by Mr. T. Dysart, published on page 135 of our issue for Aug. 6th last, will be interested to know that a complete set of gun-metal castings for building this engine are being put on the market by Mr. T. Corkhill, 35, Stanhope Street, Liverpool. We have examined a sample of these castings, and can say that



they are a good sound set, with plenty of metal in them, and correct to the published design. Mr. Corkhill also supplies finished engines, one of which is shown in the accompanying photograph. He will be pleased to send full particulars on receipt of a postcard from any reader. He also notifies us that he has in preparation complete sets of parts for building microscopes, telescopes, and tangent galvanometers.

* Simple Engine Castings.

We have received from the Model Castings and Supplies Co., Wolstanton, Staff., two sets of castings for model steam engines. One of these is for a horizontal engine with cylinder ¾-in. bore by 1½-in. stroke, and flywheel 4½ ins. diameter, and the other is for a vertical or "steeple" type engine of the same dimensions. Both these are cheap sets, and for readers requiring to make up engines of comparatively simple design represent good value at the price. The castings are well moulded, and appear to be of good quality metal.

The Editor's Page.

Although model engineers are now-a-days so well catered for by the various supply houses, every now and again a want arises which does not seem to be adequately filled. One reader may feel the need of a special tool, another for some particular size or type of steam fitting, another for a certain set of engine or workshop castings, or for some detail of electrical apparatus. As these wants cannot well be met unless their existence is made known, we propose to ask our readers to specify the particular needs which they have found the trade unable to satisfy. We accordingly offer a prize of £1 1s. for the best short article or list of "Model Engineers' Wants." The matter should not run to more than about 500 words, and should be written in ink and on one side of the paper only. The competitor may confine himself to explaining one want in detail, or he may give brief particulars of many wants; but he should only make suggestions which are capable of being carried out, and which would assist him over some real difficulty if supplied by one or other of the trade firms. If other entries than the prize article are worthy of publication, we will make a selection of the most useful hints, and will give the authors of those we publish consolation prizes of from 2s. to 5s., according to merit. We think this competition should be as helpful to the trade as to our readers in general, and we shall hope to see a big response. All letters should be marked "Wants Competition," and should be sent to The Editor, not later than December 1st.

* * *

It is with the greatest regret that we learn that the Eastern Model Yacht Association (formerly the Alexandra Model Yacht Club) have met with another disaster from fire. Their club house, with all their new twelve-metre models and a number of valuable old models of fifty years ago, have been completely destroyed. This is the second fire within twelve months, and feeling that other causes than sheer accident may be at work, the Association are offering £20 reward for information as to the cause of the outbreak. It is most unfortunate that this further calamity should have befallen the Club just as they were getting into good going order again after their previous trouble, and we are sure the heartiest sympathy of model yachtsmen in all parts of the country will go out to them.

Answers to Correspondents.

C. A. (Edinburgh).—A small gas engine would be more suitable than steam for driving your lathe, as it is always ready for work, and needs no attention while running. See our sixpenny handbook, "Gas and Oil Engines Simply Explained."

"Screwcutter" (Birmingham).—Messrs. Drummond Bros., Ltd., Rydes Hill, Guildford, Surrey, will supply you with a screw-cutting lathe on the easy payment system.

H. M. (Chiswick).—Sorry your boat was not completed in time. You can run her for our annual Speed Medals under the usual conditions, but there will not be another open regatta this year.

No Name (Hebden Bridge).—You cannot do better than follow one of the designs for Manchester type dynamo given in our hand-book—"Small Dynamos and Motors," 7d. post free.

R. L. S. (Herne Bay).—Thanks for your letter. We are glad our advice has enabled you to successfully complete your machine.

J. Mc.I. (Elton).—A very good outline drawing of the actual engine, No. 1,619, will be found in our issue of May 7th, 1908. Drawings for a model form the subject of one of the nine plates of working drawings in "The Model Locomotive," by H. Greenly, price 6s. net, 6s. 5d. post free.

B. T. (Breda Street, Cape Town).—Many thanks for your letter. Your suggestions and criticism are welcome and true. Both shall have our attention.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

How to Address Letters.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to The Advertisement Manager, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[The asterisk (*) denotes that the subject is illustrated.]

THE

Model Engineer

And Electrician.

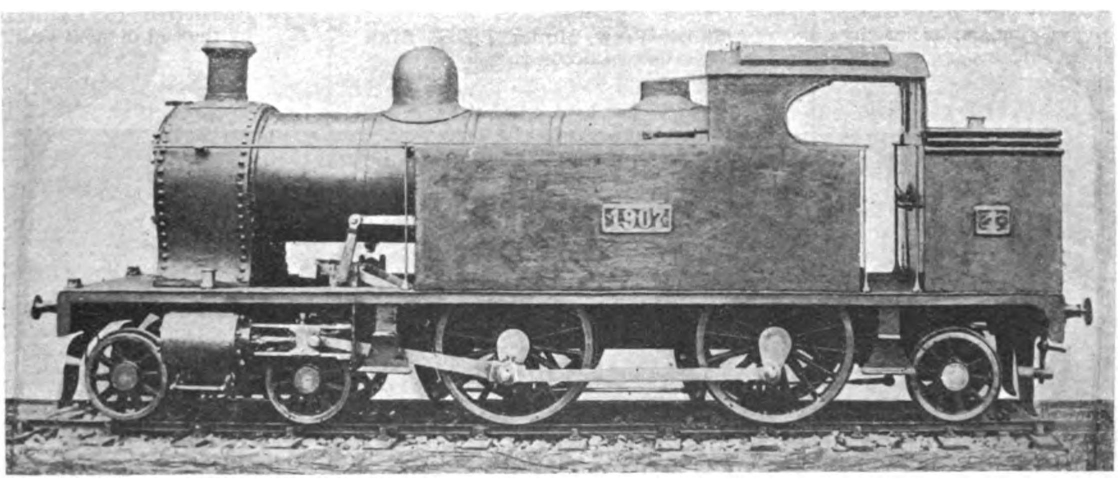
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 394. NOVEMBER 12, 1908. PUBLISHED WEEKLY

L.T.S. Model Tank Locomotive.

By W. E. GRAINGER.



MR. W. E. GRAINGER'S MODEL L.T.S. TANK LOCOMOTIVE.

PERHAPS the following brief description of a model L.T.S.R. tank locomotive may be interesting to some of your readers. I send photographs showing front of engine, side view, motion from underneath, and the boiler.

The boiler is strongly riveted. Before riveting the flanges were lightly tinned, and, after riveting was completed, solder was run into the joints to avoid any possibility of leakage.

The motion is of the Stephenson link type. Reversing is effected by means of a wheel and screw in cab.

A pump is fitted for boiler feeding worked by an eccentric on the axle of the rear pair of coupled wheels. A supply of water is carried in the tank at the back.

There is a grate in firebox for coal burning; but on account of the difficulty experienced in creating sufficient draught when raising steam, and the quantity of dust from the ashes lodging about the motion, I intend fitting an oil burner.

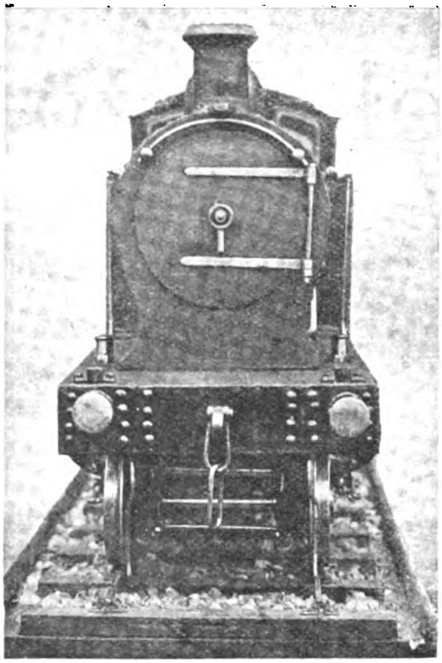
In common with most model locomotive builders, I have been troubled with wet steam. A considerable quantity of water is carried out of the boiler with the steam when regulator is opened. To obviate this I am extending the steam pipes through the tubes into firebox and back into smokebox, an arrangement similar to that adopted by Mr. Kirkby in his model.

The connecting-rods are fitted with adjustable brasses, and brass bushes are fitted in coupling rods. The engine is carried on spiral springs. This kind of spring is used for the buffers also.

The model has taken nearly three years' spare time to build. At a recent exhibition it was awarded a diploma and prize.

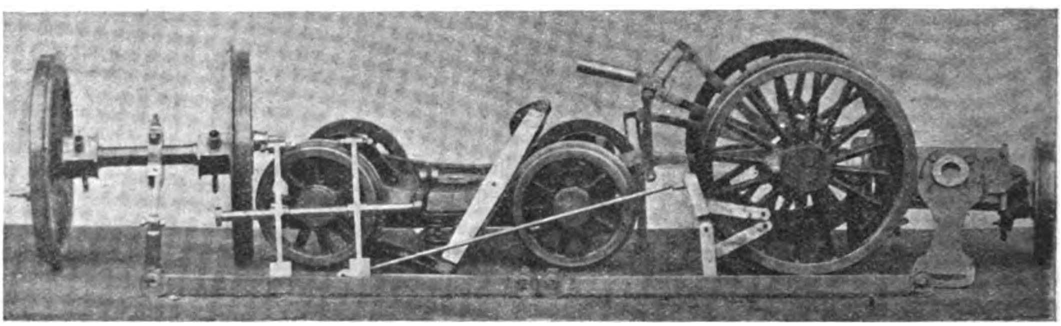
The principal dimensions are as follows:—

- Length over buffers, 35½ ins.
- Gauge, 4¾ ins.
- Diameter of boiler, 4 ins.
- Internal firebox, 5½ ins. by 2½ ins.
- Number of tubes, 8.
- Cylinders, 1¼ ins. by 1¾ ins.
- Coupled wheels, 5¼ ins. diameter.
- Leading bogie and trailing wheels, 3 ins. diameter.
- Pump, ⅜ in. by ⅜ in.

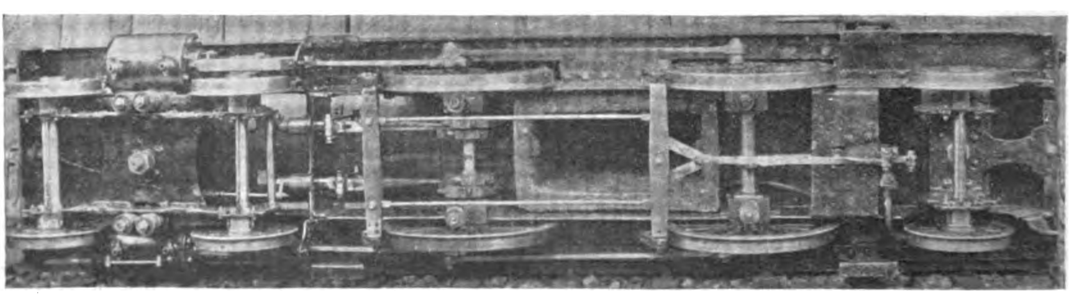


FRONT VIEW, MODEL L.T.S. TANK LOCOMOTIVE.

"IT is," states the *South-Western Gazette*, "understood that plans are now under discussion for the conversion of the ground now occupied by the locomotive works at Nine Elms into a new goods yard, with sheds and shunting roads, etc. In all probability the old semicircular engine shed and its attendant coal stages, etc., will be swept away, and the newer shed at the western end of the company's property enlarged to accommodate the other engines. The locomotive works will probably be transferred to Eastleigh by the end of next year."



VIEW OF MOTION AND PARTS OF L.T.S. TANK LOCOMOTIVE.



INVERTED PLAN VIEW OF L.T.S. TANK LOCOMOTIVE.

Design for Model Motor Fire Engine.

By Frank Finch.

(*Continued from page 65.*)

The part front elevation shown in Fig. 21 should be studied, together with Fig. 20 in the last article; it will assist in simplifying the arrangement of rods, etc., for the steering gear and their relation to the front axle. The positions of bearings for supporting the vertical steering-rod are also indicated. It is very essential for the appearance of the model that the front plate should be well curved and even. The sketch at the top of the figure gives the radii for this plate. A piece of Russian iron about 18 B.W.G. will be of ample strength, and it might be hammered round the front casting of the frame, over which it is placed when in its final position. A strip of half-round wire $5\frac{7}{8}$ ins. long (about 1-16th in. in diameter), soldered along the top edge of the sheet, will give a finish resembling the prototype. A quantity of 1-16th-in. brass wire should be obtained, as various small lengths will be required to complete the model. For instance, the handles on each side of the front plate are made of two $1\frac{1}{2}$-in. lengths; the ends to be filed flat on one side and bent over with a pair of round-nosed pliers, so that the flat sides can be soldered on to the plate in the position indicated.

The Boiler.—For the boiler shell a piece of brass tube 4 ins. diameter by 5 ins. long, No. 18 B.W.G. should be obtained from the metal merchant, also a 2-in. length, which should be expanded out so that one end remains 4 ins. diameter and gradually tapers to $4\frac{1}{4}$ ins. diameter. This forms the bottom or outside of firebox end of boiler. The foundation-ring, which is of brass, is shown in full size half-section at Fig. 22. The T-section ring for connecting the upper and lower boiler shells is shown in Fig. 23, and 1-16th-in. rivet holes are to be drilled right round, above and below the

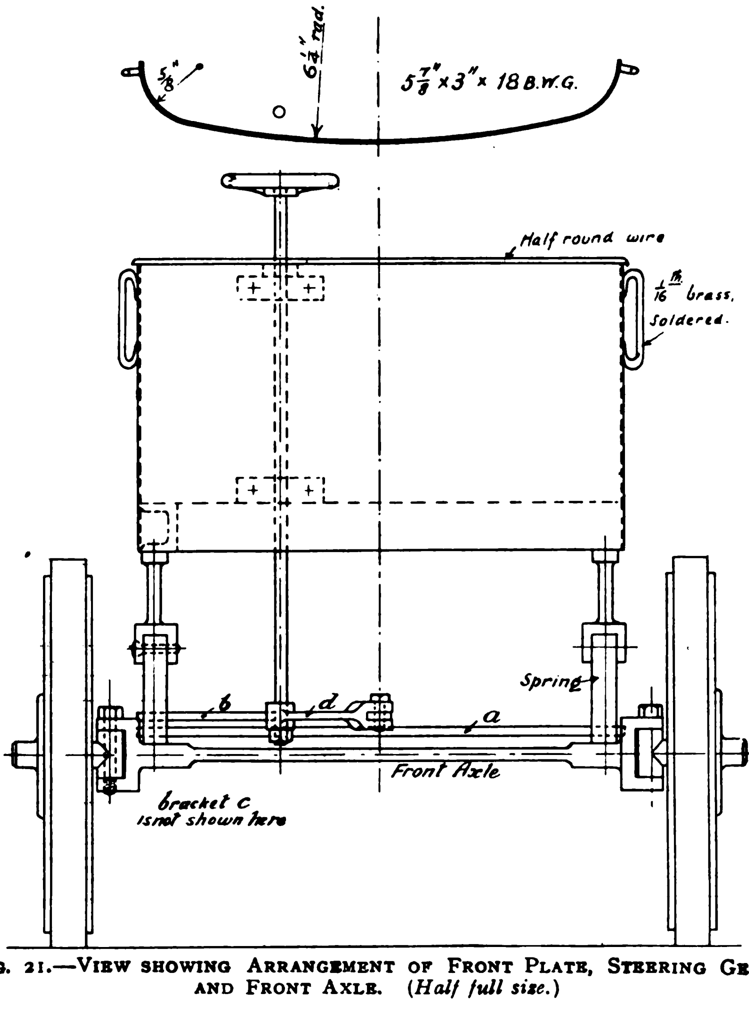


Fig. 21.—View showing Arrangement of Front Plate, Steering Gear, and Front Axle. (*Half full size.*)

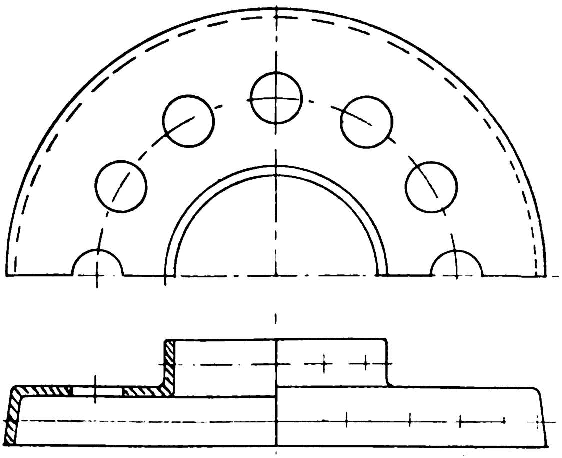


FIG. 26.—FIREBOX CROWN.

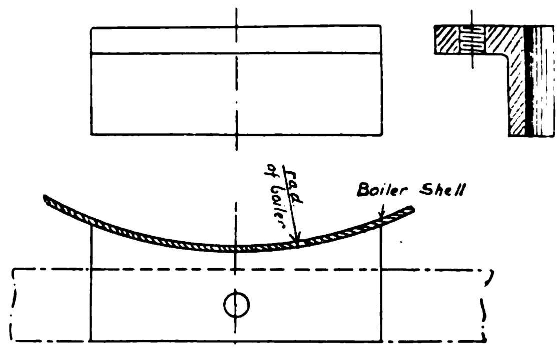


FIG. 27.—CASTING TO SECURE THE BOILER TO THE MAIN FRAME.
(*Two thus: Full size.*)

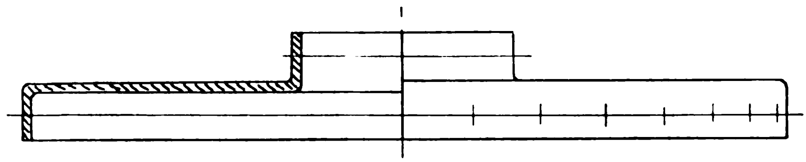


FIG. 25.—CIRCULAR PLATE TO FORM SMOKEBOX. (*Full size.*)

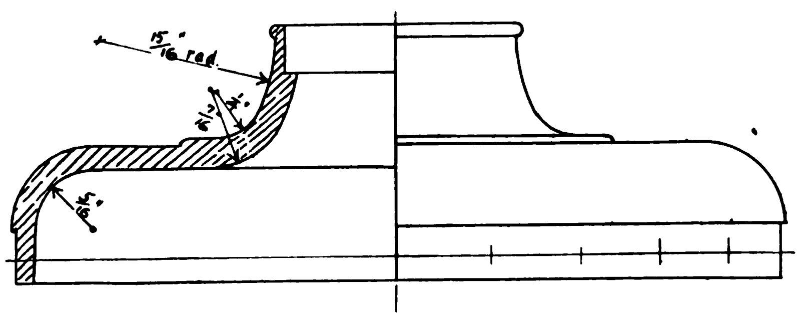


FIG. 24.—BOILER DOME. (*Full size.*)

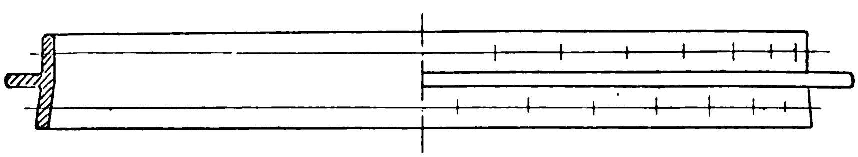


FIG. 23.—T-SECTION BOILER RING. (*Full size.*)

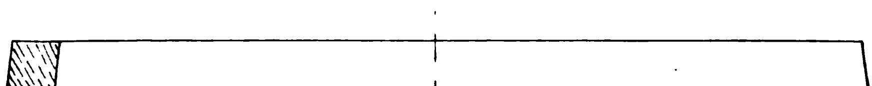


FIG. 22.—FOUNDATION RING. (*Full size.*)

BOILER AND FIREBOX DETAILS FOR MODEL FIRE ENGINE.

By FRANK FINCH.

middle web, about ⅜-in. centres. The boiler dome is, of course, a brass casting, and the half-section gives the finished sizes (Fig. 24). A set-off about 5-16ths in. wide is turned on the circumference, in order to bring the boiler shell flush with the dome. Holes are to be drilled and tapped for 3-32nds-in.

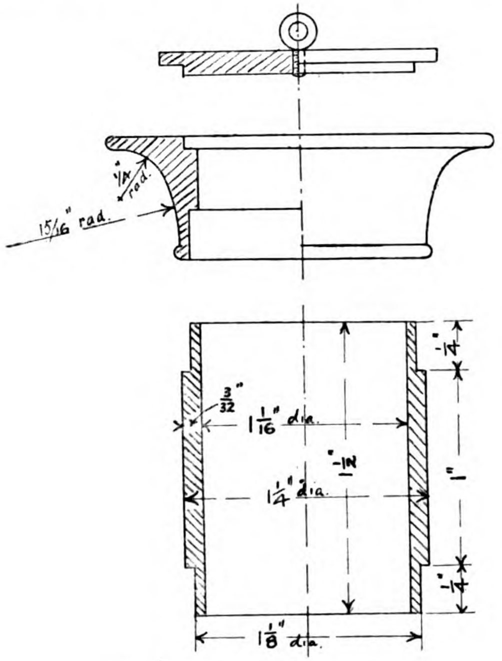


FIG. 28.—CHIMNEY PARTS.

screw (about ⅜-in. centres) all round this recess, and corresponding holes must be drilled round the upper end of boiler shell.

The circular plate shown in the coloured plate, and forming the smokebox, is also shown full-size in Fig. 25. This is of stout sheet copper 4½ ins. diameter by No. 16 B.W.G., and may be beaten into the desired shape, the centre ring to be riveted to the smoke-flue, and the outer ring to be drilled for 1-16th-in. rivets (about ⅜-in. centres) for attachment to the outer barrel. In Fig. 26 is shown, in half-section, the plate forming the firebox crown; this is of copper sheet about 3½ ins. diameter by No. 16 B.W.G. A ring of holes should be drilled upon each flange similarly to the plate (Fig. 25), and, in addition, upon a centre 1⅞ ins. diameter, scribed from the centre, should be drilled at equal distances twelve holes, to take the ends of twelve water-tubes, as shown in the coloured plate, and as indicated in Fig. 26. To secure the boiler firmly to the frame, castings should be made to the dimensions and shape shown in Fig. 27. One ⅛-in. screw will be sufficient to attach each casting to the side frame through the bottom of the water tanks. The curved surface should be brazed to the side of the boiler. A 4-in. length of 1-in. diameter copper tube constitutes the smoke-flue, and should be drilled top and bottom to coincide with the middle flanges of Figs. 25 and 26. The firebox wall may be formed from a 3-in. length of copper tube 2¾ ins. diameter, tapered out to 4 ins. diameter, and riveted right through the foundation-ring (Fig. 22). Twelve holes are to be drilled at equal distances ¾ in. from the bottom end of firebox, to take the other end of water-tubes. Each water-tube is 3½ ins. long and bent to the shape as shown in the general arrangement. It is proposed to construct the chimney in parts, as shown in the drawing (Fig. 28), especially to add to the effect of its appearance when finished. The main body is a piece of steel, turned down at each end as shown, the remainder of the circumference is left dull. The top ring is of copper and polished, whilst the cap may be turned from a piece of brass plate. The form of superheater is clearly shown in the general arrangement drawing. Boiler fittings are the usual standard patterns obtainable from advertisers in THE MODEL ENGINEER, with the exception of the safety valve, a detail drawing of which will be given in a subsequent article.

The engineer's platform and tool-boxes, which are situated at the rear of the model, are details which, although simple, call for careful workmanship. It is often such minor accessories as these that spoil the effect of a model. The drawings given in Fig. 29 are half full size, and may be accurately measured off. The main

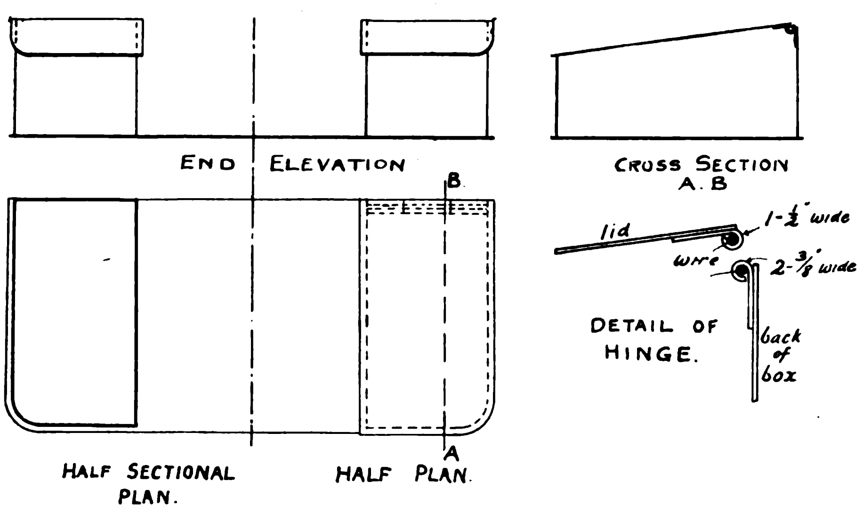


FIG. 29.—ENGINEER'S PLATFORM AND TOOL-BOXES. (*Half full size.*)

piece or platform forms also the bottom of both boxes. The sides for each box are constructed in one piece, allowance being made for the ends to overlap at one corner for soldering. A simple form of hinge is shown in the enlarged sketch. These boxes are used for tools, etc., on the prototypes, and will be found useful on the model for placing odd screws, etc., when manipulating the model. In the general arrangement drawing a sling is shown by which this platform is suspended. A strip of flat metal, as shown, will suffice. To further steady the platform, two small strips attach it to the foundation-ring of boiler, as indicated.

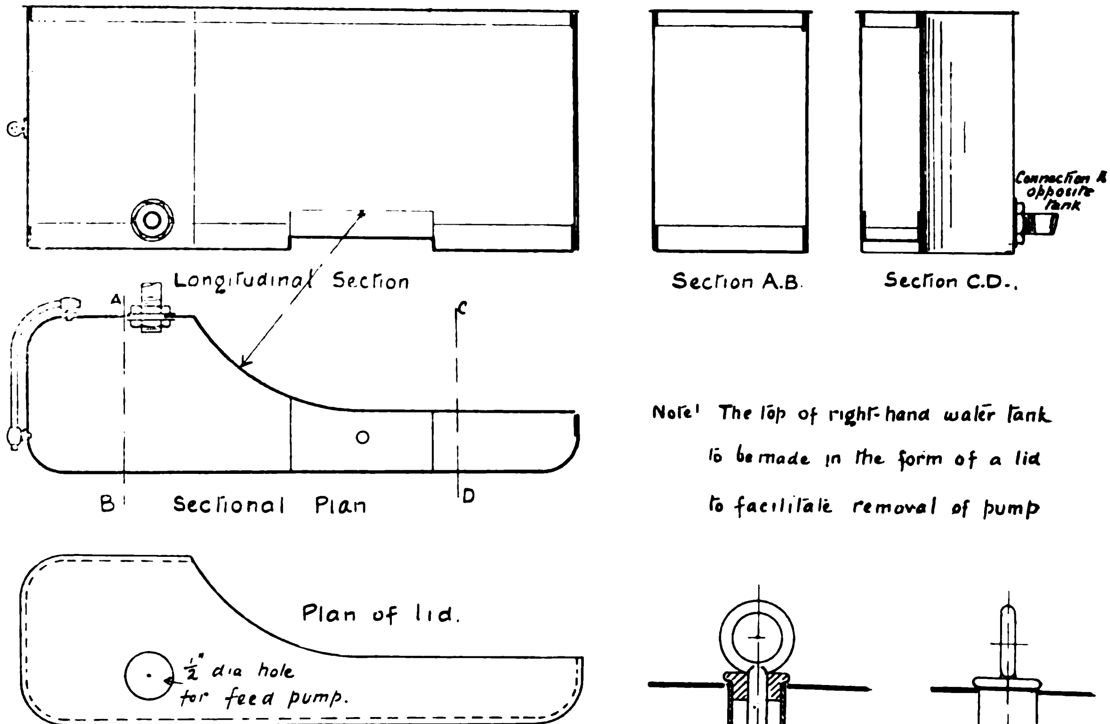


FIG. 30.—DETAILS OF FEED-WATER TANKS. (*Half full size.*)

Dealing now with the water tanks, it will be observed that these occupy the same position in the model as in the real engines. The sketches (Fig. 30) are reproduced to exactly half full size, and may be scaled off; both tanks are alike, excepting that they are right- and left-handed. The curved side is obviously to fit round the boiler, and the radius should equal that of the boiler. The step-up portion in the bottom of tank is to cover the casting which supports the boiler, the screw for same going right through bottom of tank, and thus securing the tank firmly. The small pipe, screwed at ends, and connecting the tanks, also acts as a tie-rod. In the right-hand tank it is proposed to place the feed-pump, and in order to do this the top of the tank should be made in the form of a movable lid, which can be placed on after the pump is in position. A hole should be cut in the lid, as indicated in the plan (Fig. 30), to allow for the top of pump to protrude.

Feed-pump.—Following the water tanks, we are now to deal with the hand-operated pump for feeding the water as required, into the boiler. The pump is clearly shown in the drawings (Fig. 31), which are reproduced exactly to half full size. Little or no explanation is necessary for this. Suffice it to say that the two caps are screwed to the pump body by two screws each, which go right through to the foundation-plate; the latter is held to the bottom of tank by three small screws.

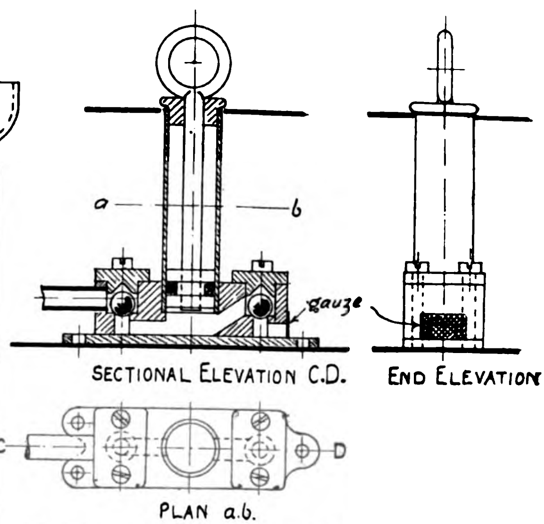


FIG. 31.—HAND-PUMP FOR FEEDING WATER TO BOILER. (*Half full size.*)

(*To be continued.*)

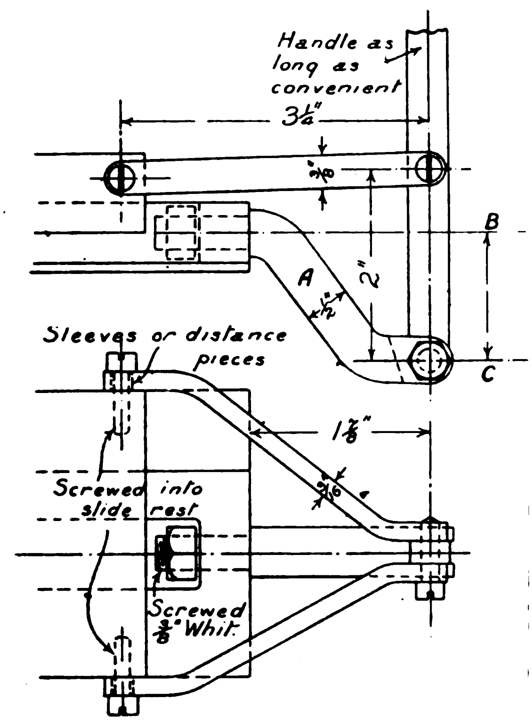
Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "Workshop" on the envelope.]

Converting a Slide-rest for Planing.

By H. H. Copus.

I have sometimes noticed that when some of my fellow-readers are describing their work, they say that they have cut a keyway in a crankshaft by fixing a parting tool in the slide-rest and then moving it along by the screw. I believe it, and other such jobs could be done much quicker with the apparatus shown in the drawings.

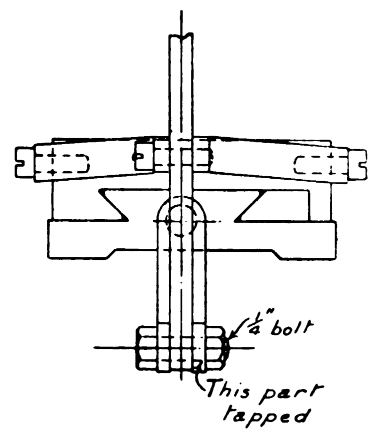


As slide-rests vary in size and design, I have omitted most of the measurements; also some would stand a heavier cut, and would require a stiffer attachment; any way, make it too stiff rather than not stiff enough. The piece wanting most explanation would be that marked A. It should be made by bending a piece of steel bar to shape and turning the end down as shown, to fit the hole from which the sliding screw has been removed, cutting a suitable thread on same. One way of turning the end would be to fix an angle-plate to the face-plate, and bolt the bar to the former. The distance B C can be made to suit, according to what stroke is required.

It will be seen that a spanner cannot be used to tighten the nut, so make the nut a trifle slack fit, place the nut in position, and screw the piece A into it. If it is not in the right position when tightened up, slack out a little and move the nut in the required direction. A try or two should get this right.

For a handle I had thought of using one off a cycle, an old front-tyre brake handle; this also must be settled by the materials the maker has at hand. One thing I should like to point out: that is that the screws should not be threaded up to the head, but sufficient left to provide a plain surface for the parts to work on. Better still, they could be made as shown in the drawing, a small collar being fitted over the screws so that the screws can be screwed up tight, yet allowing the links to move easily. If made somewhere near the sizes shown in the drawing, it should give about 1¾-in. stroke.

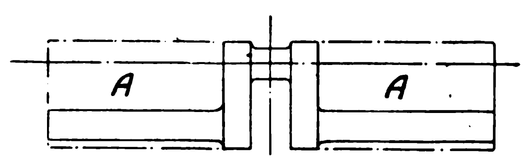
It will be seen that by drilling and tapping four holes into the slide-rest, the attachment can be used on either the cross or longitudinal slide.



Converting Slide-rest into Planing Machine.

A Hint for Turning a Crankshaft.

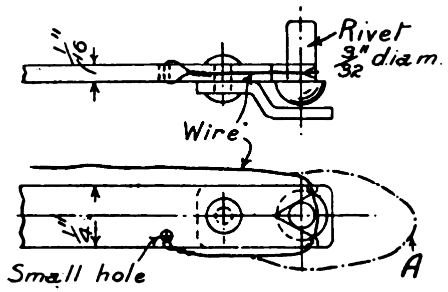
I thought, while reading a recent article on the turning of crankshafts, when they are being made from a rectangular bar, why not turn the crank-pin before cutting away the parts marked A in the



drawing? It would be as stiff then as ever it would be. One thing would have to be guarded against—that is, not to put too much stress on it while cutting away the A pieces, or it might be strained out of shape. I think this would certainly do away with some labour.

A Rivet Holder.

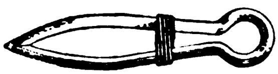
When building my last boiler, I had to fix a combined end and downcomer on to a piece of 2½-in. diameter tube, 11 ins. long. I hardly liked to trust to my silver-soldering for a job like this, so I determined to rivet it. Rivets 3-32nds in. diameter were chosen, to be inserted from the inside. The drawings show the holder I made to do this. A piece of steel ¼ in. by 3-32nds in. by 14 ins. long was found, notches were filed in the end as shown and a small hole drilled. A piece of brass was bent so as to hold the rivet head up to the bit of steel and riveted on. A piece of wire was fastened in the hole and passed around the end into the small notches, as shown in sketch. When a rivet is placed in the large vee and the wire pulled tight, it can be inserted in the



hole, with a little patience. To release the rivet let the wire go a little slack, then pull the holder back, forming a loop as at A; the holder can then be lifted clear of rivet. A piece of ⅜-in. by 2½-in. steel bar was fixed in a strong vice, sufficient projecting out at one side to reach under the heads of the rivets; on this the rivets were battered down.

Home-made Soldering Clamps.

Take a cotter pin and bend it over a small rod to bring the points together, as shown in the sketch. This will make a spring clamp that is opened to slip over the articles to be clamped together by inserting a scratch awl or scriber between the legs at the bowed portion. To make a more positive clamp, before bending the legs to a bow, slip a short coil of wire over the pin, passing it down to the ring end.

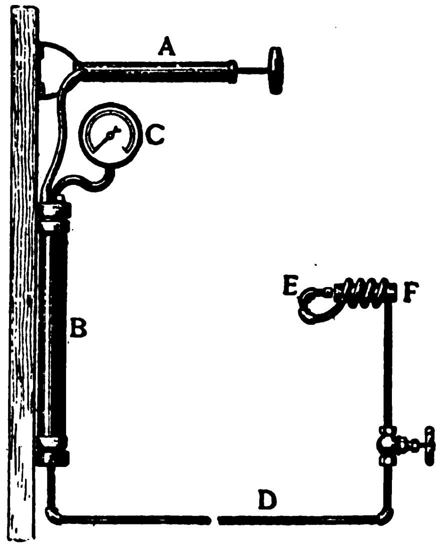


Wire 1-32nd in. in diameter wound over a wire slightly larger in diameter than that of the cotter will do. In soldering, smoke the legs well to avoid solder adhering to them. The clamp is tightened by pushing up the coil ring toward the bow of the legs and then twisting it like a nut, the coil being wound right-handed, so that it will have a screw effect.

A Home-made Brazing and Tempering Torch.

All jobbing shops have a call at some time or other to do brazing, and the forge fire is not the proper one to heat the parts to secure a first-class job. A torch using gasoline or kerosene will furnish a much better fire, and such a device can be constructed by anyone of mechanical ability. Make a tank, B, as shown in the illustration, by using a piece of 2-in. pipe 20 ins. long and covering the ends with caps. Three holes are drilled in the top cap, to one of which the rubber tube from a bicycle pump is connected, a steam gauge, C, is attached to another, and the remaining one is fitted with a screw plug and used in filling the tank with fuel oil.

A hole is drilled in the bottom cap of the tank and connections are made with ⅛-in. pipe, D, which may be of any length to suit the surroundings. About 10 ins. of the end of this pipe is first filled with lead and coiled around a 1-in. pipe, F, 6 ins. long,

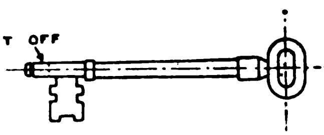


turning the end out so as to receive the two elbows and a short nipple. When the coil is finished, the lead is melted and run out. A small hole is drilled in the centre of a ⅛-in. cap and placed on the end of the pipe, as shown at E. The hole in this cap must correspond with the centre of the pipe F. It is necessary to have a globe valve placed somewhere in the ⅛-in. pipe to regulate the flow of oil in the burner, and also to shut it off when not in use. To generate it have a little cup or can of some kind that will hold three or four teaspoonfuls of oil and fix it to hang just below the coil while burning.—*Popular Mechanics.*

The Duplicator Duped.

By "Edwinstowe."

To prevent locks being opened by like keys various methods have been adopted. The duplicate keyholder may easily be baffled by cutting the key as shown, and placing the small piece in the lock.



If this is a loose fit a very little red or white lead should be placed on it, before it is pressed into the lock. Great care should be taken to keep the lead out of the wards.

Chats on Model Locomotives.

By H. Greenly.

(*Continued from page 418.*)

Model Steam Whistle Valves Again.

CONTINUING the subject of the last chat, viz., the making of model steam whistles, it will be noted on reference to the general drawing (Fig. 2) on page 417 of October 29th issue, that no provision is made for packing the plunger stem, save the turning in the plunger of

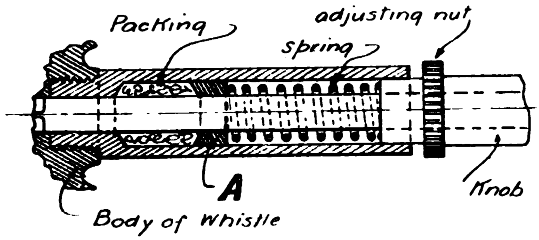


Fig. 5.—Packed Stem for "Push-in" Type of Valve.

a series of water grooves. These grooves should be about 1-20th in. deep by 1-20th in. wide (*i.e.*, a bare 1-16th in. each way) to be really effectual. If smaller, they may soon become clogged with dirt and not help at all in preventing the steam beating back down the plunger sleeve when the whistle valve is opened.

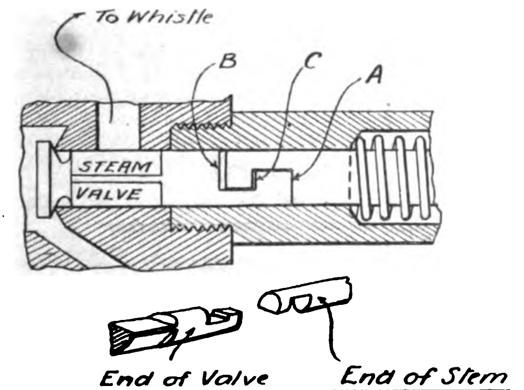


Fig. 6.—Flexible Joint for Valve Stem.

Although I did not try a plain plunger, owing to lack of time, it is not on the "live" steam side of the valve, and possibly would not leak without grooves, the joint being such a long one. However, there was no sign of any steam at the handle end of the sleeve during the whole time I saw the engine under steam, although after a few days' continuous working, examination showed the steel spring used in this whistle to be just tinged with rust.

This might be almost entirely prevented by a packing joint in the bottom of the sleeve, as shown in the accompanying detail drawing (Fig. 5). The only extra work involved with this arrangement is the drilling of the larger hole in the sleeve somewhat deeper, and the making of the brass washer A in Fig. 5. The spring may be relied upon to keep the packing quite tight, and the spring might be covered with a thick grease (tallow) before being finally fitted in place.

Another possible improvement on the original design would be to provide for any inaccuracy in the alignment of the sleeve and valve face and orifice, by making the valve separate from the plunger spindle.* This arrangement is shown by the hand sketches (which are not to scale), Fig. 6. The plunger and the valve are exactly the same as in Fig. 2 in all other respects. The joint between the two parts takes the form of a "scarf lap" joint as indicated, and allows the plunger to push the valve open and the spring on the latter to assist in closing it.

The sleeve, of course, keeps the two parts together and prevents any spreading. Both faces A and B should have the same surface, therefore either may

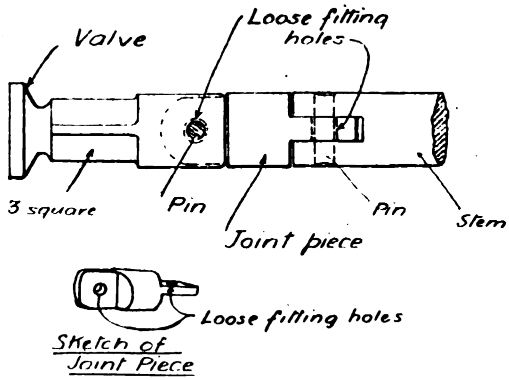


Fig. 7.—Another Design for Flexible Valve Stem.

be chosen to do the work of opening the valve. To give the desired flexibility to the joint, one however should only be taken as the working face, the other should be left quite clear, as shown on the sketch (Fig. 6). The contact-face C provides for the spring assisted closing of the valve and should also come into action when the other faces are not touching each other. In short, there must be a certain amount of looseness in the whole arrangement to ensure its practical utility.

Another joint which would appear to provide the desired flexibility is shown in Fig. 7. The loose joint piece is made out of a piece of the same sized rod as the plunger, and has spigot pieces arranged at right angles, as in the well-known "Universal" or "Hooke's" joint. The holes in the spigot pieces for the pins should be quite loose and the work of pushing the valve open performed by the *ends*, not the pin joints, of the respective parts. The pins of course come into action on the return, and, by virtue of the spring, assist the closing of the valve.

* In using the whistle shown in the photograph in last article, it was found sometimes that the valve would not close dead tight and required a slight turn of the knob to make it shut.

The half-size diagram shows the whistle in position in a Belpaire firebox model, slightly to one side of the centre line and clear of the regulator handle. In the case of a round top firebox, a pad piece or "bushing" with the top horizontal may be necessary. Another way would be to place the whistle centrally and allow the handle to stand at 45 degs. to the centre line of the engine. It may then be free of the regulator handle entirely.

The whistle is shown in Fig. 8 outside the cab. It may be placed inside the cab with only the bell projecting, as shown in Fig. 8*a*. The knob or handle, it will be noted, should be sufficiently far away from the whistle to keep it clear of the backplate of the firebox and save many burnt fingers.

While admitting its practical value, some readers may be prejudiced (I do not use the word in its offensive sense) against the "push-in" whistle valve, and prefer the type which is operated by a pull cord or wire, as on the G.E.R. locomotives.

Fig. 9 herewith shows how this can be done without altering the main features of the valve design by employing a lever of the ——— order (in spite of Mr. Tennant's "King of Prussia" rule I can never remember t'other from which). However, this does not matter, as the sketch is clear. I believe that it represents the usual arrangement adopted in real locomotives. The nut for adjusting the spring compression and limiting the valve movement should not be drilled through, and may be slotted to prevent its turning as shown.

To provide a pull-out whistle valve, the stem could, of course, be brought through a gland on the steam side in the manner shown in the sketch (Fig. 10). There is, of course, a tendency here to upset the tight seating of the valve, to say nothing of the obvious disadvantage of having the spindle gland always subjected to the steam at boiler pressure.

In the case of smaller whistles, another contrivance is suggested in Fig. 11. Here the spring is employed to close the valve against the boiler pressure or steam. The valve orifice may, and should, be as small as possible. There is no wing on the valve which would reduce the steamway, and therefore the valve orifice may not be any larger than the other passages or larger than the hole in the plug cock usually employed for model whistles. The orifice should be small because of the limits to the power of the spring. In a $1\frac{1}{2}$-in. scale engine (*i.e.*, a whistle the size of the one illustrated in Figs. 1 and 2 of last article), the orifice need not be larger than 7-64ths in. diameter, or say, ·01 in. area (1-100th sq. in.). The power theoretically necessary to keep such a valve tight against, will at 100 lbs. pressure be, of course, 1-100th of 100 lbs. = 1 lb., which is within reason.

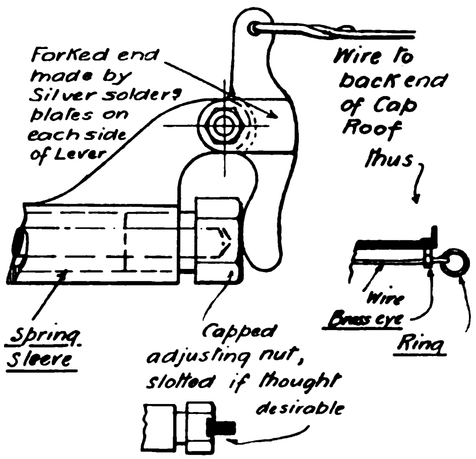


FIG. 9.—A PULL CORD VALVE ARRANGEMENT.

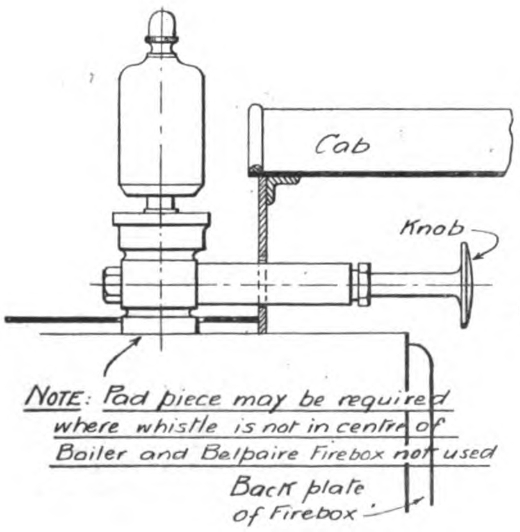


FIG. 8.—SHOWING POSITION OF WHISTLE ON BELPAIRE FIREBOX AND OUTSIDE CAB.

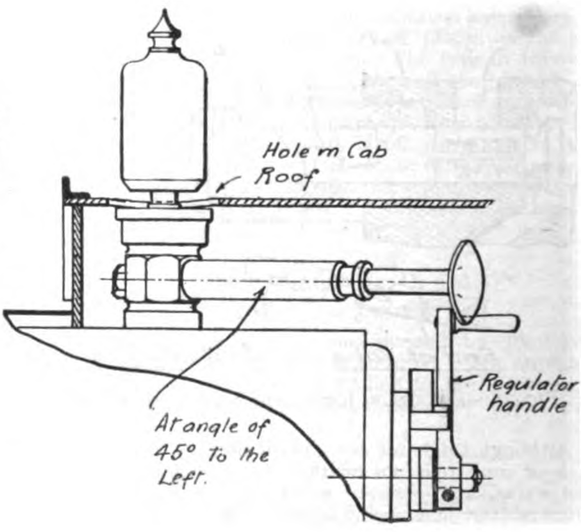


FIG. 8*a*.—ALTERNATIVE ARRANGEMENT OF WHISTLE INSIDE CAB IN CENTRE OF BOILER, WITH HANDLE AT AN ANGLE.

With a hole 1-64th smaller, *i.e.*, 3-32nds in. diam., the theoretical pressure equals about ⅔rds of a lb.

In practice, a pressure of 2 lbs. or 3 lbs. is, of course, advisable to overcome the pressure, and also the friction of the gland and other moving parts, and to still leave a balance in hand. Instead of using a bridle (as in Fig. 10) made out of flat stuff, a cylindrical cap may be used to hold the spring, as shown in Fig. 11. This drawing is roughly half full-size for a 1½-in. or 2-in. scale locomotive whistle, but the cap can, of course, be made longer to suit the length and strength of spring obtainable.

A gland may be used as shown in Fig. 11, or the water grooves (labyrinth packing) as depicted in the next diagram (Fig. 12) may be adopted, the valve stem passing through the body on the whistle side and never being subjected to the full boiler pressure. The arrangement here is something the same as in the main drawing (Fig. 2), the valve stem being provided with a collar, which may be out of solid or a separate piece

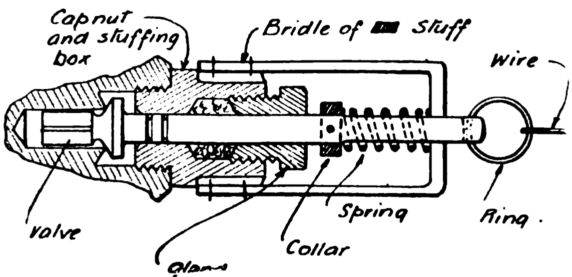


Fig. 10.—Another Design for "Pull-out" Valve.

of metal, as shown, to transmit the pressure of the spring. The compression nut at the end of the sleeve is tapped into the latter and not on to the valve stem, as in the case of the "push-in" type of valve. The sleeve may be of any suitable length, and a stop to limit the opening of the valve

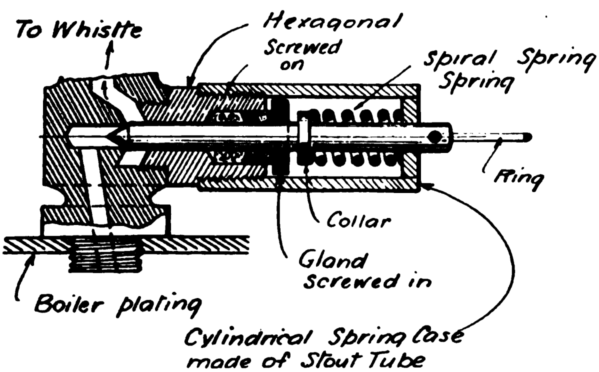


Fig. 11.—"Pull-out" Valve for Small Whistles with Packed Stem.

may be arranged in any convenient manner. There are many obvious methods of doing this.

In concluding this discourse, I may say that there are other types of whistle valves which might be used in models, but which would, in small models especially, necessitate rather fine work. The G.N.R. type with the central valve and the lever over the top of the bell, is one which comes in this category and, therefore, I have not considered the design as suitable for models which have to work under steam and stand more or less rough usage.

Furthermore, I am not musical and know nothing of the science of music. I cannot, therefore, help in determining the proportions necessary to give a certain tone. I understand size has something to do

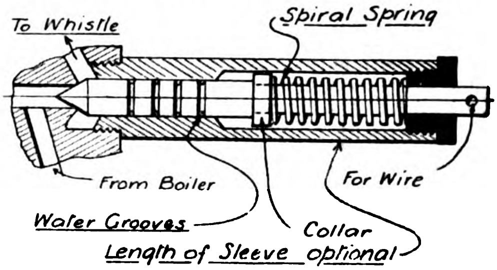


Fig. 12.—"Pull-out" Valve without Packed Gland for Stem.

with this, and that it is useless for a model maker to attempt to obtain the "Midland" or "Caledonian" note if the whole apparatus has to be got within an inch or so of total height. These remarks have, as a result, been confined more particularly to the valve arrangements.

One other point worth mentioning is that I would warn the reader against any attempt to fit a piston valve. Such would not remain satisfactory for five minutes, especially if the valve is made of brass and fits in a brass liner.

(*To be continued.*)

Small Modern Electric Light Plants.

By E. G. Kennard.

It has at one time been the aim or ambition of almost every amateur mechanic to possess a complete electric generating plant of sufficient size to effectively illuminate a small residence, although up to the present time the heavy initial outlay for the necessary apparatus suitable to light a useful number of lamps has prevented many from making it an accomplished fact.

Since the introduction of the metallic filament lamp, however, the electric light can be obtained with a much smaller consumption ot current, and therefore it is possible to greatly reduce the size and cost of small electric light plants, and it is the purpose of this article to show the possibilities of future electric lighting in this direction.

In the first place, it will be of interest to describe an installation of ten electric lamps of 10 c.-p. each, these lamps being arranged to light a small house as follows:—

Entrance hall	1
Parlour	3
Kitchen	2
Large bedroom	2
Small do.	1
Small room	1

The complete plant consists of gas engine, dynamo, storage battery, and small switchboard. The lamps employed are Osram lamps of 10 c.-p. each at 10 volts, each taking a current of 1 amp. The wiring is of the simplest character; no great precaution need be taken with the insulation, as the voltage is very low, it only being some three times as great as an ordinary bell circuit voltage. Each lamp is run on a separate circuit, consisting of a pair of single 18 S.W.G. copper wires.

The gas engine gives ¼ b.h.-p. at full load, and is capable of running for several hours at full load without attention. The dynamo is driven by means of a small belt from the engine flywheel; it is an overtype machine, with a drum armature suitably wound for charging accumulators. The dynamo is capable of giving 8–10 amps. at a pressure of 10–13 volts.

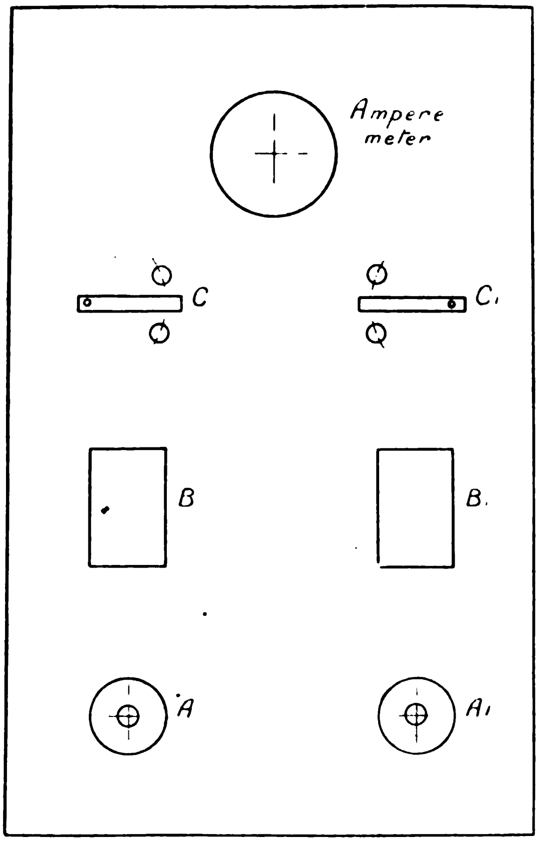


Fig 1

The storage battery consists of five cells of the glass box type, connected in series. The capacity of the cells is about 40 amps.-hour at a nine-hour discharge rate (this being sufficient to light four lamps for a period of ten hours when fully charged).

A diagram of the switchboard is shown in Fig. 1, and a sketch of the connections in Fig. 2. The left-hand side of the switchboard controls the charging current, and the right-hand side the discharging current.

A and A1 in Fig. 1 represent two main switches of sufficient size to carry 10 amps.

Switch A connects the dynamo to the cells for charging purposes, and switch A1 connects all the lamps on the circuit to the battery.

At B and B1 are safety-fuses. The fuse at B prevents the battery from discharging through the dynamo in the event of a breakdown on the engine while charging. The fuse at B1 protects the battery from heavy overloads or short circuits.

When electric lamps are lit with current supplied by a storage battery, it is necessary to reduce the number of cells which supply the lamps with current during the charging of the battery, otherwise the lamps would receive too high a voltage, which is detrimental to the life of the lamp. This will explain the necessity for the two-way switches, as shown at C and C1.

The two-way switch at C1 permits four or five cells to be connected to the lamp circuits. Thus during charging the switch is moved into a position

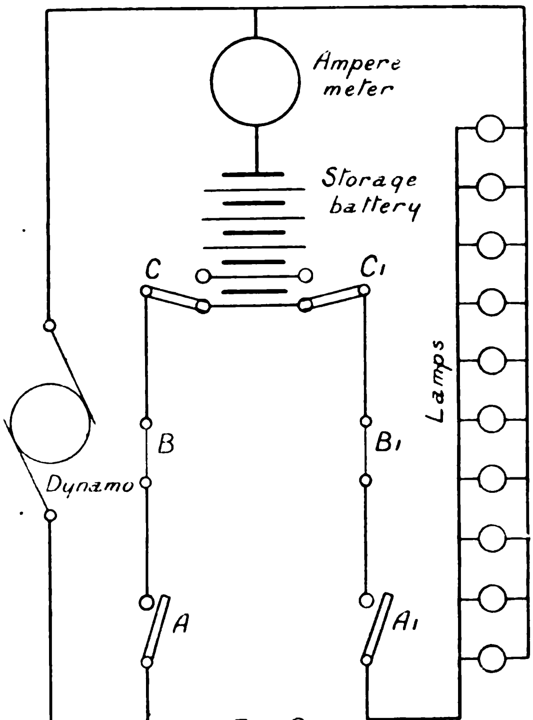


Fig 2.

which only allows four of the cells to supply the lamps; and when charging is stopped the switch is moved into the alternate position, which allows five cells to supply the lamps.

The two-way switch at C allows the fifth cell to be cut out of charge when required, as this cell becomes fully charged before the remainder of the cells.

The amperemeter shown at the top of the switchboard indicates the amount of current flowing in or out of the battery. It is essential that such an instrument be provided, in order that the proper rate of charge may be maintained.

A voltmeter may be dispensed with, however, provided that a pilot lamp be placed across the dynamo terminals, with a switch in circuit. The first cost of this plant was as follows :—

	£	s.	d.
¼ Brake horse-power gas engine	£5	0	0
13-volt 10-amp. dynamo ..	1	10	0
5 40 amps.-hour storage cells..	3	0	0
1 ammeter and sundries for switchboard	0	15	0
	£10	5	0

Thus, for an outlay of £10 a complete electric light plant can be obtained, suitable for lighting a small house or workshop. The battery is most economically charged during the dark hours, when the lamps are required. When the plant is run under these conditions the engine and dynamo will be working continuously at their full load, and therefore working at the highest efficiency.

When lighting and charging are in operation simultaneously, then, if the dynamo be giving its full charging voltage, the surplus current will be used in charging the battery. With careful usage of the lamps, two evenings' charge at five hours each will be sufficient to re-charge the battery, and the lamps can then be run for a further two evenings from the storage battery alone.

Table Giving Particulars of Small Gas-driven Electric Plants suitable for Lighting Low-voltage Metallic-filament Glowlamps.

Output of gas engine in brake horse power	⅛	¼	⅓	½
Output from dynamo in watts	36	100	150	210
Voltage	6	10	12	14
No. of electric glow-lamps	6	10	12	15
Candle-power of each lamp	6	10	12	14
Dynamo voltage ..	6-8	10-13	12-16	14-18
Dynamo current in amperes ..	4-6	8-12	9-12	11-15
No. of storage cells..	3	5	6	7
Capacity of storage battery in amp.-hours	30	40	40	40
Gas consumption of engine in cubic feet per hour	10	13	16	21
	In	shillings	(appro	x.)
Price of gas engine	80	100	130	180
Price of dynamo ..	18	30	40	55
Price of storage battery	30	60	72	85
Price of switch-gear	5	15	20	30
Total cost of plant (excluding lamps)	133	205	262	350

The gas consumption of this engine when working at full load is 13 cub. ft. per hour, the average consumption per week not exceeding 250 cub. ft. when the light is carefully used. With gas at 2s. 4d. per 1,000 cub. ft., the cost per week only comes to about 7d., with a slight increase for oil and sundries.

It is, of course, possible to employ a greater or lesser number of lamps of larger or smaller candle-power, provided the correct voltage is used and the total output from dynamo does not exceed 100 watts.

The table on this page gives a list of Osram battery lamps, showing the different candle-powers and the corresponding voltages :—

Candle-power	Voltage.	Current in amps.
4 ..	4 ..	1·0
6 ..	6 ..	1·0
8 ..	8 ..	1·0
10 ..	10 ..	1·0
12 ..	12 ..	1·0
14 ..	14 ..	1·0
16 ..	16 ..	1·0

Instead of ten lamps of 10 c.-p. each, it would be possible to use twelve lamps of 8 c.-p. each, or else eight lamps of 12 c.-p. each.

Electric lighting plants of various outputs, suitable for a larger or smaller number of lamps, can be constructed on this principle, and the table in the previous column gives the necessary particulars and approximate prices for four such plants.

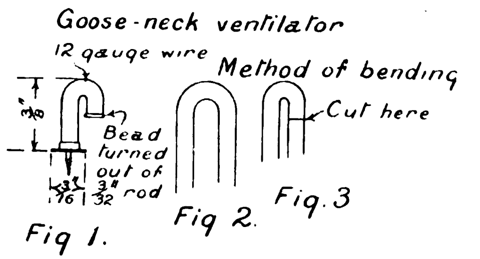
The Making of Ship's Model Fittings.

By X. Y. Z.

THE preceding series of articles being completed, we will proceed with the more elaborate ones. First of all, we will make a goose-neck ventilator (Fig. 1). These are fitted on the sleeping berths, etc., and, as they take up very little room, are used in considerable quantities. The method of construction is as follows: Soften a piece of 12-gauge wire by drawing through gas until red-hot, afterwards cooling in water; now cut into a number of pieces 1¼ ins. long, according to the number you intend to make, and bend in centre with fingers, as shown in Fig. 2. Next put a piece of 16-gauge sheet between and nip close together, as shown (Fig. 3), either with the vice or pliers, taking care not to mark the rod; to avoid this a pair of lead or tin vice clams should be used. Now put a piece of 5-32nds-in. rod in chuck and drill a 12-gauge hole through; this is to form a small bead round mouth, and is shown in Fig. 1. Now, with a fretsaw, cut one of the ends off and soft-solder the bead you have just turned neatly into position. Then turn a small angle-ring out of 3-16ths-in. rod and slide into position, afterwards soft-soldering. Now put ventilator in chuck and turn a pin to drive in deck, afterwards carefully polishing and buffing all over. There are generally a dozen or so on a ship, and they look very neat when properly made.

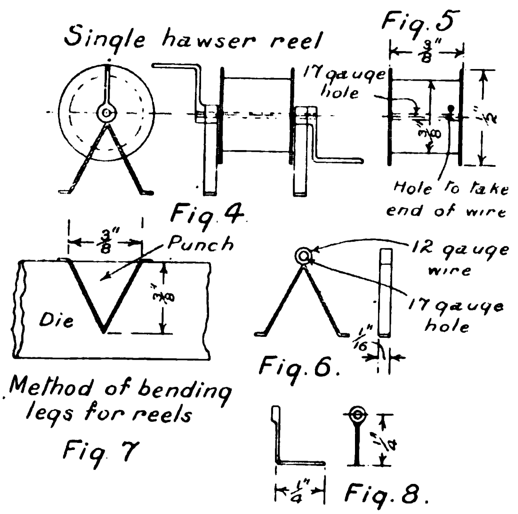
The next article we will make is called a hawse, or hawser, reel (Fig. 4); these are used to hold the steel wire ropes used on the ship for mooring purposes, etc., and they look very well, especially if they are silver-plated. To make this fitting, put a piece of ½-in. rod in chuck and turn a barrel ⅜ in. long to the shape shown in sketch (Fig. 5). Before cutting the barrel off drill a 17-gauge hole right through; polish both ends carefully, and then drill a small hole, say 20-gauge, in position shown in sketch. This is to take the twisted wire to imitate the rope.

Now put two strands of 30-gauge wire in chuck and twist together by spinning in lathe, and it will make the wire rope, or this can be bought in the shape of picture wire. Place one end of wire in hole already drilled in barrel, and fix the other end in vice, and then carefully turn the barrel round with the fingers; this will, of course, wind the wire on the barrel. When the barrel is full, tack both ends of the wire with soft solder, using the soldering-iron in preference; afterwards cut off and trim the loose ends. To make the legs, or stand, roll or hammer out flat a piece of 18-gauge wire until it is about 1-16th in. wide. To bend



(*Scale: Full size.*)

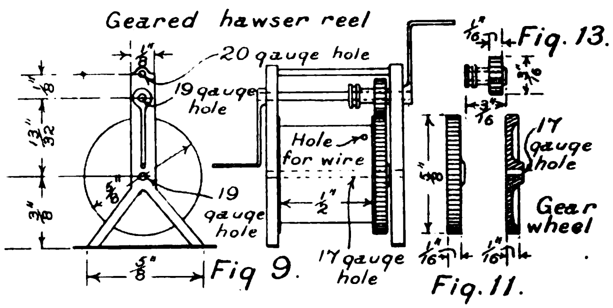
this into the shape of legs, as shown in sketch (Fig. 6), we require a tool made out of a piece of sheet brass, as shown in Fig. 7. Cut off a piece of wire a little longer than required and bend in centre with fingers; now place in die, and, with the piece of brass shaped to form the punch, tap the wire well down to the bottom of die and hammer the ends over to form the feet, making two legs



(*Scale: Full size.*)

for each reel. Now put a piece of 12-gauge wire in chuck, and drill a 17-gauge hole and cut off into small pieces 1-16th in. long; these are to form the carriages for top of legs. These require to be hard-soldered on to the legs already made. While the 12-gauge wire is in chuck we can turn the small bosses for the handles. For the handles, however, they require to have a 19-gauge hole drilled in them. Cut off into small pieces about 20-gauge thick, lay on pumice, and hard-solder to a piece of 20-gauge wire, afterwards bending with pliers at right angles, as in sketch (Fig. 8). These, of course, require tapping out 18-gauge. Now screw a length of 18-gauge wire, and, using the handles for nuts, assemble together, as shown in the complete sketch (Fig. 4), cutting off any surplus screw and filing the end flat. Add pinholes to feet, and the hawser reel is complete, and, if carefully made, will look very neat. There are, generally speaking, about four of these on a cargo steamer.

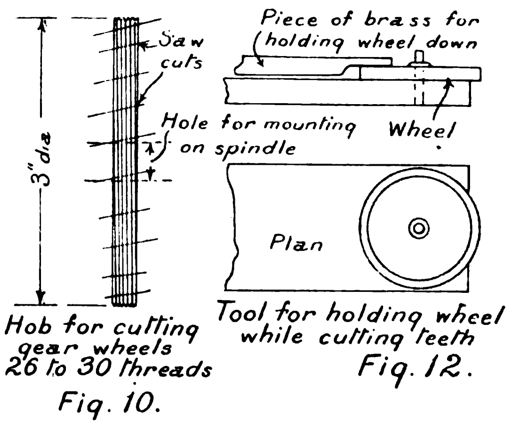
Having constructed the ordinary hawser reel,



(*Scale: Full size.*)

we will proceed with the geared hawser reel or winch (Fig. 9). These are rather more intricate than the preceding hawser reels. First of all, turn a barrel out of ⅝-in. rod, as shown in sketch (Fig. 9), and drill a 17-gauge hole through, and also a hole to take end of wire. The end of this barrel can be recessed slightly with a round-nose tool or a flat tool, and it considerably improves the appearance.

We now require a cogwheel. This can be made either by milling the teeth or by cutting. To cut the teeth, make a tool as shown in Fig. 10. This



(*Scale: Half size.*)

tool is made by mounting a disc of steel about ¼ in. or ⅜ in. wide and 2 or 3 ins. in diameter on a spindle and turning true, afterwards cutting or chasing a thread on the edge of about 26 or 30 threads to 1 in. Now make, with a hacksaw, a series of cuts across, as shown. Afterwards harden, and this completes the cutter.

To make the wheel, cut off a disc (Fig. 11) of $\frac{5}{8}$-in. rod, with a 17-gauge hole drilled through, and place on tool as shown in Fig. 12. The wheel should then be placed on the holder and held to the cutter, and the result will be a perfectly clean-cut tooth.

We now have to make a small pinion (Fig. 13). This should be turned out of 3-16ths-in. rod, and have a 20-gauge hole right through. It should then be cut in the same manner as in the larger wheel. Now make the sides or legs (Fig. 14). These are made by rolling or cutting a strip of brass $\frac{1}{8}$ in. wide and 20-gauge thick. Split or saw

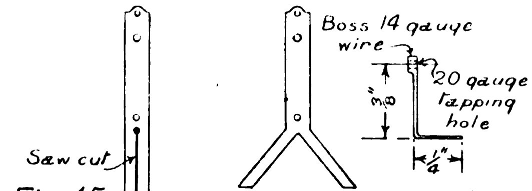


Fig 15. Fig. 14 Fig. 16

(*Scale : Full Size.*)

up with fretsaw, as shown in Fig. 15, and afterwards spread out with a three-cornered file, as in Fig. 14. Now draw a line down the centre of leg, and set-off the distance of wheel and pinion and also the small stiffening bar across the top. Now cut the legs off all one length, setting-off with the dividers, and then hard-solder a piece of 18-gauge wire hammered flat, across the bottom to form the feet.

Boat stand

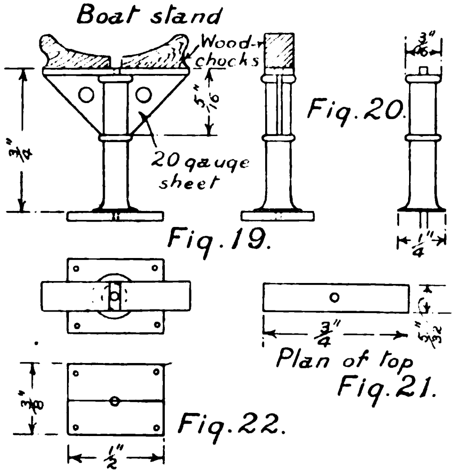


Fig. 19. Fig. 20. Fig. 21. Fig. 22.

Now drill the holes in side, using a 20- and 19-gauge drill respectively, and then trim top of leg as in sketch. Put a piece of 14-gauge wire in chuck and drill a 21 hole; cut these off to form handles (Fig. 16), as described in the previous reels. Next make two small nuts out of 12 wire, drill a 19 hole through, and then tap out 18-gauge. The reel can now be assembled, and, with the addition of pinholes to feet, completes the hawser reel. This is rather a picturesque fitting if carefully made, and is well worth the time and trouble expended on its production.

The next thing we require—to make the model as complete as possible—is a chain channel or buffer slide. Put a piece of 2 ins. or 3 ins. diameter tube in chuck and turn a channel section, as previously described in regard to the quadrant; afterwards soften and straighten, and cut off into the required length, usually about 3 ins. long. Polish, and add pinholes to it, and it is finished. This channel is used as a guide for the buffer spring, and should be wide enough to allow the buffer to lie in channel.

The next fitting we will make is called a davit socket (Fig. 17), and is used to carry the davits

Davit socket

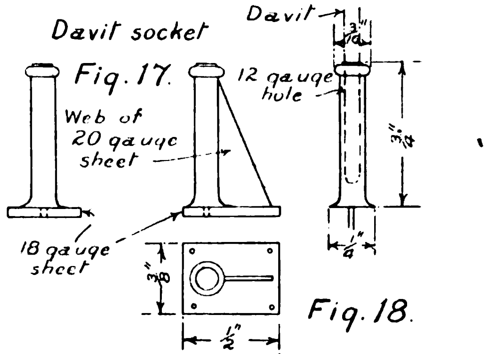


Fig. 17. Fig. 18.

where it is inconvenient or impracticable to use beams or skids. Put a piece of $\frac{1}{4}$-in. rod in chuck and turn to shape shown (Fig. 18); drill a 12-gauge hole nearly through and turn a pin on bottom. Next make a small square plate $\frac{1}{2}$ in. by $\frac{3}{8}$ in. and 18-gauge thick, and drill holes to suit pin in position shown in sketch (Fig. 18). Polish and rivet top to bottom. Now file a piece of 20-gauge sheet brass to shape of web shown in sketch (Fig. 17), and soft-solder into position, using a pair of tweezers to hold during the operation. Add pinholes as shown and file bottom level, and the socket is complete, one of these being used for each davit.

Side screen

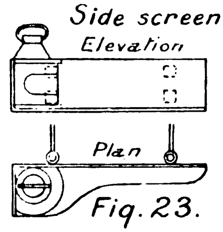


Fig. 23.

Method of bending

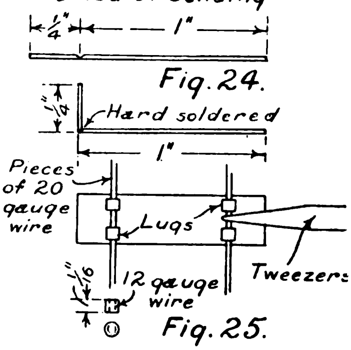
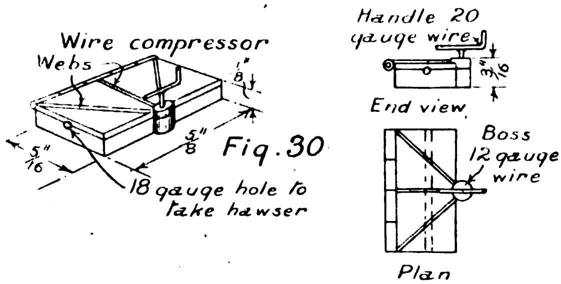


Fig. 24. Fig. 25.

The next fitting we require is a boat stand (Fig. 19). Put a piece of $\frac{1}{4}$-in. rod in chuck and turn a pillar to the size and shape shown in sketch (Fig. 20). Now take saw and saw down 5-16ths in., and afterwards insert a piece of 20-gauge sheet brass and solder into position. Now roll or cut a piece of 20 sheet $\frac{3}{4}$ in. long and 5-32nds in. wide to form the top (Fig. 21), and afterwards soft-solder into position. Now drill two holes to lighten web; then make a plate out of 18-gauge sheet ½ in. by ⅜ in. (Fig. 22). Drill a hole in centre to take pin on stand and rivet together. Bevel the edges of plate slightly and add holes for the pins and the stand itself is complete. If it be intended to place boats on stands, the operator will have to make, out of hardwood, the small chocks shown in sketch (Fig. 19).

The next fitting is called a side-screen or side-boxes (Fig. 23). These are placed one on each side of the steamer—one showing a green light, and the other a red light. Cut a strip of 22 sheet ¼ in. wide and 1½ ins. long; now cut across and nearly through with a square file a ¼ in. from the end, and bend as shown in Fig. 24. Next cut a piece of 22-gauge 1 1-16th ins. long and 5-16ths in. wide, place part already bent on top, and, placing a piece of hard solder in corner, put the lot on pumice stone and blow gently until solder runs into every crevice; drop, while hot, into pickle to remove the borax flux. Now put in chuck a piece of 14-gauge wire and drill a 20-gauge hole, and cut off into pieces 1-16th in. long. These are afterwards soft-soldered to the back of screen, as shown in Fig. 25. The method of fixing these is to slide a piece of 20-gauge wire through two of the eyes, and holding into position with tweezers whilst soldering, as shown in Fig. 25. The bottom of screen may be filed to shape shown in plan, or can be left square, according to fancy.

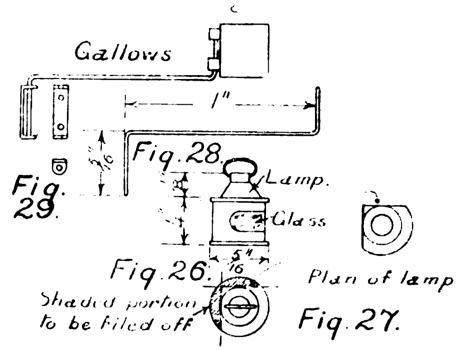
We now have to make the lamp (Fig. 26). Put



a piece of 5-16ths-in. rod in chuck and turn to shape shown in Fig. 26, and afterwards file to shape shown in plan view (Fig. 27) and cut off. Now, with a round file, file a small hollow, which is painted red or green to represent the glass. A handle or an eye may be hard-soldered on the top to give it a finish, as shown in sketch.

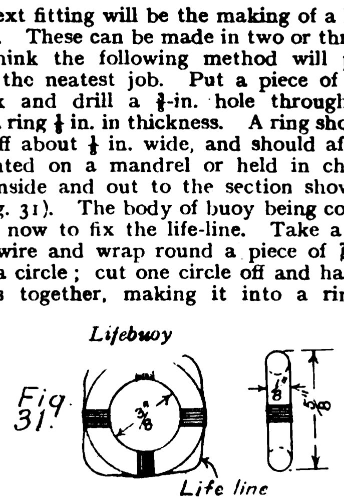
Next make two small cranes or gallows, by bending a piece of 20-gauge wire with the pliers to the sizes as shown in sketch (Fig. 28). Now make a small plate (Fig. 29) to carry the other end of gallows on to the ship's side. This is made by rolling or hammering a piece of 18-gauge wire flat, bending, and drilling a 20-gauge hole, as shown, to take the wire, adding pinholes to suit, and this completes the light screen. If the instructions have been carefully carried out, this should prove a successful job.

We will now make what is called a wire compressor or grip (Fig. 30). Take a piece of sheet brass ⅛ in. thick, ⅝ in. long, and 5-16ths in. wide; square up and polish. Next drill an 18-gauge hole in end at centre, lengthwise, as shown in sketch. Now take the dividers and scribe a line right round, as shown, to imitate joint line. Then turn, out of 16-gauge wire, the hinge, marking with the corner of tool to imitate the joint. This is then hard-soldered on one edge, as in sketch, on the opposite side; file a hollow to take the tightening boss, which is turned out of 12-gauge wire; it should be 3-16ths in. high and have a 19-gauge hole drilled through to take the tightening screw. Now roll or hammer a short piece of 18-gauge wire flat, to form webs,



filing one edge square. Lay these webs in position, as shown in sketch, moisten well with spirits, and, placing a piece of soft solder where the three points meet, gently heat with blowpipe until the solder runs neatly along the webs. The handle should now be made by hard-soldering a piece of 20-gauge wire to a piece of 18-gauge screwed wire and bending to form handle, as in sketch. This handle should now be screwed into tightening boss, which has been previously tapped out to receive it. The addition of pinholes to fancy completes this fitting, and with the exercise of a little care will prove a neat job.

The next fitting will be the making of a life-buoy (Fig. 31). These can be made in two or three ways, but I think the following method will prove in practice the neatest job. Put a piece of ⅝-in. rod in chuck and drill a ⅜-in. hole through centre, leaving a ring ⅛ in. in thickness. A ring should then be cut off about ⅛ in. wide, and should afterwards be mounted on a mandrel or held in chuck and turned inside and out to the section shown (side-view, Fig. 31). The body of buoy being completed, we have now to fix the life-line. Take a piece of twisted wire and wrap round a piece of ⅞-in. rod, making a circle; cut one circle off and hard-solder the ends together, making it into a ring. Lay



the buoy in centre of ring and seize with fine wire in the four positions shown in sketch. Soft-solder the ends of serving wire, and then cut off any surplus wire, and the life-buoy is completed. As a rule, these are painted white, and if lashed to the stanchion rails, have a pleasing effect on the model.

(*To be continued.*)

Practical Letters from Our Readers.

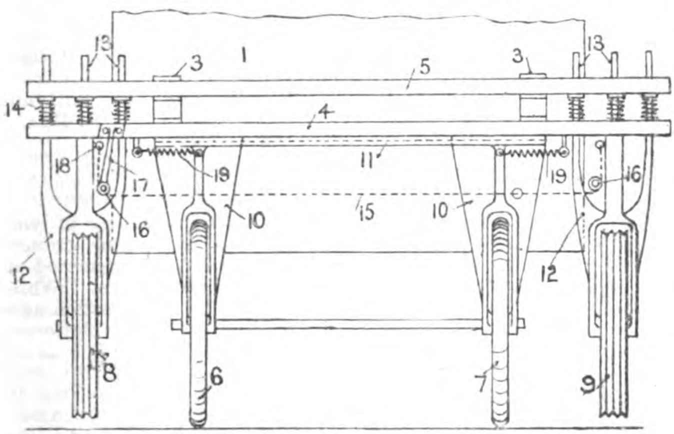
[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender MUST *invariably be attached though not necessarily for publication.]*

Prevention of Skidding.

To the Editor of *The Model Engineer*.

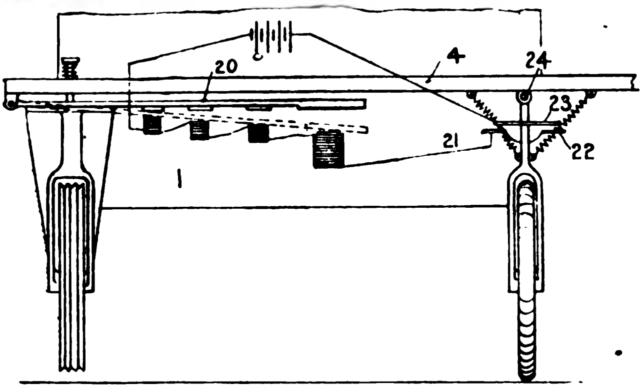
Sir,—Last month I was granted a patent for my invention for the preservation of skidding of motor vehicles, and now I wish, as soon as possible, to obtain information from your readers which will assist me in the bringing of my ideas into practical operation.

I have arranged two wheels—one at each side



General Arrangement of Non-Skidding Device.

of back of car; one of these wheels has an iron rim of best description for gripping the ground, and this wheel is held normally at a height of 3 ins. above the ground. A wheel at the other side



Showing Electrically Energised Lever.

runs normally on the ground and is rubber-tyred, and is so arranged that it will tilt at the smallest approach of a skid. When it tilts it completes an electric circuit which energises a solenoid, which pulls down, by means of a lever, the iron-rimmed wheel, which firmly grips the ground and renders skidding impossible. I want assistance with respect to the construction of a solenoid of the requisite strength, utilising the smallest possible current.—Yours truly, E. N. Hackett.

Ventry, Dingle, Ireland.

Locomotives Slipping When Running Without Steam.

To the Editor of *The Model Engineer*.

Dear Sir,—What your Oswestry correspondent refers to is by no means new, and has undoubtedly occurred in many places, as I have heard of it several times, and also seen it referred to in the trade journals, though I have never personally experienced it. I would have written earlier, only I have been waiting to see one of my informants, which only took place recently. He informs me that when he fired N.E.R. engine No. 1,071—formerly No. 71 on the S. & D.R., a 2—4—0 class frame and cranks for side-rod outside the wheels, inside cylinders, coupled wheels 6 ft. diameter, built by Timothy Hackworth, at Shildon shops—in passing through Bramhope Tunnel, on the down road to Harrogate, this engine used to surge and slip regularly, and only stopped slipping on the application of sand to the rails. My friend and I have discussed the problem, and the only cause we could ascribe it to was that at the high rate of speed the forces set up by the engine (*probably*) not being properly balanced, caused the engine wheels to slip. This occurred about thirty-five years ago.

I might say I have run engines so fast with steam on and a long goods train behind the tender, that the longitudinal oscillation has been set up so much that you could not stand up in the cab without taking hold. I have had to reduce speed for fear of the engine jumping the road. I ascribed the cause to the engine having settled down upon its springs, and so thrown the valve gear (a radial one) out of step with the piston. I admit this is a very common feature when running down banks without steam and a light load, when I think the balancing causes it again; this chiefly occurs with old types of engines.

N.E.R. Engine Driver.

Acetylene Bicycle Lamps.

To the Editor of *The Model Engineer*.

Dear Sir,—I have an acetylene bicycle lamp, for which I made a copper disc with holes perforated in it in place of the thin sheet tin one which became corroded. I placed some cotton wool in the space above the copper disc to act as a purifier to the gas. After it had been in use several months (though never very much used) I took the disc and cotton wool out to clean it. I found a little deposit on the copper, and some small particles of the cotton wool adhering to it. When I scraped the copper disc with a knife small sparks, seemingly highly explosive, flew out, and this continued till all the small particles of cotton wool were scraped off. I do not know whether this is usual for lamps that have a copper disc; but if it is not, it might be interesting to some of the readers of THE MODEL ENGINEER. I am not sufficiently acquainted with chemistry to explain the cause. There was nothing unusual, so far as I am aware, in the cotton wool, which had become quite brown from the gases passing through it.—Yours truly,

O. H. OAKES.

Originality in Model Making.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In your paper on the above, in which I was very much interested, I noticed in the latter part you made mention of, amongst other things, textile machines as subjects for modelling. Now, Sir, I notice when reading THE MODEL ENGINEER week by week, model makers seem to steer clear of these machines. Now, being engaged in one branch of the textile industry—namely, the cotton-spinning branch—I may say that if model makers would only turn their attention to some of these machines they would find something that would test their powers for originality. I have been engaged in the above trade now for about twenty years, and I may say that I have never seen or heard of a model being made, except models of separate parts supplied by the machine makers to technical schools for teaching purposes. Model makers would find something different—far different—to making model engines and dynamos. But don't you think, Sir, that it is due more to not having seen or heard so much about them, than to not having any desire to make such models? Of course, the above does not apply the same to your readers in Lancashire as to readers living in the south, although I know there are lots of people living close to the mills that have never been in one.

If you think a description of the processes which the cotton goes through in the making of cotton yarn would be interesting, I should be glad to send one. But I would like to know what your readers think about it. It would be something new for a large number of them, but unless it should prove interesting it will be of no use taking the trouble to write a description of same.—Yours truly,

"TEXTILE."

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—It was with great interest that I perused the abstract of your paper on "Originality in Model Making" in THE MODEL ENGINEER. I quite agree with you that more originality might be displayed. Your reference to the "Agenoria," and old engines in general, was particularly happy, I think; there are plenty of notable examples both in stationary, railway, and marine practice—many of them landmarks on the road of time. In addition to those enumerated might be mentioned "gas engines"—from Otto and Langen's old rack to a present day 2,000 h.-p. double-acting; both of which would, no doubt, require much experimental work to make a success. I often think it a pity that more of the old historical engines are not copied, as representing the best brains of a bygone age when engineers (all honour to them) struggled almost without tools. Taking railway machinery alone, there are many unique examples which mark epochs in the evolution of the locomotive, and would be interesting to see work, and also valuable historically. As touching the flying-machine that is a region of vast speculation. Then again, referring to the steamer section—why are paddle-boats left out in the cold? Is it because model engineers fight shy of the difficulties which seem insuperable as far as speed goes? But surely there is room for originality here.

Now, Sir, no doubt you are wondering what the writer is doing — that can only be answered by *nil!* I, being one of those who "go down to the sea in ships," am in the unenviable position of the lad who had to be contented with licking the steam off the cookshop windows; or like another who could never get a better acquaintance of those good things than reading the recipes in a cookery-book. So at present I have to be contented with reading THE MODEL ENGINEER. Possibly at some future date I may be able to resume model-making. Sincerely hoping it will be so, I am, Sir, faithfully yours,

J. R. REA.

Making Chasers.

TO THE EDITOR OF *The Model Engineer.*

SIR,—In your issue of July 9th one of your contributors gives a method of making chasers. As a toolmaker of many years' experience, I do not think this method will give good results. Whilst the chaser is being cut, it will be in a position as in

FIG. 1.

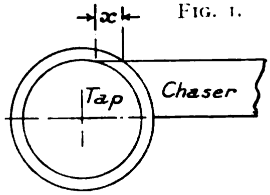


FIG. 2.

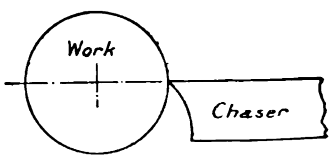


Fig. 1; and when in use, as in Fig. 2. In Fig. 1 the outer circle represents the diameter of the tap

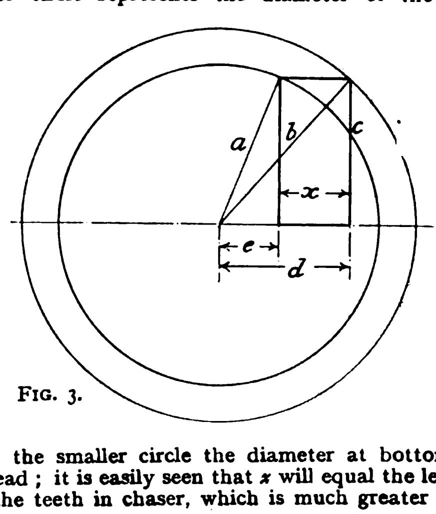


FIG. 3.

and the smaller circle the diameter at bottom of thread; it is easily seen that x will equal the length of the teeth in chaser, which is much greater than the difference of the two radii. Let us prove it mathematically. In Fig. 3—

a = radius from centre to bottom of thread.
b = radius from centre to top of thread.
c = thickness of chaser.

$x = d - e$: to find this $\sqrt{b^2 - c^2} = d$
and $\sqrt{a^2 - c^2} = e$.

$$\therefore x = (\sqrt{b^2 - c^2}) - (\sqrt{a^2 - c^2}).$$

Let us take for example a ¾ Whitworth thread, ten threads per inch. The depth of which = ·064.

$\therefore a = \cdot375 - \cdot064 = \cdot311$ and $b = \cdot375$.

And let us take $c = \cdot25$.

$$\therefore x = (\sqrt{\cdot375^2 - \cdot25^2}) - (\sqrt{\cdot311^2 - \cdot25^2}) = (\sqrt{\cdot1406 - \cdot0625}) - (\sqrt{\cdot0697 - \cdot0625}) \text{ which } = \cdot0746.$$

Multiply this by 2 and subtract the product from ·75, which is ·6008, which will give us the diameter at bottom of thread that a chaser made this way would cut. The correct diameter = ·622. The smaller the diameter of the tap, the greater this difference will be.—Yours truly, J. ESSEX.

Re Perpetual Motion.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In my opinion the above term is somewhat ambiguous. To begin with, what is really required is a source of perpetual *power*, not motion alone. The following, or a modification of it, took a leading part in the alchemists' considerations of this question :—

A B C is an endless rope round a triangle with a roller at each corner. A C is vertical, B C horizontal. The idea was that the greater mass of rope in A B would pull up A C, and that B C would follow round. A slight knowledge of mechanics will show this to be wrong, and will also show that, if there were no friction in the rollers, nor between rope and air, the system *would go on for ever*, with constant velocity, if once started, but that any attempt to make it drive anything would, of course, stop it. All other devices of this nature are subject to the same objection.

Then the word "perpetual" requires some explanation. It is commonly understood to mean that we are going to *create* a source of power. The search in this direction is time wasted, unless the experience of twenty-five centuries of mathematics and science is misleading.

As regards the modification of existing natural sources of power, this might easily be possible; but even then, we must not lose sight of the fact that the total energy of the Universe is constant, and must beware of devices which include the creation of energy, such, for instance, as a liquid air engine one heard of some time ago giving an efficiency of several hundred per cent., and a pump which, by means of a pint of liquefied gas, would create several gallons of the same without the application of external work !

Sun-motors are somewhat at a discount in the United Kingdom, though I believe they are used in Mexico.

Some of the ways of using natural energy may be feasible, but meanwhile, the old-fashioned steam engines and electric motors are much more dependable.

Trusting this may be of interest, I remain, yours truly, H. S. LIMEBEER, JUN.

9, St. John's Villas, Holloway, N.

Model Yachting Correspondence

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.*]

The Association Movement.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I have been greatly interested in the proposed adoption of a central controlling association for model yachting. The idea is one worthy of the support of all model yachtsmen who have the interests of the sport at heart. The present chaotic condition of the sport due to the variety of rating rules is far from being an ideal one. As an unattached model yachtsman, unconnected with any club, the proposed association has my cordial support.

I must, however, say that I consider any attempt to force on the clubs concerned such a rating rule as the present International Rating Rule will only end in disaster, and for this reason : The greatest bar to the adoption of a governing association is the vested interest bogey. If a man possesses a racing model built under the Length and Sail Area Rule, he would not want to scrap his boat ; but as he cannot successfully race his model under the International Rule, he will therefore vote against any proposed association which places such a rule in the forefront of its programme. The difficulty can be avoided if the association would consider the adoption of a rule which would suit all types of model.

It is unfair to say that an extreme racing machine is not a model yacht, or that it should be debarred entrance in a race. If the sport is to be model yacht *racing* as opposed to model yacht *sailing*, then any machine is fair so long as it conforms to the requirements of the rating rule.

Personally, I do not consider the International Rule to be desirable for model purposes. It must not be forgotten that this rule was adopted by its makers with the avowed intention of producing a seaworthy yacht. But has it ? I think not. When yachts built to the largest class of this rule are unable to face hard weather, evidently something is wrong with the rule. I am aware that a good deal of this is due to the scantling restrictions imposed by the rule ; but even as racers the boats produced by the International Rule have not been such a great success. The International Rule will, unless amended, be in the end, particularly in the case of models, productive of a worse type than the one it was intended to annihilate. I do not think any model yachtsman would welcome the introduction of extreme V-sectioned narrow-gutted double-ended monstrosities which can be produced under the International Rule.

What is wanted is a rule which will rate fairly all types of models, while pressing unfairly on none. That such a rating rule is possible I firmly believe, and surely, Sir, the combined brains of the proposed association should be equal to the task. The only rule I know of which is likely to rate fairly all types of model is one in which sail area is proportioned to displacement. Such a rule was advocated in 1903 by the Editor of the *Yachtsman*, who instituted a designing competition for 21-footers, in order to find out the type of yachts produced by the rule. The general opinion of experts and of those who took part in the competition was that the rule was the best they had come across. Briefly the rule was as follows :— $\sqrt{\text{Area of Mid Section} \times \text{L.W.L.}} \times 8$ = Sail Area. L.W.L. limited to 21 ft.

Writing of this proposed rule, the Editor of the *Yachtsman* says :—" We are rather more disposed to fall in with the suggestion offered by 'Thalassa,' for to him is due the credit of having proposed what we consider the most perfect rule ever suggested. This was simply this : to classify by length and to allot sail area in proportion to displacement. Thus a craft of large displacement would have large sail area and *vice-versa*. Provided all boats were equally well designed and sailed, the prizes under such a rule would be very widely distributed among boats of different types." The measurement would be simple enough. " All that is required is to take off-sets from the hull at say ·6 of the length from the stem, and compute the area of half the mid-section. This multiplied by the length will give the displacement perfectly for the purposes of allotting sail. In thinking over this suggestion, it has struck us that as classification is to be by length, there is no occasion for taking displacement into consideration, for every square foot of midship area must represent a proportion of displacement. Therefore, if we take the square root of the midship area and multiply by a suitable constant, adopting the product as the sail area, a satisfactory result is arrived at. In another column we give various areas of mid-sections of 21-footers with their appropriate displacements, and the sail areas allotted to each. We think it will be seen that the proportion of sail area to displacement is such as to make it extremely difficult to say that any one type would be specially good. The sail area is doubled as the displacement is quadrupled ; thus the lightest boat of 18 cwt. displacement has 294 sq. ft. of canvas, while the boat of 3·6 tons has 588 sq. ft. We cannot see that the skimming dish has here much room to prove 'cock of the walk.' Undoubtedly on certain days and in certain conditions she would win, but we fancy few people would build specially for such scanty chances. If they did their enterprise should be rewarded."

Continuing on a later occasion, he says :—" A light displacement craft with small sail area would be a most likely winner in a strong and steady breeze. Now between the light displacement boat for hard winds and smooth water and the very large displacement craft of small wetted surface and large sails suitable for very light weather, there is an infinite variety of types each suited to some peculiar combination of wind and water. We are firmly convinced that no monstrosity of any kind would be successful under this rule, and no rule that can be produced would give owners and designers wider choice of type of boat. Two means of killing the skimming dish type are available —a scantling rule and a fixed proportion of freeboard to beam. That, of course, is assuming that to kill the type is desirable. If the type is prevented from killing the rest, it is all that is required."

I have taken the trouble to quote this much because I firmly believe that in some such rule rests the solution of the problem. I give this idea for what it is worth, and in the hope that it may be of some use in bringing the sport together on a better basis. It is obviously unfair to tie the proposed association down to any rule, because it is advocated by any one who is largely interested in that rule. What should be done is, as before mentioned, to endeavour to find some rule to suit all types. That this can be done the opinion above quoted seems to prove. It is very nice for one man to propose sacrifice to another, but let the sacrifice be on both sides, each combining in a rule which renders it possible for both to meet on fairly level terms.—Yours truly,

WILLIAM J. E. PIKE.

Portsmouth Model Yacht Club.

THE Portsmouth Model Yacht Club held a race on Wednesday, October 28th, at the Canoe Lake, Southsea, for prizes presented by T. E. Smith, Esq., Mr. Clive Wilson, and the Club. An uncertain wind was blowing at the commencement of the race, which, unfortunately, continued throughout the race. The miniature craft were in charge of Captain Chas. Kroon, the final scores being : Mr. Bignall's *Lily*, 22 points ; Mr. Coxon's *Saucy Sally*, 20 points ; Mr. Geo. Constant's *Togo*, 16 points. Other scores were : Mr. Hablützel's *Nancy*, 12 points ; Mr. R. Tallack's *Sport* and Mr. Clive Wilson's *Florence* making 10 points each.

The scores for the winners of the prizes presented by Mr. Mark Gill, J.P., were : Mr. R. Tallack's *Sport*, 18 points ; Mr. Coxon's *Saucy Sally*, 16 points ; Mr. Hablützel's *Nancy*, 12 points. Other scores were : Mr. Clive Wilson's *Florence*, 8 points ; Mr. Constant's *Togo*, 4 points ; Mr. Leech's *Flirt*, 2 points.

The result of the race for the Medal and Certificate presented by the Editor of THE MODEL ENGINEER will be made known in the next report.—Hon. Sec., CLIVE WILSON, 343, Fawcett Road, Southsea.

Maidstone Model Yacht Club.

A CLUB has been founded at Maidstone, particulars of which will be found on page 480.

The Society of Model Engineers.

London.

AN ordinary meeting of the Society was held on Wednesday, October 28th, at the Cripplegate Institute, Golden Lane, E.C., Mr. A. M. H. Solomon taking the chair, and upwards of 100 members and a few visitors being present. The minutes of the last meeting having been read, five new members elected, and announcements of future meetings and visits made, the Chairman presented the awards to the builders of the winning locomotives in the Locomotive Running Competition. Mr. C. S. Barrett's 6-coupled Brighton engine, and Mr. H. H. G. Denvil's small " Atlantic " type engine taking the first and second prizes respectively. The Chairman also announced that the Committee had decided to award a small consolation prize in connection with the Workmanship Competitions held at each meeting where the entries were less than the minimum (4) required by the rules to constitute a competition, so that if only one exhibit was shown, its owner might not go unrewarded, provided the exhibit was of sufficiently good workmanship to justify an award being made. In conformity with this rule, Mr. C. S. Barrett was awarded the consolation prize for the double-throw crankshaft exhibited by him at the last meeting.

The formal business being concluded, Mr. Henry Greenly was called upon for his paper on his recent model-making commissions, and a most instructive and entertaining discourse resulted. With the aid of a large number of original lantern-slides, a great many scale drawings and much apparatus and complete models, etc., kindly exhibited by Messrs. Bassett-Lowke & Co., Messrs. Stuart Turner, Ltd., and Messrs. C. Butcher & Co., Mr. Greenly kept his audience keenly interested. A further report of the lecture will appear in another issue. Only two valve motions were entered in the evening's competition, and Mr. Lane's trip gear was awarded consolation prize. The subject for next meeting's competition is boiler fittings, generally.

FUTURE MEETINGS. — Wednesday, November 25th. Annual General Meeting, all members are requested to attend.

SPECIAL VISIT.—Saturday, November 14th. Messrs. W. J. Bassett-Lowke & Co. have kindly invited a party of the members to visit their works at Northampton on Saturday, November 14th, to witness the testing under steam of a 1½-in. scale locomotive of rather special construction they have just completed. Members wishing to join the party are requested to at once notify the Secretary of their intention to be present, and to assemble in the booking office at Euston Station (L. & N.W.R.) at 12 noon to catch the 12.15 p.m. train. The return half-day ticket is 3s. 9d. The return from Northampton will be made at 6 p.m.

Saturday, November 21st.—The Gas Light and Coke Company's Works at Beckton, E., will be visited.

SPECIAL NOTICE.—As announced at the close of his recent lecture before the members on "Originality in Model Work," Mr. Percival Marshall has kindly offered a prize of £2 2s. for the best piece of original work commenced and executed since the date of his lecture by any member of the Society and shown at the meeting to be held in May of next year. Members desirous of entering this competition are requested to write the Secretary, who will forward the conditions under which the prize is offered by Mr. Marshall.

Particulars of the Society and forms of application may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

Ashton and District.

The above Society had a visit to the works of Messrs. Gartside's Brookside Brewery on Saturday, October 31st, which were viewed with considerable interest. The next visit will take place on Friday, November 13th, to the works of Messrs. John Summers & Son, Ltd., Stalybridge. Members who intend joining the party are requested to meet at the Stamford Café, Stamford Street, Ashton, at 7.30 p.m. in the basement. Three members were elected on October 31st.—ARNOLD BARNES, Hon. Sec., 47, Trafalgar Street, Ashton-under-Lyne.

Junior Institution of Engineers.

NOTICE OF MEETINGS.—Visit: Saturday, November 14th, 3 p.m., to the Selfridge Store Buildings, n Oxford Street.

Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this Journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.*]

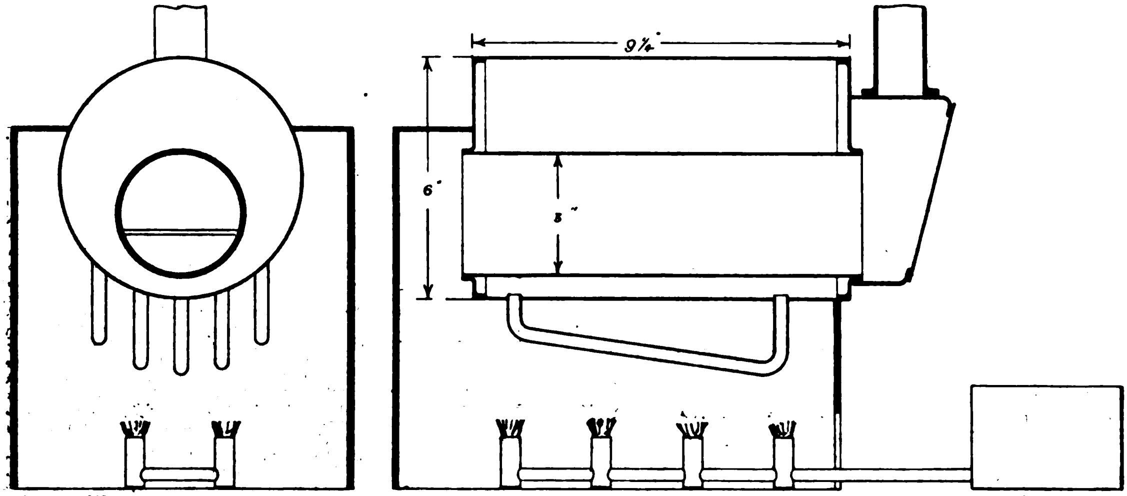
The following are selected from the Queries which have been replied to recently:—

[20,382] **Motor Design.** W. J. H. (Dover) writes: Will you kindly answer the following: I am about to build two motors of exactly the same output—*i.e.*, each to take 60 watts, one to be preferably shunt wound, to take 1 amp. when the armature is at rest, the pressure supplied being 60 volts, but it must be capable of withstanding 80 volts for a short time. The other is to be placed in a series circuit which has a normal current of 120 amps., which I want to pass through the motor with a drop of ·5 volt. I would preferably only pass 10 to 15 amps. through the armature at rest (on account of commutation), the remainder I would send round the field coils. This motor must stand a momentary current of 200 amps. Will you please give particulars as to sizes and weight of field frame, armature, and size and length of wire for each, and approximate speed of each. I would preferably not have the field-magnets wound to saturation, as I want these motors to be very sensitive to a small change of current, which is much more important than efficiency. I thought a density of about 40,000 lines per sq. in. Would this be suitable for a fairly good casting? These motors will be taking current for about twelve hours, and will, for the greater part of the time, be at rest, as they will be coupled or geared in opposition to each other, only working when the voltage and current changes.

We are afraid we must refer you to text-books or to our Expert Service Department. You are practically asking us to design a pair of motors for some special purpose which you require. This will necessitate some correspondence to make matters clear. The first-named motor will obviously absorb 60 watts when the armature is at rest, if it is to permit 1 amp. to flow through its windings; therefore, it cannot absorb anything like 60 watts when the armature is running, unless you increase the voltage with the speed to enable that current still to flow. There is also the question of fluctuation if the armature is to move at a very slow speed, also the question of starting. The second-named motor will absorb 30 watts when the armature is at rest. As soon as the armature starts it will produce a back voltage and, therefore, you will not be able to pass 120 amps. unless you raise the voltage applied to its terminals. It is not change of current, but change of voltage, which determines the speed of a motor armature. It seems that you must either design the motors yourself or obtain the services of an expert to whom you can communicate full particulars as to what you wish to do. Perhaps our book, "A.B.C. of Dynamo Design," by Mr. Avery, will help you. As far as we can see, what you appear to require is two motors whose armatures will exert an equal turning effort in opposition when at rest, but which will rotate when the balance is disturbed. For this the field of each motor can be made of equal strength and the turning effort then in balance when the currents flowing through the armatures respectively multiplied by the number of turns of wire in the coils is equal. Disturbance can be made to occur by altering the strength of either field or the flow of either current. This means an alteration of the voltage at the terminals of the motor. As to what speed the armatures will rotate at we cannot say; it would depend upon the change in the voltage. You will probably have to do some experimenting in any case. A shunt wound motor often refuses to start unless the field winding is excited before current is allowed to flow through the armature, or unless some resistance is in circuit with the armature. This necessitates the use of a suitable starting switch. You might get over the difficulty by using shunt windings of unusually low resistance, but may find series wound motors necessary to ensure starting. It seems to us that you will require a highly saturated field for the motors to be sensitive to changes of voltage. Speed depends upon voltage, turning effort depends upon current. Your motor armatures being at est, you can only cause more current to flow through the windings by raising the voltage across the terminals. If the increased flow of current increases the strength of the field, the turning effort will be increased, but the back voltage of the armature will also be increased. The increase of magnetism, therefore, partly wipes out the effect of the increase of voltage upon the speed. Perhaps these remarks will be of assistance. 40,000 lines per sq. in. is a moderately high density for cast iron.

[19,226] **Firing Small Copper Boiler with Methylated Spirit.** D. D. K. (Countess Wear) writes: I shall be grateful if you can give me advice as to above or refer me to any work or back number. I attach a sketch showing horizontal boiler with dimensions, which was originally fired with coal or charcoal. The present method of firing is with a paraffin blowlamp (supplied by Whitney), which is noisy and smelly; and, as I wish to use the engine in the house, I think methylated spirit will answer the purpose, particularly as only a very moderate pressure (5 to 10 lbs.) is required. The boiler, which is made of copper with riveted ends, and tested to 25 lbs. under steam, drives a horizontal engine, cylinder 1¼ ins. diameter, 2¼ ins. stroke. It will be noticed the flue is quite plain, no tubes of any kind.

We are very doubtful of success with methylated spirit as fuel. The absence of tubes (either water tubes or flues) is much to be regretted, and we would point out that over a certain size methylated spirit is not altogether a satisfactory method of heating a steam generator. Your boiler would appear to be one which comes under this ruling and, furthermore, does not, in our experience, seem sufficiently powerful for the engine. The heating surface is not very large. The only thing we can advise is the arrangement of the boiler with the fire underneath as added to your sketch, a few water tubes being fitted to the underside as indicated. A plain spirit lamp being used to fire the boiler. The water tubes, which may be about three to six in number, and ¼ in. or 5-16ths in. diameter outside, will enable you to use a simple spirit lamp (about six or eight wicks, ½ in. diameter), with some degree of success. If it is inconvenient to fit water tubes (these should be brazed in and if there is any soft solder about it at present this, of course, is impossible), then we advise you to fit a silent Primus burner (paraffin) to the present apparatus and use it underneath the boiler. The extra heat generated by such a burner will make up in some degree for the absence of water tubes. We shall be pleased to help you further in the matter if occasion requires.



QUERY No 19226

SMALL BOILER FITTED WITH WATER TUBES.

[20,435] **Aeroplane Calculations.** M. M. (Manchester) writes: Given the area of an aeroplane (A, sq. ft.), the angle it makes with the horizontal (θ°), and speed it moves (V, feet per sec.). Can you give me a formula to find its lifting power (W, lbs.)?

A formula such as you require is not available. Even if it were, it would be useless, for in practice there are other factors necessarily involved which are of greater importance than the three you mention. The shape of the plane, the total weight to be carried, the total resisting surface presented to the air, the state of the atmosphere—these and other things would all have to be taken into consideration before anything approaching an accurate estimate of lifting power could be made. The fact is that aeronautic science is not yet in a sufficiently advanced state to supply precise mathematical expressions of the relations between the various factors concerned in the action of aeroplanes. If you can refer to Whittaker's "Pocket Book of Aeronautics" (price 10s. 10d. post free from our offices), you will find it a valuable compendium of up-to-date knowledge on this subject. Our handbook, "Flying Machines: Past, Present, and Future" (price 1s. 2d. or 2s. 3d., post free) also contains much useful information.

[20,508] **"Model Engineer" Suction Gas Plant.** H. J. S. (Stratford-on-Avon) writes: (1) Will this type of plant be suitable for an engine with 5½-in. bore and a 9-in. stroke? The engine is at present running on oil and is a lampless engine, and is used for running an amateur workshop and driving a dynamo. The revolutions of the engine are about 250 per minute. (2) If the plant is suitable, what will the necessary increase in size be upon THE MODEL ENGINEER drawings? I presume some proportionate enlargement of dimensions could be applied throughout, that is to say, treat the measurements given as three-quarters or half (as the case may be) of what they should be for my engine. I say three-quarters or half for illustration, as I have no idea what the increase should be. (3) In the first article on the plant in THE MODEL ENGINEER, mention of the amount of attention required is made. I expect the attention is simply filling up the hopper, pushing fuel down and regulating water supply, and would not be necessary above once an hour or so? (4) The ignition of the engine is by red-hot vaporiser. Electric would probably be necessary for suction gas, I expect. (5) What would be the probable coal consumption per hour for the engine at full load, say, 2½ b.h.-p.? (6) Is it possible to get as much power from an engine with suction gas as with oil? (7) Would it be necessary to make any alteration to the compression space? This could be slightly altered either way easily with the engine in question; provision being made for different grades of oil. (8) Is there any difficulty in starting up an engine on producer gas?

(1) Yes. (2) Diameter of fire should be 7 ins. inside firebricks, and casing made to suit, leaving, say, space of 4½ ins. for bricks and ½ in. for sand backing. Internal diameter of casing would, therefore, be 17 ins. Thickness of casing as shown on drawing, depth of fire from bottom of firebrick to underside of feeding cone, 18 ins. Size of pipe connections, 1½ ins. Other dimensions as shown on drawings. (3) About an hour should be all the attention that is necessary. (4) Electric ignition is best. (5) About 4 lbs. of anthracite per hour. (6) Providing suitable treatment is given, the power from a given size of cylinder is about the same for both producer gas or oil. (7) Adjustment of compression would be necessary. Suction producer gas requires higher compression than does oil. (8) No difficulty should be experienced in starting up if the method described in the articles is carefully followed.

[18,693] **500-600-watt Dynamo Windings.** M. H. (Falkirk) writes: I have a set of finished castings for dynamo. Armature is laminated cogged ring, 4 ins. diameter, 12 slots, ⅝ in. deep by ⅜ in. wide. I have also some No. 16 D.C.C. wire for armature. Kindly say what quantity and gauge of wire would balance this on fields, and what output I may expect as a shunt machine? Also what gauge and quantity would be required for fields as a series machine, using the same armature?

You could wind your fields with 9½ lbs. of No. 21 S.W.G. The output would be in the neighbourhood of 550 to 600 watts, at about 2,200 revolutions a minute.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

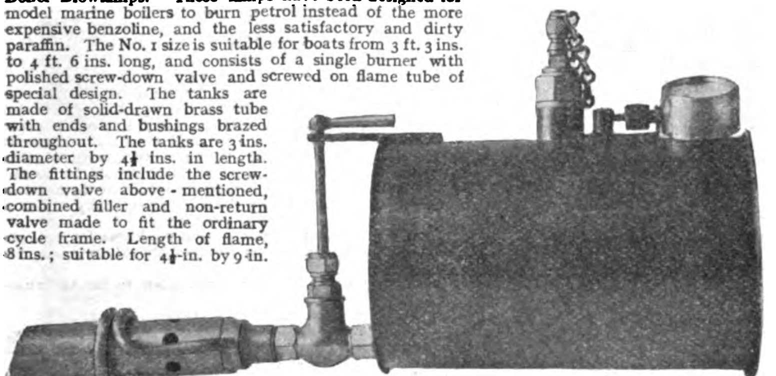
** Reviews distinguished by an asterisk have been based on actual Editorial inspection of the goods noticed.*

A Miniature Motor Tool Kit.

A new kit for automobilists, portable, handy, and compact, containing all the small tools necessary and always being used upon the road, has recently been put on the market by Messrs. Avery and Roberts, Ltd., 64, Stanley Street, Liverpool. The contents are: a contact file for platinum points, half round motor file, three square files, a pair of calipers, a steel rule, giving tapping and spanner size, a cotter punch, a milled centre punch, a round-the-corner screw-driver for getting at screws in awkward positions, one pair of combination motor pliers, a waistcoat pocket miniature spanner for small and delicate adjustments, one motor turn-screw, and a split pin extractor. The case is best quality leather, and we are informed every article is British made.

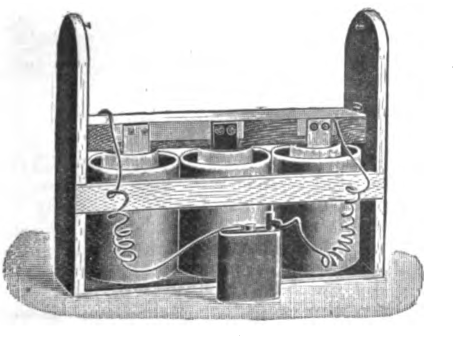
* Marine Blowlamps.

We have received from Messrs. C. Butcher & Co., 30, Balmoral Road, Watford, particulars of their new "G.B." Model Marine Boiler Blowlamps. These lamps have been designed for model marine boilers to burn petrol instead of the more expensive benzoline, and the less satisfactory and dirty paraffin. The No. 1 size is suitable for boats from 3 ft. 3 ins. to 4 ft. 6 ins. long, and consists of a single burner with polished screw-down valve and screwed on flame tube of special design. The tanks are made of solid-drawn brass tube with ends and bushings brazed throughout. The tanks are 3 ins. diameter by 4½ ins. in length. The fittings include the screw-down valve above-mentioned, combined filler and non-return valve made to fit the ordinary cycle frame. Length of flame, 8 ins.; suitable for 4½-in. by 9-in. single-flue marine boiler, and the length over all is 9 ins. The "Featherweight" lamp is intended for small metre boats of light displacement. It has a tank 2½ ins. by 3½ ins., and the burner is nearly the same power of flame as the No. 1 lamp. This lamp is supplied without pressure gauge. The "Duplex" lamp has tank, 4 ins. by 5 ins., and self-contained air-pump. The flame is, of course, double the size of the No. 1 and is intended for boilers which have a large furnace tube, which would not be filled by the flame of a single burner. A separate filler and a release valve is fitted to the "Duplex" lamp.

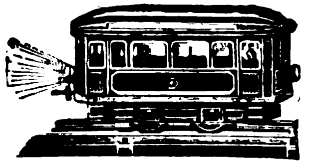


New Electrical List.

The Universal Electric Supply Company, of 60, Brook Street, C.-on-M., Manchester, one of the oldest firms dealing in amateur



electrical supplies, have just issued the 11th edition of their catalogue. This has now grown to 100 large pages, and is crammed full of items of the greatest interest to those following electricity as a hobby or a serious study. In addition to the familiar bells, batteries, telephones, alarms, coils, etc., all of which are shown in great variety, there are many novelties and some excellent lines in dynamos, motors, measuring instruments, electric light sets, lamps, medical apparatus, magnets, and insulated wires. One item which will appeal to readers having small accumulators is the "Junior" charging set, which is a 3-cell primary battery suitable for charging pocket and cycle lamp accumulators of 2 or 4 volts, for 8 to 10 hours at a time with each renewal of the battery solution. The average cost of charging works out at 1d. or 2d. The "Junior" set is shown in the accompanying illustration and is very moderate in cost. The "Universal" charging battery is a larger set suitable for charging 4, 6, or 8 volt accumulators, and also for working X-ray coils, driving motors, etc., where a steady current is required for several hours at a time. We also illustrate a neat little model electric tramcar, with headlight which gives an excellent effect. These cars take a very small current to work them. Castings and parts for making water motors, dynamos, electric motors, and all kinds of electrical apparatus are also included in this useful list which will be sent post free to any reader on application to the firm at the above address.



* Model Bricks.

The model railway enthusiast who wishes to carry out the erection of bridges, stations, tunnel facings, and other building work on his system in the most realistic way possible, may have often felt the want of miniature bricks suitable for this purpose. He need want no longer, for Mr. H. L. Brown, of the Model Brick Co., Foxton Lodge, Wolvercote, Oxford, has stepped into the breach and has placed the required article on the market. He supplies both red and yellow bricks measuring approximately 2¼ by 1 by ⅝ in. in two qualities, and also half round and arch bricks. He also makes a smaller brick than the above, and concrete slabs for paving and platform building. He issues a printed price list, which will be sent on application. We have also received some sample model bricks from Messrs. W. J. Bassett-Lowke & Co., Kingswell Street, Northampton, the dimensions in this case being 2 by 1¼ by ⅝ in. These are made of best brick clay and properly baked, and we are informed have proved very successful in actual use. This firm are also supplying model bricklaying tools, including a suitable trowel, a plumb-bob and board, and a straight-edge. Model engineers will now be able to add model bricklaying to their other accomplishments, and we have no doubt the added effect of the "real thing" will greatly improve the appearance of their railways.

Drummond Tools in London.

Messrs. Drummond Bros., Ltd., notify us that they are exhibiting at the Olympia Show, Stand No. 220, and also at the Stanley Show, Stand No. 6, ground floor, special tools for motor repairing, including 5-in. self-acting, sliding, boring, surfacing, and screw-cutting lathes; 6-in., raising to 9-in., special screw-cutting lathes for professional repair work; 3½-in. screw-cutting lathe for private garage repairs; and the new £5 model maker's screw-cutting lathe. They are also showing small hand-power shapers, lathe chucks and accessories, and a radial drilling machine of quite novel construction, suitable for foot drive. This radial drilling machine will be the first of its kind they have produced at a price low enough for motor garage and repair work, and the only radial drilling machine which can be driven by foot power.

New Catalogues and Lists.

H. Wiles, 36 & 38, Market Street, Manchester.—Mr. Wiles has just issued a new list of high-class model engine fittings and sundries, which is nicely printed on art paper and covers twenty-four pages. It deals with engine parts, lubricators, water gauges, cocks, unions, elbows, safety valves, check valves, whistles, force-pumps, pressure gauges, propeller shafts, wheels, rivets, and other items of service to the model maker, and will, we have no doubt, be of much service particularly to readers in the Manchester district. Mr. Wiles stocks a large number of amusing and interesting scientific novelties, which are well worth inspection by those interested in such lines.

The Editor's Page.

IN reference to the recent race for the Branger Cup, Mr. Alfred Walker, of Baildon, sends us the following interesting note :—"The report of the Branger Cup race in this week's MODEL ENGINEER is most interesting. I had the good fortune to be present, and was pleased to see the excellent work in many of the models. The fastest boat was the hydroplane *Rest-La*, 2¾ h.-p. single-cylinder petrol motor, total weight of boat 33 kilogrammes. It was a fine sight to see this boat make a bee-line across the lake. Its first journey I timed 31·4 secs. from the pistol shot to its reaching the opposite shore, and its second journey 38 secs.: the difference might be caused by the floating leaves and twigs. There is some uncertainty about the length of the course. The conditions of the race published in *L'Auto*, September 3rd, give it as about 300 metres; in French reports of the race it is variously stated to be 200, 165, and 150 metres; on the map in Baedeker's guide to Paris it scales 100 metres, on other maps it scales the same. If the maps are correct, the highest speed is 7 miles per hour. If this uncertainty can be removed, the accurate information will be of value to the large number of your readers who are interested in model motor-boating and the rapidly developing hydroplane boat. Your remarks about the poor arrangements made for competitors and spectators by our good friends across the Channel are amply justified, as indeed your photographs show."

* * *

From Maidstone comes the news that another local model engineering and yachting society has sprung into being under the energetic leadership of Mr. Wilfrid Heanly, of 2, Clarendon Place, Maidstone. Mr. Heanly writes that the Corporation have granted them the use of an ornamental mill lake in the centre of the town, which, in spite of certain disadvantages, is much more get-at-able than the River Medway where the local enthusiasts have hitherto been sailing their models. Already about a dozen members have joined the flag, and we hope the insertion of this notice will bring further recruits. Mr. Heanly has in view the possibility of organising a local exhibition of models of various kinds in order to arouse fresh interest in the neighbourhood, and we hope all our readers in that locality will rally round and give him a helping hand.

* * *

There has been a big run on our sets for building the cardboard model of the Midland locomotive "Princess of Wales," and we have already seen several very pretty models built up from these parts. Those who like to take the trouble, and we may say that the model is well worth it, can add much to its realistic appearance by elaborating the minor details. We have a few large engraved plates of the real engine left, which form an excellent guide for this purpose, and so long as the stock lasts they may be had from our office, price 3d. each, or 4d. post free, in a cardboard tube.

Answers to Correspondents.

W. A. G.—About 10 yds. of the large wire on each former and about 90 yds. small wire.

J. R. (Glasgow).—Armature, 1¾ ozs. No. 20 S.W.G.; fields, 6 ozs. No. 22, in shunt.

J. F. BROWN (Edinburgh).—We note your suggestion and will have pleasure in bearing it in mind. Meanwhile, we may say you will get a good description and particulars of construction for a magneto machine in Bottone's book "Magnetos for Automobilists," price 2s. 3d. post free, to which you might refer. A letter which we sent you recently has been returned by the P.O as "gone away."

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26-29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk (*) denotes that the subject is illustrated*].

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

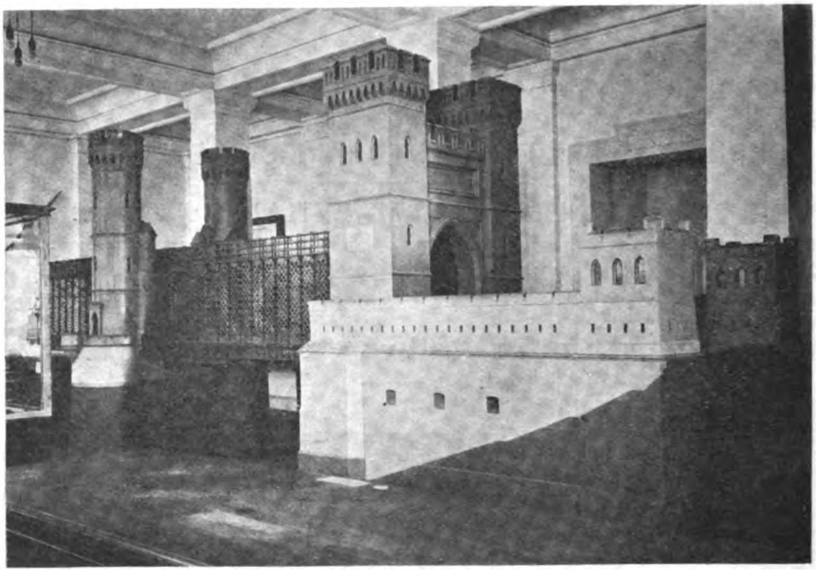
VOL. XIX. No. 395. NOVEMBER 19, 1908. PUBLISHED WEEKLY

A German Museum for Railway and Marine Engineering.

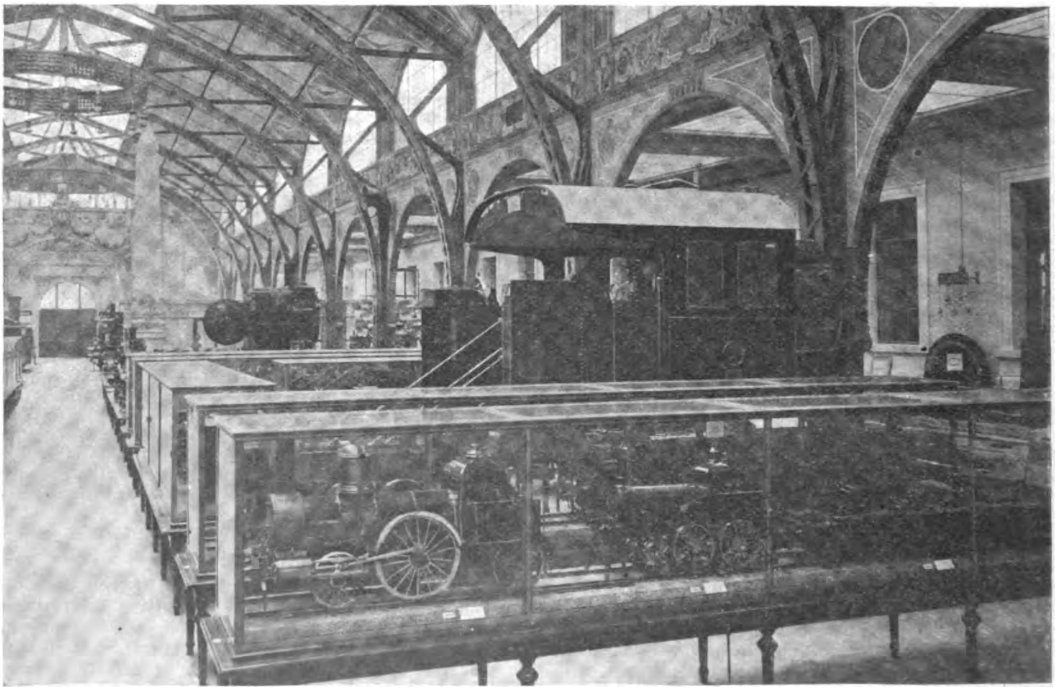
A WORKING MODEL OF A SWITCHING AND SHUNTING PLANT.

THE Kgl. Verkehrs- und Baumuseum, in Berlin, recently opened to the public, is another valuable addition to the long list of educational institutions for which Germany is famous. Contrary to the usual field of art, handicraft, and the like, the collection is confined to engineering matters, which, it is pleasant to note, find an ever-increasing popularity among the general public. For many years the German engineer, despite of his excellent education, which is not surpassed by any other nation, suffered much by the indifference and lack of respect to his person and his profession; the lawyer, the clergyman, and physician claiming and receiving practically all honours due to learned people. Happily, this state of affairs is rapidly coming to an end, and the most remarkable event of recent times is the granting of the "Doctor" title to every engineer passing the examination after his four years' study. This action is chiefly due to Emperor William, who is intensely interested in all technical matters. Thus, about a year ago, a museum was opened in Munich devoted to science and engineering, while the institution which forms

It is located in the old Hamburg terminal, in Berlin, which was abandoned several years ago, since the purchase of that line by the Government.



MODEL OF A LARGE IRON BRIDGE COMPLETED IN 1857.



A PORTION OF THE MAIN HALL.

the subject of this article is still more specialised, as it comprises only railways, water transportation, and construction.

Its exterior has been left unchanged, while extensive alterations were made in the cellar and interior rooms. The latter have an area of 4,800 sq. metres and are provided with central heating and electric lighting. For this purpose a complete power plant, which also generates compressed air, has been installed in the cellar. The latter is used for the working of many models, to show their capabilities. This is a particularly valuable feature, as it facilitates study to a large degree. Many others can be operated by hand, or small electro-motors, which take the current from the batteries in the cellar. Explanatory notes are also given, while photographs, drawings, and literature explain the internal arrangement. The exhibits comprise, chiefly, modern installations; old types, historically valuable, being confined to those subjects which would not be understood without seeing the development from early periods.

A Working Model Traction Engine.

By J. H. Alexander.

As many readers of The Model Engineer may be interested in the traction engine which I built a few years ago, I give a description of it, together with photographs of the engine, car, and tramway rails. The boiler is of the locomotive type, made of thick sheet brass, brazed and riveted together. There are eleven brass ½-in. firetubes, but no water tubes. Water space round the fire, about ½ in.; inner firebox of brass), 7 ins. by 4¼ ins. by 4 ins., with flat roof; outer firebox, 10½ ins. (from firebox to top) by 4 ins. by 5 ins.; boiler barrel, 13 ins. by 4½ ins.; total length of boiler (including smokebox), 21 ins.; funnel, 2½ ins. diameter. The dome (over firebox) is a casting, and is bolted to its seat; this carries the safety valve and whistle.

Boiler Fittings.—Schaffer & Budenberg's gauge is fitted, indicating up to 60 lbs. per sq. in.; water gauge, with three cocks; two tri-cocks, lever safety valve, blow-off cock, water plug (to fill boiler with water), whistle, regulator handle, blower pipe—which passes from dome to smokebox—with cock (this pipe passes outside the boiler and terminates in a blowpipe, into which it is screwed). The blowpipe nozzle enters the root of the funnel after passing through the smokebox, and points vertically upwards, having a very fine nozzle; it raises steam fairly well when the engine is not running. There is a clack-valve box, with valve and cock. The barrel of the boiler is lagged over with a 1-16th-in. sheet of asbestos paper, next strips of wood ¼ in. thick, and outside a sheet of tinplate 18 ins. by 13½ ins., with a lap joint screwed and soldered together.

Heating Surface.—We must first find the total heating surface of the tubes and firebox, and then from this subtract the areas of the tubes and firehole door in order to get the net heating surface of the boiler.

In the tubes π D × L × number of tubes = 3·1416 × 0·5 in. × 13 ins. × 11 = 224·6 sq. ins.

In the firebox (L × B) + 2 (L × H) + 2 (B × H) = (4 ins. × 4·25 ins.) + 2 (4 ins. × 7 ins.) + 2 (4·25 ins. × 7 ins.) = 17 + 56 + 59·5 = 132 sq. ins.

Section area of the tubes d_2^2 × ·7854 × number of tubes = 0·5 in. × 0·5 in. × ·7854 × 11 = 2·15 sq. ins.

Area of firehole door $\frac{\pi}{4}$ ($d_1 \times d_2$ = ·7854 (2 ins. × 1 in.) = 1·57 sq. ins.

Then 224·6 + 132 = 356·6, and 2·15 + 1·57 = 3·72.

∴ 356·6 − 3·72 = 352·88 = total heating surface (in sq. ins.) of boiler.

The Engine.—The cylinder is of brass 1½-in. bore by 3-in. stroke, bolted to a brass saddle support, which, in turn, is screwed to the boiler. There are two blow-off cocks, one at each end, worked by a lever. The piston is of brass—no piston rings, only asbestos string packing fills the circular groove. The cylinder is lagged with asbestos, wood, and a tin sheet outside; steam ports, ⅛ in. by ⅞ in.; exhaust port, 3-16ths in. by ⅞ in. Steam is controlled by means of a slide-valve; stuffing-boxes are packed with asbestos string. The exhaust steam pipe discharges into the funnel. There is a top and bottom guide-bar for the cross-head—each 5⅞ ins. by 3-16ths in. by 3-16ths in., screwed into the cylinder cover at one end, and at the other into a brass oval ring, with its flanges screwed to the boiler. Steam is taken from the dome by a 5-16ths-in. pipe, which passes inside the boiler and then emerges on one side near the funnel, and joins the cylinder steam chest by means of a coupling screw; thus the steam is to some extent superheated on its way to the cylinder.

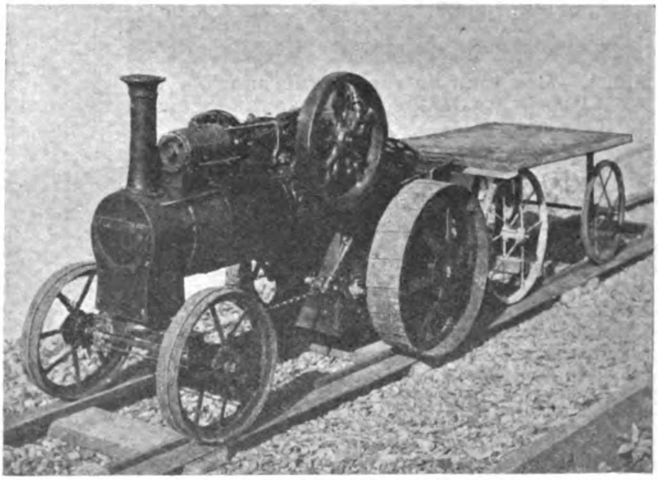


Fig. 1.—The Engine (with Steam up) and Car on the Tramway.

The regulator handle passes out through a stuffing-box at the back of the boiler and works a 3-16ths-in. cock on the steam pipe inside the boiler. Instead of the firebox plates being extended upwards to form box-brackets to carry the main bearings, an iron saddle-shaped casting sits on the top of the boiler, being screwed to the barrel in front of the dome, and is further secured in place by two strips of sheet brass, which pass round under the boiler barrel from one side to the other. The sides of the casting project upwards, and are each slotted out to carry the brass bearings (each is in two halves), one on each side for the flywheel shaft. The bearings are kept in position by side-flanges, and an iron cap is placed on the top of each. The crankshaft is a ½-in. steel rod, with bent centre-crank. The flywheel is of iron, and weighs 7½ lbs. Only one eccentric is used to work the slide-valve, and reversing is accomplished by a loose eccentric pulley, which, by means of a small lever attached to it, can be moved across the crankshaft and made to engage with stops fixed on the shaft—one stop is for forward motion and the other is for backward motion. The hind road wheels are built up; the central boss of each is a casting having two end discs, to which the sheet brass spokes are riveted; the rim is made of hoop iron (with a lap joint) 11 ins. diameter, 2½ ins. wide; there are twelve arms, alternating, six on each side. Both wheels are fixed by setscrews on a steel axle ⅝ in. diameter, which passes through brass bearings bolted to the back of the firebox. Each wheel rim has twenty cross-pieces of iron riveted to it. Washers and split pins are provided at the ends of the axle. The front wheel frame, made of stout sheet brass, swivels on a bolt in a central casting screwed to the bottom of the smokebox. The front wheels are 7¾ ins. diameter by 1½ ins. wide, made similar to the back wheels, and are fixed loosely on a ¼-in. steel axle; each contains eight arms, alternating, four on each side. These wheels are guided or steered by means of two strong steel chains (such as are used for a dog), turning in opposite directions around a brass roller which is acted on by a worm, which, in turn, derives its motion from a hand-wheel on the footplate. The tender, of sheet brass, is bolted to the firebox; it contains a water tank, in the well of which is placed a hand force-pump (not shown in photographs) for feeding the boiler. A spirit tank forms the lower part of the tender, under the footplate and water tank; it has a neck which projects inside the firebox, and is divided into two halves by a longitudinal air-space; the lamp carries two long rows of asbestos or lamp wick. These burn in the firebox and through a funnel at one side of the tender (shown in photograph). Spirits of wine is poured in to keep the fire brisk.

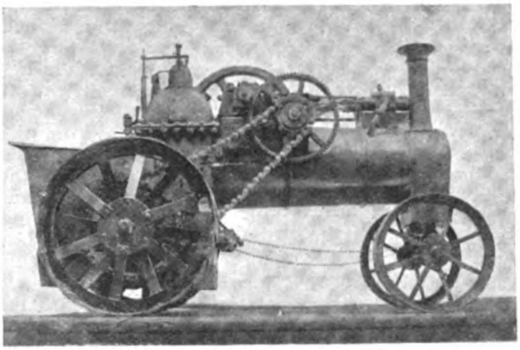


Fig. 3.—Side View of the Engine, showing the Cycle Chain Gearing, and also the Steering Chains.

Gearing.—Instead of spur-wheel gearing, as is now used in traction engines, I have adopted chain gearing (an arrangement which was used in traction engines in the early sixties). The gearing is for one speed only. There is a 1¼-in. brass pinion, which slides on the crankshaft, and which is put into and taken out of gear by means of a key; this pinion gears with a 6½ ins. diameter spur wheel, which revolves on a countershaft or stud screwed into a bracket on one side of the flywheel plummer block. A cycle 1-in. pitch chain pinion, 3 ins. diameter, is firmly bolted to this spur wheel, and revolves with it on the countershaft (both wheels revolving loosely); an end-nut keeps them from coming off. This pinion takes an endless cycle chain. The stud on which the spur wheel and chain-wheel revolve can be moved and fixed tight by an inside (next centre of engine) nut, anywhere in a curved slot in the above bracket, struck from the centre of the flywheel shaft. The part of the stud inside the slot is cut square to fit the slot, and the part of it projecting through the bracket is screwed for a nut which tightens it up against the bracket, or, by unscrewing the nut, it can be slid laterally along the slot to any position, in order to adjust the chain to keep it tight without interfering with the gearing or relative positions of the spur wheel and crankshaft pinion. In this way, by throwing into gear or removing the crankshaft pinion, the engine will run as a locomotive or a stationary engine. On the inside of the right-hand road wheel the chain passes round a cycle chain-wheel 7½ ins. diameter, bolted to and revolving with the road wheel. This causes the latter to be driven from the crankshaft through the gearing, and the motion is communicated through setscrews and axle to the other road wheel, so that both revolve when the engine travels along. The weight of the engine in working order is fully 90 lbs.

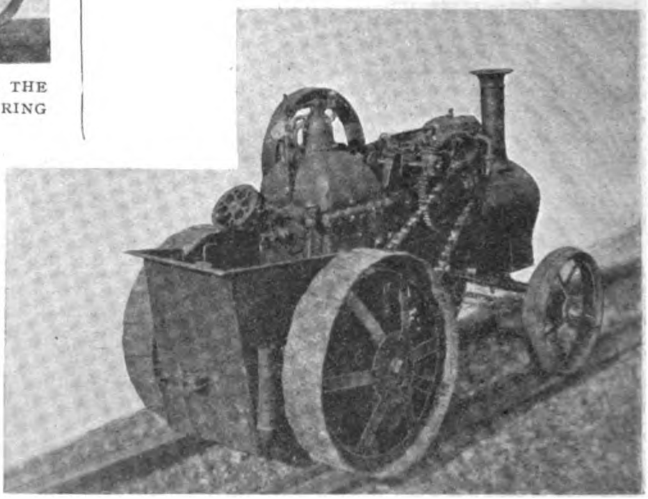


Fig. 2.—The Engine on the Tramway, Running as a Stationary Engine.

The Car.—This is of wood (21 ins. by 13¾ ins. by ½ in.), fitted with a seat shown in photograph below. The front axle swivels so that the car follows the engine round any curve. When run on the tramway the front axle frame is screwed up tight, so that both the axles are parallel. The wheels are from a perambulator—the back ones 10 ins., and the front ones 8½ ins. diameter; the rubber is removed, and, instead, a hoop iron strip 1 in. wide is put round and bolted to each rim so that the wheels will run on the tramway. The axles are of steel. An iron drawpin attaches the car to a bolt, which passes through brackets on the back of the tender.

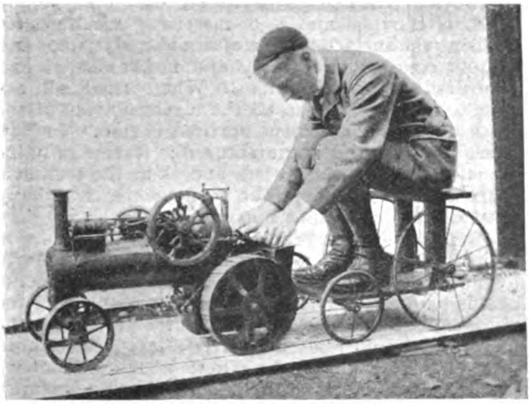


FIG. 4.—THE ENGINE, WITH PASSENGER SEATED ON THE CAR.

Tramway Rails.—These are only required as my garden path is rough with gravel, and causes too much friction for the engine to pull a load easily. The rails are of iron, each 7½ ins. by 2 ins. by ¼ in., and a ⅜-in. square iron flange is put on with countersunk rivets to one side of the rails; they are screwed down to wood sleepers ¾ in. thick with countersunk screws. The junctions of the rails at each end simply rest against those of the next section; the end sleepers project past the ends of the rails of one set, and form a support for the ends of the next set. In this way the line may be made any length desired. The rails of one section are kept in line with those of the next section by means of iron pins driven into the ground.

Getting-up Steam and Running the Engine.—Fill the boiler with water till the water gauge is about three-quarters full: a good plan is to remove the lamp from under the tender (it slides in and out along grooves), join up a Bunsen gas burner by rubber tubing, and get up steam. This takes about twenty minutes. When steam is up, substitute for the Bunsen the spirit lamp, and pour spirits of wine into the tank, as required, to keep the fire brisk. Two asbestos balls are suspended by wire in the firebox, and these getting heated, help to make the engine steam better. The funnel is 6 ins. long, 1¾ ins. diameter; but the engine steams best with a temporary funnel stuck in the mouth of the other, raising this to a height of 16 ins. A cycle pump (attached by a tube to the root of the funnel) raises steam very rapidly (this can be easily unscrewed and removed). I never run the engine with a greater pressure than from 25–30 lbs. per sq. in. Oil the motion well and squirt a little into the cylinder through the oil-cock. Open both cylinder blow-through cocks, then turn on steam, and the engine will start after the cylinder is warmed up a bit. After being run as a stationary engine, key the pinion on the crankshaft so that it will engage with the spur wheel, and the engine will run as a locomotive; attach the car, and we are ready for a run. To reverse the engine by hand, make the eccentric pulley engage with the backward stop on the crankshaft and turn on steam. (Of course, the engine will not start on the dead centres.) The locomotive will keep in motion for about one hour after lighting the fire without a fresh supply of water, and will easily pull one person or two children seated on the car, the driver walking alongside. It was exhibited to the members of a local branch of the Model Engineers' Society, and the engine pulled a good number of the men in turn, and was pronounced a great success. In fact, the greatest weight pulled on the tramway at 30 lbs. pressure was 16 stone,* not including the weight of the engine and car. As to fuel, I find that solid fuel gives trouble by blocking up the tubes with soot and requiring continual stoking, so I prefer spirits of wine, which is quite satisfactory. The open bottom of the firebox can be completely or partly closed by a sliding plate, which can be pushed in and drawn out as desired, to regulate the draught according as the weather is windy or mild out of doors.

The hand force-pump has been fitted up since the photographs were taken.

Perpetual Motion.

By R. P. HOWGRAVE-GRAHAM, A.M.I.E.E.

VERBAL definitions are not always wholly satisfactory, and to state them requires a certain amount of courage when that which is to be defined is in any sense controversial. To gain a clear mental picture of the position, we must stop down our mental lens and get sharp definition in its more abstract sense, even if this involves rather a long exposure.

One at least of those who have written about perpetual motion in THE MODEL ENGINEER uses a very large aperture, and presents us with a picture most gloriously impressionistic—full of atmosphere, so much so that at times the very subject becomes doubtful. One or two letters were plaintive about gibes at the beloved dream. Others suggest wonderful possibilities of sad waste of time over experimenting and writing on the subject.

"W. J. T." paves my way admirably by suggesting that we should drop the term "perpetual motion" in connection with utilisation of power from natural sources.

Such procedure would be indeed reasonable, but I propose to take this aspect of the subject into consideration with the rest, so far as will enable the reader to follow "W. J. T.'s" excellent advice. Otherwise it would be necessary to omit any consideration of the problems connected with radium, which naturally confused those who attended to

* With a heavier load the adhesion to the rails is insufficient and the driving wheels slip.

certain random statements recently circulated in the Press.

Perhaps we may fairly start with the following definition:—

A perpetual motor is one which will maintain continuous motion for an infinite time by its own perpetual conservation or intrinsic generation of energy, so long as no outside disturbing influence alters the original conditions.

Disturbing influences may reasonably include stoppage through wear of bearings or working parts and rust or general decay. Setting aside these last, it is obvious that if the machine could be isolated in space at a point infinitely far removed from all sources of energy, such as radiating suns, nebulæ, or other bodies, it would continue in action for all time.

The first type of perpetual motion device which will be considered involves an attempt at the complete conservation of an initial supply of energy imparted to the mechanism once and for all. Such motion is theoretically possible, but is unattainable by reason of strict limitations of space. If we could reach a point in free and matterless space where gravitational and other forces were either non-existent or equal and opposite in all directions, all frictional or analogous effects being absent, a mass set in rotation about its centre of gravity would spin for ever, but would only constitute a perpetual motion machine in a very limited sense; no sort of work could be done by it without a corresponding withdrawal of its energy, together with a retardation which would eventually bring it to rest.

Similarly, if a mass were set in motion in space along a straight line, and could travel indefinitely without encountering any extraneous influence, its motion would continue for all time, though here again it could do no work.

By similar principles, orbital motion of one body about another could be maintained if all conceivable tidal, frictional, or electrical retarding action could be annulled. Attempts have been made to attain the necessary conditions by eliminating every energy-loss. A weighted spring vibrating in the highest vacuum obtainable will convert its store of energy into heat by molecular friction in the spring, and by friction with the residual gases.

Even in a perfect vacuum a rotating mass must be supported by some kind of pivot which must cause friction, or by magnetic fields, which cannot be so applied as to avoid loss by hysteresis and eddy-currents. Such devices might move for many days, but could not move perpetually. The motion only exists by virtue of energy stored in the system, or we might say that the energy only exists by virtue of the motion. This apparent contradiction merely means that the energy and motion are co-existent and inter-dependent, so that in providing any opposing force for the system to do work upon, the energy and the motion would be taken from them together, the former being transferred to some other medium or body with or without change of kind. In the case of the weighted spring the energy oscillates between static and dynamic forms.

Once and for all let it be understood that these and other apparently dogmatic statements are based on enunciations known as "laws of Nature," *which have not been found false in any known case up to the present.*

We can be certain of nothing, but knowledge supplemented by common-sense should hold us from the old beaten tracks of fallacious thought, argument, and experiment. We must also be guarded in speaking of "all time" and "infinity"—terms involving conceptions which our finite minds can only dimly apprehend.

The second type of machine involves the supposed intrinsic generation of energy by the system itself, usually in sufficient quantity to do useful work in addition to that which is required for the mere maintenance of motion.

Endless are the drawings, patent specifications, articles, and mental activities which have been and are still wasted in this direction. Among these are arrangements of radial rods hinged in one direction to give greater leverage on one side of the axis of rotation; devices with tubes containing rolling balls, or moving masses of mercury; machines for utilising the surface tension of liquids; dynamos and motors coupled electrically and mechanically, and countless other inventions. When tried all are soon abandoned, for in all the algebraic sum of the work done by the various portions is zero. In fact, energy cannot be manufactured; it can only be transferred and transmuted, and as in the technical sense energy is the power to do work, it follows that all such machines must be inoperative.

There still remains the third class of machines, in which the energy is drawn from some natural available course, and here one of the correspondents of this paper naïvely thinks it quite possible that the rising and falling of the barometer (meaning the mercury) could be converted into continuous motion. How modest! Where is the difficulty? When once one admits the idea of tapping Nature's numberless sources of energy, possibilities crowd on one so fast that one scarcely knows where to turn.

But would baro-motors and their like be perpetual motors? In a limited practical sense, yes! In the scientific and real sense, no! The available sources of energy on the earth are none of them permanent, and the terms of their activities are all relative and only differ in degree. A rotting hay-rick might keep some form of heat-engine or thermopile and motor active for months, but it would eventually rot away. Yet to an intelligent colony of microbes in which ripe wisdom gave place to senility and death at the age of two seconds, these motors would seem perpetual.

Niagara Falls, which can supply power continuously to turbines, will exist for thousands of years longer than the rotting hay-rick if no violent geological or celestial disturbances intervene, but they must eventually cease to exist; their energy is part of the accumulated energy which the sun distributes over the surface of the earth, for they are supplied by rainfall resulting from evaporation, which can only take place by absorption of heat energy.

The local variation of the sun's radiant heat could be made to produce sufficient alternate expansion and contraction to keep mechanisms in continuous motion, but the sun will almost certainly grow cold eventually. Tides, again, afford energy which can be stored and used continuously and usefully. Now if we were to take the rick-engine, the turbine, the solar motor, and the tidal machine, to the isolated and uninfluenced spot in space, they would not work, and therefore they would not meet the requirements of our definition.

The so-called perpetual motion machine described in the article on the Lepine Exhibition belongs to this class. The device is really a steam engine, and receives its energy from the surrounding space in the form of heat. The tightening of the wetted threads can only pull the glass plate out of centre by virtue of the drying which the threads undergo when they emerge into the air, and this evaporation cannot take place without a lowering of temperature. If the machine were perfectly frictionless and could be isolated, so that no heat could reach it from its surroundings, it would get increasingly cold until the evaporation ceased; its motion would in any case stop at the freezing point of water. Apart from freezing, the motion must stop at absolute zero of temperature. In reality heat is converted into mechanical motion, and is therefore the source of energy, the device being scientifically and actually a steam engine, and, like other steam engines, requiring renewal of the water.

With regard to radium, the wonderful and epoch-making discoveries in connection with it and kindred substances led to very wild and unfounded statements from the very beginning. Radium has upset no known law, and has not solved the problem of perpetual motion, neither is its energy inexhaustible. At most it has changed our conceptions of what we mean by a chemical element, but here the interference is with a *definition* and not with a *law*. Moreover, the more thoughtful among scientists have usually made verbal and mental reservations in defining an element, thus leaving room for any growth of knowledge or change of conception.

Possibly there are cases in which the motion of electrons in atoms of matter is perpetual within the limitations which are satisfied by the rotating mass isolated in space, but no continuous emission of radiant or other energy would permit perpetuity of action.

The enormous energy stored in a mass of radium is continuously expended in the production of heat, light and ether pulses of the *X*-ray type; also streams of ionised particles are projected with great violence. These in themselves are further degraded, forming successive emanations of increasingly inert material, each change being accompanied by *loss* of energy. Thus the energetic radium actually changes into inactive matter and *loses weight* in the process.

In some far away period of geological history a certain quantity of matter became possessed of a great and highly concentrated store of energy by virtue of its existence as the highly active and unstable element radium. The ultimate transference of all this energy is as much a matter of time as the stoppage of a steam engine when all the coal has been consumed.

If an ounce of radium could be made to deliver its 30 h.-p. for 2,000 years, it would by that time be correspondingly lighter, and eventually the last trace of it would vanish coincidently with the performance of the last scrap of work done by it.

If we alter our definition to cover machines *which work perpetually so far as man's experience is likely to go* we include this last class of machines, but where shall the limit be fixed, and is such an expanded definition admissible when man's range of earthly experience in the universe is by comparison less than the beat of a fly's wing in ten thousand years? The comparison is truly inconceivable, yet less unthinkable than the infinite reality.

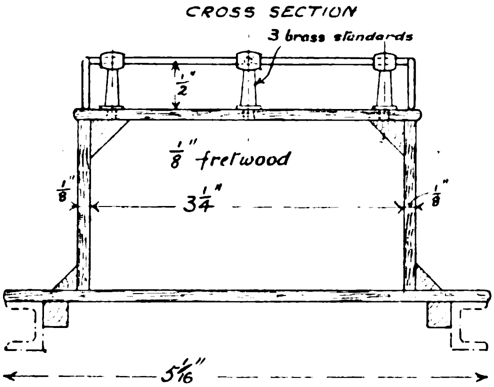
The three classes of perpetual motion machine may be tabulated as below, and those who are still unconvinced may try to discover a fourth class or to vitiate the arguments used to support either of the three which are given. In any case they are advised to try to fit their pet devices into one or other of the columns. If they *must* demonstrate the wonderful possibilities of mental inertia and perpetual motion along one line of thought leading to infinite and unproductive voids, let them at least attempt to think clearly and scientifically before giving final direction to the energy-impulses of their brains.

"PERPETUAL MOTION" MACHINES.

Inoperative Machines.		Operative Machines, but the Motion not Perpetual in the True Sense.
Principle.—Conservation of Energy.	Principle.—Production of Energy.	Principle.—Utilisation of Natural Energy.
Initial Supply of Energy to a System Freed from all Retarding Actions (*Retarding Actions cannot be eliminated*).	*All fallacious.*	
Example.—Pendulum swinging in a vacuum.	*Examples.*—Dynamo and motor coupled mechanically and electrically; arrangements of hinged levers, large cisterns forcing water to a higher level through small pipes, etc.	*Examples.*—Machine at Lepine Exhibition; tidal, radium, and solar motors.

According to the *American Machinist* the total production of petroleum in the United States for 1907 is reported as amounting to 166,095,335 barrels, or 22,149,862 metric tons. This shows an increase of 39,601,399 barrels over the production of 1905.

FIG. 31b.



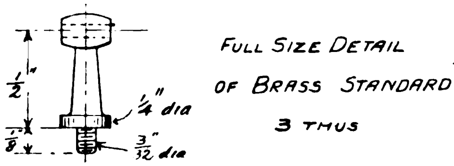


FIG. 31a.

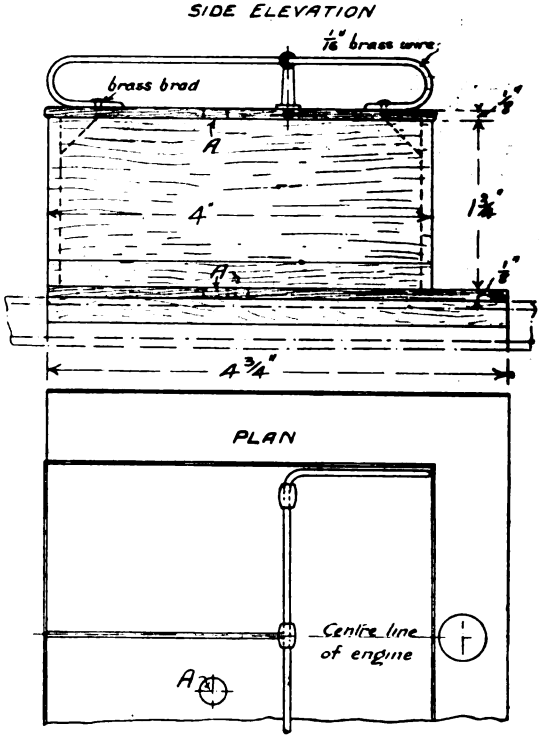


FIG. 31b.—DETAIL OF DRIVER'S WOODEN SEAT.

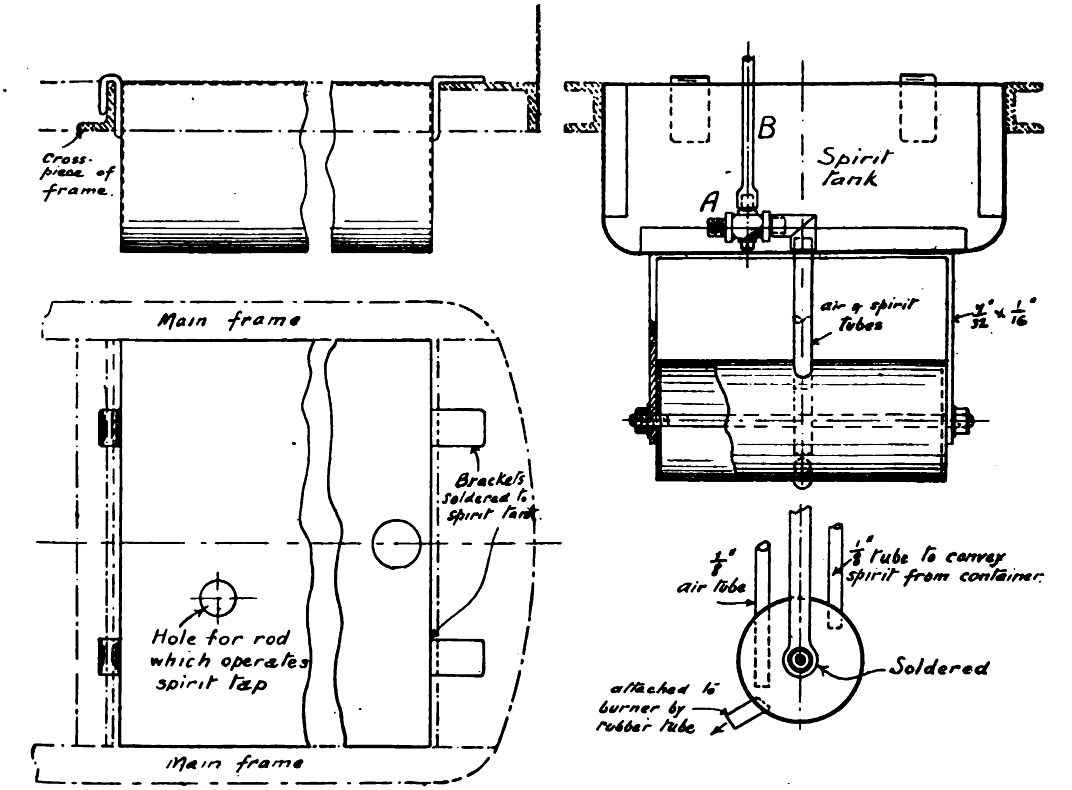


FIG. 32.—ARRANGEMENT OF SPIRIT RESERVOIR AND SUPPLY, SHOWING METHOD OF SUSPENSION BETWEEN THE FRAMES.

Design for Model Motor Fire Engine.

By Frank Finch.

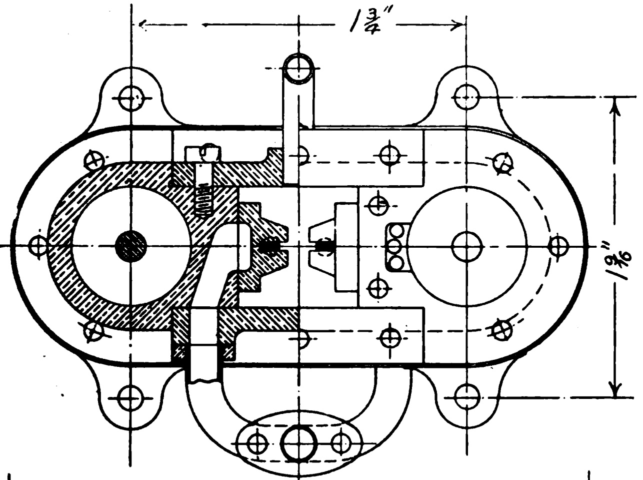
(*Continued from page* 462.)

THE only woodwork in the model, apart from the pattern-making, is the driver's seat. Thin mahogany fretwood, about ⅛ in. thick, will serve for this. Fig. 31*b* illustrates a strong method of construction. For the hand-railing 1-16th in. brass wire is used, and attached in the manner shown in the sketch. Full-size details of the three standards for carrying the railing is given herewith (Fig. 31*a*). These may be turned up from a piece of ¼ in. diameter brass or steel rod, ¾ in. long, or cast in brass from a pattern. Referring to the driver's box or seat, the holes A shown in Fig. 31*b* should coincide with the long stem B, Fig. 32, of the cock, for regulating the spirit supply from tank. Another hole is shown in the footboard. This should coincide with the hole in the spirit tank, which is intended for the filler.

From Fig. 32 the method proposed for supporting the spirit reservoir is shown. It will be observed that the spirit tap in the reservoir is fitted in the following manner: The top of the supply pipe is threaded, on to which a small brass elbow is screwed, and into this the cock A. The rod B has an enlarged end with a square hole to engage with the squared top of plug. The elbow and tap must, of course, be fitted before the top of tank is soldered on. Two designs of burner are shown in Figs. 33 and 34. The latter is to be preferred for stability. The brass plate shown at A has two holes drilled through to take the tubes, and acts as a drip catcher. The two plugged ends should fit firmly into brackets or clips attached to the bottom ring of boiler.

The steam cylinders are shown in full size detail in Figs. 35, 36, 37, 38, and 39. The drawings are so clear that further description is superfluous. The ports are gun-metal castings. The top cover for the two cylinders is in pieces, as is also

Fig. 37.—Half-sectional Plan.



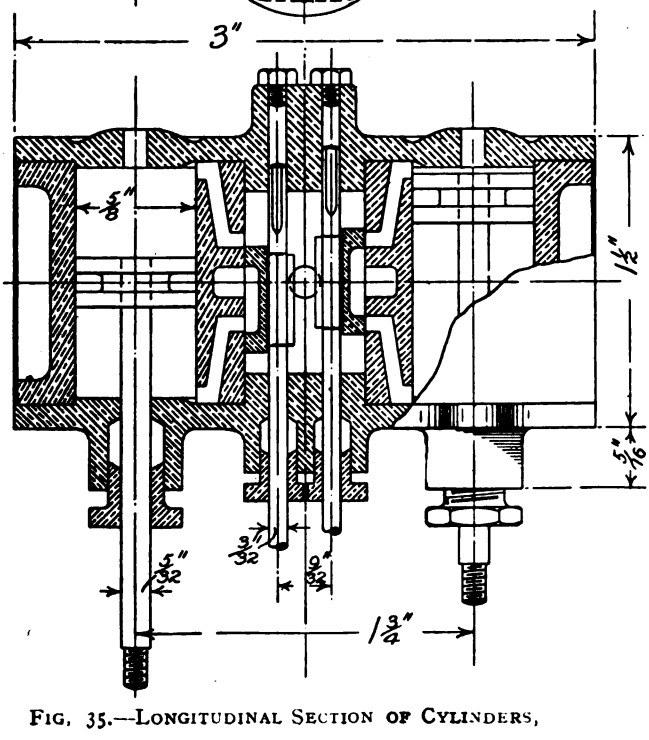


Fig. 35.—Longitudinal Section of Cylinders.

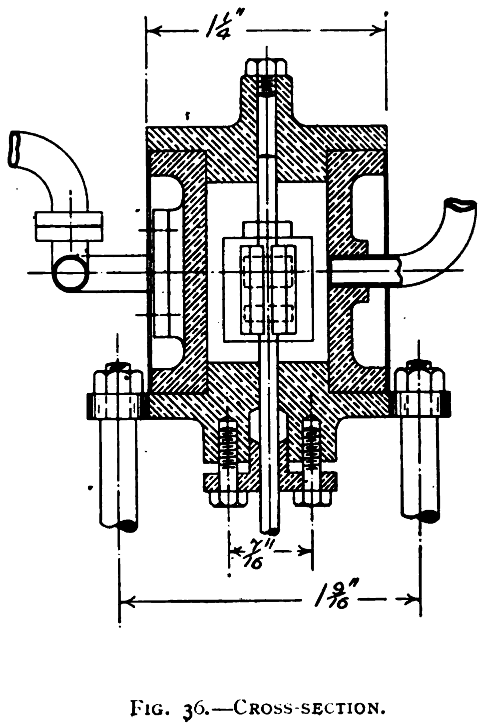


Fig. 36.—Cross-section.

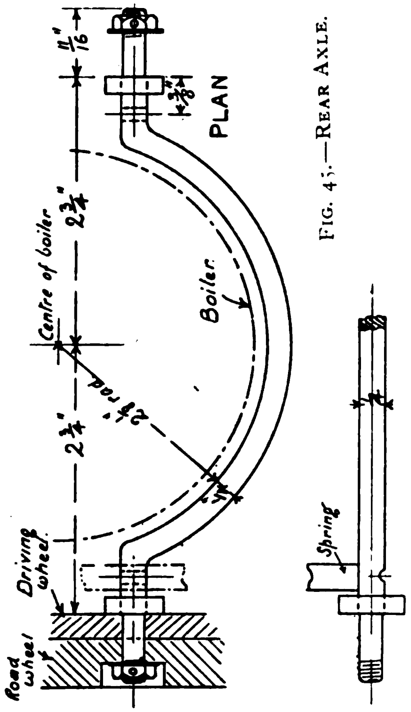


Fig. 45.—Rear Axle.

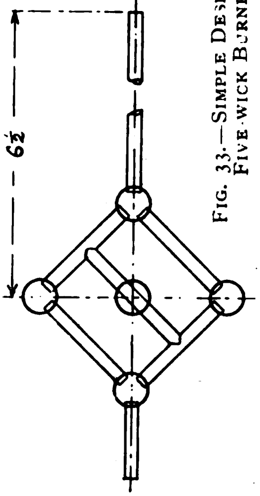


Fig. 33.—Simple Design for Five-wick Burner.

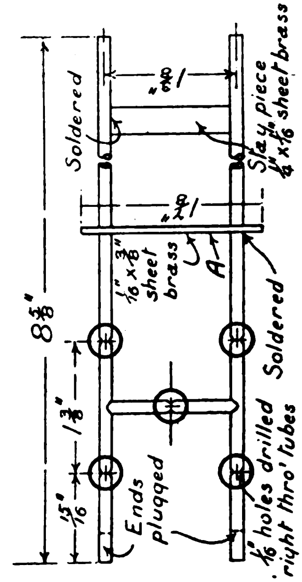


Fig. 34.—Alternative Design for Five-wick Burner.

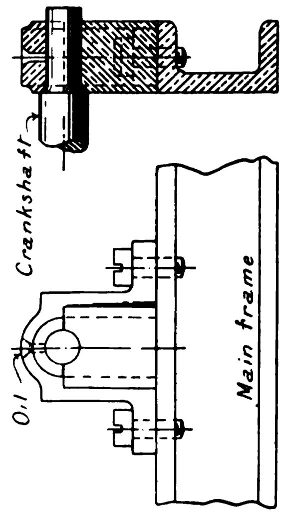


Fig. 43. Design for Crankshaft Bearings. (3 thus.)

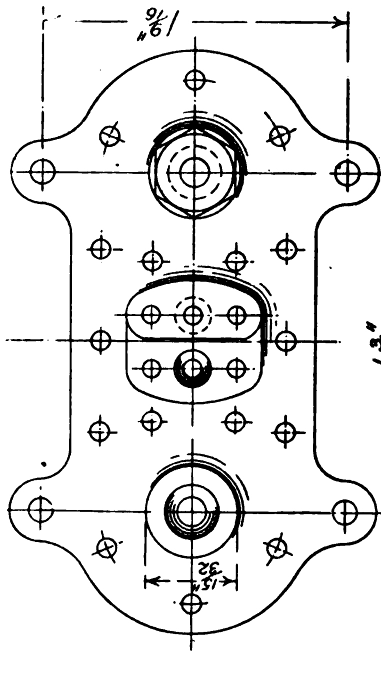


Fig. 39.—Plan of Bottom Cylinder Cover.

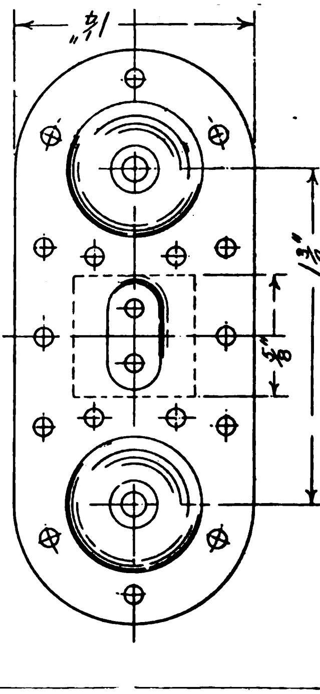
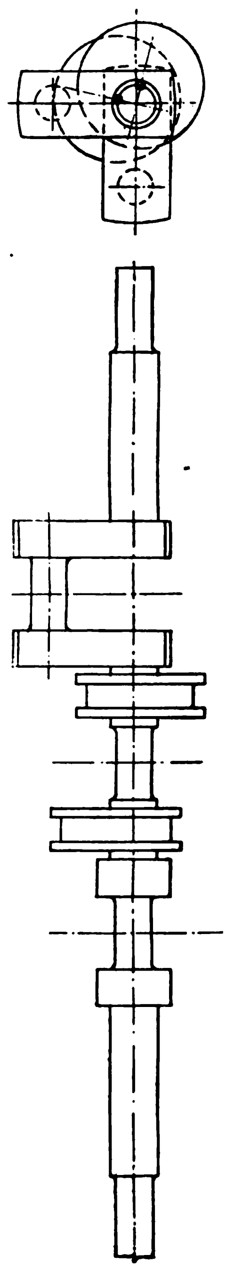


Fig. 38.—Plan of Top Cylinder Cover.

the bottom cover. This latter, it must be noted, differs from the top cover so much that it will be better to make a separate pattern for each, rather than make the same pattern do. There are four lugs, by which the cylinders are carried in steel columns from the top of the pumps. The cylinders are lagged in the usual way, and one sheet of thin brass is wrapped round to come flush between the top and bottom covers.

pump rod from the engine, the top of rod is fitted with a milled collar, so that the rod may be easily unscrewed, and the pump rod drops to the bottom of the barrel. It will be advisable to have a pair of flywheels, as indicated in the general arrangement drawing.



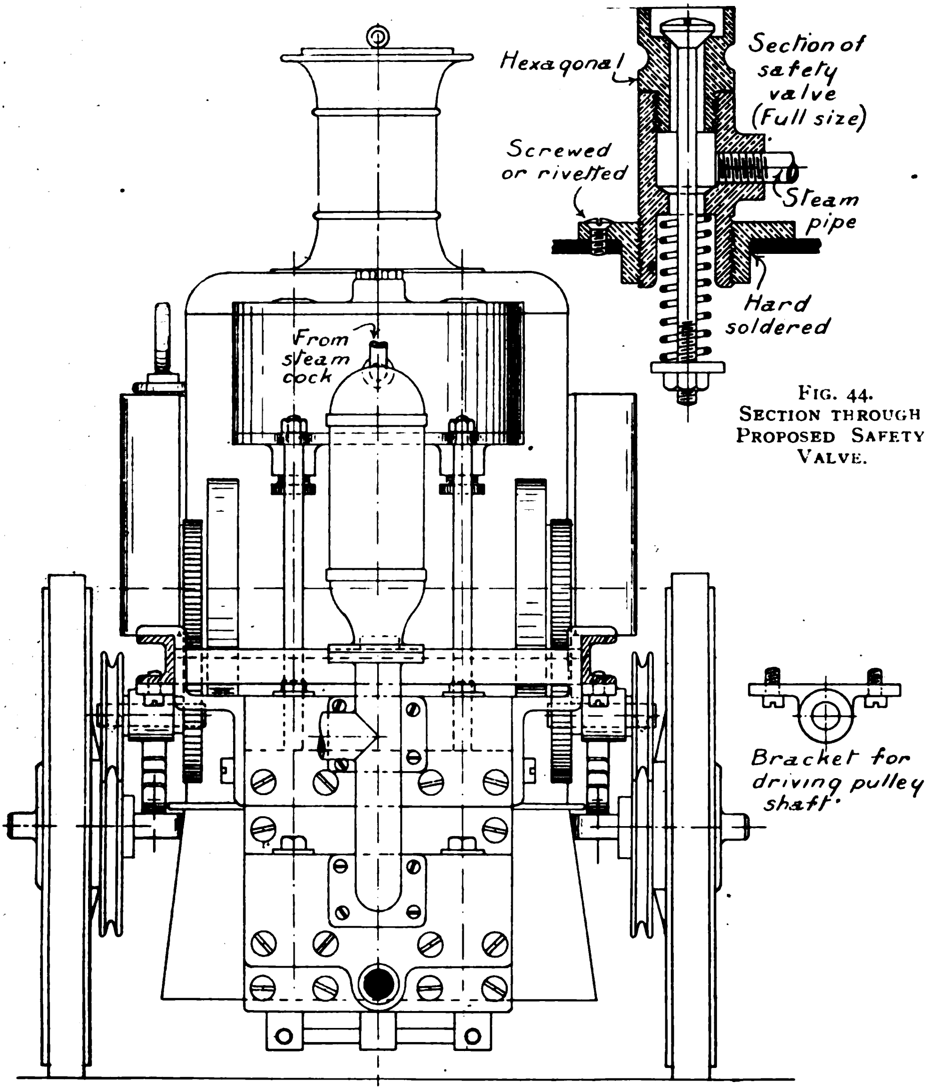


FIG. 44. SECTION THROUGH PROPOSED SAFETY VALVE.

FIG. 42.—SECTION THROUGH MODEL, SHOWING ARRANGEMENT OF ENGINE, PUMPS, AND GEARING.

FIG. 41.—DETAIL OF CRANKSHAFT. (*Full size.*)

The crossheads are of gun-metal, and made in two parts, as shown in Fig. 40. These are steadied in their movements by surrounding at each end the steel supporting columns. The lower end of the piston-rod is screwed into the boss on the upper part, and the pump rod is screwed into the boss on the lower part. To allow for disconnecting the

For propelling the model, after releasing the pump rods as described, the method of gearing is as follows, and is shown by dotted lines on the longitudinal elevation on the coloured plate. At each end of the crankshaft—which, by the way, is shown at Fig. 41—is fitted fast a gearwheel about 1⅜ in. diameter by about ½-in. face; these will come ust within the main frames of the model. The spur wheels will gear into another pair of wheels from the same pattern, supported by a bearing immediately below the main frames, and keyed to a small countershaft. On the opposite side of this countershaft bearing there is a small grooved pulley, which transmits power by means of a gut driving band to the larger grooved wheel attached to the large road wheels. In the coloured designs of the model a band-brake is shown on one side; but it is thought advisable to dispense with the brake and obtain a more efficient drive by putting both the rear road wheels into gear. When it is desired to work the pumps, the connection of the pump rod to the engine is made by means of the milled collar, and the gut driving band is slipped from the grooved pulleys.

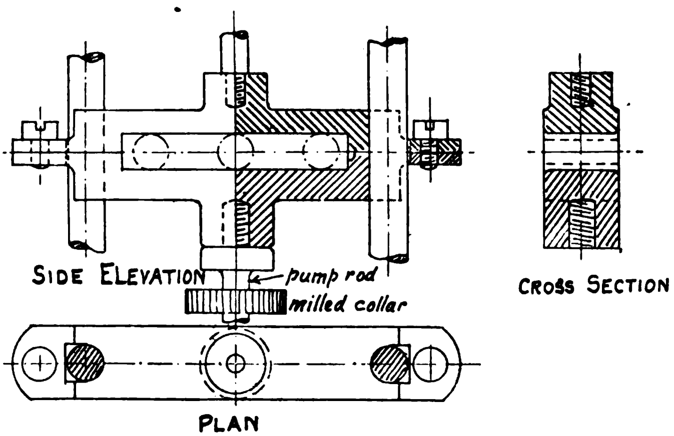


FIG. 40.—TRUNNION CROSSHEAD. (*Two thus.*)

The use of plummer blocks on small working models, as a rule gives a clumsy appearance to the work. The design shown in Fig. 43 for the main bearings of the crankshaft will be much neater. It is comprised of two parts—a kind of gun-metal seat of block, with a strap formed to fit over and allow for screwing to the frame; thus two unsightly screws are avoided. There are to be three of these bearings—one on each main frame, and one in the middle resting on a special metal bar, which rests from one crosspiece to another.

Attention may be called just here to the neat form of safety valve, the construction of which is made quite clear by the full-size section shown at Fig. 44. It is designed with a view to neatness when in position on the boiler; it is compact, not difficult to construct, and easily adjusted.

The rear axle on the actual motor fire engine is usually bent a little in order to clear the boiler fire-door. In this design for a model it has been found necessary to give it rather a large sweep around the boiler firebox. The maker of the model may, however, prefer to bend the axle so that it passes under the boiler instead of encircling it. Details are given in the drawing (Fig. 45).

The most difficult part of the model, viz., the pumps, now remains to be taken in. These will be dealt with in the concluding article next week.

(To be continued.)

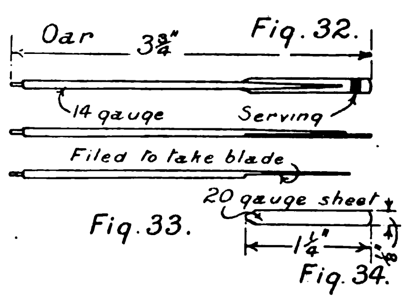
The Making of Ship's Model Fittings.

By "X. Y. Z."

(Continued from page 472.)

WE now proceed with the making of the oars for the small boats (Fig. 32). These are generally made in wood, but when made in brass are stronger and easier to make, as well as being nearer to scale. Put a piece of 14-gauge wire in chuck and turn down one end to form handle ⅛ in. long, as shown in sketch (Fig. 32). Cut off about 4 ins. long, and gently taper the opposite end, as shown in Fig. 32, ¾ in. from the end. File ½ in. round, as shown (Fig. 33), and then make the blade out of a piece of 20-gauge sheet brass, 1¼ ins. long by ⅛ in. wide (Fig. 34). Soft-solder into position and trim carefully off. Now, with a piece of fine wire, serve the end of blade as shown in sketch, and soft-solder. This operation finishes the oars, which, as in the case of lifebuoys, are painted white, and the served part painted black.

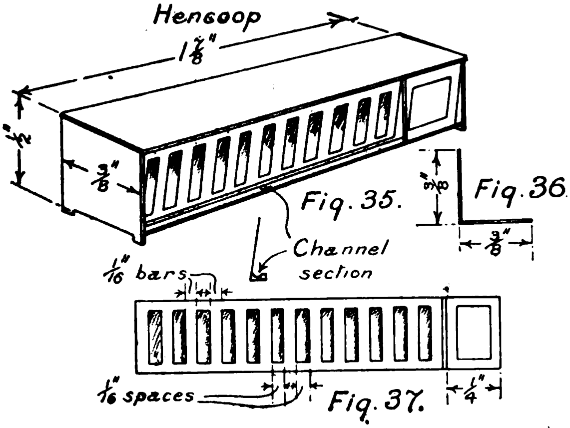
The next fitting we propose to construct is a hencoop (Fig. 35). The making of this fitting calls for a fair amount of constructive ability and patience. Cut a piece of 20-gauge sheet brass, 1⅞ ins. long by ¾ in. wide; then draw a line down centre lengthwise, take a square file, and cut nearly through and bend. This is for the back and bottom (Fig. 36). Next cut two pieces of 20-gauge sheet brass about ½ in. by ⅜ in. to form the ends, lay one of these ends on pumice stone, and lay the bottom on end and soft-solder with the blowpipe, taking care to see that some of the solder runs along the joint cut through with file; repeat the operation for the opposite end. Now file level at back, and then file the end to the shape shown in end view of sketch (Fig. 35) to form the feet. Now take a piece of 20-gauge sheet to form the top, slightly longer and wider, so as to allow it to hang over all round, and soft-solder on. The hencoop



should then be placed on a block of wood held in a vice, and filed and emery-papered all over. The coop itself being complete, we have to form the bars for the front of coop; these are made by making a piece of sheet to fit the front of coop, and setting-out to leave a bar 1-16th in. wide and then a space 1-16th in. wide, and leaving a piece for a door at the end, as shown in sketch (Fig. 37)

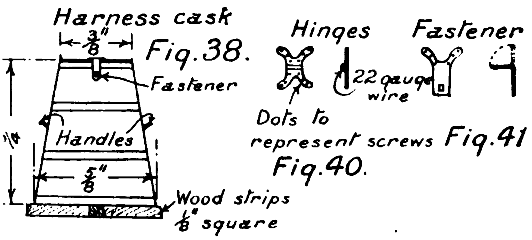
The door can be improved by soft-soldering a small square piece of brass to form a panel, as shown in sketch. A knob may also be added to give it a finished effect. This front is fitted on an angle, as shown in side view, and a piece of channel is fitted along the bottom. This is really for the fowls to feed from, and gives it a realistic appearance. This completes the hencoop, and if you have been careful, you should have had no trouble in the making of it.

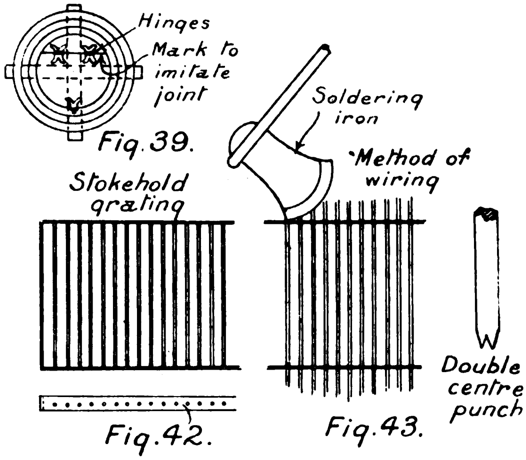
The next fitting we shall make is called a harness cask (Fig. 38), and is used to keep the salt meat in. To make this fitting, put a piece of ⅝-in. rod in chuck and turn to sizes and shape shown in sketch (Fig. 38), leaving the top slightly larger than the barrel or body, to form the lid. Mark across the top, as shown in sketch (Fig. 39), to represent the mark made by the joint of lid. Then we proceed to make the hinges as follows: Bend two pieces of 22-gauge wire to shape, as shown in Fig. 40, afterwards hard-soldering together, as shown, and embed in a piece of wood; file flat and polish. Soft-solder a piece of 22-gauge wire across to form the hinge, and they can then be neatly soft-soldered into position. The best way to solder these hinges is to tin them first, and then the solder will not run past the hinge, which ensures a neat job. To make the fastener shown on the front of the cask, bend a piece of 22-gauge wire as before; hard-solder a straight piece to it, as shown in Fig. 41, afterwards filing flat and soldering into position, as shown. A small padlock is fitted, but except in exhibition work is not the usual practice. The handles shown at each side can be made by drilling two



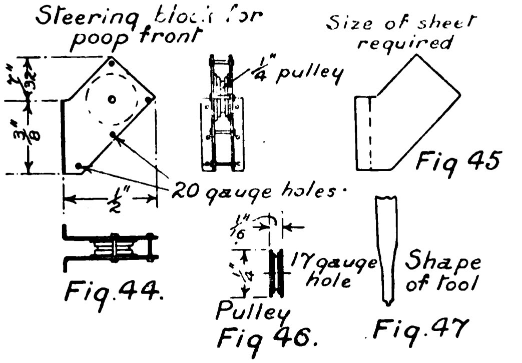
holes of 22-gauge about ⅛ in. apart, and pressing a piece of 22-gauge wire into position shown. This last operation completes the cask, but as a special finish it can be placed on two small pieces of wood about ⅛ in. square, to allow the water to escape from underneath, so as not to rot the bottom of cask. This last part is, of course, optional on the part of the operator.

The next fitting I propose to describe is called an air grating (Fig. 42), and is used to ventilate the stokehole. It is rather a simple fitting, and calls more for care than skill. Roll or hammer a strip of 18-gauge brass wire until it is 1-16th in. wide, and double the length required. Now, as in the case of ladders, bend in the centre and soft-solder the ends. The next operation is to set-out the distance of each wire; this is done by means of a double centre-punch, with the points about 1-16th in. apart (Fig. 43). Draw a line down centre and "pop" to the length you require, afterwards drilling with a 22-gauge drill. Now separate the two sides and put wires across to the length required. and solder from the outside, as





shown. Now solder a piece of the same material across the ends, and then trim all off. This completes the making of a piece of grating; of course, they are made in different shapes, but the method of construction is in all cases the same.



We will next proceed with the making of steering blocks or sheaves. There are several kinds of these, and they vary in the practice of different shipbuilders, but I propose to give you the ones used in general practice, and you will be able to make any from your own designs. The first one (Fig. 44) is used to lead the chain from the poop to the well deck. Soft-solder together two pieces of 22-gauge sheet brass, and set out to sizes in sketch (Fig. 45), and drill the holes to sizes given. Now separate the sides and polish on a piece of wood, pushing a piece of wire through holes to hold while polishing. Next turn a pulley out of 5-16ths-in. rod and about 1-16th in. wide to the section shown in Fig. 46. A small tool (shown in Fig. 47) will make a good job of these pulleys, and as you will possibly require four to six of these pulleys, it will be advisable to make this tool. Having turned the pulley and polished the sides, rivet, and cup with cupping punch the rivet ends. To do this you require two cupping punches, which have been previously described in connection with the fairleads. Place one punch in vice and use the other one on top. Now insert the cross-wires and cup these also. Next file nearly through where shown in sketch and bend at right angles; neatly soft-solder the bend and add pinholes to suit. Now scrape the edges with a turning tool or a burnisher. This gives it a workmanlike appearance.

(To be continued.)

Headstocks for Small Lathe.

By H. H. Copus.

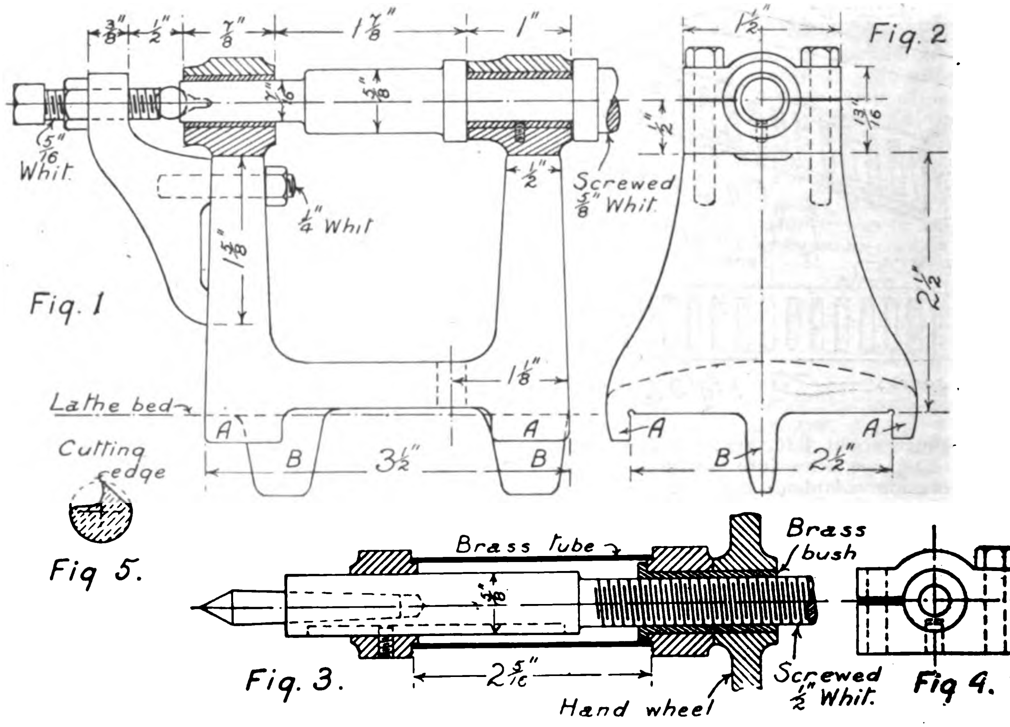
SOME little time ago I purchased a small lathe. The headstocks I found in a very poor condition, so, to make the most of my rather bad bargain, I determined to make new ones to suit. The photograph and drawings show the result of my scheming in this direction. I do not intend to pose as an expert lathe hand; but, still, my experience may help some of my fellow-readers of The Model Engineer.

Three patterns were made—one for the bottom part of the headstocks, one for bearings, and one for clamp to take up the back-thrust.

The main pieces, which were cast in iron, were taken in hand first. The projections marked A were not required on the fixed headstock, so they were cut off. On the loose headstock pieces A were left to form guides and the centre-pieces B were knocked off. (See Figs. 1 and 2.) The bases of these castings were then filed up to fit the lathe bed, care being taken that they made contact at the outer edges. Then the holes for the holding-down bolts were drilled 5-16ths in. diameter. These pieces were then bolted on to lathe bed and their tops filed level and parallel to the bed.

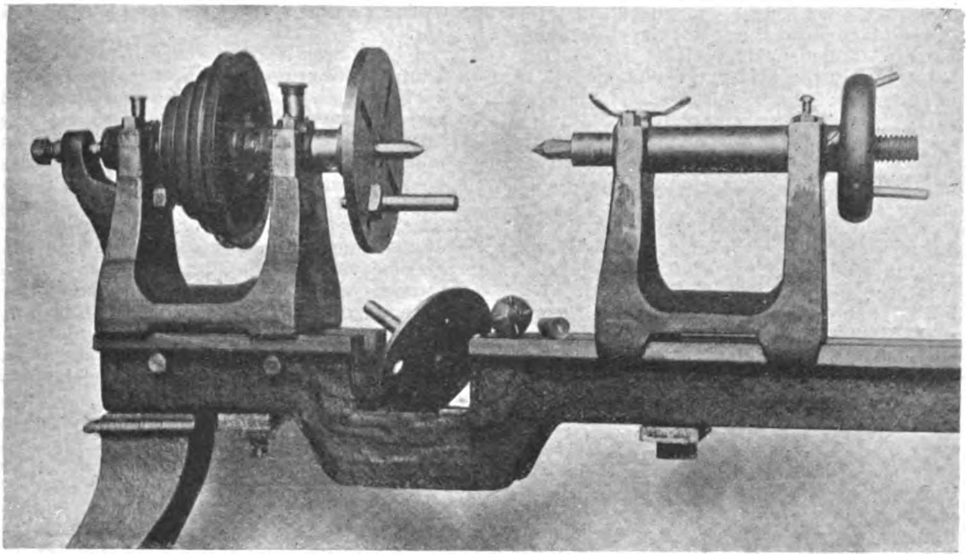
The bearings were now taken in hand and their bases fitted to the tops of the main castings already prepared. They were then ready for boring; those for the fixed headstock were split, the other two being left solid. They were bored the same way as advised in The Model Engineer for "Dynamo Armature Fitting," by A. W. M., on August 22nd, 1907, No. 330.

Brass bushes are fitted as shown in Figs. 1 and 2. The bearings are held down by 3-16ths-in. studs and nuts. For the loose headstocks, one was cast in gun-metal, the other in iron; both of these were bored ⅜ in. The one in gun-metal is shown

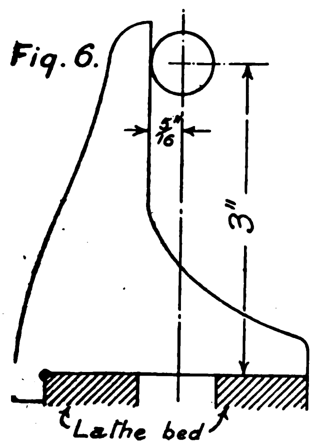


DETAILS OF HEADSTOCK FOR SMALL LATHE.

in Fig. 4; it has a cut one side to allow of tightening by means of a wing nut, the poppet spindle. The other end of this spindle is screwed ½-in. Whitworth thread; on this a brass bush fits to which the hand-wheel is fixed (see Fig. 3). This spindle is prevented from turning by a 5-32nds in. diameter pin, which fits in a slot formed in the large end of spindle. It is very important that this spindle should be parallel with the bed of the lathe. I placed the spindle in position with its bearings, then wire was wound around it, and also under the head of the holding-down bolt, which held it down fairly tight. A square may be made, as shown in Fig. 6, from stiff tinplate. This is to try how nearly parallel the spindle is to the bed. After it is correct, the holding-down bolt should be tightened to prevent further movement. The holes for the 3-16ths-in. studs may now be started with a breast drill. The bearings were now removed and the holes drilled and threaded. I ought to have said that the stud holes through bearings were drilled before this was done.



HEADSTOCK ON SMALL LATHE. By H. H. COPUS.



TINPLATE SQUARE FOR TESTING SPINDLE.

The back-thrust of mandrel is taken up by a 5-16ths-in. bolt, which passes through an iron clamp fixed as shown in Fig. 1. When the mandrel was being turned the centre-hole of one end was enlarged The adjusting-bolt had a hole made in the end. When the bolt was in its place a 5-16ths-in. steel ball was slipped in between it and the end of mandrel to take the wear; a little solder between the ball and the adjusting bolt prevented the ball from rotating.

The first thing fitted to the mandrel nose was a 3-in. three-jaw chuck. A drill was placed in this and a sinking made in poppet end; the chuck was removed and a ¼-in. drill was run into mandrel 1½ ins., ready for reamering for taper centre. The poppet was drilled likewise. In making the centres I took three pieces of ⅜-in. tool steel 4 ins. long, and turned both ends taper (about 1 in 16, I think). One of these was to make a reamer for the taper holes. Fig. 5 shows the section of cutting edge; it was filed up to shape and then hardened. The mandrel was reamered first, the reamer afterwards being reversed and placed in the hole it had made, and the hole reamered in the poppet. A carrier was fixed to reamer, which engaged with a catchplate to force it around.

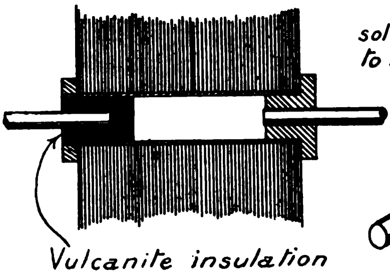
The other two pieces of tool steel were used to make two coned centres—one cup ditto, and one for wood turning. The largest piece of work I have done on this lathe was a cast-iron chuck back, 3 ins. diameter. This it did very well, although the mandrel ran three times faster than the treadle. I may perhaps mention that I had the use of a 3-in. plain lathe and slide-rest.

Further Notes on a "Dynamo-Electric" Plant for a Cycle.

By D. Peel.

In response to the many inquiries concerning the above, I am pleased to give the following information:—The field-magnets of the dynamo were taken from the "Novelty" dynamo, which being a foreign-made article, the English agent cannot supply the field-magnets alone. The "Novelty" dynamo can be supplied at a cost of 10s. 6d. By getting the complete article, the magnets are used for the electric plant, also the armature stampings and the wire. The armature shaft is ⅛ in. diameter, therefore too small to facilitate smooth, easy, and long-life running; also this shaft is made in halves as shown in Fig. 1. This shaft is very weak at the insulation point, and is best taken out, and the shaft and collecting brush as in my previous sketches, inserted. The "Novelty" dynamo may be supplied by Messrs. Parmley & Baxter, electric light and power engineers, 5, Station Road, South Shields, Durham. The armature is wound in the ordinary way for a

FIG. 1. ARMATURE SHAFT IN TWO PIECES.



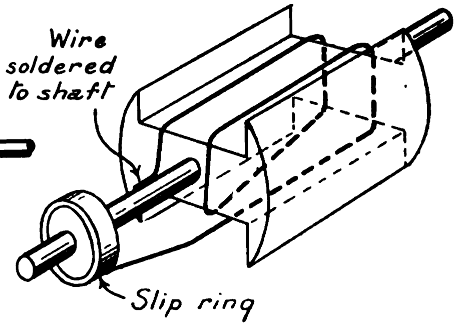


FIG. 2. METHOD OF WINDING ARMATURE.

Siemens H, as shown in Fig. 2—one end of the wire being soldered to the shaft, the other to the slip ring.

It does not matter what direction the dynamo is driven, as long as the collecting brush is set in that direction.

About another ½ oz. of wire on the armature will raise the voltage to 6 volts. The dynamo will not work any better with a drum armature. A Siemens H armature holds more wire, and the amount of wire is very important to the voltage. The diameter of the driving pulley is 1¼ ins. over rubber ring.

The field-magnets do not encircle the armature, but are exactly as shown in my previous drawings. The field-magnets cannot be heated without losing their magnetism. When pouring the lead around the magnets, the lead must be just molten and no hotter.

If the shaft is mounted in ball bearings, they will interfere greatly with the passage of the current, but this may be got over by having a brush resting on the shaft, and carrying the current along it.

The brass collecting-ring must not be split, or it will break the current every revolution. The fibre ring is only split so as to allow it to grip the shaft when the small screw in the brass ring is tightened.

The "fibre," or "red fibre" mentioned is better known as compressed paper, and is a similar material to vulcanised fibre; either these or vulcanite or ebonite may be used, as they are non-conductors and hard materials. The casing is together lead and red fibre.

The candle-power of a 4-volt Osram is 1·5; of a 6-volt Osram, 4·5 c.-p.

The average cost of the complete plant is about 15s.

I have been asked to explain why it is that the lamp is not burnt out at an excessive speed. So here I will explain to the best of my ability:—The field-magnets are permanent, hence an increase of speed does not increase the output of the dynamo as much as it would if the dynamo had self-exciting field-magnets. The current which the dynamo makes also sets up what are called "eddy currents" in the armature. At ordinary speed the effect of these may be neglected, but at high speed they become very considerable. It is my opinion that after a certain speed is reached, the eddy currents become so considerable as to neutralise the extra current caused by the speed of the dynamo. Whethet this is, or is not, the reason, the fact remains that I have found by practice that the lamp does *not* burn out even when running at about twenty-four miles per hour.

For cycles with plated rims, I would suggest that the dynamo should be driven off the tyre instead of the rim, as the plating makes it very slippery, even for a rubber drive.

A scheme for the adoption of a uniform gauge on all Spanish railways, similar to that in use in the rest of Europe, is being considered by the Corunna Chamber of Commerce and meets with universal support, but as yet the movement has not passed the preliminary stage. It is hoped that if once this necessary reform be adopted, all exports by rail will greatly increase.

Japan is about to open the main trunk railroad line constructed in Formosa since her occupation of that island in 1895. The Japanese programme of construction was laid down in 1899, and called for the completion of 272 miles of road bed in nine years. Sixty-two miles of completed road bed were taken over from the Chinese in 1895, so the main line to-day covers a total of 334 miles. Japan built the 272 miles in question at £380,000 less than the estimates. —*The Engineer*.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender MUST invariably be attached though not necessarily for publication.]

Originality in Model-Making.

To the Editor of *The Model Engineer.*

Dear Sir,—As you have invited readers of The Model Engineer to express their opinions with regard to your paper read before the Society of Model Engineers on "Originality in Model-Making," I quite agree with you in urging model engineers to use their brains as well as their hands in their model-making. I also agree with your remarks on the originality that is not required. I will quote instances.

I was invited to see a small dynamo an amateur had made, which he considered was a fine piece of workmanship. He had made his own patterns for the castings, but, Sir—the design ! He had enough metal in his dynamo to make two, and the shaft of armature, which was about 5-16ths-in. diameter, overhung the commutator and bearing about 1 in., and about 1½ ins. the pulley end, with the pulley wheel on the extreme end. Some time after my visit I happened to pass this young engineer's workshop, which led out into a side street. Over the door was a board, firmly fixed, with the following :—

Practical Model Engineer
and
Electrician.

My second invitation was to see a most ingenious piece of work, a real study of arrangements of straps and bolts, etc.

In both cases I ventured to point out the defects of these pieces of handicraft, but, Sir, I at once found out the same old proverb—" Where ignorance is bliss 'tis folly to be wise."

According to the nature of your paper you expect, Sir, every model maker, or perhaps as many as possible, to become their own draughtsman, pattern maker, turner, fitter, erector, and original thinker.

I believe you have many readers of The Model Engineer that possess these qualifications, but there are a great many who could have but won't. There are some that would try more if they could only get a little personal help and advice, and there are even some that knock up a set of castings and, when finished, put into a glass case with a plate attached bearing the maker's name and it is looked at with pride by its maker. If you happened to go as far as asking how it worked—well, that is another matter. Should you during your conversation refer to a certain article that appeared in The Model Engineer of a late issue: "No, I did not happen to see it—in fact, I do not take The Model Engineer now. It got very tame, and not at all interesting."

You have, Sir, a great task to make your ideal model-maker more general. But I believe it can be done, although it will require time.

When awarding prizes in competitions, I should suggest the first for originality, the second for originality in the construction and finishing of a set of bought castings, and a third for those who prefer to follow out the makers' set of instructions ; but included with this class of model would have to be small spanners, oil-cans, etc., a model of a, say, 2-gall. oil-can, with a label attached bearing the words : " Engine Oil," etc.

A lot of original work could be done with this class of model in the way of guard rails and floors, such as boarded floors, concrete, and tiled floors, to represent the real places they would be fixed on.

I believe that there are many more ways to help accomplish your desire. But I think I have said enough for the present.

You might, inquire—why don't I practise what I preach ? Well, Sir, I do, and it is in this way: I find my pleasure in making sketches and shaping cardboard into things that have not been, to my knowledge, made by other men. When the sketches have reached the final stage they are shaped into wood or metal, as the case may be, and then follows failure and success. When I get tired of this I have a go at some model out of The Model Engineer or handbooks. The enclosed is a copy out of No. 10, or rather my idea of copying, and the way that photo was produced was to me as original as the model. It is by no means a good specimen to send you, but it was the best I could produce at the time, as I was only a beginner. It appears to me, Sir, you have had an acorn of originality you have longed to plant for some time, and I should say, as you have already set that seed, I hope you will live to see that fine old oak tree, a real British specimen.—I am, dear Sir, yours faithfully,

W. A. Gadsden.

Boiler Feed Pumps.

To the Editor of *The Model Engineer.*

Dear Sir,—I have read with much interest your reply to Query 20,457, as I had intended at a future date making a similar boiler, but larger, following the design of Mr. R. H. Bolsover, in The Model Engineer of March 23rd and 30th, 1905, but using the automatic controlling device for the feed pump (not connected to engine crankshaft), as described by a writer whose name I do not now remember in The Model Engineer of June 30th, 1907, page 564, and seems to be well recommended. This contrivance I recommend (or rather, the description of it) to the notice of " J. W." (Glasgow); and might I suggest, Sir, that if any readers of "Ours" have had any experience with this or similar apparatus, they would be doing a service to not a few fellow-readers if they gave us their views as to the merits or demerits of the apparatus. If it is satisfactory, it is, to my mind, a much better plan to have a pump of this description with an automatic controller for admitting steam, than to have to experiment with a pump driven direct from the engine which would, in most cases, either pump too much or too little water for the boiler requirements. Trusting, Sir, this will lead to some useful information, yours, etc., Ernest Lander.

Gas Engine Firing Trouble.

To the Editor of *The Model Engineer.*

Dear Sir,—With reference to your answers to Query 20,264, October 29th, 1908, I have a Crossley ½ b.h.-p., and have been recently experimenting with a view to adopting electric ignition in place of tube, and find it not successful. I have obtained one or two small explosions, which strongly suggest that your doubt as to dead gas militating against the system where the ignition is some distance from cylinder is just.

If your querist would care to come over and see my arrangement, I beg to offer him a hearty welcome.

I may add that the electrical parts I used are in constant use on my motor cycle, and I checked them off during the trials. In order to give the system every chance I arranged a long period of contact, and also subsequently added a piece of ½ in. iron gas pipe 15 ins. long (with end stopped), so as to approximately get tube conditions all but the heat.—Yours faithfully,

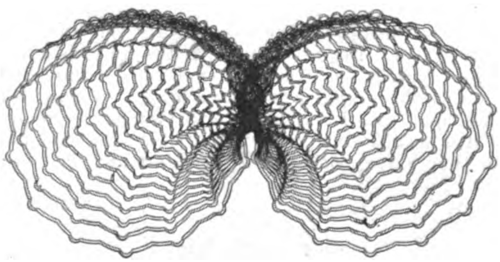
S. H. WRATTEN.

2, Courtney Road, Waddon, Croydon.

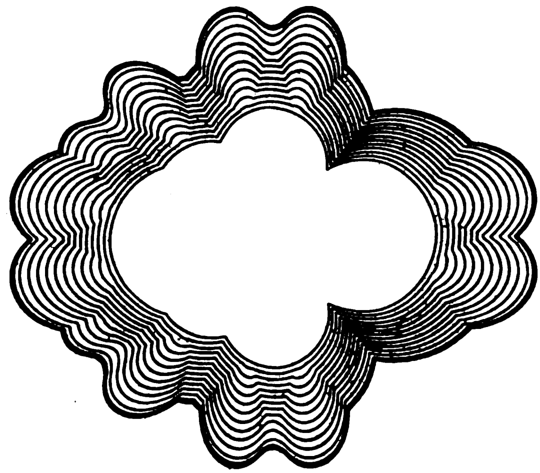
Rose Turning.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I enclose a dozen patterns executed by a new form of rose-turning apparatus which I have designed and constructed. The variety of waves



that can be produced is practically endless. The peculiarity of the specimens is that in most of the external figures the waves alter in contour, and in



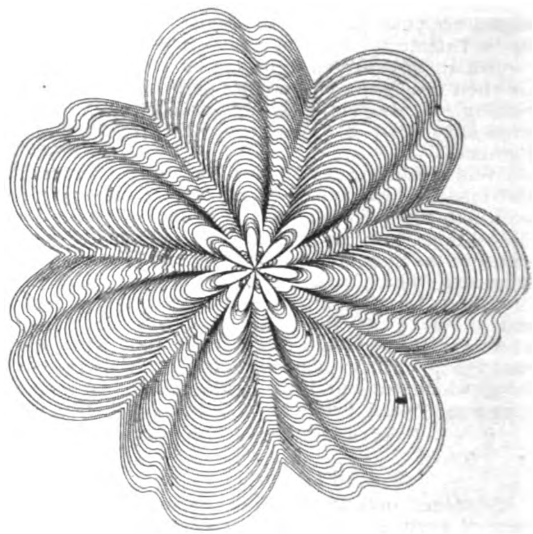
some cases disappear. Though vanishing patterns have long been done on rose-engines having two barrels of rosettes used in conjunction, so far as I am aware the effects shown cannot be produced in that way. Waves can also be executed that vary in depth as the pattern proceeds, a specimen of which is exhibited. Not only can patterns be cut on the "face," but also on the cylinder. Hoping you may consider the above-named worthy of reproduction in your valuable paper, I remain, yours truly,

J. FELL.

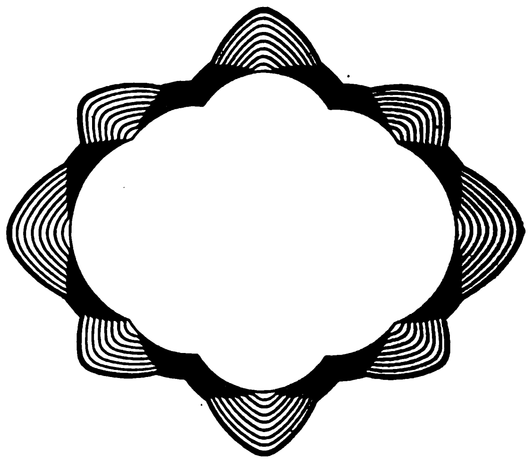
Small Belts for Driving.

TO THE EDITOR OF *The Model Engineer*.

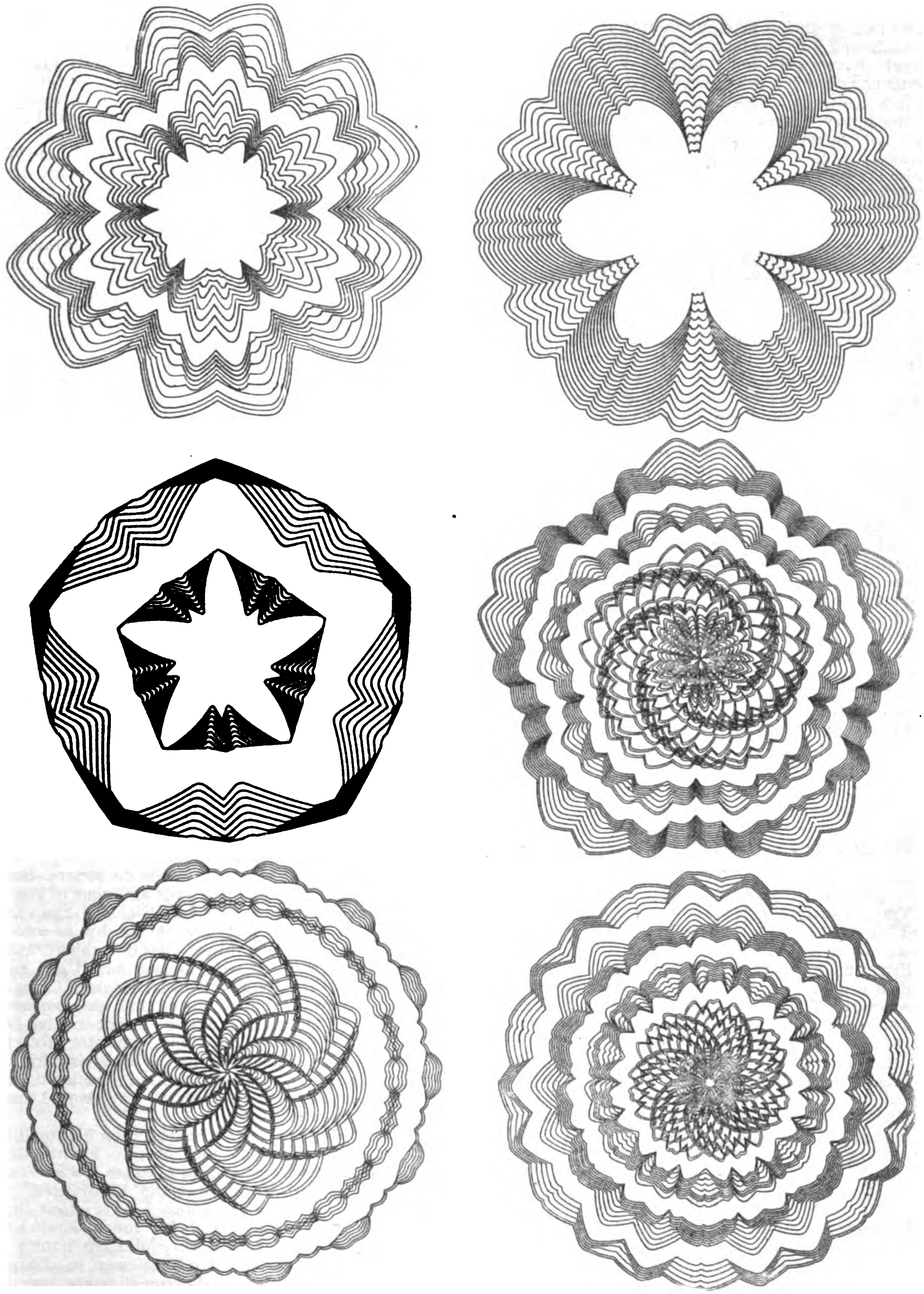
DEAR SIR,—As several readers have lately given their experiences with different kinds of cords and



belts for driving grinding spindles, etc., from the lathe overhead gear, I venture to add my own

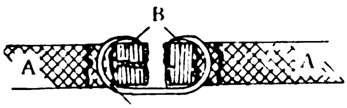


experiences in that direction, in the hope they may be of use to others. When power is available, and the tackle is in almost constant use, round or flat leather is best, and it can be joined by a wire link



EXAMPLES OF ROSE-TURNING. By J. FELL.

the same as sewing machine belting is. If the link is sunk well into the leather, the result should be a sweet drive with no "jump" every time the fastener goes over the pulleys. Catgut is also good on power-driven lathes, but the great objection to it is the heavy "click" made by the ordinary hook-and-eye fastener. For ordinary workshop use, however, this is of no great consequence, as the noise is swallowed up in the general row of the shop.



On a footlathe both gut and leather will be found to drive rather hard if used in sizes above 3-16ths in. For light work, and where it is desirable to both see and hear what the tool or grinding wheel is doing, the writer has found nothing better than common venetian blind cord, the ends being butted together and sewn with waxed thread and the join afterwards well waxed. Used thus, and in conjunction with centre hung overhead wheels, a 1-16th-in. slot drill could be "heard" cutting brass. So much for its silence. However, it is not always convenient to cut and re-sew the belt every time it is taken off, and so herewith is sent a sketch of a form of joint the writer has used in this material for the last four years. The steel link should be made from piano wire about 3-32nds in. diameter or less, and the ends of the cord be bound *tightly* with fine binding wire; the holes for the insertion of the hook being pushed through with any fine-pointed instrument so as to avoid breaking the fibres of the cord. This is cheap, easily made, and practically silent and free from jump. It will drive the finest drill or a 6-in. emery wheel with equal silence and sweetness.—Yours faithfully,

E. W. FRASER.

The Society of Model Engineers.

London.

VISIT.—Saturday, November 21st, the Gas Light and Coke Company Works at Beckton will be visited.

FUTURE MEETINGS.—Wednesday, November 25th, annual general meeting. All members are requested to attend. The subject selected for this meeting's Workmanship Competition is "Boiler Fittings."

Wednesday, December 16th. Paper by Mr. L. M. G. Ferreira on "Methods of Testing and Comparing Model Locomotives."

Full particulars of the Society and forms of application may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

Provincial Societies.

Birmingham.—A very successful meeting of the above was held at 6, High Street, Birmingham, on Wednesday, November 4th. There was an attendance of twenty, and after the official business of the evening was completed, some very interesting work made by some of the members, was shown round. Mr. T. Pearks exhibited some very fine work in connection with his model locomotive, and Mr. Powell brought with him a beautifully-made milling spindle. There were also some smaller parts on show, made by other members, which were very nicely finished and proved the patience and perseverance of the amateur model maker.

The next meeting of the Society will be on Wednesday, December 2nd. The membership of the Society is now about thirty, and any fresh members will receive a hearty welcome at the next meeting. The subscription is 5s. per annum, or 2s. 6d. per half-year, both payable in advance. Entrance-fee, 6d., to be forwarded to Sercetary with application for membership. All further information concerning this Society can be had from the Secretary, C. H. HAWKESFORD, 3, Boscombe Road, Greet Hill, Birmingham.

Bradford.—A very successful meeting was held on Nov. 2nd at the Midland Dining Rooms, Foster Square. Two new members were enrolled. Mr. T. Wilson exhibited a horizontal engine and a Stuart vertical engine in course of construction. Mr. Arthur Firth brought a set of 8-in. four-jaw chuck material. These, as well as the models, were very much appreciated by all the members. Mr. G. V. Watts, of Shipley, has consented to bring a steam turbine next meeting, November 16th. It has been decided to hold meetings on the first and third Monday in each month. After a most enjoyable evening the meeting terminated at 10.15.—AMOS BARBER, Hon. Sec., 15, Hartington Terrace, Lidget Green.

Manchester.—On October 29th, the members of the Manchester Society of Model Engineers held a meeting at the Electrical Exhibition, Manchester. About fourteen members managed to be present; but owing to the enormous number of visitors to the Exhibition on this occasion, it was impossible to account for all who may have been present, or to hold anything like an organised meeting. However, a pleasant evening was spent by those who managed to keep together, and a visit was made to THE MODEL ENGINEER Stand, which was besieged by the members, much to the consternation of the two gentlemen in charge. The siege having been raised, a descent was made on Messrs. Burton Griffiths & Co., where the pros and cons of the new Drummond lathe were eagerly discussed, the various details of the lathe being shown by an obliging attendant. Among other items which excited particular attention were a magnificent gas engine shown by the National Gas Engine Company, which, shown running on suction gas, worked as silently as an electric motor; a fine model boiler on Messrs. Galloways' Stand; the big 100 h.-p. Diesel engine, direct-coupled to an alternator; and the extremely neat high-speed, enclosed type, Sisson engines, which, by the way, would be excellent types to model.

The Committee beg to express their hearty thanks to the Publishers of THE MODEL ENGINEER for their kindness in exhibiting a notice *re* this Society on their Stand throughout the Exhibition. The Secretary begs also to express his very best thanks to Mr. Percival Marshall for much kind advice given in the course of a very pleasant hour's conversation, and to the two gentlemen in charge of the Stand for their unfailing courtesy on every occasion.—BASIL H. REYNOLDS, Hon. Sec., 35, Torbay Road, Chorlton-cum-Hardy.

Liverpool and District Electrical Association.

A MEETING of the above Association was held at the Common Hall, Hachins Hay, Dale Street, Liverpool, on Tuesday, October 27th. After several new members had been accepted, a most interesting paper was delivered by Mr. J. J. Richardson, of Liscard, regarding, "The Efficiencies of Steam Boilers," which was illustrated by a number of curves, and also several statements containing much statistical information. The chair was taken by Mr. J. Greenhalgh, of Birkenhead.—SAMUEL FRITH, Hon. Secretary and Treasurer, 77, St. John's Road, Bootle, Liverpool.

For the Bookshelf.

[Any book reviewed under this heading may be obtained from THE MODEL ENGINEER *Book Department, 26–29, Poppin's Court, Fleet Street, London, E.C., by remitting the published price and the cost of postage.]*

A new series has just been issued entitled "Metal Working," edited by Paul N. Hasluck. The series is to come out in twenty-four weekly parts, and will include information on all branches of metal work—from foundry and smith's work, surfacing metals, &c., to repoussé work and ornamental decorative brass work. The price of each part is 3d. net. Postage 1d.

Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

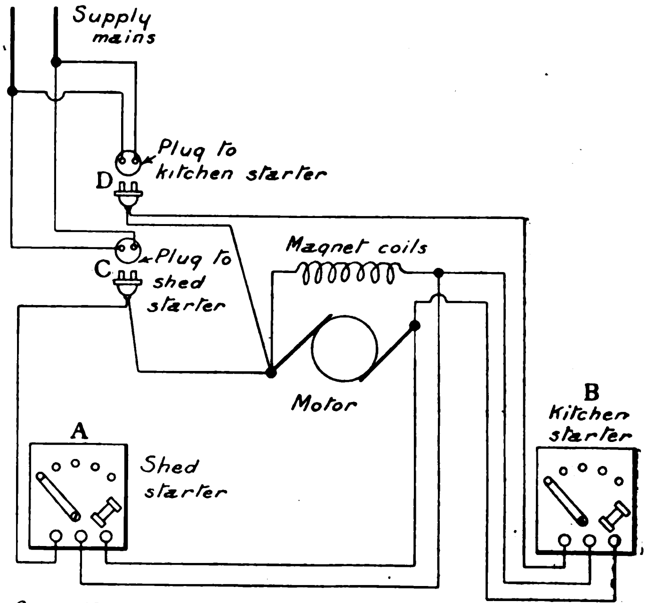
Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]

The following are selected from the Queries which have been replied to recently:—

[20,538] **G.W.R. 4—4—0 Locomotive.** A. W. R. (Brighton) writes: I should be glad if you can forward me a drawing of a G.W.R. 4—4—0 express engine and tender, to make a model from.

Please refer to our issue of June 14th (1906), which contains both drawing and photograph of one of the G.W.R. "County" 4—4—0 express passenger locomotives. The issue can be had for 3d. post free from our publishing office.

[19,586] **Pump Motor Failure to Start.** W. C. (Norwich) writes: Kindly give me advice on the following matter. I have fixed a 1 h.-p. motor for driving a pump, the motor and pump being in a shed 60 yds. from the house. I want to start the motor from the kitchen in the house without having to go to the shed, and also I want to start the motor in the shed independently. I have fixed two starters with no-voltage release (as shown in the enclosed sketch); starter A is in the shed, B in the house kitchen. The wires from the kitchen switch to motor are vulcanised, best quality, in an iron pipe underground; the main supply wires are in a separate pipe. The current is brought to two wall plugs (C and D) in shed, and through these to motor and starting switches. When we want to work by switch in the shed, the plug C is inserted; and to work from the house plug C is withdrawn and plug D inserted. Now, I find the motor will start from either of the starters when coupled up to them separately, but when all the wires are connected as in sketch, and the plug D inserted, on starting from the kitchen B the motor armature runs at a tremendous speed and fairly hums when running light, but pulls up directly the belt is put on and stops, and the switch lever won't hold on when the motor is running. I then disconnected the wires from the shed starter A by taking them off at the motor terminals. The motor will then work and run all right from the kitchen starter. I then tried the other way by taking the kitchen starter wires out of motor terminals and connecting the shed starter wires to motor and found that the motor would work all right from the shed starter, but I cannot get motor to work from the kitchen starter when all are connected up. What is the cause of this? Everything is new and seems all right. I shall be glad of your help in this matter. I have looked through the last three



Query 19586.

volumes of THE MODEL ENGINEER, but cannot find anything bearing on this kind of thing. I may add the motor is used for other work in the shed, but the pump supplies the house with water and is belt-driven, and it is necessary to be able to start the pump at any time from the kitchen.

There seems to be nothing wrong with motors, starters, or wiring. The trouble is evidently due to the fact that with the type of starters used (which are usually of a quite satisfactory type), the resistances in the starters are permanently connected across the field and armature terminals of the motor even when the starter handles are at "off" position. Consequently, when you switch on current at one starter it goes through the resistances of both in parallel to the armature. The joint resistance is now too low and the field coils do not obtain full excitation; therefore, the armature runs in a weak field. Result: excessive speed and no power. The remedy is to loop out from either field or armature lead of the shed starter to a plug or switch in kitchen and ditto from the kitchen starter to a plug in shed, so that one starter can be cut out. Or put both plugs in shed and cut out the starter which is not to be used. This query is really outside the scope of our columns. It should have been dealt with by an electrician on the spot.

[20,536] **Charging from Bichromates.** E. B. (Birmingham) writes: (1) I notice that the zincs of my bichromate charging battery are eaten away very rapidly during charging, being practically eaten off after an eight or ten hours' charge. Is there any cause of this except the amalgamation? as this was done very thoroughly just before charging. (Jars are quart size, current 1 amp.) (2) Would there be any advantage in using porous pots in this battery? (3) If porous pots are used, is it necessary to take them out of the jars when not charging, or may they be left in the solution? I only charge once a week, or less. (4) If I connect voltmeter across battery during charging it only shows about 4½ volts, whilst if I disconnect accumulator, it shows nearly 6 volts. Why is this?

(1 and 2) The amalgamation would not be the "cause" of the waste of zinc. It is done on purpose to prevent the waste, and it

well done should prevent excessive local action, which is probably due to impurities in the zinc. The introduction of a porous pot will improve matters. (3) It will suffice to withdraw the plates. (4) When battery is joined to accumulator the E.M.F. of the latter counteracts that of the battery, and the resultant voltage is the difference of the two, *i.e.*, battery E.M.F. – accumulator E.M.F.

[20,134] **G.N.R. or East Coast Joint Stock Carriage.** R. C. E. H. (Dublin) writes: I should be greatly obliged if you could kindly supply me with drawings of a G.N.R. passenger coach. which I wish to build to scale of ½ in. to the foot. I have a pair of bogies for same finished, but cannot go any farther without drawing of coach itself, which I wish to make exact, as far as external appearances go.

Please send us dimensions of the bogies you have made, and we will endeavour to supply you with drawings as soon as we can obtain the necessary information.

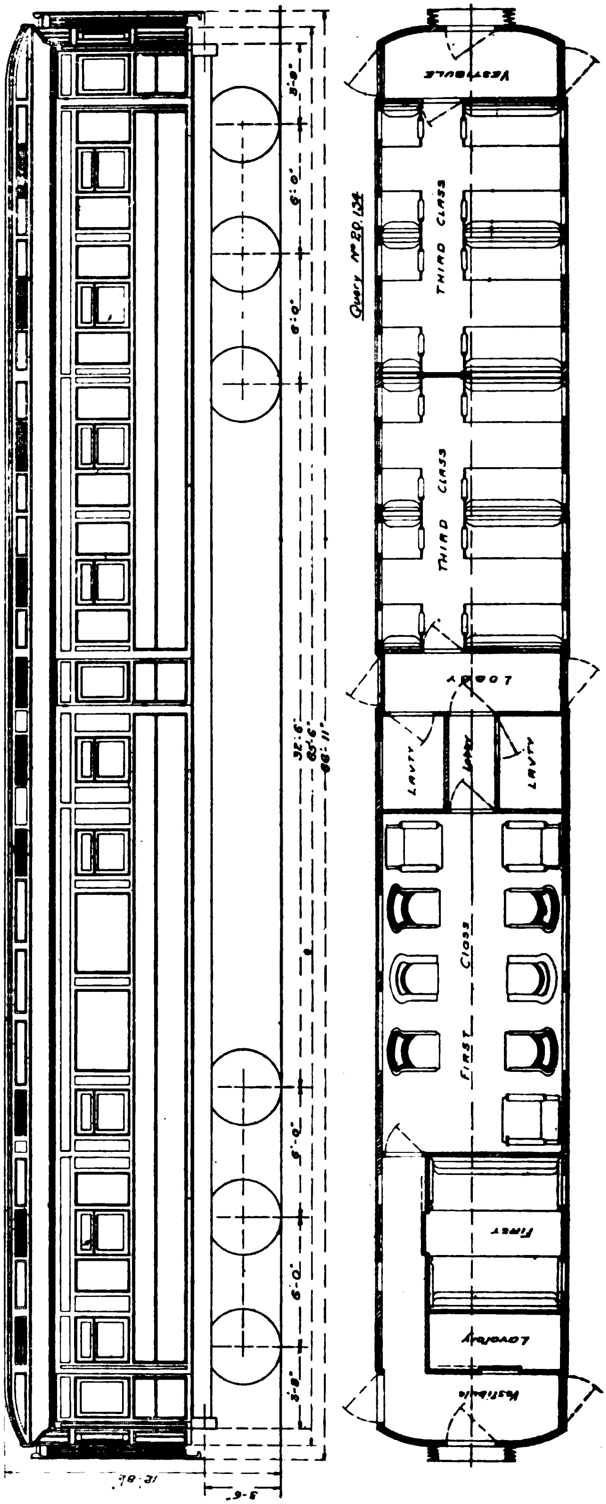
FURTHER QUERY.—I am sorry for delay. The bogies that I have are 6¾ ins. width, 3¾ ins. over axle-boxes. and wheelbase 4½ ins. (2½-in. gauge).

In reply to your Query, the only thing we can do for you at the moment is a drawing of an East Coast Joint Stock first- and third-class vestibuled corridor car. We note your bogies have a wheelbase of 4½ ins.: we presume, then, they are four-wheelers. The coach we have shown on the drawing is a twelve-wheeled one, and if you like the exterior design of coach, you might shorten it by leaving out some of the compartments to about 55 ft. long over all. To make a scale of inches take some even dimension on the drawing and divide it up into feet. Then make a mark at every alternate division and call these inches. You will then be able to read directly the published drawings in inches for a ½-in. scale model. If we, at any later date, obtain drawings of an ordinary G.N.R. (or East Coast) coach, we will make a point of publishing the same. The coach shown on the drawing herewith will be easier to make than an ordinary carriage with compartments, owing to the absence of doors. You will be able to obtain a photograph of an East Coast coach, as a guide to the lettering, from Mr. E. Pouteau, 231A, Gray's Inn Road, W.C., or the publishing department of the *Locomotive Magazine* 2, Amen Corner, E.C.

[20,288] **½-in. Scale L.T.S.R. Tank Locomotive.** P. F. (Woolwich) writes: I have partly finished building a L.T. & S.R. locomotive from instructions commenced in your issue of January 1st, 1902, but I am working to ½-in. scale instead of 1-in., as the drawings are. I shall, therefore, be thankful to you if you will help me on one or two points on which I am doubtful. (1) Shall I build my boiler to the same design, or shall I build a Smithies type? (2) What method of firing would be most advisable? (3) Shall I make use of the dome for regulator?

(1) No; we would recommend a water-tube boiler, and, to bring the engine more up to date, we recommend that you increase the diameter of the barrel and also the height of the centre of the boiler from the rail. You will find a diagram showing how this may be done in our issue of November 2nd, 1905. Of course, you can keep nearer to the standard L.T.S.R. in the matter of crosshead and other details if you like. The proportions of the boiler will, however, give you a successful model. The outer shell measures 2¼ ins. and the inner 2 ins. diameter. (2) Use about four water tubes, ¼ in. diameter. At present we can recommend nothing better than a plain spirit lamp. You might scheme a small benzoline lamp like the "Marion" torch, possibly using a couple of these lamps for the purpose of firing the boiler, the reservoir being placed in the back bunker. (3) No; there is no need to do this on a ½-in. scale model.

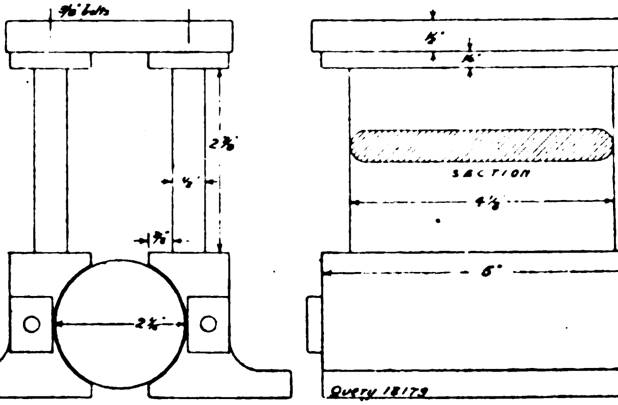
[18,179] **Small Dynamo Construction and Winding.** A. E. C. (Maidenhead) writes: I have recently purchased—from a scrap-heap—a field-magnet for an undertype dynamo, and of which please find herewith a dimensioned sketch. It is in three castings, each of which is beautifully machined, and fitted together with four ⅜-in. bolts. I have your two books, "Small Dynamos and Motors" and "Practical Dynamo and Motor Construction," but cannot find exactly what I want, as the dimensions of the castings are so oddly proportioned. An answer to the following queries would therefore be of great service. (1) What gauge wire and what quantity for—(*a*) eight-cog, eight-section drum armature, (*b*) for the field-magnet poles for a shunt winding to produce about 8 amps., the voltage, of course, to depend on output of completed dynamo? (2) What output in watts and at what speed,



G.N.R. OR EAST COAST JOINT STOCK CARRIAGE.

is to be expected from it? (3) What power will it require to drive it at full load, with power to spare for an occasional overload? I wish to make either a gas or petrol engine to drive it: which is to be preferred? (4) I have a quantity of 20 s.s.c. wire. Could I work it in on the above dynamo? (5) I have ½ lb. of No. 34 s.s.c. wire, which I intended to use instead of No. 36-gauge in making the ½-in. spark coil in your Handbook.

(1) Wind armature with No. 20-gauge wire; get on as many turns as you can, probably about ½ lb. of wire will be required. Wind two coils in each slot, and make commutator with eight sections. Wind field-magnet also with No. 20-gauge wire, about 2 lbs. on each core, connect the two in series with each other and in shunt to the brushes. (2) Possibly about 10 volts 8 amps. at 3,000 r.p.m. (3) About ½ b.h.-p. Use a gas engine. (4) The s.c.c. wire can be used but you must be very careful when winding armature not to break through the covering; D.C.C. wire would be safer for an armature. (5) Yes; but No. 36 is better.



[20,447] **Engineering Training.** D. C. (Surbiton) writes: I have a son, aged 16, who wishes to become an engineer, either civil or mechanical. Which of the following Colleges has the highest standing, and at which could he obtain the best technical and practical tuition? (1) City and Guilds, South Kensington; (2) Crystal Palace School of Engineering; (3) Hartley's Institute, Southampton. Is it better to send a boy to one of the above Colleges or into the works of a railway company or any other works?

The training for a career as a civil engineer should be considerably different from that for the career of a mechanical engineer. In either case, however, practical experience is of great importance. College training alone is not sufficient, and the procedure to follow depends upon the financial means at your disposal to give your son his start in his profession. If you are able to pay a pupil's premium, and he decides to be a civil engineer, our advice is to send him to a college now for, say, a three years' course of instruction, and then to article him as a pupil to a civil engineer in practice or to the civil engineering department of some large undertaking, or to some firm of civil engineering contractors. If he decides to be a mechanical engineer, article him now to a firm of mechanical engineers, either as a pupil or premium apprentice, for at least three years. Five years would be better. Then send him to a college when he is out of his time for, say, a three years' course. If you are unable to do more than pay either a premium or the fees for a college course, then let the college alone and send him at once either into civil or mechanical engineering work, according to his choice; he can acquire theory by evening study at some institution. The City and Guilds' Institution, at South Kensington, is an excellent college; it is rather adapted for training those who are going to be teachers or attach themselves to scientific research work; it is well equipped. We are not personally acquainted with the Hartley Institute, but it is old established and has a good reputation. The practical training at any college, though useful, is of comparatively small value; your son should go to college for theory, and not rely upon such practical training as he may obtain there. Have you read our special series of articles on "How to Become a Mechanical Engineer"? They commenced with the first issue of THE MODEL ENGINEER this year.

[20,441] **Steam Plant.** F. P. O. (Devonport) writes: Would a horizontal engine (1½-in. by 1½-in.) be capable of developing sufficient power and speed to drive a 10-volt 6-amp. dynamo at full output, if supplied with steam at 100 lbs. pressure from a boiler, as described in your issue of August 29th (1907)? Would increasing the length of generator tubes from 8 ins. to 10 ins. be an advantage, also increasing their number from twenty-four to twenty-seven? Would eight bolts (¼ in. diameter) be sufficient to hold ends of drums against a water pressure of 100 lbs. per sq. in.?

The indicated horse-power of a 1½-in. by 1½-in. cylinder engine at 50 lbs. steam chest pressure and 500 r.p.m. would be about $\frac{7}{4}\times\frac{3}{24}=\frac{1}{5}$ i.h.-p. approximately, and would consume about 6 cub. ins. of water per minute. We should think that a smaller engine (say a 1¼-in. by 1¼-in. cylinder) would do the work just as well, but if you belt the engine to run the dynamo at 3,000 when the engine is working at 300 to 350 r.p.m., and increase the heating surface of the boiler, you will obtain a satisfactory plant with the 1½-in. by 1½-in. engine. A water-tube boiler of the type chosen should not be over-engined. What is the use of 100 lbs. working pressure in a simple engine, especially when the proposed boiler would not evaporate enough water to drive the engine at this high pressure and speed? Reckon on a working pressure of 60 lbs. Each ¼-in. bolt may be calculated to safely resist a load of about 50 lbs., therefore ends should not have an area of more than 8 sq. ins.

[20,556] **Belliss and Morcom Engine.** C. H. N. (Wigan) writes: If you have the information, I should esteem it a favour if you would give me the date of the number of *Engineer* or *Engineering* containing plans and sections of a Belliss and Morcom high-speed self-lubricating compound. I am informed this engine has been described in one of the above papers.

The drawings you require appeared in *Engineering*, dated August 6th, 1897.

The News of the Trade.

*Goodwin's Castings.

We have received from Mr. F. B. Goodwin, Picton Street, Leek, several sample sets of model engine castings. These include castings for a model horizontal mill engine, for a launch engine, a locomotive cylinder, and a pair of toothed wheels. The latter were made from patterns belonging to one of our readers and are particularly clean and good castings. All the castings are nicely moulded and are made from sound soft metal, so that they should give no trouble in fitting up. Mr. Goodwin informs us that he makes a speciality of light iron castings and cored work, and also gun-metal and brass castings from customers' patterns, and will be pleased to quote for these on receipt of enquiry. We have also before us a sample sheet of instructions for fitting up a launch engine in which the method of finishing and assembling the various parts is clearly explained.

Christmas Show of Models, etc.

We have been notified by Mr. H. G. Kingston, of Tokenhouse Yard, High Street, Putney, London, S.W., that he has now opened his Christmas show of models, etc., at 4, Putney Market, where he attends personally every evening. Mr. Kingston will be pleased to see any of our readers and any of his old clients who are unable to call on him at Putney Market in the evening, at his workshop at Tokenhouse Yard during the day. He is publishing a list of his Christmas specialities which he will be pleased to send to anyone interested on application.

*A "Shift-Quick" Motorists' Soap.

Messrs. Frank Newman & Co., 195, High Street, Great Berkhamstead, recently sent us a sample of this soap which we have given a trial, and cannot speak too highly of its cleansing properties. The soap, which is blue in colour, is a thick paste made up in tin boxes. It acts instantaneously and is perfectly harmless and can be had on application to the above address.

A Motor Repair Shop Installation.

We hear from Messrs. Drummond Bros., Ltd., of Rydes Hill, near Guildford, Surrey, that they have just received an order to fit up an extensive motor repairing depôt for the Morvi State in India, which owns between fifty and sixty motor-cars, lorries, etc. Amongst a series of special tools, milling machines, etc., are included two of Messrs. Drummond's special motor repairing lathes. One of the medium light type 5-in. self-acting, sliding, boring, surfacing and screw-cutting lathes, and one of their new heavy high-speed all geared head self-acting, sliding, boring, surfacing and screw-cutting lathes. The latter tool is fitted with a novel form of turret which, when fixed to the saddle, converts the lathe into a full self-acting hexagon turret lathe capable of producing rapidly any work requiring quantities, such as standard bolts, pins, studs, etc., which are difficult to procure up country in India.

The Editor's Page.

WE have received the following letter from the Hon. Secretary of the Aberdeen Model Steamer Club on the subject of timing the competing craft in the Model Speed Boat Competition for our annual medals: "Owing to certain insinuations that have been made as regards the authenticity of description and timing of boats in last year's Speed Boat Competition, I desire, on behalf of certain members of this Society, to make the following suggestions, which are urgently needed for future competitions, so that no slurs or doubts can be cast on the performances and descriptions of competitors' boats. I would suggest that THE MODEL ENGINEER appoint thoroughly qualified and neutral persons to time competitors' boats. I have no doubt that it would be a very simple matter to get a qualified timekeeper who would be delighted to attend and time a competitor's boat, and do it gratis, and, if not, THE MODEL ENGINEER could charge a small entry fee to cover such expense. A timekeeper of a swimming or harriers' club in the town or district in which a competitor lives would be the very man; but no person directly or indirectly connected with the club to which the competitor is a member to be allowed to time any member's boat. I would also suggest that it be definitely stated where the course is that boat was run on."

* * *

We think there is a great deal to be said for the suggestion made by our correspondent, but we do not see our way to make such official timing compulsory this year, for we have already had several performances entered for the Competition, and we know that in some of the cases at least it would not be convenient for various reasons for the competitors to run their trials again. We will, however, endeavour to meet the wishes of those who have any difficulty in securing independent timing, and if a notification is sent stating when and where it is proposed to run the trial trips, we will try and arrange for a timekeeper to represent us. We cannot, of course, be expected to keep a responsible official at the beck and call of any intending competitor who wishes to keep on trying to get better results from his boat; but if those who are prepared to make a run on a given date will send us their names and state the most convenient place to run their boats, and when they will be ready to run, we will try and arrange for the timing. Personally, we should prefer for all the trials for our medals to take place publicly at some properly organised meeting, but while this might suit many competitors in big centres, we feel it would be a disadvantage to those in outlying parts, who could not conveniently get to the meeting-place, and also to others whose engagements did not permit them to bring their boats on the appointed day. The whole question of certifying these performances is a difficult one, and while we wish to be as careful as possible against inaccurate entries, we do not wish to place any competitor at a disadvantage.

* * *

Apart from the foregoing observations, we may say that our medals this year will be awarded on precisely the same basis as last. We shall admit, as we have previously stated, trips which are made on a circular course, with the boat tethered to a central post, and we are not making any special classifications for hydroplanes, which will be accepted as ordinary boats. Possibly it may be necessary next year to put hydroplanes in a class by themselves, but before coming to any decision on this point we will wait and see what this year produces.

* * *

A correspondent with the Mediterranean Fleet sends us the following experience: "I wrote to one of your advertisers ordering about £4 worth of goods. This order was received and acknowledged on October 3rd, and I was informed that the goods would be sent in *three or four* days' time. The goods were not posted until *Oct. 16th*, and timed so as to miss the parcel mail out here, which arrived on Oct. 28th. But by that mail I received a chuck which I had had made to my own drawings by an American firm, and I only posted the drawings six days before the order was sent to England, which was from stock, as the goods were advertised weekly in your journal. Now, is it surprising that trade goes to America? I might add that the American goods had to come here *via* London. I am still waiting for my English goods, but hope the next parcel mail may bring them."

Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

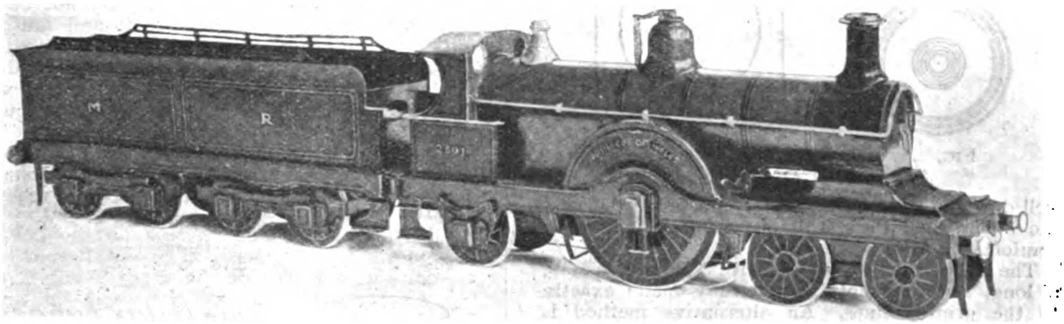
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E

VOL. XIX. No. 396. NOVEMBER 26, 1908. PUBLISHED WEEKLY.

Some Notes on Building our Cardboard Model Locomotive.

THE publication of the first design in our "Young Model Maker" series has made it quite the fashion to construct model cardboard locomotives, and young engineers—and old ones, too—the country over have little tender completed from one of these sets. The scale is so accurate, the colouring so good, and the details so complete that at first sight it is difficult to believe that so perfect a model is mainly built from simple cardboard sheets.



CARDBOARD MODEL MIDLAND LOCOMOTIVE, BUILT FROM "THE YOUNG MODEL MAKER" SET.

Midland models, either built or building. Although cardboard is so easy a material in which to work, it must not be imagined that this particular model can be built in an evening, or even in two or three evenings, for the design has been so thoroughly worked out that it is an undertaking requiring considerable patience to bring it to a satisfactory completion.

It may be said right away, however, that patience is the greatest of all the qualifications required—the model is not difficult to build, the tools required are very few and very homely, and full instructions are presented with each set. Therefore, let the young model maker proceed patiently with the work and success is assured; and what that success will be like may be gathered from the accompanying photograph, which shows a model locomotive and

Perhaps the first hint of service is in regard to the instructions. The book should be read carefully through, the various parts on the sheets identified, and the necessity of attacking the several parts in their proper order carefully appreciated. For the cutting out of the parts the use of a sharp knife is recommended, and will be found perfectly satisfactory. There is much of this work, however, which may be done with a pair of good scissors, but in this case great care is necessary in going round curves and corners to see that the cardboard is not bent or forced out of shape. When the knife is used, a piece of board, preferably of hard wood, should be placed underneath, and both card and knife must be held very firmly to prevent a false cut.

The process of thickening up certain of the parts is one which requires care. The seccotine or other adhesive must be spread very uniformly over the piece to be stuck down; this should be carefully placed in position on the thickening card, and the two surfaces firmly pressed into close contact all over and left to dry under pressure. In the case of the engine frames and other slender pieces, care must be used not to bend or distort them during the process of pressing down. Those who are fortunate enough to possess a carpenter's chisel and a gouge or two will find these tools very useful for paring round the edges of the thickened pieces. A small piece of fine glass-paper is also of service in smoothing away any irregularities; but it must be used very lightly and very cautiously or the shape of a part may easily be spoiled, or the colouring removed. Pieces which have been stuck together for thickening up should be placed under a pile of books or other weight, and left till the seccotine is thoroughly dry, as it is essential that good contact should be made all over the joining surfaces.

In building the boiler particular care should be taken to see that a sound joint is made along the bottom, plenty of adhesive being used on the butt strap, and the boiler shell being tied thereto—as shown in the book of instructions—in good contact all along its length, and left until perfectly dry. The backplate of the firebox must be cut

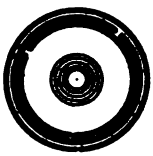


FIG. 2.

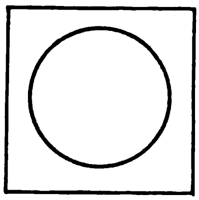


FIG. 1.

well down to size on its circular portion, otherwise the boiler shell there will be rather too large to comfortably fit the cab-front.

The wheels may be cut out with a pair of scissors, if long, sweeping cuts be carefully made exactly to the printed lines. An alternative method is shown in Fig. 3, which represents a neat little contrivance devised by one of our contributors for this purpose.

The same gentleman, pursuing his researches, arrived at a method of producing excellent built-up wheels in cardboard, which include real spokes and balance-weights, and certainly add wonderfully to the finished appearance of the model. He has favoured us with the following notes on his procedure:—

Fig. 1 represents a piece of cardboard in which a circular hole equal to the wheel in diameter is cut; this is used as a temporary "pit," in which the tread (built-up of layers of cardboard) is inserted. The first strip of cardboard is simply laid in the hole and its ends fitted together, the second laid inside the first, and so on. After fitting these nicely, so that their ends butt, the *inside* surfaces are seccotined and the whole fitted together inside the "pit," where it is left until dry and then can be removed. A perfectly circular rim on tread is thus formed, as in Fig. 2. The hub is formed of paper wound round the axle until of the right diameter, then seccotined. The hub and tread are then seccotined to a sheet of paper in the correct relative positions, and spokes of cardboard glued to the tread and hub respectively. When all is set the paper is torn off, leaving the wheel complete, except for the flange. The latter is a ring of cardboard glued to the back of the tread. For accurately cutting discs and rings the simple tool shown in Fig. 3 was made.

A straight-edge (*se*) packed up at both ends is pinned to a piece of board. A slot is cut in it,

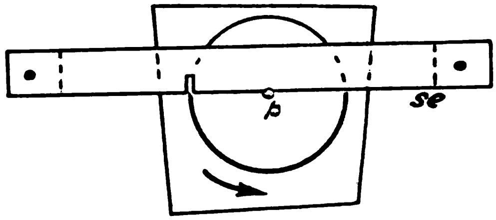
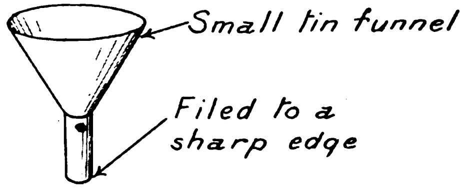


FIG. 3.

into which the point of a knife is inserted. A disc is marked on a piece of card, and the latter placed under the straight-edge so that the knife slot is on the circumference of the circle. The card is next pinned down to the baseboard by a pin through the centre of the disc, and if the knife is inserted in the slot, and the card rotated, a perfectly true disc is produced. Do not cut the disc right through, but reverse it and finish the cut from the other side. In this way the edge of the disc will be quite clean and no burr produced.

By the simple methods outlined above the writer has produced driving wheels complete, with counterweights and bogie wheels, all of which, when enamelled the right colour, enhance the appearance of the very pretty model of Mr. Johnson's fine locomotive. A photograph of one of these wheels, unpainted, is shown in Fig. 4.

FIG. 5.



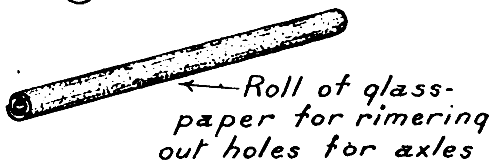


FIG. 6.

Another reader has shown some ingenuity in his method of cutting the holes for the axles, both in the frames and in the wheel centres. He took a small tin funnel which happened to be lying by, and cut off the spout at a point which corresponded in diameter to the axles. He then filed the spout round to a sharp edge, and by holding this in the hand with the thumb inserted in the mouth of the funnel, it formed a little cutting tool, which, with two or three turns, produced a nice clean-cut hole in the card. Of course, it was necessary to hold a piece of wood behind the card to receive the

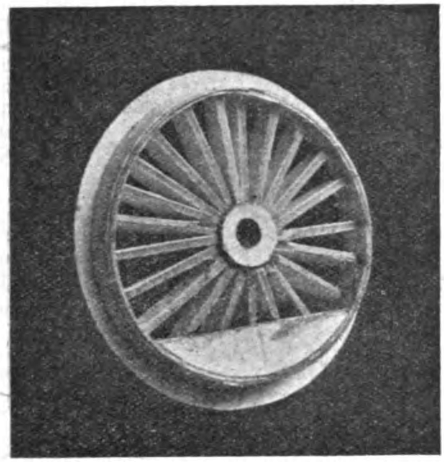


FIG. 4.

cutting pressure. This device is shown in Fig. 5. A little strip of glass-paper, rolled up as in Fig. 6, forms a useful little tool for easing out the holes in the engine and bogie frames, if they should happen to prove a little too tight for the axles.

Another suggestion emanating from one of our staff relates to the fixing of the hand-rail, the cutting out of the little pillars and their fixing to the boiler shell being a somewhat trying task. It is suggested that the hand-rail pillars be formed by piercing the boiler right through at the various points of support and passing a piece of wire through the holes thus formed. The ends of the wire are turned over round the hand-rail, and a strong job is made. This method is illustrated in Fig. 7.

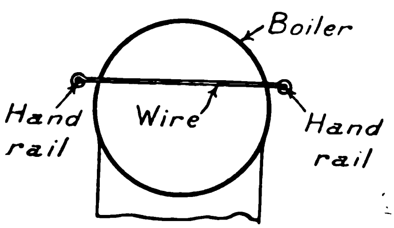


FIG. 7.

The foregoing suggestions show that in the building of this attractive model there is room for the exercise of considerable ingenuity. As with the improved type of wheels, so in other directions the details of the model may be elaborated by the builder if he cares to take the trouble, and we can say with perfect honesty that the groundwork we have provided in these sets is so good that the model is well worth all the extra trouble our readers may care to bestow upon it.

When the building of the model is completed, its appearance may be greatly improved by touching up the white edges of the card which show here and there with a suitable colour—black or red, as the case may be. The rims of the wheels may be painted with aluminium paint, or, what looks perhaps better still, a good steel grey paint. A fine gloss may then be imparted to the colours by giving the whole model a very thin coating of gum, such as is sold in penny bottles. This produces a better finish than varnish, as it is not so readily absorbed by the cardboard, and brings the colour to an exact "Midland red" shade. The gum must be put on very carefully and very evenly, to produce the right effect.

In response to several enquiries, we may add that the over-all length of the engine and tender is 14⅝ ins.

The Steam Engine for Beginners.—I.

By H. MUNCASTER.

OF all the mechanical achievements of man, none has had such a marked influence for good as the steam engine. In about the span of one lifetime it has revolutionised the world. It came unprophesied, unexpected, a simple development of

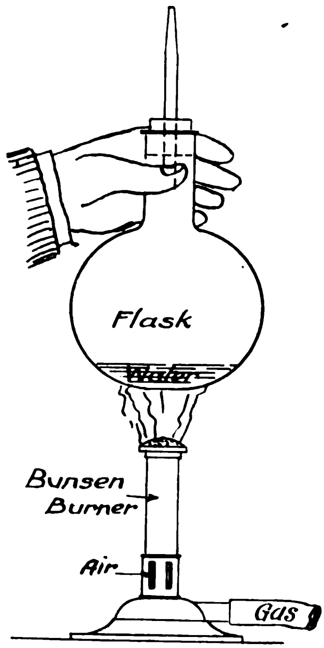


FIG. 1.

a latent idea, intended to fulfil common duties, such as the hauling of coals and the pumping of water. Savery, Papin, Newcomen, Cawley, Watt, the boy Humphrey Potter (the originator of valve gears), Trevethick, Hackworth, Hedley (the inventors of the locomotive), and others whose names are in some cases forgotten, were, without knowing it, labourers in a field where the harvest was truly great. Where the priest, prophet, and philosopher had utterly failed, or had only succeeded in more profoundly deepening the chasm that separated nation from nation, with superstition and sophistry obscuring the light of knowledge, the engineer brought the means of drawing peoples nearer peoples, dispelling prejudices and bigotry, and of bringing the dawn of the day when man was to cast off the old yoke of intolerance and of a knowledge worse than ignorance, and step out into light and liberty.

It is not intended that these papers should at all partake of an historical nature, but rather be a

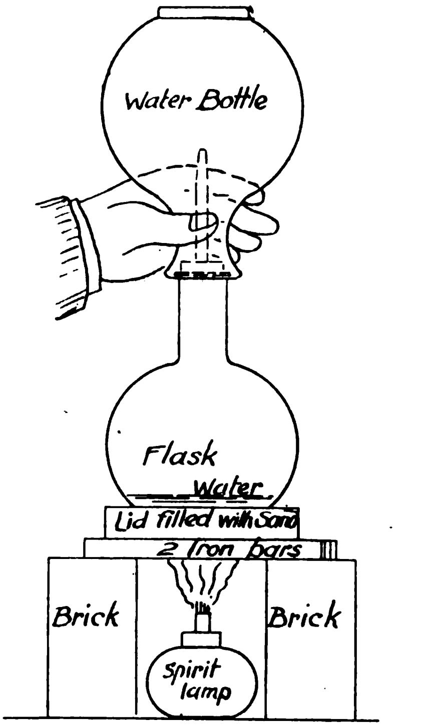


Fig. 2.

practical and easily understood description of all useful forms of the steam engine and accessories, without the use of any terms that will not be readily understood by the youth of average intelligence and training; and without resorting to any formula or figures that would require a knowledge of arithmetic beyond the rules of simple proportion. The description will include a notice of steam and boilers, as the latter is an integral and indispensable part of the steam engine, and from many points of view yields quite as interesting and instructive an object lesson as any part of the apparatus. We may look upon the boiler as a sort of mainspring, and the furnace as a key to wind it up, the power being supplied by the fuel and the oxygen of the air only; and the approach to perfection only being gauged by the ratio of the work done by the engine to the amount of fuel supplied; the best results, however, only yielding a fraction of the power actually stored up in the fuel. We will, by means of a few simple experiments, test the behaviour of a small amount of water under conditions similar to those existing in the boiler of a steam engine.

Let us first provide ourselves with a small Florence flask holding about (say) 12 ozs. to 20 ozs., a spirit lamp, a supply of methylated spirit, or, better still, if gas be available, a small Bunsen burner of the form shown in Fig. 1; or, what will do equally well, an old burner as used for incandescent gas lighting fitted on a suitable stand, a glass ear syringe, sold by druggists at about 3d., a few decent corks, a couple of yards of glass tubing about ¼ in. outside diameter, a test tube about ⅝ in. diameter, a piece of rubber pipe, a thistle funnel, a large basin of hot water, a water bottle, and a tumbler glass; also anything that may be available in the shape of retort stands, tube holders, clamps, etc., as used for simple experiments in chemical work.

Having fitted up our burner, or lamp, fit a cork to the neck of the flask, taking care that it is a good fit and not to push it too hard into the neck, for fear of breaking the delicate glass. Bore a hole in the cork to take comfortably a piece of the glass tube.

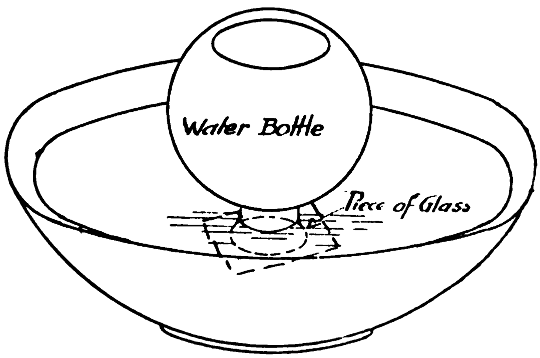


Fig. 3.

Take a length of glass tubing, and, having lighted the burner, hold the tube across the flame for a few moments, when the glass will begin to soften. Pull gently at each end of the tube, and the part over the flame will begin to elongate. As soon as this is noticeable, move it away from the flame, still drawing it until the part heated is about the thickness of whipcord, and, holding it until it is again hard. File a nick in the middle of the reduced part, and break off. The ends can then be softened in the flame so as to take off the sharp edges where the break has taken place.

Now pour about 3 ozs. of water into the flask, fit the cork in the neck, and the tube into the hole in the cork.

Wrap a small piece of flannel around the neck of the flask, and hold it over the flame of the burner, as shown in Fig. 1. The first thing to notice is the movement of the water, which is upward directly over the flame, returning to the bottom by way of the sides. This is called "convection," and is due to the water which is being warmed rendered lighter than the surrounding water. This is a very important feature, and is useful for promoting the circulation of the water in real boilers. The next thing to be noticed is the air being driven out of the tube. As the temperature rises, air is expanded by heating, and a portion is expelled. There is, however, no steam. Presently a lot of minute bubbles begin to form and rise to the surface of the water. These are of air which is held in suspension in the water. This release of the bubbles is accompanied by a humming noise, which is very familiar to every housewife as the "singing" of the kettle. Finally, bubbles begin to ascend from the bottom of the flask directly over the flame, rising rapidly, burst at the surface of the water, a somewhat vigorous motion also taking place in the water, when we know that the water has begun to boil.

Let us now support our flask so that it may continue to boil. To those who have no proper stand, a makeshift may be arranged as in Fig. 2, using a couple of bricks and two small pieces of iron bar, on which is placed a metal lid containing sand. Into the sand the bottom of the flask is bedded. After a few minutes the water again begins to boil without any noticeable "singing" previous to boiling as before. Notice that the bubbles rising burst without much report at first; but that after a while there is a decided knock, increasing in intensity until there seems some danger of breaking the flask. The reason is that all the suspended air has gone from the liquid, which is now solid and incompressible. The change in the water may easily be noticed by lifting the flask and shaking it, the water striking against the sides as if it were molten metal.

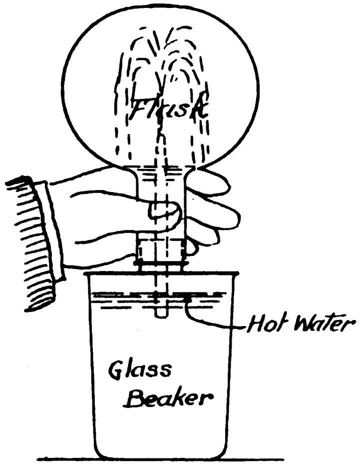


Fig. 4.

Having replaced the flask, set it to boil vigorously. As soon as the steam begins to issue out of the tube, take the water bottle and hold it for some time over the jet. The bottle will first condense the steam, which will form a mist on the inner surface of the bottle, gradually collecting into drops, which will trickle down the neck. After the bottle gets warmed, the condensation will not take place to such an extent. After the air is expelled, lift the neck clear of the tube, slip a piece of glass across the mouth, and bring it quickly down, so that the neck is about an inch into a large basin of cold water, as in Fig. 3, at the same time slipping the glass from under, leaving the opening free. The steam in the bottle will be suddenly condensed, and the water will be violently forced into the bottle, almost filling it. This will represent the action of a condenser, where the steam is condensed to form a vacuum.

A further experiment may be made by reversing the tube in the flask, so that the reduced end is inside the flask, and sufficiently far to reach above the water when the flask is inverted. Wrap a cloth around the hand for fear of accident (the flask may collapse under vacuum). Take the flask while the water boils, and quickly invert it, holding it over a beaker of *warm* water, so that the tube dips under the surface, as shown in Fig. 4. In a few moments the steam in the flask will condense, and the water in the glass will be forced up the tube into

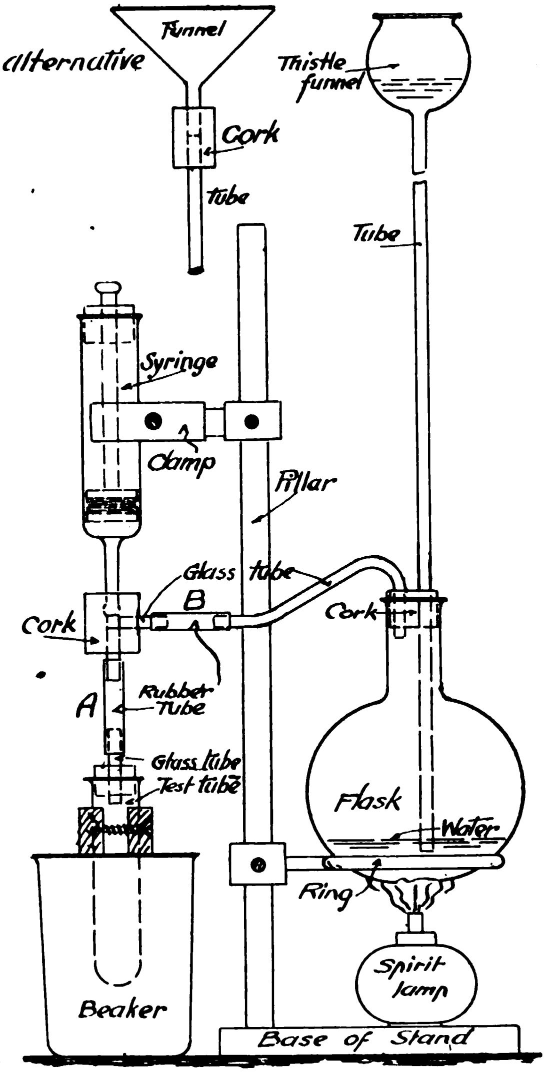


Fig. 5.

the vacuum. If the water in the glass be nearly boiling the vacuum will not be perfect, as steam will be evolved from the water in the flask boiling at a lower temperature when the atmospheric pressure is removed. We shall have a miniature fountain inside the flask. If we refill the glass with cold water, taking care that the head of the tube never rises above the surface of the water, the flask will eventually be quite filled, except a small air bubble at the highest part of the flask, the size of which depends on the amount of air not displaced by steam, and on the amount of boiling the water has had, freshly boiled water giving off air with the steam.

Try one more experiment while we have the flask at hand. Put a few ounces of water (say, one-sixth full) into the flask, and set to boil. Take the cork, and put an airtight plug in place of the tube. After the water has boiled sufficiently long to replace the air in the flask by steam, put the cork in the flask, and take the flask off the burner, holding it over a basin of cold water. The water will cease to boil. Dip the fingers or a sponge into the cold water, and sprinkle a few drops on to the flask. The cold will produce a sudden condensation, and the water in the flask will again begin to boil, filling the flask with steam at a lower temperature than before. This may be repeated several times. The reason is that as the atmospheric pressure is removed water boils at a lower temperature. Conversely, the water boils at a higher temperature as the pressure is increased.

TABLE OF TEMPERATURES AND PRESSURES.

Pressure, Atmos. included.	Temp. Fahr.	Specific Volume of Steam.*
1 lb. per sq. in.	102·1	20,582
5 ,, ,, ,,	162·3	4,527
10 ,, ,, ,,	193·3	2,358
14·7 (atmos. pres.)	212·0	1,642
30 lbs. per sq. in.	250·4	838
60 ,, ,, ,,	292·7	437
100 ,, ,, ,,	327	270
1,000 ,, ,, ,,	546·5	31

A most interesting experiment can be made by fitting up apparatus as in Fig. 5. Fit up the flask with a cork, having two holes bored for glass tubes. Into one fit a tube about a yard long, having a thistle-shaped funnel at the top. If this be not available, a common glass funnel may be used, making a socket out of a cork to join it to the top of the tube. A second piece of glass tube, about 16 ins. long, may be warmed in the flame of the gas, and bent to an angle of 60 degs. at, say, 1½ ins. from one end, and fit into the other hole in the cork. Select a large cork, bore a hole right through, then a hole from one side to meet it. Two short pieces of tube are broken off, and are pushed into the cork at right angles to each other, leaving a clear passage to the hole in the side. We have already purchased a syringe, which should be carefully overhauled so that the piston works freely, and is at the same time fairly air-tight. A little glycerine and water may be poured into it by way of a lubricant. Push the nozzle of the syringe into the cork, fit a test tube with a cork and a piece of tube as shown. Rig up one or more stands to carry the parts in the positions indicated on the figure, joining the tubes at A and B by short pieces of black rubber tubing, leaving a space of about ½ in. so that the passage may be closed by nipping the tube. Pour water into the funnel until the flask is about a quarter full, and see that the lower end of the long tube is below the surface of the water. Now light the burner, and let the water boil. The cork in the test tube should be eased to let the air and steam escape for some time, so that as much as possible of the air is driven out of the apparatus. The cork may then be pushed in tightly.

If the joints are satisfactory throughout the pressure will now gradually rise, driving the water from the flask up the long tube, which will act as a safety valve. Before the water reaches the funnel the pressure should be sufficient to lift the piston in the syringe. As soon as this takes place, take a small clip (or pliers) and nip the pipe at B to close it, at the same time pouring cold water over the test tube. The steam in the tube will now condense, and the piston will be pushed down by the atmospheric pressure on the upper side of it.

If a cold wet rag be hung round the test tube, and the rubber tubes at A and B are nipped alternately, the piston may be made to move up and down a few times. The air, however, that comes over with the steam will, eventually, partially fill the test tube, and prevent the formation of a "vacuum" sufficient to enable the piston to descend, so that we shall again have to resort to the expedient of driving it out by means of steam as at first.

We have here in miniature an atmospheric engine as used in the early days of steam. The flask represents the boiler, the syringe the cylinder, and the test tube the condenser. In the same way the stand pipe and funnel are exactly on the lines of the safety appliance for relieving the pressure on the boiler, the steam not rising more than 3 lbs. to 5 lbs. above the pressure of the atmosphere, the piston being carried to the top of the stroke by the weight of the pump rods, the steam was then admitted and the vacuum destroyed. Water was passed into the cylinder to condense the steam, causing the weight of the atmosphere to force the piston into the vacuum formed underneath. A separate condenser was not generally used until the time of Watt.

(To be continued.)

* The specific volume is the cubic feet of steam at the given pressure produced by one cubic foot of water.

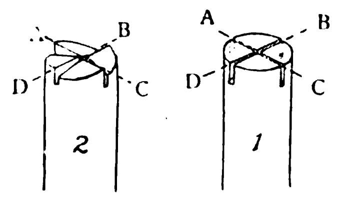
Workshop Notes and Notions.

[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "WORKSHOP" on the envelope.]

A Useful Home-made Milling Cutter.

By H. GRINSTED.

Take a short length of tool steel the diameter of the required cutter and face the end in the lathe



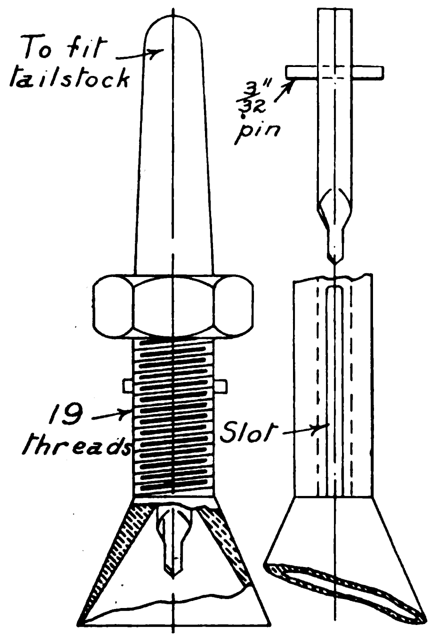
then saw two slots across the end at right angles to one another and about one-third the diameter in depth, as shown in Fig. 1. Now file away the backs of the four projecting pieces, thus giving sharp edges at A, B, C, D. Care must be taken to leave all the edges in the same plane and as smooth as possible. The cutter should then be hardened and tempered to a straw colour, and it will be found very useful for cutting keyways or surfacing in the lathe. Fig. 2 shows the finished cutter.

For a cutter less than ½ in. in diameter it is advisable to make the tool on a heavy shank, to prevent it from springing.

Combination Tool for Centreing, Drilling, and Countersinking in the Lathe.

By John Heyes.

As an adjunct to the lathe this tool will be found very handy. It should be made of mild steel excepting the countersink drill and pin, which should be made of tool steel. To use the tool, put it in place of the tailstock centre; then, having roughly centred one end of the metal to be drilled, put this end into the headstock end of the lathe and place the other end into the cone centre,



having the drill well back out of the way. Then, whilst the work is revolving, advance the drill by means of the hexagon nut shown. This nut presses on the pin of the drill and forces it into the work.

The sketch shows a tool to take up to 1½-in. round bar metal. It should be made of mild steel, with the inside face of the cone case-hardened. The drill is 2 ins. over all and is ¼ in. diameter, the pin passing through ½ in. from the back end. This pin should be slightly taper, so that it can be pushed into place and secured after the drill is in position.

The diameter of the threaded part is ⅝ in. by 1¾ ins. long, threaded 19 per in., and two equidistant slots cut out 1⅜ ins. long by ⅛ in. wide. These should be milled out.

A hole to take the drill a sliding fit should be drilled exactly in the centre, while the back-end should be turned to fit the taper of the tailstock hole.

The forcing nut will look better if made only half the height of an ordinary nut and double-faced. The cone is 1 in. long and turned to take 1½-in. bar at the largest down to ¼ in.

Drilling Holes in Lead.

By J. P. Rigby.

I wish to disclose for the benefit of *M.E.* readers, a wrinkle for drilling holes in lead with a twist drill, by putting a pinch of crushed candle wax in the start of hole after centreing to the drill. Shoulder holes can be drilled exact size of drill with a glassy smoothness to full length of drill. Of course, at a certain depth the drill requires clearing of the cuttings which come up in long tape-like lengths. A pinch of wax is required each time the drill is drawn out. By this process holes are quickly done and with a clean finish.

A Home-made Tool for Grinding Valves.

The valves in gasoline engines and automobile motors sometimes need to be ground so that they will fit closely to their seats. A very handy tool for the

Fig. 1.

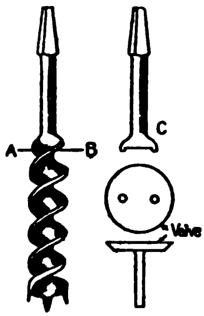


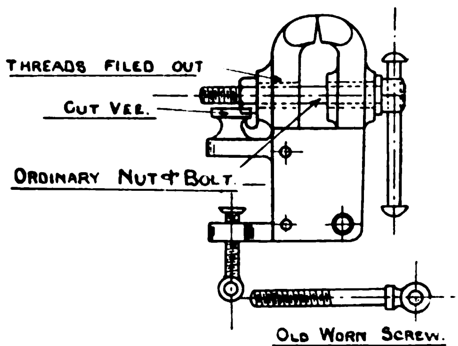
Fig. 2.

purpose may be made by using a carpenter's old bit and bitstock. The bit is cut off on the line A B, as shown in Fig. 1. The end of the remaining part is shaped as shown at C in Fig. 2. If there are no holes in the top of the valve, drill them as shown to fit the tool. A few turns with this tool, using a little fine emery on the valve seat, will make the valve fit closely. —*Popular Mechanics.*

A Common Fault Simply Remedied.

By "Edwinstowe."

The accompanying illustration shows without a very lengthy description how the chief fault of small vices may be easily overcome. The common threads of vices, which have not parallel motion, wear and



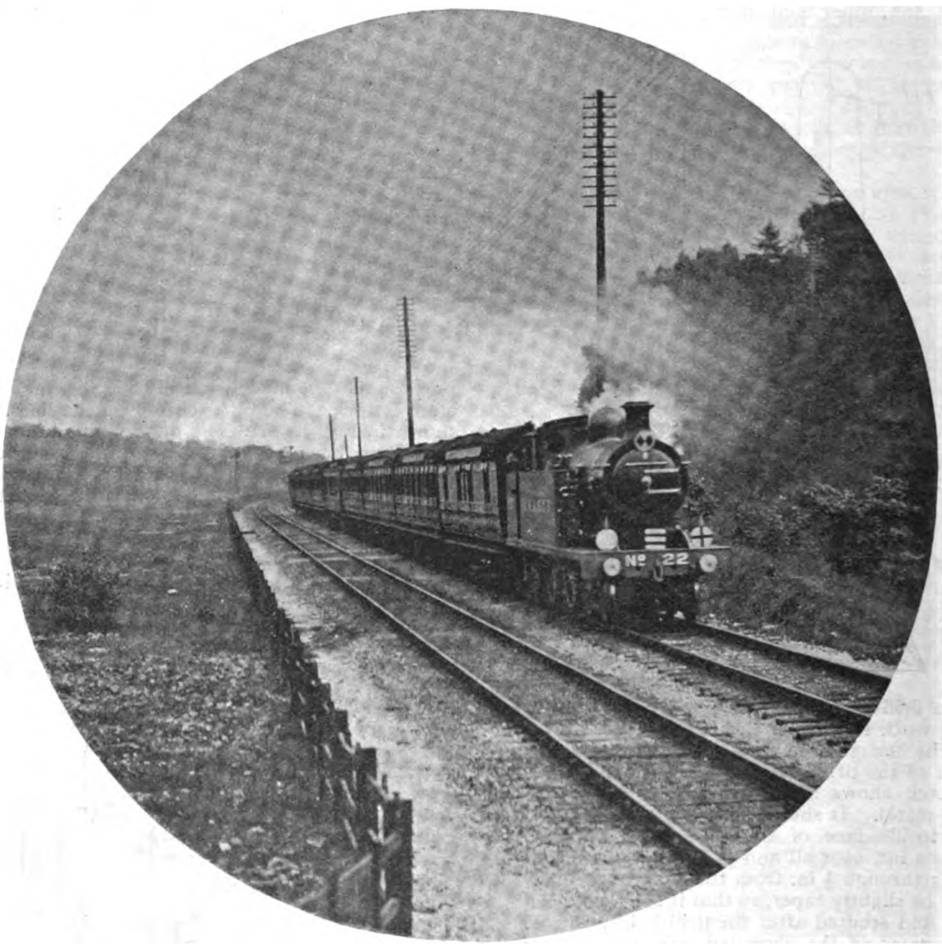
cut very quickly. This can be easily remedied by filing out the threads of the vice. Obtain an ordinary nut and bolt and drill the bolt to receive turning lever. A V-cut in the top of the anvil will keep nut in its place, and also prevent it turning round.

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

New Boat Train on the Brighton Railway.

The London, Brighton & South Coast Railway has recently introduced on its Newhaven service a new train, consisting of eight handsome bogie vehicles and a Pullman car. The train is almost invariably drawn by one of the large ten-wheeled tank engines of the 4—4—2 type designed by the present locomotive superintendent, Mr. D. Earle Marsh, and the appearance presented by the whole is a very smart and pleasing one. The carriages are of the latest standard design in the matter of external outline, and the interiors are comfortably and conveniently arranged, with roomy compartments lighted by electricity and warmed by exhaust steam. The illustrations show (1) the train *en route*, and (2) in Newhaven Harbour Station; the engine, when the photographs were taken, being No. 22 fitted with extended smokebox and Schmidt's superheating apparatus. The train affords seating accommodation for 112 first-class passengers and 272 second-class passengers, or a total of 384 passengers.

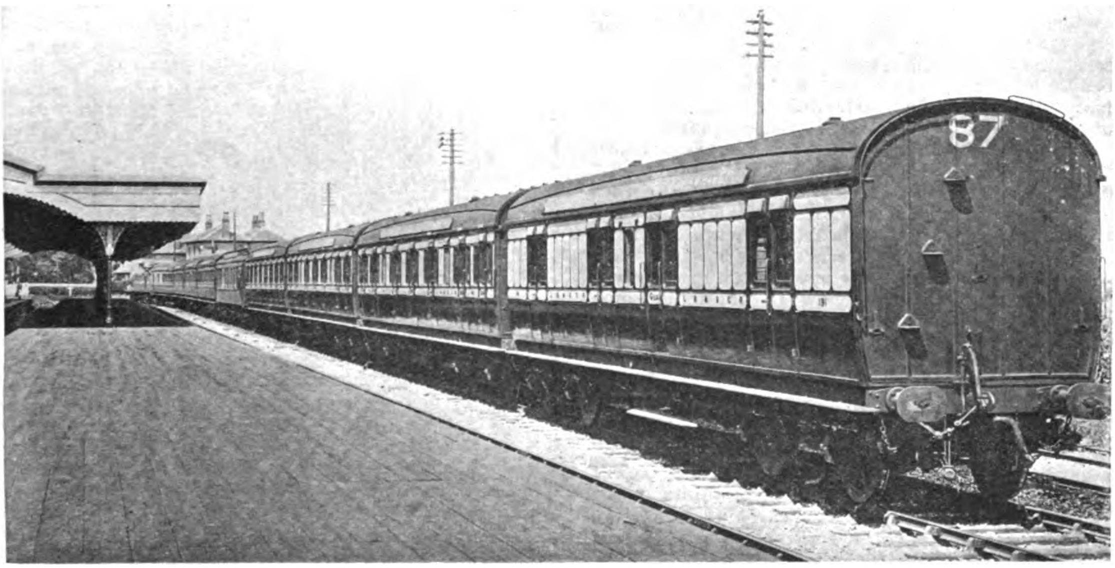


The New L.B. & S.C.R. Boat Train, near Star Lane.

Slipping Driving Wheels.

Correspondence from all parts of the country has reached the Editor and, through him, the writer, on the subject of locomotive driving wheels slipping while running with steam off. Some of the letters, as readers will have seen, have appeared in the correspondence columns of the paper, including one from Mr. John Riekie, whose thirty-five years' experience as assistant and chief locomotive engineer of an important Indian railway lends considerable weight to his views. Mr. Riekie, like the writer, doubts very much whether the slip is forward slip, and is inclined to think that what really happens is that the wheels revolve in the backward direction, a thing which is perhaps more easily explained than the opposite hypothesis. On the other hand, there are the contentions of several practical locomotive men who have been good enough to offer suggestions on the subject, and who seem to be quite under the impression, as a result of their own experiences, that forward slip is possible without steam being on the pistons.

Writing from Brighton, Mr. J. Harris Watling, who was for many years connected with the locomotive department of the L.B. & S.C. Railway, says that he originally doubted the possibility of slip taking place under the conditions now in review, but he has been assured by drivers, upon whose discretion reliance can be placed, that such a thing does indeed happen, and the conclusion which Mr. Watling has arrived at is that running at high speed, the drag of wind, or curves, we can readily understand that the momentum in the balance weights, etc., will tend to keep the driving wheels revolving at their previous speed. At times this tendency would be sufficiently strong to overcome the friction of the rails, and then the wheels would slip until that friction brought down their speed to that of the train. Another cause of the phenomenal occurrence in coupled engines is possibly this :—After an engine has been for some time in service its wheels become of slightly different diameters, due to unequal wear of the tyres. This being the case, they have a tendency to work, as it were, against one another when steam is off—a tendency which is only controlled by the coupling rods—but, when steam is on, the driving wheels control the coupled ones, and this tendency is somewhat removed. Now, when steam is shut off, the wheels would still at recurring intervals synchronise, which would, by relieving them of some load or friction, cause or allow them to slip upon the rails. Also a sudden influx of lubricant to the



Boat Train at Newhaven Harbour Station.

the pistons, or possibly some extra friction in the motion, partially stops the wheels, making the side rods clatter and the engine roll as though slipping, and this may have been mistaken for slipping ; or another possible explanation is that the heavy balance weights attain so much momentum that an extra spot of oil finding its way to the cylinders relieves the drag and the wheels spin round, but this would only apply in the case of a "single" locomotive, and not a coupled one.

Mr. Arthur H. Lucas, of Ilford, offers other suggestions which may explain the "apparent paradox" of slipping wheels without steam on. In the course of a long and interesting letter he says, "If we imagine a train travelling rapidly down an incline, with steam shut off, to have its speed retarded slightly from any cause, such as brakes, working parts might have a similar effect, because of the excess of momentum previously being used to overcome frictional resistance being suddenly transferred to make the wheels slip. This correspondent states that he has been informed by drivers that when travelling at speed down an incline through a certain tunnel with steam shut off, they have known the driving wheels to slip, and they attribute this to the greasy state of the rails in that tunnel, and to momentum in the revolving parts.

Another correspondent, who bases his views upon an article which appeared in a contemporary some time ago, and which dealt, up to a point, with the subject now under discussion, says that the phenomenon of slip without steam may possibly be caused in an engine having carrying wheels at both ends by the momentum of the heavy moving parts, together with wear of the driving wheel tyres, irregular track, and the slowing of the rest of the train—all of which agrees in large measure with the views of the previous correspondent; and the suggestion is here offered that the slipping is very likely to occur at an abrupt change of gradient from a steep down grade to one less steep, when a large proportion of the weight might be taken off the driving wheels by the carrying wheels, at each end of the engine.

Here, then, we have a variety of suggestions which are held to account for what, as everyone seems agreed, constitutes something in the nature of a phenomenon, and the question would seem to resolve itself into one of whether the slip—supposing that it really *does* occur—is in a forward or backward direction. Even as these notes are being prepared a letter comes to hand from an acting district locomotive superintendent who wishes to remain anonymous, but who says that in the whole of his considerable experience with locomotives of numerous types and sizes he has never been present when the driving wheels have slipped unless steam was on at the time. He admits that drivers have reported what they believe to have been such an occurrence, but he has always dismissed the matter as groundless, basing his opinion upon the fact that he has never had any personal demonstration of it in the course of hundreds of miles travelling on footplates.

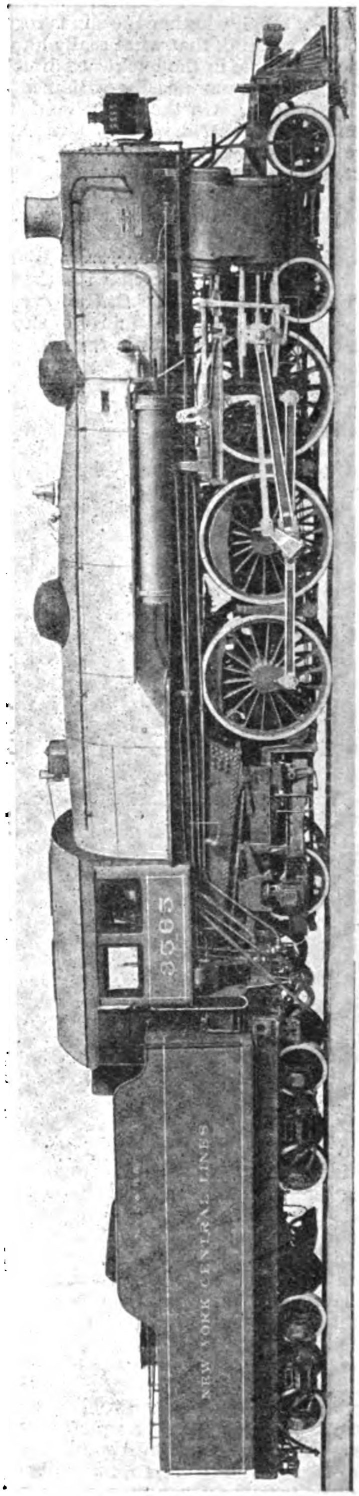
This coincides with the writer's own experience, and that of Mr. Riekie; but does not, nevertheless, dispose of the matter one way or the other. Further expressions of opinion are invited on the matter, and it would be interesting to have Mr. Henry Greenly's views, and meanwhile the writer has obtained permission to make a series of test runs on locomotives of different types with a view to obtaining some direct personal testimony on the point. The matter will be taken up afresh at a later stage.

Correspondence on other Subjects.

Apart from the correspondence on the subject dealt with above, readers have asked for information regarding the new eight-coupled locomotive on the Midland Railway, the (alleged) unsuitability of the G.W.R. locomotive "Great Bear" for the conditions it was designed to work under, and the new "Pacific" type express engine of the New York Central Lines. A photograph of the last-named locomotive appears on this page, but it is unfortunately impossible to give a separate drawing of the bogie, as requested by the correspondent, as the set of drawings in the writer's possession does not include one showing the actual construction of the bogie. The other matters will be referred to in a later issue.

The New Pacific Type Locomotive, New York Central Railroad.

As seen, this engine resembles somewhat closely the "Pacific" type engine of the Pennsylvania Railroad, of which an illustration has already appeared in these columns, but there are some important matters in which the two designs differ from one another. The New York locomotive is slightly smaller throughout than the Pennsylvania one, and there is some difference in the design of the boiler. The cylinders are single



The New "Pacific" Type Locomotive of the New York Central Railroad.

expansion with piston valves working above them, the valve gear being Walschaerts pattern with bracket for supporting the weight of the expansion link and its attachments. Special attention was paid in working out the design of the boiler, which is more generally efficient than that of the average 4—6—2 type engine. The boiler is radial stayed with conical middle ring; it is 6 ft. diameter at the front ring, and the barrel contains 382 tubes of 2-in. diameter by 20 ft. long, giving a heating surface of 3,982 sq. ft., while the firebox and arch tubes between them contribute a further 228 sq. ft., making the total heating surface 4,210 sq. ft. The grate area is 56·5 sq. ft., and the working steam pressure 200 lbs. per sq. in. The cylinders are 22 ins. diameter by 28-in. stroke, with driving wheels 6 ft. 7 ins. diameter; bogie wheels, 3 ft. diameter, and trailing wheels, 4 ft. 2¼ ins.

The coupled wheelbase is 14 ft., and the total wheelbase 36 ft. 6 ins. Weight on driving wheels, 77 tons, or 25·75 tons per axle, and total weight, without tender (in working order), 119 tons. The tender, with 8,000 U.S. gallons of water and 14 tons of bituminous coal, weighs 68 tons; so that engine and tender combined and ready for the road represent 187 tons.

These locomotives, of which twenty have been built by the American Locomotive Company, are taking the place on the fastest through trains of some "Atlantic" type engines, having 21½-in. by 26-in. cylinders developing a maximum tractive effort of 23,000 lbs., against which the new engines can exert 29,200 lbs. The "Atlantic" locomotives were satisfactory in all else but that they lacked adhesion when the heaviest trains had to be dealt with under adverse conditions.

How an Accident was Averted.

What would, according to a local paper published in the Midlands, have resulted in a very serious accident, if not a dreadful calamity, was recently avoided by the driver of a fast goods train on one of the main lines. A heavy excursion train filled with passengers was given the "right away" from a platform served by a loop off the main line, which loop rejoined the through track a little north of the station. In some way or other the fast goods was given "line clear" through the station, but as the driver of the latter approached, he noticed that the excursion train was on the move, and readily grasping the situation, he applied the brakes with full force, escaping collision with the passenger train by just four yards. The company have rewarded him with a sovereign for each of those yards. The signalman got the sack.

A New Form of Wireless Telegraph Receiver.

By G. G. Blake.

THE photograph (Fig. 1) shows a new form of wireless telegraph receiver that I have made, which is very sensitive. I have tested it to a distance of 20 miles, working untuned, with one terminal earthed, and the other attached to an aerial 40 ft. above the roof of the house, and it worked well at this distance. For purposes of demonstration I find it particularly useful; audible signalling can be carried on from the basement to the top floor of the house (four storeys high) without any earth connection, and using as transmitter the (primary) spark of an electric bell, attached to which are two short pieces of copper wire 2 ft. 6 ins. long, which act as aerials; two pieces of wire of the same length are also attached to the receiver.

Fig. 2 shows how the receiver is constructed. A is a blunt steel point, which is attached to the end of a light steel spring. The steel point rests lightly on a small piece of sulphide of iron S (which must be carefully filed till its top and bottom surfaces look metallic). The iron sulphide rests on the top of a small strip of zinc bent into the shape

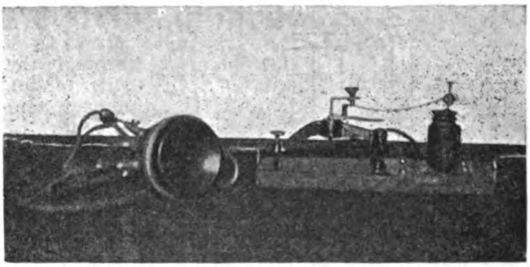
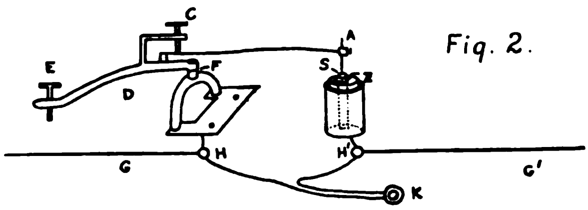


Fig. 1.

shown in Figs. 3 and 4; the zinc is pushed through a slit in an india-rubber cork Q, which fits tightly into a small iron cup Z, filled with a strong solution of caustic potash; the bottom of the cup is covered to a depth of about ¼ in. with oxide of copper (which will not dissolve). When fitted up nearly the whole of the zinc below the cork will be immersed in the caustic potash, but if amalgamated with mercury it will last for months.

D is a metal stand to which the spring B is attached; the contact between the steel point and the iron sulphide can be made more or less light, as desired, by means of two screws C and E.

The stand is pivoted at F, so that the whole



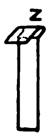
thing can be swung round to allow the chemicals or zinc in the iron cup to be renewed. H and H' are two terminals, to which the aerial wires G and G' are attached. K is a telephone receiver, which is also attached to these two terminals. I find that a telephone of fairly low resistance, such as is used on any good quality house telephone set, answers better with this receiver than a telephone having a resistance of 4,000 ohms, which I had specially wound to use with an electrolytic receiver.

The apparatus is quite automatic in its action and is self-decohering; when once it is properly adjusted it needs no further attention for a long time.

Fig. 6 shows the connections of the electric bell transmitter, which is fitted up as follows: First the bell is removed, and then a small adjustable contact-screw A is placed against the outside of the bell hammer to control its vibration, after which it is connected up as shown in Fig. 6, where M is the electro-magnet, B the contact-screw, and C the contact-spring.

The contact-spring is connected to terminal H, and thence to the aerial wire L. The contact-screw is connected to terminal H′ and to the other aerial wire L′. D is a 4-volt accumulator, of three or four batteries, and E is a Morse key (an ordinary electric bell-push will do instead of this).

Fig. 3.



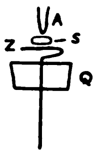
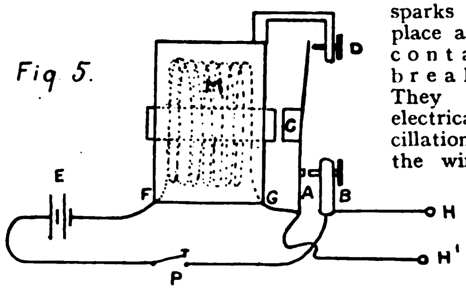


Fig. 4.

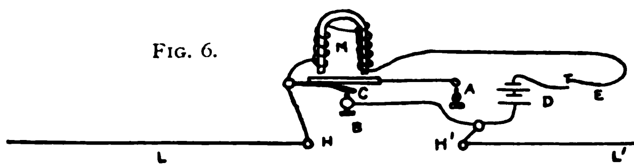
Fig. 5.



Every time the key is pressed a current flows through the coils of the magnet, and a spark or number of sparks take place at the contact-breaker. They cause electrical oscillations in the wires L and L′, from which waves travel outwards, and in turn set up oscillations in the receiving aerials G and G′ of the receiver, and anyone listening at the telephone will hear a long or short buzzing noise, according to the signals being sent from the transmitter.

Of course, as with all other forms of wireless telegraph apparatus, much greater distances can

Fig. 6.



be attained by earthing one terminal, and if this is done H′ is the best terminal to connect to earth.

Fig. 5 shows a more powerful form of primary spark transmitter. M is a large electric magnet, in front of which is a contact-breaker A B, the iron armature C of which is fixed in the centre of the spring A, opposite to the iron core of the magnet. The vibration of the spring is controlled by an adjustable screw D. E is a battery which is connected to one end of the coil of the magnet F; the other end of the coil (G) is connected to the contact-spring A. The circuit is completed through the contact-screw B. P is a Morse key, which is placed between the battery and the contact-screw.

H and H′ are the two aerial terminals. H is the best one to connect to earth.

The receiver can, if desired, be worked by the secondary spark from an induction coil; for any distance over about 1 mile this would be absolutely necessary.

Design for Model Motor Fire Engine.

By Frank Finch.

(*Concluded from page 492.*)

THE most difficult parts of the model we have yet to deal with now are the pumps. It is no easy matter to get a double-acting two-cylinder pump in such a limited space. Three main patterns must be made—one for the barrels, from which two castings will be required exactly

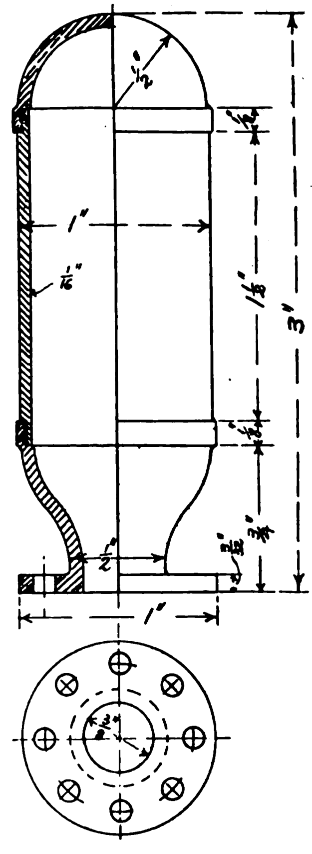


Fig. 47.—Air Vessel. (*Full size.*)

similar, and the upper and lower valve chambers. They are to be of gun-metal. With a view to lightness, the upper and lower castings are connected by a tube screwed at each end. The barrels are closed at the lower end by a screwed plug. The valve chambers are attached to the pump barrels by means of long cheese-headed screws, as shown in the plan views. There are no less than eight valves, and small cycle bearing balls are advised for these. They are kept from going astray by the protruding piece at the end of each screwed plug. To grasp

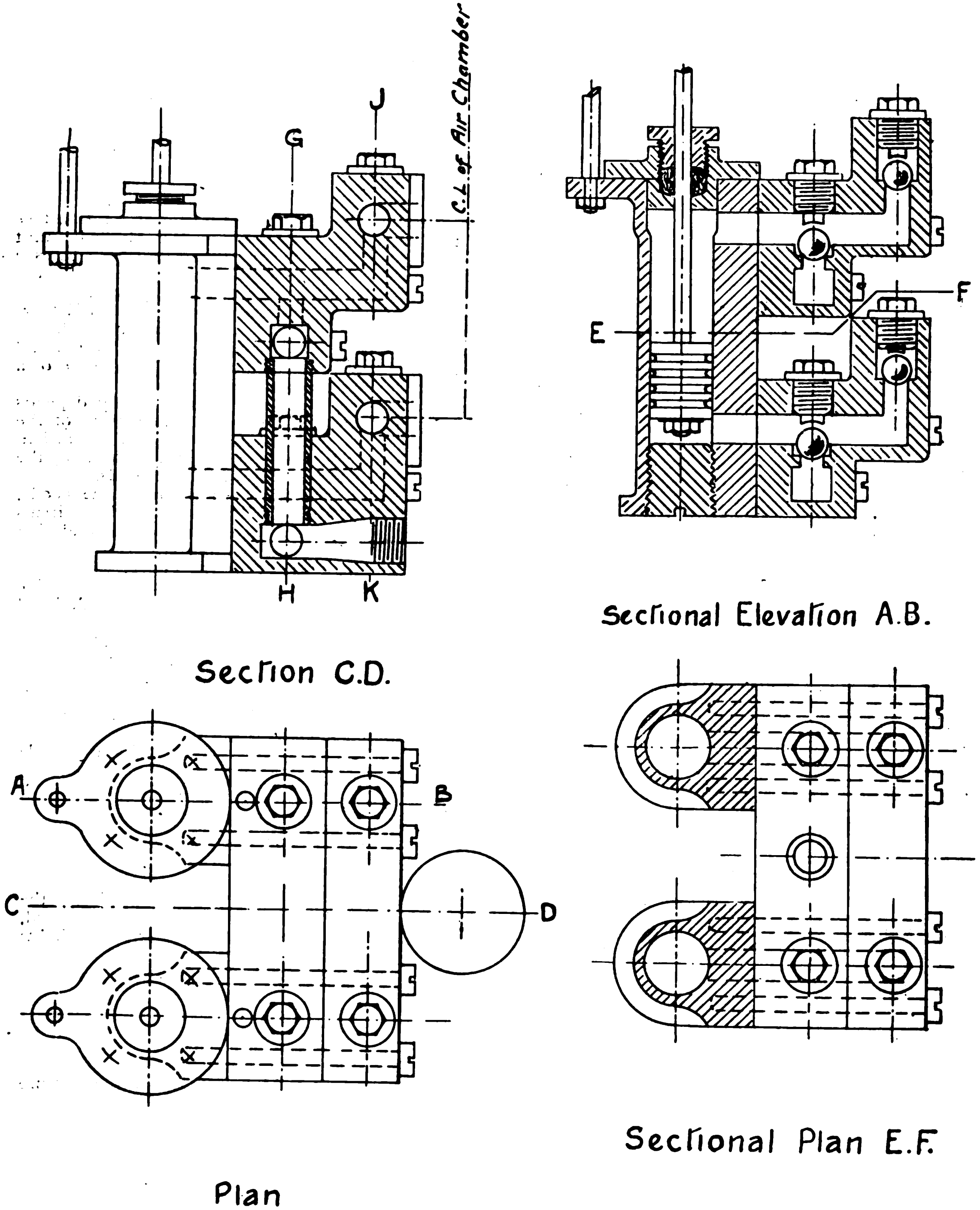


FIG. 46.—DETAILS OF TWO-CYLINDER DOUBLE-ACTING PUMPS. (*Three-quarter size.*)

the construction the various sections must be studied in conjunction with each other. On the front end elevation is shown the best method for carrying the pumps. It is by means of a hooked bracket, which is fastened to the sides of the upper valve chamber by two screws, and the brackets simply rest upon the main frame sides.

The air-vessel on the prototypes is not usually seen, being covered up by the wood box which we call the driver's seat; but a touch of polished copper lends a better effect to the model, and for this reason it has been kept in a prominent position. The detail is shown in Fig. 47. The main body is a piece of tube 1¾ ins. by 1 in. diameter, turned down and screwed for ⅛ in. at each end. The top can be beaten to the required shape and the rim turned and screwed to fit one end of tube, likewise the bottom end with flange. It may be mentioned, in concluding these articles, that there are numerous accessories which, whilst insignificant, are essential to the finished model. For instance, the hose pipe—small ⅜-in. flexible metallic tubing—is a good representation. The bell which hangs in front can be obtained from a toy dealer's. Lamps are easily made to good effect from wood or lead. When all is ready for painting, which, after all, is an important item when it refers to anything with the fire brigade, I cannot do better than refer my readers to the excellent articles that have appeared in THE MODEL ENGINEER on painting and finishing models. The brilliant red familiar to all must be carefully matched, and when the model is ready for the paint, it is advisable to compare the colour at the nearest fire station before applying it to the model. It is hardly necessary to mention that the boiler is left bright, also steam pipes, cylinders, and pumps. The parts to be coloured red include the wheels, main frame, water tank, front plate, spirit tank, and driver's seat. A little lining, if properly done, will improve the decoration, and the words—"THE MODEL ENGINEER Fire Engine"—might be added to the sides of the water tank.

The Colouring of Various Metals by Lacquering, Bronzing, etc.

By C. A. G. STANDAGE.

(*Continued from page* 401.)

CHEMICAL FLUIDS FOR COLOURING METALS.

THESE liquids are used simply by dipping the metal article in them for a sufficiently long time.

For Colouring Brass Simply by Immersion.

No. 1.—Brown tones to black:
1 pt. water.
5 drachms nitrate of iron.

No. 2.—Brown and all shades to black:
1 pt. of water.
5 drachms of protochloride of iron.

No. 3.—Brown and all tones to red:
1 pt. of water.
16 drachms nitrate of iron.
16 ,, hyposulphite of soda.

No. 4.—Brown and every shade to red:
1 pt. of water.
16 drachms of hyposulphite of soda.
1 drachm of nitric acid.

No. 5.—Brownish red:
1 pt. of water.
1 oz. nitrate of copper.
1 oz. oxalic acid.

No. 6.—Orange red:
1 pt. of water.
1 drachm of a solution of sulphide of potash.

No. 7.—Olive:
2 pts. of water.
2 drachms of perchloride of iron.

No. 8.—Blue:
1 pt. of water.
2 drachms of hyposulphite of soda.

Bronze powders are usually dusted on a surface that has been coated with some suitable agglutinant to cause the powder to adhere; in some cases a bronze paint is used, while in the case of leather articles a liquid bronzing fluid is employed.

Such a fluid is one of the easiest methods of bronzing, because the fluid is similar to a quick-drying varnish, that, when dry, exhibits a "bronzed" effect, which is generally due to the presence of a superabundance of an aniline dye.

Success in the art of bronzing greatly depends on circumstances, such as the temperature of the alloy (metallic bronzing powder) or of the solution, the proportions of the metal used in forming the powder, and the quality of the materials.

The moment at which to withdraw the goods, the drying of them, and many other little items require a care and attention in manipulation which experience alone can impart.

ANILINE BRONZING FLUID.

Take 10 parts of aniline red and 5 parts of aniline purple, dissolve them in 100 parts of methylated spirit at the heat of a water-bath.

As soon as the dyes are dissolved, add 5 parts of benzoic acid and raise the temperature of the mixture to boiling point, and keep it at that heat for five to ten minutes, until, in fact, the greenish colour of the mixture is transformed into a fine light-coloured bronze.

This fluid is laid on with a brush, and is applicable to metals, wood, leather, etc.

Bronzing Fluid.

Ingredients:
50 grains of red aniline.
50 grains of violet aniline.
2 ozs. of alcohol.
50 grains of benzoic acid.

Dissolve the aniline colours in a bottle by the aid of heat (over a water-bath), add the benzoic acid, and heat the mixture until its colour is of a light-brownish bronze.

Brown Bronze Dip.

Ingredients:
8 ozs. of iron scales.
8 ozs. hydrochloric acid.
½ oz. arsenic.
½ oz. of zinc (solid).

Mix in a bottle and keep the zinc in the mixture only while the fluid is in use.

Green Bronze Dip.

Ingredients:
4 ozs. of verdite green.
4 ozs. of common salt.
2 ozs. of sal-ammoniac.
1 oz. of alum.
16 ozs. of French berries.
4 qrts. of vinegar.

Boil all these ingredients together.

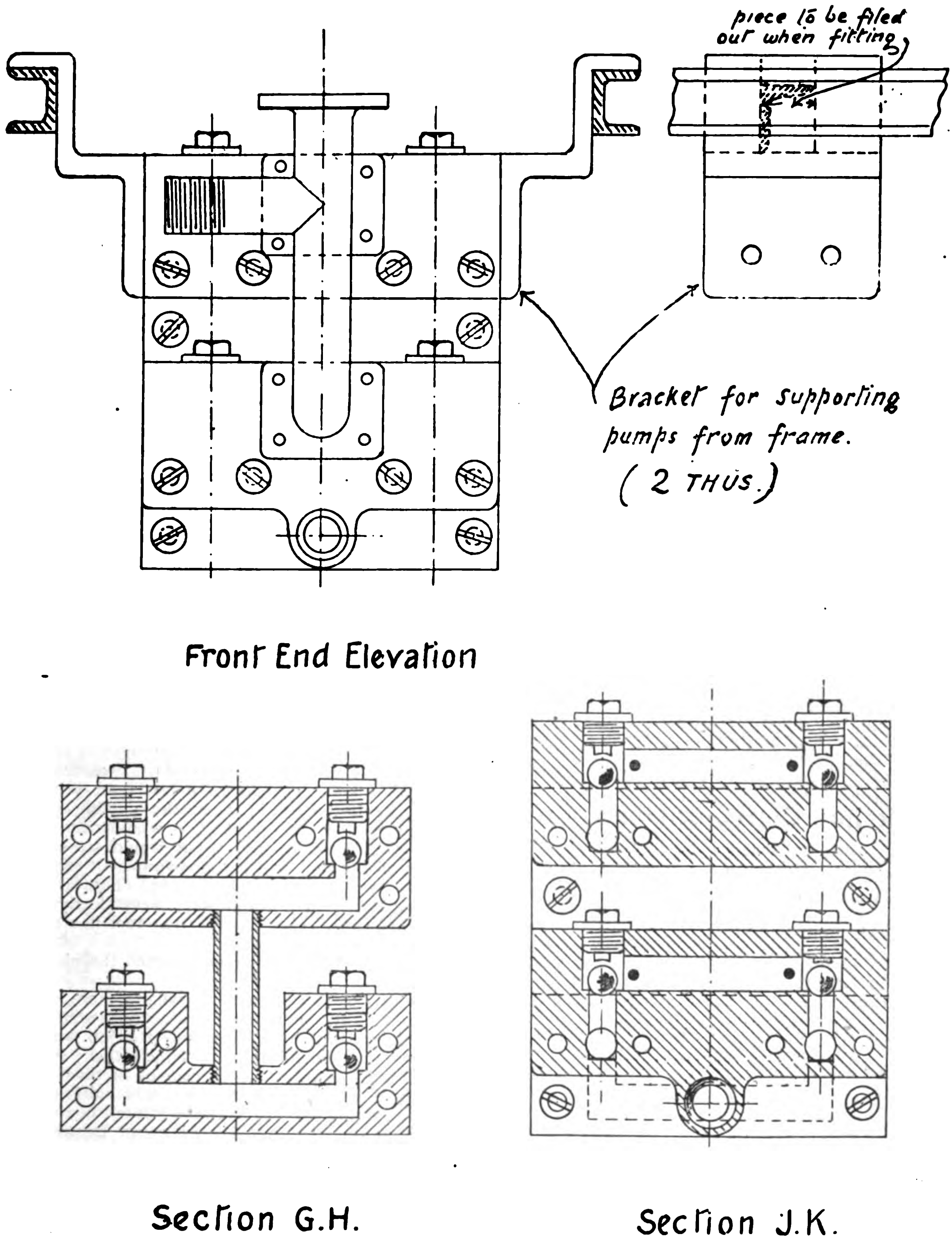


FIG. 46.—DETAILS OF TWO-CYLINDER DOUBLE-ACTING PUMPS. (*Scale : three-quarter full size.*)

Black Bronze for Brass.

Dip the bright article in nitric acid, rinse off the acid with clean water, and place it in the following mixture until it turns black.

Ingredients :

12 lbs. of hydrochloric acid.
1 lb. of sulphate of iron.
1 lb. of pure white arsenic.

Take out the article and rinse it in clean water, dry off in sawdust, polish with black-lead, and then coat with green lacquer.

Parisian Bronze Dip.

Ingredients :

1 oz. sal-ammoniac.
1 oz. common salt.
2 ozs. liquid ammonia.
2 qrts. vinegar.

Clean the metal, rub the solution over it, then dry off by friction with a brush.

Bronzing Small Articles.

Ingredients :

1 part oxide of iron.
1 part white arsenic.
12 parts hydrochloric acid.

Clean the brass well to get rid of lacquer or grease, and apply the above with a brush until the desired colour is obtained. Stop the process by oiling well, when it may be varnished or lacquered with clear lacquer.

Bronze Gold.

Ingredients :

2½ parts of burnish gold.
2 parts oxide of copper.
1 part quicksilver.
¼ of gold flux.

Having dissolved the copper in nitric acid, it is again separated from the solvent and falls to the bottom of the vessel by the addition of iron. The precipitate of copper may be decreased or increased at discretion, which modifies the colour of the bronze according to the proportion of burnish gold contained in the mixture.

Workshop Conversations.—II.

CHARACTERS.

Jones : An enthusiastic, but inexperienced model engineer.

Green : An "old hand."

SCENE.—*Jones' Workshop.*

Green (arriving): "Well, Jones, how's the new lathe? Brown tells me you're doing great things on it."

Jones : "Brown's an ass."

Green : "Well, anyway, how's it going?"

Jones : "The lathe's all right, and my parting tool's all wrong—at least, what's left of it. There it is, in two pieces."

Green : "H'm; did you call it a parting tool?"

Jones : "Well, I thought it was till it dug in, broke off, and spoilt the work."

Green : "Dear, dear! very bad behaviour for a parting tool. Most unseemly."

Jones : "Now, don't chaff, please; you're as bad as Brown."

Green : "I suppose you want to know why the trouble happened; well, I should say for three reasons—firstly, the tool was too low; secondly, it did not get enough clearance at the sides; thirdly, it was fed in too quickly."

Jones : "Here's another parting tool just like it that has got side clearance enough; show me how to use it."

Green (examining the tool): "Yes, this looks all right—plenty of clearance in side and depth, a nice cutting lip, and not too broad. We'll try it in the lathe."

Jones : "Let me put a piece of steel rod in the centres for you." (Does so.) "Now, please part a piece off that."

Green : "First we set the tool exactly centre-high. Then, using plenty of soap and water, we feed it in till it begins to cut—so. Then, very slowly, we feed it in further still. We then draw it back, move it a little to one side, and feed it in again—so. This, you see, makes the cut a little wider than the full width of the tool and frees the cutting edge at the side. We now feed it in still further, and at the same time work it slightly to and fro through the full width of the cut, and so we get gradually nearer and nearer the centre of the work. See how nicely it cuts. You must remember that you are reducing the diameter of the work smaller and smaller at every cut. If your tool was a trifle above or below the centre at starting, it would not make much difference, but as it gets further and further into the work the effect of this error in height is exaggerated. Suppose, for instance, your tool was 1-16th in. too low at starting on a piece of inch diameter rod. When you got the diameter down to ⅛ in., your cutting edge would be level with the bottom of the work! Of course, that could not happen in practice, but you see the idea. There, now, you see I have cut down almost through the rod—there is rather more than 1-16th in. holding it together, and I have had to go pretty gingerly for the last minute or so."

Jones : "Why so gingerly if your tool is set right?"

Green : "Well, you see, the strength of the job is no more than the strength of its weakest part, and that being cut down to less than ⅛ in., it is very liable to bend under the cutting pressure of the tool. If it did bend, it would ride up over the tool, the sides of the cut would close in and jamb on the tool, and perhaps your little experience of last week would be repeated. That is why I have only fed in the tool very, very slowly for the last little bit. Now the parting tool has done its work."

Jones : "But you haven't parted the piece right off."

Green : "That's so, and, what's more, I don't mean to—in the lathe. Don't you see that if I cut right through with the tool the job would fall in two, and come flying out of the lathe. Probably both ends would bury themselves in that heap of dirt and shavings which I see you cultivate as a floor covering. I just take the job out of the lathe, fix it in the vice, and accept friend Brown's kind offer of the hacksaw, with which I complete the job. I then take the screw or whatever piece I have cut off, put it in a chuck the other way round, and just finish it off in the lathe."

Jones : "But don't you ever part a piece right off with the parting tool?"

Green : "Why, certainly, under proper conditions. For instance, a piece of stick brass or a steel rod held in a chuck can be parted right through with the tool, because, being firmly grasped, it has no chance to bend up at the final moment. Just think it over quietly, and you will find that the parting tool is a good friend if you don't ask it to do too much."

Jones: "Thanks, awfully—I begin to think so, too."

Green: "Well, good-night; the best of friends, and tools, must part."

Jones: "Ah, you must have your little joke. Come in again soon."

Green: "Perhaps I will—but, say, Jones, look up that article on parting tools in THE MODEL ENGINEER for October 1st last — you will learn something. Ta-ta." (Goes out.)

Jones (merrily parting off pieces in the lathe): "I guess I can show Brown how it's done now."

For the Bookshelf.

[*Any book reviewed under this heading may be obtained from* THE MODEL ENGINEER *Book Department*, 26-29, *Poppin's Court, Fleet Street, London, E.C., by remitting the published price and the cost of postage.*]

THE YOUNG ENGINEER. By Hammond Hall. London: Methuen & Co. Price 5s.; postage 4d.

This book is a rather curious combination of real and model engineering. The author explains in a popular way the action of steam, gas, and petrol engines, and steam turbines, and gives several chapters on the locomotive—all of which form instructive matter for the youthful engineering mind. As a guide to model making, however, it rather misses its mark by reason of the weakness of the description of workshop appliances and processes. The opening chapter on this subject conveys very little information of real value to the beginner, and contains an explanation of metal turning which only serves to disclose the unpractical nature of the author's acquaintance with this portion of his subject. We quote his remarks as follows:—"Metal turning is not to be learnt from books, and I need only say here that the process is first to mark upon your work with a centre-punch the poles of the axis upon which it is to be turned, then to fix one end of the work firmly into a holder, called a chuck, and to centre it on the axis of the lathe. The work is then revolved, and, while revolving, is roughed down with a graver to the shape required, smoothed with a chisel, and finally polished with emery-cloth and oil." No mention is made in this chapter of such useful and necessary tools as the scriber, the square, and the compasses, nor is any information given in regard to the proper use of files. The result of this scarcity of information is that when the reader is presented in Chapter V with instructions for building a model horizontal engine he is confronted with a series of workshop terms and operations which he will be able to neither understand nor execute. We note also on page 21 that the diagrams and explanation show the piston to be moved from the end to the centre of the cylinder by a quarter-turn of the crank. This, of course, is not correct, and is apt to be misleading to the beginner. The various models which are described in the book are selected from the catalogues of well-known firms, and indeed, with one or two exceptions, the author seems to have depended almost entirely on the trade for his model making information and illustrations. We may say, however, that he has made his selection very well, and the favoured firms consequently reap a very liberal advertisement. Apart from these weaknesses, there is a considerable amount of useful information in the book, which is nicely got up and plentifully illustrated with photographs of models and real engines. It should certainly fire the enthusiasm of the coming model engineer.

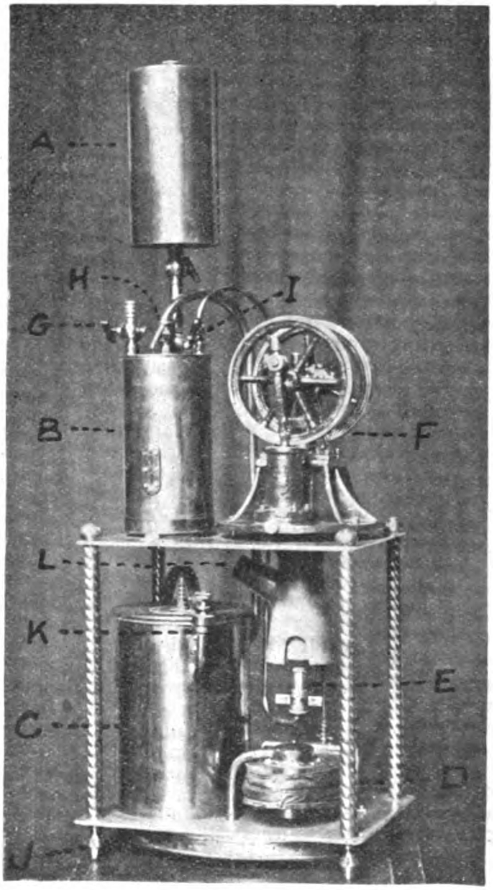
Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.*]

Model "Air Gas" Plant for Lighting.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—As "air gas" is attracting a great deal of attention just now, and is, without doubt, the coming light for country places where coal gas



MODEL "AIR GAS" LIGHTING PLANT.

is unobtainable, a description of a perfect working model air gas apparatus which I have may be of interest to your readers who might be contemplating the building of a model for themselves.

This model is on the Fischer principle, and is in fact the very machine which was made by the Fischer Company in Germany for their English representative to carry round to show prospective customers. It is extremely compact, and is enclosed in a leather case 11 ins. square, 20 ins. high.

On referring to the photograph, it will be seen that F is a hot air engine with 1¼-in. bore cylinder and 4½-in. flywheel. This engine is for the purpose of working the double-action bellows D, from which cold air is pumped into the chamber J, situated under the baseplate, from there the air passes into the baffle chamber C, and thence to the carburettor B, in which it is converted into a combustible gas. A is the reservoir for the petrol or benzole, which latter is recommended for use in the Fischer apparatus.

To begin work—the flywheel of the engine is given a few turns by hand, which generates sufficient gas to be ignited at engine burner E; when the engine has attained sufficient speed, the main tap G may be turned on and the gas ignited in the ordinary way and used with an ordinary burner and incandescent mantle.

Bijou burners are recommended for use, and one burner which gives 30 c.-p. with coal gas will give 120 c.-p. when fed with benzole gas.

Although this model is so small, it is capable of lighting three 120 c.-p. lamps, and would almost be suitable for a little week-end cottage.

Both base-plates are of nickel; pillars, curburettor, baffle chamber, and petrol reservoir of polished brass, lacquered.

I cannot give the construction of this carburettor, as that is a portion of the patent, which rights are for disposal at present in this country, but a carburettor is very simply made in many ways, the simplest being a vessel into which the air-pipe passes into the petrol and emerges through fine holes at the bottom of the pipe. By this method the gas is found very rich in petrol vapour, and any extra air that is required must be taken at the burner in the usual manner.

If the construction of a large apparatus (12 or more lights) be desired, a ball-bearing rotary fan is the simplest method of obtaining the air required. A short hot-air tube L prevents the carburettor from getting too cold, owing to the rapid evaporation of the spirit, and a safety valve K releases the air from the baffle chamber, when the pressure is more than sufficient to supply the burners.

There is no gasholder required, as the gas is generated immediately the flywheel is turned, and only sufficient is made to supply the burners which are turned on. The simplicity of this arrangement is its great charm, the engine and blower being the only moving parts.

With regard to the cost of running, 20 hours for one penny for fuel is well within the limit for a 120 c.-p. lamp. The machine may be seen working here, and any further particulars I will give with pleasure.—I remain, yours faithfully,

601, Green Lanes, Harringay Park, N. — S. C. HUDSON.

Perpetual Motion.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I am afraid that I am rather late with the following lines on perpetual motion, but they struck me as being particularly decisive and to the point when I came across them the other day. They might possibly come in some time.

It is supposed to be the reply of Robert Stephenson to a man who was continually (I was almost going to say "perpetually") bothering him about the ever-recurring subject. "If you will take yourself up by the waistband of your breeches and carry yourself round the room, I will consider the matter."—I remain, yours, etc., ARTHUR LEA.

Wigan.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Having a matter of about fourteen years' experience experimenting with the old problem, viz., perpetual motion, to my credit, and being an old reader of THE MODEL ENGINEER, I have read the letters *re* the above subject with a mixed feeling of interest and amusement. Whilst refraining from commenting upon the various views expressed by your correspondents upon this matter, I cannot help challenging your own final statement in your issue of October 29th, in which you say that they who are seeking to overcome this problem by purely mechanical means are foredoomed to failure. Now, Mr. Editor, I hope you will do as "Pat" suggested, "put on your chest protector." I do not, however, wear hob-nailed boots. I have a more convincing way of proving you wrong. The problem was solved by my humble self long before I noticed the comments upon same in THE MODEL ENGINEER, and I can assure you it has proved itself a great power; in fact, taking bulk for bulk, weight for weight, I guarantee it to be as great as any steam plant (taking the above comparison, I believe it will prove itself greater). In the near future I hope to be in a position to supply you with full working drawings of same, which at the present moment is an obvious impossibility, for the simple reason that my purse is not strong enough to obtain the necessary patents. This, to me, at the present moment is a far greater problem—*how to develop it*; and if any of your readers can suggest a remedy, they will, indeed, do me a great favour. At present I am spending my time improving as far as possible.

Permit me to conclude by saying that if any of your readers want perpetual motion on the cheap, I shall be pleased to supply them with a working model.—I am, yours sincerely,

853, Stratford Road, Sparkhill, Birmingham. — C. A. REYNOLDS.

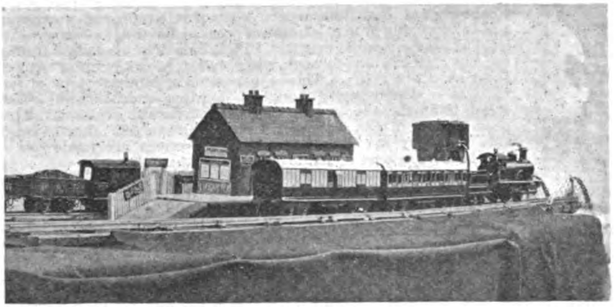
[We would suggest that our correspondent exhibits his model at the next meeting of the Birmingham Society of Model Engineers.—ED., *M.E.*]

Acetylene Bicycle Lamps.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have read with interest a letter from one of your contributor's in this week's issue of THE MODEL ENGINEER *re* the formation of an explosive substance on a copper disc contained in an acetylene bicycle lamp.

As he seems unable to explain this, I hope the following explanation will be of interest to him and to your other readers. Acetylene with copper or copper salts forms an explosive compound known as cuprous acetylide. (Cuprous acetylide is a brownish-red substance which explodes very easily when struck or subjected to friction, and these two properties will explain the sparks and the colour of the cotton-wool used in the lamp, which were noted by your reader. Owing to



THE STATION: MR. J. P. EDWARDS' MODEL RAILWAY.

this formation of cuprous acetylide by the action of acetylene on copper, it is impossible to use gas-pipes made of copper, since coal gas contains 0·06 per cent. acetylene by volume.

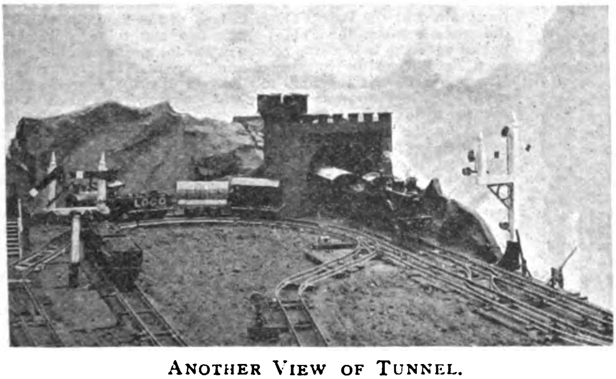
This formation of a brownish-red compound forms a very delicate test for acetylene.—Yours truly, A. J. DAISH.

South Kensington.

Slipping Loco and Cycle Wheels.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I was very interested in reading "Cyclist's" statement regarding the sudden stopping of a cycle wheel, without any apparent cause.



ANOTHER VIEW OF TUNNEL.

I have had some years' experience as a cyclist, and I have never known this to happen unless the brake has been applied too strongly. But I have observed the following phenomenon on more than one occasion. I was watching a motor-cab pass me on a clear, dry road, travelling at about 15 miles per hour. Suddenly the rear wheel *appeared* to turn round backwards. The brakes had not been applied, for the motor did not slacken its speed at all.

Now, under the existing circumstances, it was obviously impossible for the wheel to reverse. So I have come to the conclusion that it must be an optical delusion, probably caused by some effect of the light shining on the spokes. Is it this that causes the engine-driver to *think* that his driving wheels slip when going down an incline? Or does he actually *hear* or *feel* that they slip? I should like to know from the correspondent who brought up the subject which is the case.

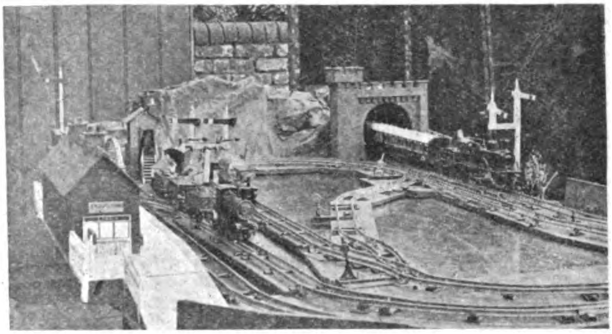
I write this hoping that it may at least be of interest, if not a solution to the problem.—Yours faithfully,

Putney, S.W. R. L. AMOORE.

A Model Railway System.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I send three photographs of a model railway system wihch I have built for my boy. The gauge is "0," or



VIEW SHOWING ENTRANCE TO TUNNEL.

¼ in. to 1 ft. The locomotive is one of the ordinary "0" gauge German-made ones, with slide-valve cylinders, and the passenger coaches are Messrs. Bassett-Lowke & Co.'s scale model L. & N.W. The station, signals, and most of the "goods" rolling stock, together with the "mountain" and tunnel are home-made. The tunnel is a rough copy of one on the G.W.R. near Bristol, which was illustrated in your issue of November 21st, 1907.

If the enclosed photographs and these slight particulars are of any interest to you, I shall be only too pleased.—Yours truly,

J. PRICE EDWARDS.

Slipping Driving Wheels.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I have read with interest the various letters concerning locomotives slipping when running without steam, and I think the following extract from a copy of the American journal, *Locomotive Engineering*, dated June, 1898, will be of interest.

"The slip of wheels at high speed is due to the centrifugal force of the counterbalance in the wheels. This force is great enough in some cases to lift the wheel appreciably from the rail. It is most noticeable in engines at speed when having heavy reciprocating parts in which a large proportion of these weights are taken to counterbalance against. The effect of this counterbalance of the reciprocating parts (which are the piston, crosshead, and from one-fourth to two-thirds of the weight of main rod) is to balance those parts while passing the centres. Such a balance is productive of a smooth-riding engine at slow speed; but at high speeds it becomes a disturbing element, as stated above."

Hoping this will be worthy of publication, I remain, yours truly, P. HENLEY.

Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[20,513] **400-watt Dynamo Winding.** D. V. J. (Manchester) writes: I have a dynamo which is wound as a plating dynamo to give 5 volts 80 amps., and would like to convert it into a machine suitable for lighting. The armature is 6 ins. long and 3¾ ins. diameter; field-magnet, 5¾ ins. by 2¾ ins. Will you please say the correct size and quantity of wire required to alter the machine, and if the 16-section commutator will be suitable? The machine is an overtype pattern.

You do not say what voltage you wish to work your lamps at. For us to advise you properly you should have sent a dimensioned sketch of the field-magnet and armature. However, if you wind the armature with No. 20-gauge D.C.C. copper wire, and the field-magnet with No. 22-gauge S.C.C. copper wire, you will not be probably going wrong. Get on as much as you can for the armature: about 1½ lbs. will probably be required, and get on at least 10 lbs. to 12 lbs. total for the field winding. Connect in shunt to the brushes. Before buying your lamps and fittings, make a trial run and find out what voltage the machine gives. It can be adjusted to some extent by running at higher or lower speed. The winding is suitable for about 50 to 60 volts. This is a convenient voltage for a small machine, especially with the metallic filament lamps which are coming so much into use. You may load the armature up to about 8 amps. The 16-section commutator will do.

[20,520] **Model Engineering as a Profession.** J. F. I. (Leith) writes: I have just finished my apprenticeship in a marine engineering shop here, but the work is not exactly to my taste, so I am thinking of changing to another branch of the profession. Would you give me your opinion of model engineering as a profession? Does it give much scope for advancement, and what would be about the highest position and wage? I can get no information on the subject here, as the trade is not carried on in this countryside, as far as I know. If you think the work is worth taking up, could you give me the names of some of the firms where I might find employment?

Model engineering, not being carried on upon so large a scale as are the main sections of engineering work, can hardly be said to give as much "scope" for employment and advancement as the larger branches of engineering. But in the model engineering branch, as in the others, there may be said to be positions of all grades, with remunerations as varied in amount. If you feel particularly interested in or qualified for this branch of the profession, we do not hesitate to advise you to apply yourself to it. For the man who is an enthusiast and determined to obtain advancement—and who works to qualify himself for that advancement—here is always scope. Your best plan is to select from our advertisement pages the names of model engineering firms which strike you as suitable, and to these firms write careful letters of application for employment.

[20,460] **A Fancied Boiler Failure.** R. H. V. (Newcastle-on-Tyne) writes: I would deem it a favour if you would kindly advise me on the following. I have recently finished a model locomotive boiler of the water-tube type, dimensions as sketch enclosed (not reproduced). I have not tested it for pressure—just got up steam. I find that it throws off a lot of water through steam pipe and safety valve orifice. I cannot account for this, as I carry water level about the normal height. I think this defect is caused through too big a circulation through water tubes, in conjunction with the short length of boiler. This is unavoidable, owing to type of locomotive—a four-wheeled coupled shunting saddle tank. When steam is up there is a series of small sounds like explosions, which occur now and then when the water is thrown off. Can I remedy this? I may say that no steam connections are made yet. I have the main part of steam pipe coiled through fire.

Your diagnosis is incorrect; any water-tube boiler will be subject to violent ebullition if worked under the conditions mentioned. The "throwing off a lot of water through the steam pipe and safety valve orifices" is simply due to the boiler being worked at atmospheric pressure. The bulk of the steam (1,600 times greater than the water from which it is generated) rising from the limited surface causes the spitting and sputtering. When subjected to pressure—as under ordinary working conditions—the bulk of the steam will be less than one-fifth of the above amount, and if you could look inside the boiler you would find it comparatively quiet. We recommend you not to worry, but get on with the engine, and if your connections are steamtight, and the piston and glands well packed, you will not see much water after the first few revolutions.

[20,576] **Patenting an Invention.** G. W. S. (Dartford) writes: I have an article I should like to patent. I have written to patent agents and they inform me their fee for Provisional Protection is £3 3s., and to complete the patent for four years is another £8 8s. and £1 5s. for sealing same, making in all £12 16s., and I cannot afford that amount. I have your book on Patents and I understand the entire Government fees for patent for four years is £4. Am I right, and can I provisionally protect for £1? Also if I fill in the Specification Form myself and was to make any mistake or put in claims, etc., that the Comptroller does not agree with, will I have to pay another £1 to purchase another Form A, or do I fill in the duplicate or Form B first and send to the Comptroller for inspection? Suppose the article is made of tube and could be made of other section of metal, such as flat, oval, square, and solid rods, could I put in the specifications? I wish to hold the right to manufacture in any section of metal or tubes, parallel or tapering, etc.

Some alterations have come into force this year, owing to the new Patents and Designs Act, 1907, and the Patents Rules, 1908, necessitating some amendments to our book. These have been put into a form for insertion. The total fees required by the Patent Office are £1 for provisional protection, £3 for complete specification, and £1 for sealing the patent, making a total of £5, instead of £4 as formerly. The forms are now numbered and can be obtained at the Patent Office instead of the Law Courts. The difference between the Patent Office fees and those charged by patent agents is the agent's remuneration for giving you his assistance and the advice you are asking from us. It is precisely in advising you what to claim and how to describe your invention where the value of an agent comes in. You will not have to pay any fee to the Patent Office on account of mistakes or objections raised by the officials; they will send your specification back to you with the request to make any required correction and will not accept it until you have made the necessary alteration. But when they have accepted your specification you will not be able to make any alteration without applying for leave to do so and paying further fees according to circumstances. You must divide your specification into two clear parts, one describing your invention in such a way that it can be made by any intelligent person, and the second stating what you claim as your invention. Such phrases as "I wish to hold the right," etc., are not admissible. Send to the Patent Office and ask them to forward you a copy of "Instructions to Applicants for Patents"; it will cost nothing (enclose a stamped envelope and address "The Comptroller"). Study this and then pay a visit to the Patent Office library and have a look at a few specifications. You will then get an idea of the wording to use and the style to be adopted in drafting your own specification. You can claim one particular form of construction and then claim modifications.

[20,577] **Transformer Design.** E. F. (Redditch) writes: What alterations would be necessary to the transformer described in THE MODEL ENGINEER, Feb. 26th, 1903, for use on a 200-volt circuit, 66 cycles, secondary output 60 watts at 25 volts? What is the rule for finding the size of transformer cores for a given output? In the article in question it states that with a frequency of 125 cycles it is not advisable to use a flux density of more than 2,000 lines per sq. in. What is the law governing the same? Could you give me a table of flux densities per sq. in. with different frequencies in common use? The transformer is for use with 25-volt metal filament lamps.

For a periodicity of 66 the flux density can be 60,000 lines per sq. in., but for the purpose required we advise you to increase the cross section of iron to some extent, say, make the core 1½ ins. by 1½ ins. For primary wind 1,200 turns (about ½ lb.) No. 22 gauge D.C.C. copper wire, and secondary 160 turns (about ½ lb.) No. 16 D.C.C. copper wire. The secondary voltage can be adjusted by winding on or unwinding a few turns as may be required. There is no rule for size of cores; it is determined by the general design of the transformer. The flux density is determined by practical results as to heating and consequent waste of energy. For frequencies of 80 to 100 periods per second, the maximum density may be 42,000 lines per sq. in.; for frequencies of 40 to 60 periods it may be 65,000 lines per sq. in. Generally it is well to work rather below these figures, especially with increase of size of transformer. You can keep to the general dimensions of the transformer referred to except making a larger cross section of iron. The winding will go easily into 4 ins. length if you care to make the reduction. Remember that the diameter of coil is increased by the larger core.

[20,263] **Model Festiniog Railway "Fairlie" Locomotive.** S. J. (Birkenhead) writes: I would be much obliged if you could furnish me with (1) a dimensioned sketch of one of the "Fairlie" bogie engines used on the Festiniog Railway. (2) Also could you tell me, to a rail, of what weight is Bassett-Lowke's ¾-in. scale model permanent way modelled? (3) And if used for a 2½-in. gauge model railway of 1-in. scale, what would be the weight per yard of the full size rail to which it would then correspond?

(1) In reply to your Query, we have no drawings of the double-boiler "Fairlie" type engines designed for the Festiniog Railway in 1869, but can give you full dimensions of the locomotive put on the line about 1876. The general proportions of the various component parts are much the same, and if you have a photograph of one of the double-boiler engines, you ought to be able to make a comparatively accurate model. You will find a drawing for a model double-ended "Fairlie" engine in Greenly's "Model Locomotive," price 6s. net, price 6s. 5d. post free. The drawing of the engine "Taliesin" herewith is reproduced to a scale of ¼ in. to the foot. An inch scale model gives 2-in. gauge. Therefore for 2½-in. gauge you should model the locomotive to 1¼-in. scale. (2) With regard to the rail, the permanent way mentioned is modelled on the Midland section—100 lbs. per yd., we believe. Possibly, a 40-lb. rail would be used at Festiniog. This is, however, only a guess; but presuming it is correct, we think the permanent way should not look amiss for a 2½-in. gauge Festiniog engine. We have made a sketch, and this confirms our opinion. We do not happen to have a sample of the ¾-in. scale permanent way handy at the moment of writing, but can estimate the actual weight theoretically. It should be: 1-16th × 1-16th (the 1-16th is the size of the model) × 100 lbs. per yd., which works out at—

$$\frac{1}{256} \times \frac{100}{1} = \cdot 4 \text{ lb. per yard.}$$

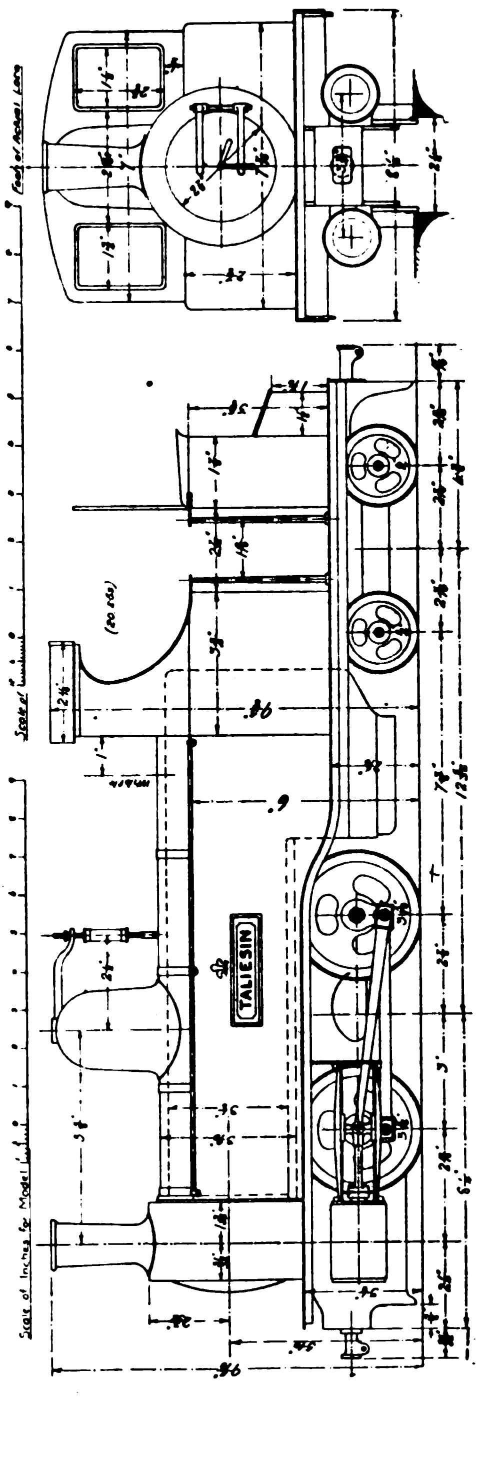
The weight of the rail for a Festiniog model on 2½-in. gauge should be the square of the size (1¼-in. scale—1-10th the full size approx.) × weight of actual rail, which we have estimated at 40 lbs. This works out as follows:—

$$\frac{1}{10} \times \frac{1}{10} \times 40 \text{ lbs.} = \frac{40}{100} = \frac{4}{10} = \cdot 4 \text{ lb. per yard.}$$

This happens to exactly coincide with the weight of the ¾-in. scale model rail, and again confirms our opinion as to its suitability. We trust our explanation is clear.

[20,515] **Copper-plating Wax Carbons.** W. G. (Jersey) writes: With reference to the fitting-up of carbons in bichromate batteries, I note, in an article in one of your back volumes, that the writer advises to soak about ½ in. of the carbon plate in melted paraffin wax, and then to electro-copper-plate over, so that a copper strip may be soldered on to make a good connection. Before treating my carbons in this manner I should like to have your advice as to whether this method is practicable, for, at first sight, it appears to me that the copper solution would not deposit properly, if at all, on the waxed portion of the carbon. I propose treating them as above and screwing to wood strips as supports, providing you advise the method as satisfactory.

We have not personally tried the method advocated by our contributor, so cannot speak with the confidence of experience. But we think the idea suggested is a good one. Of course, you will not get a deposit of copper upon the wax. That is impossible, and, even if possible, it would be useless, as the copper deposit would be insulated from the carbon by the wax, and the whole object of the process is to get the best possible connection with the carbon. Try the following plan. When the carbon plate has been soaked in the wax and properly drained, take it and *scrape* the waxed part that is to be plated. After thoroughly scraping the surface, apply a coating of black-lead, rubbing it well in. Then scrape again to remove any superfluous black-lead, and proceed to copper-plate. We think this preparation should make the plating practicable for the following reason. The wax may be considered as merely filling up the pores of the carbon, the conductivity of the carbon forming the walls round the pores being unaffected, so that by scraping we expose these conductive walls, and then, by wiping with black-lead, we put a conductive film upon the surface of the wax-filled pores, thus making the whole surface of the waxed carbon capable of being successfully copper-plated.



MODEL FESTINIOG RAILWAY "FAIRLIE" LOCOMOTIVE.

[20,382] **Ports of Oscillating Cylinders.** G. K. H. (London) writes: I am at present constructing a small model launch engine, with double-acting oscillating cylinder. I have a cylinder, with valve, as per sketch below (Fig. 1), but I am not sure as to the construction of a steam chest for a double-acting

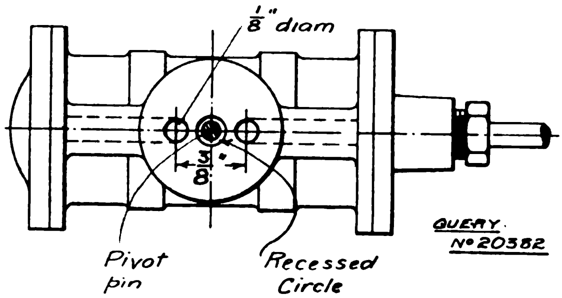


FIG. 1.—OSCILLATING CYLINDERS.

oscillating cylinder, and would be obliged if you would inform me —(1) As to the construction of steam chest. (2) If 1-16th in. would be proper clearance for such a cylinder? (3) If suspending cylinder between two brackets and putting spring on side opposite from valve is the usual method of working?

We would recommend you to read up the second chapter of our handbook (No. 28), "Model Steam Engines," and also to look up the back issues of this journal. The notes on the subject in "The Model Locomotive" should also be referred to. (1) We append sketches (Figs. 2 and 3) of the steam block suitable for the given cylinder. The ports in the cylinder seem rather closely spaced; but we cannot say much about this, as you do not send us the distances between cylinder centres and crankshaft, which is an important item in setting out the ports of an oscillating cylinder. The exact shape of the steam block may be altered to suit circumstances. The steam ports on the block may be 3-32nds diameter, and open into passages of the same, or slightly larger, diameter. Of course, the steam and exhaust passages may be transposed to give a contrary direction of rotation. The blank space between the ports of the steam block should be ⅛ in. full, so that live steam does not pass from the steam side to exhaust. (2) Clearance where? About

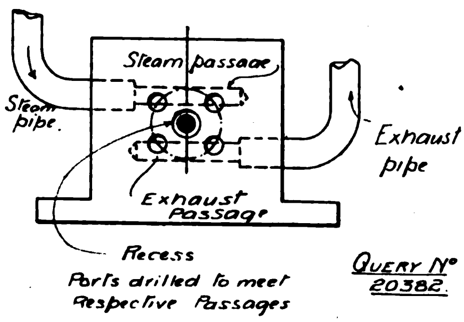


FIG. 3.

1-20th of an inch at each end say (3-32nds in all) is enough clearance for the piston at each end of the stroke. (3) The drawings show how we would arrange the spring contact, and as we have already pointed out in these columns, the centre space round the spring pivot on both cylinder port face and steam block must be recessed so that there is no contact at this part. The size of the recessed circle should be as large as the ports will allow. In the present case the diameter of the recess cannot be more than 3-16ths in., the ports being spaced on a pitch circle of only ⅜ in. diameter. The depth of recesses may be 1-32nd in.

[20,539] **Wireless Telegraphy; Tesla Coil.** R. F. B. (Hounslow) writes: *Re* Wireless telegraphy. (1) Is it possible to work an electrolytic coherer in circuit with a sensitive relay and bell for receiving messages? If so, will you kindly give the connections? (2) The sending apparatus is a 1-in. spark coil with oscillators, etc. What should be about the maximum distance messages are receivable with a 30-ft. aerial, using an electrolytic coherer? (3) What voltage and kind of cell are best for working such a coherer? (4) Where could I obtain the thin Wollastone platinum wire? *Re* Tesla coil. (1) I have a ½-in. spark coil; what would be the dimensions (as regards wire and condenser) of a suitable Tesla coil to work with it? (2) I made a small Tesla, using 120 turns of No. 28 s.c.c. waxed for secondary and 15 of No. 22 for primary. The condenser was twelve sheets of foil, 3 ins. by 4 ins.; this, having glass as an insulating medium, brushed at the edges. Does this indicate an insufficient capacity? (3) Is an ordinary good class varnish an insulator, for I unthinkingly coated the primary of the Tesla with it? If a poor insulator, it perhaps helps to account for the feeble action of the coil. (4) Are these high tension sparks any use in producing wireless waves instead of the induction spark coil?

Re Wireless Telegraphy. (1) An electrolytic coherer will not work with a relay; the changes of resistances are so excessively rapid that the finest relay cannot follow them. (2) We regret to say that we cannot give this information (see remarks as to range in "Wireless Telegraphy for Amateurs," our publication), especially as you do not describe type of aerial or size of coil. (3) Any good primary cell and a potentiometer, as used with the Lodge-Muirhead apparatus (see above-mentioned book). (4) This we cannot answer as we know of no dealer who supplies them except made up as complete cells. We have known success attained by hammering out the thinnest available platinum wire at the end until excessively thin, then cutting away the flattened portion until it is as thin as it can be made. *Re* Tesla Coil. (1) We think that you would do well to follow the directions for a small Tesla coil given by Mr. F. T. Webb, in THE MODEL ENGINEER of March 26th, 1908; but we doubt whether you will get very remarkable results with so small an induction coil. (2) The glass should be perfectly cleaned and dried round the margins and should then be painted with good shellac varnish so as to overlap the edge of tinfoil, then it should be thoroughly dried by prolonged exposure to gentle heat. Some commercial sheet glass is very unsatisfactory for this purpose. (3) Most good varnishes are insulators, and we do not think that even a poor varnish would seriously damage the insulation when painted on the primary coil. (4) We do not recommend the use of Tesla coils for wireless telegraphy. Nothing is gained except in cases where the power to be used is very great, and then troublesome tuning arrangements must be adopted.

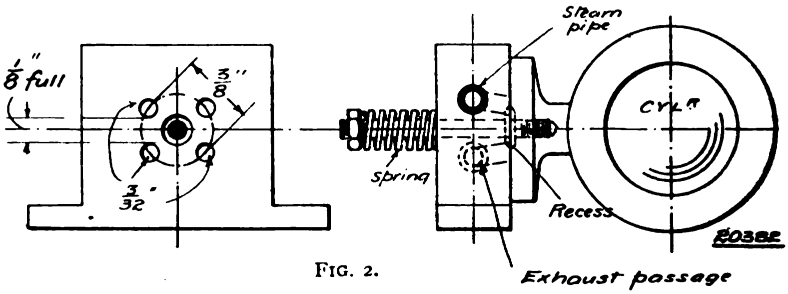
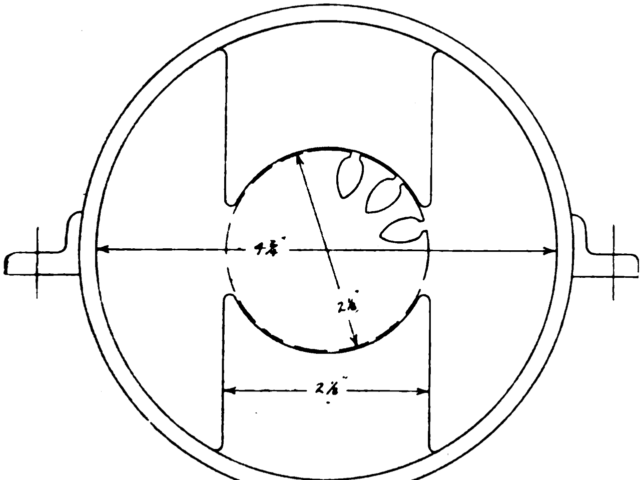


FIG. 2.

[18,056] **200-watt Undertype Dynamo.** H. L. (Runcorn) writes: I have an undertype dynamo and should be glad of a few particulars about same. I have your Handbook, "Small Dynamos and Motors," but find that the 50-watt machine described and my machine are somewhat different in size, so would be pleased if you would say what quantity of wire and gauge I should require to get as much light as possible, and also to charge accumulators. The armature is 7 ins. long over-all, already wound with No. 14-gauge wire. I cannot say how many turns there are on it, but it weighs 6 lbs. Commutator is 1¼ ins. long and ¾ in. thick; shaft, 14 ins. long, 7-16ths diameter, 6-section drum armature, cogged pattern. Please say how many revolutions. My gas engine is a National 1½ h.-p.; therefore if the flywheel is too great a diameter, I should have to have a smaller pulley wheel made. I want the above particulars for the wiring of the fields to be shunt wound. Trusting I have given all particulars. This is my first experience with electric machines. The stampings on armature are about 140, and in length 5 ins. I trust this will be a further guide.

The speed of machine should be about 2,800 r.p.m. Your best plan is to run it and see what current it gives with present windings. Output will be somewhere in the neighbourhood of 200 watts; voltage should be about 20. It will take fully ½ h.-p. to drive it at full load comfortably. Wind fields with about 7 lbs. No. 19 S.W.G. in shunt.

[19,950] **Two-pole Dynamo Windings.** C. E. (Manchester) writes: Would you kindly recommend a suitable winding for the dynamo, as enclosed sketch. I would like the output of this machine to be as near 100 watts as I could have it, namely, 10 volts 10 amps. If, however, this would not suit the build of the machine, kindly state the nearest to it, as I intend to buy the accumulators to suit the machine. The field-magnets are of cast iron, 1¼ ins. wide; the stampings are of soft sheet iron, 1¼ ins. wide; shellaced and insulated with a stamping of mica at each end; the slots with Empire cloth and presspahn; there are twelve slots; twelve sections in the commutator. Would you advise having it shunt-wound or series-



Query No 19950

shunt? As I have no particular work for this machine to do—only to get as much power out of it as I can. In reply, would you kindly consider the distance between the magnets and the inside of the casting for the windings. Also, what would be the best mechanical power to drive it? Do you think a ¼ h.-p. gas engine would suit? I have one of your small books on Dynamos and Motors, but this is a different type of machine than what is stated in your winding table.

This machine is too small for 100 watts output; about 60 watts is nearer to its probable output, but the yoke-ring must have more metal in it. The cross-section should be about 1½ sq. ins. if the length is equal to that of the poles: this means that you must make the ring about 1 in. in thickness, but it would look better if made about 2½ ins. in length by about ½ in. thick. For an output of about 10 volts, wind the armature with No. 22 gauge D.C.C. copper wire (about 6 ozs. will be required), and wind field-magnet with about ½ lb. of No. 22 gauge S.C.C. copper wire on each pole; get on more if you can (as much as possible); connect in shunt to the brushes. If the machine is made already, wind the armature with No. 24 D.S.C. copper wire; run at 3,000 r.p.m., and see what output you can obtain. We are afraid you are taking up too much space with insulation—the presspahn alone ought to be ample for this low voltage. A ¼ b.h.-p. engine is scarcely powerful enough to drive the machine to full output; a ½ b.h.-p. engine would be better; a gas engine will do very well: try Mr. Stuart Turner, of Henley-on-Thames. With the thin yoke shown in your drawing, we doubt if you will obtain more than about 6 volts 3 amps.; a ¼ h.-p. engine would probably do for this.

[20,630] **Gravity Daniell Battery.** H. V. C. (Chiswick) writes: I am making a battery and set of accumulators (as described in your Handbook No. 22), but should be very glad of your assistance as follows:—(1) Please give instructions for making the zinc sulphate solution for the gravity cells. (2) Please say if there is any method of stopping the zincs from "fizzing." I have used dilute sulphuric acid in the weakest solution, and still the zinc is eaten away and made black, and I have amalgamated them thoroughly, but all to no purpose; and the "fizzing" is so bad that I have had to take the zincs out of the cells. Those I have bought specially amalgamated have been just as bad. (3) Is it not necessary to insulate the wire leading from the copper as well as from the zinc? (4) How can I insulate the wires so as to make them acid-proof? (5) What do you mean when you say the zinc receives a coating of copper? I don't understand how the cell can work, if this is the case. (6) Are the cells always connected to the accumulators? If so, what prevents the current running back when the batteries run down? Is it possible to fit any arrangement so that when the cells run down equal to the accumulators the current is automatically cut off?

(1) Mix in the proportion of ¼ lb. of zinc sulphate to 1 gallon of water. (2) Probably you are using impure zinc. Get some thoroughly pure zinc, amalgamate it, and we think you will have no trouble. (3) Yes, better insulate both. (4) Cover them with gutta percha. (5) The wording of our handbook is not quite clear on this point. What is meant is that if the cells are put *out* of circuit the copper rises and the zinc gets a coat. You are right in thinking this coating of copper would interfere with the action of the cell. (6) Yes, the cells can be always connected to the accumulators. The voltage of cells should never fall below that of the accumulators. There is in use such an apparatus as you suggest. It is called an "automatic cut-out." Advertisements for them frequently appear in our advertisement pages, and we have published more than one description of their methods of action.

[20,324] **Cornish Boiler.** H. J. C. (Somerset) writes: I have a small Cornish pattern boiler, well made and stayed. I enclose a rough sketch (not reproduced) giving dimensions. Length, 30 ins.; diameter, 13 ins.; fire grate, 16 ins. by 6 ins.; furnace tube, 6 ins. diameter. What size single engine will it drive with 60 lbs. of steam. By single engine, I mean single-cylinder slide-valve.

As pointed out in the second chapter of our sixpenny Handbook, "Model Boiler Making," the "Cornish" type boiler is not very powerful per unit of weight, and unless set in brickwork, a large amount of heat is lost by radiation. To get the best from the fire the flues should pass round boiler, as shown in Fig. 3A of above-named book. With such a setting, the boiler you have should run a 1¼-in. by 2-in. horizontal engine at 60 lbs. pressure and about 300 r.p.m. Natural draught should suffice. We do not recommend a larger engine, although the boiler might prove sufficiently powerful for one of double the nominal power, the maintained steam pressure would be rather low, the heat losses, owing to condensation, much greater, and the actual power obtained possibly less than that of the engine mentioned above. A compound condensing engine would suit the boiler well.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

** Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

Marine Petrol Motors.

In a neatly printed illustrated list before us Messrs. G. Hallas and Co., King Street and Jamaica Street, Alloa, N.B., give particulars and prices of several types of marine motors suitable for various size craft. Special attention is called to the "V" type motor they are making, which is particularly suitable for hydroplanes. In this twin-cylinder motor the cylinders are placed at a slight angle on opposite sides of the crank chamber, each cylinder being slightly staggered with reference to the centre line of crank chamber. Each cylinder drives on to the same crank-pin, and it is claimed that this arrangement has proved most satisfactory in practice. A particularly neat set for the dinghy class of vessel is illustrated, comprising motor, propeller shaft, propeller, petrol tank, accumulator, coil, etc. together with stern tube and reversing lever. Reversing propellers, accumulators, coils, petrol tanks, are also separately listed and priced. Complete charging plants are also manufactured by this firm, and parts, sets of castings, etc., for any of the finished goods in the list before us can be supplied for those who prefer to make up their own engines, etc., from castings. It is a small yet interesting catalogue and should certainly be consulted by those contemplating putting power into their boats, either large or small.

*A Model Turbine.

Under the name of the "Tangomotor" a miniature water-motor has been placed on the market by Mr. Percy Pitman, 3, Willcott Road, Acton, London, W. This motor can be connected up to the ordinary house tap with a piece of rubber hose pipe, and will run at a high speed. It is suitable for driving small dynamos, or other light models, and stands four inches high over all. It can also be worked by steam pressure, but is, of course, more economical when used as a water-motor. Either complete models, or sets of castings and parts, are supplied. Mr. Pitman makes a number of water-motors of larger size, particulars of which may be had on application.

The Editor's Page.

WE commence in this issue a new series entitled "The Steam Engine for Beginners," by Mr. H. Muncaster, who will be well known to our readers by his many previous contributions. We think this series will be of interest not only to those who are commencing a serious study of the steam engine, but also to many amateurs who like to know the how and why of things without dipping too deeply into the subject or without having recourse to text-books, where the matter is usually too severely technical for popular reading. We have some other good articles in hand for our younger readers, which will show them how a good deal of interesting work can be accomplished with a minimum of expense, equipment, and skill.

* * *

We would remind those who are thinking of entering for our "Wants" Competition, as announced in our issue of November 5th, that their lists should reach us by December 1st. Some of the entries already received show that certain of our readers possess a sense of humour; their efforts are amusing, but not quite to the point. The prize of £1 1s. which we are offering should enable the successful competitor to fill some of his wants, especially those which he does not put on his list as being at present unobtainable.

* * *

A new London club has just been founded under the name of the Hobby Club, its purpose being to bring together people interested in hobbies of all kinds. It is being run on high-class lines, it being the intention of the executive to secure extensive premises in the West End, where ample accommodation will be provided for the members. The annual subscription has been fixed at five guineas, with an entrance-fee of seven guineas after a limited number of Founder Members and Associates have been elected. The Hon. Secretaries are Viscount Molesworth and the Hon. George Scott, while the Secretary, Mr. Stuart Nuthall, 38, Wilton Place, London, W., will be pleased to furnish particulars to any who are interested.

Answers to Correspondents.

E. A. R. (Lewisham).—We advise you to read Mr. Howgrave-Graham's article on "Perpetual Motion" in our last issue. We think this will answer your enquiries.

"Arc Lamps" (Wombwell).—No, not for 10 volts supply. Minimum possible voltage is about 40.

W. H. S. (Antofagasta, Chile).—Our issue dated May 23rd, 1907, contained design for ½-in. scale model of L. & N.W.R. locomotive, "Experiment."

J. N. (Bootle).—See "Ferric and Heliographic Processes," price 2s. 3d. post free.

V. P. (Turin).—We have tried Clarke's fliers with success, and think you need have no hesitation in taking up this novelty.

—— (Dalmellington).—We cannot write you as you give no address. Most of your queries could be answered by referring to a manufacturers' catalogue.

H. M. H. (Tipton).—We can only advise you to experiment as others attempting the conquest of the air have to do.

E. H. (East Orange, U.S.A.).—(1) Yes, but not fast. (2) The manufacturers you name would supply suitable boiler from stock. This would be cheaper. The propeller to which you refer is suitable.

Wilson (Sunderland).—We consider your suggestion a good one. Try reduction of clearance.

H. G. (Sheffield).—We thank you for your suggestion. which shall have consideration.

G. H. Duff (Fort Robinson).—We do not think the Railway companies would sell tracing to you, but drawings of the leading British expresses are published from time to time in *The Engineer*, *Engineering*, *The Railway Engineer*, and other journals. There are a number of working drawings of noted engines given in our book, "The World's Locomotives," price 11s. 4d. post free. We think this would perhaps meet your requirements.

C. P. H. (Battersea).—Many thanks for your suggestion. It is one we have had in mind for a year or so past, but pressure of other work has prevented our taking it up. We may be able to do something of the kind in the future, as we believe it would be generally appreciated.

G. Castellazzo (Genoa).—Messrs. Stuart Turner, Ltd., inform us that they have already sent *two* lists to you, but these have been returned by the post office, owing to your address being insufficient. If you will give a fuller address, they will send another list. The same firm have several other letters from readers who have omitted their addresses.

W. H. (Bexhill).—(1) Cotton & Johnson, 14, Gerrard Street, Soho, London, W. (2) Try the Tempered Spring Company, Ltd., Sheffield.

Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

THE

Model Engineer

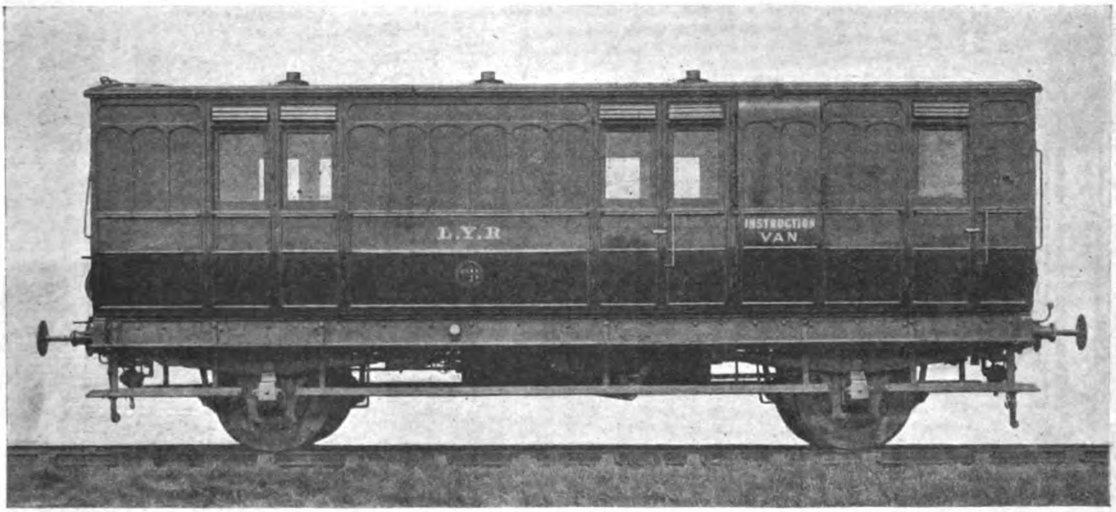
And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 397. DECEMBER 3, 1908. PUBLISHED WEEKLY

A Portable Instruction Car for Railway Men.



EXTERIOR VIEW OF PORTABLE INSTRUCTION CAR FOR RAILWAY MEN.

MR. GEORGE HUGHES, the Chief Mechanical Engineer of the Lancashire and Yorkshire Railway Company, has recently equipped an instruction car as a portable lecture-room. The intention is that the car shall be sent to the various locomotive depôts on the Company's line where mutual improvement classes have been formed, and lectures given by qualified persons to the engine-drivers, firemen, mechanics, etc., with the object of thoroughly familiarising them with all the various mechanisms they have to deal with when engaged on locomotives.

The interior of the car is fitted up with a number of seats for the audience, also lecture table, models, drawings, and a small library of useful books having special reference to locomotives. The drawings are suspended from a roller fastened to the roof of the car when being used for purposes of explanation by the lecturer. Ample facilities have been provided for having the lectures well illustrated, as will be seen by referring to the appended list of drawings, models, etc., and there is no doubt that the provision of such means of diffusing knowledge is bound to result in the members of the locomotive staff possessing a keener intellectual grip of the machine that is placed in their charge.

LIST OF DRAWINGS.

Sight-feed lubricator.
Water pick-up.
Slide-valves.
Motion.
Brake fittings.
Section of boiler and smokebox.
Radial axle-box.

Types of regulator heads.
Both types of big ends.
Sanding arrangement.
Pump ejector.
Vacuum diaphragm cylinder and ball valve.
R.H. injector. L.H. injector.
Combination ejector.
Joy's motion.

LIST OF MODELS.

Joy's motion.
Link motion.
Vacuum pump in two sections.
Section of vacuum ball valve.
Section of vacuum auxiliary valve.

LIST OF BOOKS.

The Locomotive Up-to-date, by C. McShane.
The Locomotive of To-day.
Modern Locomotive Practice, by C. E. Wolff.
Developments in Locomotive Practice, by C. J. B. Cooe.
Indicator Diagrams, by W. W. F. Pullen.
Sketches of Engine and Machine Details, by W. Bentley.
Locomotive Engine Running and Management, by A. Sinclair.
Locomotive Breakdown Emergencies, and their Remedies, by G. L. Fowler.
Indicator Handbook (Parts I and II), by G. N. Pickworth.

VIEW OF INTERIOR OF INSTRUCTION CAR, L. & Y.R.

Two sections of old type injector.
Section of combination injector.
Five sections of large combination injector.
Three sections pump type ejector.
Four sections new type ejector.
Section of sight-feed lubricator.
Two sections vacuum brake rapid-acting valve.
Vacuum brake diaphragm cylinder.
Hand vacuum pump.
One pair weighing scales with weights.
One flask with shut-off cock.
Two bell jars.
One mercury barometer.
One glass bottle, jar and six flasks.

History of the Steam Engine, by R. H. Thurston.
Bearings and Lubrication, by A. J. Wallis-Taylor.
The Locomotive and Its Development, by C. E. Stretton.
Injectors: Their Theory, Construction, and Working, by W. W. F. Pullen.
Elementary Manual on Steam and the Steam Engine, by A. Jamieson.
The Combustion of Fuel, by W. W. F. Pullen.
The Construction of the Locomotive, by Geo. Hughes.
Twentieth Century Locomotive, by A. Sinclair.
Slide-Valve Gear, by F. A. Halsey.
Locomotive Slide-valve Setting.

Care and Management of Locomotive Boilers, by A. Sinclair.
Elementary Principles of the Locomotive, by M. Reynolds.
The Locomotive: Its Failures and Remedies, by T. Pearce.
Lubricants, by — Redwood.
Indicator Diagrams and Engine and Boiler Testing, by C. Day.
Inorganic Chemistry for Beginners, by Roscoe.
The World's Locomotives, by Chas. S. Lake.
Locomotives of 1906, by Chas. S. Lake.
Locomotives of 1907, by Chas. S. Lake.

Another Model Traction Engine.

By W. E. Ashworth.

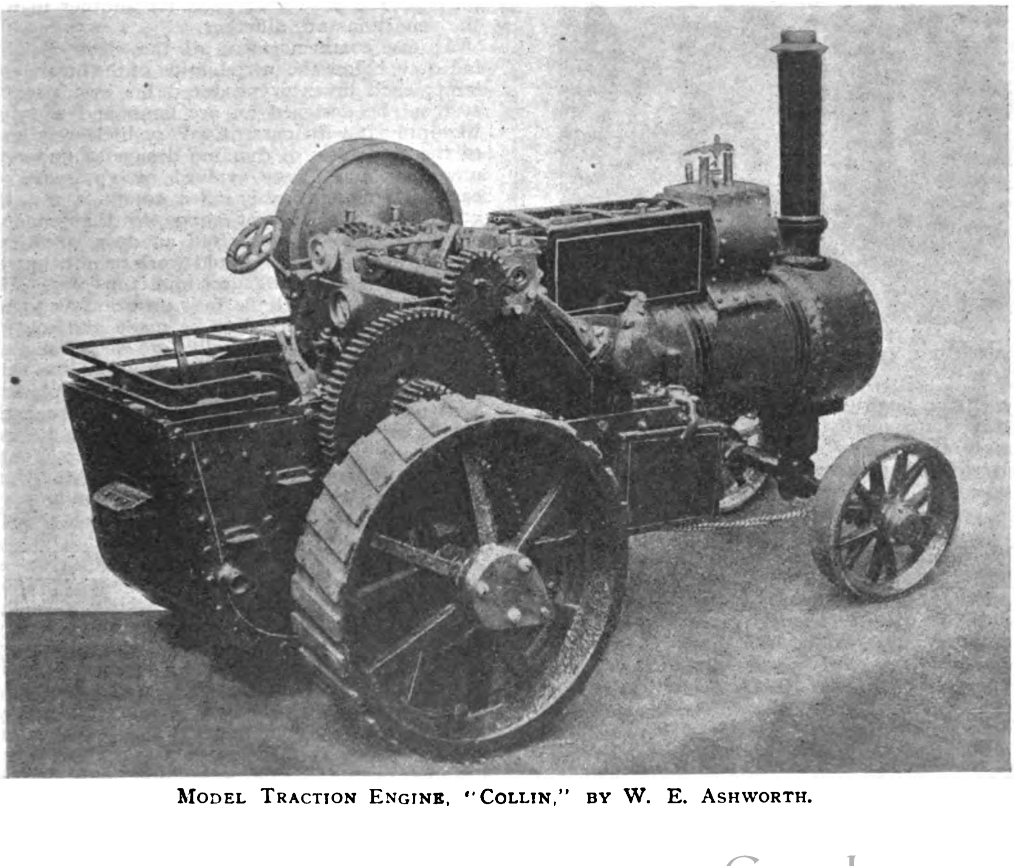
MY road engine, "Collin," was first designed by Mr. Collin Fidler, late president of the Manchester Society of Model Engineers, to whose engineering abilities I can testify. He also built a similar engine up to the running stage, but did not complete it, and it was the splendid efficiency of his engine that induced me to commence one on my own, and with the exception of the worm at the end of the steering-rod, which was cut on a screw-cutting lathe, the whole of the engine was turned out at home, with the most primitive tools and lathe.

The first start was made three years ago with the boiler, following very closely your little handbook on the subject. The barrel is 1-16th in. thick solid-drawn copper, 4 ins. diameter, 9 ins. long; firebox—outer, 3-32nds in. thick copper, 4¾ ins. long: inner, 3-32nds in thick, about 4 ins. square, with slightly sloping sides, all joints being flanged and riveted. The roof is supported by four ¼-in. brass stays, the sides by 3-16ths-in. copper stays; there are also three ¼-in. stays running from backplate to front tubeplate, the remainder of firebox and tubeplate being stayed by seven ½-in. flue tubes, with walls 1-32nd in. thick solid-drawn, the whole boiler being riveted throughout and made steamtight with solder.

The smokebox is 2½ ins. long and fitted with hinged door. A very simple method of shaping copper smokebox door is to lay a piece of copper sheet on a stout wood block and beat it with the round end of the hammer wherever it requires to be rounded; the copper will gradually spring to the required shape. It must, of course, be kept well annealed; afterwards it can be shellaced to faceplate of the lathe and finished with emery, etc.

The boiler was lagged with asbestos and covered with thin copper. This part took about ten months to complete, and I think I was lucky to get through it without the landlord throwing me out, as it was a case of constant knocking, much to the amusement of neighbours, whose opinion of model engineers, I am afraid, must be anything but complimentary.

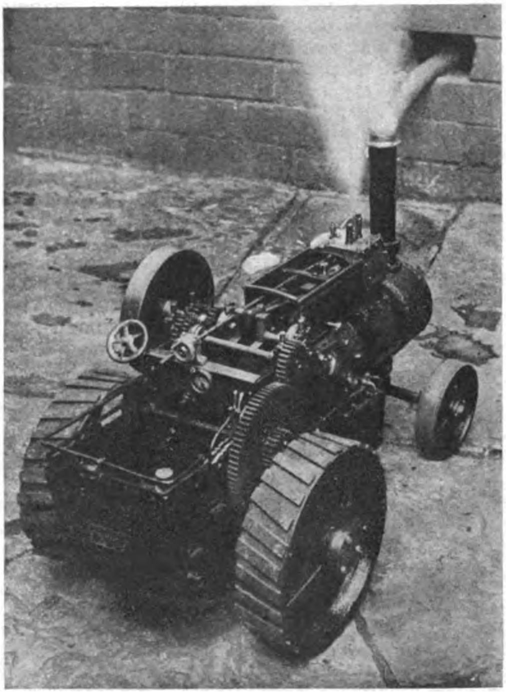
I next turned up my wheels, and then commenced



Model Traction Engine, "Collin," by W. E. Ashworth.

engine proper. The bore of the cylinder is 1 3-16ths by 1¼-in. stroke, with dome and Ramsbottom safety valve on top, two slide-bars, extended valve rod (reversed by Stephenson's link motion). The regulator is an idea of my own, and controlled by turning a small wheel (see illustration) instead of pulling a lever. The advantages of this arrangement are fine, giving rapid adjustment and a straight pull. On large traction engines the lever pulling the rod against the gland side is a source of trouble, and this small part of the cylinder, which is subject to very little wear in comparison with piston glands, is always requiring re-packing.

The pump is also of original design, and is very much larger than scale size. I think that this part



ANOTHER VIEW OF TRACTION ENGINE.

of my engine ought to be quite large enough to meet any demand that could possibly be made. I regulate the supply of water by the overflow tap; it is fitted with ball valves and air-chamber, the latter being added to increase its efficiency at high speed, which I think is about 1,200 revs.

The tender is made in the form of a reservoir, and fitted with air-pump, etc., for paraffin fuel. This, however, has not been utilised, as I find charcoal everything that can be desired, maintaining boiler easily at maximum pressure.

The safety valve is screwed down to 50 lbs., although I have worked her at 80, which is quite safe. I find that at 50 lbs. she is sufficiently powerful and travels at a good speed, whilst she does not require half the attention. Might I here add a caution about using boilers without pressure gauges and the valve set at goodness only knows what. When I first made my engine I worked it without gauge, and there was a great deal of guessing as to what the pressure was. Some put it at 20 lbs., some at 50 lbs.; but imagine my surprise when I fixed the gauge to find it was between 80–90 lbs.

How to Choose a Dynamo.

By ALFRED W. MARSHALL, M.I.Mech.E., A.M.I.E.E.

Part I.—Windings.

DYNAMOS are of several types, and a novice may easily find himself wondering which to select when intending to buy or make one. My remarks are meant to apply to small machines, and not to the large dynamos used for producing electricity in power stations. As the size increases, considerations come into the matter which need not be taken into account with the small machines which an amateur is likely to require. A manufacturer's or dealer's list is not of much use as a guide; naturally, the vendor of a machine or set of parts will wish to convince a prospective purchaser that the article offered for sale represents the best practice in design and construction. If the amateur desires to make his own plans, he may be confused with the variety of types in trying to decide that which is superior to all the rest. There is no "best" type of design, each has advantages and drawbacks peculiar to itself; therefore, a pattern which may not be so suitable for a certain purpose would be very good for another in which the conditions are different.

At the commencement of the electric lighting industry, before the introduction of the incandescent lamp, each inventor produced his own particular system; he designed an arc lamp and a dynamo to supply it with current. Very little was known of the principles of dynamo design as understood now; machines were evolved by guesswork, and each designer probably tried to make a ttern which was of different shape to that made by anybody else. It was often an open question as to whether a machine would work or not, but they did work and were successful thus far. Those whose designers had the best intuition as to what was required continued to be made and sold; the inferior types, mechanically or electrically, disappeared. It was a case of survival of the fittest. Amongst these early dynamos was the Elphinstone Vincent machine having two distinct field-magnets, one being placed inside the armature, its poles reinforcing those of the external magnet; Loutin's machine with multipolar armature; and the Burgin machine with multi-ring armature, having spiral displacement of the coils, presumably devised to circumvent the Gramme patent.

As knowledge of the principles of design and working of dynamos developed, it was applied to improve the various patterns which were being made commercially by different firms, with the result that the type made by one good firm was practically equal to that made by any other firm of similar repute, though each differed in system and shape. Gramme, with his ring armature machine, was the first really commercial maker of dynamos. He devised many different patterns, all having his distinctive ring system armature, and met with great success. Probably his designs served as models to those who followed; nobody understanding much about the principles involved, it would be wise for a firm starting to make dynamos to copy a machine which they knew would work. Siemens was making small dynamos having his well-known H or shuttle armature. Shortly after Gramme had established the reputation of his machines, von Hefner Alteneck developed the single coil shuttle armature into the multi-coil drum armature, and a second race of commercial dynamos came into being. The two distinct kinds were those having ring armatures and those having drum armatures; in addition, there continued a class of very small machines which retained the shuttle armature, or its modifications, as polar armatures.

The point of principal importance is the winding. It must be of suitable type and construction. Dynamos are wound according to three systems, known respectively as shunt, series, and compound windings. The shunt system is the one which is most generally useful; it is essential if the dynamo is to be used for charging accumulators or for electro-plating purposes. It is very suitable for lighting incandescent lamps, and is always a safe method for an amateur to select, whether buying a finished machine or making one. The terms apply entirely to the coils which are wound on the core of the field-magnet, and have nothing to do with either the type or winding of the armature. With the shunt method of winding, a small portion of the current which is generated in the armature is taken to excite the field-magnet coils. Nearly all the armature current flows away to the lamps, etc., and has nothing to do with the field coils. The very small flow of current which does go to the field coils merely flows through that winding and returns to the armature. It has nothing to do with the lamps, etc., to which the dynamo is supplying electricity. Being thus independent of the total flow of current produced by the armature, it will be of a definite amount, and will not be a certain proportion of the current which the armature is generating. The ends of the winding are connected directly to the brushes and the current for exciting the magnet coils is thus shunted away from that going to the lamps, etc., in the outer circuit; hence the term shunt winding. If the outer circuit is disconnected the magnet winding will still receive its flow of current, which, in this extreme case, will comprise the whole of the current being generated by the armature. As the current used to excite the field coils is a part of the energy wasted in the dynamo itself, the amount of flow is made as small as possible consistent with proper working. The resistance of the winding must, therefore, be high as compared with that of the armature. It follows that the wire will be of similar or smaller gauge. A shunt wound dynamo can be distinguished by the size of the wire wound upon the field cores; this will usually be of slightly smaller gauge to that which is wound upon the armature. It may be of equal gauge, but is never of decidedly larger gauge.

The series method of winding is the one which is of least general use to an amateur. Though good for lighting an arc lamp, for heating wire, or workable for lighting a definite number of incandescent lamps or driving an electric motor, it should not be selected except for some special reason. With this method the whole of the current generated by the armature passes through the field-magnet coils. One end of the winding is connected to one brush, and the other end to the circuit of lamps, etc. Therefore, the excitation of the field coils, and consequently the quantity of magnetism which they produce, depends upon how much current is being taken from the armature. If the outer circuit of lamps, etc., is disconnected, obviously no current can flow from the armature; the field-magnet coils will therefore receive no current and the dynamo will not excite, though in perfect working order. One may argue that this does not matter, as the lamps, etc., having been disconnected, no current is required. The trouble is, however, that the dynamo will not excite when lamps, etc., are connected to it unless the amount of current demanded by the circuit reaches some critical value. Stating the matter in a better way, the resistance of the circuit of lamps, etc., must be less than some critical value to enable the dynamo to send any appreciable current. We may, therefore, have such a dynamo, in perfect order, refusing to work, though some lamps, etc., are connected to it. As soon as the resistance of the outer circuit is adjusted so that it is less than the critical value, we may have the opposite effect if the field-magnet has an ample margin of iron. The voltage will rise as more current is taken from the machine and may eventually cause such an increase of current that the lamps will be damaged. Obviously each increment of current must pass through the winding of the field-magnet and therefore increase its magnetising power. As the whole of the current generated by the armature passes through the field-magnet coils, the wire used for winding these coils must be at least of equal current-carrying capacity. But some voltage is lost in driving the current through the wire, therefore the resistance of the field coils is made to be as low as possible consistent with practical conditions of working, in order that the lost voltage may be small. A series-wound dynamo can be distinguished by reason of its field coils being wound with wire which is of thicker gauge than that upon the armature. It ought to be very thick compared to that upon the armature.

A series-wound dynamo is suitable for supplying a current of constant value and for which it has been designed. A single arc lamp, for example, or several such lamps when connected in series, require a flow of current which does not alter in value. For such a purpose, the series-wound dynamo is suitable, as this flow of current would be selected to have a value equal to that required for fully exciting the field-magnet coils. A series-wound dynamo could also be used to supply current to a circuit of incandescent lamps connected in parallel, provided the number of lamps burning at one time was not altered to any great extent and the total current required by them was equal to that required for fully exciting the field-magnet coils. Dynamos wound on this method are useful for heating wire and driving series-wound motors. The resistance of the wire or motor winding must, however, be low enough to permit sufficient current to flow to excite the field coils of the dynamo. Series-wound dynamos are quite unsuitable for charging accumulators or electro-plating, because an accumulator or electro-plating bath gives a back voltage which is opposed to that of the dynamo. They are both, in fact, electric batteries when a current has been passed through them. If the dynamo voltage falls below that of the accumulator or plating bath a current will flow through its winding in the reverse direction. The polarity of the field-magnet will, therefore, be reversed and the armature will consequently change the polarity of its voltage and produce a flow of current through the entire circuit in the reverse direction to the original flow. All the previous work of charging or plating will, therefore, be undone, with, perhaps, damage to the plates or articles.

A shunt-wound dynamo is free from this trouble, as the direction of current through the field-magnet winding cannot change with reversal of flow of current through the armature. The back voltage of the accumulator or plating bath may overcome the voltage of the dynamo and send current through its windings, thus driving it as a motor; but the armature will still continue to produce a voltage opposed to that of the accumulator or bath and will send current through them again when their voltage has become inferior to its own. A shunt-wound dynamo will best tend to excite its field-magnet winding when no circuit of lamps, etc., at all are connected to it; in fact, when on open circuit, as the term is. Under these circumstances the armature has nothing to do but to supply current to the field-magnet winding. It can excite this very well, as the winding is connected at both ends to the brushes. Such a dynamo finds a difficulty in exciting its field-magnet winding when a circuit of lamps, etc., connected to it has a comparatively low resistance, because this circuit tries to absorb all the current which the armature can produce. In fact, if the resistance be less than some critical value, the dynamo fails to excite and no appreciable current is produced by its armature. Within certain limits a shunt-wound dynamo is not much affected by a varied demand for current. Provided the resistance of the circuit does not become less than the critical value, the armature will continue to generate current and voltage, though a considerable variation is made in the number of lamps, etc., in use at one time. But as more or less current is generated by the armature, so more or less volts will be absorbed in driving that current through the armature winding. The voltage at the brushes will, therefore, fall with increase or rise with decrease of current taken by the outer circuit. Consequently, the field-magnet coils will receive less current when a greater supply is required by the lamps, etc.; and *vice versa*. The voltage will be affected also by this fluctuation of magnetism in addition, so that the machine is only partially self-regulating. On the whole, however, it will work within a fairly wide range of load, and this property gives the winding its general usefulness. If we attempt to supply current to a circuit of very low resistance, such as when heating a piece of wire or starting a motor which has a low resistance winding, the machine fails to excite, and we must adjust the resistance of the motor or wire until it is sufficiently high to enable the field-magnet winding to obtain some current. In this respect it is inferior to a series-wound machine, but a novice has much less difficulty in getting it to do some work.

There are thus two methods of winding a dynamo, each one having the opposite character to the other. The shunt method excites only when a circuit which has a resistance higher than some critical value is connected to it. The series method excites only when a circuit which has a resistance lower than some critical value is connected to it. We may conclude from this that a combination of the two methods would be most generally useful and enable a dynamo to deal with all conditions of service. This is so, and as the armature winding is the same for either, the question resolves itself into an arrangement of the field-magnet coils. One method is to make the field-magnet large enough to take two separate and complete windings and connect either the one or the other into service as required. Or we may wind the coils on to removable bobbins and slip on the one system or the other as required. In the latter arrangement the field-magnet need only be of normal size to take the shunt or series coils, according to which may be in use; but with the former arrangement the magnet must be increased in size to be able to take two complete windings simultaneously, otherwise each winding can only be of one-half its proper magnetising power.

With these arrangements we should be still retaining the drawbacks of either method in working; but if we connect the two so that they are in service simultaneously, each may be made to counteract the irregularity of the other. Such an arrangement is called a compound winding. The two coils are connected so that their magnetising forces assist each other. Obviously with this method the dynamo will still excite if no circuit of lamps, etc., is connected to it, because the shunt-winding will be in position of maximum operation, whilst if a circuit of very low resistance is connected to it the excitation will still be maintained because the series-winding will be in position of maximum operation. Two complete windings may be used in this way for general purposes, but they would not regulate well because the magnetism would be very much increased at the load which enabled both to be equally excited. The machine would be over-compounded, as it is termed, to a considerable extent. Usually the shunt-winding is made of normal proportions so that the dynamo could work as a pure shunt machine. Then a moderate proportion of series-winding is added to give sufficient magnetism to compensate for the fall in voltage due to effect of the armature reaction and winding loss. It is not possible to obtain a complete compensating effect with small machines, and the design affects matters to some extent, but such a winding prevents the loss of excitation due to low resistance in the outer circuit and partly corrects the variation in voltage produced at the terminals.

This does not detract from the general usefulness of a pure shunt-winding, as a series-winding can always be added and need scarcely be more than one or two layers of thick wire wound over the shunt coils. A practical method of determining compound windings is given in THE MODEL ENGINEER for August 31st, 1905, page 200. A fourth method of winding is that for separate excitation. In this method the current of the field-magnet coils is not derived from the armature at all, but from an entirely separate source, such as a battery or another dynamo. The winding is then determined as to size, by the source of supply. It has the advantage that the resistance of the circuit of lamps, etc., connected to the armature does not affect it at all, and in this respect it may be considered the most useful method, but a separate source of current is not always available and the attractiveness of the self-exciting principle is lost.

(*To be continued.*)

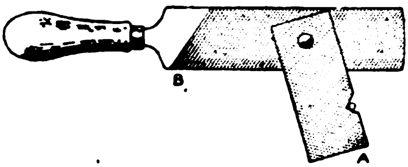
Workshop Notes and Notions.

[*Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked* " WORKSHOP " *on the envelope.*]

Home-made Wire Cutter.

The following, taken from a writer in *Popular Mechanics*, are useful hints for the workshop.

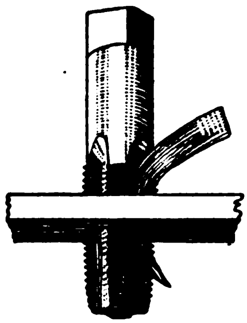
Any flat file that is worn out can be used to make a wire cutter as shown in the sketch. A short piece, A, is broken off from the end of the file and annealed, so a hole can be drilled in one end and a V-shaped notch cut in the side of it. The larger part, B, is also annealed, and a hole drilled in the centre and at such



a distance from the end to match the one drilled into the short piece. The parts are now tempered and riveted together as shown. The wire is placed in the notch and is cut off by striking the piece A, or this may be held in the vice and the part B used as the cutting lever.

Making a Tap Cut Larger than its Size.

If a tapped hole is too tight for a stud or bolt, cut a small strip of sheet copper and insert it in the flute of the tap, as shown in the illustration. This



will crowd the tap over to one side, which makes a larger threaded hole. This will work in the same manner on reamers.

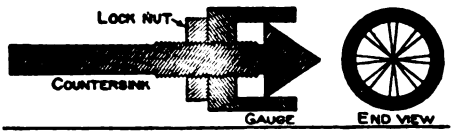
A Note on "Lining" Models.

By E. J. H.

Do not attempt lining with enamel; it is far too sticky and would not flow, and if thinned out it would not cover. Enamels generally have little covering power. It would be better to make up a colour with oil and turps (half and half); this will work better, and then varnish it over. Always get the work up in varnish and turps (half and half) and not used too thickly; it would run together so as not to show brush marks. Dry hard so as to run down nicely, and then finish with a good varnish if for outside; thin carriage if the work is pale, then French oil. Better work would be done in this way than using thick enamel; some gathers on the work, as it sets quickly, and makes it look "ropy." Good enamels take a long time to dry—two days—but will stand outdoors, such as Velure and Rippolin.

An Adjustable Gauge for a Countersink.

Countersinking holes to different depths for flat-headed screws in pieces varying in thickness makes it impossible to gauge the depth by the drill press spindle, or to do the work neatly with a hand drill. The sketch shows how to make a gauge on a counter-



sink that will gauge the work perfectly, whether used with a hand drill or in a drill press. The gauge is in the form of a cup that can be adjusted by turning it on threads of the countersink. A lock nut is fitted to hold the gauge when set at the proper depth.

How to Remove a Broken Tap.

A machine tap should never be rushed, and especially when taking a deep cut. Cutting threads in wrought iron, the metal will form as shown in Fig. 1. The tap will cut its entire length if it is turned back frequently to cut off this metal. Never

FIG. 1.

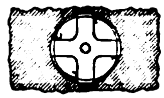
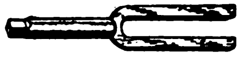


FIG. 2.



turn a tap by one handle of the holder, as this will cause a side strain that often breaks it. If a tap is broken off flush with the work, the broken part may be removed with a tool made as shown in Fig. 2. If it will not start, heat the work with a plumber's torch.—*Popular Mechanics.*

THE *Berlin*, the second large steamer built locally for the New York-Mediterranean service of the North German Lloyd, was launched on the 7th inst., at the yard of the Weser Shipbuilding Company, Bremen. She is 19,200 tons gross register, and her principal dimensions are:—Length, 612 ft. 3 ins.; breadth, 69 ft. 8 ins.; depth, 31 ft. 8 ins. She will be fitted with two sets of quadruple-expansion reciprocating engines, aggregating 14,000 i.h.-p., giving a speed of 17 knots.

Model Rolling-stock Notes.

By Hy. Greenly.

L.N.W.R. "Property" Trucks: a Prototype for Drivers' Truck for large Scale Model Railway.—Part I.

Although it was my intention to give the subject of modelling railway wagons and other rolling-stock a temporary period of rest, communications have reached me that a continuance will prove acceptable to at least a section of the numerous readers of "Ours." I do this in spite of the rudely drawn caricature of a man photographing an impossible wagon, which passed through my letter-box a month or so ago, together with an intimation of the advisability of providing for more "Locomotive Chat."

The ever-growing popularity of the larger scale model locomotive inevitably creates a demand for the many accessories to the engine, and, as mentioned in my last article, recent experience with 1½-in. scale railways has necessitated various designs for model passenger-carrying vehicles. While the particular design for the model 20-ton open wagon (Fig. 28, on page 347, of the issue of October 8th) can be adopted for a driver's truck, it is more suited to the carrying of passengers who have no other duty but to hold on tight and look pleasant. I therefore submit, as promised, a design for a model double-bogie truck arranged for a 1½-in. scale 7¼-in. gauge railway, which follows the lines of the well-known theatrical "property" truck used on the London & North-Western Railway.

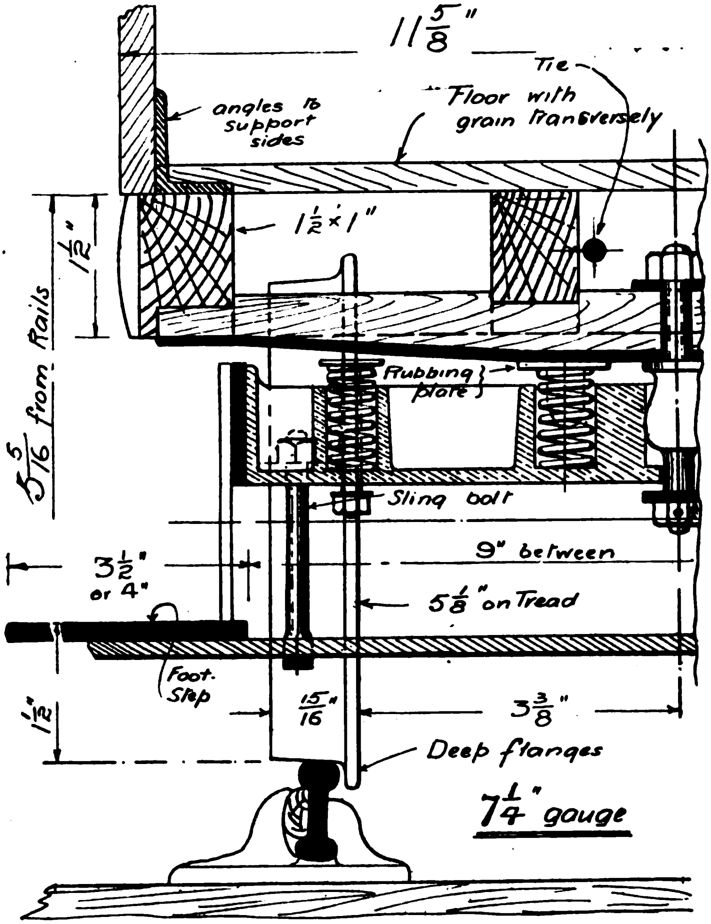


Fig. 4.—Half-section through Centre of Bogie of Model Truck, showing Bogie Stretcher and Spring Arrangement.

A drawing of the actual vehicle is included, so that those desirous of extreme accuracy may be able to correctly model the chosen prototype.

The model truck is primarily intended for use in driving a tank locomotive, and although I can make no claims as an artist, I hope that the diagram (Fig. 3) shows the manner in which I propose the driver shall sit and manipulate the reversing lever, regulator, etc., in the locomotive cab. I have not shown the driver's head, not only because it is of no particular utility

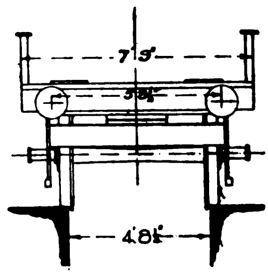


Fig. 2.—End View of Property Truck.

in the present case, and would represent so much waste of valuable space, but because my pencil finds itself unable to delineate the object in a respectable manner. However, it does not matter; it is in the disposition of the driver's feet that I am more particularly concerned.

This season I have had the pleasure of many trips on a model locomotive of about 1½-in. scale, and have observed that although one *can* arrange his legs within the tender of the locomotive, it is much more convenient to place them outside the tender sides and rest them on the edge of the footplate. This is especially the case when it is necessary to do any firing or attend to the injector and various other fittings.

In an ordinary locomotive tender there is, of course, not much metal overhanging the tender sides on which to rest the feet, and also damage

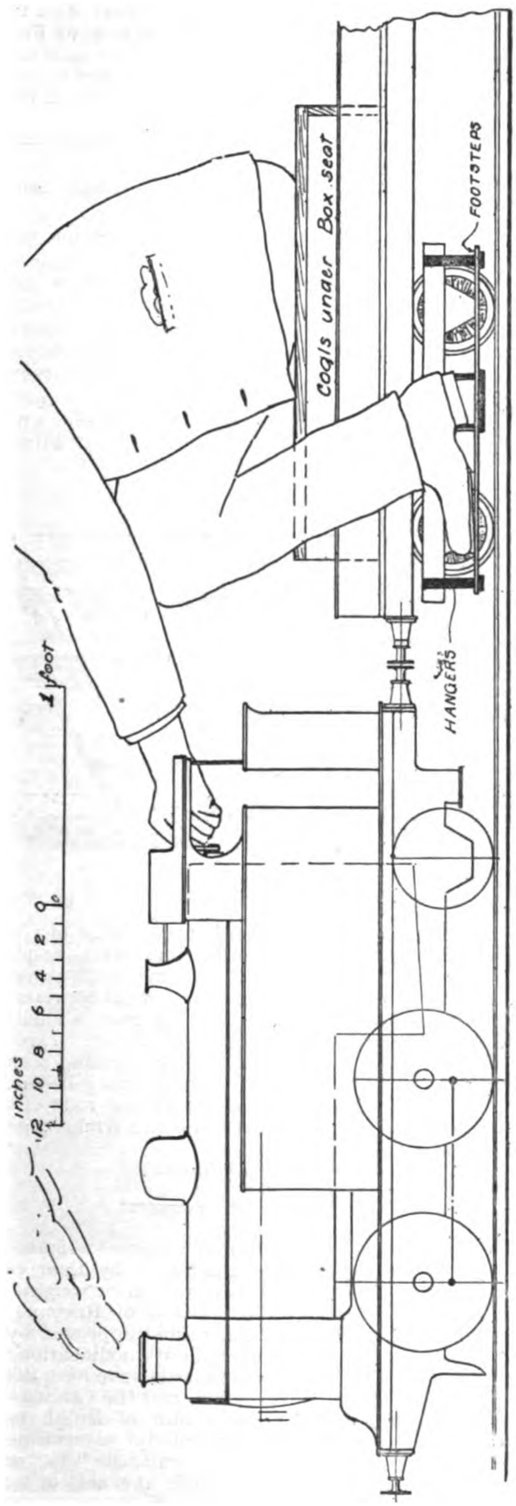


FIG. 3.—THE USE OF THE "DRIVER'S" TRUCK FOR MANIPULATING A 1½-IN. SCALE MODEL TANK ENGINE.

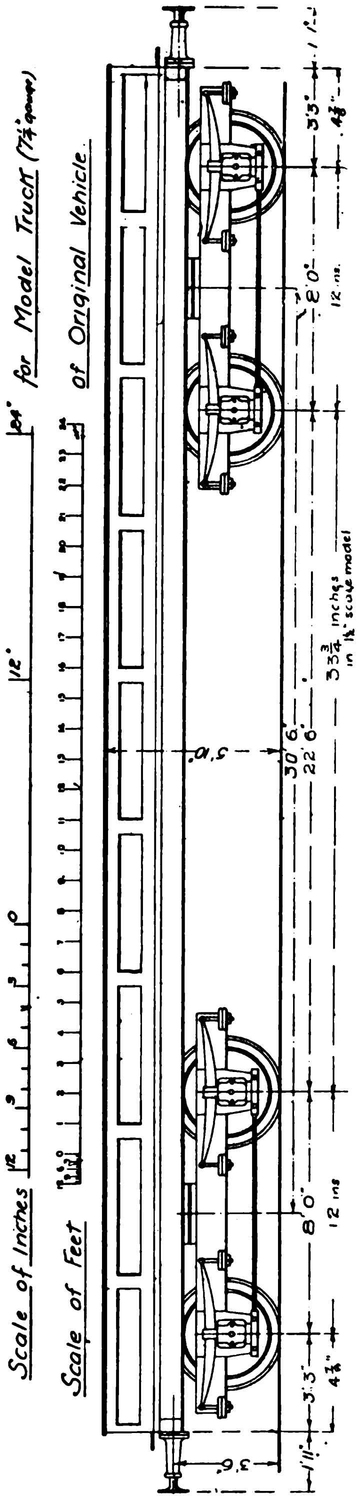


FIG. 1.—LONDON AND NORTH-WESTERN RAILWAY OPEN CARRIAGE AND "THEATRICAL PROPERTY" TRUCK.

(*A suitable prototype for a 1½-in. scale Model "Driver's" Truck.*)

to the paint is the likely result of the procedure. Therefore, the use of an outside step—an accessory entirely to the usual steps—as low as possible outside the frames of the tender, provides the most comfortable arrangement in a model of 1½-in. scale and also smaller locomotives.

Where a separate truck, as in the case of a tank locomotive, is employed to carry the driver, the outside step may be arranged in a similar manner, as indicated in the sketch drawing (Fig. 3) herewith.

The step will, of course, require to be extended to give sufficient bearing for the feet on each side of the bogie or carrying wheels of the model truck. With reference to height, it may be placed in about the same position on the lower footboard as fitted to some companies' coaching-stock, and may be supported by hangers from the bogie or main frames of the truck, as the case may be.

Referring for a moment to the drawing of the prototype, these vehicles were designed by Mr. Park, of Wolverton Carriage Works, to provide for the better and safer handling of scenery and case of a short wagon of the four-wheel open type I would advise the construction shown in Fig. 5, and also, in place of the rather shallow solebars of the prototype, the use of 1½-in. deep timbers (scale equivalent to 1 ft.), with as few joints—which would weaken them vertically—as possible.

The component parts of the under-frame recommended are as follows:—

Two solebars of 1½-in. by 1-in. oak, ash, or other suitable hard wood.

Two headstocks 1½-in. by ¾-in. section of the same material.

Six longitudinals (four long and two short), making really two continuous timbers) of 1½-in. by ⅞-in. oak or other hard wood.

Two transverse timbers of 1½-in. by 1-in. section, tenoned into the solebars with *horizontal* tenon-pieces.

Two transverse beams for bogie-pin, out of 2½-in. by 1-in. wood, notched into the solebars and longitudinals.

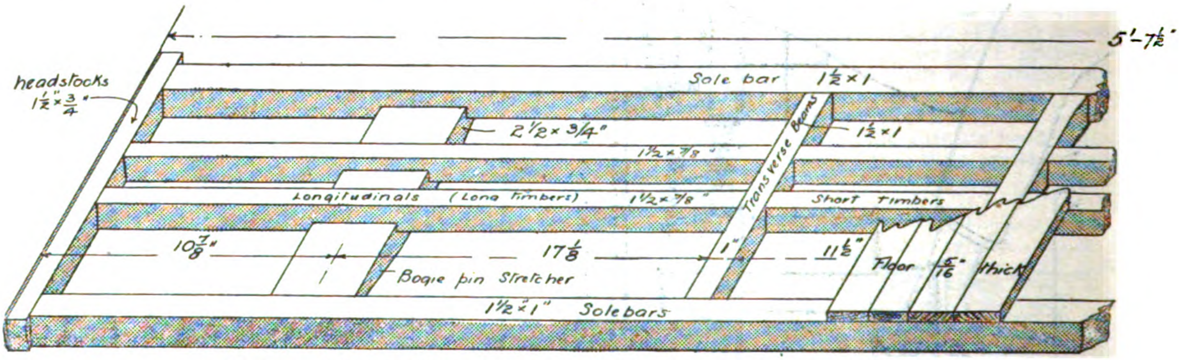


FIG. 5.—UNDERFRAME FOR 1½-IN. SCALE MODEL "DRIVER'S" TRUCK.

other lengthy items of the theatrical managers' stock-in-trade. Previously, two carriage trucks had to be employed, but the present 45-ft. vehicles may be seen (on Sundays especially), dealing with the particular traffic in an excellent manner. There are no ends to the body, and wheelplates placed flush with the floor are extended over the buffers after the manner adopted in ordinary open carriage trucks, to allow for road vehicles to be wheeled on to the truck from the platform. The side "parapets," if the term may be allowed, is a framed structure panelled out as shown in the elevation drawing. The bogies are of the standard carriage type, with spring bolsters and outside laminated springs over each axle-box. Indeed, the whole structure is built to passenger carriage specifications, and fitted with vacuum apparatus (or piped) so that they may be used on fast passenger trains.

In the model the "parapets" may be retained; but as they cannot be fixed in the ordinary way in a really strong manner, they should have, as an additional security, metal angles placed at intervals along the whole length, fixing the sides or parapets firmly to the solebars.

The under-frame in a 1½-in. scale model may, of course, be considerably simplified; but as the vehicle is a long one, a more elaborate system of framing of the timbers will be required than in the

The flooring of the vehicle may consist of 5-16ths in. thick slats of wood, only 1 in. wide, or planks of the same thickness 3, 4, or 6 ins. wide, according to convenience. Personally, I would prefer the narrow slats. In any case, the grain should run transversely from solebar to solebar. This will tie the under-frame together laterally, and a strong job will result. The buffer plank may be flitched with a piece of ⅛-in. plate, and two rods of ¼-in. steel may be employed to tie the frame together longitudinally.

(*To be continued.*)

UP to the present time Chinese weights and measures have been distinguished by their extraordinary diversity. A new system of weights and measures devised by the Board of Revenue and Commerce, and submitted to and approved by the Committee of Reforms without modification, has become law. The new standards have been defined in terms of the metric sytem, and the various units are as follows:—The new unit of length is the "tchi"; it is defined as exactly 32 centimetres. The capacity table has, as its unit, the "to," which is equal to 10·355 litres; while the unit of weight is the "lian," of 37·301 grms.

A Visit to the Royal Scottish Museum, Edinburgh.

Machinery Section.

(*Continued from page 276.*)

ALTHOUGH the subject of the next model to be referred to is a very common one to our readers, the writer does not remember an illustration of the "Cochran" vertical multitubular boiler in these pages, and has therefore selected it for these notes. Needless perhaps to say, this form of vertical boiler is more efficient than the ordinary vertical boiler, and is largely used, not only for marine work, but for many purposes on land. The internal arrangement is similar to that of a marine boiler, the flame and hot gases being led from the fire-grate into a combustion chamber at the back of the boiler, then through a nest of horizontal tubes into the uptake, from whence the flue gases escape by the chimney into the atmosphere. The hemispherical crowns of the firebox and boiler shell render staying unnecessary, and the tube plates—the only flat portions of the boiler—are sufficiently supported by the expanded tubes. The boiler is fitted with a manhole and mudholes, giving access to the interior for cleaning purposes; the short horizontal fire-tubes are easily cleaned from the uptake doors. The spring-loaded safety-valve is fitted with easing gear. The model was presented by Messrs. Cochran & Co., Ltd., Annan, N.B.

The concluding feature of these articles is a sectioned model of a Belliss & Morcom triple-expansion engine (Fig. 16). This model illustrates the quick revolution double-acting type of engine, an essential feature of which is the forced lubrication of all bearing surfaces by a method introduced by Messrs. Belliss & Morcom so far back as 1890. The oil is forced by valveless pumps worked off the H.-P. eccentric strap (not seen in the model) through a system of pipes, and is delivered on the bearings at a pressure of from 10 lbs. to 20 lbs. As the stresses in the engine mechanism are reversed at the end of each stroke a film of oil easily finds its way between the working surfaces. The oil escaping

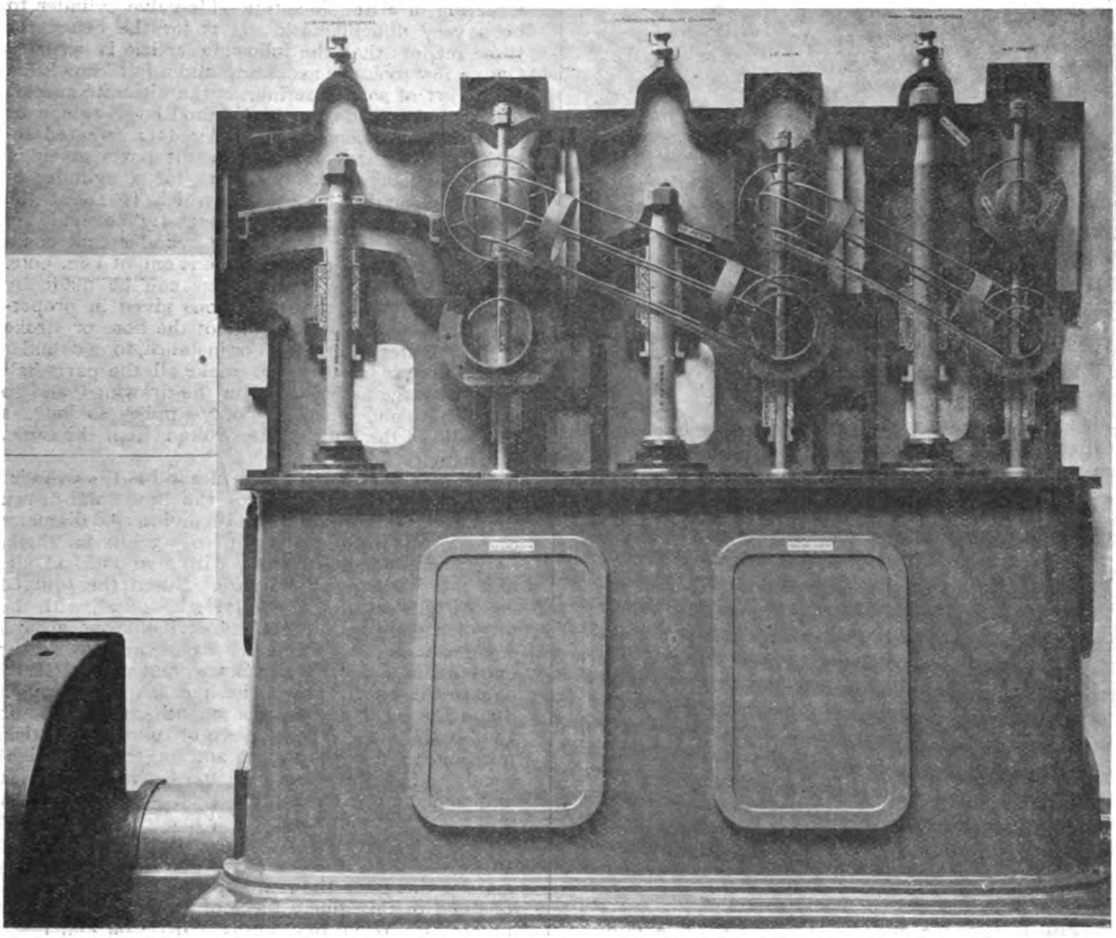


FIG. 16.—SECTION MODEL OF BELLISS AND MORCOM TRIPLE-EXPANSION ENGINE.

from the bearings drains into the crank pit, and after passing through a strainer is ready for use again. This system of lubrication enables these engines to run noiselessly and without shock at high speeds; they are thus suitable for direct connection with dynamos and other high-speed machines. This is a triple-expansion three-cylinder engine with cranks at 120 degs. Steam is admitted to each cylinder by a piston-valve taking steam on the inside edge. The exhaust space of one cylinder is connected by a cast-iron pipe with the steam space of the next, and the weights of the moving parts in connection with each cylinder are made equal, thus eliminating unbalanced inertia

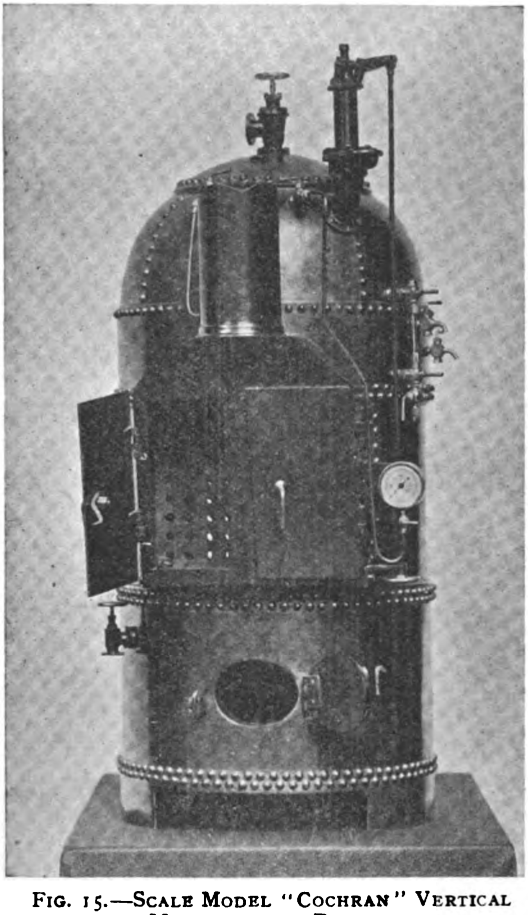


FIG. 15.—SCALE MODEL "COCHRAN" VERTICAL MULTITUBULAR BOILER.

forces acting in the plane of the engine. Steam is cut off in each cylinder at about ⅝ stroke on the down stroke, and on the up stroke a little later, owing to the moving parts having to be accelerated against the action of gravity. In this design of engine the number of different parts is reduced to a minimum, and each part is made as simple as possible, yet the efficiency is practically quite as great as that of engines fitted with very complicated valve gears. The speed of the engine is regulated by a governor (not shown on the model) attached to an extension of the crankshaft, which controls a throttle valve on the main steam pipe. This type of engine is made in sizes from 200 to 2,000 h.-p., smaller sizes having two cylinders only.

How to Construct a "Built-up" Slide-valve Cylinder.

By ALFRED J. BUDD.

THERE are, no doubt, a number of readers of THE MODEL ENGINEER who, not being the happy possessors of lathes, imagine the construction of a double-acting slide-valve cylinder to be a very difficult task. It is for the benefit of these readers that the following article is written. Only a few tools are necessary and a fair knowledge of the art of soft-soldering, as the ultimate success of a cylinder made by this method largely depends on the parts being well soldered or sweated together. The sizes of the different parts given in the accompanying sketches are for a cylinder of ⅝-in. bore and 1-in. stroke, which is about the smallest size that could conveniently be made by this method. The largest size cylinder that could safely be made on this principle is one of 1-in. bore. This and any intermediate size can be made by simply increasing the dimensions given in proportion to the increased amount of the bore or stroke of the cylinder adopted. For instance, for a cylinder with a bore of 15-16ths in., make all the parts half again as large as indicated in the drawings, and so on. This rule, of course, only applies so long as the ratio of the bore to the stroke is kept the same, *i.e.*, ⅝ to 1.

The first part to be taken in hand is the cylinder barrel. For this a piece of the best solid-drawn brass tube will be required, with an internal diameter of ⅝ in. and from 1-16th in. to 3-32nds in. thick. Square up one end carefully with a smooth-cut file, and test with a small square. Stand the squared end of tube on a piece of plate-glass, and, with the aid of a compass or dividers, scribe a line around tube exactly 1 13-32nds in. from the end. Now cut off this piece with a hacksaw, and very carefully square the end down to the line. A good way of doing this is to lay a wide smooth-cut file flat on the bench, then hold the piece of tube in a vertical position between the thumb and fingers of the right hand, and, without pressing too heavily, work the end to and fro over the file, keeping the latter quite still with the other hand. The inside of tube should now be cleaned up. A handy way of doing this is to get a piece of circular wooden rod of slightly smaller diameter than the bore of tube and round one end of this glue a piece of fine emery-cloth, as in Fig. 4. When dry, apply a little oil and insert rod in tube, working it round with a twisting movement. After a little application of this sort the bore should be nice and smooth, and can then be cleaned well with a piece of rag to remove all the oil, etc.

Having done this, file out the slots *a*, *b* (Fig. 5) to the size shown, and then polish up the outside of tube. For the flanges two brass washers should be procured of the size shown in Fig. 5, the hole in the centre being a little less than the outside diameter of the tube. If these washers or collars cannot easily be obtained from stock, they must be cut out and filed to shape from sheet brass of the required thickness. The holes in the collars should be filed out with a half-round file until they are a nice fit on the cylinder barrel.

Slots *c* can now be filed out, and should be of the same width as *a* and *b*, the upper parts of the slots being filed at an angle, as indicated at *d* (Fig. 5). The collars should now be pressed on to the ends of cylinder tube so that the slot *c* coincides with *a* and *b*. By using a small square, set the flanges at right angles with the tube and solder in position. The next part to be taken in hand is what might be termed the "steam-port block," and is shown in Fig. 6. To make this, procure a piece of stick brass 1 in. by ½ in., and cut off a length of just over 1¼ ins. Cut away as indicated at *e* and *f* by the aid of a hacksaw and file, and then, with a ½-in. round file, proceed to shape up the under part *g*, which must be made a true fit to the cylinder tube. To do this, first prepare a fairly stiff mixture of red ochre and oil, and apply a thin coating to the cylinder barrel. The surface *g* should then be pressed against the coated part of the barrel and rubbed slightly up and down. On separating, it will easily be seen which parts of the surface have to be filed down. After repeating this operation three or four times, the surface *g* should be true enough for the present purpose.

After having removed all traces of oil, etc., the sides and ends of block should be squared up, so that when finished the block will just fit between the collars, as in Fig. 1. Clean up the face *h*, and then carefully mark out the position of the steam and exhaust ports. At the point marked *k* at the side of the block, drill a 5-32nds-in. hole to a depth of ⅜ in. Now drill and chip out the exhaust port to meet this hole. Next drill and file out the two steam ports right through the block, as in Fig. 1. These, it will be seen, must be drilled at an angle, so as to clear the exhaust port. The steamways *l* can be chiselled out to the depth indicated at *m*. The hole in the side of block at *k* should be enlarged slightly and tapped with a suitable thread to take the screwed end of the exhaust pipe, which should be of the diameter shown in Fig. 2. The valve face *h* should be faced up true on a surface plate or a piece of plate-glass. This completes the "steam-port block."

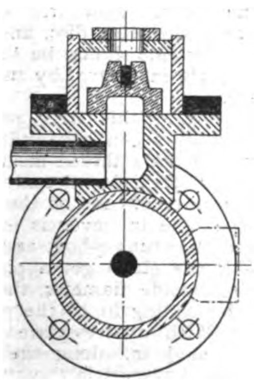


Fig. 2.

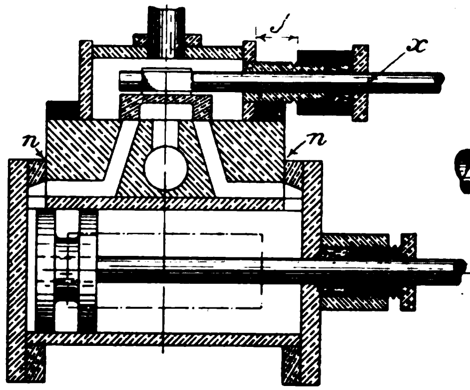


Fig. 1.

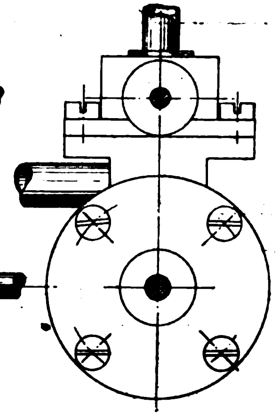
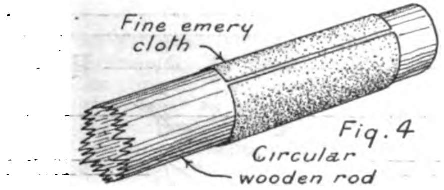


Fig. 3.

Now take the cylinder barrel and "tin" the parts between the slots *a* and *b* on which the concave surface *g* rests. The latter should be treated in the same way, and also the two ends of block, and part of the inside of each flange, which come in contact as indicated at *n* (Fig. 1). Having done this, press the block in place between the flanges and see that the steamways *l* are in alignment with slots *a*, *b*, and *c*. By using a suitable clamp, hold these parts firmly in position, and sweat well together by holding in the flame of a Bunsen burner or blowlamp.



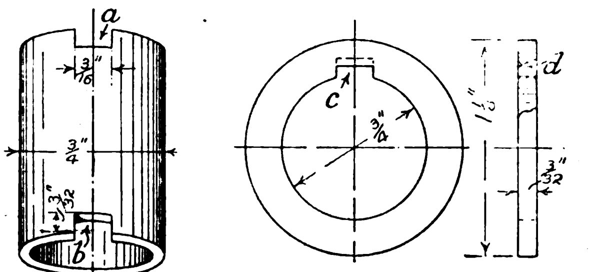


Fig. 5.

It will be as well, before going farther, to sweat the fixing or holding-down lug for cylinder in position. This is filed up out of a block of brass to about the size shown in Fig. 7. The under-side must be bedded down to cylinder barrel in the same way as the "steam-port" block, after which two holes can be drilled and tapped near the ends for 3-32nds-in. fixing screws. This lug or boss is then sweated on to the cylinder barrel in the position indicated by dotted lines in Figs. 1 and 2. The surface of the boss should be made to project a little beyond the level of the cylinder flanges.

We can now turn our attention to the steam chest. To make this, get a piece of sheet brass 1-16th in. thick and file up square to the size shown in Fig. 8. With the aid of a small square and

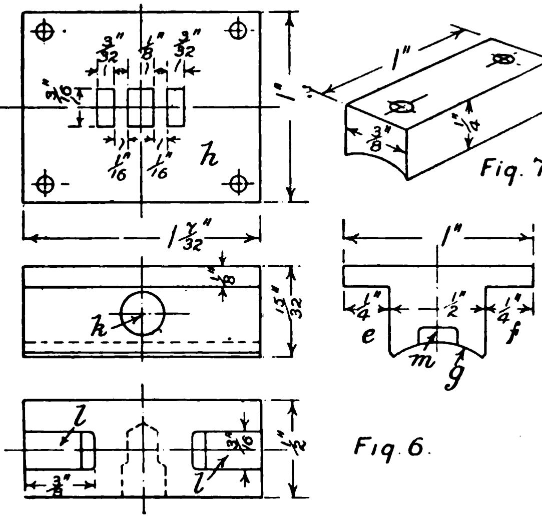


Fig. 7

Fig. 6.

scriber mark off the lines 1, 2, and 3. Now, with a fine-cut file of square section, file nearly through the strip of brass at each of the lines, as indicated at *o*. The strip can now be bent so that the faces of the filed nicks come together, as at *p*. Fig. 9 shows the shape the strip will now assume, and also the overlapping of the end-piece at *r*. Provision is made for this in the dimensions given in Fig. 8. The box-shaped strip should now be held in a suitable clamp, and the four corners well sweated together from the inside. When this is done, a 3-16ths-in. hole can be drilled in the centre of one of the narrow sides, as shown at *s* (Fig. 9). This is to take the valve-rod gland.

The steam-chest flange (shown in Fig. 10) is cut out of a piece of perfectly flat sheet brass 3-32nds in. thick. Mark out the size on the piece of brass, and proceed to drill and file out the rectangular hole, which must be made to fit nicely round the bottom of steam chest. Now roughly cut round with a hacksaw, place in a vice, and file up the edges as square as possible. Next drill four 3-32nds-in. holes—one at each corner, as indicated. Now press the flange in place on the bottom of steam chest, and after adjusting so that the edges of the latter are flush with the face of the flange (as at *t*, Fig. 10), they can be soldered together. By using an old file, remove the superfluous solder from the bottom of flange and face up in the same way as the valve face.

It will be as well now to drill the holes in the valve face for the fixing screws. These holes must exactly correspond with those in the steam-chest flange, and should be tapped for 3-32nds-in. screws. The top of the steam chest will be left till last, to facilitate the setting of the valve.

We will now turn our attention to the cylinder covers. For these two flat brass discs 3-32nds in. thick and 1¼ ins. in diameter will be required. If these cannot be obtained ready-made, they must be cut out of sheet brass the required thickness, with hammer and chisel, the edges being nicely squared up afterwards with a file. Four holes should now be drilled in each cover for the fixing screws, at the points indicated in Figs. 2 and 3. Take one of the discs and face up one side. This will complete one cover. Now drill a ⅛-in. hole through the centre of the other disc, and face up on one side. The other side should be slightly countersunk round the hole in centre, by using a ⅜-in. drill bit and brace.

To make the stuffing-box for this cover, procure a short length of brass tubing of ⅛-in. bore and about ⅜ in. outside diameter, and tap a thread inside one end to a depth of ⅜ in. Cut off this length and square the ends. Now hold this piece of tube on the cover and adjust so that the hole in cover is exactly central with the hole in the stuffing-box, and then solder in position. For the gland get a piece of brass tubing 9-32nds in. outside diameter, the bore of which must be a nice sliding fit to the piston-rod (⅛ in. diameter). With a screwplate cut a thread on one end about ¼ in. along the tube, corresponding to the thread tapped in the stuffing-box. This piece can then be cut off. Now obtain or make a small brass washer, which should be about ⅜ in. diameter and 3-32nds in. thick, and drill a ⅛-in. hole in the centre.

Hold this washer and the small screwed gland in a clamp, and, after carefully adjusting, sweat well together. The stuffing-box and gland for the valve rod are made in a similar way, but their positions are reversed, the gland being soldered into the steam chest. It will also be noticed that slightly different sizes of tubing are used. (See Fig. 1.)

The piston should claim our attention next. Of course, if any reader intending to make this little cylinder can get a friend who has a lathe to turn up the piston, so much the better; if not, it can be made up as follows: Get two brass discs

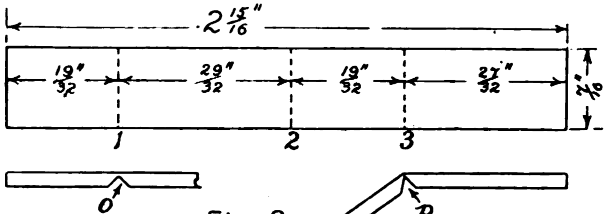
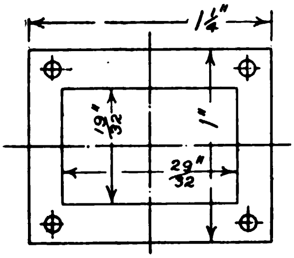


Fig. 8.

3-32nds in. thick, and which fit nicely into the bore of cylinder, and one smaller one ¼ in. thick and 5-16ths in. diameter. Take the two larger discs, and after slightly tinning one side of each, hold them in a clamp so that they exactly coincide, and sweat together. With a centre-punch carefully mark the centre and drill a 3-32nds-in. hole through the two discs. If is, of course, essential that the hole should be quite square with the face of the disc. Now tap a 1/8-in. thread right through, and hold in Bunsen flame to separate, then clean up both sides. The small disc should have a 1/8-in. hole drilled in the centre.

For the piston-rod obtain a length of German silver rod of 1/8 in. diameter. This metal is preferable to steel owing to the latter being subject to corrosion, which soon upsets the smooth working of the piston-rod through the gland, etc. Having placed the piece of rod in a vice, cut a 1/8-in. thread along one end a distance of 5-16ths in. by the aid of a screw-plate. One of the tapped discs can now be screwed "home," as indicated at *u* (Fig. 11). The middle part of piston can now be slipped on and the other disc screwed up tight, clamping the middle part in position. Now apply a little soldering flux at *v*, and sweat this end of piston to rod by using a soldering iron. File off all superfluous solder and carefully clean up the edges *w*, which must be left quite square. The piston-rod can now be cut off to the length required and the end squared up. The slide-valve is made out of a piece of stick brass or gun-metal, and should be filed to shape and the cavity chipped out with a small chisel to the size shown in Figs. 1 and 2. Only a small amount of lap is indicated (about 1-64th in.), which will be found suitable for general use. The valve rod can be of brass or German silver, being filed away where it engages in the slot in the valve. (See Fig. 2.)



and then, holding the valve in mid-position, with a scriber make a slight mark on the valve rod flush with the face of gland, as indicated at *x* (Fig. 1). Now carefully measure the distance *y*, and make a note of it for future reference. This method allows the position of valve and length of eccentric rod to be determined when all the parts have been

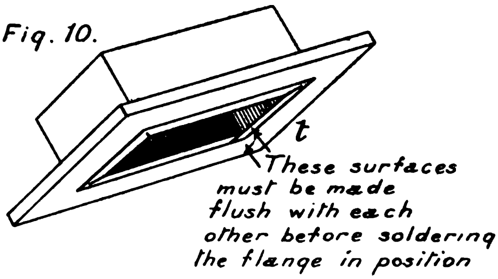


Fig. 10.

assembled. The two screws and the valve rod can now be withdrawn, and the stuffing-box unscrewed.

All that remains to be done now to complete the cylinder is the steam chest top. This is simply a piece of sheet brass 1-16th in. thick, cut out to just fit the inside of steam chest. (See Figs. 1 and 2.) In the middle of this brass plate sweat on a small brass washer, and having marked the centre, drill a 5-32nds-in. hole, which can be tapped to take the screwed end of the steam pipe. Now take the plate and press it down so that its surface is a little below the top of steam chest, and then well solder all round.

The parts can now be assembled and the steam chest screwed down, having packed the joint in

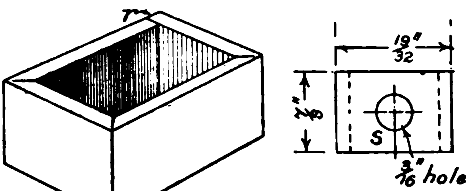


Fig. 9.

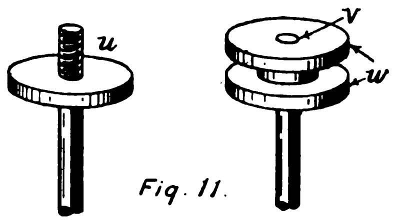


Fig. 11.

Having got so far, proceed to drill and tap the holes in the cylinder flanges for taking the fixing screws for covers. The positions of the four holes must, of course, exactly correspond with those already drilled in the covers. Each hole is to be tapped to take 3-32nds-in. screws, or bolts if the latter are preferred.

The piston can be packed in the usual way with asbestos string or hemp saturated with Russian tallow. We are now ready to fix down the covers, but before doing so cut two circles of thin brown paper the diameter of the cylinder flange and soak well in linseed oil. These are placed between the flanges and the covers when the latter are screwed down, and will make a perfectly steam-tight joint.

The valve can now be set. To do this, first place the valve rod and steam chest in position, and fix the latter down with a couple of screws. Screw up the stuffing-box sufficiently to hold it tight, the same way as the cylinder covers. The stuffing-boxes can be packed with the same sort of material used for the piston, and the cylinder is then ready for steam. Although not shown in the drawings, the cylinder should be lagged in the usual way to prevent excessive radiation. With regard to the steam pressure, 20 to 25 lbs. could be safely used, provided that all the joints have been well soldered.

It would be as well perhaps to mention here that the writer some time ago constructed a small horizontal engine, the cylinder of which was a "built-up" one, very similar to the one described, and which worked very satisfactorily.

If the instructions given are carefully followed out, coupled with a good deal of patience, the builder will find that he is in possession of a neat and efficient little cylinder which will amply repay him for the time and trouble expended in its construction.

In apologising to the reader for the length of this article, the writer hopes that some beginners at least will pick up a few hints from it of use to them in the pursuit of their favourite hobby.

A Double-Circuit Switchboard.

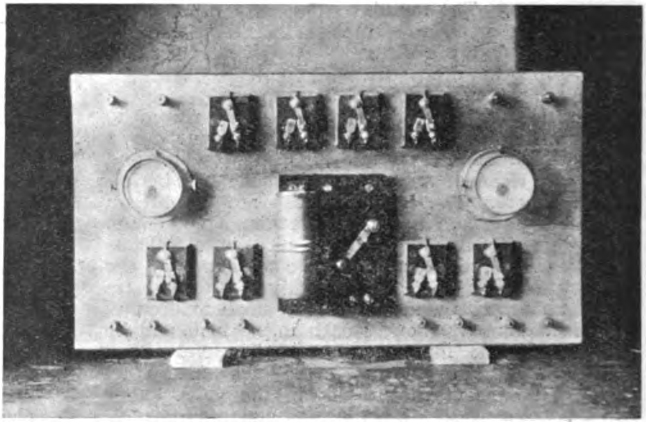
By M. Macleod.

THIS switchboard was planned and constructed in order to enable two operations to be carried out at the same time, namely, to charge an accumulator or accumulators from a dynamo or battery, and to run an electro-plating cell from a small dynamo, the voltage and current flowing in either circuit being readable at will by moving the necessary switches. In addition, an adjustable resistance is provided, which can be switched into either circuit without interrupting the flow of current in the other.

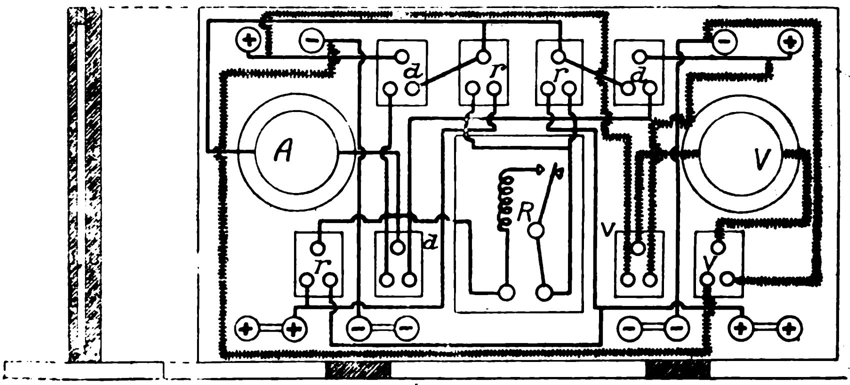
The board is made in the form of a very shallow box supported on two feet. The dimensions are 20 ins. × 11 ins. and 1½ ins. in thickness. The face consists of a board ½ in. thick. Round the edges of its back are fixed wooden strips ½ in. × ¼ in. thick, and the shallow box-like cavity thus formed is covered in by a ¼-in. wood backing. All the connecting wires lie in this cavity, and are thus out of sight and protected from injury. This method is, besides, much neater than using a plain board with the wires hanging out behind. On the face are fixed an adjustable resistance, an ammeter, a voltmeter, eight two-way switches, and twelve terminals. The adjustable resistance is a cylindrical coil of German silver wire, whose full resistance is 21·5 ohms. This can be reduced by moving a sliding brass ring down the coil, which gradually cuts out resistance. Of course, any resistance could be used, this particular one was picked up second-hand, which accounts for the rather unusual number of ohms. This resistance also has a switch of its own, which can, if necessary, be used for breaking circuit. The ammeter and voltmeter are of the ordinary flanged charging-board type. Of the eight switches, three belong to the ammeter, two to the voltmeter, and three to the adjustable resistance. The six terminals on the left of the board form the left-hand circuit, the top ones being connected to the generator, and the bottom ones (which are duplicated) to the accumulator or plating cell. The top and bottom outer terminals are positive, and the inner terminals negative, as shown in diagram. The right-hand circuit is exactly similar.

The diagram shows the system of wiring. The thick lines represent the current-carrying wires, the dotted lines the voltmeter wires. The connections are shown as straight lines for clearness, though in reality they take the form of insulated wire going directly from point to point.

Each set of switches moves together. To take the left-hand circuit as an example, if it is desired to read the current flowing, all the three ammeter switches are moved over to the left, thus putting the ammeter into the left-hand circuit. Now, supposing it is desired to read the current flowing in the right-hand circuit. In order to put the ammeter into this circuit, its three switches are moved to the right. This, however, does not stop the flow of current in the left-hand circuit, because the top left-



General View of Finished Switchboard.



A. Ammeter.
V. Voltmeter.
R. Adjustable resistance.
d d d. Ammeter switches.
v v. Voltmeter switches.
r r r. Resistance switches.

Diagram of Switchboard Connections. (*Scale: ⅛th full size.*)

hand ammeter switch, when moved to the right, provides a short cut for the current to the top left-hand resistance switch, whence it goes, through the resistance or its alternative path, to the lower left-hand positive terminal. The same principle applies to the adjustable resistance and its three switches. The case of the voltmeter is somewhat simpler. It has only two switches, since, as the voltmeter connections are not current-carrying wires (that is, as concerns the main current) it is not necessary to provide any alternative paths. The number of switches may, at first sight, seem excessive, but has been found necessary in order to prevent the current from one circuit leaking into the other.

The switchboard took about a week's spare time to fit up, and in practice has given the utmost satisfaction. The two circuits are entirely separate from one another, and yet are controlled by the same apparatus. Another use has been found for the switchboard, namely—the finding of unknown resistances. To do this the unknown resistance is connected between the bottom terminals of one circuit, while a battery or other source of E.M.F. is connected between the top terminals. The ammeter and voltmeter are then switched into this circuit (the adjustable resistance being cut out by switching it into the other circuit), and the voltage and current flowing are read off. The required resistance is then found from the formula $R = \frac{E}{C}$, where E is the voltage, and C the current flowing. The photo gives a good idea of the general appearance of the switchboard.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Acetylene Bicycle Lamp.

To the Editor of *The Model Engineer.*

Dear Sir,—With reference to the letter of O. H. Oakes in The Model Engineer for Nov. 12th, the deposit referred to is copper acetylide, produced by the action of impure acetylene on unalloyed copper. Copper acetylide is, when dry, highly explosive and will detonate when struck or even rubbed. For this reason, the use of copper in the construction of acetylene generators, burners, etc., is absolutely forbidden in most countries.

The Model Engineer would, therefore, be doing a good service to call the attention of its readers to the danger of using copper; brass may be used for taps, but acetylene generators should be made of zinc or steel.—Yours truly, "Zodiac."

To the Editor of *The Model Engineer.*

Dear Sir,—In reply to your correspondent, O. H. Oakes, I think there can be little doubt that a deposit of cuprous acetylide had been formed on the copper disc. If acetylene be passed through an ammoniacal solution of cuprous chloride a dark red precipitate is formed called cuprous acetylide, which is highly explosive. I did not know that acetylene would act directly on metallic copper, but this certainly seems to be the case. A similar compound is formed with silver, prepared in this case by passing the gas through a solution of silver nitrate.—Yours faithfully, D. Clease.

To the Editor of *The Model Engineer.*

Dear Sir,—Perhaps the following may be of some use to Mr. O. H. Oakes, and offer a solution to the mystery connected with his acetylene lamp.

The deposit which formed on the copper plate and sparked with some violence was evidently copper acetylide—a substance formed when acetylene is passed through certain solutions of copper salts. It acts very much in the same way as a "fulminate," exploding on heat, friction or percussion being applied. For this reason, bare copper should never be used in acetylene gas apparatus.

The soluble copper salt is rather more difficult to account for, but impurities in the carbide, the water or the wool are not improbable, the carbide being most likely the guilty agent. Then, again, the lapse of time between actual use would favour the formation of copper compounds. Mr. Oakes should have his copper nickel-plated or use zinc.—I am, yours faithfully,

Albert V. Ballhatchet.

To the Editor of *The Model Engineer.*

Dear Sir,—In reply to Mr. O. H. Oakes' letter of the November 12th issue, I advance the following explanation :—

(1) The lamp at certain periods contains air; thus we get the formation of cupric oxide—

$$2Cu + O_2 = 2CuO.$$

(2) Since when the lamp is in use the plate becomes hot, a partial reduction takes place—

$$2CuO = Cu_2O + O.$$

(3) When acetyline passes over Cu_2O cuprous acetylide is formed.

$$(a)\ Cu_2O + C_2H_2 = Cu_2C_2 + H_2O.$$
$$(b)\ Cu_2O + C_2H_2 = Cu_2C_2 \cdot H_2O.$$

Reaction (*a*) only takes place if the lamp is allowed to stand and thus dry the substance.

It will thus be seen that copper should not be used in any part of an apparatus containing acetyline. The cotton plays no part in the reaction.—I am, yours truly,

E. Moore Mumford.

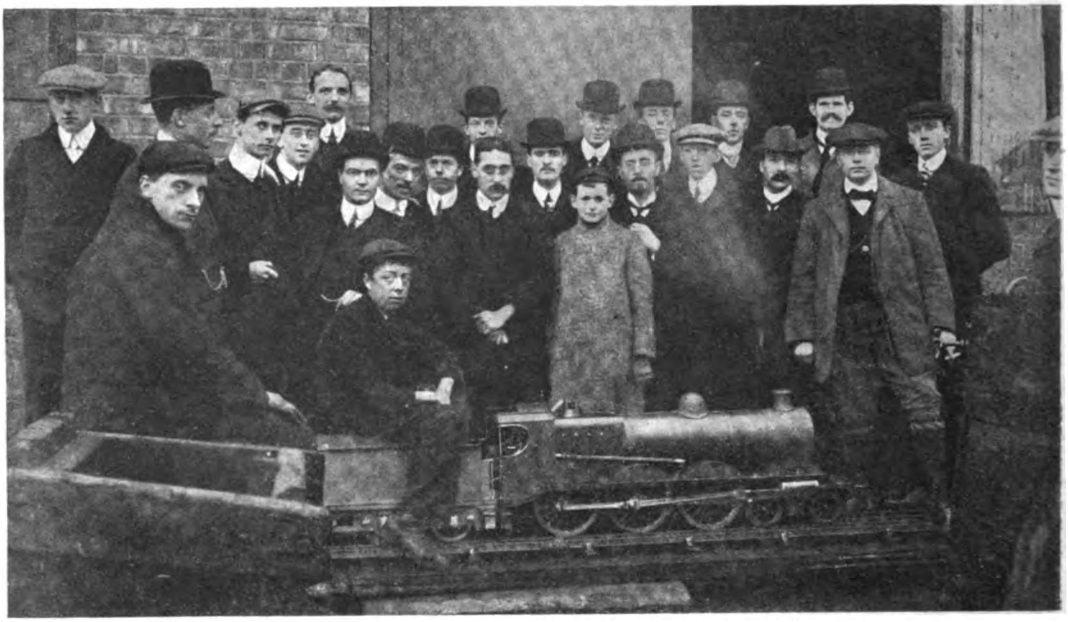
Slipping Driving Wheels.

To the Editor of *The Model Engineer.*

Dear Sir,—Having read Mr. Rolph's letter in Nov. 5th issue, I thought, perhaps, it would interest you to know that I have also seen a case of an engine absolutely refusing to start. The engine was, as in Mr. Rolph's case, one of the new G.W.R. "Flower" class (4—4—0 type), bearing the name "Calceolaria," and was attached to a local train composed of five small coaches running between Bath and Bristol. At Keynsham it was punctual, and hence could not have experienced any difficulty in getting away from previous stations. However, on the driver and fireman attempting to start, the engine refused to move. Reversing was tried without success. The brakes on each individual carriage were then examined and found to be "off." Thus the train had to wait until help arrived in the shape of a slow goods train, the engine of which started us without the slightest difficulty. Once "under way" the rapid acceleration proved very little to be the matter. The start from the subsequent station, although on an uphill grade, was accomplished in fine style. All this tends to show that the valve setting was probably at fault, and although this may not be the only fault, I do not attempt to advance any other theory.

I should also like to point out to Mr. Richards that the speed of the driving wheels can very easily exceed the speed of the trailing wheels. Suppose, when starting, the driving wheels slip without moving the train. What then?

Mr. Richards also says that "a very large amount of work is being done . . . in overcoming . . . the inertia forces. Now, if the speed is constant, the work thus expended is *nil.* The meaning of "easing negative slip" is also rather vague.



GROUP OF S.M.E. VISITORS TO THE WORKS OF W. J. BASSETT-LOWKE AT NORTHAMPTON.

Mr. Coomb's theory *re* "jacking" up of the driving wheels due to defective track, is, I think, also inadmissible, as most driving wheels are mounted on springs, and any slight dip in the rails would be followed by the wheels by reason of the compression of the springs. Then, even supposing the wheels did *momentarily* leave the rails, the large amount of *kinetic energy* possessed by the driving wheels would overcome any pumping action in the cylinders. Apologising for this somewhat lengthy letter, I remain, yours faithfully,

C. H. BOND.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I note one of your correspondents on this subject recently drew attention to the fact that amongst those who uphold the idea that slipping *does* occur on down grade, even when there is admittedly no propulsive force behind the piston, none have gone further than to affirm "it is so."

Speaking to an experienced driver (S.E. and C.Rly.) the other day, he told me that many of the drivers of the large 6-ft. 8-in. four-coupled engines had frequently asked him what to do when their machines had "got the ghost," as they put it. His reply is, "Pick her up, and give her some steam." Although I have had no actual experience with locomotives, I may be entitled to say that I think the phenomenal behaviour which many drivers have witnessed needs substantiating before one can be persuaded that something happens which is contrary to all the known laws of science. The centrifugal action, or the out of balance factor, recently referred to by correspondents, whatever else its effect may be, *cannot give us acceleration*—and very rapid acceleration, too—for that is what we are asked to believe. There is only one way to establish the fact, if fact it be, and that is to fit a recording speed indicator. I suppose this could readily be done, but whether or no it is worth while, the locomotive men must decide.—Yours faithfully,

W. C. R.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—With regard to "N.E.R. Driver's" letter in Nov. 12th issue of THE MODEL ENGINEER, may I suggest that the pitching mentioned in last paragraph was (and still is in some cases) due to the cylinders being inclined, causing a force to act on springs which it is, to say the least, difficult to balance. I have seen a distinct "lift" at the buffers of a 6-coupled goods when starting a heavy train, and at a high speed the effect would have more play—and the N.E.R. goods engines can travel when required.

I should like to ask "N.E.R. Driver" whether he ever noticed the "shouldering" of the 4-coupled bogie engines, once very common on the Whitby lines? They were small engines, not unlike some Midland engines, but their "waggle" at starting was often very pronounced.—Yours faithfully,

LEE SHEPPARD.

Modelling Textile Machinery.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—It was with interest I read the letter from "Textile" in Nov. 12th MODEL ENGINEER, with regard to models of textile machinery. It is certainly a branch of engineering which is very interesting and would call for originality and ingenuity on the part of a model maker. Although not in a spinning mill I am interested in the cotton trade, and a description of the various machines (scutching, slubbing, roving, spinning, etc.) would, I am sure, prove interesting to many readers who, like myself, are unable to get into actual touch with the machinery. This is a subject which has received scant consideration from model makers, and anyone striking out in this line would have a fresh field open to him, with the consequent pleasure of doing *original work.*

I am at present making a model of a cargo steamer, not working (particulars of which I hope to submit at some later date), and have had thoughts for some time of turning my attention in the direction of textile machines (when the present model is finished), so that any particulars "Textile" could supply would be much appreciated by myself and many others.—Yours faithfully,

B. FARROW.

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before its usual date of publication.]*

London.

A LARGE party of the members visited, on Saturday, November 21st, the Works, at Beckton, of the Gas Light and Coke Company, and under the guidance of Messrs. Methvyn and Moyse spent a most interesting time in the exploration of a portion of the vast extent of ground covered by the Works. An inspection was first made of the finely equipped outdoor and indoor rifle ranges, used by some of the 4,000 employees, the 100 yds. indoor range being one of the very few to be found near London. The whole party then mounted the directors' carriage attached to one of the thirty locomotives employed in hauling coal, etc., over the 42 miles of line in the Works. This particular locomotive and one other having been built in the Company's own workshops at Beckton, came in for much attention from the members, and is a four-wheeled coupled tank engine, with outside cylinders and a low-pitched boiler. The signal to start having been given, the party was speedily pulled up a very long gradient of about 1 in 35 to the coaling stages erected on piles in the river, where the unloading of coal from a Newcastle steamer was in operation, several large hydraulic cranes unloading it by self-acting grabs, each lifting a ton at a time and depositing the coal in trucks on the stage. Boarding the "special" again, a tortuous journey brought the party to the pumping-room, where the whole of the gas produced is pumped under pressure from the gas-holders to the mains; the next stop was made at one of the many retort-houses, and a long time was spent in watching the compressed air stoking machines at work, the combined noise, smoke, flames, and glowing furnaces making the operations very weird and spectacular. Emerging from this Inferno, our faithful friend whisked us off to another retort-house, where the machinery was worked by hydraulic power—a somewhat quieter method than compressed air. The air-compressing plant was found very interesting, and the gas engines driving the coal conveyors were also glanced at. A further ride brought the party to the newer portion of the Works, where a retort-house in course of construction was seen, and also the elaborate system of bathrooms for the use of the stokers. Boarding our train for the last time, we were hurried along to the offices of Mr. J. N. Reeson (the resident engineer), who cordially invited the party to tea, which everyone found very welcome and did full justice to. "Smokes" having been handed round, the Secretary rose to propose a vote of thanks to the Company and their representative (Mr. Reeson) for the splendid arrangements he had made for the members' enjoyment; also to Messrs. Methvyn and Moyse for the able and painstaking efforts to show the members everything possible to interest them. The vote was given with great applause, Mr. Reeson, in replying, expressing the great pleasure it gave him to have the members there.

Visit to Northampton.

A party of seventeen members visited the works of Messrs. W. J. Bassett-Lowke and Co., to view the very fine 1½-in. scale model Great Central Railway 4—6—0 type express locomotive built to the order of a private customer from designs by Mr. H. Greenly, under its first steam trials. The engine runs on a gauge of 7¼ ins., and a temporary track of the new permanent-way was laid down for a length of about 150 ft. in the works yard.

The tests were in every way successful, and the engine pulled (under unfavourable weather conditions) a total load of about 1,870 lbs., or, with the engine, over one ton. The model has cylinders 1¾ ins. by 3 ins., driving wheels 9¾ ins. diameter, and is a replica of the No. 1,097 "Immingham" 6-ft. 6-in. class of 4—6—0 express engines lately designed by Mr. Robinson. The various departments, permanent-way, signals, and rolling-stock were visited, also the stores and packing rooms, the members expressing themselves well satisfied with the quality of the work turned out. Two 3-in. scale engines are being commenced at Northampton, and also three more 1½-in. scale engines, and Messrs. Bassett-Lowke extend the invitation to the Society and also general readers to visit them next spring when it is hoped these engines will be completed and under test, due notice of which will be given.

One of the visitors, Mr. Spriggs, of Birmingham, brought the model G.W.R. 2—4—2 type tank engine (illustrated in these pages in 1907), and kindly explained the main features of the design, and also his three years' experience with the running of this model.

Tea was provided by Messrs. Bassett-Lowke at the Divan Café, and at the close of this function, Mr. D. Corse-Glen, M.I.Mech.E., in a few well chosen words, moved a vote of thanks to Messrs. Bassett-Lowke for the interesting afternoon which they had provided for the members. Mr. Bassett-Lowke replied and the members returned by a fast train at 6 p.m. to London.

FUTURE MEETINGS.—The next meeting will be held on Wednesday, December 16th, when Mr. L. M. G. Ferreira will read a paper on "Testing and Comparing the Performances of Model Locomotives."—HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green.

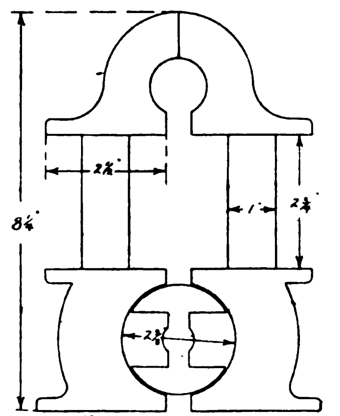
Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[18,718] **Small Undertype Dynamo Windings.** R. A. (Basford) writes: I should be pleased if you could kindly assist me in the matter of a small dynamo I am rewinding. This is the type used by potters to recharge slip magnets, and has been wound



Query N° 18718

as a series dynamo. I am now desirous of using this machine to light 4-volt lamps in my workshop, and should be pleased if you could let me know with what gauge of wire to wind same, so as to get the best results. I am willing to fit same with a drum armature if this will increase output, and in that case kindly tell me what quantity and gauge of wire I should require for a six- or eight-sided drum to give 4 volts. This machine was in a very bad condition when it came to me, and so I could not get a run from same The fields were wound with 4 lbs. of the enclosed wire (2 lbs. on each side), and the H armature was wound with the same gauge of wire, though I do not know the quantity. Enclosed is a rough sketch of machine castings, which I hope may assist you in answering my queries.

Your dynamo, with its present windings—namely, 8 ozs. of No. 18 S.W.G. on armature and 4 lbs. of same gauge on fields—should give about 10 volts and 4 amps. output when run at 2,900 r.p.m. If you require to light 4-volt lamps from this machine, you should first find out by trial exactly what voltage it will give. You will probably find that it is necessary to connect your 4-volt lamps in sets of twos in series. If a higher voltage is obtained, then you might be able to use three 4-volt lamps in series. You can best arrange this matter when you have ascertained the voltage of your machine. The sample of wire you enclose is No. 18 S.W.G.

[20,347] **Plate for Model Locomotive Boiler.** W. A. L. (Pangbourne) writes: I have built the ¾-in. scale model of Caledonian locomotive with exception of boiler. Will you kindly answer the following questions *re* latter? It is difficult to obtain copper plate exactly 1-20th in. thick—will 18-gauge do? Also what gauge should the ½ in. diameter boiler tubes be?

We do not see that the difference is worth bothering about. Use the standard size, 18 S.W.G., which, according to Colonel Bagnold's "Table of Screws and Wire Gauges" (price 3d. post free from this office), is equivalent to 1-21th of an inch. You might get 1-20th plate after a deal of trouble. The tubes should be 18 or 20 S.W.G. if they are to be screwed into the firebox. The thread should be not coarser than 40 per inch, Whitworth form. We strongly recommend screwing.

[20,439] **Model Boiler Design.** K. A. (Plymouth) writes: Will you please answer the following query *re* horizontal copper boiler? What would be the highest safe pressure I could screw the safety valve down to on the boiler described below? It is made of seamless copper tube 1-16th in. thick, and 5 ins. by 12 ins. long; both ends (each 1-32nd in. thick) are soldered with tinman's solder over the ends of the boiler tube; both ends have flanges like a tin lid. The ends are further stayed with a copper stay (¼ in. diameter) running from end to end. The boiler is fitted with four ½-in. copper water tubes, which are soldered with tinman's solder inside the boiler; the firing is by means of a single No. 5 Primus stove (3 ins. diameter).

The shell would safely stand a pressure of

$$\frac{20{,}000 \times \frac{1}{16} \times 2}{5} \div 10 \text{ (factor of safety)} = 50 \text{ lbs. per sq. in.}$$

The ends should be slightly thicker rather than thinner than the shell, and would not be safe at anything near the above pressure if only 1-32nd-in. plate is used, as, without being riveted to the shell, the end might open out after the fashion of an umbrella in a gale of wind. To obtain greater strength with the given ends, we would recommend riveting or screwing the flanged ends to the shell, and instead of one central stay about *five* (one placed centrally, and the others spaced round it) stays about 3-16ths in. diameter. We would, however, employ ends at least 5-64ths in. thick, if we were you. The pressure on the end is about 1,000 lbs. (nearly ½ ton) at 50 lbs. pressure. Why not employ a turned flanged gun-metal casting? We do not advise under any circumstances a water-tube boiler in which the water tubes are soft-soldered only. You must adopt some such arrangement as described in our book, "The Model Locomotive," page 192, Fig. 247, and under the heading of "Chats on Model Locomotives," in our issue of September 12th, 1907. Here the tubes are fitted into gun-metal castings forming upcomer and downcomer respectively.

[20,420] **Model Steamer Machinery.** E. J. H. (Folkestone) writes: I have built a 5-ft. boat on the lines of Mr. Lomax's design; the boiler is 11 ins. by 5 ins., locomotive type, has had 60 lbs. pressure, steams well. I do not suppose it would have to work more than 30 lbs. Now I want a good engine. It will have a single 3-in. propeller. (1) Is a compound better than simple? (2) Is a two-cylinder engine better than one large cylinder, and whichever is best, what size or sizes would suit? (3) Would Stuart Turner's ¾-in. by ¾-in. single-action do as well (or better) than a two-cylinder ¾-in. by ¾-in.? The steam is superheated by coiling the supply pipe twice in the smokebox. I wondered if brass cylinders would score. With respect to pump, I want to know if, as the pump has a delivery valve, it is necessary to have a check valve on the inlet to boiler. Also, what size?

(1) There is not very much in it, but it is as well to remember that for several years a compound engine held the record of speed in the Model Steamer Competitions. (2) There is no *best* in the ordinary sense of the word. Workmanship tells more than whether one cylinder or two cylinders are employed. Of course, if you are obliged to use two cylinders, then make the engine a compound. There may then be some saving in steam, or, what comes to the same thing, the engine will give more power from the boiler at a given rate of evaporation. (3) One will work at double the pressure of the other. The degree of superheat will not hurt the cylinder. It is likely to do no more than dry the steam. (4) A check valve is almost a necessity. The size of the pump depends on the evaporation of the boiler. At least 50 per cent. loss should be allowed for in the efficiency of the pump.

[18,821] **Overtype Dynamo Windings.** A. V. W. (Southampton) writes: I have got an overtype dynamo. I have your book on "Small Dynamos," but the machine is too big to use a tripolar armature, as far as I can see. Would you tell me if it would be wise to put a 12-tooth cog drum in the place of the tripolar armature, and could you tell me what size and weight of wire for field-magnet and armature? I want as big an output as possible.

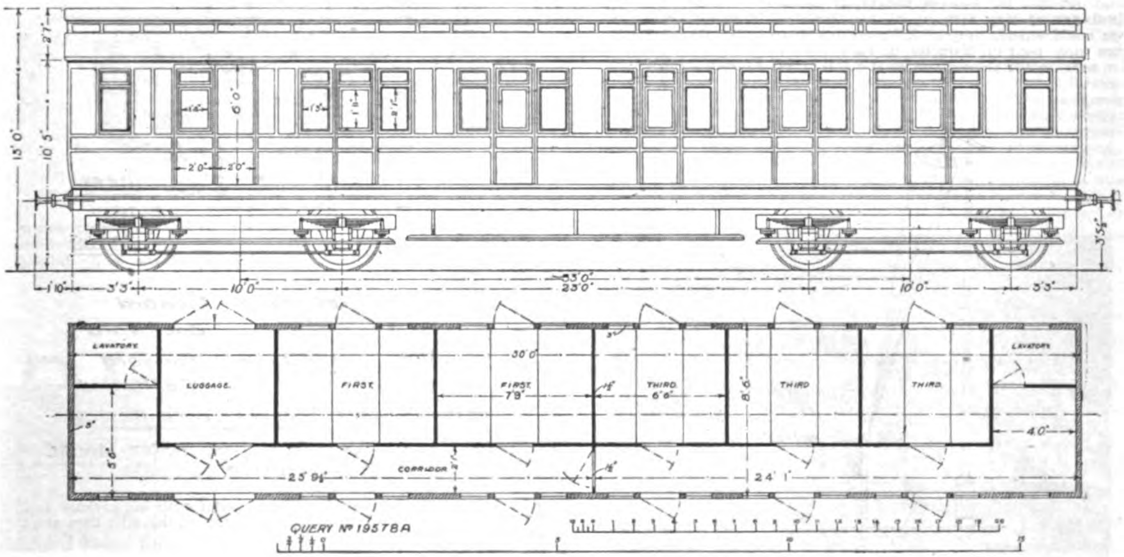
In reply to your enquiry *re* overtype dynamo, you may safely fit a drum wound armature and should wind armature with 8 ozs. No. 22 S.W.G. and field-magnets with about 3 lbs. No. 24 S.W.G., or as much as this as you can get on in the space; 2,600 r.p.m. would not be too high a speed; 2,800 would be better if you can get it.

[19,578A] **Midland Corridor Coach.** C. H. (Tufnell Park) writes: Being a constant reader of THE MODEL ENGINEER, I am taking the liberty of asking you if you could send me a fully-dimensioned drawing for a 2-in. gauge Midland Railway ordinary passenger coach.

[2,042] **Engines for Aeroplanes.** J. D. (London, N.) writes: I should be obliged if you will answer the following questions. What would be the lightest motor or engine I could use for a model aeroplane, excepting petrol engine, to give about ½ h.-p. and about 2,000 r.p.m.? Could you recommend me a firm who would make it for me cheap, and about how much would they charge? What size two-bladed propeller could I expect ½ h.-p. to drive (working in air) to give the best results?

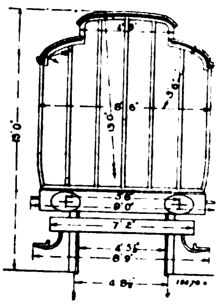
We do not know that any other type of motor would be suitable, and even a petrol engine sufficiently light to give passable results would entail much careful designing, and is largely a matter of experiment. You might try some of the firms advertising for such work in this journal, but its nature would naturally command a high price.

[20,624] **Cinematograph Arc Lamps.** J. S. (Bideford) writes: I want you to send a diagram of the usual connections for an arc lamp employed in a cinematograph lantern both for continuous and alternating currents. Also how much resistance



MIDLAND CORRIDOR COACH.

We append a drawing of a Midland carriage with a scale of inches for 7-16ths in. scale model. The end view is reproduced to the same scale. The coach is a standard one with square cornered windows and clerestory roof. The original coach has the flexible covered ways, but these may be omitted. As it is drawn the coach represents a "through" 1st and 3rd composite corridor carriage.

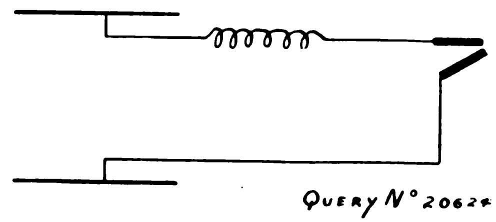


END VIEW OF COACH.

A "through" coach is one which is attached to a main line train, which is broken up at some distant point, from whence coach proceeds on another train to its destination. Living in London you will be able to take notes of the colours.

to use. The arc lamps I think usually take about 20 to 30 amps., at about 100 volts, but if you would be so good as to get to know from a maker of such lamps what size is usually employed, I should be much obliged.

Arc lamps are used for cinematographs on all voltages, according to the voltage of the supply available, and they require various amounts of current according to the candle-power used. The resistance, too, varies according to the voltage and amperage of



lamp, and also is different for continuous and for alternating current. We regret that as you do not specify any particular size of lamp or state the nature of the electric supply to be used, we cannot answer you more definitely. The connections are simple, as shown in diagram herewith.

[20,458] **Testing Strength of Model Boiler.** T. H. C. (Glasgow) writes: I tested a boiler according to instructions in "Model Boiler Making," but not having book by me just now I cannot refer to it. I used a piece of solid-drawn steel tube (½ in. inside diameter) and turned a ram to fit with small dish soldered.

on top. I then screwed tube into boiler, put ram in place, and then a 3½-lb. weight on top. I pumped water in with a large inflator till it lifted weight 1½ ins. to escape-hole in tube. What pressure had I on the boiler?

As the pressure in pounds per square inch inside the boiler was sufficient to lift 3½ lbs. pressing on a surface equal to the area of a ¼ in. diameter plunger, we get the following equation:—

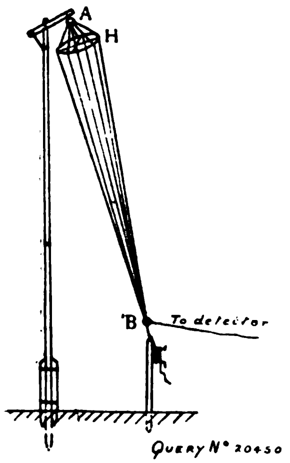
$$x \text{ lbs. pressure per sq. in.} = \frac{3\frac{1}{2}}{\text{Area of } \frac{1}{4}\text{-in. plunger.}}$$

$$x = \frac{7/2}{5/100} = \frac{7 \times 100}{2 \times 5} =$$

$$x = 70 \text{ lbs. per square inch.}$$

Possibly, the pressure was 75 lbs. actually, owing to the friction of plunger and weight of the latter and of the scale pan.

[20,450] **Electrolytic Detector.** H. W. (Smethwick) writes: I have been much interested in Mr. Bornhardt's electrolytic detector for wireless telegraphy (described in THE MODEL ENGINEER of May 14th, 1908), and I should be much obliged if you could answer me the following questions:—(1) Would platinum wire, ·0001 in. diameter, do for the one pole of cell? (2) What size aerial would be used and what metal? (3) From what distance

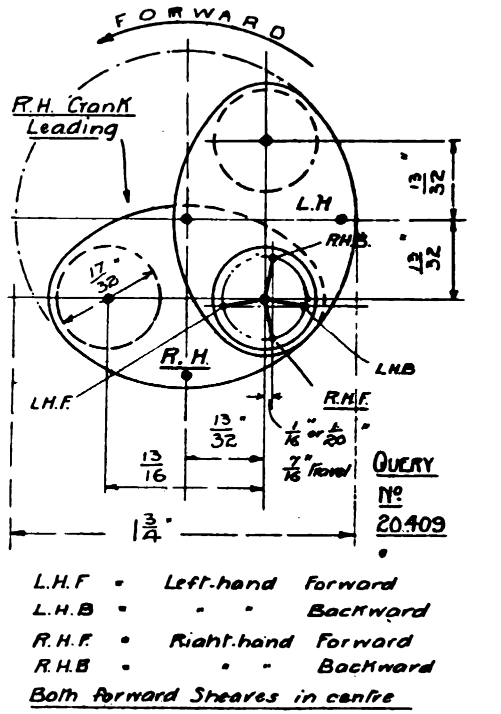


about will it detect the waves, and can waves be detected from any station within that radius? (4) Are the cores of choking coils made of iron or brass, and is the No. 36 wire covered?

(1) Yes, excellently. (2) If you intend telegraphing over a distance of more than a mile you will need fairly high receiving wires. If for short distances (1–4 miles) an aerial like sketch will be excellent. It should be about 60 ft. high, the wooden hoop H can be of about 30 ins. diameter. The four or six wires forming the net are stretched out between two strong porcelain rings A and B. The wires must be copper. (3) The distance over which electrolytic detector will detect depends greatly upon the energy radiated from the transmitting station and sensitiveness of receiving apparatus. If the stations are tuned the distance will be greater. Signals for a 2-in. coil can easily be received over a distance of a mile or more with aerials as above, if the transmitting and receiving stations are tuned to the same wave length six or more times the distance can be crossed. (4) The core of the choking coils must be of iron. The No. 36 copper wire on choking coils should be silk covered.

[20,409] **Locomotive Crank Axle and Eccentrics.** T. P. S. (North Scale) writes: In your handbook "The Model Locomotive: Its Design and Construction," page 105, Fig. 119, is illustrated a crank axle with eccentric turned from one piece of metal. Would you kindly forward me a diagram of the setting out of the eccentrics in their accurate positions?

We append a full-size diagram showing the relative positions of the cranks and four eccentrics. There are ten centres required, and care must be exercised to see that the correct eccentric sheaves are being turned when the forging is centred for the particular one it is desired to machine. It is important that the two forward sheaves should be in the centre and the backward sheaves on the outside, next the crankwebs. Further particulars of the valve gear are given on pages 159 and 160 of "The Model Locomotive." It must be noted that the throw or travel of the sheaves should be 7-16ths in., not ½ in. as in the original drawings published in THE MODEL ENGINEER. **Experience has shown that the smaller travel gives too early a cut-off with 1-16th in. lap. For a working model**



SOLID CRANK AXLE FOR ¾-IN. SCALE MODEL LOCOMOTIVE.

with 4-in. eccentric rods we would advise 1-20th in. advance and 1-20th in. lap instead of 1-16th in. The engine will then start much more readily.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

** Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

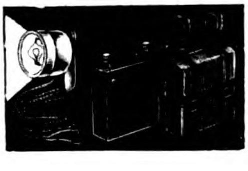
The "Novelty" Dynamo.

With reference to the statement by Mr. D. Peel in his article in our issue of November 19th that the "Novelty" dynamo was a foreign-made article, we are asked by the Universal Electric Supply Co., 60, Brook Street, C.-on-M., Manchester, to point out that this is incorrect, the machine being English-made throughout. We are pleased to be able to support this correction from personal knowledge, and to say that not only can the Universal Electric Supply Co. supply as many complete "Novelty" dynamos as our readers require, but they can supply the magnets or any of the other separate parts in any quantity.

* Armstrong's Specialities.

Messrs. Armstrong & Co., Faraday Works, Twickenham, London, S.W., have sent us for inspection a number of samples of the electrical specialities in their new 1909 lists, which are now ready. Of these we illustrate in Fig. 2 the horizontal type of boat accumulators with celluloid tops (Reg. No. 509,848). These are made in six different voltages and capacities, and are excellent value. The design makes them suitable either for use in electric boats or for ignition purposes on motor bicycles. Fig. 4 shows the ordinary type of celluloid acid-proof case accumulator, the particular pattern illustrated having a capacity of 6 ampere-hours at 8 volts. In these cells the plates are completely armoured with perforated celluloid separators, preventing internal short-circuits and "buck ling." These are specially suitable for all kinds of small lighting and power installations, portable lamps, and for medical purposes. In Fig. 3 is shown an electric reading lamp for attaching to the headrail of a bed. It has a plated copper reflector with adjustable joint, and can be fixed in position in a few moments. A 4-volt Osram lamp is fitted. Fig. 1 depicts a 4-volt 8-hour cycle lamp with accumulator in leather case, fitted with straps for attaching to cycle. A variety of patterns of cycle lamps are made to suit various requirements. In addition to these lines, which are all splendidly made, we have received several samples of portable lamps of good quality. One of these is a registered design (No. 528,642),

FIG. 1.



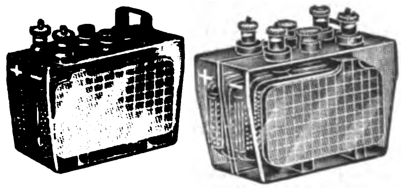


FIG. 2.

which has a removable celluloid accumulator, the connections being made by merely placing the accumulator inside the case and closing the lid. The new lists include a wide selection of accumulators of

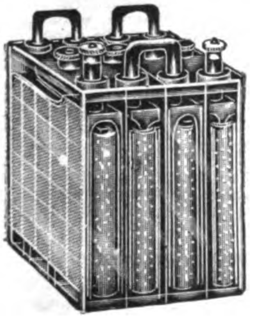


FIG. 4.

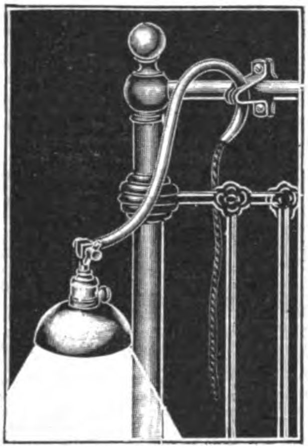


FIG. 3.

all types, and a range of other electrical goods which cannot fail to be of interest.

"Stuart" Developments.

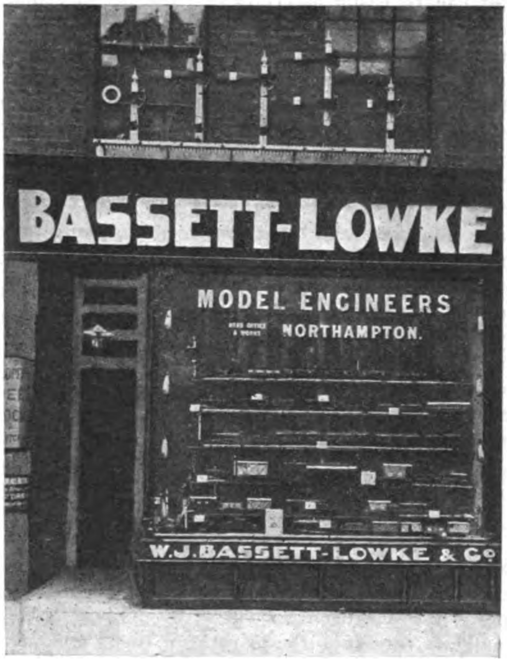
On the occasion of a recent visit to the new works of Messrs. Stuart Turner, Ltd., at Henley-on-Thames, we found considerable evidence of the rapid strides this firm has made. The new premises opposite the Town Hall are not only much larger than those previously occupied, but important additions have been made both to the power and machine tool plant, which will enable a considerably increased output to be maintained. Not the least noteworthy of the improvements is the extension in office, stores, and packing accommodation, a development which has been rendered absolutely necessary by increasing business. At the time of our visit we saw a large portion of the 1,000 sets of machined parts for the new No. 10 "Stuart" vertical engine going through the works, and the systematic way in which this line was being dealt with was very interesting. This engine possesses all the excellent "Stuart" characteristics of good design and first-class materials, and, in view of the price at which it is being offered, it should prove remarkably popular; in fact, no one need now be without a "Stuart" engine. The special machinery for carving boat hulls was shown in operation, and we also saw two new hull models which are to be placed on the market. One of these is an excellent tug-boat design, which we can strongly recommend to those who wish to build for good appearance and easy comfortable steaming, without special considerations of high speed. In the tool and precision room we saw a beautiful sectional model being built to special order for the South Kensington Museum. Of this we hope to give further particulars in an early issue, so we will content ourselves for the moment with saying that it was a splendid example of the highest class workmanship and finish. A number of the excellent "Stuart" gas engines and vertical steam engines of various sizes were in progress in the works, testifying to the strong demand for this company's productions.

New Electrical Lists.

The new season's lists issued by Messrs. Archibald J. Wright, Ltd., Leyton Green Road, London, N.E., are now ready. They cover a wide range of electrical goods and other novelties, including hand-lamps, pocket-lamps, and torches, small accumulators, tie-pins, lamp stands and holders, medical and shocking coils and parts for making, batteries of all kinds, a variety of electric motors and dynamos, castings and parts, armature stampings, bells and telephones, model steam engines and engine parts, and many other lines. A separate 4-page list deals with pocket electric lamps, wireless telegraphy apparatus, telephones, &c. Messrs. Wright, Ltd., will be pleased to send any reader copies of these lists. They will be specially pleased to hear from the trade for whom they principally cater.

*Bassett-Lowke's New London Branch.

Our London readers will have been specially interested in Messrs. Bassett-Lowke's new branch premises in London, which have now been open for a week or more. They are situated in a very central position at 257, High Holborn, W.C., and what the external appearance is like may be gathered from the accompanying photograph. At the time of a recent call we made, the fine 1½-in. scale model G.B.R. locomotive, recently built by this firm for Mr. E. Coats, was on view in the window, and naturally attracted a big crowd. It is intended to maintain a complete stock of fittings and all goods in



the firm's catalogue at this address, and as several tracks have been installed inside the shop, demonstrations of the running of many of the models will be able to be given. We understand that the signal gantry above the shop is lighted up after dusk, and this will form an effective advertisement. Mr. Hobbs, a member of the London Society of Model Engineers, has been appointed manager to the branch, and will be pleased at any time to show the stock to model locomotive enthusiasts.

Tool Bargains.

Model engineers and mechanics generally who want to add to their stock of tools have a good opportunity just now in the bargain sale which Messrs. C. W. Burton, Griffiths & Co., Ludgate Square, Ludgate Hill, London, E.C., are just about to hold. They are issuing a special bargain list which contains particulars of a large number of useful tools all offered at substantially reduced prices. The list will be ready on the 7th inst., and will be sent post free to any reader forwarding his name and address. The prices come into operation on December 10th.

The Editor's Page.

In an interesting letter recently received from an enthusiastic model engineer in South Africa the question of postage on parcels to the Colonies is again raised. Some of our advertisers, we know, make a point of stating clearly in their catalogues the postage on various goods to the different Colonies and other places abroad, but this practice is not as general as it should be. We know from the large number of readers we have abroad, and from the letters we receive, that there is excellent business to be done by those firms who will study the convenience of their foreign customers. It is not sufficient to state that an extra remittance should accompany orders from abroad to cover postage and packing, but each item in the catalogue should be clearly marked with the total cost of sending either to an address at home or to one abroad, or its weight (packed) should be stated, so that the cost can be easily ascertained. The art of selling goods from catalogues is to give the prospective customer complete information in regard to each article in the list, so that he only has to make his choice and he knows the exact amount he has to remit. The easier it is made to buy, the more easily will the sale be effected. Another point in regard to foreign orders is to see that the right goods are sent, that the complete order is executed, with no parts omitted, and that the whole is properly packed and promptly despatched. It may be thought unnecessary to emphasise these points, but so many firms get themselves a bad name by neglect of these apparently obvious matters that we think the advice is worth all the prominence we can give it. The Colonial customer, as a rule, spends freely, but he wants what he pays for; and if he is satisfied with the execution of his order, he will not only come again, but will induce others to do likewise.

* * *

We are asked by Mr. Henry, in reference to his recent letter on the subject of timing model speed boats, to point out that the correct title of his Club now is the Aberdeen Society of Mechanical Model Engineers, and not the Aberdeen Model Steamer Club. We imagine that this indicates a broader sphere of action for the members, and we wish the Society increased success on its new lines.

* * *

Mr. A. Lonsdale, of Bulwell, Notts, in the course of an interesting letter, tells us of several recent successes he has scored at exhibitions with his electrical models, and he is kind enough to add that it is largely through the help obtained by reading our pages that he has done so well. He goes on to say that he has shown our Journal to several friends who have become regular readers, and who have expressed surprise at the amount of really useful technical information we give. To use his own words, they have said they had only thought it to be "a bit of a model paper." We think many people who have picked up THE MODEL ENGINEER for the first time have been surprised to find it so really practical in character, and we know that a large section of our readers who are professionally engaged in some branch or other of real engineering, do not disdain to cull wrinkles from our columns. Perhaps this is partly because we try to encourage model makers to do their work in a really practical way; but it is in any case a happy proof of the fact that there is a lot of solid engineering education to be derived from model work.

Answers to Correspondents.

A. W. (Hampton).—Thanks for your suggestion *re* next "*M.E.*" model, which we will bear in mind. No. 2 is already in hand, however.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*

THE
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EDITED BY PERCIVAL MARSHALL, A.I.MECH.E
VOL. XIX. No. 398. DECEMBER 10, 1908. PUBLISHED WEEKLY.

A Model 2-in. Gauge Locomotive.

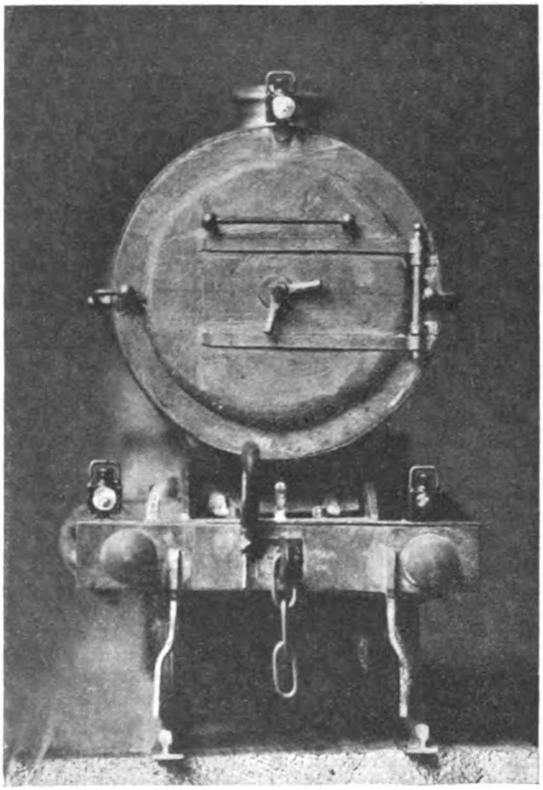
By F. REYNOLDS.

THE accompanying photographs illustrate a 7-16ths in. scale "Pacific" locomotive, which I have built in my spare time. It was designed by a friend of mine, and, as will be seen, it is built from the G.N.R. style of locomotive.

The chief dimensions are as follows:—Length of engine, 17½ ins.; height, 5¾ ins. (about); length of boiler, 1 ft.; diameter, 3 ins.; length of smokebox, 2½ ins.; length of firebox, 3 ins.; total wheelbase, 14¾ ins.; wheelbase of coupled wheels, 5 3-16ths ins.; diameter of driving and coupled wheels, 2 5-16ths ins.; diameter of bogie and trailing wheels, 1½ ins.; weight of engine, 13½ lbs.

The trailing wheels are on a pony truck, and the main frames are cut away to clear the bogie wheels, but even now she will not take a smaller curve than 12 ft. radius. Length of tender, 11¾ ins.; wheelbase, 7¾ ins.; wheelbase of bogie, 2½ ins.; height of tender sides, 2 3-16ths ins.; total length of engine and tender, 29¾ ins.

The engine is fitted with one of Bassett-Lowke's motors and reversing switch, for which there was plenty of room in the 3-in. boiler. The engine and tender is entirely built up of sheet brass, there being no castings used, with the exception of the wheels, funnel, and dome.



FRONT VIEW OF MR. F. REYNOLDS' 2-IN. GAUGE LOCOMOTIVE.

I found an ordinary G.N.R. "Atlantic" funnel was far too high, so I cut it in half and cut out a ring ⅛ in. thick, then soldered the two halves together, again making the total height of funnel ½ in. The engine is built exactly to scale, and all details, such as brakes and sand pipes, are fitted.

The cab is an exact model of the G.N.R. "Atlantic" locomotives, having all the fittings as far as possible to scale.

I have not yet given her a fair test, but find with 8 volts she mounts an incline of 1 in 20 with a load of 4 lbs.; 12 volts is the correct current pressure for this motor, which I think would make all the difference with regard to power and speed.

[NOTE.—We are always pleased to receive photographs and descriptious of well-built model locomotives, especially if they embody certain original features. The value of such descriptions, however, is greatly increased when particulars of the running performance is given, and we hope that readers who may favour us with accounts of their work will kindly bear this in mind.—ED., *M.E. & E.*]

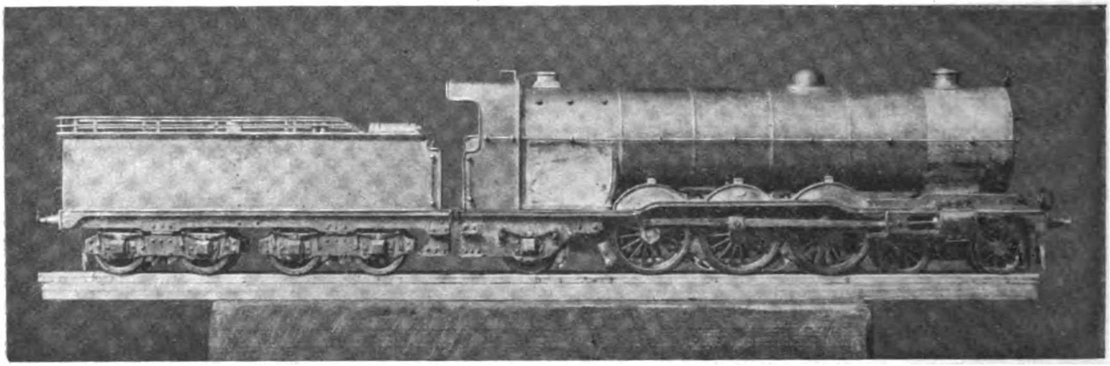
Practical Notes on Various Types of Galvanometers.

GALVANOMETERS are instruments for indicating the presence of an electric current. Nearly all galvanometers work on the principle of attraction and repulsion between a coil of insulated wire, through which the current flows, and a magnetised needle or powerful permanent magnet. The construction and arrangement, however, varies considerably in different patterns. The following are in general use.

The sketches are only intended to illustrate the essential features and arrangement of the various patterns; but they have been put into practical form, so that easily constructed instruments of homely character could be made from them. And such plain-looking instruments are not to be despised. The brass polish and lacquer of the orthodox shop instrument is absolutely unnecessary, and though it need not be deprecated, being pleasant to look at and evidence of workmanship and completeness, a simple construction of plain wood, with the other essential parts, can give quite as accurate results in working. In fact, with instruments for measuring alternating currents, metal is avoided as much as possible, beyond the actual coils and needle. A glass cover is useful, as it not only keeps the instrument free from dust, but prevents currents of air from influencing a sensitive needle. When using a galvanometer, beware of the effect of steel keys or other articles made of iron or steel which may be in your pockets. As you move near the instrument they are liable to affect the needle and cause it to give false movements. Any tools or pieces of iron or steel which may be lying on the bench near to the instrument should not be moved until you have completed your testing, as they may also affect the movement of the needle. If the needle is suspended by a delicate fibre of silk, you should avoid sending a powerful current through it; when the needle receives a violent impulse the silk thread may be broken.

Detector Galvanometer (see Figs. 1 to 4).—These instruments are sometimes called galvanoscopes. The essential parts are a coil of insulated wire and a magnetised needle, which is sometimes placed inside the coil and sometimes placed close to it outside. The needle is supported on a pivot or suspended so that it can swing with as little friction as possible. When an electric current flows through the coil it influences the needle, which will try to set itself in a line with the axis of the coil. The greater the amount of current flowing the larger will be the deflection of the needle from the zero position, though not necessarily in proportion to the current.

Fig. 1 shows a pattern having the needle inside the coil. The turns of wire must be wound entirely in one direction. When a current of electricity is made to flow through the coil, the needle tends to set itself in the direction shown by the dotted line A B. It is necessary to place the coil so that it lies north and south, as the needle will point thus, and must lie parallel with the turns, as shown, before the current is made to flow through the wire. When the current is cut off, the needle returns to its diagonal position by the action of the earth's magnetism, which is thus the force against which the magnetic effect of the current is balanced. Fig. 2 shows a pattern having the needle outside the coil, which is merely wound on to a solid bobbin of wood. The needle tends to set itself in the direction C D. Figs. 3 and 4 show patterns in which the needle is arranged to move vertically. With this arrangement a small weight is necessary to compel the needle to come to the zero position when current is cut off. The force which balances the magnetic effort of the current is therefore gravity. A pointer is usually fitted to the spindle to indicate the movement of the needle. The balance weight may be attached to the pointer, or the needle may be mounted slightly out of centre, so that the heavier part acts as a balance weight. Two coils may be used, as in Fig. 4, to increase the effect of the current upon the needle; they should be wound in the same direction. In the sketch the near coil is partly broken away to show the needle; it is merely a repetition of the other—the two, in fact, form a single coil, with the needle enclosed, on the principle of Fig. 1. These vertical pattern instruments are more convenient in some respects than the horizontal pattern. The coils do not



For description] MR. F. REYNOLDS' 2-IN. GAUGE MODEL LOCOMOTIVE. [*see previous page.*

require to be placed N. and S., and the needles come to rest more rapidly.

An *Astatic Galvanometer* is of similar construction (see Fig. 5), but a pair of magnetised needles is used. In the simple pattern illustrated, one needle is inside and the other outside the coil, which acts upon both when a current is flowing through its

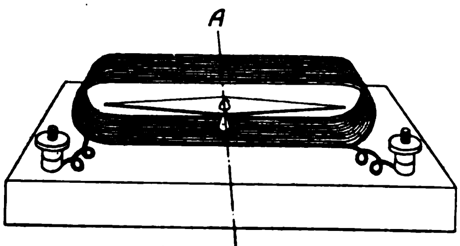


Fig. 1.

turns. The needles are rigidly attached to a rod, which is pivoted or suspended so that they can swing with freedom. The needles are fixed so that the North end of one is next to the South of the other. The instrument is always arranged so that the needles swing horizontally. This arrangement of magnetic needles is called an astatic combination. If only one needle is used, as in the ordinary detector galvanometer, it will always point North and South when no current is flowing through the coils; by using an astatic combination of needles this effect is obliterated, and the needles point East and West. It is necessary that one needle is placed outside the coil. If both were placed inside or outside, the current would have no effect upon them. Being free from the effect of the earth's magnetism, an astatic galvanometer can be made more sensitive than one in which a single needle is used.

The two coils shown in Fig. 5 really form one coil,

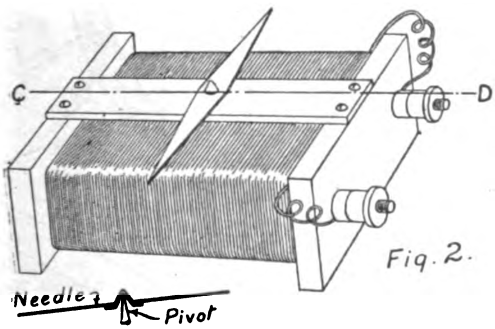


Fig. 2.

which is divided in the centre to allow the system of needles to be placed in position and to swing; they should be wound in the same direction. Sensitiveness may be increased by surrounding each needle by a coil, as indicated in the small diagram. The coils should be wound in the same direction, but the current in the lower one should flow through it in the reverse direction to that in which it flows through the upper one. A force is necessary to balance the magnetic effort of the current; it is usually provided by having one of the needles slightly more magnetised than the other, so that the combination is not truly astatic, but sets itself North and South with a very small directive force. A current flowing through the coils will thus deflect the needle to a greater extent than if a non-astatic arrangement of needle is used.

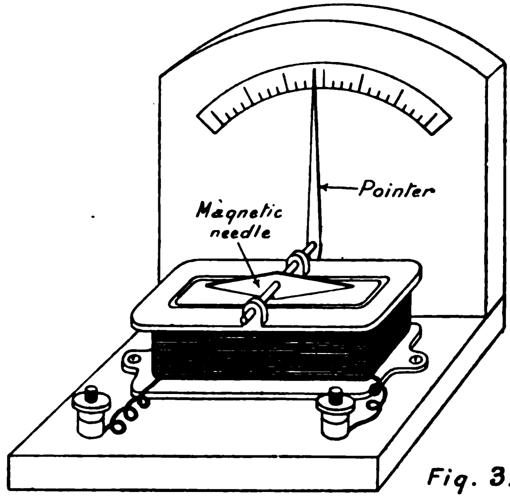


Fig. 3.

A more advanced construction is that adopted by the late Lord Kelvin in his astatic reflecting galvanometer. In this instrument two pairs of coils and two sets of four needles are used.

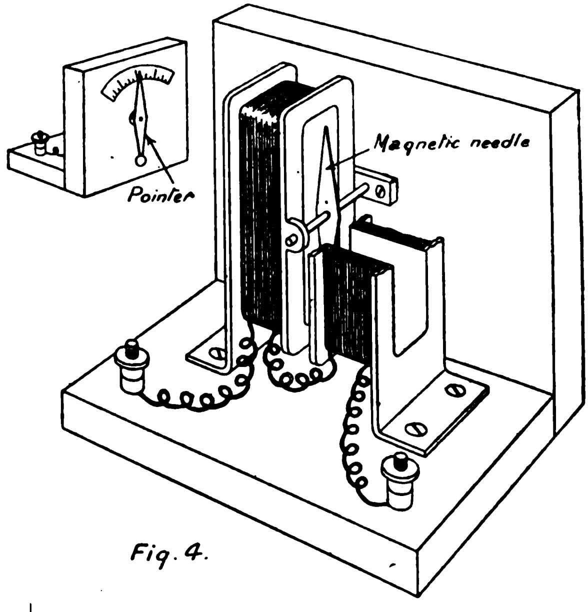


Fig. 4.

Tangent Galvanometer—so called because the amount of current flowing through its coils is directly proportional to the tangent of the angle through which the needle is deflected. If, therefore the value of current strength is ascertained for one deflection, the strength of other currents can be found by ascertaining the tangent of the angle to which any one of them deflects the needle, and comparing it with the tangent of the angle to which the needle was deflected by the current of known

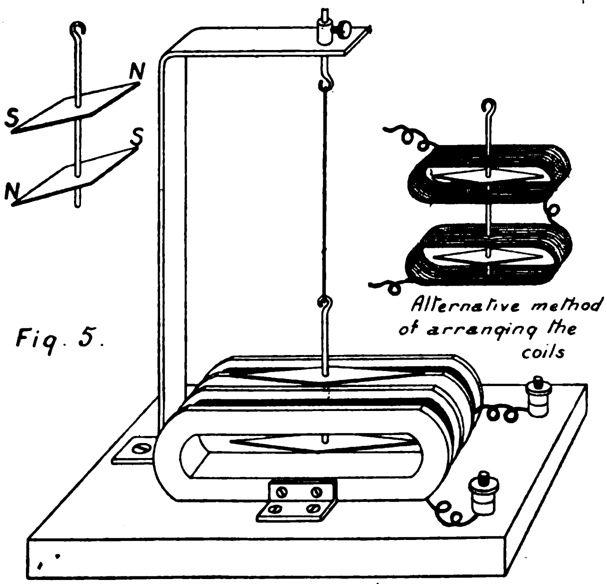


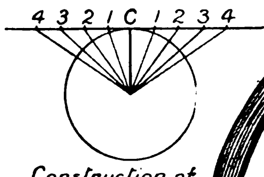
Fig. 5.

strength. The best deflection to use is at or near 45 degs. The coil through which the current flows is made very large relatively to the size of the needle, which is suspended at the centre of the coil (see Fig. 6). The needle is so small that a light pointer is usually attached to it to enable the deflections to be easily observed; that which appears to be the needle in the illustration is the pointer. The instrument would not give accurate indications if the needle was not made very small in comparison with the size of the coil.

If the coil was 6 ins. diameter, the length of the needle should be about ¾ in. A tangent scale may be constructed, as shown in the small diagram. Mark off equal divisions C (1, 2, 3, etc.); join the points to the centre of the circle. The places where the lines cut the circumference will be divisions proportional to the tangent of deflections of the needle, which may be read without reference to a table of tangents. As in the case of the detector (Fig. 1), the coil must be set North and South before a current is sent through it to be measured. The breadth of the coil should be kept small—about 5-16ths in. for a 6-in. diameter coil.

Reflecting Galvanometer—so called because the indications given by the moving part of the instrument are shown by means of a beam of light which is reflected from a small mirror to a fixed graduated scale placed near the galvanometer, the beam thus forming a weightless pointer of great length. The mirror is attached to the moving part, and receives the light from a lamp or other convenient source. A lens is sometimes used to focus the light upon the mirror. The galvanometer illustrated in Fig. 7 is of the moving-coil type, or Deprez d'Arsonval, as it is called, after the original designers. In this instrument the coil through which the current flows is the moving part, and the needle, which in this instrument takes the form of a powerful horseshoe magnet, is the fixed part. The coil is suspended as close as possible to the magnet by means of thin stretched wires, such as silver or phosphor-bronze, attached to the top and bottom, as shown, which permit it to easily rotate either way through a considerable angle. Current enters and leaves the coil by way of the stretched wires. When the current is flowing the coil tries to place itself at a right angle to the plane of the magnet, the turning effort increasing with increase of flow. The turning movement is resisted by the elasticity of the wires; they become twisted. When the current is switched off, the wires untwist and bring the coil back again to its original position. The coil may be wound upon a frame of flat copper.

Galvanometers of the d'Arsonval kind are very good for workshop use, as they are scarcely affected by external magnetic influences, and are dead-beat, that is, the coil comes to rest almost immediately, and does not swing to and fro after receiving or losing the impulse of the flow of current. The small diagram shows the principle of the reflected beam of light. As the beam of light projected upon the scale has an angular movement of twice the deflection of the mirror, very small movements of the latter can be easily observed. If a line is marked upon the lens, its image will be projected upon the scale, and thus provide a means of reading with accuracy. The mirror may be plane or concave, the latter being usually preferable. It is of very small size—⅜ in.



Construction of tangent scale

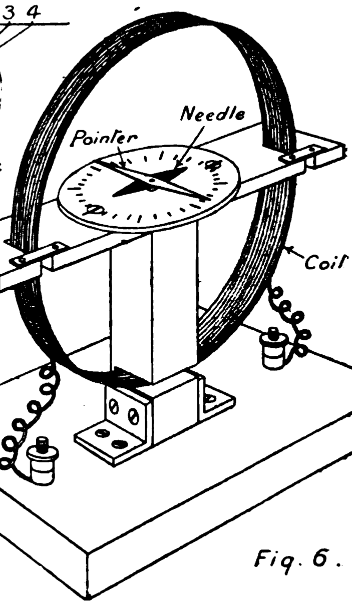


Fig. 6.

to ½ in. diameter, and has a focus of 18 to 36 ins. length. Mirror galvanometers are generally used for purposes when the fact that no current passes through the coils is the result to be determined. Small deflections are therefore the rule, and sensitiveness, instead of range, is the object for which they are designed.

Each kind of galvanometer is suitable for certain work in particular. The coil of any galvanometer should be wound with wire of a gauge suitable for the strength of current with which the instrument will be used. If it is to be used in connection with circuits of high resistance, the strength of current will be small, and the galvanometer coil should consist of a large number of turns of very fine gauge wire. If it is to be used in connection with circuits of low resistance, the strength of current will be comparatively large: the galvanometer coil should then consist of a small number of turns of thick wire, or even of a single turn of copper strip or rod, the power of the coil being thus derived from either a large number of turns carrying a small flow of current or a small number of turns carrying a large flow of current. Sometimes the instrument is fitted with the two sets of coils, so that it may be used for both kinds of work. It is therefore necessary to select a galvanometer which has a coil wound to suit the strength of current

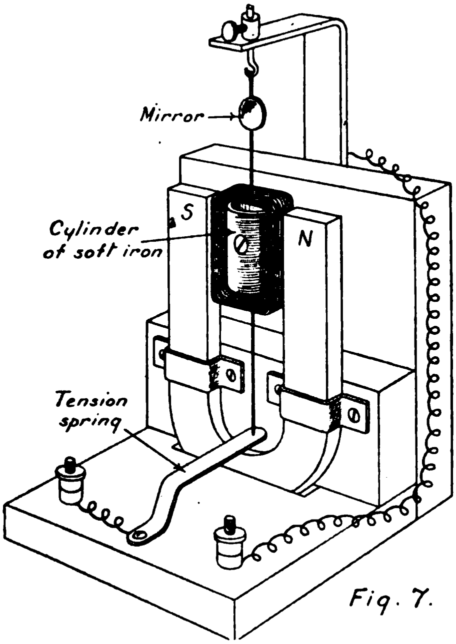


Fig. 7.

which is to be dealt with. The galvanometer coil should have a resistance as nearly as possible the same as that of the circuit with which it is to be used.

Galvanometers are used for testing the resistance of various forms of insulation to the flow of electricity through them or over their surfaces; for ascertaining if a circuit of wire is continuous throughout its length or has a break in it; for detecting a flow of current in a variety of arrangements of wires and apparatus, either the strength of the current or the presence or absence of any current at all enabling the operator to determine certain results. If no current flows through the coil the moving part of the instrument, whether needle or coil, remains at rest. If a current flows through the coil, the moving part of the instrument responds by a movement which is greater or less, according to the strength of the current; but this movement is not in all instruments directly proportional to the strength of the current—that is, a double strength of current does not necessarily cause the moving part of the galvanometer to swing through an angle twice as great. This is an important fact to remember.

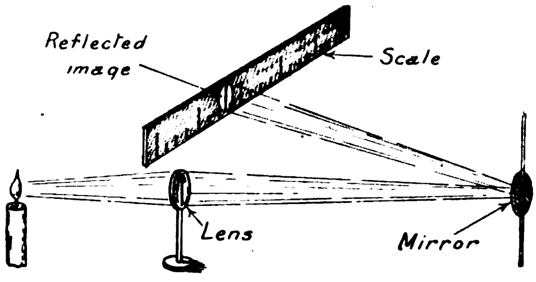
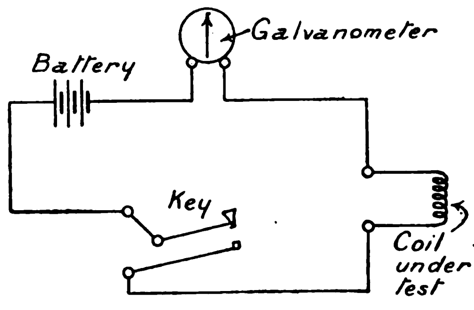


FIG. 7a.

Generally speaking, however, very small deflections in any galvanometer are practically proportional to the strength of current flowing through the coils. A galvanometer may be made to indicate a larger flow of current than that which is passing through its coils by the method known as shunting. A wire is connected across its terminals, and some of the current to be measured flowing in the main circuit is shunted by. The resistance of this shunt wire is made to some suitable proportion of that



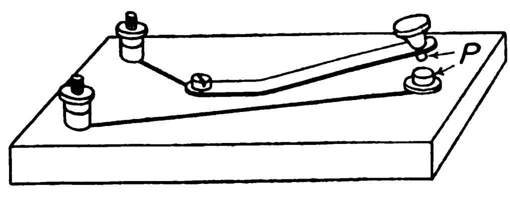


Fig 8

of the galvanometer coils, and, being known, gives a multiplying figure for the galvanometer deflections. The resistance is usually 1-9th, 1-99th, or 1-999th of that of the galvanometer coils. The deflections with the respective shunts would then require to be multiplied by 10, 100, and 1,000 to indicate the flow of current in the main circuit. This value is called the multiplying power of the shunt.

An exceptional type is the differential galvanometer. This instrument is used to measure the strength of two separate electric currents. Two distinct coils are used, one for each current. These coils act upon a magnetic needle in opposition to each other: if the currents are of equal value, the needle does not move; but if either current is of greater strength than the other, the needle moves in one or the other direction accordingly.

There is also the ballistic galvanometer, for measuring a sudden rush of current, such as the discharge of a condenser. The first swing of the needle from zero is the deflection observed and by which the current is measured. The needle is usually made comparatively heavy or weighted, so that its swinging movement is slow; the thread by which it is suspended should be long.

A useful accessory to a galvanometer is an appliance called a key. It is a form of switch, and enables a momentary or prolonged contact to be readily made for the purpose of completing the circuit through the galvanometer, battery, and object under test. Fig. 8 shows a simple contact-key. It consists of a flat spring of brass, fixed at one end to a wood or ebonite base. The other end is free to move up or down. A pair of terminals fixed to the base are connected, as shown, respectively to the fixed end of the spring and to a contact-piece which is touched by the end of the spring when it is pressed down. A small knob of insulating material should be fitted to the spring to prevent metallic contact with the operator's hand, and small pieces of platinum (P) also fitted to form the actual points of contact. The small diagram shows the key connected in circuit with a galvanometer and a coil under test. By tapping the key, very brief contact can be made and a momentary flow of current sent through the galvanometer coils. This enables the operator to exercise a control over the swing of the needle, preventing a violent motion, which might occur if the circuit was completed by means of an ordinary switch. It is also useful for stopping oscillations of the needle and bringing it to zero, as the key can be tapped just as the needle swings back from the direction in which it has been deflected by the current, and its motion checked by small impulses until it stops at zero. Keys are made in more complicated forms by which two contacts can be made in succession, or contacts made from one circuit to another, and so on; they are used for more extended methods of testing, especially when condensers are employed in the experiment. A spark often occurs at the contact-points when the key opens the circuit. This will cause oxidisation of the metal unless some precaution is taken. The film of oxide eventually prevents metallic contact from taking place, and current cannot flow though the key is pressed down. A false indication is thus produced. Platinum scarcely oxidises at all; the contact-pieces are usually made of this metal to ensure reliability in the working of the key. Platinum is very expensive, but only very small pieces are necessary. They need not be fitted if the brass is repeatedly cleaned at the place of contact, but it makes the key more reliable if they are fitted; failing platinum, silver is a fair substitute.

Workshop Notes and Notions.

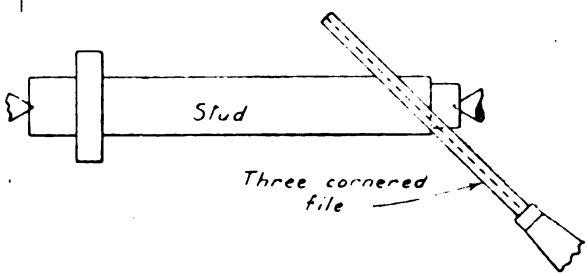
[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "WORKSHOP" on the envelope.]

Cutting Oil-ways.

By T. GOLDSWORTHY CRUMP.

The necessity of providing adequate arrangements for the efficient lubrication of any bearing or spindle is a *sine qua non*. In this connection the spiral oil groove on the stud or axle is about the simplest and at the same time easiest to execute. At first sight, it would appear that this groove could only be satisfactorily produced in a screw-cutting lathe fitted with a milling apparatus. The object of this communication is to show that this groove can be formed in a plain lathe in a very quick and simple manner.

The stud or axle having been turned to its



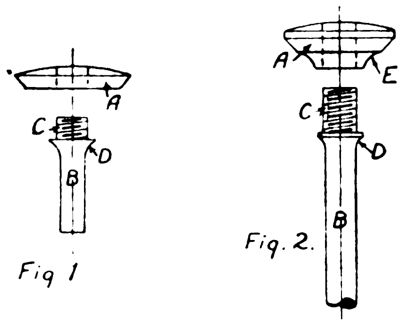
finished diameter, a small three-square file is taken and held in the position shown in sketch, and a slight mark filed on the axle. The file should be held perfectly level and at the same horizontal angle, and kept in motion with the right-hand, while the left slowly revolves the mandrel head towards the operator. It will now be found that the file will trace a fairly true spiral, the pitch of which will depend upon the horizontal angle at which the file is held. After the first outline has been traced the deepening of the groove is a simple matter, and it may be left as a V or made semicircular by finishing with a fine rat-tail file. The removal of any burr set up by the filing completes the operation.

Valves with Separate Heads.

By W. ISLIP.

Valves with separate heads are being extensively used for motor cycle engines, and they certainly possess advantages over the one-piece type of valve. Almost the only trouble with separate head valves is breakage where the stem joins the head, but the chance of breakage can be reduced to a minimum by correct construction. Fig. 1 shows an automatic inlet valve. A is the head: the hole in the head should be tapped 5-16ths in. fine thread; B is the stem, and C is screwed to suit the tapped hole in head A. Note the large radius D, which should finish with a sharp edge and fit flush with the valve face. Of course, an automatic valve should be as light as possible; therefore, the head A should be as thin as possible and may be dished if desired, but leaving the metal as thick as possible where C screws into.

Fig. 2 shows the type of valve that should be used for an exhaust or mechanical inlet. A is the head, which should be thicker than in one-piece valves. Note the large radius E. The hole in the head should be screwed $\frac{3}{8}$ in. fine thread; $\frac{3}{8}$ in. will be strong enough for 3 to 4 h.-p. engines. B is the stem with a radius at D; C is screwed to suit the hole in valve head and should be a tight fit.



The end of the stem can be dubbed over slightly, but if C is a tight fit in head A it is not necessary. One of the best metals for making the heads is cylinder iron, which should be of very close grain. Ordinary cast iron is practically useless, besides having a greater tendency to break. The stems should be made of a tough steel. Ordinary soft mild steel shears off easily either under the head or by the cotter hole. A valve made as described is very little heavier than an ordinary valve and can safely be considered stronger, besides possessing other good points. Note the valve seat face should be turned on the stem to ensure being true with same.

Making Eccentrics.

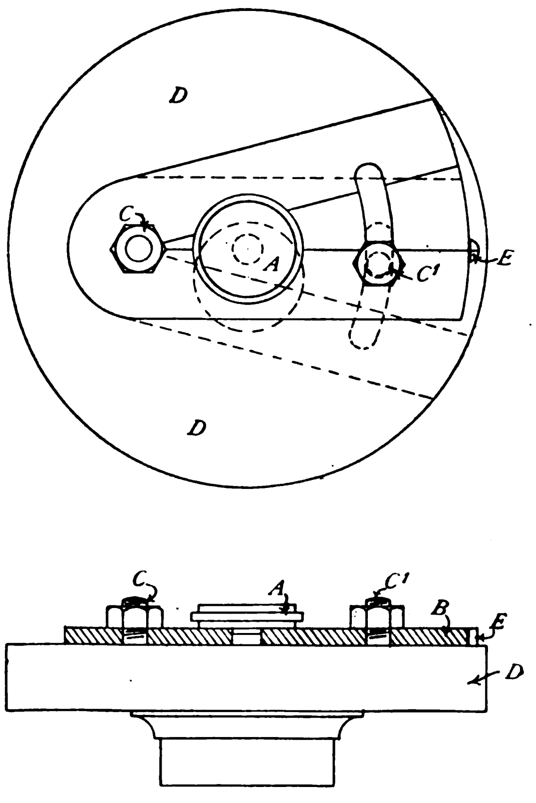
By V. W. Delves-Broughton.

Without some special appliance it is somewhat difficult to make an eccentric having a predetermined amount of eccentricity, and also difficult to bore the hole at right angles to the line of motion. Most modern eccentrics are made with a groove in the strap and a corresponding tongue turned on the sheave, the strap being made in two pieces to allow the groove to be slipped over the tongue.

The first thing to be done is to face up the flanges of the two halves of the strap and sweat them together; next drill the bolt holes and fit temporary bolts; then face one side of the strap and sweat to a faceplate, bore out, recess the groove and face the remaining side. The lathe work being finished, the strap is detached from the faceplate, the bolts removed, and the two halves of the strap separated and any adhering solder carefully removed with a sharp scraper. A short piece of rod or a special casting, to form the sheave, is next chucked in lathe, faced on one side, leaving a small pin to centre in the appliance described below.

The general design for this appliance is shown in sketch. A shows the eccentric partly finished. B is a plate of metal pivoted on the stud C and clamped by the stud C1. This plate is provided with a hole in which the pin turned on the eccentric accurately fits to ensure the sheave being truly centred. It will be noticed that the stud C works in a slot, which allows the whole plate B to turn through a certain angle. D shows a faceplate. E shows a pin screwed into D, on which a line is scribed to act as an index point.

In the drawing the distance from C to the centre of the sheave is one-third of the length from C to the index point E, so that if a chord equal to three times the required eccentricity is set off on the circular edge of the plate, the plate, on being turned through the arc of the circle lying between these



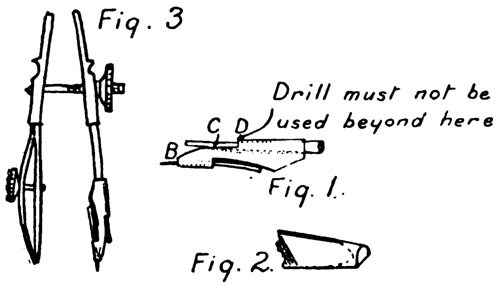
two points, will move the sheave through the angle corresponding to the eccentricity required. The sheave is attached to the plate by being sweated on, the pin only serving to hold it in the proper position during this process. After being attached the sheave is first brought to the position shown in the full lines, faced, and the tongue and circumference turned to fit the strap. The plate is then shifted to the position shown by the dotted lines and the hole for the shaft bored. It is evident that any error in setting off the amount of eccentricity will be reduced to one-third, and that, provided the appliance is accurately constructed, the axis of the shaft must be perpendicular to the line of revolution.

Fitting Needle Points to Spring Bow Compasses.

By G. R. Atkins.

Many of those who use spring bow compasses without needle points will probably have trouble with them sooner or later. It is true that the points of the pencil and divider bows can be ground, but the pen bow cannot, as the legs are then uneven, and it is not possible for an amateur to grind down the pen portion. A simple fitting can be made which obviates this difficulty.

It is made of ⅛-in. by ⅜-in. brass rod. First, the outline is cut with a fretsaw or file to shape, as Fig. 1. Next a 1-16th in. hole is drilled half the

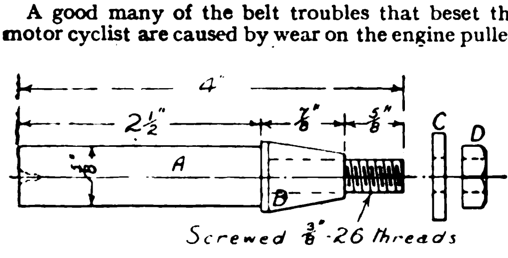


length of brass (see Fig. 1) and a 1-32nd in. hole at B, both done with twist drills, the smaller one needing great care. Now trim up at D so that surface agrees with half the depth of hole D. Take a triangle file and grind one of the edges at point to a semi-circle, as in Fig. 2; use this as a chisel to cut a slanting groove (C. Fig. 1) down to the hole D Now push leg of compass in till it is jammed. A good needle point is selected and passed through the 1-32nd in. hole till it is also jammed (see Fig. 1). The end must be cut off so that about 1-16th in. of point projects. The brass fitting should be just level with the end of pen and fined down as much as possible at its extremity to allow for tiny circles. It is shown fitted to the bow in Fig. 3. When the fitting is completed and is satisfactory (not before for obvious reasons), the old point of leg can be cut off conveniently short. This fitting has no troublesome small screws or nuts and I find it very satisfactory.

Mandrel for Motor Cycle Pulleys.

By W. Islip.

A good many of the belt troubles that beset the motor cyclist are caused by wear on the engine pulley



grooves, thus destroying the wedge grip of a V-belt. The drawing shows a mandrel for mounting the pulley on for turning the grooves, and is particularly suitable for a motor repairer. A is a mandrel screwed one end ⅜ in. 26 thread. B is an ordinary bicycle back hub cone softened and turned to suit the pulley taper C, a washer, and D a nut to fit mandrel A. A number of cones (B) should be turned, each one to fit a pulley of a standard machine. The cones should be turned on the mandrel, and see that they have a good back face so as to ensure running true. Two small flats should be filed on large end of cone to remove same without damage. A useful size mandrel is shown.

Vice Jaws.

By H. Palmer.

Most amateurs know how difficult it is to finish off a piece of work in the vice without marking it, and when lead clams are used, they are soon cut and rounded at the edges, so that they are useless for holding thin work. To overcome this difficulty, take out the removable steel jaws and replace with ones made of red fibre, and leave them projecting about 3-16ths in. above the surface of the vice, so that when they get worn at the edges, a rub or two with the file will soon put them right, and when worn right down they can be easily replaced.

The Use of Models for Shipbuilding Instruction.—For instructional purposes in practical shipbuilding at Leith Nautical College there is at present being completed, in the works of Kelso and Co., mechanicians and ship model makers, Pollokshaws Road, Glasgow, a large sectional model of a modern sea-going steamer. The model, which is to the scale of ½ in. per foot, says *The Engineer*, is not of the ordinary "block" order, but is "built" of brass bars and plates, and represents an up-to-date cargo steamer, with raised quarterdeck, bridge, and forecastle, the dimensions being—length, 280 ft.; breadth, 40 ft.; and depth, 20 ft. It shows sectionally from stem to stern the vessel's interior, with the framework and plating of all the main structural features, such as cellular double bottom, floor plates, frames, reverse frames, hold side frames, bracket connections of side frames to tank margin plates, water-tight bulkheads, beams, stringers, deck plating, etc. One side of the model is completely plated, the landing edges, butts, and straps all appearing, while at various parts the riveting of butts and landings is shown with striking fidelity to such minute but vital features in the actual ship. For some length about midships the full section of the vessel is shown, with shell plating left off on one side, giving a view of the entire transverse framing, with engine and boiler siding, etc. The model, in short, is intended, and ingeniously devised, as far as possible, to show all details of ship construction, and enable students who have rarely the opportunity of visiting shipyards to have an intelligent understanding of how ocean vessels are constructed. Two classes of students in the College will benefit from this instructional model, namely, the "South Kensington" naval architecture evening classes and the day class held in the Nautical College for sea-faring men, who are desirous of obtaining an extra master's certificate, and who have to pass an examination on ship construction in order to obtain it. The teacher in both departments is Mr. James Stephenson, head designer in the shipyard of Ramage & Ferguson, Leith.

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

A Run from London to Doncaster.

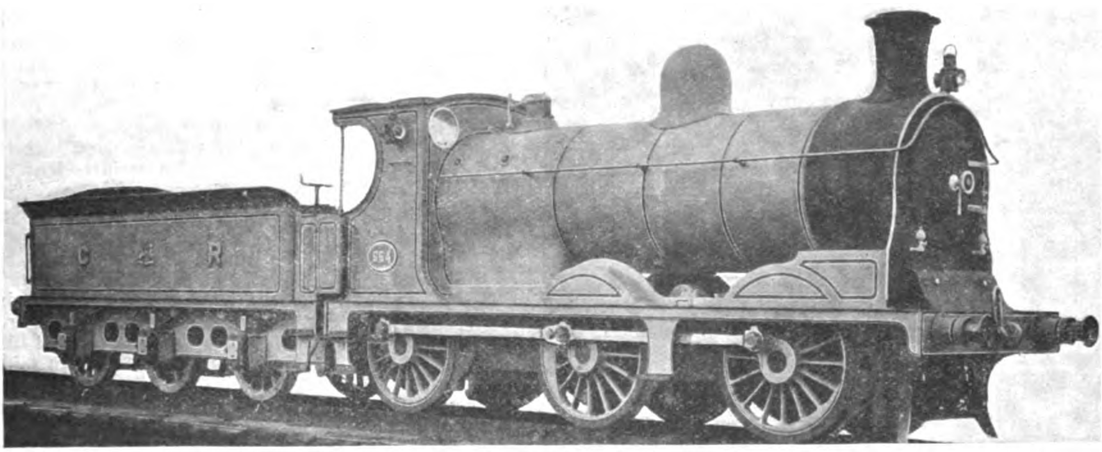
The writer recently had occasion to travel from London to Doncaster, and selected the 10.10. a.m. train from King's Cross for the purpose. This train is allowed 3 hours 1 minute for the 158-mile journey, with stops at Peterborough and Grantham, which stops, on the occasion referred to, occupied between them just 11 minutes, thus reducing the actual running time to 2 hours 50 minutes. The engine was No. 1,418 of the enlarged "Atlantic" type, and the load about 220 tons behind the tender. Very consistent running was made to the Peterborough stop, the average speed over the 76½ miles being 57 miles per hour. Leaving Peterborough at 11.36 a.m. the next 29 odd miles to Grantham were covered in just over half-an-hour, so that after a five minutes' stay in Grantham station there remained 58 minutes in which to complete the 53 miles run to Doncaster. No. 1,418 made light work of this task, arriving at Doncaster one minute early, or exactly three hours after leaving King's Cross, viz., at 1.10 p.m. In this way the average speed, after deducting stops, for the entire journey, worked out at slightly over 56 miles per hour, which must be considered a veiy good performance.

New Goods Engines with Spark Arresters on the Caledonian Railway.

The new goods engines recently built and building at the St. Rollox Works of the Caledonian Railway are of the 0—6—0 type with inside cylinders. There is nothing to remark upon in the design, perhaps, apart from the new type of spark arrester which Mr. J. F. M'Intosh has invented, and which is fitted to this series of locomotives, and will, in future, be added to all new Caledonian engines. The apparatus, of which an illustration appears on the next page, consists of two vertical planes formed of steel plates meeting at an angle a few inches in front of the vertical centre line of the tube plate. In plan the section of the planes is a "V" with the apex next the tubes and the blast pipe in the opening of the angle. The arrester extends from the bottom of the hood down to the level of the lowest row of tubes. To permit of the cleaning of the tubes it is pivoted on its supports on the blast pipe and so can be easily turned to either side alternately to give free access to the tubes. Two diagonal stays at the front lock it in the central position, and it can readily be removed *en bloc* from the smokebox by lifting it off the pivots. The main purpose of the invention is to deflect live sparks away from the current of steam issuing from the blast pipe, and to induce piling up of the cinders in the front portion of the smokebox away from the tube plate and so keep the lower rows of tubes clear. As the cinders are piled up at the front they gradually roll back, but as they are within the angle of the deflector, they are largely kept away from the tube plate. Experience with the device has shown that the live cinders are broken up on striking the deflector plate, and that whatever cinders are thrown out are black and, therefore, harmless.

The apparatus, as will be seen, is simple both in design and method of operation, and, so far as the experiments have demonstrated, it will well fulfil its object in actual working.

The new goods locomotives have 18½-in. by 26-in. cylinders and wheels of 5 ft. diameter. The wheelbase of engine alone is 16 ft. 9 ins., and of engine and tender combined 38 ft. 7½ ins. The boiler is 4 ft. 8½ ins. diameter by 10 ft. 3½ ins. long, and it is fixed with its centre line 7 ft. 9 ins. above the level of the rails. The tubes number 275 of 1¾-in. external diameter, and the heating surface they provide amounts to 1,284 sq. ft. The firebox heating surface is 119 sq. ft., making the total 1,403 sq. ft. Other particulars are: Grate area, 20·63 sq. ft.; working boiler pressure, 160 lbs. per

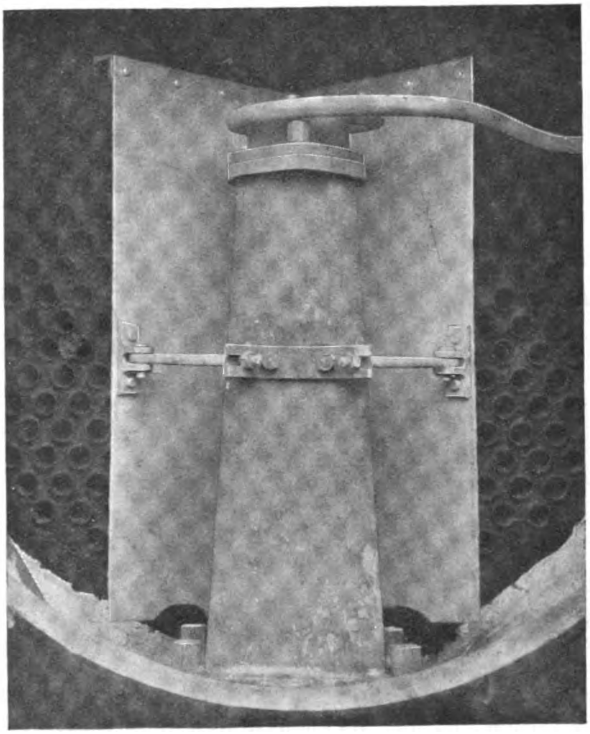


New Six-wheeled Goods Engine Caledonian Railway.

sq. in.; tractive force, 17,800 lbs.; weight (engine only) in working order, 46 tons 14 cwts. The tender carries 3,000 gallons of water when full, and 4½ tons of coal. Its wheels are 4 ft. diameter, and wheelbase 13⅞ft. In working order the tender weighs 37 tons 18 cwts., and engine and tender together and ready for the road turn the scale at 83 tons 12 cwt.

New Continental Locomotive.

The Société Alsacienne de Constructions Mécaniques, in a letter to the writer, state that they have in hand at their Belfort and Grafenstaden Works some further "Pacific" type express locomotives for the Paris-Orleans Railway and others for the



Front View of New Spark Arrester, Caledonian Railway.

Midi, or Southern, Railway of France. In addition to these, the Alsace-Lorraine railways are having some "Pacifics" built by this concern. The Paris-Orleans Company have placed an order for some very powerful tank engines which will have the 0—10—0 wheel arrangement, and also for some goods engines of the 2—10—0 type. This shows that the French railways are taking the lead in adopting types of locomotives hitherto associated principally with American practice and, at this rate, it will soon be the case that we have to look to France for the heaviest and most powerful locomotives in use on this side of the Atlantic.

New 4—6—0's for an Indian Railway.

Some handsome looking express passenger locomotives, built for the Bengal-Nagpur Railway, recently left the works of Messrs. Robert Stephenson & Co., Ltd., at Darlington. They are of the 4—6—0 type with outside cylinders and Walschaerts valve gear, and one of their number, bearing the name "Formidable," is, by courtesy of the builders, illustrated on next page. Steam reversing gear is fitted and the horizontal cylinders of this can be seen between the leading coupled and driving wheel splashers in the accompanying illustration.

The boiler is of the Belpaire firebox type, and an extension smokebox is fitted. The cabs on engine and tender are designed to meet Indian climatic conditions, each having louvred sliding shutters in the place of the usual fitted to many European and all American locomotives.

That the engines are of powerful build will be gathered from the dimensions, of which the leading ones are given below, viz.:—

Cylinders, 20 ins. diameter by 26-in. stroke.
Coupled wheels, 6 ft. 1½ ins. diameter.
Total heating surface, 1702·5 sq. ft.
Grate area, 32 sq. ft.
Working boiler pressure, 180 lbs. per sq. in.
Tractive force, 22,922 lbs.
Weight in working order, without tender, 63 tons 10 cwt.
Weight on coupled wheels, 47½ tons.

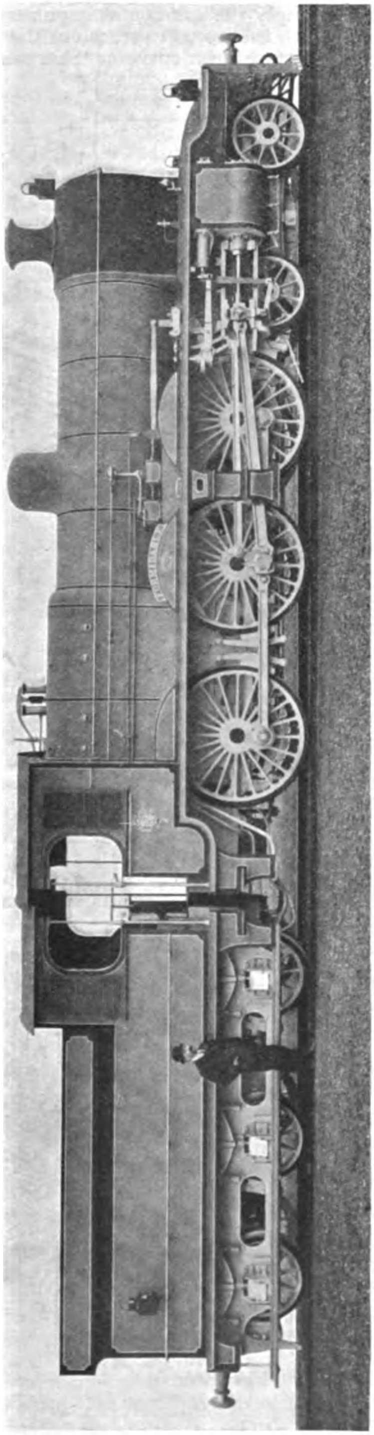
The tender has a tank capacity of 3,500 gallons, and a fuel space of 310 cub. ft. is provided. Engine and tender fully loaded weigh 104 tons 14 cwt.

Slipping Driving Wheels.

The writer has received from Mr. F. J. M'Intosh, locomotive, carriage and wagon superintendent of the Caledonian Railway, a letter, in the course of which the following passage occurs:—"The controversy you mention (*re* slipping of wheels) raises an exceedingly interesting point. Personally, I never experienced the phenomenon, although I remember hearing long ago of several of the early Caledonian outside cylinder engines having their coupling-rods broken when running down hill without steam, in consequence, as the drivers said, of the engines 'commencing to slip.' I have no recollection, however, of a case of this kind having come under my notice during the last twenty years, and may mention in this connection that my instructions to drivers when taking down grades without steam is to put the lever right full forward with the view of preventing any possible contingency which might arise through it being allowed to remain in the expansion position in which the engine had previously been working. In regard to the alleged cases already mentioned, I was always, to a large extent, sceptical, and under all the circumstances I would not care to hazard an opinion on the subject."

From the above it will be seen that here we have another instance in which a locomotive engineer of long experience is to be found who is very undecided as to what to believe on the subject of locomotive driving wheels slipping without steam being "on" at the time. Mr. M'Intosh, like Mr. Riekie, whose views have already appeared, does not actually say that such slipping *cannot* occur, but both apparently find it difficult to believe that the action referred to is a positive one.

Meanwhile, the writer has been enabled to conduct some experiments with a view to establishing the point to his own satisfaction, and the experiences met with will be referred to in a succeeding issue.



New 4—6—0 Type Express Locomotive, with Walschaerts Valve Gear: Bengal-Nagpur Railway.

A Simple Mechanical Harmonograph.

By A. H. Avery, A.I.E.E.

The harmonograph is perhaps one of the most fascinating scientific instruments ever discovered. It deals with the subject of "harmonic" motion, and produces endless examples of most beautifully intricate and symmetrical figures, which are not only intensely pleasing to the eye, but at the same time of great scientific interest and value. The modern view of "energy" in all its various shapes and forms is to regard it as a *vibration*, or harmonic motion, in various complex combinations as regards direction, intensity, and rate. Most people are familiar with the experiments of Lissajous, wherein a spot of light was reflected from mirrors attached to the ends of two vibrating tuning forks on to a screen; the

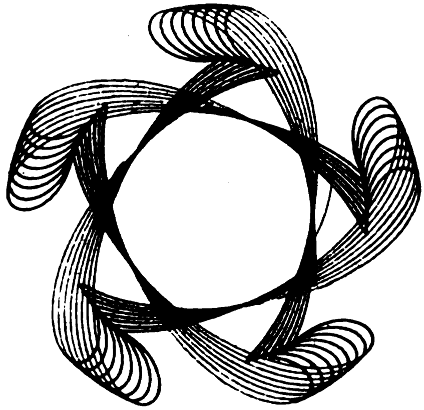


Figure Traced by Simple Mechanical Harmonograph.

result was a symmetrical pattern or figure caused by the spot of doubly-reflected light responding to the vibrations of the forks, and thus rendering, as it were, the sounds actually visible to the eye.

The name "harmonograph" really signifies *sound-writer* in fact, although its scope is by no means limited to acoustical problems. A simple harmonic motion is one recurring at regular intervals, caused by the application of a single disturbing force. Where two or more forces are exerted in regular cycles, the result is compound harmonic motion. Certain time ratios between the two or more applied rhythmic motions always produce the same harmonic figures when in the same relative phase. From what has been said above, it is evident that although it has nearly always been customary to associate harmonographs with the idea of sound waves, they are really instruments which can be used to analyse and imitate any form almost of harmonic wave-motion, whether it be of sound, light, heat, electricity, or magnetic and other phenomena. The whole subject is one of deep interest, and every science student, of whatever age or station he may be, will find it well worthy of his investigation.

The little instrument here described is one of the many and various types of harmonographs, but so simplified as to enable anyone with limited mechanical experience and workshop facilities to construct it. If the following directions are carefully carried out there will be no difficulty experienced in making a successful apparatus that will produce many thousands of most beautiful figures, in any form of harmonograph is, of course, to produce two or more harmonic vibrations or movements, and apply the compound impulses to a pen or pencil which is allowed to trace out the resultant motion in the form of a curve or "harmonogram"

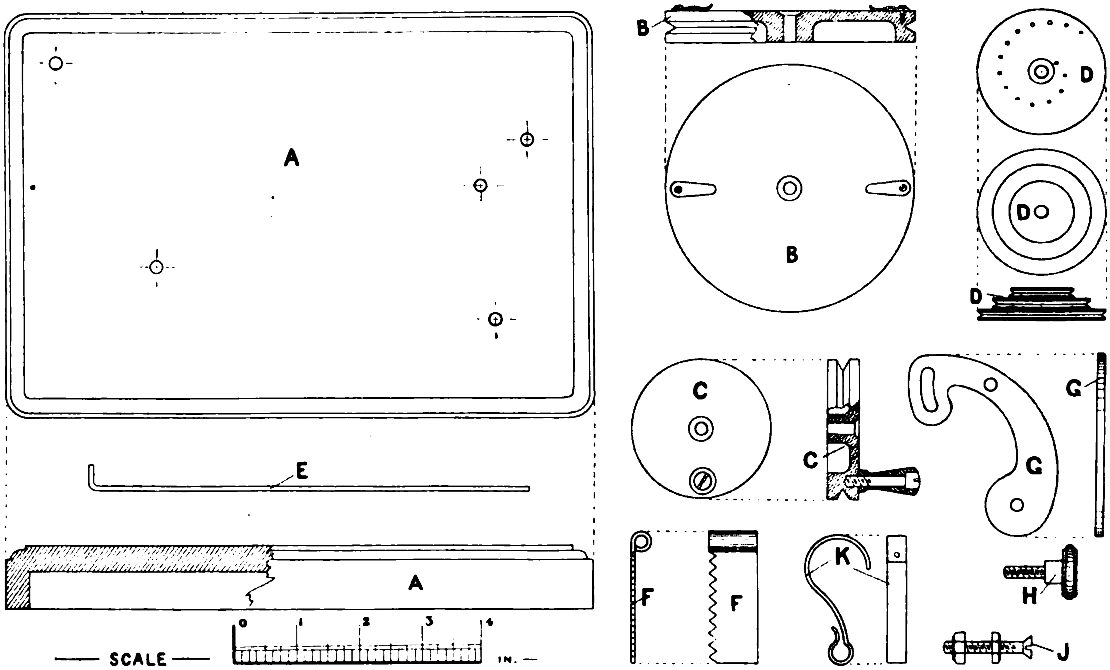
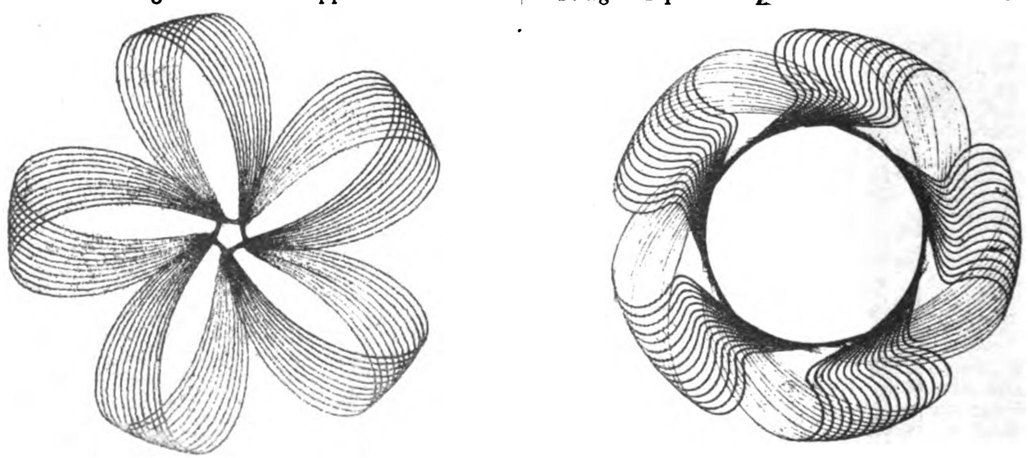


Fig. 1.—Details of Complete Harmonograph.

with much less labour than required in the making of the more elaborate pendulum-type instruments, as there is no delicate work involved calling for special skill.

Reference to Fig. 2 shows the appearance of the on a fixed paper. In some instruments the pen is influenced by the combined impulses, while in others the pen vibrates in accord with one impulse only and the paper with the other, both movements being independent. The results are almost iden-



Figures traced by Mechanical Harmonograph.

finished instrument, and the relative position of the assembled parts; while Fig. 1 is a scale drawing of the individual items required in building the complete harmonograph. The object to be attained tical. The impulses themselves may be of a rectilinear or an elliptical nature, the figure varying somewhat in general outline in similar manner.

The motions of the pen and paper in the present example are imparted in a very simple fashion by a system of three revolving pulleys B, C, and D, arranged to turn easily on their pivots, one of which (B) forms a table for the paper to rest on, another (D) carrying the arm and penholder, while the third (C) forms the driving pulley, the latter operating the other two by means of an endless driving band.

FIG. 2.—PHOTOGRAPH OF HARMONOGRAPH.

Different ratios of motion between pen and paper are obtained by the 3-stepped pen pulley D. The amplitude, or size of figure, is governed by the throw of the rocker-bar E, which can be placed in any one of the fifteen holes shown at different radii in the top surface of pulley D, and also by the position of the bar E in the notched support F at its free end. Also the actual position of the penholder itself affects the contour of the figure as it is slid along the bar E to any convenient point.

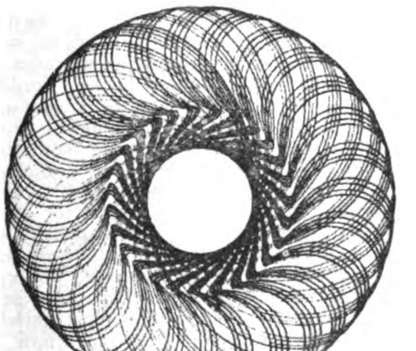


FIGURE TRACED BY MECHANICAL HARMONOGRAPH.

The baseboard A is prepared from walnut or mahogany, nicely polished, and recessed underneath as shown in section. Mark out five centres for the pivots as shown in the drawing, and drill 3-16ths in. through. Three of these are for the pivots J, on which the pulleys turn, the countersunk heads being recessed to lie flush with the tops of the pulleys, while the double nut at the other end holds the pivot rigid and vertical, leaving the pulleys free to turn quite easily but without shake. The pulleys themselves are made from hard vulcanised fibre, cut roughly to size, drilled squarely through, and finished up on a mandrel in the lathe. The table pulley B has two little spring brass clips fitted, as shown, to hold the paper down and prevent it from shifting under the pressure of the pen.

The driving pulley C is similar to the table pulley, except for the addition of a handle for operating the instrument. The pen pulley D, as explained above, has three grooves, and instead of being pivoted direct to the baseboard its pivot is screwed to a swinging brass arm G, so that in shifting the driving band from one step to another, the slack in the belt can be taken up, after which the arm is clamped by the milled head nut H. To set out the involute curved line on which the holes are drilled in pulley D, coil a piece of thread around a 3-16ths in. rod passed through the centre of the pulley, having a small loop at the free end. Insert a finely-pointed pencil or scriber in the loop and, keeping the thread taut and the scriber upright, carry the latter round the centre rod, when the required curve is traced out. Afterwards the centres for drilling can be set out with dividers and equally spaced. These holes are not to be drilled right through the pulley, but only to a depth of 3-16ths in., so that the cranked end of E rests at the bottom of the hole.

The penholder bar E is made from a length of 1-16th in. silver steel rod, the bent end being inserted in one of the top holes of D when in use, while the other end rests lightly by its own weight in any convenient notch on the support F. F is simply a piece of brass sheet bent round neatly into an eye at one end and screwed firmly to the wood base in a vertical position by a long screw passing through its eye.

The swinging arm G is also filed out of a piece of thick sheet brass, one end being slotted to allow sufficient play about the clamp screw H from the centre hole where it is pivoted to the base, while the other circular shaped end is drilled and tapped to receive the screw forming the pivot on which D rotates. This pivot requires to be a tight fit in G and must be flushed off on the underside.

H calls for no particular remark, being merely a milled head clamping screw passing through the slotted end of G, and through the base A into a stout piece of sheet brass screwed to the underside to form a nut.

The penholder I is easily formed up out of a piece of spring sheet brass about 22-gauge, the small open loop at one end being of suitable size to accommodate the pen, while the other end is turned to a larger radius and bored through at two opposite points in the bend to take the bar E. When threaded on to bar E with the pen in position, it forms a kind of hinged joint, free to rise and fall if necessary, and so keeping an even pressure on the paper. At the same time, there is sufficient resistance to lateral movement to prevent displacement.

While on the subject of pens, it might be well to mention that by far the most convenient and least troublesome kind for general use is the ordinary fountain pen with a rather fine flexible point, set to rest on the paper at a slight angle. Glass pens give a superior line of more even thickness when set vertically, but are very delicate things to make, and extremely liable to damage, for which reasons they are apt to be out of favour with amateurs. A good style pen works well if fine pointed and with not too heavy a spring. Carefully smoked glass and a needle-point "pen" can be made use of, too, if preferred, good specimens of figures being preserved by taking a photographic print from the tracing used as a negative.

The variety and beauty of the figures obtainable even with this little instrument is very striking: although not impossible, it is difficult to hit off the same figure twice unless the rocking-bar E is graduated and the holes in D numbered for references, as well as the notches in F.

Crossing the driving band to make the motions counter-current instead of con-current will give a totally distinct range of figures.

In conclusion, a few typical specimens of figures produced with the actual instrument here illustrated and described may be found of interest, and will emphasise as nothing else will the possibilities of this wonderful little appliance.

Notes on Model Steam Engines.

By H. GREENLY.

(*Continued from page* 535, *Vol. XV.*)

"TURNING A FAILURE INTO A SUCCESS."

THE consideration of a certain failure of an amateur model maker to obtain success with a small steam plant, owing to the excessive dimensions of the engine compared with that of the boiler, has led me to revive the idea of using an ejector condenser, worked from the ordinary house supply, to both augment the ultimate power developed by the engine and enable it to be worked at a more economical and satisfactory steam pressure.

The cause of failure in the above case is simply explained by the fact that the engine cylinder measures somewhere about 2½-in. bore by 3½-in. stroke, and the steam generator is a plain vertical centre-flue boiler 11½ ins. diameter and 24 ins. high. As all readers are doubtless aware, although the boiler, theoretically, should work the engine at a low pressure; in practice, even this measure of success has not been obtained with the above combination of engine and boiler. It appears that the use of the exhaust steam to induce a draught—more or less fierce, according to the amount of nozzling at the orifice—has not been tried. This is a method which may be employed in cases in which the disparity between engine capacity and boiler power is not too great, but a centre-flue boiler is not one which will stand a deal of forcing. The chimney gets red-hot, showing how much heat is not utilised, and the boiler primes if it is urged to its utmost, and, per pound of coal consumed, the evaporative efficiency of the boiler is very low indeed.

No, the vertical centre-flue boiler is a type which likes a quiet life. It should be large in proportion to the work required of it. The attendant will have a less anxious time if this is the case, and also, instead of relying on any system of forced draught, it is worked under natural draught induced by a chimney of ample length. This chimney may be double-cased with advantage, so that column of heated gases is not reduced in temperature before finally emerging from the top. Natural draught depends on the comparative weights per unit of volume of the gases inside the chimney and the outside air, and if the gases in the stack are cooled down, they may become heavier than the surrounding atmosphere, and the draught retarded. In small chimneys, as in small cylinders, the radiation surfaces are proportionally larger, and therefore the heat losses may be very considerable.

Under good natural draught I would not reckon on more than 2¾ to 3½ cub. ins. of water per minute from a 11½-in. by 24-in. boiler, the effective heating surface of which is about 350 sq. ins. Of course, I am aware that double the evaporation of water might be obtained by forcing the fire, but very frequent firing would be necessary, and the feed would require careful regulation. The coal consumption would, however, be more than double the amount, and a large proportion would be wasted.

The same remark applies to other boilers. I believe I have been adversely criticised owing to several years ago having propounded as a standard rule that 100 sq. ins. of heating surface will evaporate 1 cub. in. of water per minute. I contend that, as a safe rule, this still obtains, but I have never doubted that by good workmanship, coupled with good design and also scientific "engine-driving," a higher value could not be obtained. For instance, in horizontal marine boilers of the single-flue type, a small evaporative power would be obtained if the rate of firing was normal. It is solely the intensity and force of the flame of a powerful blowlamp on a collection of water tubes which makes these boilers a success. As Cornish type boilers, with the mild flame of an ordinary methylated spirit lamp, the large surfaces of the shell, especially if the boiler is heavy, would dissipate the heat of the fire as fast as it were applied, and the process of steam raising would be prolonged indefinitely. But this is wandering from the subject. Referring to the table which I included in the article under the above general heading in the issue of THE MODEL ENGINEER for May 3rd, 1906, it will be seen that at 10 lbs. pressure a 2½-in. by 3½-in. cylinder would consume (not allowing for any serious loss in steam pipes and for cylinder condensation) $\cdot 8 \times 3\frac{1}{2} = 2\cdot 8$ cub. ins. of water per 100 r.p.m., and even under the most satisfactory conditions of natural draught, 150 r.p.m. would be the most one could expect.

This looks fairly reasonable on paper; but I rather fancy if the matter were put to practical test, the owner of such a plant would have quite another tale to tell. Supposing steam is raised to, say, 10 or even 15 lbs. pressure in the boiler, and turned on to a cold engine. The flywheel is given a few turns by hand to get rid of the water of condensation, and by the time this is done a reference (if necessary) is made to the steam gauge. Ten to one the needle will be very near the zero mark, showing that the whole of the steam pressure has been dissipated in the warming-up process and that another start will have to be made after a more or less prolonged period of waiting. I have known this sort of thing to have been continued for hours.

If the pressure is raised to a much higher figure, unless great care is exercised the opening of the stop valve to the engine, while getting over the warming-up difficulty and certainly making the engine rush round at a good rate for a minute or so, generally results in a violent state of ebullition in the generator, and consequent priming. The comparatively large cylinder and the large amount of metal to be raised to steam heat drains the boiler of water, especially if the revolutions are allowed to exceed the pre-determined 100 per minute. The operation has much the same effect of lifting on the top of the boiler. The whole pent-up energies of the water are released, and there is a good deal of what may be determined as "confusion" in the boiler, and water gets out with the steam. The net result is that the pressure is perhaps reduced to lower than normal at the "end of the beginning"; but what is more serious, very little water is left in the boiler, and pumping in of cold water brings the plant to a state of rest.

Where the piping is lengthy, as is usually the case in a model horizontal engine coupled to a vertical boiler, the simplest remedy is, of course, to superheat the steam supply. This has been suggested many times in these columns, and if the steam pipe is led through the fire, the warming-up process will present less difficulties. The fire being a good one, the steam pressure, say, 30 lbs. per sq. in., and the stop valve being opened only sufficient to run the engine light at, say, 50 to 100 r.p.m.,* the steam, as it passes the possibly red-hot superheater, will be well dried, if not highly superheated, and more quickly warm up the cylinder to working temperature. As a result, the steam pressure may not be affected. Even if it does fall, it will not do so so rapidly and cause the boiler to prime, and by the time the engine has got rid of all signs of cylinder condensation, the water will not have disappeared from the gauge glass, as previously experienced. The governor, if fitted, will not allow the engine to race away and overtax the evaporative power of the boiler.

While the above is perhaps a simple solution of the troubles of which we hear so much when a boiler is much "over-cylindered," or an engine "over-boilered," I have another suggestion, which, although it involves more work, certainly adds a further interest to the model. The idea is to compound the engine, which, if too large, may be done by adding a high-pressure cylinder,† and to employ the *house water supply* in an instrument known as an ejector condenser, which, cold water under pressure being provided, acts as a condenser and air-pump, and may be operated by a simple water cock and opened simultaneously with the stop valve of the engine.

* A governor and throttle valve are always a desirable feature on a small steam plant. It is a pity that they are so often omitted.

† Sometimes a plant may be quite successful in itself, but be less powerful than the owners would wish. I shall describe how the ejector condenser may be added to increase the power, a low-pressure cylinder beng added to make engine compound.

Before going into details, I will attempt to state the theoretical advantage to be gained by calling in the aid of the water company and compounding the engine. Compounding the engine alone would not help the success of the "under-boilered" engine much. The new high-pressure cylinder would do most, if not all, of the work, owing to the terminal pressure of the low-pressure cylinder having to be something above the atmospheric pressure; the excessive size would not allow of this. Supposing we have a 2¼-in. by 3½-in. cylinder (capacity, 14 cub. ins.), and want to add a high-pressure cylinder. We find, on referring to the above table, that at 40 lbs. pressure, a high-pressure cylinder of the same stroke (a tandem is proposed) to run at 150 r.p.m., would have to have a bore of 1 5-16ths in., if it is limited to a consumption of 3 cub. ins. of water per minute.

The capacity of such a cylinder would be 4⅔ cub. ins., or exactly one-third of that of the low-pressure cylinder. The pressure of the steam acting on the low-pressure piston would therefore be one-third that of the high, viz., one-third of 54½ lbs. (40 lbs. gauge pressure + 14½ lbs. atmospheric pressure), which is a trifle over 16 lbs. absolute pressure, or 1½ lbs. on the steam gauge. There is no need to dilate on the small practical value of this, especially as the inevitable losses have not been considered. Most likely the low-pressure cylinder would be a positive drag on the engine, and therefore, without the condensing gear the apparatus would be less satisfactory than if the old 2¼-in. by 3½-in. cylinder were taken off and a 1 5-16ths-in. by 3½-in. high-pressure cylinder or one of the same capacity used in its place, which would work as a simple engine more or less satisfactorily at 40 lbs. pressure.

As we have already seen, if a cylinder one-third the total capacity is coupled to the boiler, the maintained pressure at 150 r.p.m. is raised to 40 lbs. per sq. in. This is much better than 10 lbs., and means that with the given rate of evaporation (viz., 3 cub. ins. per minute), a smaller bulk of steam is supplied to the engine, the water in the boiler is steadied, and the tendency to priming lessened. One cub. in. of water at a pressure of 10 lbs. makes about 1,000 cub. ins. of steam, whereas at 100 lbs. pressure the bulk of steam is reduced to 225 cub. ins. Moreover, with a superheater as well, the steam will be delivered in a much drier state.

Having agreed on all these points, we can proceed to consider the comparative outputs of the plant as a low-pressure simple engine and a compound condensing engine, the non-condensing compound engine being dismissed as quite out of the question.

(To be continued.)

The extent of the depression in shipbuilding on the Wear will be seen from the figures for the ten months' output of this year as compared with the corresponding period of 1907. There have been thirty vessels launched this year, aggregating a tonnage of 73,420, as compared with seventy-seven vessels and 241,507 tons for the ten months of last. Four vessels were launched from Wear yards last month, of 5,660 tons. This shows a decrease of three vessels and 17,887 tons, as against October, 1907.

Practical Letters from our Readers.

Re Small Modern Electric Light Plants.

To the Editor of *The Model Engineer.*

Dear Sir,—Being greatly interested in this matter, and having had some experience in handling "Osram" lamps, both from a practical and commercial point of view, I should be glad if you will allow me to make a few remarks on this subject. I had much pleasure in reading Mr. E. G. Kennard's clearly written article, but do not think he has set to work in the most satisfactory way.

It must be remembered that metallic filament battery lamps are not very economical from an amateur's point of view; that is to say, that although they give a greatly increased light, they demand an equal increase of current, and it is the amperes we want to keep down, both for considerations of wiring and accumulator capacity. It should also be borne in mind that the candle-power given in electrical suppliers' lists is generally of a very elastic nature so far as regards these small lamps, as the standards of light used in testing vary with different manufacturers. "Osram" lamps have an efficiency of approximately 1¼ watts per English Standard candle-power, the efficiency of 1 watt per candle-power stated being based on the German standard (Heffner candle-power). It will be seen from this that the 10-volt, 10 c.-p. lamps recommended by Mr. Kennard require 12·5 watts each, or 1·25 amps. at 10 volts, if they are to give their best light, which not only demands a large gauge wire, but also a very high discharge rate from accumulators, if many lamps are to be lit.

I would strongly recommend any amateurs fitting up such an installation to use 25-volt "Osrams." They are the best of the "Osram" lamps on the market, superior even to the 100-volt and 200-volt lamps of the same make. They may be burned in any position, and have a life of upwards of 2,000 hours.

The dynamo mentioned by Mr. Kennard is of 130 watts capacity, and if wound differently, say, for 33 volts 4 amps., and run at a slightly higher speed, would have been ample to charge the thirteen cells required for a 25-volt circuit. A well-made dynamo of 150 watts, wound for 35 volts 4·25 amps., would be better and would be within the power of a reliable ¼ b.h.-p. gas engine. A set of thirteen accumulator cells (open-glass type) of twenty-four hours' capacity, may be obtained for £3 18s., very little more than the 5–40 amp. cells mentioned by the writer of the above article.

The following table, based on the customary distribution of light tables, will be found suitable for the ordinary small house:—

Rooms.	No. of lamps required.	Current consumption.
Hall	— 10 c.-p.	·4 amp.
Dining-room	2 — 16 c.-p.	1·28 ,,
Drawing-room	2 — 16 c.-p.	1·28 ,,
3 bedrooms ..	3 — 10 c.-p.	1·2 ,,
Kitchen ..	2 — 10 c.-p.	·8 ,,
Bathroom ..	1 — 10 c.-p.	·4 ,,
Total .. 8 rooms	11 l'ps. = 134 c.p.	5·36 amps.

The above current consumption is, for convenience, based on the manufacturers' figures; it should be increased by 25 per cent. to bring the light up to English Standard C.-P.

These eleven lamps will, of course, never be in use all at once, and it is unlikely that more than 3 to 3·5 amps. will be required at one time, under ordinary circumstances, so that an extra 16 c.-p. lamp may be placed in the two best rooms with advantage. The discharge rate of the above-mentioned accumulators is about 4 amps. for five or six hours and due regard should be paid to this when using the light.

The main cable from the dynamo to the accumulators, and from the accumulators to the main distribution board, should be a No. 14-gauge wire. Branch circuits carrying two 16 c.-p. lamps may be No. 18 wire with No. 22 fuse wire, or No. 16 wire protected by No. 20 fuse wire if three lamps per room are fitted. No. 20 wire with No. 26 fuses may be used for circuits carrying not more than two 10 c.-p. lamps.

It will be seen from the foregoing that we have been able to get about 50 per cent. more light for the same current, and practically the same outlay, to say nothing of reducing the cost of wiring. The cost of the 25-volt lamp is only 9d. more than the 10-volt.

With regard to the plan of charging accumulators while they are discharging current, I have never ventured to do this, and should be glad to hear other readers' opinion on the matter. Thanking Mr. Kennard for his article, and apologising to you, Sir, for the length of this letter.—Yours truly,

Basil H. Reynolds, Hon. Sec.,
Manchester Society of Model Engineers.

Improving Leclanche Cells.

To the Editor of *The Model Engineer.*

Dear Sir,—Having tried most types of primary cells for experiments extending over periods of half-an-hour, I found none of them really efficient—not even the Bunsen—owing to its objectionable fumes and the rapidity with which the zinc dissolves, although amalgamated. I consequently came to the conclusion that accumulators are the only reliable batteries, but since then I have changed that opinion somewhat.

Having some old Leclanché porous pots complete with their carbons and manganese dioxide, etc., I recently decided to make use of them, and therefore placed them in glass jars containing strong sal-ammoniac solution. The voltage, instead of being about 1·5, was barely 1·25, and the cells only rang a bell feebly. The voltage would not rise above 1·25, but, on the contrary, soon fell below that figure after using the cells a short time. I then tried to increase the output of the cells by adding additional chemicals and, to my surprise and pleasure, was very successful.

First, I took the porous pots out of the sal-ammoniac solution and drilled a hole 3-16ths in. in diameter in them. The following chemicals were then added to the sal-ammoniac solution in the glass jars:—1½ ozs. common salt, 1 oz. potassium nitrate (saltpetre), 1½ ozs. potassium bichromate, 2 ozs. strong nitric acid, and a trace of sulphur acid (½ oz. will be sufficient). These chemicals were stirred thoroughly till all were dissolved. In a short time, after replacing the porous pots in the solution, the voltage rose from 1·25 to 1·75, on cell ringing a bell very loudly and working other models very well.

I then subjected the cells to rigid tests, and found that a cell of the size of a No. 2 Leclanché thus recharged would supply a continuous current for about an hour, when the voltage fell to about 1·4; but even then, of course, the cell could still be used.

All that is necessary to be done again to get the original voltage of 1·75, is to take the porous pots out of the solution, let the liquid run out of them through the holes in their bottoms into the outer solution, and then replace the pots in their solutions, which rise into the porous pots again. The cells are then allowed to rest for about two or three minutes, when they may again be used.

If the zincs appear to be dissolving, slightly dilute the electrolyte by pouring some of it out and adding water, when all action will cease, and we are now left with thoroughly reliable and efficient cells which we may be sure will last a long time without causing any trouble, such as the setting in of local action, the generating of obnoxious fumes, and the dissolving of zincs. I have tried to substitute a carbon rod for the porous pot, but find the best results are obtained by retaining the latter.

Perhaps some experimenter who has spare time and chemicals may further improve the electrolyte by using different chemicals, or using them in different proportions to those I have given. In conclusion, let me strongly advise all who have not an accumulator, and who desire to have a really reliable battery, to improve their Leclanché cells in the way I have.—Yours, etc., B. Isaacs.

Slipping Driving Wheels.

To the Editor of *The Model Engineer*.

Dear Sir,—I have been reading your correspondents' opinions as to the slipping of locomotive driving wheels, and have been specially interested in Mr. Amoore's letter on the subject. Well, Mr. Amoore says, *re* the seeming reversed motion of the motor-cab wheel, that he concludes "that it must be an optical delusion."

Now, if a toothed wheel be revolved slowly, so that the teeth catch in another *fixed* tooth or similar object, and slip over it, the jerky motion produces a delusion similar to that described by Mr. Amoore, but only if the wheel be spoked. The spokes appear to remain stationary and even to rotate backwards. Is it possible that this fact will assist in explaining this strange apparent behaviour of the locomotive wheels?—Hoping this may interest your correspondent, I remain, yours truly, Ernest Didcote.

Leyton.

The Society of Model Engineers.

London.

The eleventh annual General Meeting of the Society was held on Wednesday, November 25th, at the Cripplegate Institute, Golden Lane, E.C., Mr. A. M. H. Solomon taking the chair, and seventy-five members being present.

The minutes of the tenth annual General Meeting were read and signed, and three gentlemen elected members.

The report and accounts for the past year were presented by the Secretary and Treasurer, a feature of the report being the great increase in the membership of the Society during that period, also in the increased number of meetings held and visits arranged. The accounts showed a very satisfactory financial position, notwithstanding the heavy expenditure made on medals and awards in the biennial and numerous other Competitions held during the year. The adoption of the report was moved by Mr. D. Corse Glen, seconded by Mr. E. Seldon, and carried unanimously.

The motions by various members for alterations of or additions to the rules of the Society occupied the attention of the meeting for a very considerable time. The new edition of rules, containing the alterations, etc., will be issued to all members early in December.

The election of officers for the year then took place, two scrutineers having first been elected, the result being that Mr. A. M. H. Solomon was unanimously re-elected to the chair. Mr. T. R. Welsman (the late vice-chairman) not wishing to be re-elected, the Chairman nominated Mr. John Wills, jun., who was unanimously elected to the vice-chairmanship of the Society and to his late post as tool custodian. Mr. T. Norman Gilbert was re-elected to the post of treasurer, and Mr. Edward Seldon to that of librarian. The ballot for the seven remaining seats on the Committee resulted in the following being appointed, viz., Messrs. Paul Blankenberg, T. H. J. Bunt, L. M. G. Ferreira, H. Arkell, W. B. Hart, H. Hildersley, and H. Clayton. The ballot for Track Committee resulted as follows: Mr. L. M. G. Ferreira (chairman), and Messrs. W. B. Hart, C. S. Barrett, John Wills, jun., P. Blankenberg, and H. Clayton. Votes of thanks to retiring officers and to Messrs. Poulet and Rainger, the scrutineers, brought this portion of the proceedings to a close.

The Chairman announced the date of future meetings and presented the consolation prize in the Workmanship Competition for Boiler Fittings to Mr. O. K. Meredith for his model direct spring-loaded safety valve. At the request of the members present, the subject for the next meeting's competition is "Armatures for Dynamos or Motors."

Exhibits by members included a ½-in. spark induction coil, some small motors, and several novel coil contact-breakers—all excellent pieces of work by Mr. Allman, jun., and an unfinished pair of locomotive cylinders for 1½-in. scale, by Mr. J. V. Bourks. The meeting terminated at 10.35 p.m.

Future Meetings.—The next meeting will be held on Wednesday, December 16th, when Mr. L. M. G. Ferreira will lecture on "The Testing and Comparing of Model Locomotives." The following meeting will be held on Friday, January 8th, when the annual Rummage Sale will be held. —Full particulars of the Society and forms of application may be obtained from the Secretary, Herbert G. Riddle, 37, Minard Road, Hither Green, S.E.

The battleship *Collingwood* was launched at Devonport on the 7th ult. Her weight when she left the slip was about 7,500 tons, or about two-fifths of her total completed burthen of 19,366 tons. Her principal dimensions are:—Total length, 536 ft.; beam, 84 ft.; and mean draught, 27 ft. Her turbine machinery is expected to develop 24,500 i.h.-p. on forced draught, which is estimated to give a speed of 21 knots.

The Junior Institution of Engineers.

A LARGE number of members of this Institution recently availed themselves of the invitation to visit Messrs. Siebe Gorman & Co.'s submarine engineering works in Westminster Bridge Road. After being received by Sir Richard Awdry, K.C.B., one of the directors, they listened to an extremely interesting address by Dr. Leonard Hill, F.R.S., on the physics and physiology of diving, caisson disease, etc. Demonstrations were then carried out in the large experimental diving tank to illustrate the following: Diving apparatus as used in the British Navy, fitted with telephone and electric lamps; self-contained diving apparatus employed in cases where the ordinary apparatus with pumps and air pipes would be impracticable; the Hall-Rees self-contained dress enabling men to escape from disabled submarines. A glass-fronted airtight chamber filled with dense fumes was brought into use for demonstrating the method of operating with the self-contained breathing apparatus in irrespirable atmospheres, for rescue work in mines, etc. Mr. H. A. Fleuss, the inventor of the first apparatus of this description also spoke, giving an account of his experience in connection with the flooding of the Severn tunnel, and other particulars of much interest.

Some of the members donned the diving dress and made descents into the tank, and at the conclusion of the visit, on the proposal of Mr. J. Wylie Nisbet, seconded by Mr. Geo. T. Bullock (Vice-chairman), a cordial vote of thanks was passed for all that had been arranged to render the occasion so exceedingly interesting and agreeable, Sir Richard Awdry responding. The ensuing visit will be to the Garage and Shops of the London General Omnibus Company in connection with a paper on "Motor Omnibuses," to be read by Mr. Eric Boult, on December 16th, at the Royal United Service Institution, Whitehall.

VISIT.—Saturday afternoon, December 12th, at 3 p.m., the Garage and Shops of the London General Omnibus Company, at Black Horse Lane, Walthamstow.

Liverpool and District Electrical Association.

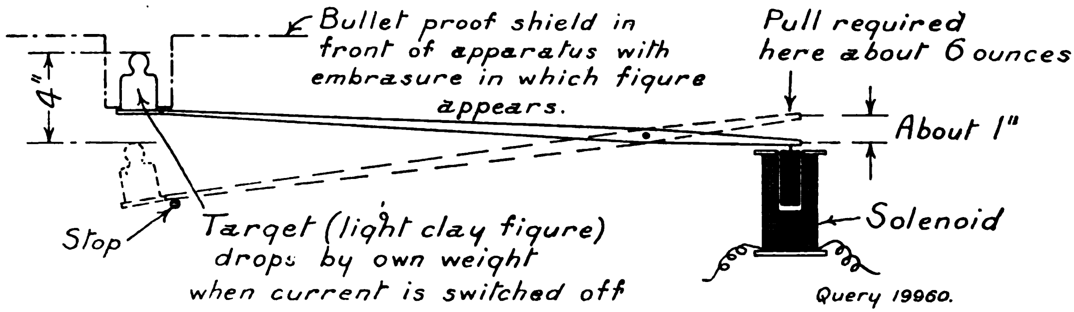
ON Saturday, November 28th, a party of members of the above Association paid a visit to the Birkenhead Corporation Electricity Works (lighting and traction). The visitors were met on arrival by Mr. W. Wylde, the chief engineer, and Mr. O. P. Shallcross, the assistant engineer, when a complete inspection was made of the entire plant, boiler-house, engines, generators, and much interest was manifested in the meter testing department. Altogether a very pleasant and interesting time was spent, due in no small measure to the kindness and courtesy of Mr. W. Wylde, Mr. Shallcross, and the other officials who conducted the party over the works. The members of the Electrical Association were accompanied by Messrs. J. Maxwell, and J. J. Richardson, members of Council, and Mr. Samuel Frith, Hon. Secretary and Treasurer.

Queries and Replies.

[*Attention is especially directed to the first condition given below and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.*

The following are selected from the Queries which have been replied to recently:—

[19,960] **Electric Rifle Range.** A. W. (Hampton-on Thames) writes: I have been asked to assist in making an apparatus for disappearing targets for a miniature rifle range. Distance is 25 yards, targets are to be worked electrically, controlled from a selector switch at firing point. Although fairly capable as an amateur engineer and model-maker, and thus able to use my tools, I have not the electrical knowledge necessary to work out the general dimensions, etc., of the apparatus. The "work" required for the apparatus is practically to lift a weight of, say, 6 ozs. 1 in., or, perhaps, 1½ ins. I propose to use a solenoid, having an iron core in one half, and a moving core adapted to move into the other half, without sliding friction. Power is to be supplied by a 4-volt accumulator from a motor-car (ampereage unknown). In order to provide me with a starting-point for experiments, will you kindly give me approximately the length of solenoid, quantity and gauge of wire for same, diameter of core. Does a better mode of doing the work occur to you? I subjoin a rough sketch showing the bare outline of my idea.



Query 19960.

A simple solenoid without a fixed core will probably answer your requirements and be easy to make. It has the advantage that the core may fit quite loose and does not require to be guided. Make the bobbin about 4 ins. in length, with, say, hole ⅞ in. diam., flanges circular, about 2½ ins. diameter; use brass or other non-magnetic material for the bobbin flanges and tube. Core to be iron about ¾ in. diameter, length 6 ins. approximately. Suspend it so that the end dips about one-third of the length of the bobbin when weight is normal; say that it dips about 1½ ins. in the bobbin. Wind with about a pound of No. 22 gauge s.c.c. copper wire and make a trial. If power is insufficient, raise the voltage of battery. If you prefer to increase the pull at end of stroke, fit a short plug of iron as a fixed core, about ¾ in. length will probably be ample. Should the cores touch, interpose a piece of thin brass to prevent actual contact of iron to iron. You correctly realise that this kind of work can only be determined by experiment. It is advisable to try a core of greater length than the bobbin.

[20,567] **Medical Magneto.** F. P. (Blackhill) writes: I wish to make a magneto machine for shocking purposes, using a permanent horseshoe magnet. Can you give me a dimensioned sketch of one? What kind of steel should I use for magnet, and how do I magnetise it?

See Mr. Bottone's book, "Electrical Instrument Making for Amateurs," price 3s. 9d. post free from our office, which, besides much other valuable information, contains instructions with complete design for making such a machine as you require.

[18,770] **L.B. & S.C.R. "Wivelsfield" Class 0—6—2 (Tank) Locomotives.** R. A. P. D. writes: I am about to make an electrically driven model (¾-in. scale) of one of Mr. Billington's six-coupled tank engines (0—6—2 type) on the L.B. and S.C.R. I have a good post-card from which to make drawings, but I am quite ignorant of the dimensions of this type of engine, and would be greatly obliged if you could give the diameter of the driving wheels or any other dimension.

There are several classes of 0—6—2 tank locomotives on the L.B. & S.C.R. The smallest—"West Brighton"—was actually designed in Mr. Stroudley's time, and has 4-ft. 6-in. wheels. Then there are Billington's No. 165 "Blatchington" class, with the same sized wheels. The engine shown in the drawing is one of the "Wivelsfield" No. 463 class, with 5-ft. wheels and higher boiler. The latest class—No. 567, "Freshwater"—were built in 1902, and have 5 ft. 6 in. wheels, larger and higher-pitched boiler, plain dome, aad twin-pillar safety valve over the firebox.

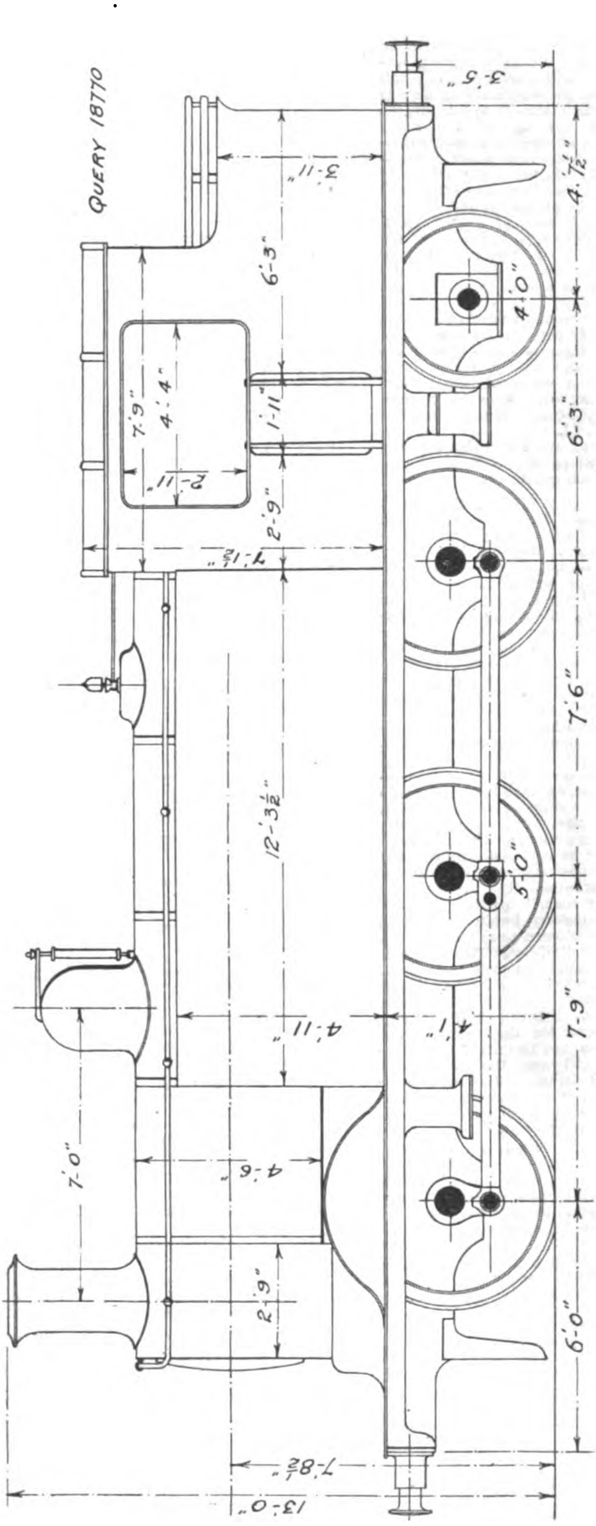
[20,339] **Steam Ports; Engine and Boiler Queries.** W. A. M. (Cambridge) writes: I have a cylinder—1¾-in. bore by 2½-in. stroke. The steam ports are 3-16ths in. by ⅞ in., and exhaust port 5-16ths in. by ⅞ in. (1) Are these ports large enough? The steam chest is connected to ¼-in. pipe (internal). What size should exhaust pipe be? (2) Would a cylinder 1¾ ins. by 2½ ins., and a cylinder 1 5-16ths ins. by 2½ ins. work as a compound if I connected the exhaust from small cylinder to large cylinder? The connecting-pipe being ½ in. internal diameter, and the steam pipe from boiler being 3-16ths in. (full) internal diameter (to small cylinder). What size boiler should I require, and what pressure?

(1) It depends on the steam pressure and piston speed at which the engine is intended to work. For high-speed work the ports should be as follows: Steam ports, ⅞ in. by 3-16ths in.; port bar, 3-16ths in. wide; exhaust port, ⅞ in. by ⅜ in., or 7-16ths in. wide. However, for all ordinary purposes, the ports in your cylinder will suffice. Exhaust pipe should be ⅜ in. bore. (2) For use as a non-condensing engine, the cylinders would work all right compounded, the working pressure not being less than 55 or 60 lbs., with ordinary valve setting. You will require a fairly large boiler, say one with about 500 to 600 sq. ins. of heating surface. The speed would be 400 to 500 r.p.m. You would find the boiler on page 34 of "Model Boiler Making" work well with natural draught and solid fuel. For oil fuel, the boiler (Fig. 9c) in the same book is worth considering; three burners should be used to give full power, and the boiler should measure 8 ins. by 9 ins. by 15 ins. or 16 ins., and be provided with twenty-four to twenty-eight tubes ½ in. diameter (outside). A horizontal water-tube boiler would also give good results with gas firing, but would be rather more expensive to make. If you can fit an ejector condenser, do so. Await articles for full description.

[18,772] **30-watt Dynamo Windings.** P. L. (Sheffield) writes: I have castings for a 40-watt overtype dynamo. Would you kindly tell me how much and what gauge wire to use to get most light from it? Eight-slot armature, 1¾ ins. diameter, 2 ins. long, slots 5-16ths in. by 5-16ths in., with 8-section commutator. Also how many lamps will the above light?

Your machine will scarcely give 40 watts; 30 watts would be nearer the mark. Wind armature with 4 ozs. No. 22 S.W.G. and field-magnets with 1½ lbs. No. 24 S.W.G. The output should be about 10 volts and 3 amps. After the machine is finished run it up to speed and find, by actual trial, what voltage it gives, then obtain your lamps to correspond.

[20,585] **H.M.S. "Dreadnought."** C. H. (Troedyrhiw) writes: I am writing to you with regard to a model battleship (*Dreadnought* class) which I am desirous of making, and I should be much obliged if you would kindly assist me. The model is not to be fitted with engines as it is only meant as a show model. The length is to be 40 ins., 6-in. beam,



L.B. & S.C.R. "Wivelsfield" Class (0—6—2) Tank Locomotive.

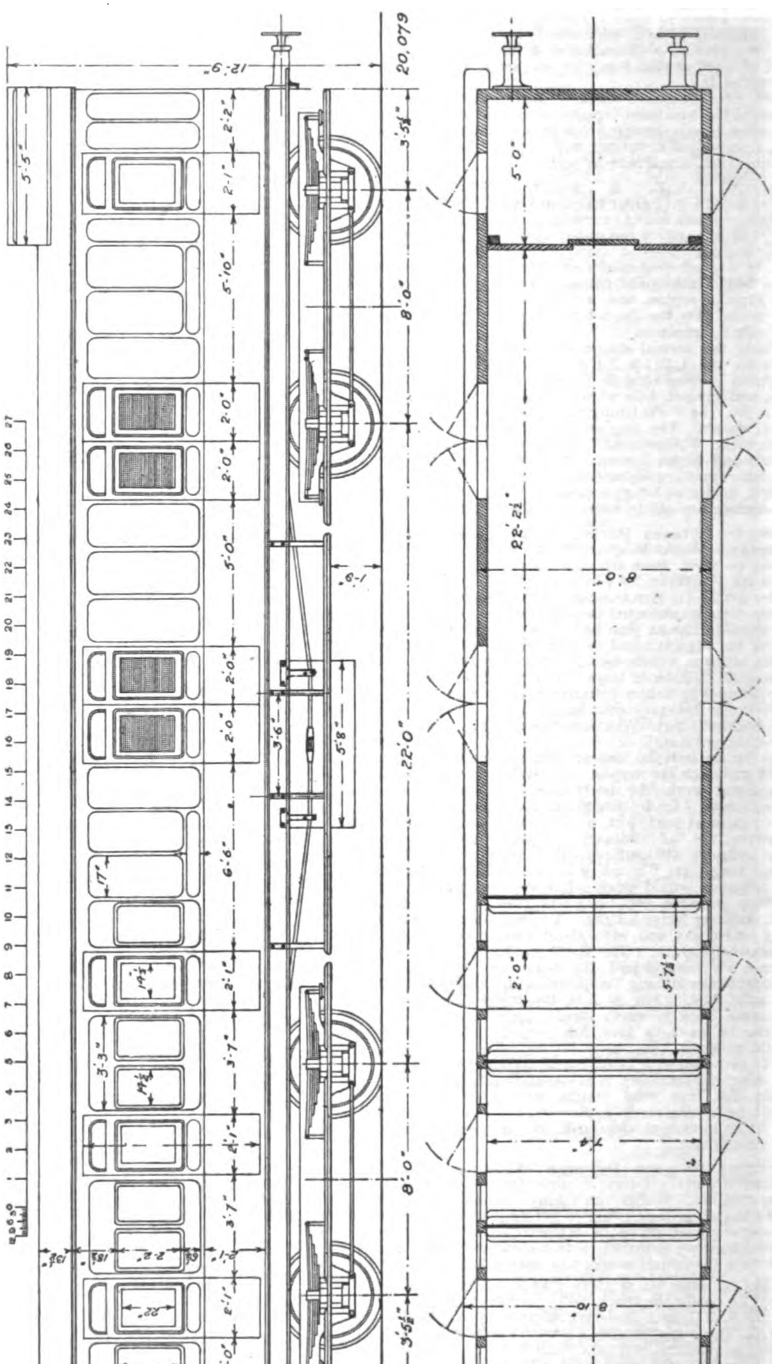
5 ins. deep, and in construction the "dug-out" style will be adopted. Would you kindly furnish me with a scale drawing (half size) of the bulkheads or moulds with the distances apart, for the proper shaping of the hull? Could you refer me to any periodicals in which have appeared drawings or illustrations, particularly of the deck fittings, etc., that would be of use to me?

In our issue of August 22nd, 1907, there appeared an illustrated article on a model of H.M.S. *Dreadnought*. The model described is almost exactly to the dimensions you give, and the article would probably interest you. In our October 25th, 1906, issue, there is a full-page photograph of the prototype with nearly a page of description. *The Engineer* (office 33, Norfolk Street, Strand, W.C.), published in Vol. CL, pages 8, 34, 174, 221, 352, 579, articles on this warship, from which you could, no doubt, get much assistance.

[20,079] S.E. & C.R. Passenger Stock. J. L. R. (Sydenham) writes: I noticed in the issue of May 28th, Mr. Greenly gave an article on "Model Rolling Stock Notes," in which I was exceedingly interested as I am thinking of making a model six-wheeled coach to ⅜-in. scale of the S.E. & C.R., so I thought there might be an opportunity of including this particular one in his articles as it might be of interest to fellow readers.

Since acknowledging your query and reminding you that the humble goods truck is a very good model on which to gain some experience, we have been able to obtain drawings of a S.E. & C.R. third class bogie carriage with guard's compartment, technically known as a "brake third," and we publish herewith a scale outline drawing. The usual guard's "wing seats" are not used by this Company, but the old raised roof is adhered to as on the North London Railway. This is a relic of the hand and chain brake days. The coaches are of modern design and have pressed steel bogie frames. You can obtain castings of these for the model. The coaches are also fitted with electric light and the accumulator box is shown on the outline drawing. Two end views are included to show shape of guard's "look-out" at the end.

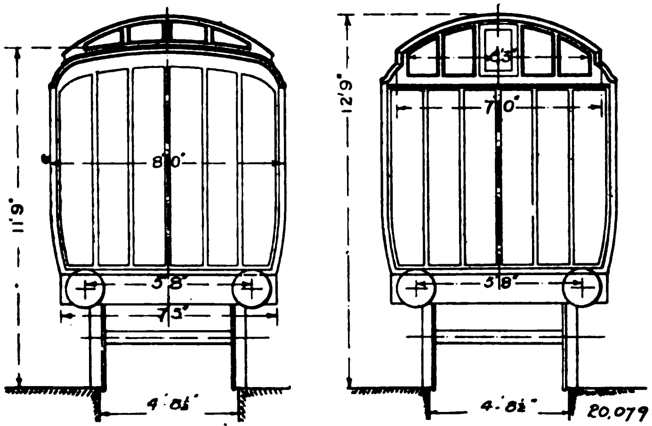
[19,346] Dynamo Renovation. C. G. G. (Barnstaple) writes: I enclose a rough sketch of dynamo (not reproduced), with necessary dimensions given. I am also forwarding the armature, and should be much obliged if you will give me your opinion on it. When I bought the castings that was already wound and the commutator fitted, but I myself have not a very high opinion of it. It seems to me that a great deal more wire might have been wound on. Also it is wound upon a wooden core. Would this be really capable of doing regular work? Or, would it be necessary to rewind and re-make the whole thing? The commutator also tears the brushes (copper gauze) owing to the large gaps between the brass segments. The field-magnets are wound with eleven layers of No. 20 B.W.G. wire.



S.E. & C.R. Third Class Bogie Carriage.

The instructions said: wind with nine layers each, but as I had enough wire for the extra and plenty of room, I wound two extra on each pole.

Your armature certainly does appear to be capable of carrying a greater number of turns of wire. With regard to the wooden core, you are mistaken, we think, probably there are only wooden end-pieces, and the core itself is made up of wrought-iron laminations.



END VIEWS OF S.E. & C.R. CARRIAGE.

The commutator is certainly very rough, but if properly dressed down, we think it should run without doing much damage to the brushes. It would, of course, be better had it been built up with proper insulating pieces of mica. The whole armature seems to have been subjected to a good deal of careless usage, and the damage has been owing probably to badly worn bearings causing the armature to touch one of the pole-pieces of the field-magnets. If the machine does not give a satisfactory output, we think you should send the whole thing to Messrs. Thompson & Co., 28, Deptford Bridge, Greenwich, S.E., and have it rewound and thoroughly overhauled. The large gap clearance is undoubtedly a contributory cause of the unsatisfactory performance of the machine. We advise you to re-bore the tunnel, so that clearance is equal on either side of the armature, and to fit a wrought-iron liner to each pole-face, so as to reduce the clearance to the smallest practicable amount. Or you could fit a liner to the pole-face which has the excess clearance. A reduction of clearance will very much improve matters unless the field-magnet is already magnetically saturated when the machine is at work. It is worth a trial. Also make sure that the brushes are in good contact with the commutator and do not jump. Set the brushes to angle of best effect.

[20,643] **Wireless Telegraphy.** W. H. C. (Sunderland) writes: I should feel much obliged if you could answer the following queries? (1) What size of induction coil (*i.e.*, what length of spark) would be necessary for a wireless telegraphy set to correspond up to about 400 yds., there being two terraces of houses in between us. (2) If the receiving antennæ were made in inverted cone form, what would the distance from apex to base need to be? (3) Would a height of 22 ft. be sufficient for these antennæ?

(1) A good 2- or 3-in. spark should be sufficient, and if your apparatus is well arranged and sensitive, you could be successful with a good deal less. It is almost impossible to give figures when there are so many uncertain factors. (2 and 3) We do not greatly recommend the inverted cone, and can hardly suggest dimensions as they depend greatly on the circumstances. Any network or other arrangement of wires giving suitable capacity should work at the distance named if it is 22 ft. high. You will find useful directions with regard to all such matters in our publication, "Wireless Telegraphy for Amateurs."

[20,672] **Winding Induction Coil.** C. J. (Castleford) writes: As I am starting to make a shocking coil, I wish to know if the two samples of wire enclosed would act all right as primary and secondary windings. Also if you would kindly inform me the standard wire gauge of each sample. And if the jointing of wire would be any inconvenience to the coil, as there are many breakages in the secondary, and what kind of soldering flux to use.

The larger wire is No. 27 S.W.G. It is too small and too thickly insulated to be suited for a primary coil. The smaller wire is No. 34, and is well suited for secondary winding. For primary use No. 20 s.c.c. Joints are allowable, if carefully made. Thoroughly clean the ends, twist together and solder, using only resin as a flux. The joint should be made as smooth and neat as possible, then well insulated.

[20,564] **Screw Diameters.** T. R. M. (Renfrew) writes: Would you be good enough to enlighten me on a small matter concerning the correct diameter of top of thread of 1½ gas? Having had occasion to make a gauge for same, a dispute arose about the correct diameter. Since then I have seen two different sizes, namely, 2·160 and 2·047. Will be pleased to have your authority at your earliest convenience.

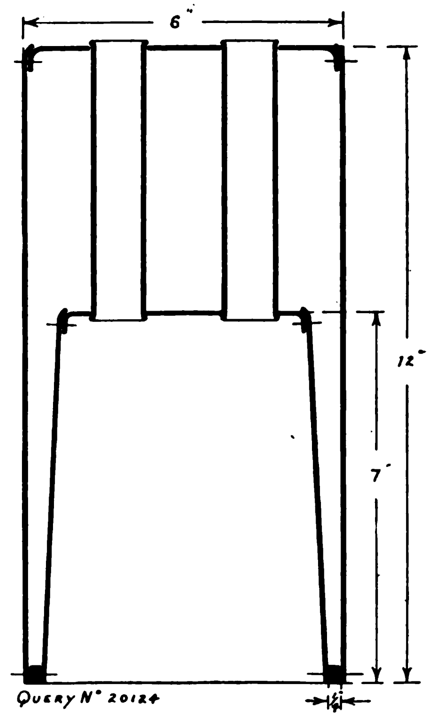
The figure 2·160, which you give, is the size of the external diameter of a 1½-in. gas pipe, and so is the size of the diameter at top of thread. The diameter at the bottom of thread is 2·042.

[20,254] **Shocking Coil Winding.** A. B. (Wallsend-on-Tyne) writes: I wish to know how much secondary wire it takes for the shocking coil in your handbook, No. 11, pp. 21-28?

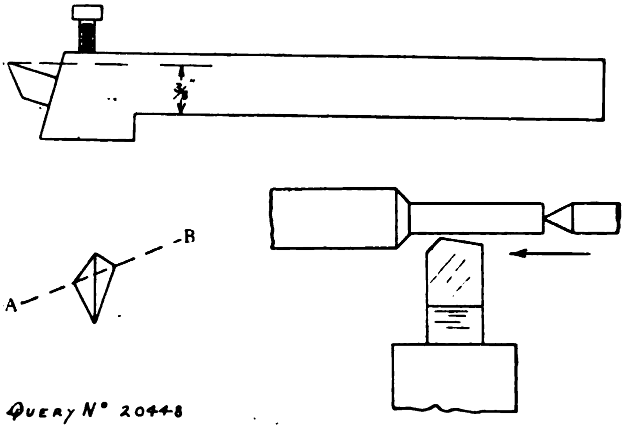
For the secondary coil, about ¼ lb. of No. 36 S.W.G. wire should be used, filling the bobbin.

[20,124] **Model Vertical Boiler.** J. J. (Stafford) writes: Please find herewith a rough sketch of a boiler which I have; it is not well designed, but if you would let me know in what way it might be improved, I should be much obliged; also the best method of firing, and its capabilities. It is made of 1-16th-in. copper throughout. The shell has a double-riveted butt joint. The four 1-in. copper tubes are only burred over and sweated in. The general construction is similar to that described in your sixpenny handbook on "Boiler Making." Please also state safe working pressure.

We cannot suggest any method of improving the boiler, unless you pull it to pieces and insert some cross-tubes in the firebox, near the top. They should be ⅝ in. diameter, inclined, and brazed or silver-soldered in. A smokebox should be fitted, and, if possible, a superheater coil arranged in it. The boiler may be fired with coal (it is not suitable for oil-fuel apparatus), and the exhaust of the engine should be employed to induce a draught. We would suggest a working pressure of 40 lbs., if the boiler is well made. The boiler would work well with a 1-in. by 1-in. horizontal or vertical engine, working at 300 r.p.m.; but everything will depend on the efficiency of the draught.



[20,448] **Shape of Tools.** W. H. H. (Eltham) writes: I enclose sketch of a toolholder which I have made for use with a 3½-in. Drummond lathe. The cutter is ¼ in. Mushet square steel, and the cutting edges of 57 degs. angle are just on a line with lathe centres. Can you tell me what is wrong? The clearance rake, etc., seem quite right, and according to your "Metal Turning" which I have, but the tool only tears off from a mild steel bar, leaving a rough jagged surface. The Drummond people advise slide-rest tools, and I notice that in their list they are illustrated as almost flat on the top, but I understand that top rake was a *sine qua non*. I got a slide-rest tool (not Drummond's), it had



no top rake, it would not cut a bit, only tear. I ground top rake more and more trying it, from time to time until the angle of nose was 40 degs. as against the 57 degs. your book recommends. It then cut beautifully one continuous shaving 8 ft. long off the same bar which my toolholder will now only tear. All this is rather confusing to a beginner. Can you explain it, and also how the cutters for my holder should be ground?

A tool to cut steel should have a top rake as shown in Fig. 1 of the book you refer to. A tool which is flat on the top is only suitable for brass as regards ordinary "roughing" down cutting. The principles upon which the cutting edges are formed are the same for either solid tools or cutters held in a bar. From your sketch we consider you have too much front clearance, that is, the angle A, Fig. 1, is too large. You should make this angle as small as you can, whilst not so small that the point rubs. It is not sufficient to deal with angle B only. If B is correct but A too large, the tool will not cut well. This seems to be a fault in your tool. A certain amount of side rake is of assistance. That is, the top edge should slope away from the cut as indicated by Fig. 7, if you are cutting from right to left. Looking at the tool from the front it should be something like sketch herewith, the top face slanting as indicated by line AB. If you want to obtain a good surface the tool should be formed or set so that it presents one edge nearly at a right angle to the work and the other nearly parallel to it, so looking down on the tool from above as sketch the direction of cutting being indicated by the arrow. The actual cutting angles can all be varied to a small extent. You will only obtain good results after some practice and will discover by experience the shapes which give best results with the various metals. Material is not always the same and to some extent the tools require adapting to the particular quality under treatment at the moment.

[20,525] **Alternator Plant Trouble.** T. L. (Swansea) writes: I am connected with a coal mine where there is an electric plant. I should think it is a three-phase alternating current generator, excited by a separate exciter. It gives 550 volts, but 500 is the working voltage. There is a transformer connected to it rising 3,500 volts, and an automatic switch between the transformer and a pump underground driven by a motor of about 75 h.-p. There is another pump working direct from generator. The generator is belt-driven by a steam engine. The top of the colliery is lighted by the exciter, which is continuous current. Now what puzzles me is this: when the machine is working and all is going on, the light will go out and then will come back in a moment. I happened to be by the switchboard once, and I noticed the voltmeter going down and the ammeter going up, as if a spring was let loose. This occurred once, and the pump connected to the transformer stopped, and the automatic switch remained unmoved. Of course, this does not occur often. I do not think it is short-circuit, since the light comes back; no fuses are burning either. I do not think I can inform you any more; if you can help me through this difficulty I will be much obliged.

This query is altogether beyond the scope of our query columns. We advise you to apply to the firm who installed the plant. Peculiar effects such as this are not uncommon with alternating circuits We are inclined to think that the pump overloads the generator, but owing to the design of the latter it cannot maintain its pressure owing to the self-induction of the armature; the voltage therefore drops. This causes loss of power at the pump motor, which cannot take its load, and stops working or slows up temporarily. Alternators having high self-induction may be short-circuited without doing any harm, as they simply cannot give more than a certain amount of current. The result of trying to take more current from the machine is merely to cause the volts to fall; the armature also partially de-magnetises the field. This may not be the cause of your trouble; does it happen when the motor is switched off?

[20,543] **Steam Launch Machinery.** W. E. L. (Kew) writes: I am about to build a small steam launch. Could you tell me what size compound condensing engine (high-speed, about 400 r.p.m.) would be required to drive a 12- or 14-ft. boat, 4-ft. beam, to carry three persons 6 to 7 miles per hour in still water? What heating surface would be required in boiler, working pressure 140 lbs. per sq. in.? What size propeller and pitch? Would a 14-ft. be better than 12-ft. of the same beam?

Everything depends on the amount (of cash or time) you wish to expend upon the plant. A small Stuart compound engine, cylinder 1¼ ins. by 2¼ ins. by 1½-in. stroke, would do the work all right, but, of course, you could not expect it to work day after day without considerable wear and tear taking place. For ordinary spare time use, however, we would recommend this engine, castings of which are stock articles. With regard to the speed, we would reckon on at least 600 r.p.m. The propeller should be about 6 ins. diameter and 11- or 12-in. pitch. You will not get more than about 5½ miles per hour. Of course, this is cutting things fine, but it is surprising what power can be obtained from such a small engine. We would recommend, for simplicity, an oil-fired boiler of the flat (*i.e.*, squat) multitubular vertical type. The heating surface should be at least 2,000 sq. ins. of heating surface. The tubes should not be larger than ½ in. or 9-16ths in. in diameter. The burners should be large (No. 5) Primus burners, with the nipples slightly increased in bore. To do the thing well, a much larger engine should be fitted, say a 2-in. by 3-in. by 3-in. compound and a coal-fired multitubular boiler. The vertical type of boiler provides a better draught, but the tubes are liable to burn out rapidly at the top if the plant is forced. The boiler should provide half as much more heating surface, viz., about 3,000 sq. ins., and the boat may be 14 ft. long with advantage. The propeller may be 10 ins. diameter and 14-in. or 15-in. pitch.

[20,649] **Centrifugal Pump.** A. R. C. (Lincoln) writes: Will you please help me with the following? A centrifugal pump, 18-in. wheel, 6-in. discharge, revolutions 1,400, head 55 ft. What horse-power will be required and how many gallons per minute will it discharge? Both suction and delivery are 6 ins. diameter.

From the data you supply we cannot give very confident answers to your queries, but we judge the pump would deliver about 600 gallons per minute. For heads as large as 55 ft. this type of pump will not compare satisfactorily with other types in efficiency. We reckon that about 14 h.-p. will be required to drive it.

The News of the Trade.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use. It must be understood that these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.]

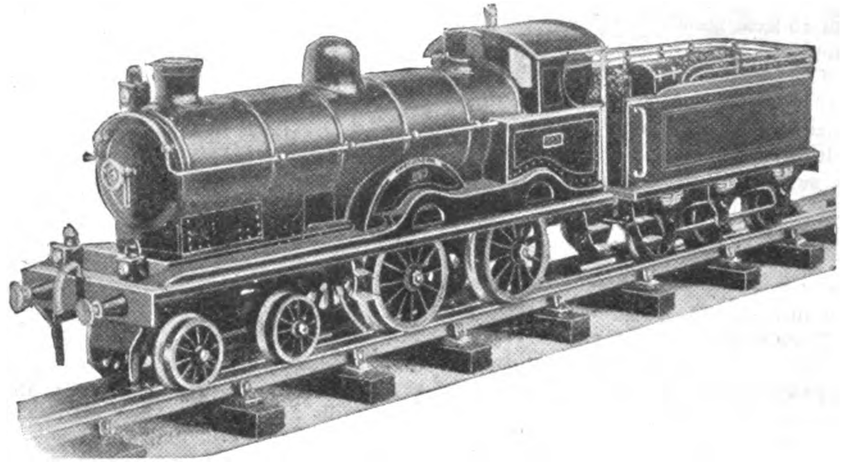
** Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

A Domestic Water Softener.

Those of our readers who are troubled with hard water, either in their engineering work or for their domestic requirements, may be interested to know that a softening plant specially suited to small consumers has recently been introduced by Messrs. Lassen and Hjort, of 52, Queen Victoria Street, London, E.C., a firm who are held in high repute for the excellent plants they manufacture for water softening on a large scale for engineering and industrial purposes. This softener measures 2 ft. 6 ins. in height, and has a capacity of 10 gallons per hour. Some very interesting and instructive notes on the subject of water softening are contained in a little book entitled, "Soft Water—What it means and how to get it," which Messrs. Lassen & Hjort will be pleased to send to any reader on application.

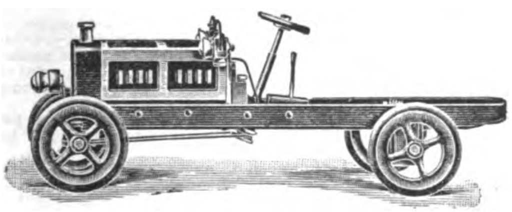
A Model Auto-Car.

An exceptionally novel working model has just been introduced by The Hammersmith Model and Electrical Works, 32, Bridge Avenue, Hammersmith, London, W. It is known as the "Rotary Simplex" Model Auto-car, and represents the model motor car extremely well. The chassis is fitted with a powerful electric motor under the bonnet, which drives on to the back axle through a shaft, with worm-wheel gearing. The steering arrangements enable the car to turn in a 2-ft. 8-in. circle. Accumulators (4-volt) are carried, from which current is taken to supply the motor. One



ELECTRICALLY DRIVEN SCALE MODEL L. & N.W.R. "PRECURSOR."

forward speed, and reverse, is provided. The model can be had either with or without the motor, and a complete set for chassis



A NEW MODEL AUTO-CAR.

without motor, but including machined worm-wheels, may also be had.

Pocket Lamp Accumulators.

Messrs. Richford & Co., of 153, Fleet Street, London, E.C., have long been known as a most enterprising firm for manufacturing and handling pocket and hand lamps, accumulators, dry batteries for flash lamps, etc. They are maintaining this well-earned reputation, and the most recent step towards further

A NEW ACCUMULATOR FOR SMALL POCKET LAMPS.

popularity is the introduction of a small pocket lamp accumulator of 1½ amp.-hour capacity, which measures approximately 2¾ ins. by 2½ ins. by ⅝ in. The case is of clear celluloid and the plates are of best quality. The terminals are made so that the connections for pocket lamp can be taken off, and the cell used conveniently for other purposes. It is unspillable, and possesses one great advantage over the old type of dry cell, viz., it can be recharged at about half the cost. The illustration shows the accumulator approximately one-third full size. It may also be mentioned that small 2-volt metallic filament lamps for use with the above can be supplied at a very reasonable figure. Similar cells to that just referred to can also be had of 4 volts, 6 volts, and 8 volts pressure

A New Scale Model Electric Locomotive.

The illustration below shows an electrically-driven scale model of the L. & N.W.R. "Precursor," No. 513, which Messrs. A. W. Gamage, Ltd., of Holborn, London, E.C., are at present offering at a very low price. The carcase is built of heavy brass plate, and is carefully enamelled, lined and lettered in the correct colours. Spring buffers, electric headlights, dummy vacuum tubes and sand pipes are fitted, and a suitable reversing switch is mounted in the cab. The total length of engine and tender is 20 ins. Some improvements have been introduced into the design of the motor, which is supplied with current at 6 volts from the third rail in the usual manner. The model is a thoroughly well-made article, and in view of the popularity of the prototye should appeal strongly to those in favour of electrically driven locomotives.

New Catalogues and Lists.

Messrs. F. Darton & Co., 142, St. John Street, London, E.C., have issued a well illustrated catalogue which describes a large variety of electrical goods. There are all kinds of patterns of electric motors, fans, and dynamos; sets of castings for dynamo building, pocket and switchboard type measuring instruments; electric hand lamps and torches, dry cell and accumulator flash lamps, bicycle lamps with accumulators in cases and carriers; watch and clock stands of neat design, fitted with small brackets carrying lamps; electric alarm clocks and bells, and telephone sets. Further, there are shocking and medical coils of numerous types and of various powers, and a large selection of medical electrical accessories, vacuum tubes, etc., as well as stereoscopes and magic lanterns.

The Clyde Model Dockyard and Engine Depot, Argyll Arcade, Glasgow.—In a new catalogue to hand from this firm we have a most comprehensive list of working models. It will be noted with interest that many items in the way of miniature plant are illustrated and priced, such as circular saws, emery wheels, and grindstones, drilling machines, cranes, printing presses, etc., which can be driven from models of power generators of various types, thus enabling a very realistic miniature workshop to be fitted up. In the section devoted to locomotive matters, some very fine scale model engines are illustrated. Particular mention may be made of their models of the N.B.R. Company's latest flyers; the Caledonian 6-coupled express and 4-coupled passenger engines, and the L. & N.W.R. "Precursor." Electric and steam speed boats and also torpedo boats are given much space. Something new in the model ship line is the electric gunboat, which can be worked and steered from the shore by electrical means. For the rest, there is much in the way of rolling-stock listed, mountain (cog wheel) railways and locomotives, and clockwork trains of all sizes and descriptions; motor 'buses, trams, fire engines and station complete, etc.

The Editor's Page.

WE seem to have been a "little previous" in our note last week on the Aberdeen Mechanical Model Engineers' Society, which we are now informed has no connection with the Aberdeen Model Steamer Club. The latter body is still living a healthy and energetic existence on its original lines, and is likely to long continue to do so. The present Honorary Secretary is Mr. W. Bunting, 51, Ashvale Place, Aberdeen.

* * *

At the time of writing these notes the "Wants" Competition is just about to close, and entries are flowing in. Evidently there *are* some wants, and we hope by the time our next issue is due to have carefully sifted them out and selected those suitable for bringing into public notice.

* * *

A correspondent, A. E. S. (York), is anxious that we should encourage the inventor of small means, and proposes that we should devote space in our journal each week to publishing various ideas which our inventive readers might send up. He thinks that we might offer a prize for the most useful invention, or perhaps make some payment for the various ideas published. In addition to this, the publicity given to the various inventions might be the means of somebody taking them up in a commercial way, with benefit to the inventor. While we think that the faculty of invention is worthy of all encouragement, we are afraid that our correspondent's proposal is hardly a practicable one so far as THE MODEL ENGINEER is concerned. So many ideas are conceived which are either old, or have little or no practical value, that it would be waste of space for these to be included, while any ideas which were really new and good would, by publication, become ineligible for a patent. We are always willing to accept and pay for any original ideas which are likely to be of service to our readers in the practice of model engineering, but we are afraid it is out of the question for us to set up a department for the development of inventions generally. The poor inventor has a very difficult path to tread, but we do not see how our correspondent's suggestion is likely to be of any practical benefit to him or us.

Answers to Correspondents.

F. C. (Wollaston).—We have already published an excellent series of articles, entitled "Simple Lessons in Pattern Making" (see Vols. VIII, IX, and X). Some good electrical articles are coming along. Thanks for your letter.

"CLASS FOUR" (Portobello).—Thanks for your letter. The device illustrated is a very old and well-known one.

AIR-GAS PLANT.—Mr. Hudson has asked us to notify readers that in consequence of the large number of inquiries he has received, he is only able to answer those with which a stamped addressed envelope is sent.

F. A. SCHULZ (Detroit).—Glad to have your letter and the address contained therein.

J. A. BARKER (White Hart Hotel).—You cannot do better than refer to a series of twelve articles on "Milling in Small Lathes," by C. W. Cook, in our Vols. VIII and IX. Our letter was returned by the Post Office.

H. W. DAVEY.—A correspondent is desirous of communicating with you. Will you kindly send us your present address?

W. H. S. (Ashford).—See Mr. Goldsworthy-Crump's articles in THE MODEL ENGINEER on "Ornamental Turning." He deals with the spiral-fluted work in our issue of June 18th, 1908.

L. P. (Neath).—With reference to your Query 20,428, a correspondent writes that in Part I of "Cassell's Cyclopædia of Mechanics" you will find instructions for converting sewing machine to lathe.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

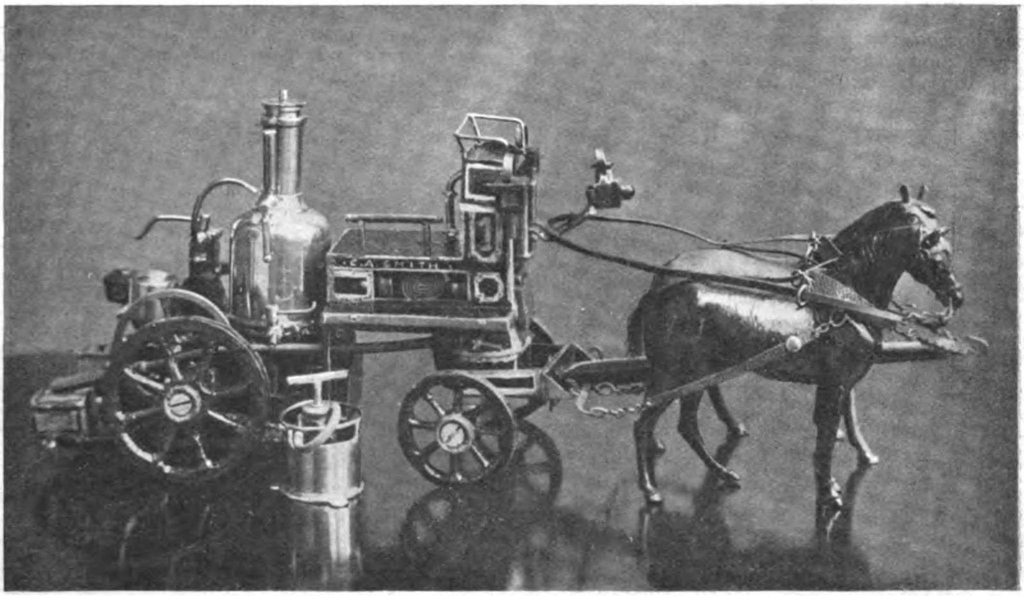
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 399. DECEMBER 17, 1908. PUBLISHED WEEKLY

A Model Steam Fire Engine and Two Manuals.

By C. A. SMITH.



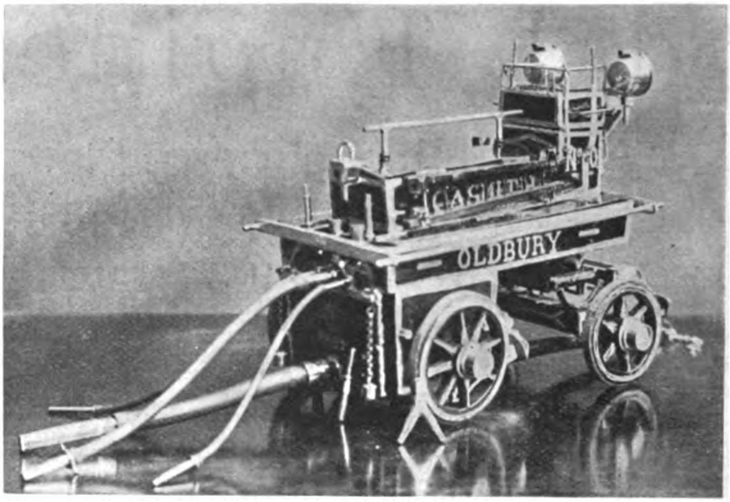
MR. C. A. SMITH'S MODEL STEAM FIRE ENGINE.

THE following is a short description of my first attempt at making a model steam fire engine, which I made in the year 1895, but have since improved by adding three water tubes, which are ¼ in. diameter.

The boiler, which is made of brass, is 1¾ ins. diameter and 6 ins. high from bottom of firebox to top of funnel. It has a starting-tap, blow-off cock, spring safety valve on one side of funnel, and steam whistle on the other side, the steam being raised by a spirit lamp, which is an oblong tank, 1½ ins. long, 1 in. wide, and 1 in. high, with screw plug on top, with small hole in centre for air, and a square elbow projecting from side to act as a burner, which is placed underneath the boiler from centre of engine.

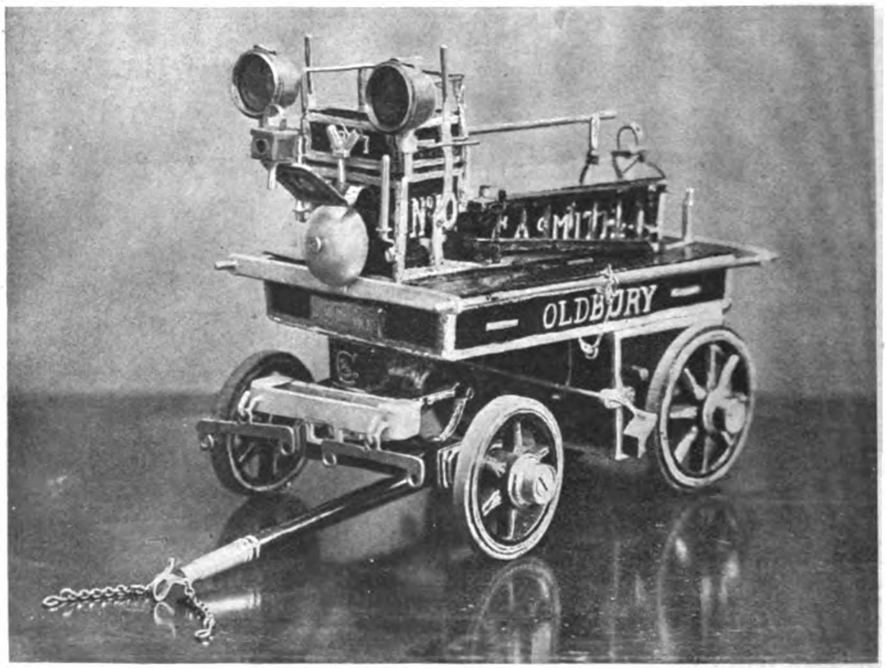
The cylinder is oscillating, ½-in. bore; the pump is ½-in. stroke and ⅜-in. bore, with brass delivery air-vessel with one 3-16ths-in. outlet and ¼-in. suction, which are central at rear of engine. The pump being single-action, is worked by a crank between the cylinder and flywheel, and by soldering a piece of brass between two of the spokes in the flywheel to form balance-piece, it caused the engine to work much better. The steam pressure is raised in three minutes: enough to send a stream of water to a height of 4 ft. through a 1-16th-in. nozzle.

The engine is 9 ins. long, 5 ins. wide, and 6½ ins. high to hand-rail on driver's seat. The engine has



Mr. C. A. Smith's Model Manual.

an open hosebox, with engineer's cupboard at end with brass knob on door, and brass rail and stand-pipe on top of seat for firemen, the footboard



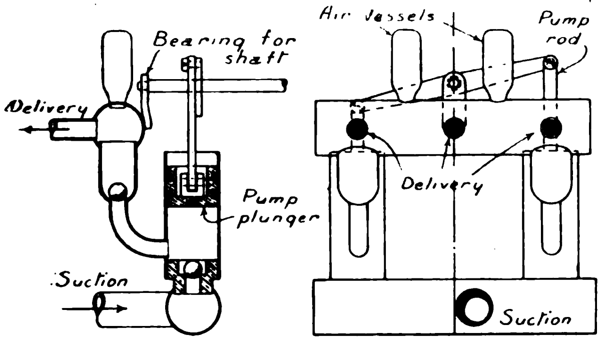
Another View of Mr. C. A. Smith's Model Manual.

having brass beading round, adding appearance to the engine; there are also two tool-boxes at rear.

The wheels are cut out of teak with fretsaw. The engine and wheels are painted with bright red and lined with white and blue. The hand-pump (which is similar to sketch on page 579) stands 2 ins. high to top of pump handle, and throws a small stream of water 18 ins. high. The bucket is 1⅜ ins. diameter.

The following is a description of my second attempt at making a model manual fire engine, finished in the year 1901. I bought the horses and made the harness myself.

The manual is 10½ ins. long, 6 ins. wide, and 6¾ ins. high to hand-rail on driver's box. The body of engine is made of wood, the lid, with brass rail on hosebox, forming seats for firemen; there are pockets at each side of engine for suction



SKETCH OF HAND PUMPS.

hose, the lids forming footboards for firemen. The driver's footboard has an alarm bell fixed to it to work by driver's foot for clearing the way. The body of engine is painted red and lined with white and blue. The wheels are the same as ordinary fire engine wheels—made of oak, being varnished—with brass rings round hubs, and lever brakes to act on back wheels.

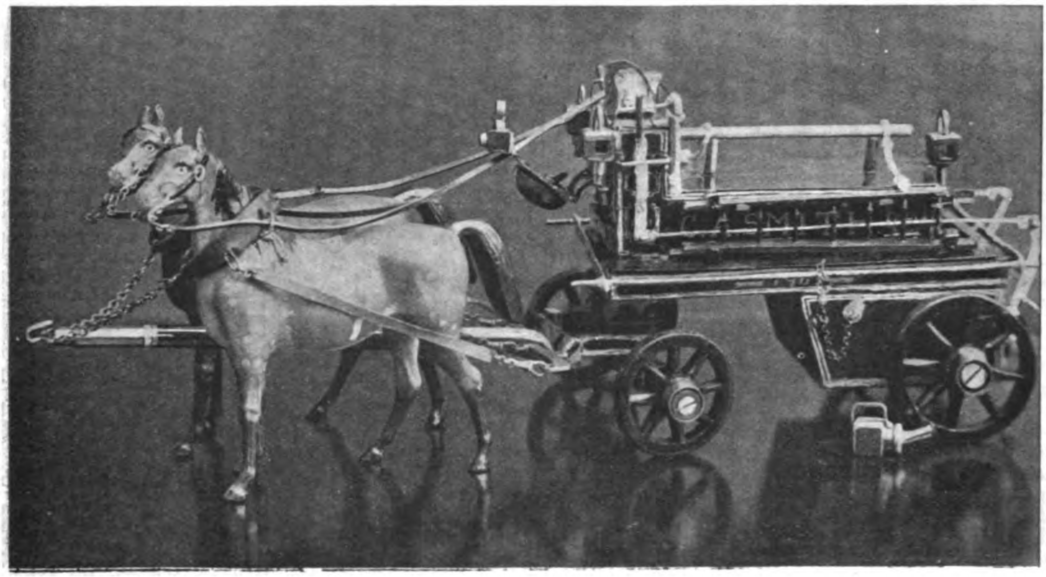
through a 1-16th-in. nozzle to the height of 10 ft. I may mention that all joints are soldered.

The engine carries suction hose with copper strainer, delivery hose-pipes, two brass branch-pipes, one brass breaching-piece, so as to connect the two deliveries into one if required, also stand-pipe key for hydrants, wrenching-bar, large axe, four lamps, torch light, and two scaling ladders. The brass helmet shown on driver's seat in illustration below is one of six helmets I have.

The following is a description of the manual fire engine, "Excelsior," which I designed and built twelve months ago.

The body and wheels and pole for horses are made of wood, and are painted bright red and lined with white and blue, the driver's seat and hosebox having brass hand-rails; pump levers, lamps, and sway-bars are brass. The large lamp on each side of driver's seat I made out of a damaged opera-glass, and all four lamps have candles in them. There is also an alarm bell under driver's footboard, arranged for driver to work with foot for clearing the way. The wheels are the same as ordinary fire engine wheels, having brass rings on hubs. The spokes are driven into hub and forced into rim, which is cut in one ring with a fretsaw, and pins driven through rim into each spoke, then rubber tyres fixed. The front wheels turn on a carriage, and hind wheels have lever brakes acting on them.

The engine is 1 ft. long over all by 7 ins. wide and 8½ ins. high to top of driver's seat. The pumps,



A MODEL MANUAL: A SECOND ATTEMPT AT MODEL MAKING.

There are two pumps, similar to those shown on plan of "Excelsior" engine, the deliveries coming from the ends of cross-tube instead of where they are shown on plan. The pumps are ¾-in. stroke, 1-in. bore, and ½-in. ball valves, with ⅜-in. suction at rear of engine, and delivery 3-16ths-in. on each side of engine. There are also two air-vessels. The pumps will deliver a stream of water

which are all soldered together, are single-acting with cup-shape plungers, 1-in. stroke by 1½-in, bore, with 5-16ths in. diameter phosphor-bronze balls, having two brass air-vessels, three outlets, and suction at rear of engine; the suction is ⅜ in. large outlet in centre is 5-16ths in., and small outlets on each side of large outlet are 3-16ths in. The pumps will deliver 3 pints of water through a branch pipe—diminished to ⅛ in., connected to 5-16ths-in. outlet on engine—9 ft. high in one minute. The highest the engine has thrown is 14 ft. through 1-16th-in. branch-pipe connected to 3-16ths in. outlet on engine, and by having all three branch-pipes at work, which are shown connected in the sketch on page 579. The height reached is 4 ft. 9 ins. and 5 ft. I can also take out large branch pipe and connect breaching-piece, which is shown reared by the back wheel in photo, and two small hosepipes and branch-pipes which are standing on back of engine, and get four streams of water 4 ft. 6 ins. high. The engine has pockets at sides for suction pipes, the lids answering for footboards for firemen, and hose and tool-box, with lid, doing duty as seats. The engine also carries one length of suction pipe 9½ ins. long and copper strainer attached, and three lengths of large delivery hose and four lengths of small delivery hose; two scaling ladders and one junction branch-pipe; large and small breaching-pieces, key for hydrant, wrenching-bar, large axe, two hand-torches, and stands for taking weight of branch-pipes.

I may say that I have never had an engineering lesson, but I take a great interest in fire engines, and it has been my hobby to try and make them. I have also other fire engines, fire escapes, and hose-carts with horses, and hand-pumps fixed in buckets; also an ambulance van, with two model fire-stations with hose-towers. This has been my hobby for about sixteen years, but the one I have described last is my largest and best, though I have some to come near to it.

Induction Motors, and How They Work.

By Norman E. Noble.

In this article it is intended to deal with the description of induction motors and principle upon which they work. This is a subject that most amateurs (whose study of alternating current motors has not progressed very far) consider somewhat of a mystery, and it is for their benefit that this article is written. I have endeavoured, as far as possible, to keep the description and drawings as clear as I can, considering the nature of the subject; also the mathematics of induction motors have been left out entirely, as they are rather complex and might have induced the amateur to slip over some of the most important points. It has been assumed that those who wish to study the principle of induction motors have a good all-round knowledge of the properties of direct-current motors and apparatus, and have also a slight knowledge of the fundamental principles of alternating currents and one or two of its peculiarities, as induction motors depend upon alternating current for their power. However, for those whose knowledge is slightly rusty, I will commence with a brief description of their derivation; but for any further information, I must refer them to articles which have previously appeared on alternating current in this journal.

An alternating current is one that is neither constant in direction or pressure, but varies—first flowing in one direction round the circuit, commencing from a zero value and rising to a maximum, and then back to zero; it then changes its direction and flows round the circuit in the opposite direction: from zero to a maximum, and back to zero. This cycle of operations being repeated at regular intervals of time.

Let us now consider Fig. 1, in which the curved line represents an alternating current, and shows the variation in direction and pressure. The line X Y represents the zero line—volts in one direction being marked above the line, and volts in the opposite direction below the line, time being marked horizontally. The current starts at a zero value at A, and increases, at a varying rate (as shown by the curve), to a maximum value at B; then it decreases from a maximum to a zero value marked C, all in one distance round the circuit. The direction is now changed, and the

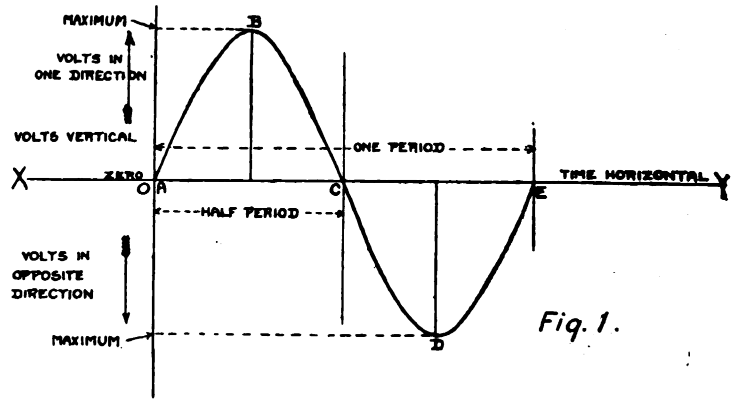


Fig. 1.

current increases from a zero value at C to a maximum value at D, and then down to a zero value at E—all in the opposite direction round the circuit. This complete cycle of variations—that is, from A to E—is called one period; this period or cycle of variations is repeated at regular intervals of time, each period occupying 1-50th or 1-25th of a second, according to the design of the alternator supplying the current. Thus, we get a current having 50 or 25 complete periods of variation per second; of course, we can get currents having 100 or 60, or any other number of complete periods of variation, but 25 and 50 periods per second are the most common; the periodicity or frequency of the current being a fixed quantity for any particular alternator at its proper speed.

We will now consider how these alternating currents can be produced. For our illustration let us consider a single coil of wire revolving in a direct-current magnetic field, and each end of

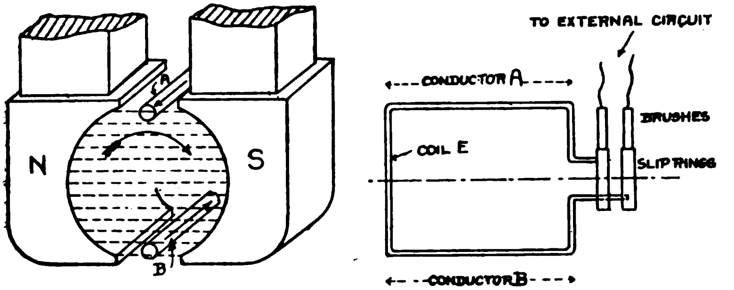


Fig. 2.

the coil being connected to a separate slip-ring. (See Fig. 2.) The coil E is assumed to be rotating in a clockwise direction, as indicated. As the coil revolves, the conductor A cuts the lines of force in one direction; this induces an E.M.F. in the conductor, which causes a current to flow, the direction of which can be easily determined by remembering the following simple rule: "Hold the palm of the right hand so as to meet the lines of force (coming from the N. pole to the S. pole), and place the hand so that the thumb indicates the direction of motion of the conductor, and the fingers will point out the direction of the induced current." (See Fig. 3.)

If this rule be applied to Fig. 2, the induced currents will be found to flow in the direction shown by the arrows. We will now deal with the currents generated during the first quarter of a revolution (that is, 90 degs.). Considering the conductor A, this will start cutting the lines of force gradually, and as it rotates will cut an increasing number of lines, until, when it has moved 90 degs. it is cutting a maximum number of lines. Now

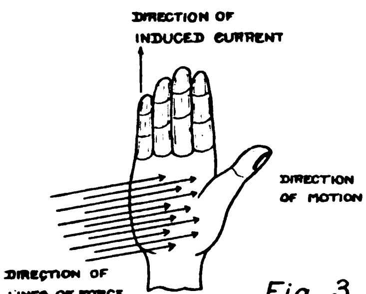


Fig. 3.

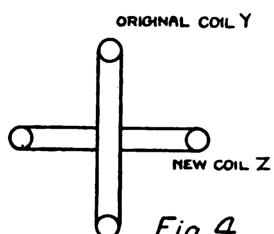


Fig. 4.

the E.M.F. induced in any conductor is directly proportional to the rate of cutting; therefore, it will be seen that the E.M.F. generated during the first 90 degs. of a revolution corresponds to that portion of the curve (Fig. 1) from A to B. Of course, at the same time there is an E.M.F. generated in the conductor B (Fig. 2) which assists that generated in the conductor A. During the second quarter of the revolution (that is, from 90 degs. to 180 degs.), the number of lines cut is a maximum at the commencement, and gradually decreases to zero; thus, the E.M.F. generated in this portion of the revolution will vary from a maximum to a zero value, and will correspond to that portion of the curve B to C (Fig. 1). Now, during the third quarter (that is, from 180 degs. to 270 degs.) the direction of the induced current is changed, because the conductors cut the lines of force in the reverse direction; the E.M.F. generated will vary in perssure from zero to a maximum, as in the first quarter of a revolution, and will correspond to that part of the curve C to D,

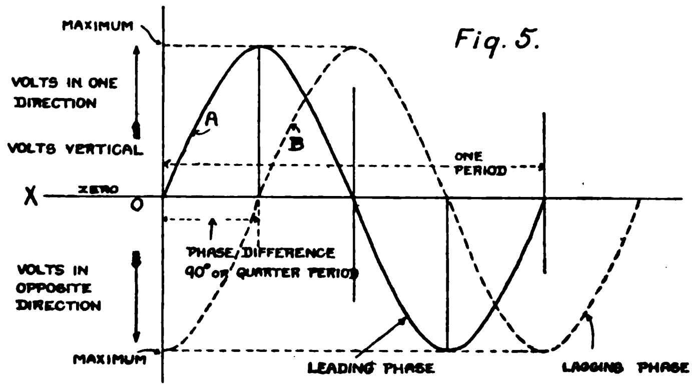


Fig. 5.

and, finally, in the last quarter (that is, from 270 degs. to 360 degs.), the E.M.F. generated will vary from a maximum to a zero value (as in the second quarter), and corresponds to that portion of the curve D to E (Fig. 1).

The current produced by this single coil revolving in a two-pole field, as in Fig. 2, is a single-phase alternating current, and we get one complete period produced during one revolution of the coil; therefore, to get 50 periods per second, we must rotate the coil at 50 revs. per sec. If we had a four-pole field, we should get *two* complete periods during one revolution of the coil; so. under these conditions, we need only revolve the coil at 1,500 r.p.m. to produce 50 periods per second. Hence, as we increase the number of poles of the field, we increase the periodicity of the current (that is, of course, for a given speed). Therefore, to find the periodicity of an alternator, we have—

Periodicity per second = revs. per second × number of pairs of poles.

Referring back to Fig. 2, we had one coil only.

Now, suppose we wind another similar coil at right angles to the original coil, and connect it to two more slip-rings (that is, four altogether). (See Fig 4.) The coil Z would be generating a maximum E.M.F. when the coil Y was generating no E.M.F., and *vice versa*; so, if we revolve these coils in a two-pole magnetic field, as before, we shall get two alternating currents, one having its maximum value when the other has its zero value, the difference between the two being 90 degs. (See Fig. 5). This is called a two-phase current, the phase difference being 90 degs. Curve A represents one phase, and the curve B represents the other phase. As regards the periodicity of the currents, it is exactly the same as previously pointed out—that is, it depends on the speed and the number of pairs of poles.

If we had to wind three coils having 120 degs. between each of them, we should get three currents having a phase difference of 120 degs. (See Fig. 6.) This is all that will be said on the derivation of alternating currents.

Induction motors can be made to run on either single-, two-, or three-phase current circuits. We will consider two-phase motors first. Let us take a soft iron ring-shaped core, as shown in Fig. 7—(it must, of course, be laminated to prevent eddy currents)—and wind a coil of wire in two halves—A and B—on opposite sides of the ring. If we now pass a direct current through the coils in the direction shown, we shall get a magnetic field produced inside the ring, as indicated by the dotted lines, the N. and S. poles being as shown; if we put a small compass needle in the centre of the ring, it will, of course, take up a horizontal position. Let us now wind another similar coil of wire in two halves C and D, and at right angles to the coils A and B. (See Fig. 8.) If we pass a direct current through the coils C and D in the direction indicated, we get a vertical magnetic field, having its N. pole at the top and its S. pole at the bottom. If we now pass the same current through both coils in the directions shown, simultaneously, we get two magnetic fields at right angles to one another, and a compass needle placed inside the ring will take up a position midway between the two fields, as shown in Fig. 8. Turning back to Fig. 7, let us supply the coils A and B with an alternating current (single-phase); therefore, we shall get a current flowing first in one direction, and then in the other. At one particular instant the current would be flowing as indicated by the arrows, and consequently would produce a magnetic field having its N. and S. poles in the ring, as shown. The strength of the field would gradually increase from zero to a maximum, and then decrease to zero. Then, with the current changing its direction, the poles of the magnetic field would be reversed—that is, the N. pole would become S., and *vice versa*, during the period that the current was flowing in the opposite direction to that shown. The result is—we get what is called a pulsating field, and a compass needle placed inside the ring under these conditions would first be pulled in one direction and then the other; and if we looked closely at the needle we should be able to see a visible vibration, but no rotation, unless we first gave the needle a twist; the reason being that the needle has not time enough to turn partly round in one direction before it is pulled back with the field reversing, which occurs perhaps fifty times a second, depending on the frequency of the supply.

Let us now consider Fig. 8, and supply both coils A and B and C and D with alternating current (single-phase), and we shall get two pulsating fields at right angles to one another, and a compass needle will take a vibratory position midway between the two if they are of equal strengths.

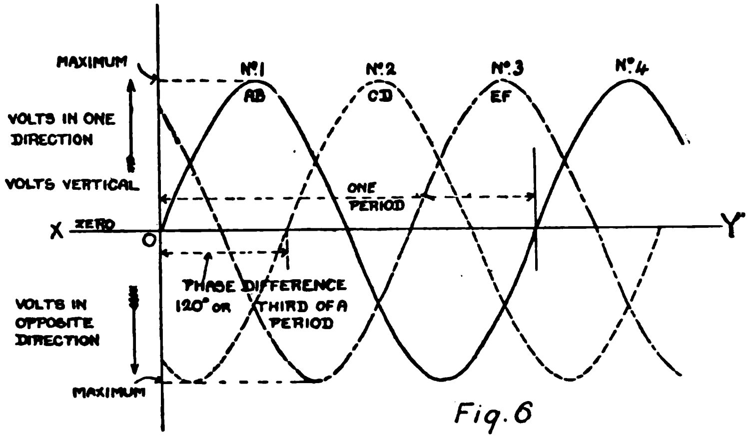


Fig. 6

From these two experiments we conclude that neither of the two methods are suitable for producing rotation. To produce rotation we require a rotating field, and not a pulsating field.

The production of a rotating field can be accomplished by supplying two or more suitably placed coils with alternating currents differing in phase; by that is meant—one current attains its maximum value a certain fixed time after or before the other. Let us take a two-phase current (that is, one quarter of a period phase difference—see Fig. 5) and supply the coils A and B with one phase of the current, say, the lagging current, and the coils C and D with the other phase (that is, the leading current). (See Fig. 8.) Under these conditions we shall get a rotating magnetic field revolving at a uniform rate in a clock-wise direction in this case, and if the following explanation be carefully studied, the reader will have got over the most difficult part, and one which causes trouble to many amateurs. At that instant when the current in the coils A and B is at zero, the current in the coils C and D is at a maximum, and is assumed to be flowing in the direction C to D; therefore, the magnetic field due to these coils C and D will be vertical, as per Fig. 8, its N. pole being at the top and its S. pole at the bottom. Now, the value of the current in the coils C and D decreases from maximum to zero at a certain rate,; but as this is happening, the current in the coils A and B (which is assumed to flow at this instant from A to B) begins to increase from zero to a maximum value, and the magnetic

field thus produced will be horizontal, with poles as per Fig. 8. This would be the case if we consider the coils separately; but as the magnetic field due to the coils C and D is weakening, owing to the current decreasing in value, the magnetic field due to the coils A and B is increasing in strength, hence the two fields act upon one another at right angles and produce a rotating field having its position at any instant in between the two fields, and its relative position between the two being directly in proportion to the strengths of the two fields. Thus, at the beginning the field produced

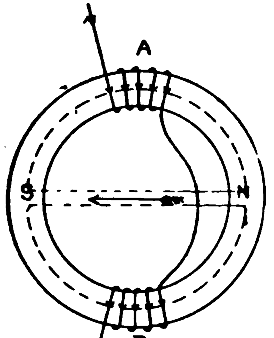


Fig. 7.

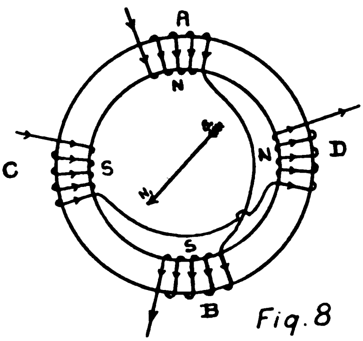


Fig. 8

by the coils C and D is vertical, and the field due to the two coils A and B is at zero value; now, when the currents have passed through a quarter of a period, the field due to the coils C and D is at zero, and that produced by the coils A and B is at a maximum and is horizontal; therefore, it

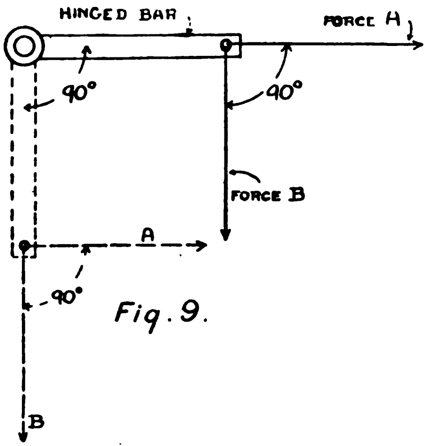


Fig. 9.

will be seen that the magnetic field has moved a quarter of a revolution in a clock-wise direction, in the same amount of time that the currents have passed through a quarter of a period variation. Now, the movement of the magnetic field from one position to another is not instantaneous, but is uniform, because when one set of coils is producing its maximum magnetic field (which gradually decreases to zero), the other set of coils is producing a zero field (which gradually increases to a maximum value), and both are varying at the same rate of change. This can perhaps be made a little clearer by comparison with an every-day fact: Suppose we have two ropes attached to a hinged bar—(see Fig. 9) at right angles to each other, a force A pulling at one rope, and a force B pulling at the other. Assume that the force A starts at 10 lbs. and gradually decreases at a certain rate to nothing; and the force B starts at nothing and gradually increases (at the same rate that A decreases) to 10 lbs. It is quite evident that at the commencement, the hinged bar will be in a position, as shown by the full lines, and that at the completion of the experiment the hinged bar will be in a position as shown by the dotted lines; also, at any intermediate point between the initial and final positions, the bar will be in that position the resultant of the two forces occupies, seeing that the two forces are varying continually and at the same rate of change; therefore, the resultant must be constantly changing its position. These two varying pulls A and B are comparable with the two varying field-strengths produced by the coils in the previous case, and the hinged bar is comparable with the revolving field. This analogy, no doubt, will help the reader to understand how a rotating force can be produced with alternating currents.

Returning back to our consideration of Fig. 8, we had arrived at the point when the field due to the coil A and B was at a maximum and horizontal. The current in these coils now begins to diminish to zero, but at the same time the current in the coils C and D begins to increase from zero to a maximum value, but the direction of the field is reversed, owing to the current having changed its direction.

The resultant field, or revolving field, will now move away from the weakening field and towards the strengthening field—that is, it will move another quarter of a revolution in a clockwise direction during a quarter of a period in variation of the currents. If the remaining operations be gone through in a similar manner to the above, we shall get one complete revolution of the magnetic field for one complete period of variation of the currents. (See Fig. 5.)

(To be continued.)

THE Metallurgique motor for *Sea Dog II* will, it is stated, be of a very extreme racing type. The stroke will be between 9 ins. and 10 ins., the valves exceptionally large, and the system of forced lubrication rather elaborate. Between 80 h.-p. and 100 h.-p. is expected at about 1,350 revolutions. The hull, which is in course of construction at the Pitre yard in Paris, is of the double-wedge type, so long popular in France. The boat is to race in British waters after the Monaco meeting, so that marine motorists will have excellent opportunities of judging how the French idea of a hull compares with that of the Thornycroft and Napier boat.

Notes on Model Steam Engines.

By H. Greenly.

Fitting an Ejector Condenser.

(Continued from page 567.)

IN comparing the work done by the original engine mentioned in the last article and the compound fitted with the proposed condensing gear, we can at the outset omit all conditions which would tend to alter the mean pressures of steam of the respective cylinders; and after the theoretical indicated horse-power of each arrangement has been obtained by calculation, allowance may be made for the losses peculiar to each system of working.

Presuming a complete cylinderful of steam at each stroke (100 per cent. cut-off point) and no heat losses, the most the original simple engine with the $2\frac{1}{4}$-in. by $3\frac{1}{2}$-in. cylinder could develop would be as follows:—

$$\frac{P \times L \times A \times N}{33{,}000} = \text{i.h.-p.}$$

Working out this well-known and much used and abused formula, we get, with an average pressure in the cylinder of 10 lbs. per square inch, at 150 r.p.m.:—

$$\frac{10 \times 3\frac{1}{2} \times 4 \times 300}{12 \times 33{,}000} = \frac{7}{66} = \text{nearly 1-9th i.h.-p.;}$$

this, of course, rather favouring the simple engine. We know that the correspondent could not get any work worth having for a continuous period. It also means that the $11\frac{1}{2}$-in. by 24-in. boiler would have to supply somewhat more than the normal amount of steam, and to obtain this a superheater would be necessary, and also an induced draught. The back-pressure of the latter would be at least 2 or 3 lbs. per sq. in., but it has not been deducted from the forward pressure. This is again giving the simple engine the advantage on paper.

To obtain the nominal indicated horse-power of the engine when converted to a compound condensing engine, as suggested, each cylinder must be dealt with separately, and the results added together.

In computing the power of the high-pressure cylinder, it also must not be forgotten that *forward pressure* in the *low* is *back pressure* on the *high* pressure piston, and that the amount of the back-pressure depends on the ratio of expansion adopted for the two cylinders, or, in other words, their respective capacities.

With a large low-pressure cylinder the expansion of steam is greater, back-pressure in the H.-P. is reduced, and this reduced pressure is the forward pressure on the L.-P. piston. The area of the latter is, however, greater, and the work done about the same, with a given condenser pressure (or vacuum). The sizes should be chosen so that the work done by the high-pressure cylinder is more or less equal to that of the low-pressure cylinder.

In designing a model compound, this and other points should be fully gone into. The present

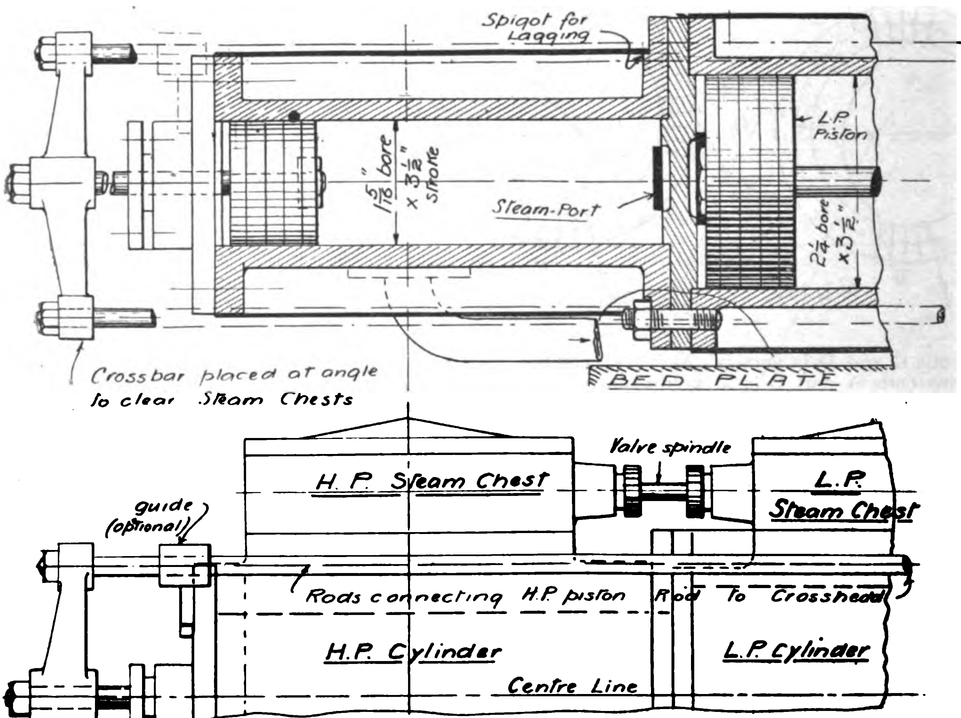


Fig. 2.—Sectional Elevation and Plan of Suggested Arrangement for adding a H.-P. Cylinder to an existing $2\frac{1}{4}$ by $3\frac{1}{2}$ Engine. *(Scale: Half full size.)*

circumstanes, however, fix the dimensions of the L.-P. cylinder, and therefore we must settle on the most suitable size of high-pressure cylinder, remembering that whatever the size, we have to dispose

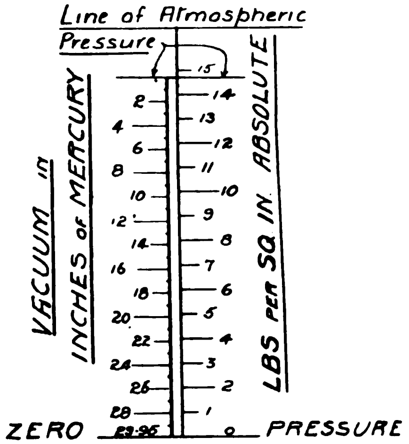


FIG. 1.—DIAGRAM FOR CONVERTING INCHES OF VACUUM TO ABSOLUTE PRESSURES AT A GLANCE.

of 3 cub. ins. of water (in the form of steam—it is hoped), which must pass through the L.-P. cylinder. If we make the high-pressure cylinder too small, the pressure may rise in the boiler to an inconvenient figure. If it is too large the steam pressure may be correspondingly low, and some of the troubles mentioned in the last article may recur, to

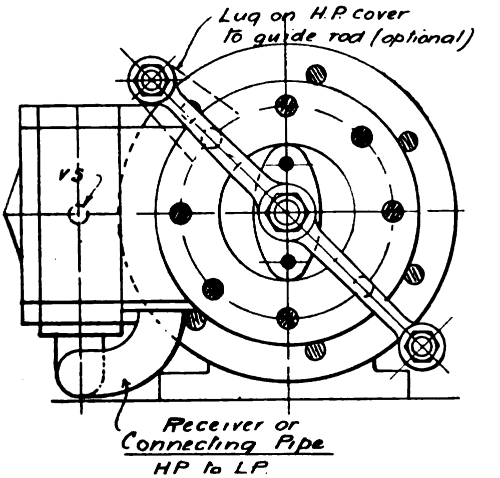


FIG. 3.—END VIEW, SHOWING CROSSBAR.

say nothing of the smaller amount of work which will be done by the H.-P. cylinder.

Referring to the May, 1906, table of steam consumption, and also to the last article, we find that a 1 5-16ths in. diameter cylinder, with the 3½-in. stroke in common with the original cylinder, will, at a speed of 150 r.p.m., cause the maintained pressure in the boiler to rise to 10 lbs. This should happen with a good natural draught. Possibly a superheater would not be necessary, although, of course, this accessory is always an advantage to a small power engine. According to the table, the engine would consume per inch of stroke and per hundred revolutions per minute ·6 cub. in. of water. For the 3½-in. stroke and 150 revs., the consumption would be

$$\cdot 6 \times 3\tfrac{1}{2} \times 1\cdot 5 = 3\cdot 2 \text{ cub. ins.}$$

or under 1 cub. in. per minute per 100 sq. ins. of heating surface. This, it will be seen, is not forcing the boiler.

I showed in the last article that the respective capacities of high- and low-pressure cylinders of the chosen size (1 5-16ths in. and 2¼-in. bore respectively) worked out at 4⅝ and 14 cub. ins., *i.e.*, a ratio of 1 to 3. Boyle's law of expansion of gases demonstrates that if a volume of steam (with no temperature drop) is expanded to three times

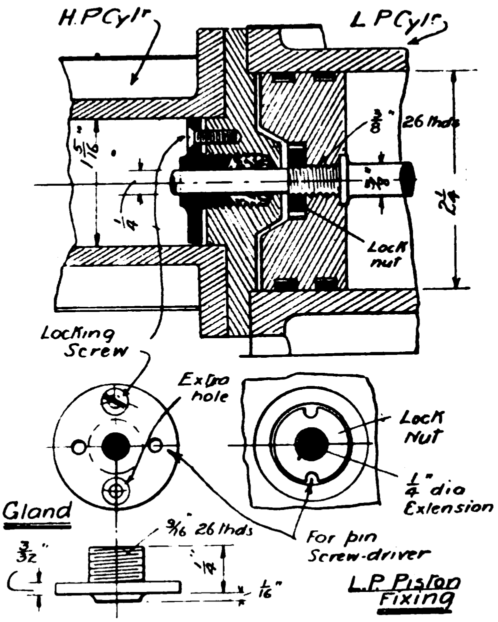


FIG. 3*a*.—ALTERNATIVE METHOD OF COUPLING H.-P. AND L.-P. PISTONS. (*Half full size.*)

its original volume its pressure falls in an inverse ratio. The pressure on the L.-P. piston of the compound engine now under consideration will therefore be one-third of that of the terminal pressure in the H.-P. cylinder. There is no early cut-off; the expansion of steam in the smaller cylinder need not enter into the question.* The expansion and pressure drop must, of course, be dealt with in terms of absolute pressures, that is, with the atmospheric pressure (14·7 lbs. per sq. in.) added to the steam gauge pressures.

Before proceeding to figures, the proposed

* I have known several cases where the pressure drop in the individual cylinders of a compound engine fitted with link motion has, owing to the low boiler pressure, resulted in the failure of the L.-P. cylinder to do useful work. The effects of early cut-offs must be considered as well as cylinder capacities.

vacuum is another point about which some assumption (based on practical experience) must be made. On the vacuum almost the whole of the output of the L.-P. cylinder will depend. The actual pressure value of the steam without the vacuum as indicated in the last article is nothing. We proved that with a low model boiler power it was futile to compound the unsuccessful simple by only adding the H.-P. cylinder. Only one or two pounds of steam (gauge pressure) would be available for should say that 16 ins. of vacuum should be maintained without the slightest difficulty. This, as shown by the diagram, means that the back pressure on the L.-P. piston will be reduced to 7 lbs. absolute. In actual practice a good ejector condenser would provide a vacuum of not less than 25 ins. of mercury quite easily, so that in fixing the model vacuum at 16 ins. we should be on the safe side.

We can now tabulate the various forward and back pressures and find the mean pressures which

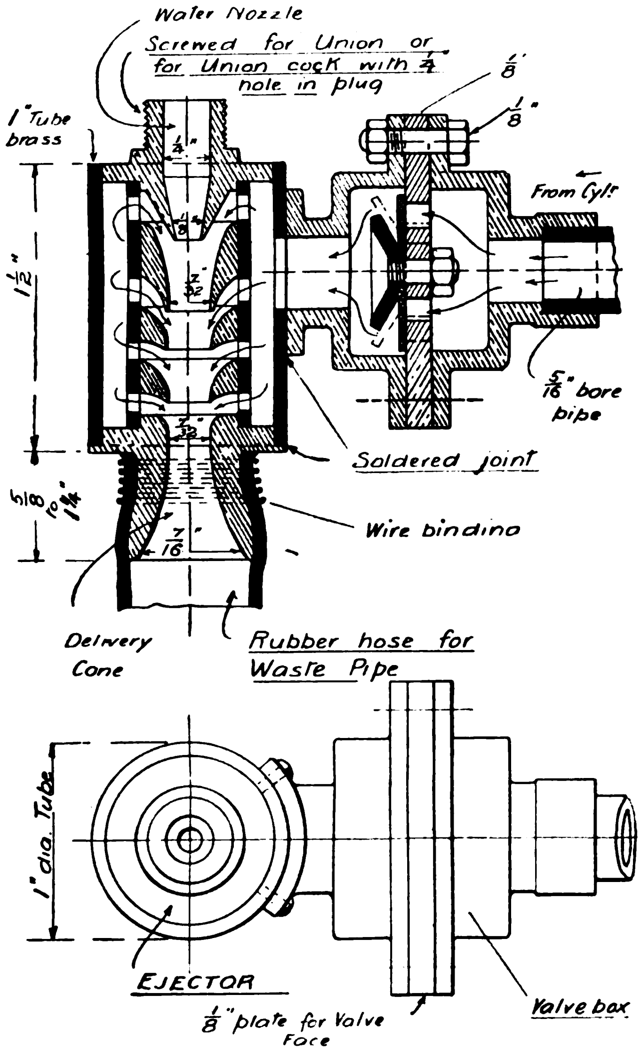


Fig. 4.—General Arrangement of Ejector Condenser for 1/4 I.H.-P. Model Steam Engine.

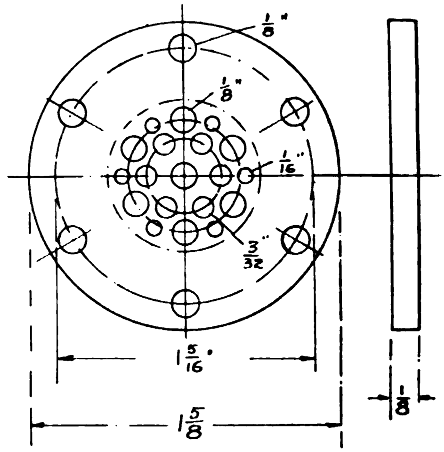


Fig. 5.—Port Face of Condenser Valve. (*Full size.*)

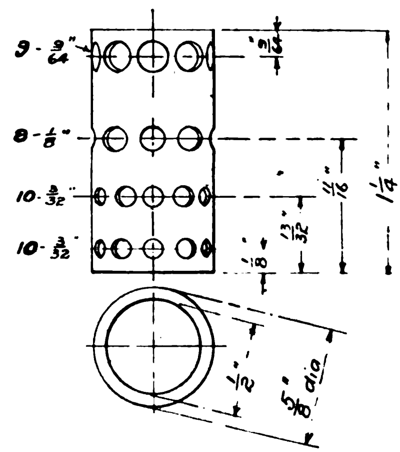


Fig. 6.—Liner of Jet Condenser for holding Nozzles. (*Full size.*)

useful work, and this would disappear if the governor came into action and reduced the initial pressure of steam, or if the inevitable temperature losses became appreciable.

Under ordinary circumstances, with a good head of water to work the ejector condenser, I are actually doing work on the respective pistons, as follows :—

Low-pressure Cylinder :

Forward pressure on piston (1/3 of 55) = 18 lbs.
Back pressure (16 ins. mercury) = 7 „
Actual pressure on piston (18 − 7) = 11 „

High-pressure Cylinder :

Working pressure as gauge	=40	lbs.
Absolute pressure (40 + 15*)	=55	,,
Back pressure (⅓ of 55)	=18	,,
Actual pressure on piston (55 − 18)	37	,,

The mean pressure on the H.-P. piston may be altered to 33 lbs. for the same reason as we include the atmospheric pressure at the round figure of 15 lbs., and also as a part allowance for any losses in steam distribution and transmission, and, using the well-known formula, we obtain :

$$\frac{PLAN}{33{,}000} = \frac{33 \times 7 \times 4 \times 300}{24 \times 3 \times 33{,}000} = \frac{7}{60} \text{ i.h.-p.}$$

for the high-pressure cylinder.

The area of the 1 5-16ths-in. diameter piston is taken at 1⅓ sq. ins., and the number of strokes 300 per minute (*i.e.*, 150 revs. × 2). The low-pressure cylinder at the same speed should develop, on paper :—

$$\frac{11 \times 7 \times 4 \times 300}{24 \times 33{,}000} = \frac{7}{60} \text{ i.h.-p.}$$

This shows that the size of the cylinders has been chosen to give approximately an equal output, and adding the two i.h.-p.'s together, we get

$$\frac{7+7}{60+60} = \frac{7}{30}, \text{ or nearly } \tfrac{1}{4} \text{ i.h.-p.}$$

This is more than twice the power developed by the original cylinder (now used as the L.-P.), employing steam direct from the boiler, and not condensing.

With regard to the comparative losses of the two systems, in estimating the horse-power of the original engine with the 2¼-in. by 3½-in. cylinder, the pressure maintained in the steam chest was taken at 10 lbs. Under ordinary circumstances, supposing that excessive cylinder condensation and consequent priming does not prevent continuous working, 4 cub. ins. of water per minute would have to be supplied by the boiler. By compounding and fitting an ejector condenser, only 3 cub. ins. are required at the speed named (150 revs.). This and the smaller bulk of the steam rising from the surface of the water should steady the water and reduce priming to a minimum. The extra internal work the compound would have to do would be to overcome the friction of the H.-P. cylinder and valve, these additional features being arranged tandem-wise to reduce this friction as much as possible. No air-pump is needed, as the pressure of water in the household mains is relied on to supply all the energy required to eject the air and non-condensible gases. The allowance for impaired vacuum is, I think, ample. If 20 ins. of mercury can be obtained, this should increase the output of the engine considerably, as every pound of actual or mean pressure is important, and is equal to an increment of 3 lbs. on the H.-P. piston.

The work of altering the engine to a compound should not be very much more difficult than making and fitting a liner to the old one. Of course, the jet condenser could be used connected direct to the original cylinder, but I am afraid this would not be altogether successful. The intervening H.-P. cylinder of the compound engine, between boiler and L.-P. (which is open to the condenser every stroke, and therefore to a certain extent cooled) will reduce the heat (and therefore the energy) losses, considerably.

* Atmospheric pressure is approximately taken as 15 lbs. to simplify the calculations and eliminate the decimal point.

One method of arranging the engine is shown in Fig. 2, the advantage of this being that a pair of glands in an outward position between the two cylinders are rendered unnecessary, and as the H.-P. cylinder forms part of the L.-P. front cylinder cover, the alignment of the two cylinders may be assured without relying on the flatness of the bed-plate. The latter also will need no extension. The crossbar fitted to the outer end of the H.-P. piston-rod is shown placed at an angle so that it may clear the valve chests of both cylinders. A similar crossbar, the exact shape and attachment depending on the design of the crosshead, must be fixed to the latter to take the other end of the tie-rods, and an intermediate guide provided on the L.-P. steam chest and bedplate to prevent the rods bowing out when under compression. A second pair of guides may be arranged on the outer H.-P. cover as indicated ; these guides may be cast on the cover or made separately attached by the adjacent cover studs. The H.-P. cylinder should have its

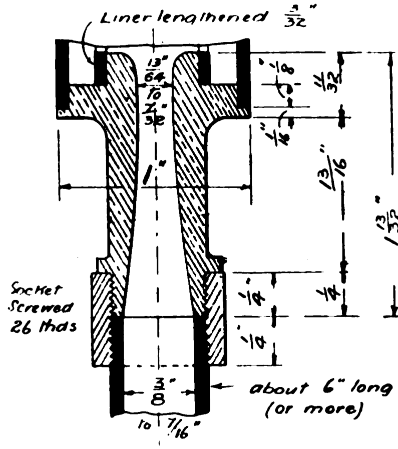


FIG. 7.—ALTERNATIVE DESIGN OF DELIVERY NOZZLE FOR HIGHER PRESSURES, AND WHERE DISCHARGE HAS TO FALL A CONSIDERABLE DISTANCE. (*Full size.*)

steam chest placed slightly out of the longitudinal centre so as to leave the maximum amount of room between the two chests for the valve spindle glands.

The system of coupling the H.-P. and L.-P. cylinders is not unknown in actual practice. I remember having seen, I think at one of the London gas works, a tandem horizontal engine arranged on this plan. I cannot quite remember the details, but believe the bedplate was extended beyond the H.-P. cylinder and supported guide bars of the ordinary type.

Another method of fitting the second cylinder is shown in Fig. 3. The H.-P. piston-rod here is simply an extension of the L.-P. rod, and a single gland is used to prevent steam passing from the H.-P. to the L.-P. cylinder. This is perhaps not a method which could be recommended for an engine which has much hard work to perform, but for ordinary model purposes, with good fitting and a large gland, no trouble should accrue from its adoption. The L.-P. piston is recessed in to make room for the stuffing-box and to reduce clearance losses the flange of the gland is made as large as possible, almost filling the bore of the cylinder.

The gland should be drilled with a couple of holes and then, by removing the H.-P. piston, it may be screwed up without disturbing the cylinders and valve chests. A third hole may also be drilled for a countersunk screw, which will engage one of several holes in the centre distance-piece between the two cylinders (*i.e.*, the stuffing-box portion) and lock the gland in position. Of course, the internal gland means extra clearance losses, but in the H.-P. cylinder of a compound condensing these are relatively unimportant.

We now come to the details of the ejector condenser. The design provides for the expenditure of about 1 gallon per minute with a 20-ft. head of water (nearly 9 lbs. per sq. in.). The energy in this water is theoretically about 7-100ths h.-p., therefore it will be seen that it would not be worth while to fit a pump to force the water, simply to obtain the extra power from use of the condensing gear. It

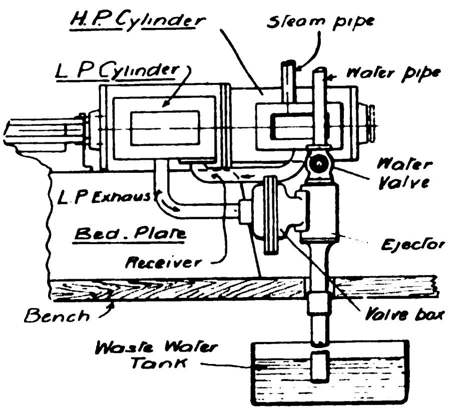


FIG. 8.—GENERAL ARRANGEMENT OF CONNECTIONS OF EJECTOR CONDENSER TO COMPOUND ENGINE. (*Not to scale.*)

would be like taking two half-pennies for a penny; but by employing the house supply, the engine has nothing to lose.

Where the head is greater than 20 ft., the diameter of the jet may be reduced slightly, the mixing nozzles being reduced in proportion. The lengths of the latter should remain the same, and the angle of the jet nozzle should be about 14 degs., as shown on the drawing.

The liner into which the nozzles are fixed is shown in elevation in Fig. 6. The nozzles are best made from rod brass, the inner profiles being finished with suitable reamers, which if only one condenser is to be made, may be turned out of silver steel to the required shape and filed exactly in halves to form cutting edge. There is no need to harden them for one job. The two lower nozzles are identical in shape and size, and if the reader does not mind the work, four of these may be used instead of two. The main idea of these nozzles and holes in the liner of the condenser is to present as much surface for contact of condensing water and steam.

Where the condenser does not discharge through a pipe which is under water, the delivery nozzle may be twice as long as shown on the drawing, the diameters at the neck and the outlet remaining the same, the latter perhaps being somewhat smaller, say ⅜ in. instead of 7-16ths in. The condenser may, of course, discharge through a copper pipe instead of the hose shown on the drawing. A union or socket being used to connect the two. The pipe must have an internal diameter not less than ⅜ in., as shown in the detail drawing, Fig. 7.

The discharge cone should be finished first, and the whole structure built up from this as a basis. Both the tubes should be turned dead square at the ends to ensure the alignment and the cones should be fitted into the inner liner. The jet, which also forms the top cap, may be fitted and secured with soft solder. The latter material should be used sparingly in fixing the cones to the inner tube, as, so long as the top and bottom joints of the outer case are air-tight, the perfectness of the inside joints is relatively unimportant, the function of the inner liner being simply to hold the cones concentric and at the required distance apart.

Between the ejector condenser and the L.-P. cylinder a valve is usually fitted. This may take the form of a flap valve, as shown in the drawing, or a commercial (not model) "straight line" check valve may be employed. The valve in the drawing herewith should be made of vulcanised rubber, and should be provided with a cage or stop plate to limit the opening and prevent it folding over. The valve casing may be made as indicated from castings, or be built up out of tube and plate. Care should be taken to prevent any air leakage at the various joints.

The ejector may be placed in any position, but, of course, the vertical position is the best, as the force of gravity is assisting the jet. If the engine is to be used intermittently, as in a workshop where it is to be employed to drive a lathe, the stop valve lever or rod may also be arranged to open the water supply, so that when steam is turned on the ejector is in advance of the first cylinderful of L.-P. steam that reaches it.

This completes the description of the apparatus, and although I know from practical experiments that the use of a jet condenser does increase the power of even a small model with a single high-pressure cylinder, I shall await the reports of any reader who may make this or a similar instrument, and fix the same to a compound engine, with considerable interest. It must, however, be borne in mind that the condensing gear is only suitable in cases where the boiler can be successfully worked by natural draught, and readers should not attempt fitting it to, say, a model undertype or other engine with a locomotive type boiler, which requires the exhaust to induce sufficient draught.

The use of the ejector condenser worked from the house supply to increase the power of a given plant may also be considered. Supposing we have a 1-in. by 2-in. stationary engine supplied for, say, a gas-fired boiler which requires no special arrangements for inducing a draught. The exhaust is simply going to waste, and I suggest that if an L.-P. cylinder, with a capacity ratio of at least 3 to 1 is fitted, and an ejector condenser as illustrated herewith rigged up to work in connection with it, the trouble of getting rid of the exhaust will be overcome, and at the same time the power of the engine will be nearly doubled. If the boiler easily supplies steam to the given engine at a pressure of above 40 lbs. per sq. in., the capacity ratio of the L.-P. and H.-P. cylinders may be increased to about 1 to 3½ or 1 to 4.

(*To be continued.*)

Showing that Two Currents can be Sent along one Wire Simultaneously.

By G. G. Blake.

THE following is a description of a simple way of demonstrating the principles of a system invented by Edison for telegraphing to and from trains while in motion by means of currents of high voltage, induced on the outer surfaces of existing telegraph lines which run parallel to the railway, without interfering with any messages already being transmitted along them.

Fig. 1 shows the general arrangement of the apparatus. I will first describe the low-voltage transmitter and receiver.

The transmitter A consists simply of a battery through a Morse key (J). One of the secondary terminals of this coil is earthed at S, while the other is connected to a piece of brass tube (T), through which the insulated wire M N passes.

The receiver D is an ordinary telephone, one terminal of which is earthed at W, while the other is connected to a piece of brass tube (U), which encases the insulated wire P L.

When the Morse key J is pressed, the brass tube T is charged with a current of very high voltage, which, by induction, creates a high-voltage current on the wire N M K L P, and this wire in its turn sets up a second induced current on the tube U, which passes to earth through the telephone D, causing its diaphragm to vibrate, and so giving an audible signal.

Now, after having made the necessary connections and tested both the high and the low-voltage currents separately to see that they both work

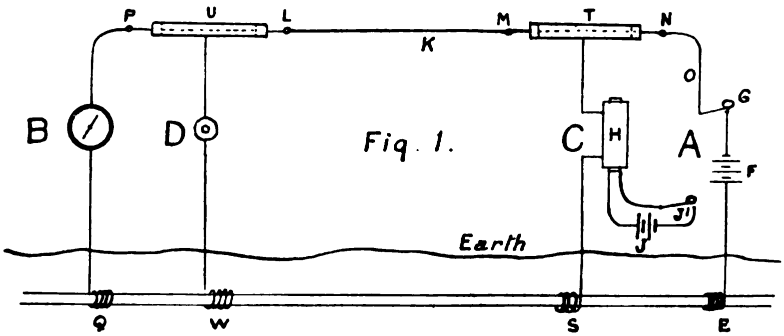


Fig. 1.

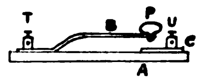


Fig. 3.

of one or two dry cells (F), one terminal of which is earthed at E by connecting it to a gas or water pipe. The other terminal is connected to a Morse key G, and then by wire O to N, where it is fastened to the end of a piece of 1/16 gauge well-insulated electric light cable; the end M of this cable is in turn connected to a length of bare 1/16 wire (K), along which the two currents are to travel. The other end of K is connected at L to another piece of well-insulated 1/16 cable.

A wire is fastened to this at P, which leads to the receiver B; this consists simply of a galvanometer, the other terminal of which is earthed at Q.

Every time the Morse key G is pressed a current of low voltage will travel along the wire K from the battery through the galvanometer, causing its needle to be deflected.

C represents the high-voltage transmitter, which consists of a battery or accumulator, which is connected to the primary of a small induction coil H properly, it will be found that if the two transmitters are worked simultaneously, both the currents will travel along the wire K without in any way affecting each other, and both of the receivers will be affected by their own transmitters only.

The explanation of this experiment probably is that low-voltage currents travel practically along the whole section of the wire, while the high-voltage currents travel only on its surface.

Fig. 2.

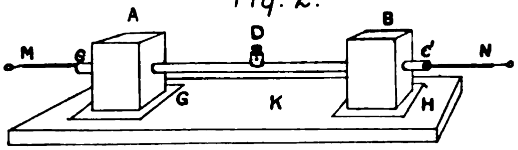


Fig. 4.

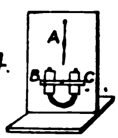


Fig. 5.

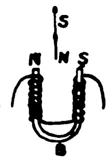


Fig. 2 shows how the brass tubes U and T are fitted up.

A and B are two small blocks of wood 3 ins. by 2 ins. by 2 ins., through the centre of each of which is bored a hole, through which the brass rod C C passes; this is ⅝ in. in diameter and about 20 ins. long. On the centre of this rod is soldered a terminal (D).

The insulated wire M N (which is of 1/16 gauge) passes through holes in two india-rubber corks which are fitted into each end of the tube.

The two wooden blocks A and B are glued to two small pieces of thin plate-glass 3 ins. square (G and H), which serve as insulators, and these two pieces of glass are in turn glued to a wooden base-board (K).

Fig. 3 shows the construction of a simple form of Morse key suitable for this experiment. A is a small block of wood, on which is fastened a short piece of steel clock-spring B connected to terminal T, and a small brass plate C connected to terminal U. P is a small wooden knob, which is fastened to the end of the clock-spring by a round-headed brass screw, the head of which, when the spring is pressed down, touches the brass plate C.

Fig. 4 shows a simple way of fitting up a suitable galvanometer for this experiment.

A is a magnetised sewing needle suspended by a single thread of silk, the North end of which hangs between the poles of an electro-magnet B (the magnet from an old electric bell would do nicely); C is a short piece of wood, through the centre of which passes a screw; this holds the magnet in position. Now, if a current be passed through the coils of the magnet (see Fig. 5) the South pole will attract the needle, while the North pole of the magnet will repel it, so that the needle will at once swing to one side or the other, according to which way the current is passing.

A ¾-inch Scale Model Railway.

By S. C. and C. S. L. Ford.

NOTICING just of late that a great many readers of The Model Engineer are getting greatly interested in model locomotives and railways, we thought we might still further interest them by the illustration and description of a railway we have just completed. In building the model about to be described, our chief object was to get everything as near to scale as possible.

Now we will deal first with the railway track itself. Before anything was commenced, a view or a "survey" of the garden was taken, and such points as gradients, curves, etc., noted down, and termini decided. After this drawings were prepared for the construction; but before the actual working was commenced costs were got out for the various materials required, and from this you see we had a good idea of the total cost of the whole thing, and we may say we were only about 1s. out when the whole concern was balanced up.

Now to the building and erecting of the railway. As regards the height from ground to level of rail, it was decided to have it 4 ft. We chose this height on account of things being easily accessible and easy to construct, no back-aching work being required, as we have had some experience of that before. The railway consists of single uprights of 2½ ins. by 2½ ins. square, placed 4 ft. 6 ins. apart, and on opposite sides of uprights, 2 ins. down from the top, small brackets are fixed, and on these rest the main beams, which consist of 2-in. by ¾-in. deal, these in turn carry the sleepers, rails and guard-rails, etc. All this can be further understood by reference to Fig. 1, which will give an idea of the arrangement.

At this stage we may say the line is absolutely level end to end, and is 110 ft. long (not including sidings, etc.). The way we maintained the level of the line was to make a straight-edge of the same dimensions as the main beams, 2 ins. by ¾ in. by 6 ft. long, planed dead true and square. The first upright being fixed at the requisite height and well rammed home, the second one was placed in position, and the straight-edge laid on the brackets on the side of the uprights (above-mentioned), and adjusted until the correct level was shown by spirit-level laid on the straight-edge. To prevent the posts from sinking any appreciable amount, good footings were placed on the bottoms, as shown in Fig. 1. This procedure was continued all round the line.

The sleepers are of yellow pine (7 ins. by 1 in. by ½ in.), and the guard-rails are of ½-in. by ⅛-in. flat iron, bent and twisted into shape, as seen in

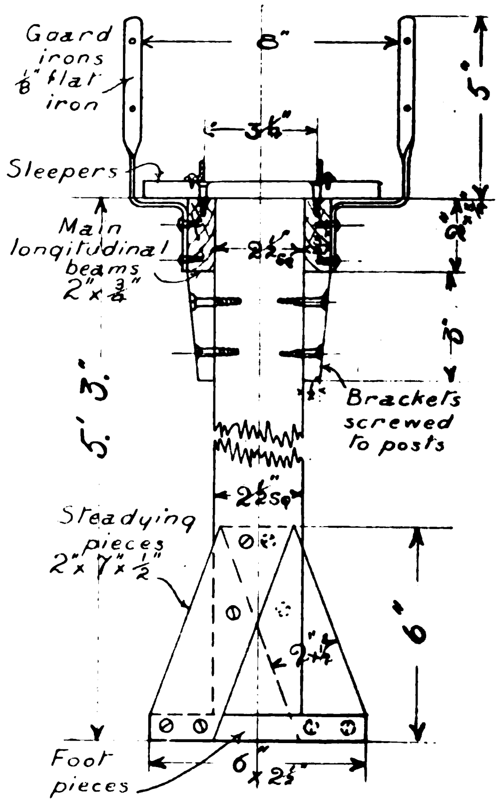
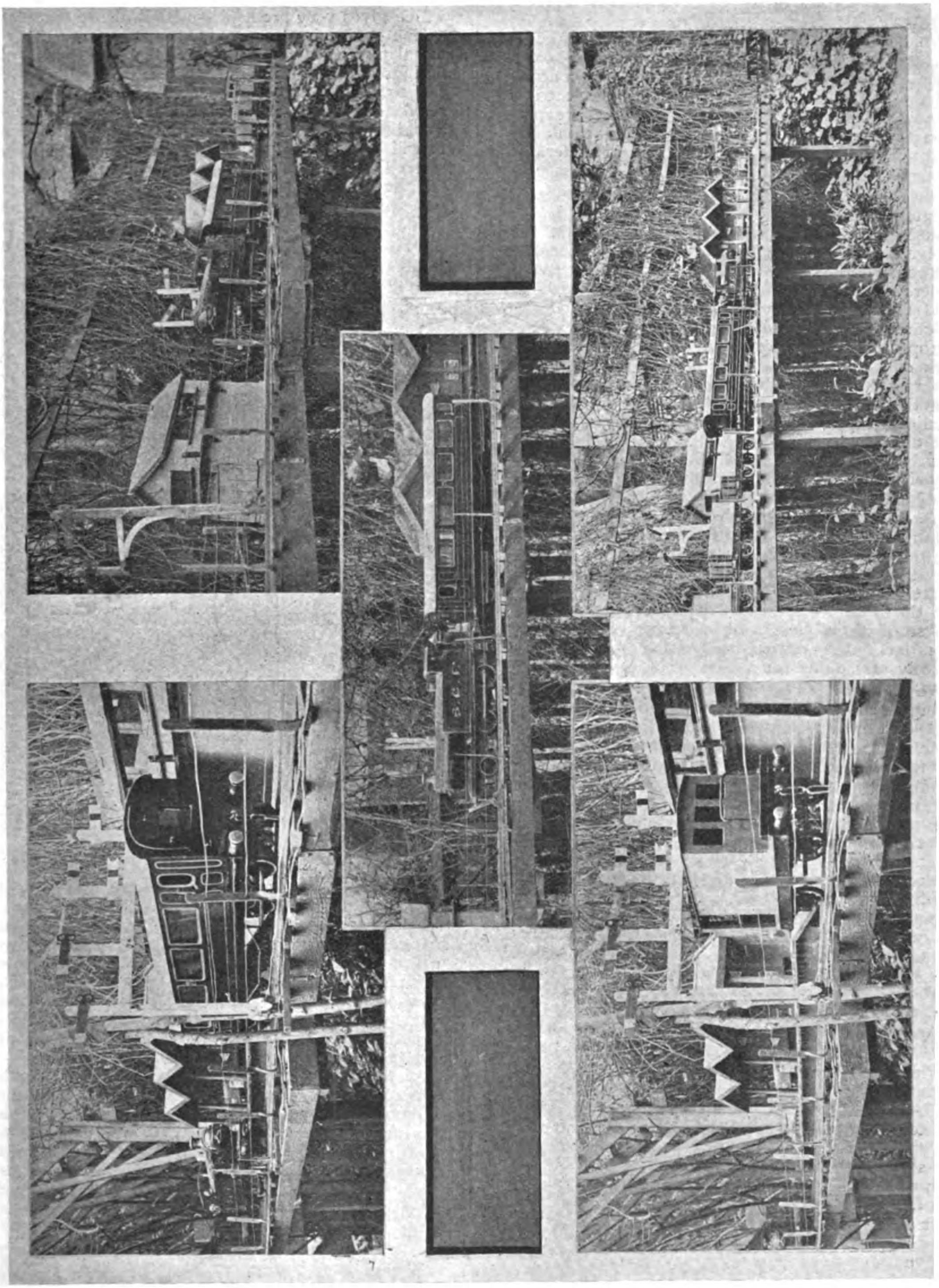


Fig. 1.

photographs. The rails are of ½-in. by ½-in. by 5-32nds-in. angle-iron, the correct section of rails and chairs being far in excess of what our pockets would allow, and we find it is excellent material for this work. As many readers may know, it is well adapted for making points and crossings.

At present we have three goods sidings—one at each end, and a spacious goods siding in the middle of the line branching off into a shady nook of the garden. All the points and crossings are manipulated by correct rods, links, and levers. There are two stations at present, and another is under con-



SEVERAL INTERESTING VIEWS ON MESSRS. S. C. & C. S. L. FORD'S MODEL RAILWAY.

struction. These two are placed one at each end of the line, and are studded with excellent little tin-plate advertisements.

We have a correct system of signalling, which is operated at present by levers in the two signal-boxes, which contain six levers each, and each box controls half the line. We contemplate having an electrical system of signalling very shortly, as we are preparing to have the line electrified, and think (as most railway enthusiasts know) this is far preferable to the ordinary method.

The next great obstacle met with was the bridging of a large gangway leading to the workshop. This is of 6-ft. 9-in. span, so we resolved to make a bowstring girder bridge. The construction of this bridge may interest many readers of this journal. Now it was decided to build this bridge entirely of iron throughout, and we chose ½-in. by ½-in. by 5-32nds-in. angle-iron for top and bottom chords and struts; and lattice-work of ½-in. by ⅛-in. flat iron. Before anything was commenced, scale drawings were prepared, and then the work was started. We found it a tedious job drilling holes, which finally numbered 880, and the rivets numbered 230. All holes were drilled full 5-32nds in., and 5-32nds-in. rivets used, and riveted cold. The flooring consists of angle-iron ½ in. by ½ in. by 5-32nds in., placed transversely 6 ins. apart and wooden sleepers screwed to these, and in turn the rails. To finish the description of the bridge a few leading items would be interesting to mention: Total length, 7 ft. 2 ins. and 16 ins. greatest height, and 11 ins. inside clear space, and the total weight is 60 lbs., and on a test it has stood three people of 9 stones standing on it, as near the centre as possible, and showed scarcely any deflection.

We will now direct our attention towards the rolling-stock, dealing first with the engine. This is of our own design and construction, and here again working drawings were prepared beforehand. The following are a few of the leading dimensions: Inner tube (or boiler proper), 2½ ins. diameter and 11 ins. long; outer tube, 3½ ins. diameter and 14 ins. long; one single cylinder, ⅝-in. bore and 1¼-in. stroke. Driving and trailing wheels, 2½ ins. diameter, fixed 4¼-in. centres. A pony truck is placed under centre-line of chimney, and the diameter of wheels are 2 1-16th ins. This truck, we find, gives great ease to the engine in negotiating curves, of which the sharpest is 5-ft. radius. The total wheelbase of engine is 10 ins.; total length over buffers (which are of the spring type), 21 ins. A water-tower, oil-tower, and a steaming shed are provided for the engine at one of the termini, these being a great addition to the railway and of great use.

With reference to the inner boiler, this is provided with five water tubes ¼ in. diameter and a ⊥ down-comer, the drum of which is of ⅞-in. tube, and to this a blow-off cock is fitted. We find that five tubes makes the boiler steam excellently. The steam is taken away by means of a perforated tube running along the top of the boiler and then into a 3-16ths-in. plug cock. The pipe then goes twice around the smokebox, then down the boiler into the firebox, and back again into the cylinder: that method gives us a very dry steam.

The slip eccentric system is employed for reversing, this being a very simple device of which most readers know. The firing is done by means of a Primus burner, using vaporised paraffin oil, which gives very great heat and is also economical.

The engine is also provided with a suitable gun-metal pump fitted with "wing" valves. The cab fittings consist of pressure gauge (reading 100 lbs. per sq. in), two blow-off cocks, check valve, and regulating gear; the total weight of engine in working order is 25 lbs., and the tractive effort 3·4. It will haul just on 70 lbs., and this cannot be considered a fair test, owing to the greater portion of the line (unfortunately) being on the curve, and this, of course, produces a great deal of friction, especially as check-rail is used on all the curves, and consequently absorbs a great deal of power.

There is not much to say concerning the trucks, carriage, and brake van, as these are all made to scale sizes as nearly as possible, as can be seen by the photograph. The under-frames and bodies are made of oak, and the corners are protected by the usual plates, as in the prototype, and strengthening angle-irons at the back, etc. One thing we might point out is the axle-boxes, which were made from a mould and cast as nearly as possible to scale, in Britannia metal. We then marked them off, slotted them to an easy fit for the axle-guards, drilled them for an insertion of a small brass bush, and, lastly, a hole drilled on top leading to the axle for the oil to be put in when needed. We have found this type of axle-box gives excellent results. All the stock constructed on this principle runs along with the greatest of ease—in fact, we can go so far as to say as good as ball bearings.

The brake van is modelled after the style of the Midland Railway, and is made after the same manner as the trucks. Lastly, we deal with the bogie saloon carriage, and this is to standard size. This and the engine, we may point out, were the most difficult pieces of work in the whole concern. The former is entirely of walnut; the sides and partitions were cut out from templates. The seats and backs are all upholstered, and mats laid on the floor, etc. There are four doors—two for entrance into the car and two for guard's or luggage van, and the glass in the windows is easily removable, if at any time it gets broken. The bogie frames and distance-pieces are of 1-16th-in. sheet metal, and the axle-boxes are of the same type as described above. The equalising is done by means of stretcher-bars mounted on springs in the usual way, and has excellent brass swivel arrangements, which are our own design. The total length of the carriage is 2 ft. 6 ins. long over buffers (which are of the spring type), and it is painted the standard Midland Railway colours and gold lining, which shows it off very well.

At the time of writing we are preparing for the construction of some more coaches and another locomotive (already in hand). We may say that this model railway has taken us just on fourteen months, and the spare time has been limited indeed. Thanks are due to THE MODEL ENGINEER for the great amount of information it has given us on more than one occasion.

THE next part of "The Steam Engine for Beginners" will be given in our issue of Dec. 24th.

Practical Letters from Our Readers.

[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.*]

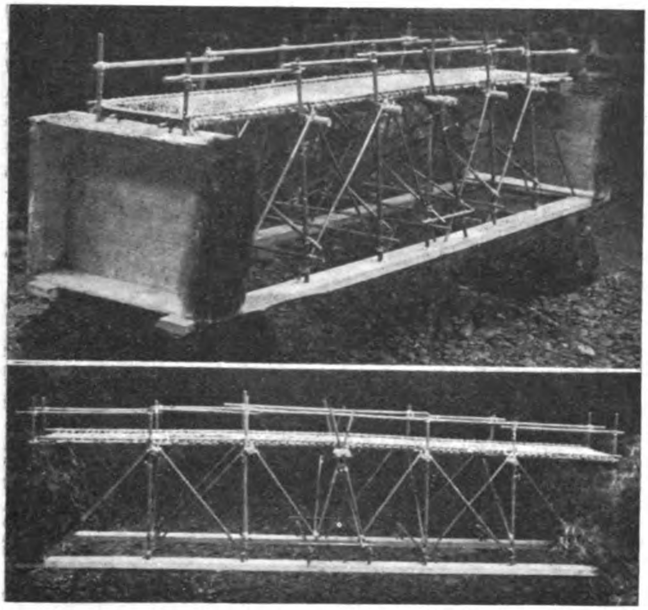
A Model Military Bridge.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I submit two photographs of a model of a military bridge, such as is used in the Service for crossing shallow streams or rivers where the bottom can be touched throughout.

It is built of bamboo (with strings for lashings) to a scale of 1 in. to 1 ft., the size of the model being 72 ins. between the banks and 14 ins. wide, the width of the roadway being 9 ins. This bridge took me three months to build and was awarded first prize in the model competition in a local R.E. Volunteer Corps.—Yours truly,

PERCY DOTTERILL.



TWO VIEWS OF A MODEL MILITARY BRIDGE.

Originality in Model Making.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have read with the greatest interest in THE MODEL ENGINEER the article on originality in model making, by Mr. Percival Marshall, and the letters concerning his article. I was rather astonished to see that in their letters nearly all the readers of THE MODEL ENGINEER seem to think that to find an original subject to copy, they must go back to the very oldest types of engines, locomotives, etc., or else take as prototype, machine tools, printing presses, etc.

Now I should like to point out, that however interesting it would be to make those models, they can never be of real practical use. It is, therefore, on account of this that I should like to draw the attention of the readers of THE MODEL ENGINEER to there being now-a-days lots of engines which have never been modelled, and which should not entail more work than those old and intricate machines. For instance, I feel sure that motor-car engines have very rarely been copied, and I think it would be original and interesting to build, for example, a six-cylinder Napier engine or one of the new Daimler engines (Knight patent, without mushroom valves), or, again, a two-stroke valveless engine, as used on the cars built by the Valveless Company, Ltd.

I hope some of the readers of THE MODEL ENGINEER will agree with me that engines like those I have mentioned should be of the greatest usefulness for driving their lathes or other tools, or of coupling up direct on to a dynamo. It is, of course, possible, once such a model is built, to go still further in originality and use it to propel a model airship or even a model aeroplane. Considering the lot of motor-car engine drawings which appear in all the principal motoring papers, it should still be easier to build these comparatively complicated pieces of mechanism than to make the models of the old engines of which I speak in this letter, as scale drawings of these engines are very difficult to procure. Hoping that this letter will find room in your valuable paper and that my suggestions will be useful to your readers, I remain, yours truly,

HENRI DE MALGLAIVEY.

St. Germain.

Originality in Model Making: Paddle Steamers.

To THE EDITOR OF *The Model Engineer.*

SIR,—*Re* the recent discussion on "Originality in Model Making," surely we have a most interesting field, considerably neglected at present, in paddle steamers.

I think it is somewhat regrettable that the making of high-speed models has taken such a hold, to the exclusion of the model correct in details. It is not always possible to race, and surely a model of reasonable speed, but a model representing as nearly as possible its prototype, is well worth making and having, and will prove a source of pleasure when afloat or laid up. At the same time, I fully recognise the fact that much ingenuity and skill have been expended in making successful speed boats, and that the designs of engines and boilers have advanced materially in consequence of this.

I think a series of articles on the design of a paddle steamer would be appreciated, and perhaps other readers will favour us with their views on this matter.—Yours faithfully, H. L. PHILLIPS.

Small Modern Electric Light Plants.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The articles contained in your issue of November 12th, on "Small Modern Electric Light Plants," by Mr. E. G. Kennard, I found very interesting, in common, I should imagine, with many of your readers, particularly as it deals with a plant of 100-watt capacity.

Since the advent of the metallic filament lamp the cost of installing the necessary plant for effectually lighting a small residence has been much reduced, and I have been considering the best means to adopt for the purpose. The chief difficulty is whether to adopt a 25-volt system, without a battery, or a 10-volt system, with a battery. The former would distribute the current more economically, but the high cost would prohibit accumulators being used. I was therefore very pleased to see the above-mentioned article explaining the working of a 10-volt system with battery.

There is one point, however, which I do not understand. It says: "It is necessary to reduce the number of cells which supply the lamps with current during the charging of the battery, otherwise the lamps would receive too high a voltage," etc.

(1) Is it not a fact, Sir, that the *dynamo* supplies the lamps, and not the battery? It seems impossible to me that a battery can be charging and discharging at one and the same time, and from Fig. 2 (if I interpret the diagram aright) the battery and lamps are in parallel with the dynamo; therefore, if the dynamo was giving its full charging voltage of, say 13 volts—no matter how many cells might be cut-out—the lamps would still receive the 13 volts.

(2) Then, again, Mr. Kennard says it is essential that the proper rate of charge for the battery should be maintained. I cannot see what provision is made for doing this, and the only method that occurs to me is to alter the speed of engine as desired, which one cannot consider a good arrangement.

(3) Another point is with reference to the lighting of the lamps from battery. During the second half of the discharge the voltage will probably not amount to 10, and when to this is added the drop on the wiring, the voltage at the lamps (at any rate, those at the farthest point) would only be 9, thereby causing disappointment in the reduced candle-power of the lamps.

I should be glad if you could supply me with replies to these queries, either yourself or through Mr. Kennard, as I should think the matter is of sufficient interest to a number of the readers to warrant same.—Yours faithfully,

"INTERESTED."

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In reply to your correspondent:

(1) In Fig. 1 the battery of five cells in series, together with the two lamps, are connected in parallel across the dynamo terminals. There will be, therefore, the same fall of potential across the lamps as across the battery, viz., about 13 volts. But if, as in Fig. 2, the connections be altered so as to put the combination of four cells in series in parallel with the lamps, the remaining cell will then be in series with this combination. All the current supplied from the dynamo will flow through cell No. 1 before reaching the four remaining cells or the lamps. As each cell requires a pressure of about 2½ volts to overcome its internal resistance and back E.M.F. on charge, therefore the four cells in series and the lamps will receive about 10¼ volts.

(2) It is not possible to maintain the charging current at an absolutely constant value when lighting is being carried out at the same time, but large changes in the charging current should be avoided by speed control of the engine or by shunt control of the dynamo.

(3) The voltage drop at the approaching end of

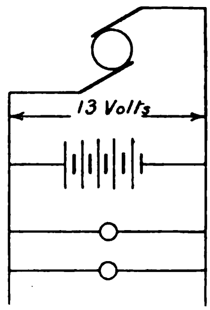


FIG. 1.

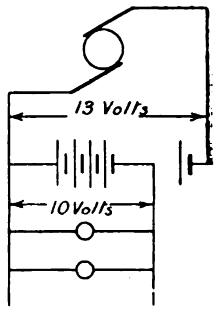


FIG. 2.

the battery discharge will not be of sufficient magnitude to cause inconvenience. Metallic filament lamps are far less susceptible to decrease in voltage than carbon filament lamps, and a 10-volt lamp burning on 9 volts will still continue to give a fairly good light.—Yours faithfully,

E. G. KENNARD.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have read with great interest the article by Mr. E. G. Kennard, viz., "Small Modern Electric Lighting Plants."

You would be doing me a great favour by asking Mr. Kennard if the ¼ h.-p. gas engine he recommends could be driven by producer gas? Also whether a model gas producer could be made small enough to drive the engine?—Yours faithfully,

H. L. MANSELL.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In reply to Mr. Mansell I may say I do not recommend a suction gas plant for the ¼ b.h.-p. set, as reliability is an essential feature of a generating plant for charging accumulators, where it is desirable to leave the engine running without attention for several hours. If the engine cannot be run on the gas mains, it would be preferable to employ an oil engine. The dynamo should be of high efficiency, viz., between 50-60 per cent. at full load, and when ordering, it would be well to get the makers' figure for this. If, however, your correspondent intends building his own dynamo, I should be pleased to examine the design and give an approximate idea of the performance of the machine, as regards efficiency, heating, etc.—I am, yours very faithfully, E. G. KENNARD.

Slipping Driving Wheels.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—With regard to the correspondence in your paper concerning the apparent slipping of coupled wheels of locomotives when running fast with the regulator closed, I have recently had two experiences which explain the apparent mystery.

One case was in France and one was in this country; both engines were of the 4—4—0 simple type.

Both cases were similar, namely, that when running on a down-grade through a tunnel at a high speed the coupled wheels appeared to slip. The locomotives were carefully examined, one of them in the shops, and it was found that the quartering of the coupling-rod pins were not the same on the driving and coupled wheels. The crankshaft in one case had become slightly twisted, and one of the coupling pins was bent in the other case.

The result was that, when running without steam, the coupling-rods set up a series of vibrations which became so acute at a high speed that, in the darkness or in a tunnel, the effect was similar to the vibration set up by the slipping of coupled wheels when in steam.—Believe me to remain, yours faithfully,
JAMES C. CREBBIN.

P.S.—To those who are interested in this locomotive it may be satisfactory for them to learn that the "Great Bear" is now in regular service between Paddington and Bristol.—J. C.

Small Driving Belts.

DEAR SIR,—In the issue of November 19th, I read with much interest a letter on "Small Belts for Driving." In it Mr. Fraser, after describing various forms of belts, continues: "For light work . . . the writer has found nothing better than Venetian blind cord."

For some time I have used such a belt, but I found great trouble arising from its absorption of moisture. This, of course, caused it to tighten, but when the room was warmed up, the belt dried, and so slackened very much. My belt was driving a V-shaped pulley, and I found that it gripped much better when an ordinary elastic band was stretched round the pulley inside the groove. I noticed the slipping of the belt all the more as it was driving a small dynamo. The slip would not matter so much for a grindstone or drill, but, still —there it is!—Yours faithfully,
WILLIAM M. GRAHAM.

Rose Turning.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I have examined the patterns produced with Mr. Fell's rose-turning apparatus, as reproduced in THE MODEL ENGINEER for Nov. 19th, 1908, and think a description of the apparatus would be of great interest, both to ornamental turners and harmonograph students—should Mr. Fell care to give it.—Yours sincerely,
CYRIL H. H. FRANKLIN.

The Design of Model Power Boats.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—It is with timidity that I launch forth on to this vexed question, but I feel I must do so even at the cost of putting the "fat in the fire." The reason of my doing this is: I am of the opinion that there is too much time and study spent on the theoretical part of the design of a power boat at the expense of "Nature." During the last two years I don't think there has appeared in THE MODEL ENGINEER one design of a power racing boat that has shown the mark of the "master hand," the reason of which it is hard to tell; seeing we have expert mechanical draughtsmen who contribute to the mechanical portion of THE MODEL ENGINEER, so surely there are some expert naval architects.

As a yacht and launch draughtsman, I have had from time to time the opportunity of seeing some of our best power boats both afloat, on the stocks, and on paper, and I shall not forget seeing the whole of the high-powered boats which represented us at Monaco against America (bar *Wolseley Sideley*), this through the courtesy of Mr. Saunders, jun., who kindly took me through the famous Saunders yards. Although nearly all these boats were extreme in type, and one would have to stretch a point to call them beautiful, one was at once struck with the beauty, and natural fairness of their lines. This is what I refer to when I say "Nature." If we are going to have fast boats, they must be easily driven, and to make them that their lines must be "fair" and "sweet," due consideration being given to the type of boat, curving, displacement, etc. The double wedge boat has been in favour for some time, but it is about to fade away; its lines are harsh, and the type hard to drive. This has been proved by *Dixie I* and *II*, *Gyrinus*, etc. I am of the opinion that the model power boat to do the fastest time will be a round bodied boat with a fairly deep forefront, but not so deep as the practice of the last year or so; the water-lines terminating in point similar to the deck plan of a canoe, and the after sections having more rise on the floor than is usual. The hull and machinery to be of the light type. In other words, it will be a contest between brute force and a light, round, easily-driven hull. I prophesy the latter.

While making these remarks, I am fully alive to the difficulties arising from such a form—such as stability, engine space, etc., but think the petrol motor, and a little thought and contriving on the part of our mechanical readers will do the trick.

If the Editor will permit, I shall be glad to submit a design for, say, a metre boat, and hope my fellow readers will let me down gently.
C. F. BRIERLEY.

HOBBIES' EXHIBITION.—A very successful Exhibition was held at the Memorial Hall, London, E.C., on December 1st, 2nd, and 3rd, of work done by readers of *Hobbies*. The exhibits included many hundreds of examples of the fretworkers' art, cut in wood, gun-metal, brass, aluminium, ivorine, ebony, etc.; woodcarving, both in relief and chip; pokerwork; stencilling on linen, silk, velvet, etc.; articles in repoussé metal, working models, and mechanical toys; modelling in Plasticine, etc., the whole of the work being done in their leisure-hours by amateurs of both sexes. In addition, there was on show a fine collection of British-made tools used for such work. A particularly useful machine was a treadle circular saw suited for sawing all kinds of wood up to about ¾ in. in thickness. This was fitted with an adjustable angle-gauge, so that wood could be sawn at any angle and geometrical patterns for inlay work very easily cut. Several varieties of treadle fretsaw machines and woodturning lathes were also shown at work. Other attractions were provided, in the way of demonstrations of arts and crafts, men and women working in wood and metal; daylight and gaslight photography, and on the concluding evening prize medals and certificates were presented by Alderman Jermyn, J.P. and C.C., Chairman of *Hobbies*, Ltd. Mr. Charles Hastings, the Exhibition Secretary, deserves great credit for the excellent management of this highly interesting event.

Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this Journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

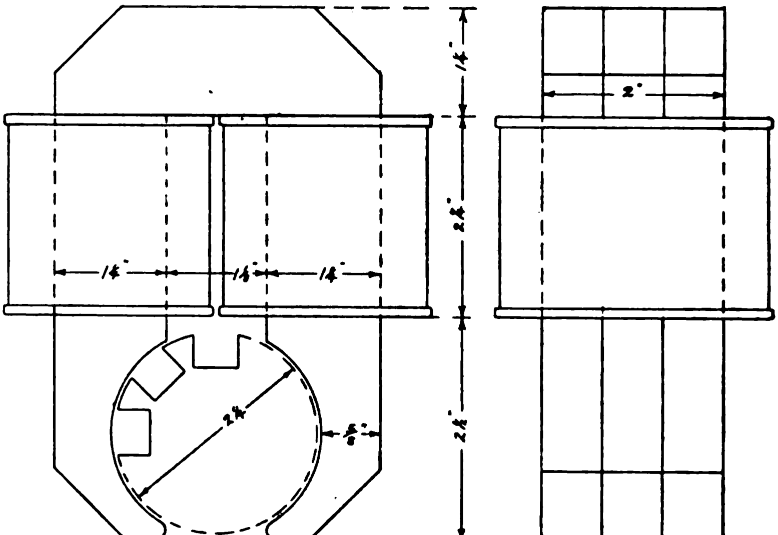
[20,619] **"A B C of Dynamo Design."** G. A. E. (Manchester) writes: I have got a copy of "The A B C of Dynamo Design," third edition, and would be glad if you would enlighten me on the following points. I have all the numbers of THE MODEL ENGINEER from Vol. V, and find them invaluable as works of reference. (1) First and foremost, Mr. Avery states, on page 63, that by adopting the Avery-Lahmeyer type of field-magnet a saving of 80 per cent. of copper is effected. Is not this a wrong statement, as, by comparing the amount of wire given in the design for a 500-watt machine, namely, 1,200 yds., or 15 lbs., with the field-magnet windings given in your No. 10 Handbook, the Avery-Lahmeyer dynamo comes out worst, for in none of the designs given in that book does the amount exceed 15 lbs. In Figs. 8, 9, 10, it is 12½ lbs.; in Fig. 11 it is 10 lbs. Where is the 80 per cent. saving? It seems more like 20 per cent. more. (2) Which is the right number of turns on field-magnet core—1,200, as given in chapter, or 1,050, as given on drawing at beginning of book (500-watt design)? (3) Is winding system given in Fig. 40 adaptable to any number of slots? (4) Is there any particular reason why tinned copper wire is specified for binding armature? Would not brass or iron wire be stronger? (5) Mr. Avery says that it is no use insulating core discs from one another and then mounting them on a bare steel shaft. Is this so? (6) Is not the winding diagram shown in Fig. 40 rather confusing, as it shows each section with one half at the top of the slot and the other half at the bottom? This is impossible, as the first section to be wound must have both halves at the bottom of slots. I must apologise for the number of queries, which I trust you will be able to clear up satisfactorily?

Mr. Avery has kindly replied as follows: "(1) The statement that the ironclad carcase effects a saving of some 80 per cent. of copper for exciting purposes is quite justified. It is quite true that machines of other types can be built to work with the same amount of copper on the field-magnets, but to make a fair comparison the speed of the dynamo and its electrical efficiency must be placed on a level basis. The reason that the ironclad type requires so little wire lies in its compact magnetic circuit, and low-leakage co-efficient or waste field, which, in a Manchester type machine, amounts to nearly 50 per cent. of the total flux generated, while in the ironclad it is but 12 per cent. (2) The exact number of turns on the fields is of no great consequence. A good winder will get on 1,200 turns per bobbin in the space provided and the machine will be a trifle more efficient than if only 1,050 turns were put on. (3) Fig. 40 is applicable to any armature having an even number of slots. (4) Tinned copper binding wire is easier to handle and to solder than brass or iron would be. If preferred, tinned steel wire can be obtained, but is troublesome to put on, as it is very springy. (5) Yes, the reasons are clearly stated in the same chapter. (6) The diagram of winding in Fig. 40 is drawn symmetrical, or would be confusing to the eye and the connections difficult to follow. This is exactly how a "former"-wound armature would have its coils spaced; if hand-wound, the first section would have to be wound close to the core on both sides, and the last section away from the core on both sides. (See Chap. IX). This is clearly explained in the last chapter of the third edition."

[20,243] **G.C.R. "Atlantic"; Motive Power for Boat.** A. B. (Ashton-under-Lyne) writes: Have you a working drawing of a Great Central "Atlantic" type locomotive? If you have none where could I obtain one? (2) Which engine would be suitable to drive a 12-ft. boat, petrol or steam, about 2 h.-p.? What speed could I obtain out of her with propeller 10 ins. diameter, 6-in. pitch?

(1) You will find drawings of the G.C.R. "Atlantic" locomotives in *The Railway Engineer* for December, 1903, price 1s. 2d. post free from the office of this journal. (2) Unless you are much better acquainted with steam than petrol as motive power, we should advise the latter. You will find it rather cheaper in initial cost, and it will need less attention than steam. We cannot estimate speed from the particulars you give.

[18,918] **Undertype Dynamo.** S. R. W. (Tamworth) writes: Enclosed please find sketch of 60-watt dynamo, 15 volts 4 amps., I propose making. Will you kindly criticise the proportions, which I have calculated from "A B C of Dynamo Design." The armature is 8-slot drum, 2¼ ins. diameter by 2 ins. long, wound with 54 yds. No. 22 D.C.C., 60 conductors in each slot, making total of 480 conductors. Setting aside 3·25 amps. for field-magnets I calculate 275 turns (68 yds.), 45 turns, six layers of No. 21 D.C.C. on each limb. Total wire on field-magnets, 135 yds. Field-magnets are of wrought iron in three layers bent to shape, riveted together, and well annealed. Speed, 2,750 r.p.m.



Query No. 18918

The windings stated for your machine appear to be quite correct, and should give the output you require. A slight variation of the speed one way or the other will finally adjust matters so that you will get the exact voltage required.

[20,426] **Gas Engine Trouble.** R. B. C. (South Hylton) writes: I would be very much obliged if you will advise me about a vertical gas engine of the following size:—Cylinder, 3 ins. diam., 4½-in. stroke. The cylinder is recessed at the top 3¼ ins. diameter, and it has 1½-in. clearance between cover and the piston. The gas and air valves work automatically, the gas being ¼ in. diameter and the air 9-16ths in. The exhaust valve is ⅝ in. diameter. The ignition tube is ¼ in. inside diameter and 8 ins. long. Should this engine run from an ordinary house gas jet? It seems to have a fairly good compression, but I cannot get it to work, although when the exhaust opens it seems as if the gas had exploded, but I get no work from it. I have a heavy flywheel, about 3½ stone, 18 ins. diameter. The cylinder cover is ½ in. thick. Will you kindly give me any particulars which you think will enable me to get the engine to work?

In reply to your enquiry *re* gas engine, it will not run well from the ordinary house supply unless the nipple or burner is removed from the gas fitting before you connect up the engine. A ½-in. supply pipe should be ample, but we advise you to fit a gas-bag with an anti-fluctuator otherwise the pressure in the adjacent pipes would fluctuate considerably when the engine takes gas for every explosion stroke. You do not say whether engine is second-hand or new, nor give any particulars as to how it is connected up: therefore we are quite unable to locate the trouble definitely. A very likely source of trouble is the exhaust connections. When trying engine you should disconnect the exhaust pipe at the engine. You will then hear distinctly whether you are getting any explosion at all or not. If engine runs with exhaust pipe disconnected, but refuses when exhaust is connected up, it shows conclusively that there is a stoppage somewhere in exhaust pipes. For further information *re* adjustments, etc., we recommend you to read our handbook, "Gas and Oil Engines," 7d. post free. At the same time, if you have further trouble we should be pleased to hear from you again, only you should give as full particulars of what you have done to remedy matters as possible.

[19,808] **Permanent Magnet Motors for Locomotives.** B. W. L. (Portsmouth) writes: I have four magneto magnets (same size) each of which will lift 3-4 lbs. dead weight. I wish to use them for a motor to drive a tank engine. They are 3¾ ins. long (over-all) by 2 7-16th ins.; section ⅜-in. bare by ⅜-in. Should I be using them to the best advantage with regard to the space at my disposal if I placed them as Fig. 1? I intended to put them in a ⅜-in. scale S.B. & C.R. tank engine, one pair of magnets

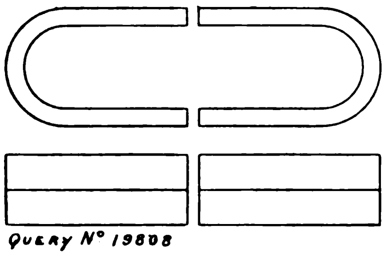


FIG. 1.

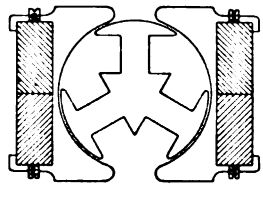


FIG 2.

would extend right through cab and into coal bunker. The armature I propose placing in the same plane as the magnets. What length ought armature to be? Can I use a 1¼-in. diameter armature, as this will only leave 1-16th in. for the thinnest part of iron pole-piece, allowing for 1-32nd-in. clearance between armature and pole-piece? What length ought pole-pieces to be? Pole-pieces to be made a good fit over magnets with setscrews (as Fig. 2) thus making the whole thing rigid. What wire should I use for 8-volt, and what quantity? Will this arrangement make a reasonably powerful motor for locomotive driving?

You could use the permanent magnets in the manner you suggest, which would give you consequent poles. We think it would be preferable, however, to place all the magnets available side by side, and place the armature across the pole-pieces after the style of an ordinary over- or undertype machine. The length of the armature should be equal to the total width of the magnets, and we should recommend you to fit wrought-iron pole-pieces to the magnets, as reducing the latter to a sixteenth of an inch would be detrimental to the results expected. Of course, we do not include the space which must be allowed for the end windings of the armature when we give its length as equal to the total width of magnets.

[20,522] **Windings for 260-watt Dynamo.** H. A. (Shotley) writes: I am making a small dynamo and want to get 10 amps. with 26 volts. I propose winding the armature with 40 yds. of No. 16 S.W.G. The armature is 6 ins. long, 2¾ ins. diameter (drum). Is the wire for armature correct? Will you tell me what wire I should want in size and weight for field-magnets for series, shunt and compound wound, as I cannot work them out although I have your book? Must I join the field-magnet together at top or bottom with iron?

Wind armature with No. 19 gauge D.C.C. copper wire. If you have sixteen coils (with a 16-section commutator) wound as Fig. 46 of our handbook, "Small Dynamos and Motors," you should be able to wind 12 turns of wire for each coil. As your core has no cogs, you should fit driving pieces of hard vulcanised fibre (as shown in Fig. 40, page 41 of our book No. 5 on "Practical Dynamo and Motor Construction") to keep the coils in place and prevent their slipping on the core when the machine is at work; probably about 1½ lbs. of wire will be required. Wind the armature before you fit up the field-magnet so that you can place the pole-pieces just far enough apart to reduce clearance to a minimum. The cores must be joined by a slab of wrought iron or cast iron at the top, at least 4 ins. wide by 1 in. thick. You can make it as much larger in section as you like. As regards bedplate (see our book No. 5, pages 11 and 12), but on no account should you join the poles together by iron or steel. Shunt winding for field-magnet; about 5 lbs. No. 20 S.C.C. copper wire on each core. Series winding to work as a series machine. Use No. 12 gauge D.C.C. copper wire same weight. For compound series winding you can try a single layer of No. 12 gauge D.C.C. on top of each shunt coil; but to determine a compound winding, see THE MODEL ENGINEER, August 31st, 1905, page 201. We do not advise you to wind dynamo as a series machine unless you have some special reason. Use a shunt winding to start with and add a compound series winding afterwards. Speed will probably be about 3,000 r.p.m., but you must adjust this until you obtain the desired voltage. You will do well to round off the sharp corners of the cores, to prevent any likelihood of their cutting the insulation. Our book, "Practical Dynamo and Motor Construction," price 1s. 3d. post free, would help you over many constructional difficulties.

[19,930] **Gas Engine Electric Ignition.** J. C. S. D. (Rugby) writes: I have a small gas engine (1¼-in. by 3-in. stroke), fitted with tube ignition. I rather wish to fit electric ignition, or, if possible, have both kinds. (1) Do you think that the idea in Fig. 1 would act, or would exhaust gases remain in the pocket? (2) Is it possible to obtain a small spark plug to fit into ordinary ignition tube hole? (3) Would an ordinary 3-16ths-in. spark coil be sufficient for ignition purposes? (4) Would a spring rubbing on the same cam as exhaust valve is opened by be suitable as a wipe contact? (5) Would a piece of clock spring be suitable for the spring? (See Fig. 2.)

(1) We are afraid there would be trouble with misfiring, owing to the burnt gases hanging about in the pocket. (2) Most spark plugs are slightly larger than this, but you could consult some maker's catalogue or write to some of our advertisers asking for size of the smallest spark plug they make. (3) We should recommend a coil capable of giving at least ½-in. spark in air. When a

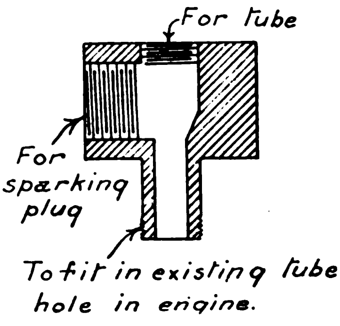


FIG. 1.

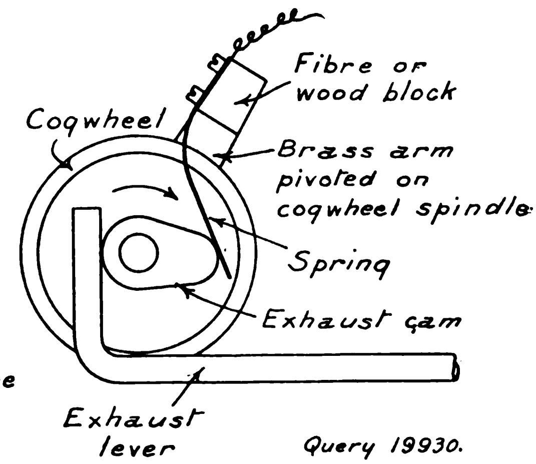


FIG. 2.

spark occurs under pressure of the atmosphere or gases, its length is greatly reduced. (4) Contact could be made in this way, but we should advise a separate contact cam of brass or copper also, because lubricating oil might affect the conductivity of the circuit if you used the exhaust cam for making contact. We recommend the method adopted and shown in our article in March 29th, 1906, issue. (5) Yes.

[20,504] **Bichromatised Glue.** D. S. C. (Glasgow) writes: Can you kindly tell me how to prepare bichromatised glue; also

if it is suitable for fixing in the stern tube of a model boat, and the best way to apply it? Also best way to store it?

The following recipe is said to give good results, and should meet your needs:—"Soak 6 parts of glue in water, and, when soft, pour off the excess; the softened material is melted by heat, and 1 part of bichromate of potash, dissolved in the least quantity of water, is added. This cement should be kept in the dark till required, then melted down by heat and applied. On exposing the cemented parts to light the material becomes insoluble." We think this glue would serve well for the purpose you mention.

[20,260] **Frames for L.S.W.R. 4—4—0 Type Locomotive. No. 415.** S. H. (Wimbledon) writes: I am building a ¾-in. scale L.S.W.R. four-coupled express, inside cylinders (415 class). I have the "Model Locomotive" book, but on reference to it for dimensions of frames, boiler, etc., I cannot find anything. I should be obliged if you could give me a sketch of the frames as shown on page 69 of the "Model Locomotive," only to ¾-in. scale.

We append a drawing dimensioned for ¾-in. scale model of engine No. 415, L.S.W.R. The frames are more or less exactly to scale, and you must make them to suit your own requirements in details.

With regard to the widths, these are also to scale, and if 3½-in gauge is adopted, will have to be modified to suit the gauge. You may use THE MODEL ENGINEER locomotive cylinders, and you can obtain castings which will turn up to 4 3-16ths ins. to 4¼ ins. diameter for driving and coupled wheels. The frames are set in between cylinders and leading bogie wheel, the line of the bend being indicated on the drawing. As to the boiler, work according to THE MODEL ENGINEER steam locomotive as far as possible. For outline of engine and tender please refer to the reply to Query 18,795 of Sept. 3rd last.

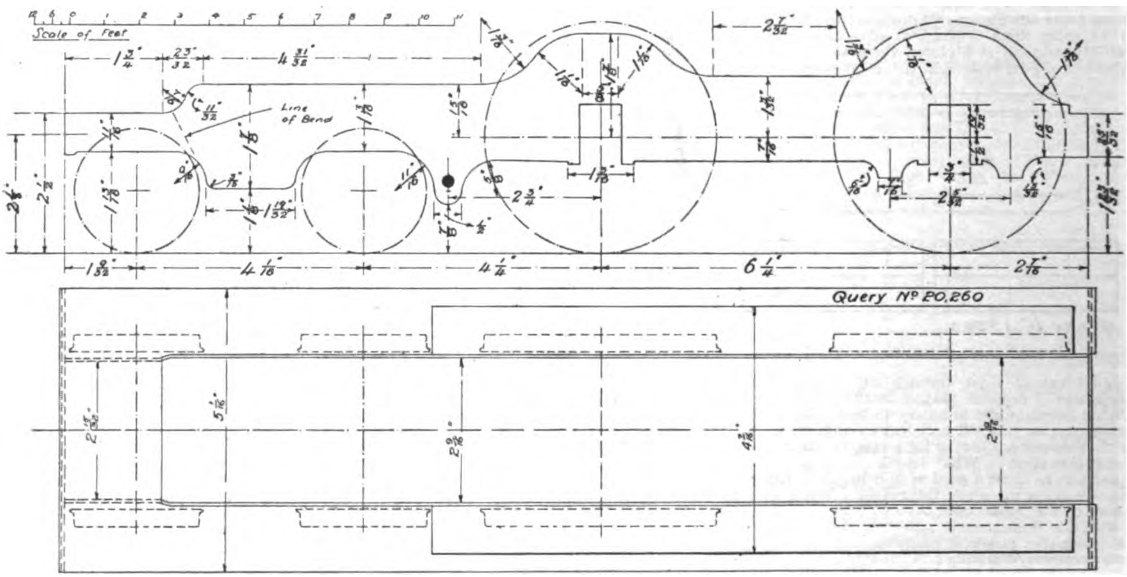
[20,701] **Electro-Therapeutics.** T. W. M. (Ennis) writes: Some time ago I attended an electrical specialist who, in treating me, made use of a current which had nothing in the nature of a shock, but gave a sensation somewhat like a gentle exhilarating thrill that I considered most satisfactory. Since then I have purchased both an electro-magnetic machine and a medical coil, which I have used with an ordinary dry battery. Both of these give a current distinctly different from the one used by the specialist. Am I correct in assuming that the current made use of by the latter was "galvanic" or "constant," whereas my batteries give a "Faradic" or "intermittent" one? And if this be so, would you tell me what battery, when connected up with my coil, would give a galvanic current?

The terms "galvanic" and "Faradic" properly refer merely to the methods of obtaining a flow of electricity. Galvani and Volta were the first scientists to discover and produce current electricity, and as for a long time after their day chemical action was the only means used for the production of electric currents, the words "galvanic" and "voltaic" are sometimes used to denote currents chemically generated. To Faraday is due the credit of discovering the laws of magnetic induction, and the word "faradic" is sometimes used to distinguish currents generated by induction. So that "galvanic" and "faradic" currents are not necessarily at all different in quality, but only in the method of their production. We think you are probably correct in the suggestion that the current used by the specialist was a constant one, and the others being interrupted currents gave more sensation of shock. A few small cells of very small current, but of about 40 volts pressure, are sufficient for producing the gentle thrill of which you speak, but we cannot advise you to experiment in this direction, as it often happens that more harm than good is done by those who use electricity for medical purposes without being qualified by technical knowledge and experience to do so.

[20,663] **Alternating Current Transforming.** J. H. (Rochdale) writes: I have a small electric alternating motor, 100 volts 60 periods, and my supply is 200 volts 83 periods. What would you advise me to do to get the best and most economical way to reduce the current to the desired voltage? The motor is 1-25th h.-p.

The most economical way would be to rewind the motor. As your supply is of higher periodicity than that for which the motor was designed, you will not require to have double the number of turns. Probably if you select a wire of such a gauge that you get about 1¼ times as many turns as now on, you will find the result satisfactory. You do not say what type of motor it is; probably the speed will be higher in proportion to the higher periodicity. Notice the way the motor is wound and rewind in precisely the same way. As an alternative to rewinding the motor you could make a small transformer to reduce the voltage to, say, 125, the extra 25 volts being to make up for the effect of the increased periodicity. Make the iron core of ring stampings, 4½ in. outside diameter by 2¾ ins. inside diameter, built up to a depth of 1 in. Wind the primary with 1,200 turns of No. 26 gauge D.C.C. copper wire, and secondary winding 750 turns of No. 22 gauge D.C.C. copper wire. Wind exactly as for a Gramme ring armature —primary on first and secondary on top of primary. We advise you to make the transformer rather than rewind the motor; it will probably be less trouble in the end and you can accommodate matters by winding on more or taking off some of the secondary until you get the motor to run well. The ring must be well insulated, also primary from secondary. Direction of winding does not matter. Connect primary winding to mains and secondary to motor.

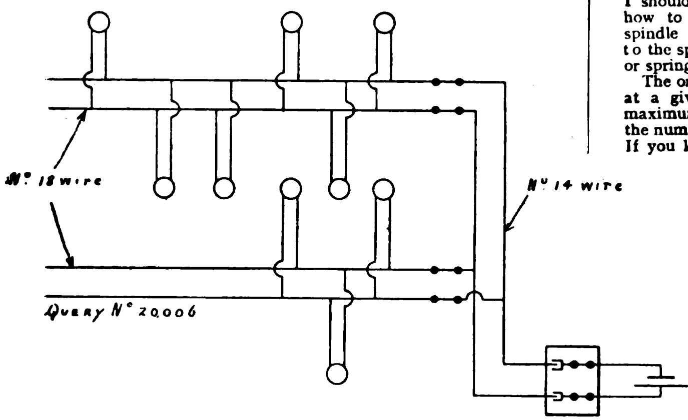
[20,006] **Model House Electric Lighting.** F. J. P. (Birmingham) writes: Being a continual reader of your valuable paper, I should be pleased if you would kindly answer me the following questions respecting the lighting up of a small model of a residence. I have got the model very forward, but should like to fix in the wires before putting the roof on, etc. I have enclosed a plan (not reproduced) of above, and you will see there are eight rooms and two halls on ground floor; there are also the same number of rooms over these on second floor. I wish to fix a light in each room, that would be twenty lights in all. Can I do this from a battery, and how many switches should I have to fix?



FRAMES FOR L.S.W.R. 4—4—0 TYPE LOCOMOTIVE, NO. 415.

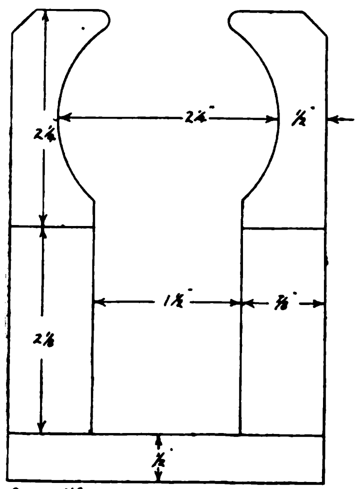
The lamps would be about ¼ in. to 5-16ths in. diameter. Should I have to fix an accumulator; and, if so, would it require two sets of wires? I should only want the light to last about 20 mins. I should like also to know the best book on the subject.

See our handbook, "Electric Lighting for Amateurs," 7d. post free. Probably this book will give you all the information you



require. Yes, you will need two wires from the battery, one from positive and one from negative terminal. Lead these two wires straight through the house, not taking them to the lamps—you should lead the current from these main wires by branch wires into each room. The following diagram will show what we mean. If the lamps absorb about 4 watts each and you have an 8-volt accumulator, then each lamp will take ½ amp., so the accumulator must supply in all 10 amps. We advise an accumulator of about 40 amp.-hours capacity at 8 volts. If you want to use all the lamps at once one switch will be enough, but if you want to vary the number of lamps in use, you will want an extra switch for each variation. Between the accumulator and the lamp you should have a small distribution board with main switch and fuses. The main fuses should be capable of passing a maximum current of 20 amps. The branch fuses should fuse with a current of 10 amps.

[18,898] **100-watt Dynamo.** W. F. B. (Bedford) writes: I should be very much obliged if you would give me a little advice concerning a set of dynamo castings (sketch enclosed). What I want to know is—the size wire for a four-slot drum armature,



and also field-magnets, and, if possible, I should like the dynamo to give 20 volts 5 amps. What power would it give as a motor, and how many 4-volt ½-amp. lamps would it light? Width of pole-piece, 3½ ins.

Wind armature with 8½ ozs. No. 20 S.W.G., and field-magnets with 3½ lbs. No. 21 S.W.G. As a motor supply, with plenty of current, it should give an output of about ⅛ h.-p., that is, approximately equivalent with 100-watt output. It should light about fifty 4-volt ½-amp. lamps successfully. They would have to be connected in sets of five in series, ten such sets being in parallel.

[20,578] **Clockwork Motor.** J. W. (New Barnet) writes: I should be greatly obliged if you could give me particulars of how to determine the following. If (after gearing) the pulley spindle revolves 80 times while the wheel which is fastened on to the spring barrel revolves once, what length and width of spring or springs would be required for it to run a given time?

The only factor governing the time for which the spring will turn at a given rate is the spring's length. You can calculate the maximum number of turns which a spring will give by calculating the number of turns required to wind the spring tight on its spindle. If you know the diameter of spindle and the thickness of spring, you can reckon approximately what length of spring will be required to go a given number of times round that spindle. Each turn, of course, since it lies over the last, will be longer than the last. Perhaps the best method of reckoning the length is to draw a series of concentric circles each of larger radius than the last by an amount equal to the thickness of the spring. Their number will be rather more than the number of turns the spring is required to supply, because, of course, it will not completely unwind. By adding together the lengths of all the circumferences of these circles, you will get approximately the length of spring required to supply a certain number of turns of the spring spindle. The speed of revolution —the number of turns per minute—depends upon the breadth, thickness, and quality of the spring, and also upon the work being done. These factors can only be determined by experiment.

[20,628] **Gas Engine Valves and Compression.** J. V. G. (Newark) writes: I am building a 2-in. bore by 3-in. stroke gas engine from a set of castings purchased through THE MODEL ENGINEER. I have got on all right so far, but am at a loss to know what length, at 2 ins. diameter, to make the compression chamber; also do you think it will work all right as there are only two valves, one for exhaust, and the gas and air are drawn through the other.

From what you say in your letter we gather that the engine is not as perfect in design as it might be. These engines with one inlet for gas and air give very good results when running at a high speed and constant load, but, of course, you could not expect them to do as well as more expensive engines. It is possible to arrange the gas and air to be admitted by one valve. The design must provide for preventing gas leakage when engine is not running; that is, the gas must be automatically shut off when engine stops. A good type of valve combining gas and air in one is illustrated on the coloured plate of our issue for January 4th, 1906. *Re* compression space, the length of connecting-rod and the stroke will determine this. Roughly, it should be quarter of total cylinder volume.

The News of the Trade.

* *Reviews distinguished by an asterisk have been based on actual Editorial Inspection of the goods noticed.*

Unexecuted Orders.

The Universal Electric Supply Co., of Manchester, inform us that they have several orders awaiting dispatch because the customers have forgotten to give any name or address to which the goods are to be sent. They will be pleased to hear from any of our readers who may feel that this notice refers to them.

American Electrical Novelties.

A very brightly produced list of electric goods has reached us from the Electro Importing Company, of 86a, West Broadway, New York, U.S.A. Amongst other things, this illustrates and describes the "Electro Whistle," a novelty which is intended to be used in place of the ordinary electric bell, and which can be readily attached to any bell circuit. Coils, transmitters, coherers, and other apparatus for amateur wireless telegraphy workers are listed in great variety; as also is the case with *X*-ray appliances and machines and apparatus for electro-static experiments. We notice a neat little machine for winding magnet and other coils operated by hand power. This attaches to the corner of a table by a cramp, and should be very convenient for electrical workers. Dynamos, motors, lamps, batteries, and sundry fittings are also well represented in this list, which will be found of considerable interest to all amateur electricians. A noteworthy feature is the insertion of a number of practical notes on the working of the appliances described, and experiments which can be performed by their aid. The list will be sent post free to any part of the world on application to the above address.

The Editor's Page.

OUR attention has been called to the fact that lathes are being advertised in our Private Sale Column under such descriptions as "Drummond pattern," "Similar to Drummonds'," etc., but that such lathes are not made by the well-known Guildford firm. A photograph of one of these lathes which we have seen bears no resemblance to a real Drummond lathe, except in the outline of the bed. While we do not wish to impute any dishonest motives to those who have advertised in this way, it is obvious that the introduction of the name "Drummond" into the advertisement has for its purpose the creating of a favourable impression in the mind of the purchaser, who is presumed to be familiar with the high-class qualities of the genuine Drummond tools. The lathe offered for sale may or may not be good value for the money, but we think it necessary to caution our readers against being misled by what we can only regard as an unjustifiable use of Messrs. Drummonds' name. In future we shall not accept any advertisements so worded, and if any of our readers who may contemplate buying a second-hand lathe should be offered a tool described in this way, we think they would do well to ascertain the exact origin of the lathe before completing the purchase. Those who know the history of the cycle trade will remember somewhat similar happenings after certain reputations had been successfully established.

* * *

The task of selecting the successful "wants" from the large number sent in by our readers has been a somewhat difficult one, as it is not easy to say which of the many excellent suggestions made is likely to be of the greatest general service. After giving due consideration to the matter, however, we have decided to give the prize of £1 10s. to—

Mr. ALBERT LUSCOMBE,
3, Stanley Villas,
Mount Pleasant, Southall.

We propose to publish the winning "want" in an early issue, and also a selection of the "wants" of the following readers, to all of whom consolation prizes will be sent, varying in amount according to our offer: E. Wilson (West Hartlepool), W. S. Farren (Cambridge), W. F. Thain (Portsmouth), A. T. Towle (Nottingham), R. Young (Chester-le-Street), W. Newton (Old Whittington), E. C. Stocken (Streatham), J. R. Rea (Goole), L. F. G. Dillon (Dublin), C. P. W. Peters (Rugby), L. M. Kale (Ilford), J. Howland (Ashford), A. Walford (South Tottenham), C. E. Lyon (Lincoln), W. F. Manley (Seven Kings), S. C. Saunders (Willesden). A number of entries related to wants which are already well catered for, or to those which the sender could with very little trouble supply himself, while others were hardly within the regions of practical fulfilment.

* * *

We were much interested to see in a report of a meeting recently held in connection with Looe Mechanics' Institute that one of the speakers advocated the formation of a class to teach the building of model yachts. We do not know whether the suggestion is to be acted upon or not, but we have often thought that not only model yachts, but many other branches of model making might very properly be included in the instruction given at local institutes. The educational value of model making is too obvious to admit of much discussion, and there is no doubt of its great attractiveness. We are sure that the starting of a model engine making class, and an electrical model making class, in competent hands, would be a distinct success in almost any well-populated centre. Those who have the welfare of the young men in their district at heart might well consider the possibilities of this suggestion.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This Journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

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All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

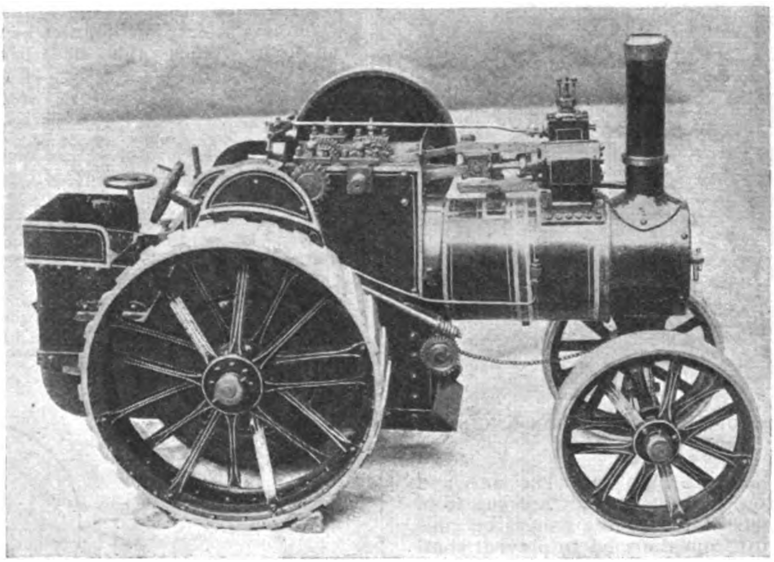
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 400. DECEMBER 24, 1908. PUBLISHED WEEKLY.

A Model Traction Engine.

By G. MIDDLEMISS.

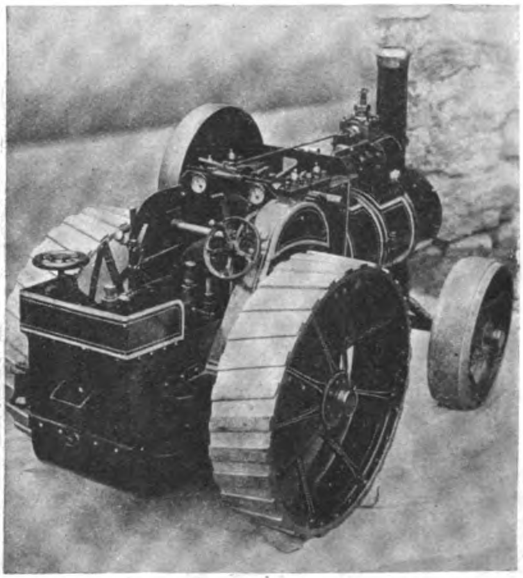


A 1½-IN. SCALE TRACTION ENGINE, BY MR. G. MIDDLEMISS.

I WELL remember the excitement created in my native Northumbrian village some forty odd years ago by the advent of the first traction engine. I also clearly recollect the childish awe with which I beheld the puffing monster, as it drew its accompanying patent threshing machine into a neighbouring stackyard. The days that followed were full of wondering interest to me, as, my fears overcome by curiosity and the explanations of my father, I stood and "watched the wheels go round." I then resolved that *some* day I, too, should have a similar engine. All these years have fled, and there have been many ups and downs, but through it all my love for an engine has remained, and at last, thanks to THE MODEL ENGINEER coming my way, a miniature was suggested, and having been duly carried into effect, the wish of my life has at length been consummated.

In constructing my model, cost was a consideration, so I decided that as far as possible everything must be made, and to this end, after having decided on a design, all the suitable scrap I could come across was duly commandeered. I fixed on the scale of 1½ ins. = 1 ft., as being a convenient size to make and handle afterwards, and this has proved thoroughly satisfactory. The engine illustrated has a cylinder 1⅛ ins. by 1⅛ ins., and this is fitted in the usual manner, with the solitary exception of the governor, which I purposely omitted. Reversing gear is Stephenson's link motion, controlled from the footplate by the customary lever and quadrant, and works well. I turned the crankshaft from a round bar of mild steel, leaving the webs to the full size and shape of the bar, and these and the shaft, being nicely polished, look very nice indeed. The engine has two speeds for travelling, and these are operated by a single handle, as shown in photo, just between the steam and oil pressure gauges. She also has differential gear, and a winding drum with steel wire rope. Two pumps are supplied—one, hand, for filling, and one worked by eccentric from crankshaft. The brake is a very powerful screw type, controlling by a shoe on to a special rim on winding drum.

The road wheels are: rear, 10½ ins., and front



Another View of Model Traction Engine, By Mr. G. Middlemiss.

6 ins. diameter, and are built up. The rims and hubs are cast iron, and the spokes are cut from discs of steel sheet. I turned the flanges on rims (to rivet spokes to) from the solid to prevent complications in pattern making; but, like Poe's "Raven," "never more." The castings had been chilled, so I need only say that the turning on a pedal lathe was simply heartbreaking. Each back wheel contains ninety-three rivets and thirty-two screws, so what with drilling, turning, and tapping, I almost despaired of ever getting them finished. The completed job has, however, well repaid me for all the trouble.

The boiler is a sort of novelty. It is made of copper tube 3 ins. in diameter, and a casting is let up from the under side, from which three ½-in. tubes are carried to front plate. These tubes and the whole of the boiler provide heating surface, and being enclosed in an outer wrapper, should be ample; but it is not a great success, the metal being far too thick. This I propose to remedy by fitting water tubes in the near future.

I have had the engine painted and lined by a professional coach-painter, and his work was well done. I congratulate myself on being the possessor of as nice a model as one need wish for. I may add that I am now engaged on a direct-coupled electric lighting set to my own designs and patterns, and have also a 1½-in. scale road locomotive well in hand, but of these more anon. In conclusion, let me offer my best thanks to the courteous Editor and staff of The Model Engineer for many valuable hints and most useful help so kindly given.

The Steam Engine for Beginners—II.

By H. Muncaster, A.M.I.Mech.E.

(*Continued from page* 510.)

WHILE we have our flask in hand, we might try another instructive experiment. Rig up the test tube so that a piece of the glass tube leading from the flask will reach almost to the bottom, as shown. Measure out as much cold water as will about three-parts fill the test tube, light the lamp under the flask, and let the steam produced pass through the water in the test tube which will after a few minutes be raised to the boiling-point. When this has been accomplished,

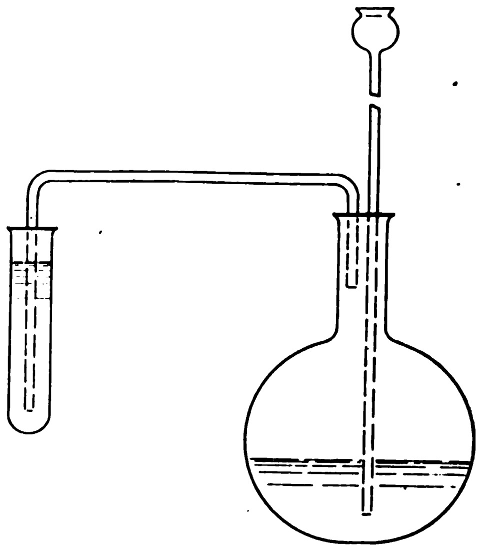


Fig. 6.

at once take away the test tube and measure the amount of water therein. It will be found that a quantity of steam has been condensed from the flask, and there is now in the test tube about one-sixth more water than when we began. The meaning is—that to bring the water in the test tube up to boiling-point only about one-sixth that amount has been condensed out of the steam passing through, having given up its heat to the water in the tube; or, in other words, there has been used to turn water at 212° F. into steam at that temperature six times as much heat as would raise an equal quantity of cold water to the boiling temperature.

A similar phenomenon occurs when we turn, by means of heat, a piece of ice into water. This may be illustrated by putting a piece of ice into an equal weight of boiling water, the resulting liquid will be quite cold, the heat having been absorbed by the water into which the ice is changed.

This amount of heat, which is not apparent,

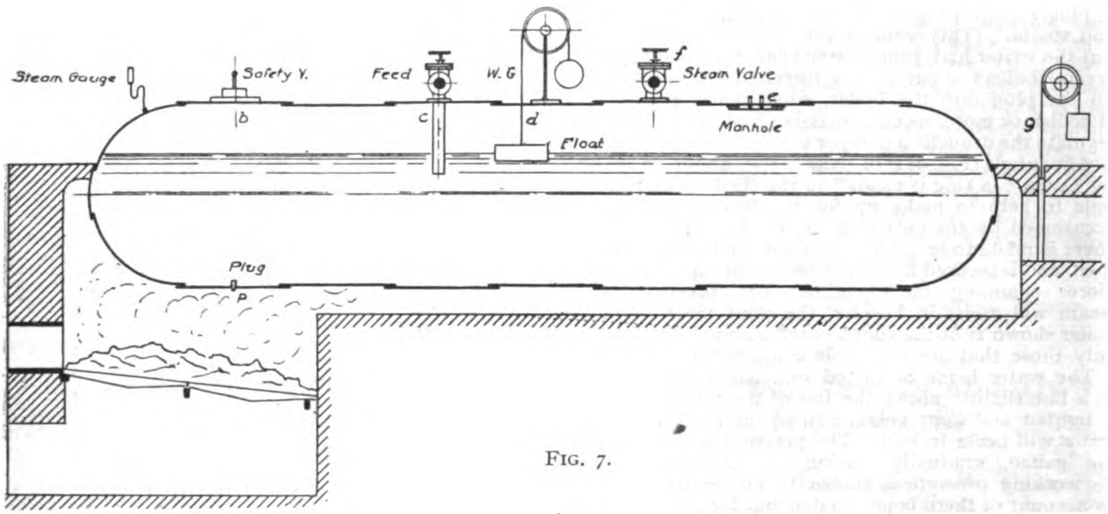


Fig. 7.

is called the *latent* heat, and is thus defined : *Latent heat* is the quantity of heat necessary to convert a body from one given state into another given state without any apparent change of temperature. Experiment proves that it requires 966·6 *units of heat** to convert 1 lb. of *boiling* water into steam,

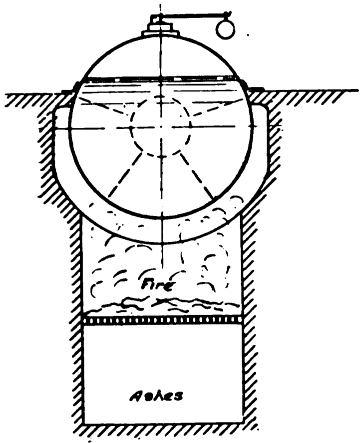


Fig. 8.

and 143 to 144 units of heat to convert 1 lb. of ice at a temperature of 32° F. into water at the same temperature.

The theory of latent heat—of which more will be said later—has a very important bearing on the efficiency of the steam engine, and it was the result of investigations into the behaviour of water under various conditions and temperatures that led to the improvements in the arrangement of the cylinders and condensers which caused such a marked economy in the engines of James Watt and others of his time over the older types. As our object is not chiefly historical, we may pass over some of the earlier forms of the steam engine—forms which are now entirely obsolete as quite unsuited to modern requirements—and consider first some of the types that are in use and capable of satisfactorily performing work under present conditions.

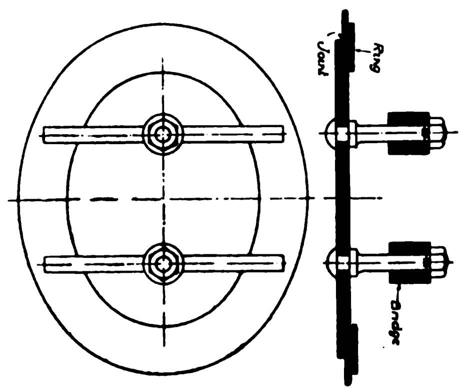


Fig. 9.

To illustrate the method of raising steam an example of a cylindrical boiler with hemispherical ends is given in Figs. 7 and 8. This boiler is still in use, although of a primitive type and somewhat wasteful of fuel. It is made of ⅜ in. thick iron plates in nine rings, and ends in five segments radiating from a circular plate. The boiler is 5 ft. mean diameter and 30 ft. long over ends ; the weight is supported on six angle brackets, *a*, riveted to the shell and resting on the brickwork. The construction of the furnace and flues will be

* A *unit of heat* is the quantity of heat required to raise 1 lb. of water (avoirdupois) at about 40° F. to a temperature = 1° F. higher.

easily seen. The fittings are: *b*, safety valve; *c*, feed-valve, with dip-pipe conveying the water through the steam space and dipping into the water; *d*, water gauge (this is a " float " of stone partially balanced by a weight hung over a pulley); *e*, manhole and cover, to enable a man to get into the boiler for the purpose of cleaning, etc.; *f*, steam stop valve, to shut off the supply to the engine when desired; *p*, plug for the purpose of " blowing off " the water and steam. (This seems a very crude contrivance, but the writer had, some thirty years ago, to " tap " several boilers about once a fortnight by knocking up the plug into the boiler, when under pressure of 30 lbs. or more, using a massive iron poker.) To regulate the draught a damper is fixed as shown at *g*. The manhole (Fig. 9) is of oval shape, about 16 ins. by 12 ins.; a ring is riveted to the shell around the hole to help to make up for the loss of strength occasioned by the cutting away of the plate. The cover is made to be held up against the inside of the shell, and is secured by bolts passing through bridge-pieces spanning the opening. The pressure of steam will assist in keeping the joint tight. The boiler shown is of the simplest form and the fittings only those that are of absolute necessity.

The water being admitted sufficiently to fill up to a line slightly above the top of the flue, the fire is lighted and kept going. In about an hour the water will begin to boil. The pressure soon affects the gauge, gradually raising the pointer until the working pressure is shown to be reached. If, on account of there being no demand for the steam, the steam valve is kept closed while the fire is still burning, the pressure is likely to rise above what may be safely contained by the boiler, the surplus escapes at the safety valve. This valve is shown in detail (Fig. 11). The valve is of the mushroom type, having three wings to keep it central in the seating. The lever is attached to *f*

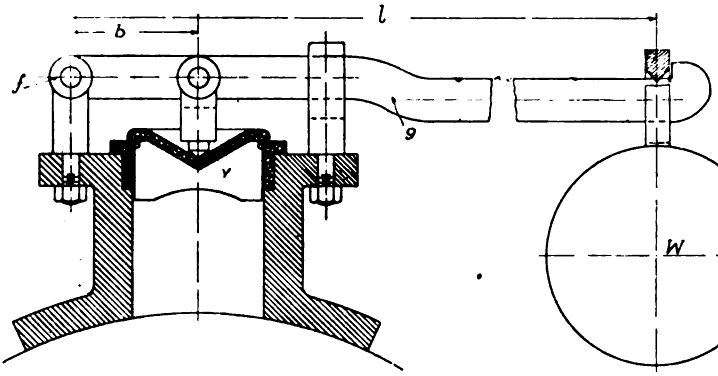


Fig. 11.

as a fulcrum, and a suitable weight hung at a distance L to give the necessary load on the valve. To find the proper position of the weight, find first the weight of the valve (in pounds), the weight of the lever, and the centre of gravity *g* of the same. (This may be readily done by suspending it by a piece of string until the ends balance each other.) Let a = the area of the valves (sq. ins.);
b = distance from fulcrum to centre of valve;
g = distance from fulcrum to centre of gravity;
w = weight of valve (lbs.).

Let w^1 = weight of lever (lbs.);
W = weight of ball (lbs.);
p = pressure of steam per sq. in.;
L = length of lever.

$$L = \frac{a \times p \times b - \left(\frac{g \times w^1}{b} + w\right)}{W}$$

The water gauge is a slab of stone hung on a bronze rod attached to a piece of chain passing over a

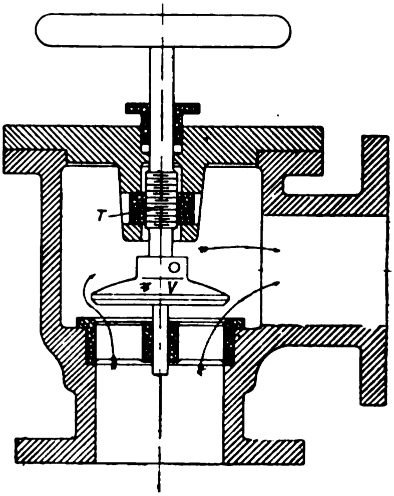


Fig. 13.

wheel which is carried on a forked pillar support. The stone is partly counterbalanced by an iron weight. Where the rod passes the boiler shell is

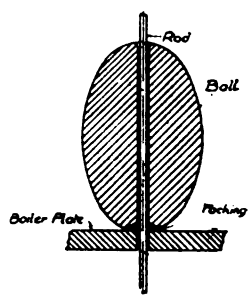


Fig. 12.

a small stuffing-box, although in many cases a ball, as shown in Fig. 12, is threaded on the rod, the lower end of the hole countersunk, and a few shreds of hemp are turned around the rod, and the ball dropped on it, the weight of the ball being sufficient to make a steamtight joint without binding the rod. The weight to balance the stone is:

$$= \text{weight of stone} - \left(\frac{\text{weight of water displaced}}{2}\right)$$

Supposing the stone to weigh 200 lbs., the displacement will be about two-fifths of that amount =

80 lbs.; now, if we make the weight $= 200 - \frac{80}{2} =$ 160 lbs., we shall have a force of 40 lbs. available to overcome the friction of the apparatus when it is moved by a change of level of the water in the

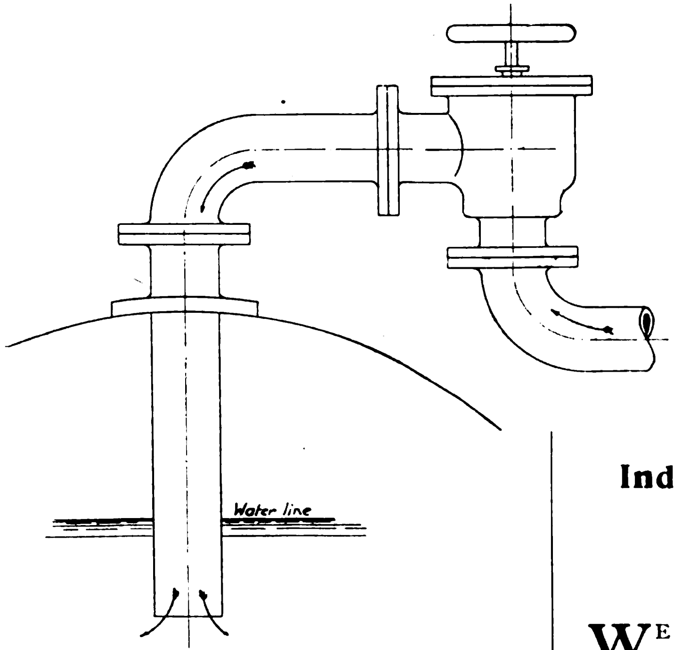


FIG. 14.

boiler. A pointer on the wheel will indicate the working level of the water.

The principle of the float ought to be well understood, for the reason that it has a very extensive application in modern stationary boiler practice.

The plug shown is driven from the inside of the boiler (so that the pressure cannot blow it out if it gets loose), a little red lead and a little frayed hemp wrapped round the plug being sufficient to prevent leakage.

The damper shown at *g* is simply a plate slightly wider than the flue, sliding in grooves in the brickwork at the side. It is intended to shut off the flue from the chimney to stop or modify, as may be desired, the current of air passing through the furnace. This plate is balanced by a weight hung over a pulley and connected to the damper by a chain.

The details of the steam valve are shown in Fig. 13. V is a brass valve of the mushroom type, closing on a brass seating having a guide for the valve stem. The valve is lifted by means of a spindle, on which is cut a screw thread. This thread engages in a square nut slipped into a recess in the valve box cover; if we turn this spindle, the valve will be lifted from its seat. A stuffing-box and gland is fitted to prevent leakage where the spindle enters the cover.

The valve for the feed-water pipe is quite the same thing, except that it is made smaller. This is arranged so as to allow the water to pass upwards through the valve; it is usual to allow the valve to drop free of the spindle; it then forms a non-return valve, the steam pressure in the boiler always acting so as to close the valve. For this reason the valve is not set directly on the top of the dip-pipe. The arrangement is shown in Fig. 14.

The form of boiler shown is, as we said, somewhat wasteful of fuel, and is rarely employed except for pumping and hauling at a coal pit, where coal is cheap or where there is a lot of inferior slack, etc., available that is not worth sending away. We may say that it is, however, for a given capacity, more cheaply made than any other; and because no part of it is supported by stays, for the reason that the pressure does not tend to change its shape, it is very safe under proper working conditions, with the extra advantages that it can be easily examined and cleaned when necessary, and repairs are of a very simple character.

(To be continued.)

Induction Motors and How They Work.

By NORMAN E. NOBLE.

(Continued from page 583.)

WE shall now have to consider how we can utilise the rotating magnetic field so as to produce a rotary movement of a body in it. It is quite true that if we placed a compass needle inside the ring supplied with two-phase currents, that we should get a constant rotation of the needle, this being so because the needle is bound to lie in the magnetic field, and compelled to revolve because the field does.

Now let us consider a well-known fact, and see how it will help us. It is known by most amateur electricians that if we rapidly rotate an iron ring or a solid piece of iron in a strong magnetic field, the iron will eventually become warm, and perhaps very hot, if the speed be high enough; the explanation of this being that the rotating ring cuts the lines of force, and an E.M.F. is induced which produces currents which circulate in the iron and cause heating effects. These induced currents oppose the motion which causes them (by Lenz's law). The same effect would be produced if we rotated a magnetic field round a stationary iron ring. Thus, if we place an iron ring in the rotating field—as produced by the two-phase currents in Fig. 8—before we pass current through the coils, the iron ring will be stationary. Now, when we switch the current on a rotating field is produced, which, as it revolves, cuts the ring, and obviously, from the above example, induces currents in the ring. These currents produce a magnetic field which opposes the rotating field; but the iron ring, being free to revolve, is carried round with the rotating field, because it cannot stop it.

Let us now consider a simple form of induction motor, as in Fig. 10. The motor consists essentially of an external ring-shaped iron core, which is called the stator, because it comprises the stationary part ; on the inside of same are cut slots into which the field-coils can be wound. The rotating part, named the rotor, consists of an iron core with slots in the periphery, in which the rotor conductors are placed. The conductors can be connected in many ways ; the method we will deal with first is shown in Fig. 11, and is known as a squirrel-cage rotor.

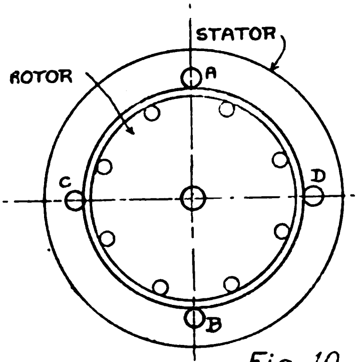
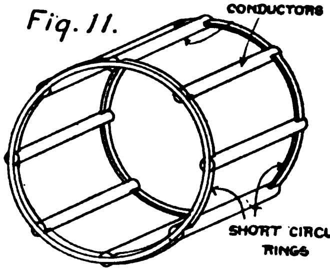


Fig. 10.

In this type of rotor both ends of the conductors are short-circuited by means of copper rings. (See Fig. 11.) In both the case of the stator and rotor cores, they are composed of thin sheets of iron insulated from one another ; this is done to prevent eddy or induced currents flowing in them.

In the stator there are four slots, A and B being for one winding of the two-phase current, and C and D for the other phase winding. When the slots are wound and each coil supplied with one phase of a two-phase supply, we get a rotating field. As the field rotates it cuts the rotor conductors and induces an E.M.F. ; and because the rotor conductors form a circuit, a current flows in them which produces a magnetic field opposing the rotation of the stator field. The rotor, however,

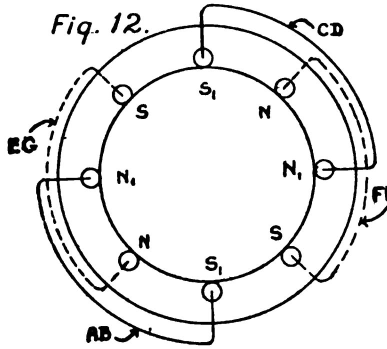
Fig. 11.



is free to rotate and is carried round with stator field, and we can derive mechanical energy from the rotor shaft. The speed of the revolving field depends on the periodicity of the supply, and also on the number of pairs of poles of the revolving field. For example, in the above case the revolving field has one pair of poles ; assume the periodicity of the supply to be 50 cycles per second. Now speed of field in revolution per second is equal to $\frac{\text{periodicity of supply}}{\text{number of pairs of poles}}$; therefore, in the previous example we shall get a field speed of 50 revs per second, or 3,000 r.p.m., which is the same as we got from Fig. 8—that is, one revolution of the field for one period in variation of the currents. The induced E.M.F. in any conductor depends on the rate the lines of force cut it, and the strength of the magnetic field ; hence, when we switch the stator windings on to the supply, the field immediately revolves at full speed and the rotor is at rest, consequently, the lines of force of the revolving field cut the rotor conductors at a maximum rate, and an induced current flows in them, producing a magnetic field which opposes the rotation of the stator field and tries to stop it ; but as long as we pass current through the stator windings, the field will revolve at a constant rate, hence the rotor is carried round with it in the same direction as the stator field revolves in.

Now, with a supply having a periodicity of 50 cycles per minute, we get with a motor, as shown in Fig. 10 (that is, a two-pole motor), a field revolving at 3,000 r.p.m., and just as the rotor is starting from rest, we get the lines of force of the stator field cutting the rotor conductors at a maximum rate, hence inducing a maximum current,

Fig. 12.



which, in turn, gives a maximum turning effort. Assuming the motor is running light, the rotor will quickly increase in speed, and will reach almost the same speed as the revolving field, which is rotating at 3,000 r.p.m. It cannot, of course, reach exactly the same speed, because if it did the stator field would not cut the rotor conductors, hence no currents would be induced and, consequently, no turning effort available. But a motor running on light load only requires sufficient torque to overcome the frictional and air-resistances of the moving parts, and it would be found very difficult to determine by means of a tachometer any appreciable difference between the theoretical speed of stator field and the rotor speed. It will be quite evident to the reader, that, as the speed of the rotor increases from zero, the rate at which the conductors are cut decreases, due to it catching up the speed of the stator field. Now, as pointed out before, the rotor speed at light loads is nearly the same as the stator field speed, and, if we load up the motor a little, it gives out extra power. To do this a number of things have to happen, viz. : firstly, the torque must increase ; secondly, more current is required to produce the increased torque, which requires a greater E.M.F. to be generated in the rotor conductors ; this means that the stator field must cut the rotor conductors at an increased speed. Now the speed of the stator field is a fixed quantity, because it depends on the frequency of the supply, which is unalterable unless we vary the speed of the generator; therefore, the only thing that can happen to satisfy the above conditions is for the rotor speed to drop, which is exactly what happens. It may be asked why the stator field strength does not increase, which would produce the effect required; but to answer this question would open a very big argument, and would necessitate comparison with a loaded transformer; therefore, we will take it for granted that the stator flux is, for our considerations, constant, and independent of the load; the only variation of the field strength is caused by volt drop on the windings, caused by the increased currents in same where

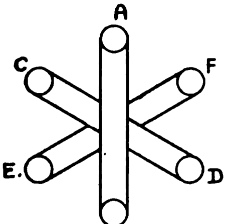


Fig. 13.

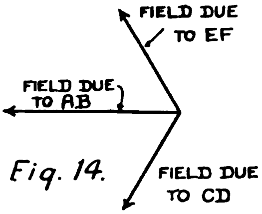


Fig. 14.

load is applied; of course, this is not very great up to full load currents. Returning to our considerations, we had decided that the load when applied to a motor causes the rotor speed to drop; the amount of drop being governed by the load. This difference between the field speed and rotor speed is termed the slip of the motor; for example, if the field speed was 3,000 r.p.m., and for a given load the rotor speed was 2,900 r.p.m., the slip would be 100 r.p.m., or, expressed as a fraction of the field speed, the slip would be $\frac{100}{3000} = \frac{1}{30}$ or $3\frac{1}{3}$ per cent.

The motor we have considered so far (see Fig. 10) is a two-phase two-pole motor, from which we get a rotor speed of nearly 3,000 r.p.m.; this is rather a high speed, from a mechanical point of view. So we will now consider means for reducing it. We could, of course, supply the motor from a lower frequency, say 25 cycles per second instead of 50; this would reduce the speed to 1,500 r.p.m. But this is not always convenient, hence the only alternative is to produce more poles in the revolving field. This can be done by winding more coils on the stator, as in Fig. 12, which represents the necessary slots in stator, to produce a four-pole field, or two slots per pole; we could have more slots per pole, but this example will serve our purpose. The full lines represent one phase, and the dotted lines the other phase; each of the two coils forming one phase are wound so as to produce like poles in that part of the stator they embrace. When the current in the coils A B and C D is a maximum, we should get a magnetic field as shown by the letters N N, these causing consecutive poles S S to appear, as indicated (Fig. 12). When the current in these coils has diminished to zero, the current in the coils E G and F H would be a maximum, and would produce magnetic fields N_1 N_1 giving consecutive poles S_1 S_1. It is therefore evident that the stator field will move one-eighth of a revolution during a quarter of a period variation of the currents, or one revolution of the field to two periods variation of the currents. Therefore, for 50 periods per second supply, we get a rotor speed of practically 1,500 r.p.m. We could by increasing the number of poles still further reduce the field speed; therefore, the rotor speed. For instance, a six-pole field would give 1,000 r.p.m., and an eight-pole field 750 r.p.m., and so on; this is, of course, reckoning on a supply of 50 periods per second.

As pointed out before, induction motors can be made to run a three-phase supply, that is, each current differing in phase by 120 degs. (See Fig. 6.) If these currents were passed through the three coils (120 degs. apart), as shown in Fig. 13, each coil being similarly lettered to the phases in Fig. 6 (that is, phase A B passing through the coil A B). When the coil A B produces its maximum magnetic strength, which is horizontal, and its N. pole to be at the left of diagram (being assumed). At this same instant the fields due to the coils C D and E F are not at their maximum strength, but they have equal strengths, as will be seen from the curves (Fig. 6); so we shall get three fields directed as in Fig. 14 (the coils being suitably wound). At the point marked No. 2 (Fig. 6) the field due to the coils C D and A B have reversed their directions, and the field due to C D being at a maximum, and A B at an intermediate value. The field due to the coils E F has still the same value and direction as at point No. 1, but it has passed through its maximum value (see Fig. 6). From these we get a result as shown in Fig. 15.

At the point No. 3 (Fig. 6) the phase E F is a maximum value, and has changed its direction; C D has changed its direction, and is not at an intermediate value; and A B has the same magnitude and direction as at point No. 2. These currents now produce a field, as indicated in Fig. 16. Finally, at the point marked No. 4 (Fig. 6), we get the field as shown in Fig. 14, which is the same as we commenced with. Thus we have one revolution of the

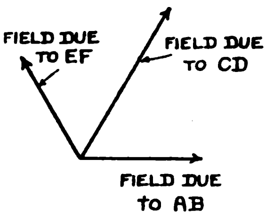


Fig. 15.

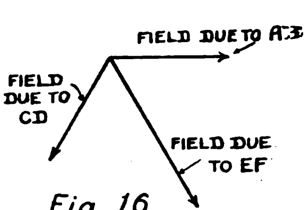


Fig. 16.

magnetic field for one period of variation of the currents—that is, from point No. 1 to point No. 4 (Fig. 6). In each case the three fields give one resultant field, having its direction the same as the strongest of the three, and the magnitude greater than the strongest field, because the other two fields are pulling in the same direction.

This is a two-pole field, and, as with the two-phase field, we get one revolution for one period variation. This three-phase two-pole field consequently suffers from the same disadvantage as the two-pole two-phase field, the speed being too high. To reduce this high speed, we do as we did in the case of the two-phase field—that is, we wind on the stator another set of coils, which produces another field either in front of or behind the original field; therefore, we get a four-pole field, which reduces the field speed to 1,500 r.p.m., a further increase in number of the poles reducing the speed still further, as pointed out with the two-phase field.

With regard to the rotor, a squirrel cage rotor can be employed for either two- or three-phase and single-phase induction motors. In two- and three-phase motors the stator windings is the only place where a difference between the two can be distinguished, generally speaking.

We have yet to deal with the action of single-phase motors, as their action is somewhat different from two- and three-phase motors. A single-phase motor depends for its action on a pulsating field, and not a rotating field, as was the case with the others. Referring to Fig. 7, we found that, with such a winding as shown, we got a pulsating field. Let us assume that we had a two-phase motor in which each phase of the supply had an

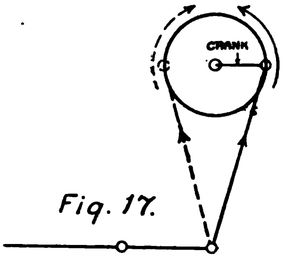


Fig. 17.

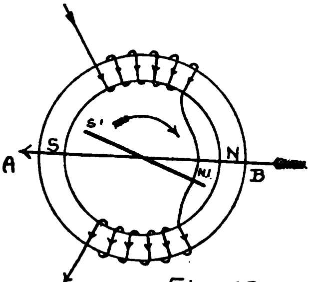


Fig. 18.

independent switch; now, while it is running on light load, let us open one of the switches and we shall find that the motor will run at its proper speed, and, what is more peculiar, we can derive mechanical energy, although it is running on one phase. We shall, however, be able to see the current in the phase which is running the motor is greater than when the motor was running on two phases. If we now open the switch of the remaining phase the motor will stop, and if we attempt to try and start the motor again with only one phase connected, we shall find we are unable to do so; therefore, we conclude that a single-phase motor is not self-starting, but if, when we have opened the switch of the remaining phase to stop it as before, and close it again before the motor comes to rest, we shall find the motor will run up to speed again. This shows that a single-phase motor, if given an initial start as the current is switched on, will run up to its proper speed. Another peculiarity of single-phase motors is, that they will rotate in either direction, just whichever the initial start is given in. The reason for the non-starting of single-phase motors is, because we only have a pulsating field and not a rotating field, consequently no turning effort is given to the rotor, but merely a force first pulling, and then pushing at the rotor. From our mechanical knowledge, we know that a motion of this kind can be converted into circular motion—the treadle motion of a sewing machine affords a good example (see Fig. 17).

It is, of course, necessary in the treadle motion that the crank should be past its dead centre before the push of the connecting-rod is of any use: thus if we give the wheel a start by hand, it will continue to rotate in the direction in which it is started. The action of a single-phase motor is much the same: if we give the rotor a start, a revolving magnetic field is formed in the rotor which reacts on the stator pulsating field at that instant, and is reversed as the stator field reverses, the initial start carrying the rotor over what might be termed the dead centres. However, considering the matter electrically, what we have is this: when the current is switched on to the stator windings, a pulsating field is produced which, as it threads through the rotor windings, induces in them a current which itself produces a pulsating field in the rotor. This field, which we will call A, has always the same direction as the stator field, but attains its maximum strength when the stator field has its zero strength, or, in other words, it is 90 degs. out of phase with the stator field. This is so because the strength of any current induced by lines of force cutting a conductor depends on the rate at which the lines of force cut it, or the rate of change of the magnetic field, in this instance. At that instant when the current is at zero, that is, just when it is reversing its direction, the stator field is at its maximum rate of change, hence the induced current will be at its maximum value in the rotor conductors. Therefore this rotor field A is in the same direction as the stator field, but 90 degs. out of phase with it. Immediately we give the rotor a turn by hand the conductors cut the lines of force of the stator field, this induces in them a current, and thus produces a magnetic field (pulsating) which is at right angles to the field A. This second field we will call B, and its direction depends on the direction the initial start is given in. This field B is in phase with the stator field—that is, they both attain their maximum value at the same instant. These two rotor fluxes, 90 degs. out of phase with one another, and also at right angles to each other, produce between them a rotating field in the rotor, just as we got a rotating field from two alternating fluxes 90 degs. out of phase, and at right angles to one another, in the two-phase stator. Let the long arrow AB in Fig. 18 indicate the direction of the stator field, at that instant when it is at its maximum value. Now, when we give the rotor an initial start, we get a rotor revolving field as previously stated; let its position and direction at the instant under consideration be as shown by the arrow NS (Fig. 18). The stator field now acts upon this rotor revolving field and produces half a revolution of the rotor. The stator field now changes owing to the current changing its direction; that is, it changes its polarity, and we get another half revolution of the rotor.

The motor will now continue these operations and run up to its proper speed; we must not forget at any time, that no revolving field exists in the rotor until we have given it an initial start. As previously mentioned, a single-phase motor will run in either direction, whichever direction the initial start is given in, except in the case where starting devices are used, which will be dealt with later. The motor (as shown in Fig. 18) is a two-pole field motor, and the rotor speed will be almost equal to field speed on light load. The field on a

50 periods supply would revolve at 3,000 r.p.m. in this case. This speed is too high, but can be reduced by increasing the number of poles of the field, just the same as we did with the two- and three-phase motors, the only difference being that single-phase motors have a pulsating field and not a rotating field, as with two- and three-phase motors.

(*To be continued.*)

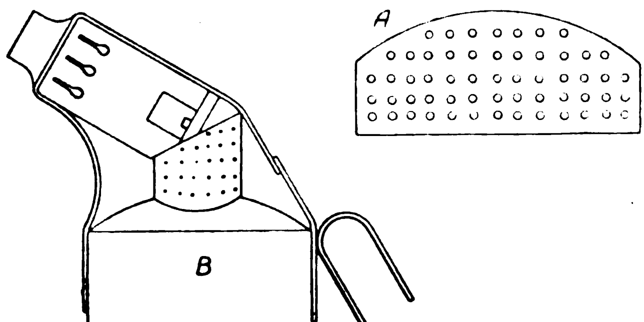
Workshop Notes and Notions.

[*Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked* "WORKSHOP" *on the envelope.*]

"Starting Up" Blowlamps.

By F. J. Nance.

Many of your readers who use blowlamps or Primus stoves for heating purposes may have found the inconvenience of requiring to use spirits of wine to "start up" the lamp or stove, and have doubtless wished they could use paraffin for the purpose without the smoke attendant on its use. The device illustrated is a ready way of overcoming the difficulty. As I have tried it myself and found it highly successful, I can recommend it to others. All that is wanted is a piece of sheet iron or brass roughly of the size and shape shown at A, and perforated with holes. I use a piece of an old combustion cylinder from a "Perfection" oil stove. The piece of metal is bent into a cylindrical shape and placed around the tube of the blowlamp as shown in B. A little waste, shavings, or asbestos fibre is then placed in the cup, saturated with paraffin, and lighted. The remainder of the manipulation is the same as if spirits were used. I may say that a much smaller quantity of paraffin is required than spirits. Your readers will find that a little loose asbestos packing placed in the cup may be retained permanently in place and used when required. A convenient way of saturating it with paraffin is to close the valve and pump very gently till the oil dribbles from the nozzle and runs into the cup, then open the valve. A great advantage of the arrangement described above is that the overflow of paraffin into the cup is not inconvenient, as it is when spirits are used, owing to the smoke from the mingled spirits and oil.



Keyway Cutting Tool for Lathe.

By Walter Giuliano.

The advantages claimed for this tool are: easily constructed, strong, and keyway can be cut after boring without removing job from the lathe, thereby ensuring accurate results. The body is a piece of ½-in. tool steel turned down one end for about 1 in., or according to the length of keyway to be cut. It is then clamped in the toolholder of the slide-rest, level with the lathe centres, and

Fig. 1.

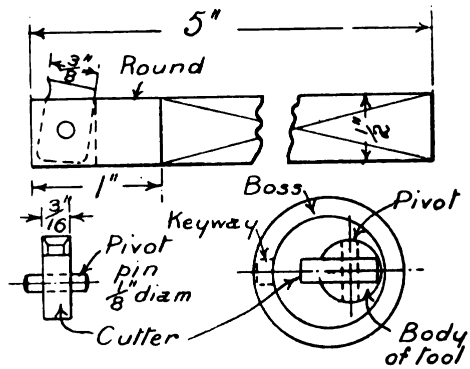


Fig. 2. Fig. 3.

slotted 9-16ths in. by ½ in. with a milling cutter, if possible, as this will ensure the slot being parallel with slide-rest travel. The cutter to fit same is fitted up as shown in Fig. 1, and is of 3-16ths in. by ⅜ in. tool steel; it is then pushed into the slot with its back 1-32nd in. from end of same and drilled to take a ⅛ in. pivot; this will allow cutter to trail back over the cut without shifting slide-rest to let same clear each time. After tempering cutter to pale brown the tool is ready for use. The body is clamped in slide-rest as before, with cutter in horizontal position, as in Fig. 3. The feed should be about ·01 in. per cut, the depth being regulated with slide-rest, and traverse with lead screw hand-wheel. Cutters can be made to suit many jobs of varying size. The measurements here given are suitable for 3½-in. Drummond lathe.

Sulphated Accumulator Plates.

By H. C. Robson.

The following may be of some use to your readers. Having an accumulator to clean that was badly sulphated, I set to work to clean it in the following way:—Get about ½ lb. of ammonium acetate, dissolve in quart of water and put in earthenware jar and immerse the lead plates and allow them to stay for half-ar-hour, keeping them hot during this while. The plates will now be free from the sulphate, wash and dry, and they can now be replaced in the accumulator case. In this method the plates need not be detached, thus saving a great deal of time. I might say that the ammonium acetate can be bought at any chemist's and is fairly cheap.

I.—The Apparition.

It really was an old-fashioned Christmas Eve, or, to speak correctly, it was so in that part of the British Isles in which George Brown lived and earned his daily bread. Just the kind of snowy, frosty, sparkling Christmas Eve when everyone feels in a jolly, done-with-work, ready-for-roast-goose-and-plum-pudding kind of mood, when mysterious and seemingly weighty canvas sacks are carried about by prosperous-looking old gentlemen and obviously-looking working-men; when trains are late, not only finding it impossible to start to time, but hopeless to expect to reach destinations until hours after the schedule says they will arrive. But who cares on Christmas Eve if banks of fog do delay trains in places, and specials and all sorts of extra traffic play havoc with time-tables? Destinations are eventually reached, and welcomes all the more hearty to compensate for the delay.

Who cares on Christmas Eve?—certainly not George on this particular occasion, surrounded by an array of tools in the very roomy attic which had been surrendered to him for his exclusive use as a workshop. George was supremely happy.

He was one of the lucky ones: his long-wished-for start as an amateur engineer could now be made. For years—ever since he left off petticoats—he had scraped together and hoarded up a little kit of tools, making queer structures of wood, cardboard, and wire. His pocket-money had not permitted an extensive equipment, and he was still very young, though now "a man of business." But old uncle Joe Carbide, the ironmaster, had heard of his nephew's modest hobby. "Bless the boy," he exclaimed to Aunt Carbide; "capital—couldn't be better occupied, if he does sit on a stool all day to earn his living. I'll send him a Christmas present."

So the present had duly arrived that very day, heralded by a big-hearted letter: ". . . Stick to your banking, lad, for your business, and play at engineering—that's the best way to take it. I am sending you a box of tools—take care of your fingers, and don't try to design, build, and occupy in the same day.—Your affectionate uncle, J. Carbide."

And what a box it was! The carman and his boy decided that it must at least contain a grand piano. George (whose mind had pictured a "selected gentleman's tool chest," with chisel, gouge, plane, etc.) merely remarked that he was "blowed," and set to work to obey the urgent request of the feminine portion of the household—"Do get it out of the hall, there's a good boy—it's right under the mistletoe."

And What a Box it was!

And here was George, alone and happy, bubbling over with enthusiasm as he contemplated his new possessions. The old friends were there, too—the familiar soldering-bit, the hammer (his first love, purchased with saved-up pennies when he had scarcely mastered the art of locomotion on two legs), various chisels, and a treasure in an Archimedean drill, with the other modest items. Do we not all know them? does the latest thing in twisted augurs or spiral-fluted reamers ever destroy our affection for them? What pleasure they have given to us, and how much we have accomplished with them in our own little world of art and craft. "Tools and the man." Let him who would write the epic on this also include the boy, as he has the fullest possession of the joy of "make-believe."

But the new love—surely that was the glistening screw-cutting lathe which he had managed to erect after much wondering and wiping off of grease. What an array of things seemed to belong to it —he had no idea that a lathe could become such a glorious and complicated machine, very different from the picture in that old book which had taught him so much and yet so little of mechanical work. With what pride he had called a long-suffering household to come and see it. " I don't yet know what the great screw is for," he had somewhat patronisingly declared ; " you see, I have only just had a general look-round, but I shall find out in time. Look at all these things — here's a set of fat gimlets "—displaying a case of twist drills —" but these are a mystery at present "—showing another case containing fluted reamers. " But they are splendid, aren't they ?—isn't Uncle Joe a brick ? "

" Ugh ! " said his sister May, " shut them up—they do so remind me of the dentist. But you are a dear boy, and I'll try to like the horrid things for your sake."

Uncle Joe was indeed a brick. There were wood and iron turning tools, a parallel vice, calipers, taps and dies, files, pliers, surface-plate —surely he must have given a *carte blanche* order to a tool shop for a complete outfit—and a rare supply of screws, brass, strange-looking castings, and odds and ends of all sorts —enough to last a year or more to the most enthusiastic of amateurs. But he was feeling tired : the struggle to put the lathe together, to say nothing of opening the packing-case and clearing-up afterwards—(we all know that, too)—had told its tale, and George had settled in his armchair to have a final look round. Of course, he had a trial run. The self-centreing chuck was too much of a puzzle and had been placed on one side "*pro tem.*," as he remarked ; but he had managed to fix a wobbly piece of brass somehow in the bell chuck, and had made a rash attempt to turn a part of it with a wood chisel. Result—disaster to chisel and brass, but much joy also to George.

" Here's a Set of Fat Gimlets."

Yes, he had determined on a comfortable chair as part of the furniture of his workshop. Would he not have to sit and make sketches and calculations occasionally, or think out some problem in the machines he was going to build ? Besides, a friend might occasionally drop in to see him whilst he was too much engrossed in his work to leave it. He called it " work," and meant it. How puzzling, though, all this variety of tools and things. If he could only have someone close at hand to whom he could refer, someone who knew all about engineering and tools, he would get along famously.

Click, click, click, click.

Ah, that was his own present to himself—not an expensive one, indeed only a few shillings—his workshop clock. Just the clock for an amateur's workshop, with its shiny round body, bras sfeet and rim, and metallic kind of tick. Just an ordinary " made-in-U.S.A." clock.

Click, click, click, click.

" Yes, old fellow," said George, addressing the clock, " you and I will be companions for many an hour, I hope. You are cheap—no burglar would trouble to take you away—but how many men have worked out their lives to enable you to go well and be sold for so little money ; how many men, since the monks made that old clock with the iron wheels which I saw in London last year ? " Which proved that George was a thinker and had the right bent for an amateur engineer. " Will your merry click make me do my work faster, like Nasmyth's engine ? "—which also proved that he read the right kind of books for an amateur engineer. Oh, yes, that was a book he was going to read at leisure—he had been obliged to take a hasty look through it since its arrival by post that very morning. There was no time for more, but to-morrow or the day after he would start to read it—every word, he was sure.

Click, click, click, click.

It sounded differently now—a soft, far away kind of tick, and surely he had forgotten to fill his lamp—the wick was burning very dim. No, it wasn't a wick at all—it was an electric light—how could it have that blue colour ? And what a funny clock—ha ! ha ! he had never noticed it before—almost like a face.

It was a funny clock—no longer a clock at all, but in its place stood one of the most extraordinary figures he had ever imagined. There was nothing ghostly about it beyond a vague kind of vibration or etherealism suggesting that the visitor was no mortal being, and the fact, which George at once noticed, that he cast no shadow. He was not Santa Claus—he was much too young, but his face beamed with the jovial smile associated with pictorial representations of that gentleman. Like friend Santa, however, he had on a long garment, a kind of coat which was fitted with a great number of pockets, out of some of which peeped—not toys, but rolls of paper, and out of others things which were evidently calipers, rules, and similar engineering instruments. He was of large stature and seemed to be overflowing with good-humour : he evidently possessed an abundance of energy and vitality. At the moment when George became aware of his presence the Ghost was engaged in making calculations in a large book with the aid of a pencil and slide-rule, and with astounding rapidity. Sheet after sheet was covered with figures and sketches of things quite unintelligible to George, whilst occasional words, such as " base of Napierian logarithms," " inverse square," " sign integral," " tenth harmonic," " five hundred to the eight power," softly murmured, indicated that this remarkable being was absorbed in some gigantic calculation highly interesting to himself.

George was unable to stir for some minutes, but sat gazing with wonder ; at last he endeavoured to rise, and catching his foot against the chair, attracted the attention of the calculator.

" Good evening," said the Ghost, in a most friendly way, shutting up his book with a vigorous bang and depositing it in one of his many pockets ; " you seem tired. I was just waiting until you awoke, and filling in time with a few memoranda." And the jolly fellow, pulling a cigar from another pocket, clipped it with a pair of cutting pliers which were lying on the bench, stuck it in his mouth, and lighting the end over the lamp, puffed away as if it was the most natural thing for a ghost to do.

"Nice kit of tools," continued the Apparition, indicating Uncle Joe's present by a wave of his hand.

"Yes," said George, "but a Chinese puzzle to me at present.

The Apparition shook with good-humoured laughter. "So I perceive—by your attempts at turning."

"Well, I don't know who you are or where you come from," said George, "but you seem to be mighty clever; if could you tell me the names and uses of a few of the things I should be much obliged." It was impossible to be frightened at such a kindly spirit.

"That's exactly what I am here for," chuckled the Ghost, and stretching out his hand, he placed it gently upon George's forehead.

What followed he could not afterwards exactly describe. The Ghost took the self-centreing chuck from the bench, and, lo! its mechanism was explained—George knew how to use it and just what he could do with it. The other tools, in turn, were all explained: the Ghost manipulated the lathe—cutting screws, turning, drilling; he filed pieces in the vice and demonstrated the difference between good and bad methods; he explained what is meant by filing flat, calipering, mechanical drawing, and gave some advice on hardening, tempering, grinding, and shaping cutting tools. It all seemed so easy, and was so interesting that George had no idea how much time had been occupied.

"There," he said, "these are the real thing."

"I feel I can do something now," he remarked to the Ghost" — not patronisingly this time — oh, no, he was beginning to learn and becoming humble.

"Yes," said the Ghost, "you understand your tools now. I will show you something in the way of work," and again plunging his hands into various pockets, he produced models of locomotives, vertical engines, dynamos, and steamboats. "There," he said; "these are the real thing."

"What beauties!" said George, entranced. "Will you help me to make such models, too. But that is impossible—you will soon vanish; work like that requires time to do it properly."

"True," said the Ghost; "but you can always have my help and advice if you wish. I exist for such labours—it is my delight."

"Tell me how I can keep you with me," said George, eagerly; "but surely you will not help me alone, such a being as you are must have other claims upon your benevolence. I cannot be the only one to have your favours."

"No," said the Ghost, "there are many others. I help all who ask me: my power is great, my reach wide, but I only work to promote happiness. I fight despair, I create hope. Would you see those whom I have touched as I did yourself this night? would you see part of the world of knowledge which I can bring you to?"

"I would follow you anywhere," said George, in his enthusiasm.

"Come, then," said the Ghost, and taking a large cloak from another of the wonderful pockets, he flung it around George and himself. The room faded away.

II.—The Journey.

Out into the night they passed, George finding himself floating through the air in company with his wonderful companion. They approached a large house which stood in a spacious garden—the owner was evidently a person possessed of plenty of money. Some little distance from the house was a low building, and they came near, the sound of machinery at work indicated that something or somebody was busy.

"We will enter," said the Ghost. The exterior of the building seemed to dissolve, and George found himself standing in a well-lighted place, which was arranged as a workshop. A shaft and pulleys attached to the ceiling were in full motion, driven from an electric motor, which just indicated its position by a slight purring sound, as if it was a pet cat which had discovered that life was very pleasant at the moment.

"Here," said the Ghost, "is an amateur engineer similar to yourself; he has an excellent equipment of tools. You notice three lathes, one a small high-speed lathe of simple construction; this is for fine, small work: the tool itself, though simple, is accurate and well designed. The second lathe is for the work in general; it is also a first-class tool, like your own lathe. The third is for preparing the work to be finished by the other two; it is of very strong construction—a comparatively cheap tool; its use is to remove the rough surplus metal, so that the other tools are not strained: by this method their accuracy is preserved. That tool is a shaping machine—there is a drilling machine — here is a milling machine; in the adjoining room is a forge, grindstone, and emery-grinder, kept there so that the dust from them may not reach the slides and bearings of the machine tools here. Observe how well the place is kept: the cupboards filled with chucks, drills, taps, dies, and other accessories—everything one could possibly require."

The owner was in keeping with his workshop—clad in neat overalls of some light, comfortable material. He was engaged in turning a delicate casting chucked in the high-speed lathe. George watched him entranced as his supple fingers manipulated the tools with delightful skill.

"He is a clever man," said the Ghost. "We are very good friends: you will know him also now."

At this moment the amateur stopped his lathe and a puzzled look came to his face.

"He is making an exact copy of an engine," said the Ghost, "and is uncertain about a detail. We will help him: that old print which you had in your workshop happens to be a picture of this engine. I have brought it with me; let us show it to him."

Taking the print from a pocket, the Ghost spread it before the amateur and touched him gently. At once the puzzled look vanished, the lathe was started again, and the work proceeded with.

"You have commenced well," said the Ghost to George, with a kindly smile; "you have helped him, through me—some day he may help you."

They resumed their journey, but the next scene was very different. It seemed to be a manufacturing place: the houses were small here, the gardens scarcely worth the name. In a room which was evidently workshop, kitchen, and living-room all in one sat a man of toil. Whatever his business by which the daily bread was earned, it had exacted a full measure of servitude. He was still young, but the lines in his face marked him as one of those who find the battle of life a real fight indeed. A home-made work bench had been placed under the lamp which hung from the centre of the ceiling, and the owner was adjusting a piece of mechanism supported upon a temporary frame of rough wood. By the fire sat his wife, watching him in the intervals of domestic occupation. At last the man paused in his endeavours.

"There is something wrong," he remarked; "it is made properly, but it doesn't do what I thought it would, and this is the third model I have made."

"Third time is lucky," said his wife.

"This is also one who knows me," said the Ghost, stretching his hand towards the man and touching him.

The effect was magical. The man jumped up with a hearty laugh. "What a dunderhead I am," he said, "just as if I couldn't have seen that before—me, the smartest fitter in the works, they say; you are right—third one is lucky. I shall have to scrap part of it, but the rest will come in again. I see what's the matter now."

"We will leave him," said the Ghost; "he is, indeed, a capable mechanic, but it is not given to any one man to know all things."

They journeyed from place to place, visiting a remarkable variety of people engaged in some kind of mechanical or scientific work, many of them regarding it purely as a recreation, others as a means to an instructive purpose, or to serve eventually as monetary profit. One was engaged in teaching, and was making models of engines so that he could instruct his students to better advantage than with diagrams. Another was an apprentice making a model valve gear, so that he could study its operation at leisure. At one house was an enthusiastic clerk, obliged to have his work bench and tools in his bedroom, spending his leisure in practising turning and filing, in the hope that he might some day be able to leave his office stool and become a professional mechanic; others were in remote parts of the world, away from civilisation, but finding life agreeable in the pursuit of their hobby, even under difficulties. The Ghost was well acquainted with all—smoothing their troubles, curiously appearing to become more vigorous than ever with each effort, instead of being fatigued.

They visited lakes and harbours, where groups of amateur yachtsmen, young and old, were sailing model boats or running steamers. The Ghost knew them and continued his work of assistance: things always seemed to improve during his presence, and his energy to receive a new impetus. Then they visited a large room filled with a crowd of young men, who were discussing the merits of various pieces of models or tools; some were engaged in running model steam engines and electric motors; others argued questions with the aid of sketches and diagrams. It was evidently a Society of some kind. Again the Ghost exerted his influence and received a tremendous addition to his store of energy. He was enjoying himself hugely, and smiled with great good-humour and satisfaction.


"THERE IS SOMETHING WRONG," HE REMARKED.

"Remember this," he remarked to his companion, "it is one of the ways by which you may obtain knowledge and happiness; mark it well. I have more to show."

"That which you have seen," said the Ghost, "is the Present — it indicates the work which I am constantly engaged with, but I can reveal to you that which has gone before. You shall now take a lesson from the Past."

The Earth sank from them, and they seemed to rise through the air towards the stars. Higher and higher they went, until a vast gloom obliterated all idea of distance or objects. Slowly, however, a distinctness came over the scene, and they were standing in an immense, brilliantly lighted building, through which passed to and fro numbers of spiritual shapes of human resemblance but ethereal in substance. These shapes all possessed a dignified, but contented and benevolent manner. They were evidently persons of great importance, as a countless number of small ethereal shapes jostled around them, as if they would wait upon them and minister to their desires.

In the presence of the Great Ones the Ghost's manner became very respectful. "This is the Hall of Shades," he remarked to George in a low voice. "Here are gathered the spirits of the renowned engineers and inventors of the past. There is Watt—there, Trevithick—there, the two Brunels, with Nasymth, Whitworth, Arkwright, Jacquard. I could mention many others and tell you what they have done. Notice the lesser spirits who wait upon them—they are some of the millions who have benefited by the labours of these men." He pointed to a window at one part of the Hall, and George saw through it an immense vista of machinery and structures—engines, bridges, guns, ships, cranes. There seemed no end to it.

At another part of the Hall the flooring was slightly raised, and the lighting there seemed to be of a delightfully soft, restful character. Other spirits of somewhat different appearance moved about, exchanging conversation amongst themselves: they all had gentle and reposeful expressions. The lesser spirits crowded about them, also eagerly indicating their desires to serve their wishes. George noticed that the Great Spirits from the other part of the Hall were very deferential in their manner towards these gentle ones, paying much respect and consideration to them.

"These are the spirits of great inventors and workers of the past," observed the Ghost, "but they laboured in obscurity and died in poverty—many unknown. Their struggles are over, and they have happiness knowing that their work has

"This is the Hall of Shades," he remarked . . . . in a low voice.

promoted the well-being of others. Behold now the Future."

In a moment the scene changed, and George discovered that they were standing in a hall of smaller dimensions, also brilliantly lit, and crowded with people of all ages. Soft music filled the air, but a great battle seemed to be in progress. The people crowded and surged around many small enclosures, which contained lathes and other tools, books, engines, models, and similar things. Each enclosure had defenders, but they did not appear able to prevent the attackers from seizing and carrying away the contents. The attackers charged resolutely in solid masses, each one capturing something which he appeared to desire and to be determined to obtain, and which he carried off with much gratification.

"Let us help the defenders," said George, turning towards the Ghost. "This is a monstrous thing." But to his astonishment the Ghost was rapidly flitting in all directions amongst the crowd, touching everybody.

"Do you not see how happy they all are," said a voice by his side. "I am still with you, but you are looking at my reflection, and therefore thought I had gone. Observe that the attackers compensate the defenders, and each one is satisfied."

George looked again, and, lo! each enclosure contained piles of golden sovereigns.

"This," said the Ghost, "is a Model Engineer Exhibition; but we need not wait, I shall bring you to it again."

The sounds of music now changed to the pleasant murmur of young voices, and instead of the crowds of people, George beheld a great concourse of children. They were spread over a large plain, which looked like a world of itself. Each child was busily engaged in pulling to pieces various kinds of toys, and all were radiantly happy.

Monkeys on sticks, wood and tin engines and carriages, boats, clockwork mice, tops, stuffed animals, really good model engines and boilers of substantial construction, clocks, watches, telescopes, railways, cranes—every description of toy was undergoing a process of destruction.

"What a waste," said George.

"Not at all," rejoined the Ghost, his face absolutely beaming upon the children. "Behold a race of experimental philosophers; they are teaching themselves by the sure method of experiment. Do not rebuke them—rather, learn from them; they do not know me yet." And passing amongst the children, he touched some of them, who immediately commenced to reconstruct their toys or to make new ones of strange shape from the parts of several.

"We shall see them again," said the Ghost. "I love them—they have enthusiasm."

"I understand," said George; "but may we now return. I long to do some work with my tools."

"As you will," said the Ghost; and darkness closed around them once more.

III.—The Apparition Explains.

George sat thinking for some minutes; the proceedings of the evening had been so extraordinary that he could scarcely believe it to be true, yet he fully realised its great significance to himself. Only an hour or two ago he was a puzzled novice, with apparently a world of troubles in front of him, like the little bear; now he had found a guide to steer him through his difficulties and was already equipped with knowledge which would enable him to start his work confidently.

The ghost stood in the same place where he had first appeared and regarded George with a pleasant smile on his jovial face.

"Tell me, who are you?" said George, "to take this interest in one unknown to you."

"I am the spirit of The Model Engineer," said the Ghost. "I exist to help and encourage all those who have pleasure in doing mechanical work as a hobby; I strive to abolish discord and unworthy jealousy; my endeavour is to promote harmony and good feeling in all who seek me and who have felt my touch. Neither age nor station need prevent any from asking a share of my advice. My desire is the happiness of all, friendly and worthy rivalry, knowledge of that which is good; hope, charity, generosity, amongst the workers in this recreation."

"And what do you require from me in return," asked George, his mind suddenly picturing parchment deeds signed in human blood.

"Gratitude," said the Ghost somewhat discursively, assuming a serious and judicial manner, "has been defined as a lively anticipation of favours to come."

"AND WHAT DO YOU REQUIRE OF ME IN RETURN?"

"Oh, no," said George, "I am not so bad as that."

"The Court does not apply the definition to you in particular," continued the Ghost with a curious departure from personality and with increasing Judge-like appearance. "It is the kind of gratitude we are used to; in fact, we like it, and shall expect you to regard it in this way, though we appreciate and cherish the kind which says 'Thank you' and means it. You can prove your gratitude by telling others of my existence and in sharing your experience and knowledge with those whom it may benefit. In doing this you will increase my power to help your own self as it derives its vigour from the direction in which it is expended. Kind of regenerative action," he remarked, with a chuckle, re-assuming his engineer-like manner.

"One thing more," said George, anxious to seize the opportunity. "Wonderful Spirit, tell me the secret of perpetual motion."

At these words the Ghost became very agitated. "Oh! foolish mortal, you also wish to solve the unsolvable, but I am henceforth your guide, and with pity for your inexperience deride not your request. Here, then, is the secret of perpetual motion." Saying this he took from a pocket a sheet of paper and writing a few words upon it, folded it up and tossed it into George's lap. Then quickly lighting another cigar and puffing at it furiously, he addressed him with vehement gesticulations. "You shall see perpetual motion. I am perpetual motion!!! I am a fourth dimension. I am a hyperbola. I spread wider and wider for ever into space. I am a billion to the millionth power. I am a turbo-rotator." At these words he commenced to revolve like a gigantic Catherine wheel, the cigar becoming a fiery luminous ring. Round and round spun the wheel with ever increasing velocity, but instead of spreading and throwing off showers of sparks as it ought to have done, according to the long-established custom of such fireworks, it gradually became smaller, shrinking and shrinking until it became a little circle of light with a pale moon-like centre.

Bang, bang, bang, bang. Good gracious, what was that din in his ears. *Click, click, click, click.* Why that's the clock. Where was the Ghost and the Catherine wheel? Gone, and there he was sitting in his chair with the clock staring him in the face! Ha, ha! how very funny. He had imagined the brass edge of the clock to be the Ghost's cigar.

Ding dong, ding dong; goodwill, goodwill to all, to all. Hark! the sound of bells across the snow. It must be Christmas morning. Had he been asleep—but the Ghost—and what was this in his lap—the paper with the secret of perpetual motion on it. How had it come there if there were no Ghost? He had that, at all events. He tremblingly lifted the paper—a telegram, just a common telegram.

"Victoria Docks, six thirty. Fog on river. Late coming in. Lost train. Be with you midnight.—Jack."

His old friend and schoolmate, Jack Clifton. He had not seen him since the time when Jack had left the Clyde to start as fourth engineer on the *Kangaroo* bound for the South, and now he was going to spend Christmas with them. What a time they would have, not all fun, they really would have to spend one afternoon at least with the tools, and he would get a few wrinkles about using them from a real live engineer; not a crack-brained old Ghost. Ha! ha! what a joke it was, and yet it was very strange. How did the telegram come there?

GOOD GRACIOUS! WHAT WAS THAT DIN IN HIS EARS. . . WHERE WAS THE GHOST?

"Hullo, George; are you going to stay up there all night?" shouted a hearty voice.

"Why, that's Jack, or I'm a Dutchman."

"Hullo, old man, merry Christmas!" and down the stairs three at a time went George. "Here you are at last," and he was shaking hands with a bronzed young giant who looked "sea-going" from top to toe.

"You *are* a beauty, grubbing amongst a lot of old tools and scrap on Christmas Eve," said the man of spanners and oilcans, "leaving your sister to dent her pretty fingers trying to nail up the holly. If you had seen as much of hammers and files as I have this last voyage you wouldn't want to see any tools for a day or two. Our thrust started a crack when we were four days out in the thick of dirty weather, and old Sam, our chief, had us up night and day; but there, you don't want the yarn now. What's the matter? You look as if you had seen a ghost."

"Well, I'm not so sure that I haven't seen one, and a most extraordinary chap he was," said George; "and look at this," holding up the telegram, "I should like to know how that materialised on to my lap without anyone being visible. I did not see it come except by a ghost."

"You dear silly of a boy," said May, looking at the "sea-going" one out of the corners of her eyes all the time, "I brought it up to you directly it came and you were fast asleep in your chair, so tired, I hadn't the heart to wake you up."

"I know all about that," retorted George; "you wanted to open the door to Jack yourself—that's why you were so anxious for me to clear away my box from under the mistletoe, was it, Miss?"

"Both of you go straight off and have some supper at once; it is all ready in the dining-room and I'm sure you must want it," said May, not waiting to argue the matter. "Good-night; mind you don't stay up too late yarning, as you call it, and be down in time for breakfast. I'll hear all about your ghost by daylight, please."

* * * * * *

"Well," said Jack Clifton about an hour later, as he drew his chair to the fire and prepared that which he was pleased to call "his last pipe,"—"It is a strange story, but you have certainly been touched by the Spirit of THE MODEL ENGINEER." "I know it well," he continued, reflectively, pulling and puffing at his pipe in the "sea-going" manner, "and so does Jim Watson, our second; clever chap though he is, he'd tell you so if he was here. You should see the lovely little set of 'triples' he has made; keeps 'em under a glass case in his cabin, and the lady visitors—the young ones, I mean—say 'what a darling little steam engine' when they see it. And old man Sam knows it, too, though he doesn't say much. What did he borrow my last volume for—at least, it disappeared from my cabin and was found lying on his bunk: how was it his table fan went all right afterwards and wouldn't go before? Old Sam knows no more about electricity than a cat; so does the superintendent. 'What's this?' he says, picking up a number from my table, 'just the thing for my boy.' Funny, isn't it, he always comes in to see me since then when we are in port and he's aboard. Asks me how I'm getting along; and now I am to go and see his workshop. He wants me to see his models. He's quite an enthusiast about them, like a schoolboy. Yes, George, you know the Spirit of THE MODEL ENGINEER now; it's true, it goes to queer places, at home and abroad. I have heard about your new present. Remember what the Spirit has said to you, and you will always find him in your workshop and your work. He will help you to turn out something to be proud of, and you will enjoy your hobby all the better for knowing him. There, I'm getting prosy, old chap; this is the time to be jolly. You didn't ask me for a lecture. And yet the idea of ghosts makes me thoughtful. I remember the phantom liner, but that's a yarn for another day. Of course, these things are all easily explained. You had been reading that copy of THE MODEL ENGINEER which I sent to you, and reading about Nasmyth. You were excited about your new tools and went to sleep looking at the clock. The rest can be guessed."

"Yes," said George, "and I had been letting off fireworks last November. Of course it was a dream, but a very pleasant one for all that. Still, as you say, old fellow, there is something real in it. I am going to stick to that Spirit now I've found him."

"That's right. My word, it's two o'clock! quite time we turned in. No engine room watch for me to-night, thank the stars."

"Good night, old fellow."

"Good night, Jack."

As George laid his head on the pillow his thoughts strayed back to the strange adventure that night. "The Spirit of THE MODEL ENGINEER," he murmured sleepily. And the sound of the bells again came through the air—goodwill, goodwill, to all, to all.

[END.]

The M.E. "Wants" Competition.

Paints and Transfers for Model Locomotives.

(*Awarded First Prize.*)

Your announcement in the November 5th issue has led me to think of two "wants," which would undoubtedly be of good service to modellers. It matters not what particular line of model is made, it is always spoilt in the painting and lining. A model that is really well made is sometimes marred of its attractions through this. A paint could be made, packed up in convenient-size tins, that would stand great heat and not blister, unlike the paints on sale now. Even enamel will blister and, besides, it lacks in body. A paint combining the advantages of the aforesaid could be used much thinner, easier to use, and freer than enamel, and made by any firm that manufacture strong varnishes. And now we will come to the lining. We will take the locomotive for an example. How handsome it looks when an expert has lined it! But it is quite possible for the amateur to do the same, only not with the lining pencil. I suggest that the skilled mechanic can be replaced by the transfer. What a tedious and difficult job to line out the boiler shell, let alone the other parts, but with a little patience it can be easily done by the use of transfers! They are used to the present day, in real live work in some of our large tramway workshops, only, of course, on a larger scale. Scrolls, numbers, letters, and lines of all thicknesses in gold and colour are applied in this manner, and a little thought and care, and also patience, brings the reward. Now, surely those firms that make transfers would, if approached, cater for our wants, just the same as the engineering firms cater for us now. I am quite sure there would be a healthy response, if it were put on the market. And now, Sir, I hope I have made my letter reveal two of the many wants that no doubt do exist.—ALBERT LUSCOMBE. (*Awarded Prize of £1 1s.*)

OTHER READERS' "WANTS."

Portable Air-Compressor.—One want not supplied by the modelling firms may be mentioned, viz., a portable air-compressor. Owners of model steam-engines, locomotives, and turbines often refrain from experimenting with or exhibiting them working to their friends for a short while, on account of the trouble and mess before and after getting up steam. The advantages of compressed air over steam are clearly shown at Kensington Museum, or our local industrial exhibitions. Now a compressor with vertical cylinder about 3 ins. diameter, and 6 ins. or 8 ins. stroke, single acting, worked by hand lever up to 25 lbs. pressure, with a fair-sized receiver attached, would appeal to many enthusiasts.

Smith's Tools.—The following tools I have found the trade unable to supply recently, unless they are made specially, viz.: blacksmiths' tools, suitable for model work, such as tongs (various), anvil tools, comprising various sizes of setts, swages, pullers, and all necessary tools, &c. Small 75-lb. anvils appear to have standard size holes in faces, but tools are not made to fit. The nearest I could obtain were for anvils of 2 and 3 cwts., which are of no use for model forging work.

Lathe Steady.—Another item regarding a steady for a lathe. The usual ones that are supplied I consider are worthless, the time taken to fit blocks of wood and metal on that to save wear being longer than that to do the complete job. These obsolete rests are still supplied with the latest lathes. Now, if makers wake up and supply similar ones to those supplied with American lathes, with three adjustable jaws and a single casting with a finger for travelling with the saddle—I am sure if the makers supplied castings for making these, or the finished articles, say, for lathes 3 ins. to 4 ins. centres they would have a ready sale.

Small Grooved Pulleys.—There is one thing at the moment I require which I do not find obtainable from stock, and that is a V-groove pulley of about 2 ins. diameter. This is really a "*small* engineer's" want, but there must be many readers who are making up experimental machine tools, where either a small grooved or flat pulley is wanted. I think a range of these, running from, say, 1½ ins. to 3 ins. or 4 ins. diameter would be very saleable. The bosses could be so made that there would be plenty of metal for a good range of bores to each size. As a V-groove pulley entails a fair amount of machining, if the groove is turned, they might possibly be cheaply pressed out of mild steel.

Small Scale Tank Locomotives.—Speaking of the trade supply houses, although ready-made working model locomotives have been greatly cheapened (½ in. scale), and the partly machined sets have been a great boon to many amateurs (thanks be to Messrs. Carson & Co., of Birmingham), there are still a great number of model engineers in want. I speak of those who are considerably handicapped for want of space, and there are many who are obliged to be content with a spare room to run their models, judging by the number of queries that appear almost every week in THE MODEL ENGINEER. To such as these, express engines or tank engines of fairly long wheelbase that require fairly large curves, are out of it altogether. In looking through the many catalogues which I have by me, I fail to find anything in the nature of, say, a ½ in. scale tank engine of reasonably small wheelbase of, say the 0—4—0 or 2—4—0 type, either in the rough castings or in the finished article. What is really wanted by the model engineer, who must necessarily be content with small curves of, say, 4 ft. to 5 ft. radius, is a tank locomotive (not less than ½ in. scale) with as large a boiler as possible to hold sufficient water for a fairly lengthy run, and to steam continuously so that shunting may be done, etc. (See Mr. Greenly's advice in "The Model Locomotive," page 18.) The construction of such tank engines need only be quite simple, such, for instance, as the 6-wheeled tank locomotive built by Mr. Smithies, and described in THE MODEL ENGINEER, of April 15th, 1901, which is said to have held sufficient water in boiler for a run of 1½ hours continuously.

Such an engine, or similar, could be supplied by the trade very cheaply, and I feel sure would command a ready sale, especially among model engineers who are compelled to adopt short radius curves, and those with limited means. Of course, the 2-in. gauge models, to a certain extent, meet this want; but this size model looks too much of the toy variety and there is also the trouble of refilling every few minutes, owing to the smallness of the boiler. I should therefore not advise an engine under a scale of ½ in. to the foot: gauge 2½ ins. Such engines need not be a scale reproduction of any particular engine or railway, but a sort of nondescript, consistent with a fairly good modern appearance, and reasonably cheap, but must be inside fired, in case anyone should require it to be run out of doors. I feel sure if some firm in the trade could supply such an engine, either in the complete sets of castings or the finished article, they would be filling the long-felt want of the model engineer who is compelled to be content with small radius curves of 4 ft. or thereabouts.

Small Piping.—My greatest trouble in model-making has been to obtain small tubing (copper and brass). Many dodges have appeared in "Ours" for getting over the difficulty when a short piece has been required, and I may say I have resorted to the robbing of cheap German toy engines to get the small piping, which I could never procure in this country. Perhaps Mr. Bassett-Lowke did not notice such, when doing the round of the Nuremberg toy factories, for I believe if it were stocked there would be a ready sale for it. I also want very light brass tube, suitable for marine condensers.

Copper Rivets.—Many of your advertisers stock rivets, yet nothing longer than half an inch at an eighth diameter. Now, the bottom ring of a boiler, if there is anything like a water space at all, demands longer than this, yet I have never found them obtainable.

Brazing Lamps are numerous, many giving enough flame to melt a delicate job. I have yet to find one with a fine fierce flame.

Vacuum Gauge.—Requiring one, I searched in vain.

Small Ignition Plugs, suitable for small petrol motors.

Engine Castings are numerous, and many splendid designs of locomotives have appeared in THE MODEL ENGINEER. Sets of many are procurable, also good plates of the leading companies' engines, and here, in conclusion, I put the plea for the present-day triple expansion, which I think is neglected. The ocean-going steamships contain some of the finest examples of engineering.

Rolling-stock Parts.—In giving my experience on model engineers' wants, I feel I have the sympathy of a large number of your readers, who have experienced the same difficulty. I refer to the difficulty in obtaining materials for building model railway stock. After the splendid series of articles recently appearing in THE MODEL ENGINEER, I am sure a great many of your readers wished that some of the principal parts required to construct some of the designs could have been purchased from some of the firms who specialise in model work. For myself, I have always had the desire to have some rolling-stock built to scale from the Railway Clearing House specifications. This may be an expensive item seeing so many designs would be wanted for a model railway, but it would be worth the trouble and cost to the owner when complete. It may surprise some to know that to construct such models the cost would probably be £5 or £6, or even more, according to the work put on them—a large sum, no doubt, but it is so. I find the most difficult parts to get are materials for building up wheels, proper cored axle-boxes and bolts. These are the chief items. Referring to the axle-boxes, I had my own patterns several years, and had great difficulty in getting proper castings. I tried several firms, but they could not make a satisfactory job for me, so I took on the job myself, and cast them from old composition pipe. These were much better than those I had cast in metal. Then there are buffer-rams. These are very hard to make if made properly (*i.e.*, solid head and spindle) and take a lot of forging which cannot be done in the kitchen fire—usually the only fire some model-makers have access to. Spring steel of the proper section is very hard to get, but by far the most expensive item is bolts and nuts. One would think that, with so many firms making this one of their specialities, bolts and nuts would be cheap enough and easy to get, but it is not so. Bolts and nuts, for this class of work, have usually to be specially made, and unless you can buy a large quantity they are very expensive. It would certainly be a great benefit to your readers if some of the leading firms would take up this class of work and supply the materials for rolling-stock models. This would certainly tend to open up a new branch of model work, and encourage the fitting-up of model and small scale railways.

(*⁎* *Further "Wants" will be dealt with in a subsequent issue.*)

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily for publication.]*

Starting G.W.R. Locomotives.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Referring to Messrs. Rolph's and Bond's letters about the G.W.R. locomotives refusing to start, I notice that neither of these gentlemen make any remark about the cylinder drains being opened. On the line where I was employed, if a locomotive refused to start—which was not an unusual occurrence on the suburban trains—the driver would open the cylinder cocks first, and this usually got them away. If it did not, then reversing was resorted to; but I never before heard of an express passenger engine having to be "pushed off" with only five coaches. Any locomotive may refuse to start with water in the cylinders, however.

Another of your correspondents called attention to a taxicab wheel, which appeared to suddenly reverse its motion. As a matter of fact, there was no illusion due to light on the spokes or anything else. The "obviously impossible" actually happened," as it does scores of times every day. I will endeavour to explain. On a number of London taxicabs the driver's foot-brake acts upon the gear-shaft. The drive to the rear wheels is through a differential gear. Now suppose the back of the cab is jacked up, leaving the wheels free to revolve, and the engine started. Both wheels will revolve at the same speed. Now stop the engine, fix one back wheel so that it cannot move, and start up again, and it will be found that the other back wheel will revolve *twice* as fast, owing to the action of the differential gear. Now stop the engine again and turn one of the back wheels by hand whilst the engine is stationary, and the other back wheel will revolve in the *opposite direction*, due to the action of the differential gear.

What happened to the cab your correspondent saw was this: the driver suddenly applied his brake too hard. Had the friction between the two back wheels and the roadway been equal, both back wheels would instantly have become locked and commenced to slide along the ground; but if a taxicab's back wheels be examined, it will be found that one of them is provided with several rows of steel studs or some other form of non-skid, in compliance with the police regulations. Your correspondent says the road was dry, therefore the plain-tyred wheel had the most "grip" on the road; had the road been greasy or wet, the non-skid wheel would have gripped hardest. Well, on the driver slipping out his clutch and applying his foot-brake, evidently putting it too hard on, the gear-shaft and propeller (or cardan) shaft *became locked*. As the wheels had unequal gripping power or adhesion, owing to the non-skid, that one which had the greater refused to stop, and overcoming the lesser grip of the other wheel, turned it backwards by means of the differential gear. The speed of the cab would be diminished very little until the driver released the brake and applied it a little more gently.

I am afraid my explanation is rather crudely put, but the same thing has happened to cars I have been driving, and I can vouch for its accuracy —Faithfully yours, L. L.

Slipping Driving Wheels.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I notice a gentleman signing himself " R. L. Amoore " mentions the slipping of a motor-car's driving wheels. This is quite a common occurrence, and is due to the differential gear.

If your correspondent understands this gear, he will know that so long as both wheels revolve at the same rate all is well, but if, for any reason, one wheel slips slightly, either forward or backward, probably due to a binding brake-band or to one wheel running upon a patch of slippery ground, and slipping because of the drive of the engine, then the other wheel at once revolves backwards. This may be seen by watching a car starting or stopping in the gutter, where one wheel is biting and the other not.—Yours faithfully, " CYCLIST."

To THE EDITOR OF *The Model Engineer.*

DEAR SIR.—Although my experience of locomotives only amounts to a little model work, I may perhaps be allowed to offer a suggestion *re* the slipping of locomotive and cycle wheels. I have often observed the seeming change in the direction of rotation of motor-car wheels, mentioned by Mr. R. L. Amoore in your issue of Nov. 26th, but while thinking with him that it is merely an optical delusion, I cannot agree that it is caused by " some effect of the light shining on the spokes."

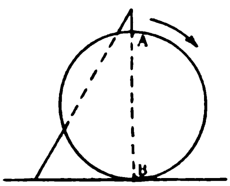


FIG. 1.

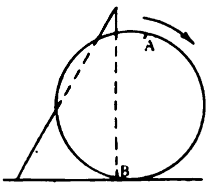


FIG. 2.

I will give what seems to be a more feasible explanation.

It may not be generally known that the upper half of a wheel rolling in contact with a flat surface moves faster than the lower part. However impossible this may seem, it may be easily demonstrated as follows: Take a circular disc of cardboard, and on its circumference mark two diametrically opposite points A and B. Now place a set-square on edge upon a horizontal surface, and against it place the disc, so that the line joining the points A B shall coincide with the vertical side of the square. The rough sketch (Fig. 1) will explain my meaning. If the disc be now rolled forward, it will assume a position as in Fig. 2, showing conclusively that in the same space of time the point A has travelled a greater distance than point B. Hence its speed must have been proportionately higher.

Now, Sir, in the case of the motor-car, if the wheel be suddenly checked by the application of the brake, the normal conditions are almost reversed. In other words, the speed of the upper part of the wheel is diminished and that of the lower part is accelerated (in the direction in which the car is moving). In my humble opinion this is what creates the impression of backward rotation. Even if, as Mr. Amoore states, the car " did not slacken its speed," it does not necessarily follow that " the brakes " were not applied," for if they were applied, and instantly released, the effect would be the momentary locking of the wheel, without any perceptible diminution in the speed of the car.

Whether a similar theory could be applied to the locomotive slip I cannot say, but unless your correspondent's assertions are based upon something more reliable than " appearances," the idea may at least be deemed worthy of consideration.—Thanking you in anticipation, I am, Sir, yours faithfully
A. W. LUDLOW DORE.

The Kite Flying Association of Great Britain.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—As a result of the Kite Flying Exhibition, held at Wimbledon on September 12th, it has been decided to form an association (both amateurs and professionals to be eligible) under the above title, subject to the approval of the meeting, for the purpose of creating more interest among kite flyers.

A meeting will be held shortly to consider the whole subject, elect president, advisory council, etc., but in the meantime it will be a source of much satisfaction to me if you will favour me with any suggestions *re* its formation, and also the names of any gentlemen who would like to become members. The keen interest which has already been shown in the association since the inception of the idea is a splendid augury for its ultimate success. The subject of kites, with which aeroplanes are so closely allied, is one of universal, and almost supreme importance and interest, as there is no doubt that it is the recent amazing advance in the construction of the kite that has made the aeroplane a practical possibility.

There is hardly a matter upon which more inventive energy is being expended just now, both by professionals and amateurs. The field is absolutely open, as the ideal form of flight is a thing in which fancy has still, as one might say, a free hand. Above all, though it is not everyone who has the time and money to construct full size aeroplanes (if they have, I advise them to join the Aeronautical Society, which caters for this), the devising and making of kites is a delightful hobby for anyone; it involves the most healthful exercise possible, and there is always the chance that it may lead to the one perfect invention that everyone is waiting for. This will in no way be an attempt to rival the Aero Club or Aeronautical Society, but I hope it will supply recruits to them from time to time, as this will be a Kite Flying Association only. I shall be pleased to receive the names of prospective members and any suggestions.—I remain, yours faithfully,

27, Victory Road, Wimbledon, S.W. W. H. AKEHURST.

[An interesting article on " Kites " will appear in our issue of Jan. 7, 1909.—ED., *M.E. & E.*]

The Society of Model Engineers.

Provincial Societies.

Birmingham.—The monthly meeting of this Society was held at 6, High Street, Birmingham, on Wednesday, December 2nd. A fairly good attendance of members was recorded, despite the fact of a heavy fog which overhung the city. Some very interesting work was shown round, including a very nicely-finished model of a vertical engine made by Mr. Gooch; portions of locomotive being built by Mr. A. J. Perks; and also some parts of locomotives made by Messrs. J. Carson & Co., Ltd., and kindly sent by Mr. J. Carson for inspection.

FUTURE MEETINGS.—The next meeting will be held on Wednesday, January 6th, 1909, at 6, High Street, Birmingham, at 7.30 p.m. Members who are at present engaged on models, &c., are requested to bring their work to the meeting, if convenient; also any finished models they may have. Mr. C. A. Reynolds, of Sparkhill, has kindly promised to exhibit his model of perpetual motion device. Also details of future visits to various engineering works in the neighbourhood will be announced.—All information concerning the Society can be had from the Secretary, C. H. HAWKESFORD, 3, Boscombe Road, Greet Hill, Birmingham.

Bradford.—A meeting of this Society was held on Monday night, December 7th, in the smoke-room at the Midland Dining Rooms, Foster Square. Mr. Hollins brought a model Daimler motor-car made in cardboard. A great amount of curiosity was aroused by this model, and everyone present was delighted with it. It has been decided that we hold an Exhibition of Models at Mr. Hepworth's (tailor), Kirkgate, during Christmas. Readers of THE MODEL ENGINEER in Bradford and district will have an opportunity of seeing a good show of models for about a fortnight.—Further particulars to be had from A. BARBER, Hon. Sec., 15, Harrington Terrace, Lidget Green, Bradford.

Sheffield.—With reference to the paragraph *re* the proposed Sheffield Society inserted some time ago, readers will, no doubt, be interested to know that a Society has been successfully formed, and meetings are now in full swing. So far we have 14 members, but I am of the opinion that there must be a considerable number of model engineers in this town, only they want finding. Meetings are held on the second and fourth Wednesdays in the month at Wentworth Café, Pinstone Street, and the subscription is 5s. per annum.—JOSEPH A. WOOD, Hon. Secretary, 133, Hill Street, Sheffield.

The Junior Institution of Engineers.

WITH the permission of Mr. Selfridge, the members of this Institution were recently enabled to visit the Selfridge Store Building in course of erection at 410, Oxford Street, London. They were shown over by the architect, Mr. R. Frank Atkinson, F.R.I.B.A., and Mr. S. Bylander (Member of Council), chief engineer to the contractors, Messrs. Waring and White (1906), Ltd. At the conclusion afternoon tea was provided, and before the party dispersed their acknowledgments for all that had been done for their reception was expressed by Mr. Geo. T. Bullock (vice-chairman).

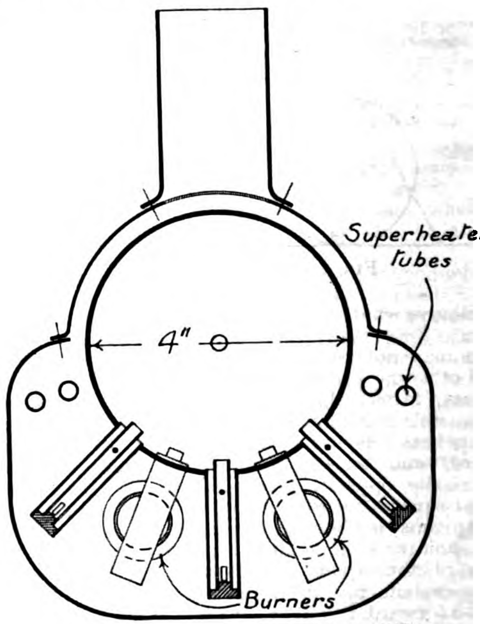
Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[17,562] **Steamer Machinery.** J. A. F. (Barry) writes: I am building a boat 6 ft. 6 ins. long, 10 ins. beam, and 8 ins. deep 'midships; she is of rather powerful lines, but should be fast. I enclose sketch of boiler I intend to make; kindly give number of tubes, brass or copper, total length of drum, diameter, etc. I propose firing with three Vesuvius burners, as they are easier to get at than Primus. Please give size of compound engine to drive single screw about 5½ ins., also size of double-cylinder high-pressure engine, cranks at right angles. Could I work boiler at 120 lbs. per sq. in.? Where could I get patterns for cylinders, etc., made, also who will cast them in cast iron? Stuart Turner informs me that they do not cast from customers' patterns. How are field-tubes fixed into drum? Would they do screwed in only? Could I silver-solder or braze with a Vesuvius burner?



Query. 17562.

As you intend to work the boiler at 120 lbs. per sq. in., you should find Stuart Turner's ⅝-in. by 1¼-in. by ⅞-in. compound engine suit the boat very well. It may be possible to bore out the cylinders to 13-16ths in. by 15-16ths in. Write to this firm for particulars and prices. We believe the cylinders are supplied in cast iron. It is exceedingly troublesome for a manufacturer to obtain a single casting in iron. We recommend a benzoline burner in place of the Vesuvius paraffin burner. The former will give a larger flame, and we think that a single large burner (in any case, only two) would do better than the three you propose using. We note with pleasure that you have provided a large steam drum. Add a superheater, as marked on your sketch. See that the material of the boiler tube is sufficiently thick to allow for that cut away for the "Field" tubes. Sercw the latter tubes into the shell with a fine taper thread.

[20,659] **Model Steam Engines and Boilers.** V. B. F. (Westbury) writes: A model undertype engine, with two equal sized cylinders 1½-in. stroke by ¾-in. bore, is to run up to 500 r.p.m.; boiler pressure to be 25 lbs. per sq. in. (1) How many square inches of heating surface should be provided? (2) What is the most suitable size for the firetubes? (3) What is the cleanest and most convenient way of firing? (4) Please give formula used for arriving at amount of heating surface required for a model engine of a given size and speed and boiler pressure.

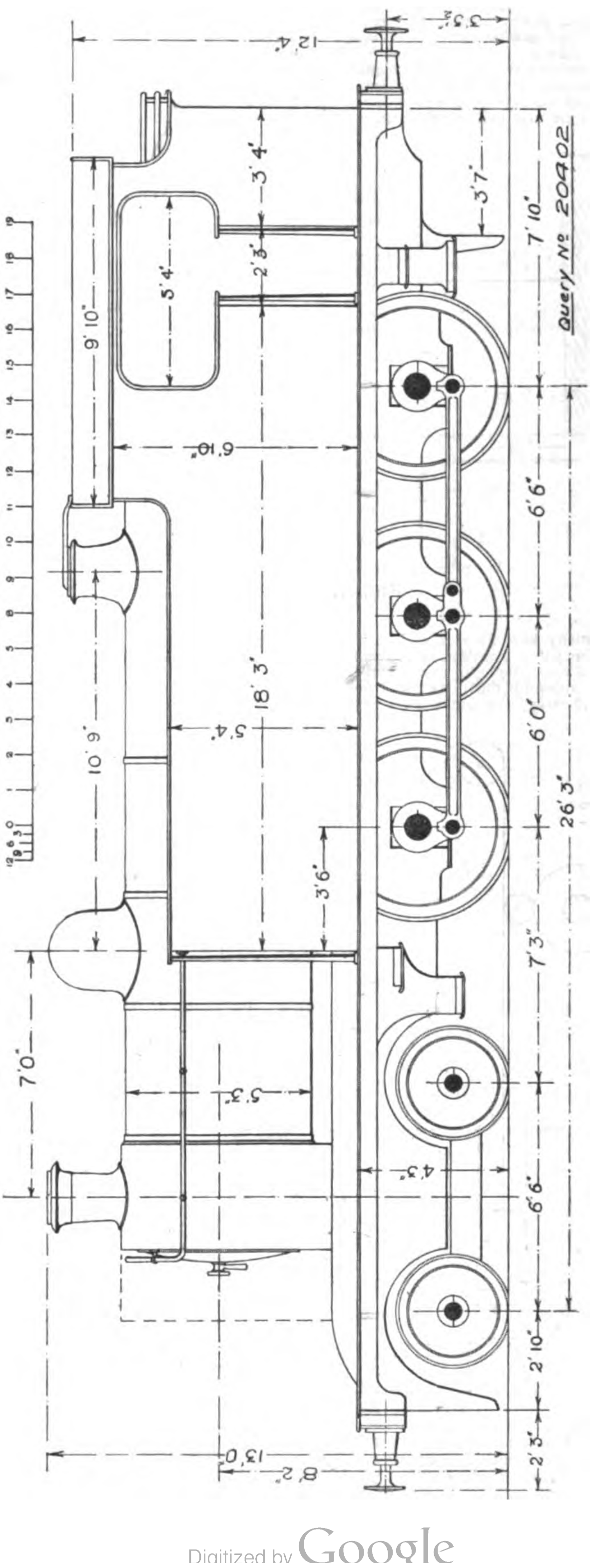
(1) We should not provide less than 150 sq. ins. of heating surface; 200 sq. ins. would be better. (2) 7-16ths in. or ⅜ in. diameter if the tubes are thin. (3) "Primus burner. Silent pattern No. 5, 3 ins. diameter. (4) Please refer to "The Model Locomotive," by H. Greenly, more particularly the chapter on boiler design.

[20,402] **N.E.R. 4—6—0 Tank Locomotives.** C. W. A. (Leeds) writes: I want to make a ½-in. scale model of No. 695, North-Eastern six-coupled bogie tank locomotive, and would be very gratified if you would oblige me with dimensions of same. If possible, would you send me a sketch of the engine?

We append a scale drawing of tank locomotive No. 695, on the North-Eastern Railway, and would point out that some of these engines have smokeboxes extended as shown by the dotted lines in sketch. These engines should make good models and be fairly flexible in the wheelbase, in spite of the six-coupled wheels, owing to the use of small bogie wheels. The driving wheels are 5 ft. 1 in. diameter, and the bogie wheels 3 ft. 1½ ins. The type of locomotive is not altogether suitable for a coal-burning model, owing to the use of the shallow grate.

[20,797] **Transforming and Rectifying.** W. B. (Watford) writes: Our current supply here is 200 volts 50 periods alternating, and I propose to obtain a transformer to transform this current to 25 volts 10 or 12 amps., and wire the house for this voltage, using Osram or other high-efficiency lamps of this pattern. If you will kindly answer these questions in the order given, I shall be obliged. (1) What would be the probable cost of a transformer to transform from 200 volts to 25 volts 10 or 12 amps.—(a) new, (b) second-hand? I do not want a "rotary" transformer, but one that will be stationary, and consequently the current will be alternating. (2) If the primary current to the transformer should be switched on, but lamp or other work is not being performed by the secondary current, can you please say how long it would take to waste one unit of current? From back numbers of THE MODEL ENGINEER I understand that no harm is done to the transformer if the primary current is left on during the time the secondary is idle. (3) Would 18-gauge electric bell wire (india-rubber covered, D.C.C., and paraffined) be suitable for wiring, provided the lamps on each set of wires did not take more than 1·8 amps., and that fuses were inserted at a suitable point to avoid the amps. being exceeded. (4) I should require to charge one or two 4-volt accumulators from the 25-volt alternating current. Would a rectifier, as described on page 303, Vol. XV, of THE MODEL ENGINEER for 1906, answer the purpose; and as the voltage is only one-quarter of that given in the article, would only two cells be necessary, or if it be necessary to have four cells, would it do if the plates were only half the size? (5) How many amp.-hours does one unit consist of, please?

(1) About £4, new. Price second-hand is problematical. (2) Reckon somewhere about 150 hours. This factor varies greatly, according to make and condition of transformer. (3) Yes. (4) Yes. Four cells will be required. Voltage need not be taken into account when deciding upon size of the cells. The amount of current which will be allowed to pass settles the size. We do not think the cells, as described by Mr. Martinetti, would pass much more than the 3 amps. he mentions, without heating. As, probably, you will need this amount of current, we do not advise you to reduce the size of cell. (5) One B.O.T. unit equals 1,000 watt-hours, or 1,000 volt-amp.-hours.



NEW SIX-COUPLED BOGIE TANK ENGINE, NO. 695 CLASS, N.E.R.

[19,626] **Gauging Water Level in Storage Tank.** H. S. (Kentish Town) writes: Will you kindly give me your assistance with the following matter? I have built a brick-lined tank under the roadway of a factory yard for the storage of hot water (temperature, 200 to 212°) for the steam boiler, and as the tank is covered in, we cannot tell how many feet of water it contains at various times of the day. Can a pipe be arranged to be fixed at the bottom and a circular dial gauge be attached to the upper end to show

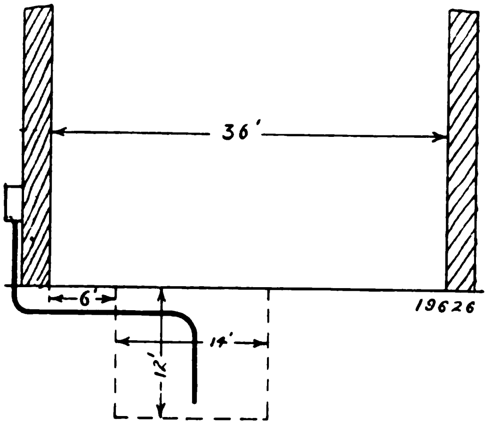


FIG. 1.

how many feet of water, as Fig. 1? I have tried a float and rod, but this will not answer, as it gets furred up, and also gets knocked by the vans passing in and out of the yard.

We append herewith two sketches showing suggestions for device for indicating the water level in tank below ground. In Fig. 2

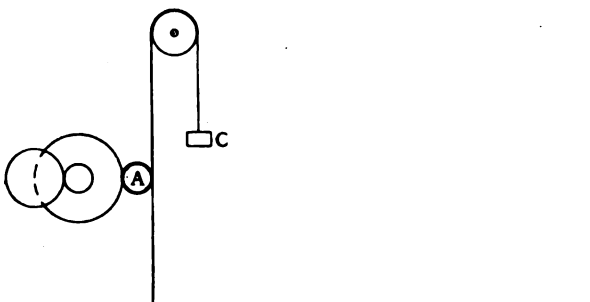


FIG. 2.

a float of fair size is used, and a flexible cord taken from this round a pulley or spindle and over another pulley wheel fixed in some convenient position. To the opposite end of this cord a weight is attached. To the gearwheel A a train of wheels giving suitable reduction is meshed. The action of the indicator will depend upon the difference in weight of the float in and out of the water. Thus, when the level falls, the weight of the float will virtually increase and overcome the weight of counter-balance C. The reverse takes place upon the water rising in the tank. The float is raised and the counter-balance weight acts in a downward

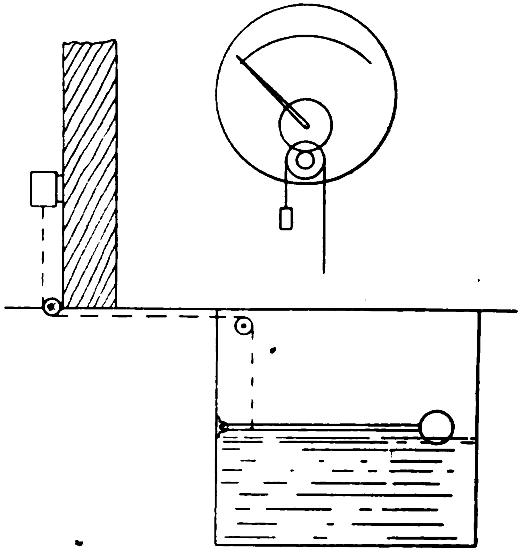


FIG. 3.

direction, so operating the train of wheels moving the indicator pointer. In the sketch (Fig. 3) a more direct method is employed, which needs little explanation. The details of construction can only be settled by personal inspection of the job, but these suggestions may give you at least an idea to work upon.

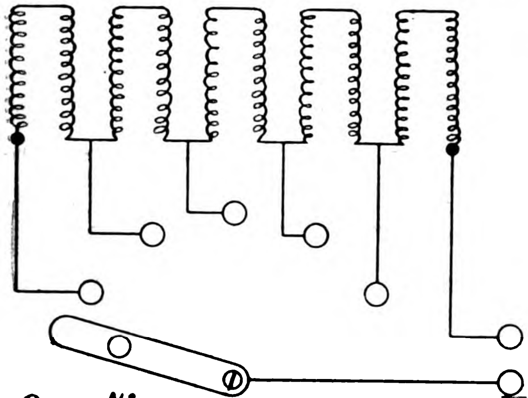
[20,690] **General Queries.** R. S. A. (Ross) writes: I am building a model traction engine (1 in. to foot), with 7½-in. driving and 4½-in. front wheels. (1) Will you kindly describe, with sketches, the best and simplest way of constructing these road wheels, without, if possible, using castings? (2) Where can I get castings and parts for Mr. Greenly's current model? (I cannot wait for his drawing for wheels—apparently it will be months before they are reached!) (3) Where can I get brass or steel of tee and channel section? Could this be bent into 4½-in. circle? I have tried some model firms. (4) Can you refer me to any full and complete article on blowlamps for workshop use? (5) The Drummond firm do not recommend a toolholder for 3½-in. lathe. Can you tell we why, and if you can do so?

(1) We do not think you will obtain castings. Try Stuart Turner, Ltd., as we believe some time ago they took up the method of casting traction engine wheels devised by Mr. J. Barker, and this size may be obtainable. See back issues for notice in our "News of Trade" column. (2) We hear that Messrs. Bassett-Lowke & Co. will be able to supply good castings very shortly. (3) You will have some difficulty in getting a small quantity. Try Messrs. Young's, No. 220, Old Street. (4) There is nothing worthy of note. (5) A matter of choice. English made lathes are not usually designed for a toolholder.

[20,787] **Speedometers.** A. W. E. (Kentish Town) writes: On what principle does a modern speedometer work for motor cycles to register the speed at which you are travelling? I have tried to make one on the governor principle, but cannot get the needle to give sufficient range of movement, as the weight knocks on casing.

Many different forms of speedometer have been devised and there are several now on the market. The method of their construction is usually made the subject of a patent. Many of them work on the centrifugal-governor principle, and this type, being at the same time very simple and very efficient, is perhaps the most suitable for adoption by the model engineer. It is usual to have the governor quite apart from the dial, and to transmit the governor's sliding motion to the pointer by a rod, or, as in an interesting patent of 1906, by the Bowden wire device. This allows the dial-box to be of very small dimensions, since it contains only some very simple gearing mechanism, and also allows the governor to be stowed away in any convenient position. Since your instrument is already made with the governor inside the dial-box, we do not think it necessary to alter it in that respect. You can easily increase the range of the pointer's movement by the use of suitable gearing. Let the governor's sliding ring move a rack gearing with a pinion on the pointer's spindle.

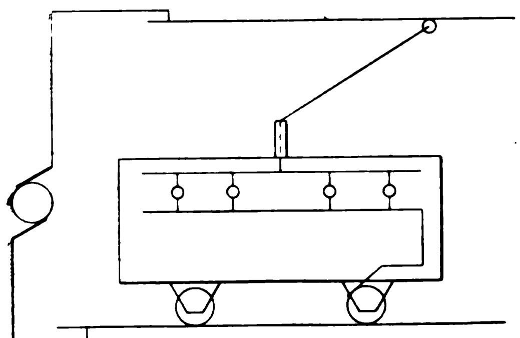
[20,648] **Adjustable Resistance.** J. W. (Middlesbrough) writes: Would you please give me instructions on making a resistance, like that shown in the illustration enclosed (not reproduced), which is to be adjustable for 250-volt circuit, giving 8, 10, 12, 15, and 20 amps., which are what I require for lantern purposes. I want a rough sketch showing how it is connected up and the length of wire in each spiral, and the size; then, I think I can manage.



QUERY No 20648

The resistance coils are in series, and are connected to the switch as in the above diagram. You will see that with the handle on the first contact all the coils are in circuit, and as the handle is moved over the coils are cut-out step by step, until at the last contact only one coil is left in. We cannot give you details of the wiring, as you omit to mention what is the resistance of the apparatus which will be in series with the rheostat. If we call that resistance *x*, then the resistances introduced at the five contacts must be: 31·25—*x*, 25—*x*, 20·8—*x*, 16·6—*x*, and 12·5—*x* ohms. The wire of the last (fifth) coil must be of a size capable of carrying 20 amps. comfortably, that of the fourth 15 amps., the third 12 amps., the second 10 amps., and the first 8 amps. At the end of our handbook, "Small Electric Motors" (price 7d. post free) there are tables giving sizes, resistances, and current-carrying powers of various kinds of wire suitable for your purpose.

[19,660] **Electric Tramcar Lighting.** E. K. S. (Wye) writes: Please explain what is the best method of connecting up



QUERY No 19660

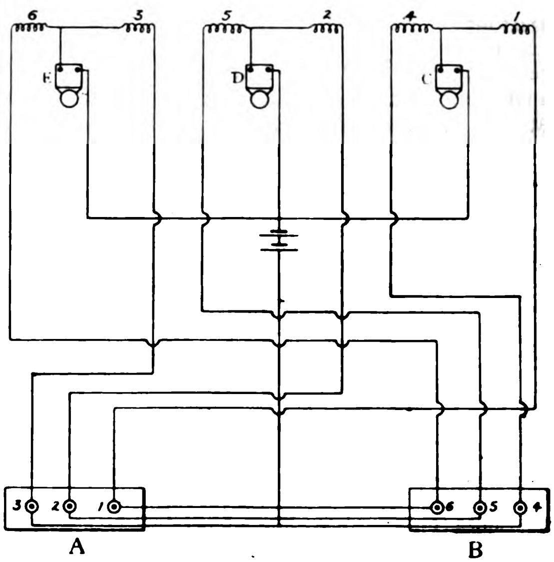
the lamps in my electric tramcar. It works on the "overhead" system.

Connect the lamps in parallel with the motor, as shown in above diagram.

[20,612] **Model Locomotives.** A. L. P. (Malta) writes I want to construct an engine wth three cylinders and locomotive pattern boiler, and I should like to know—(1) which of the two following boilers is most efficient—(*a*) Smithies' type, outer shell 3 ins. diameter, inner 2½ ins. by 15 ins.—it would have nine water tubes 3-16ths in. diameter—fuel is methylated spirit lamp; (*b*) locomotive type, 3 ins. diameter by 15 ins. long, ten ⅜-in. tubes and four water tubes—Wooten firebox, grate area 3 ins. by 3 ins.—firebox crown half-way up boiler. (2) Would a No. 4 Primus or charcoal give best result in latter boiler? (3) The stroke of my cylinders being limited to 1 in., would either of the boilers supply three ⅝-in. by 1-in. cylinders, or would it be better to have two H.-P. of ½ in. and one L.-P. of, say ¾ in. I want to run as powerfully as possible, and about fifteen to twenty minutes on one charge of water. If you can suggest any more powerful combination of three cylinders, I should be glad.

(1) (*a*) Nine water tubes is out of the question. Use about five. Generally speaking, the water-tube boiler will prove most efficient in ordinary working; (*b*) greater power may be obtained from the firetube boiler (fired by a Primus No. 4 burner), but the boiler will be more difficult to manage. (2) Charcoal is not suitable unless the firebox is deeper than the usual Wooten type firebox. (3) There is no great advantage in compounding a model. We would prefer the "Smith" system—two L.-P.'s at ⅝ in. by 1 in., and one H.-P. ⅝ ins. by 1 in.

[20,483] **Bell Wiring Diagram.** F. A. (Clapton) writes: Will you kindly give me the connections for these bells and indi-



QUERY No 20483

cators? Room A wishes to ring bell C and indicator 1, also bell D and indicator 2, and bell E and indicator 3. Room B wishes to ring the bells C, D, and E and indicators 4, 5, 6.

The above diagram shows the correct connections.

New Catalogues and Lists.

Messrs. Whitney, 117, City Road, London, E.C.—A new catalogue recently issued by this firm includes particulars and illustrations of their now well-known model marine engines and pumps. For some years past Messrs. Whitney have been adding to their well-known series of model marine engines, introducing new patterns, and sparing no trouble or expense likely to make them the very best value obtainable. From illustrations in this catalogue the reader will be able to see the class of work in which they specialise. We understand that if a remittance to cover cost of postage and model be sent Messrs. Whitney will be pleased to send sample engine for inspection. Donkey pumps of the single and double-acting type, horizontal, and also the Westinghouse type for locomotives are illustrated. Launch engines, both single and double cylinder, simple and compound, are listed and priced. Twin-screw launch engines of particularly neat design will attract much attention. Another type, listed as the "G" type of high-speed single acting with one eccentric, should appeal large'y to model motor boat enthusiasts: the bore is ⅝ths, with ⅝ in. stroke height of engine, 2½ ins.; and it weighs 12 ozs.

The Editor's Page.

A VERY HAPPY CHRISTMAS and the brightest of New Years is the cordial wish of the Editor to all his readers.

* * *

We are frequently asked by readers abroad to undertake for them the execution of small commissions for the buying of various goods advertised in our pages or in other journals. Hitherto we have done our best to conform to the wishes of our correspondents, but as such commissions frequently involve a good deal of personal supervision, which at times clashes with our other work, we have appointed Mr. F. E. Spon, of 1, Dartmouth Place, Greenwich, London, S.E., to act for us in these matters. Mr. Spon, who is related to the well-known firm of publishers of that name, and who also acts as buying agent for Messrs. Spon & Chamberlain, of New York, has had a long business experience in the execution of export orders, and we can confidently recommend his services to those of our readers abroad, whether trade or private, who wish to purchase goods from this country. Mr. Spon is able to give his personal attention to the collection, checking, and packing of goods prior to dispatch, and in this way can be of much use in seeing that the wishes of his correspondents are properly carried out.

* * *

Referring again to the reconstruction of the Aberdeen Society of Model Engineers, we have received the following letter from Mr. W. Bunting: "SIR,—I have been approached by model engineers in this city, some of whom were members of the old society, with a view to re-forming the old Aberdeen Society of Model Engineers. At a meeting of the Aberdeen Model Steamer Club, held on the 9th inst., I put the matter before the members, and they unanimously agreed to give the Society the best support they could, namely, by becoming members of same. Unfortunately the steamer club has been unable to embrace all the branches of model engineering, as there are model engineers who have no sympathy with the boats at all. except with the propelling power—there their interest stops. As already some prominent men in engineering circles here have promised to take an interest in the Society, I have no fear as to the result, and if the members take the same interest in the Society as the members of the Steamer Club have done, the Aberdeen Society of Model Engineers will be on a firmer basis than ever. In connection with the above Society a Meeting will be held on Monday, December 28th, at 8 p.m., in the County Hotel, King Street, Aberdeen, for the election of office-bearers; all interested in the above are invited to attend. I may say that at present the Steamer Club will remain as a separate branch, having no connection, but readers may become members of either or both Societies.—W. BUNTING, Honorary Sec. A.M.S.C., 51, Ashwall Place, Aberdeen."

* * *

We do not think we need offer any apology to our readers for having strayed this once, in our story, "A Strange Christmas Eve," from the path of material model making to more ethereal regions. The spirit of the times—at least, of these few days—will, in some measure, justify our lapse. Of one thing we are sure, that even the most stern amongst our friends will look upon our digression leniently, if this night augurs as well for his as for our friend George's happiness and contentment during the coming year.

* * *

We would remind readers that all entries for our Speed Boat Competition must be sent in by December 31st.

Answers to Correspondents.

J. H. (Dudley).—We regret we cannot give you a reply. Not only is your query very confused, but you ignore the rules of our Query Department.

J. C. P. S. (The Hague).—Choice of system is a matter to be decided largely by personal preference. Please refer to Mr. Bottone's "Magnetos for Automobilists" (2s., foreign postage, 5d.).

A. D. (Workington).—If you will refer to recent back numbers of THE MODEL ENGINEER, you will find your query dealt with several times. Please note our Query Department regulations and our correct address.

"ENTHUSIAST" (Pilton).—Thanks for your want, which you will see we have inserted.

E. WOOD (Brockley).—(1) If you will learn to use the scales given in the handbook, no further drawings of the dynamo will be required. (2) See page 47. 100 watts size machine. (3) Yes, ¼-h.p. is suitable.

F. BEAZLEY (Southampton).—No alterations probably, will be required. Drive it in same direction as that in which it has been running. See "Small Dynamos and Motors" (7d. post free).

Contents.

[*The asterisk (*) denotes that the subject is illustrated.*]

THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XIX. No. 401. DECEMBER 31, 1908. PUBLISHED WEEKLY

Some Working Model Cardboard Locomotives.

By F. DE FRETTES.

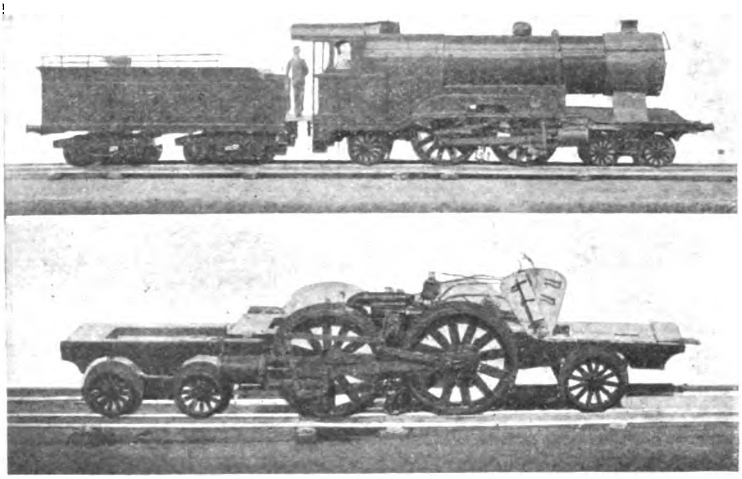


FIG. 1.—SHOWING 4—4—2 CARDBOARD LOCOMOTIVE UNDER CONSTRUCTION AND FINISHED.

THIS is a description of some cardboard models I have made, which are not merely show pieces, but actual working engines.

Half-inch scale railway. Fig. 4. This set was made some six years ago and is made of cardboard entirely, even the track, of which there was some 30 ft., including two points and a cross-over. The photograph shows the rolling-stock—composed of a tank locomotive, a first-class corridor carriage, and a composite third-class and luggage van. The signals and buffers can also be seen. The motive power was furnished by an elastic rubber band, as Fig. 5, and was sufficiently powerful to enable the engine to draw the two carriages across a large room at a good pace. The first-class carriage had five compartments, with upholstered seats and imitation luggage carriers and lamps. The doors inside and at the ends of the carriage were made to open and fitted with handles. The composite carriage, being only third-class, had not its seats upholstered, but had the luggage carriers and doors to open as the other one. The guard's part had sliding doors. The gantry was automatically worked from the truck by the train itself.

Half-inch locomotive, type " La France," shown in Figs. 1 and 2. This engine was also made of cardboard and is electrically driven by a small three-pole motor placed lengthwise with, and between the frames. The boiler, cab, and footplate were detachable from the rest of the engine, so as to render any adjustment required to the motor or connections easy. The current is taken from one rail and returned through the other one, the two being insulated by the wooden slippers by contacts made of brass wire and having springs so as to ensure a good contact. The motor was most simply fixed to the frames. A bridge made of a piece of stout cardboard was mounted between, and the base of the motor securely fastened on it with seccotine. This arrangement never gave me any trouble. The switch is plainly seen and provides forward and reverse motion, worked from the rail after the fashion of the clockwork engines on the market. The dome was a closely grained cork, just cut with a penknife, then filed and finally smoothed over with sand-paper. The chimney was made as Fig. 5 will explain, and looked very well when finished. A tube was first made of card, then the ridges was cut of card and plenty of glue allowed to dry on, so as to produce the curves." The bottom one was formed of a piece of string gummed round the base of the funnel and covered over with glue. The arrangement was very successful from the appearance point of view.

The steam pipe outside the boiler is a piece of india-rubber tubing, and the wheel on the smokebox door a drawing pin. The engine and tender rails were brass wire polished bright. The engine was painted green, the smokebox, chimney, and inside of tender grey, and the inside of cab black. The cab had all the fittings made of cardboard as well. This model was rather powerful and carried easily some 12 lbs. of my motor cycle tools. In fact, when the full current was switched on—8 volts from accumulators—I had to put some of the tools on the boiler over the driving wheels, as otherwise slipping was taking place, notwithstanding I had put about 2 lbs. of lead inside the boiler to give greater adhesive power.

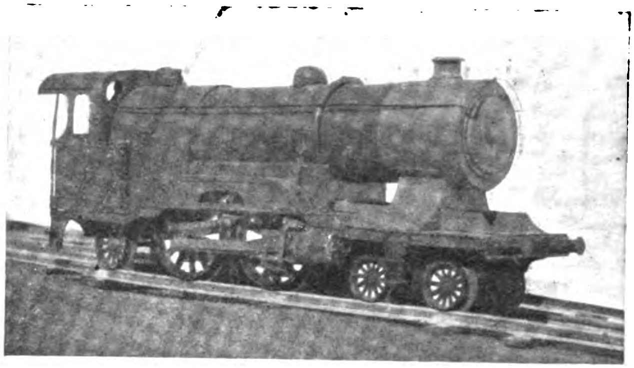


Fig. 2.—Another View of Fig. 1.

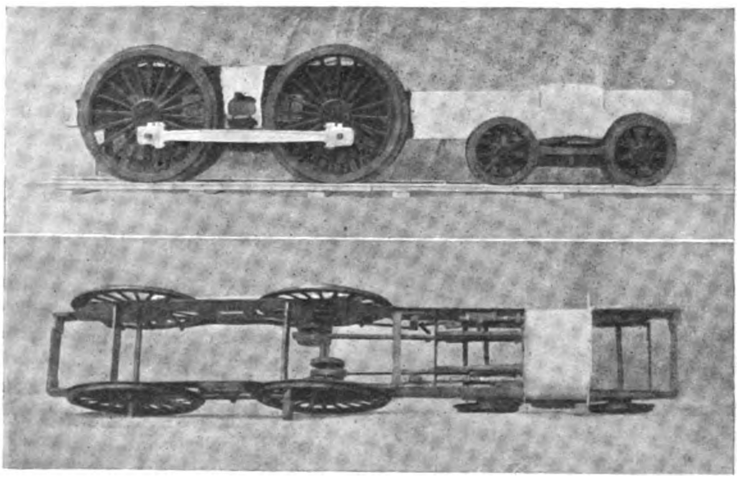


Fig. 3.—Parts of Unfinished ⅞-in. Scale Locomotive.

A rather novel idea, I think, and which I have not seen described in The Model Engineer before, is the way I managed to place "real people" on a model engine. First I had my photograph taken and then took a friend of mine holding a shovel, as a stoker. The prints were mounted on card, then carefully cut out and placed on the engine. A photograph of the lot was then taken, and the result—well, is generally admitted to be a success. Of course, the first photograph had to be taken of such a size as to be "to scale" with the engine.

Seven-eighth inch scale unfinished model of a four-cylinder compound locomotive of the Western Railway of France. This is an exact scale model of a locomotive I am at present engaged in making. It is entirely made of cardboard, except the axles and piston and valve rods, which are pencils. As can be gathered from the photograph of its present

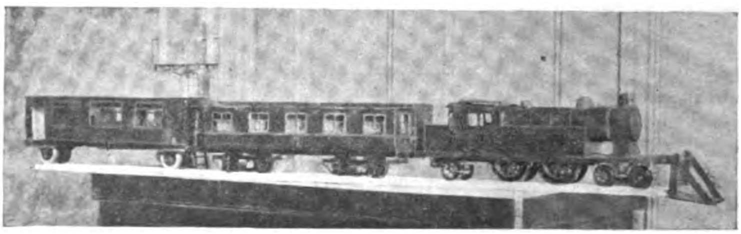


Fig. 4.—½-in. Scale Model Railway.

state, every care has been taken to make the engine a perfect model. The parts where there is any friction are black-leaded, which gives a very sweet running motion, all others being painted. The engine is intended to work with compressed air, and one of the outside cylinders, at present finished, works admirably. Like the other parts of the engine, it is made of cardboard, and, judging by

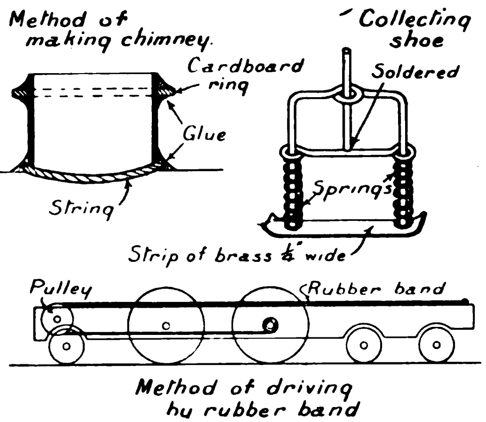


FIG. 5.

the present results, I feel very confident as to the ultimate success. I may add that I always use Gleaser's enamel for my engines, and always found it to give a superb finish equal to stove enamel.

Model Rolling-stock Notes.

By H. GREENLY.

L.N.W.R. PROPERTY TRUCK FOR 7¼ IN. GAUGE RAILWAY.

(*Continued from page* 538.)

THE longitudinal timbers should be jointed into the headstocks, as shown in Fig. 6, with a horizontal tenon piece. The same jointing should be used to attach the transverse beams to the sole bars, the thickness of the tenon being about ¼ in. A horizontal joint is necessary, because any other would weaken the under-frame considerably in regard to vertical loads on the coach. When the frame is built it should be tested by placing it on two chocks of wood spaced at a distance apart equal to that of the bogie centres, and if any appreciable deflection is noticed when it is loaded to approximately half the probable load I would recommend the fitting of truss bars, as in the original coach, under each sole bar. The diagram Fig. 7 gives the general sizes, and also the details of the bar and tension screw. Should the builder of the truck have no objection to spending the extra time necessary in fitting the trusses, then the preliminary testing may be abandoned, and the above work may be proceeded with in due course.

The palm of the truss bar, it should be noted, is sunk into the wood. This helps the screw to resist the strain of the tension bolt. The latter is not tapped into the sleeve, but merely fits it reasonably well. The whole of the work is done by the nut against the sleeve, the stud bolt being notched at the end to fit the bar, and thus it is unable to turn when the nut is screwed up and the stress applied.

All joints of the wood and iron work should be painted well just before the parts are put together, the tenons being pinned with wood pins, so fitted that the joints are drawn together when the pins are driven in. If any instruction is required in making

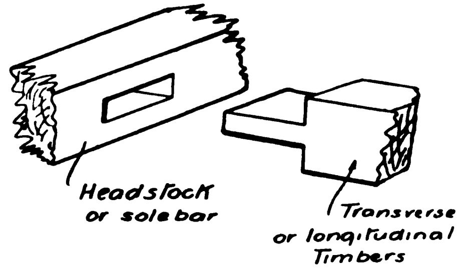


FIG. 6.—HORIZONTAL TENON JOINTS FOR HEADSTOCK AND LONGITUDINALS AND THE TRANSVERSE TIMBERS AND SOLE BARS.

woodwork joints, the two little handbooks "Woodwork Joints" and "The Beginner's Guide to Carpentry," may be studied with advantage.

The draw gear should not be attached to the headstocks, but may be either continuous, as shown in sketch, Fig. 8, or may be attached directly to the bogie pin, as shown in the next diagram, Fig. 9. The continuous draw-gear, with spring arrangement, is very much used in railway practice, but I think in the present case some work will be saved by the second method. Should the device in Fig. 8 be adopted, holes must be provided in the transverse members before they are fixed in place. This also applies to the holes required for the longitudinal tie bolts.

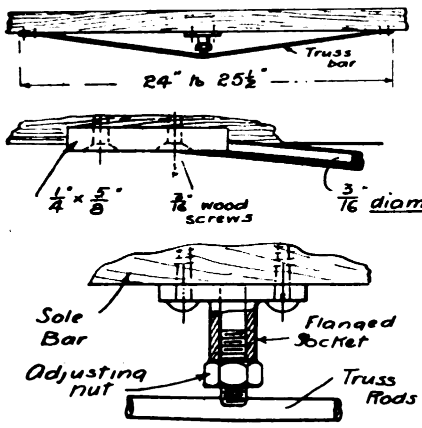


FIG. 7.—UNDER-FRAME TRUSS ROD AND DETAILS. (*Not to scale.*)

The swing of the drawhook is more or less necessary in such a long vehicle, and if the buffer beam is not flitched with a piece of ¼ in. or 3-32nds in. steel over its whole surface, drawbar plates should be used, as employed in the standard wagons already described in these columns. The buffers may be self-contained spring buffers, and should in the above circumstances be fixed to plates, and the plates fixed to the wooden headstocks after the manner depicted in the photographs (Fig. 12) on page 1 :8 of the issue of Augu t 6th, 1908.

There are many methods of arranging the bogies. In the matter of simplicity, the plain unsprung bogie (*i.e.*, with the axle boxes fixed in the horn-plates), resting on a rocking pivot or universal joint, which may or may not be provided with a vertical spring, cannot be beaten. The wheelbase of the truck should, however, not exceed the scale equivalent of 7 ft. or 8 ft. under any circumstances, and the wheel flanges should be deep to allow for the inequalities of the road.

The type of bogie pin bearing used in locomotive work, or any arrangement which does not allow of a universal movement of the bogie in relation to the

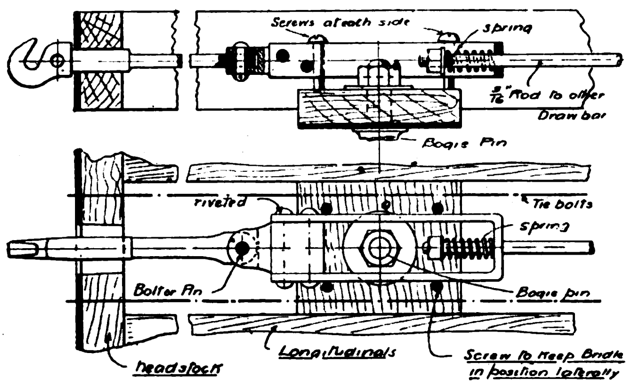


FIG. 8.—SPRING DRAW BAR GEAR (CONTINUOUS).

under-frame, should not be used where the total wheelbase is long, as in the present vehicle. Even when well laid, an outdoor track will be found to have a certain amount of surface "wind" in the rails, and the individual springing of the axle-boxes is hardly sufficient to allow for this where the total wheelbase exceeds the scale equivalent of 25 ft. or 30 ft.

This lack of play in the bogies was another fault of the truck built with the high centre of gravity referred to in the course of the last article, the seating of which I altered. When first I tried it up and down the track, in addition to its natural instability, I noticed that the vertical play of the axle-box spring (spiral in this case) was insufficient to ensure all the wheels touching the rails, especially when the truck was lightly or unequally loaded.

To provide greater flexibility, I removed the heads of two screws on each side of the bogie pin, which were placed in the bogie crossbeam, and which formed a bearing for the transverse plate of the bogie, and prevented any other movement but the horizontal rotation of the bogie frame. Between the bogie and the under-frame I fixed some pads of rubber cut from an old motor car inner tube, and although th s rough and ready cure is one which

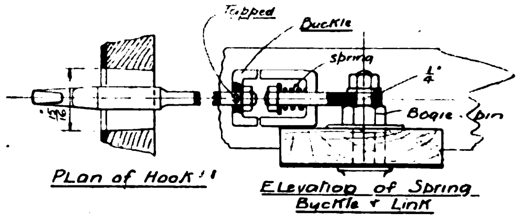


FIG. 9.—SEPARATE SPRING DRAW-BAR GEAR.

would not be used for a new carriage, it worked out all right, and prevented a good many derailments.

The design for the bogie. Fig. 5, in the last article, and Figs. 10 and 11 in this, involves the same principle, spiral springs being substituted for the rubber pads. The bogie pin is not parallel, but is so shaped that it allows the bogie to rock a considerable amount. The hole in bogie stretcher or bolster need not be drilled $\frac{3}{4}$ in. and $\frac{3}{8}$ in., but may, if desired, be drilled the larger size right through, and the bogie pin provided with a bigger safety washer at the bottom. The major portion of the load is taken by the four spiral springs near the bogie. Each pair of these should be fitted with bearing plates, as shown in Fig. 12. The single side springs are intended only to take load when the bogie rocks to one side or the other. Bearing washers should be fitted to these springs, and to prevent the springs becoming lost should the bogie be removed, these washers or plates may be fixed to a bolt which passes through a hole in the bolster, as shown in the last article.

Laminated springs may be used for the axle-boxes.

Generally I do not approve of laminated springs. In a locomotive model they cannot very well be

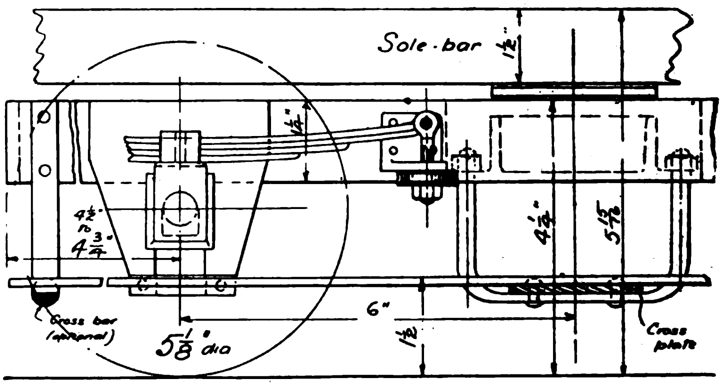


FIG. 10.—PART ELEVATION OF BOGIE.

utilised owing to their working out, in model sizes, much too strong and rigid for the load. A model truck which has to carry passengers is, however, overloaded proportionately. For instance, taking the weight of the actual loaded vehicle at 16 tons, the weight on the axles in a scale model 7¼ in. gauge would be approximately.

$\frac{1}{8} \times \frac{1}{8} \times \frac{1}{8} \times 16$ tons = 70 lbs.,

or about 9 lbs. per axle-box, which would be an absurdly light load for scale model laminated springs. But when the passengers are aboard the truck the

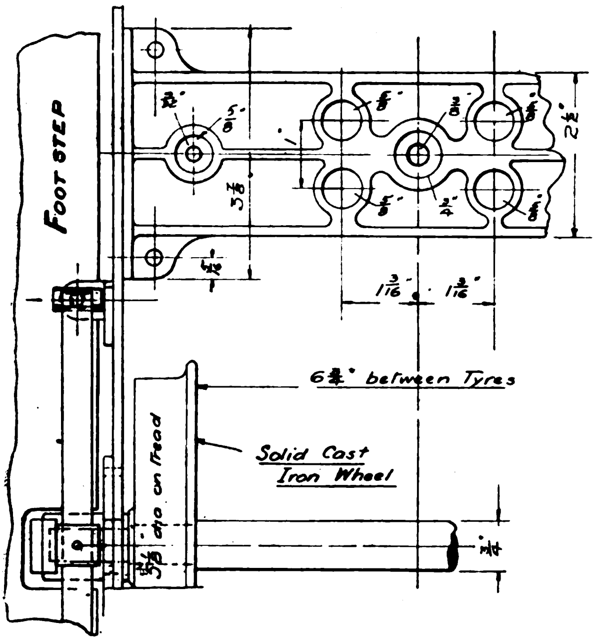


Fig. 11.—Part Plan of Bolster.

load may rise to about 320 lbs., or 40 lbs. per axle-box. Now, 40 lbs. on a laminated spring, such as shown, is a reasonable load, and a laminated spring may be found superior to spiral springs for the particular purpose. It is only a question whether the builder will go to the extra trouble of making them.

The axle-boxes may be modelled more or less on correct practice. They are a little too small to have

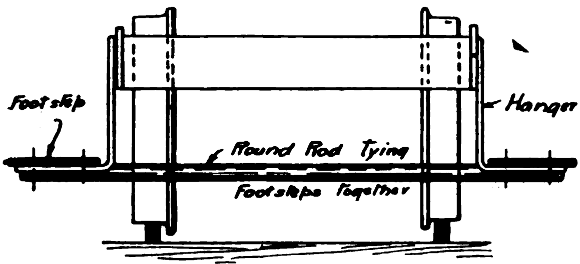


Fig. 14.—Extra Support for Step at each End of Bogie.

cast in one piece, with the oil retainer cored out, but if made with a plate front to be screwed or soldered on, an oil retaining keep may be used.

With reference to the outside footstep, on second thoughts, and after making of the plan view Fig. 11, I suggest that the outside step be made of ⅛ in. stuff 5 ins. apart instead of 4½ ins. and 2½ ins. wide. The centre portion may be supported by a cross-plate 2 ins. × 9 ins. × ⅛ in. thick (see Fig. 10), which can be slung from the bolster casting as indicated. The ends of the footsteps may be slung from flat

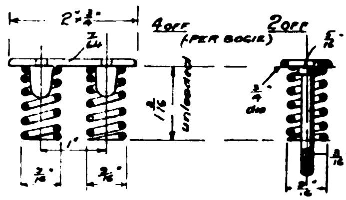


Fig. 12.—Bolster Springs and Bearing Plate.

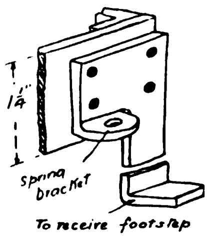


Fig. 13.—Laminated Spring Bracket and Step-hanger.

hangers fixed to the side plates of the bogie, or, where laminated springs are adopted, a combined spring bracket and footstep hanger may be employed for the purpose. If only ⅛ in. material is used for the hangers, a further support should be provided for the step in the shape of a cross rod tying the footsteps on each side of the bogie together, and preventing the hangers from being bent inwards by the weight. The idea is shown more clearly by Fig. 14.

There are other types of bogies which may be used to allow for all inequalities of track, but space prevents their description just now. They will be mentioned when dealing with other prototypes for double bogie trucks suitable for the purposes of riding on when driving a model tank locomotive.

Horse-power of Drill.—Fourteen months were occupied by a Sullivan drill, working 24 hours each day, in putting down a 5,561-ft. hole at Doorkloof, Transvaal, says *Science and Art of Mining*. For the first 700 ft., a 2-in. core was extracted; the total weight of the rods was between 15 and 16 tons, and they were hoisted in 50 ft. lengths, a 66-ft. tubular steel derrick being used for the purpose. Toward the final depth, from 7 to 10 hours were consumed in raising and lowering the rod. The cost of this drill and its entire equipment, including the boiler, etc., was about £1,800. A drill boring a 2-in. diameter hole (core ⅞ in.) will require, when boring at about 600 ft. depth, 2¾ horse-power.

A Design for a Model Electric Torpedo-boat Destroyer.*

By C. A. Willomes.

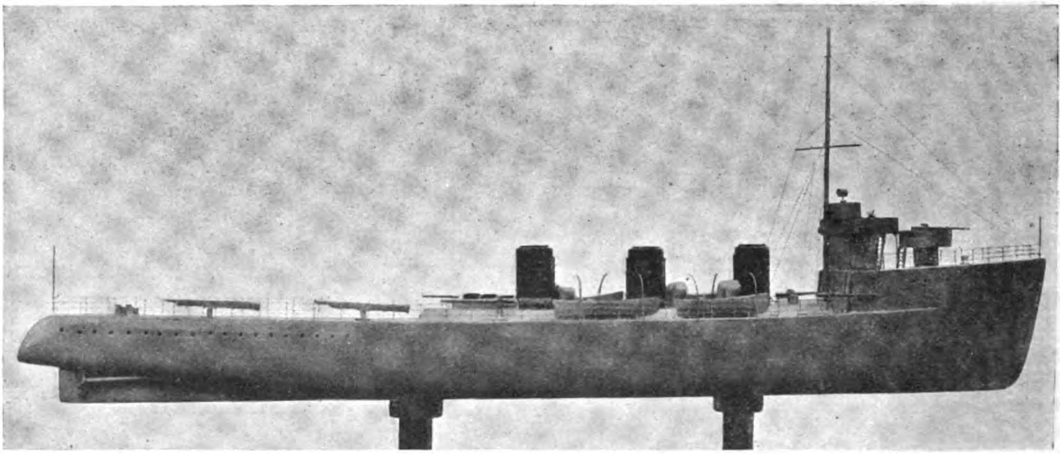
As from time to time such excellent working models of locomotives appear in your pages, while models of torpedo-boat destroyers seldom bear a close resemblance to the prototype, we determined to build a model of an up-to-date destroyer, which should be as faithful a model as possible on so small a scale, and at the same time be a working model. To combine both, speed had necessarily to be sacrificed by keeping to two propellers, which are, of course, very small. Should speed be required, the substitution of one large one would probably give the result, and would not show when the boat is in the water.

Our model is an "Improved River Type," having the high foc'sle typical of this class, its scale being approximately ⅛ in. to 1 ft., giving her a length of about 270 ft. compared to "River" class of 225 ft. But since her armament has been made—five 14-pounders, as against the one 1-pounder and five 6-pounders at present carried (although orders have been given to recall the 6-pounders)—the extra length is not excessive.

We propose to deal with the construction of every part in detail. The first job taken in hand was the preparation of working drawings. These were made full-size and every detail put in. It took some considerabe time to get the arrangement on deck quite to our satisfaction. We found some difficulty in getting photographs of modern destroyers showing the torpedo tubes. When the drawings were finished, the hull was commenced.

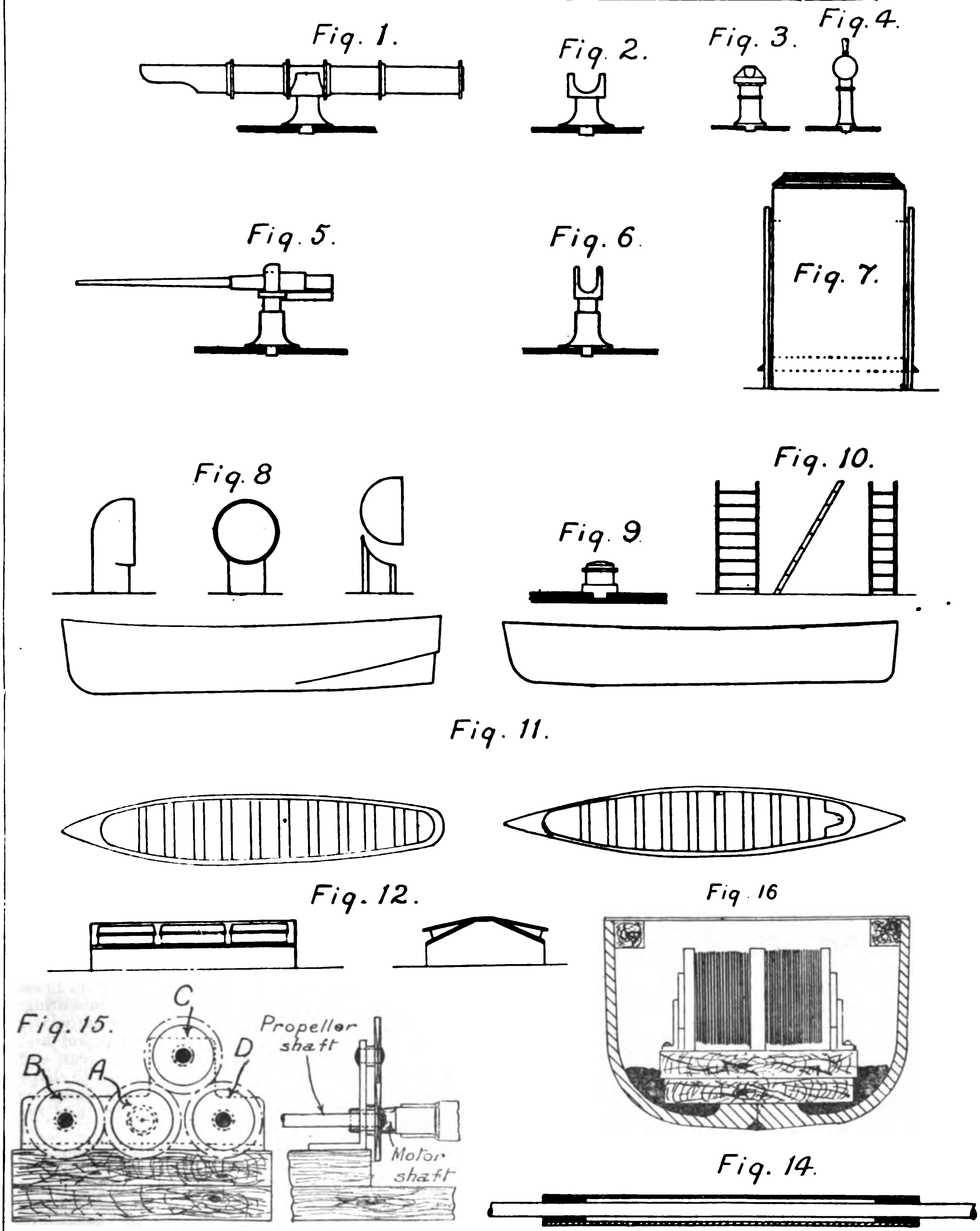
The hull was carved from two pieces of pine, and joined together down the middle line. A piece of wood was cut to these dimensions (3 ft. by 3½ ins. by 2 ins.); on its narrowest surface was drawn the half-deck plan from a cardboard template. The surplus wood was then sawn and chipped off vertical with the deck. Then the shaping proper commenced. On the inner surface of the wood the amidships section (longitudinal) was drawn, also the outline of the space to be hollowed. As much hollowing as was safe was done before the finishing cuts were put on the outside of the hull. We lay stress on this point, because it is so much easier to cut away the wood inside with a gouge and mallet while the hull is still thick and strong. The outside was then finished to the desired shape, and the hollowing carried on until the hull was about ⅛ in. thick all over, with the exception of either end and the stringer running from bow to stern in the middle line. The other side was treated in a similar manner, and the two pieces fixed together. To make this joint watertight the stringers were bevelled, as shown in Fig. 22, which is exaggerated for clearness. The upper surfaces A were glued together and the bows and stern screwed with brass screws, bringing up both sides into close apposition everywhere. When the glue was set quite firm, the groove B was filled in with red lead and the transverse strips C were screwed into place. This made a perfectly watertight job. The finished hull weighed 20 ozs. The fore-part was decked over up to the mast, and on this the foc'sle was built up out of two strips of pine, each side jointed where the cut-away commences, to enable the upper deck forward guns to fire ahead. The hull was then finished off with glass-paper and paint. The portholes are 1-16th in. diameter, and were drilled right through the hull and then covered inside by a thin strip of wood, which was well painted. A stringer was nailed and glued along each side to fasten the deck to (see section plan), and the inside of the hull given several coats of red oxide paint.

The engine is a "T1" Avery motor, built up from castings, and although it is the first and only electric job we have tackled (neither of us knowing anything about the subject of electricity), it was found to run well when finished. The castings supplied were beautifully clean. The motor shaft is fitted with a brass cogwheel and a brass bush, and is geared on to the propeller shafts in such a



Profile of Model Electric Torpedo-Boat Destroyer.

* Sectional plans and elevation, deck plan, and profile will be given in next issue, Jan. 7, 1909.



DETAILS OF FITTINGS OF ELECTRIC T.B.D.

way that both propellers move in the same direction, either inwards or outwards.

The teeth of A are in mesh with those of B and C, and those of C with those of D. The wheel bracket is cut out of 1-16th-in. sheet brass. The shafts are 1 ft. long, and 5-32nds in. diameter brass rod. The stern tubes are copper ($3\frac{1}{2}$ ins. long and $\frac{1}{4}$-in. bore); they are bushed each end with brass, which is drilled to take the shafts, and the intermediate space is filled in with tallow; they are absolutely watertight and run beautifully smooth. To accurately align the tubes for the shafts the following method was adopted: the holes for them were cut in the skin and the tubes pushed into place, and the shafts passed through them into their respective holes in the wheel brackets; a piece of wood was carved to just fit under the tubes, glued, and put into position. When the glue was set, it was screwed to the bottom of the boat and a piece of wood screwed to it, covering both tubes and holding them quite firm,* being recessed to half the diameter of the tubes (section, elevation, and plan). Then the space between this frame and the holes in the skin was filled in with putty, and pressed in until it

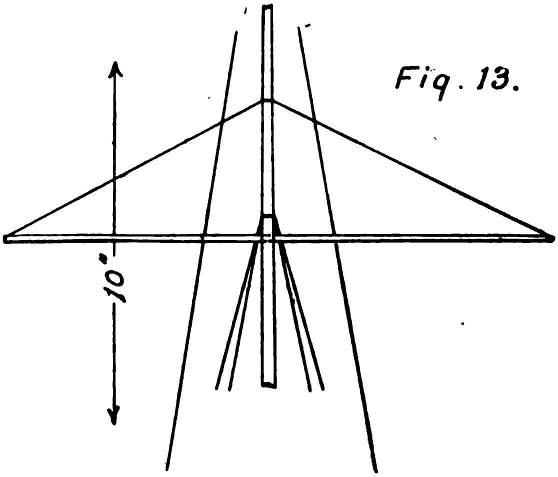


Fig. 13.

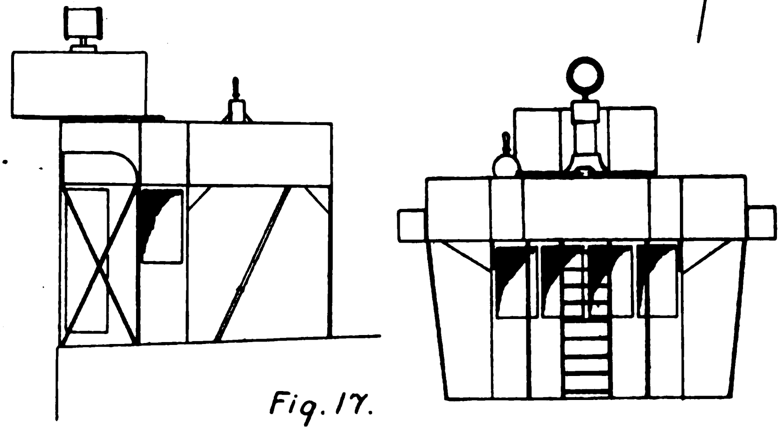
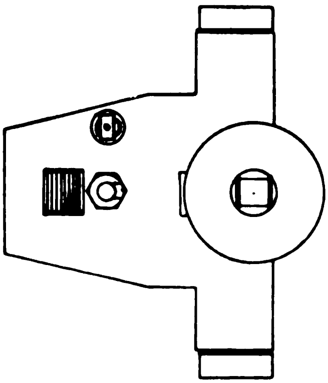


Fig. 17.



squeezed out all round the stern tubes. Two or three days later, when quite hard, it was finished off and coated inside and out with paint. The tubes are absolutely rigid.

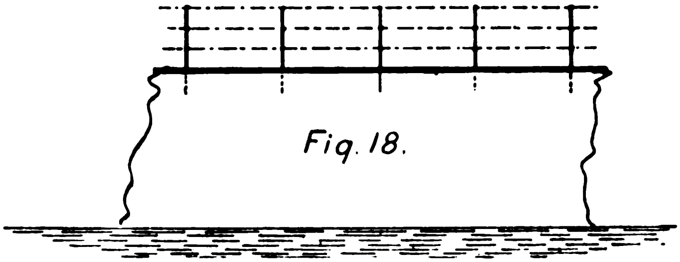
The accumulator is a small 4-volt boat type, and is placed in the bottom of the boat just forward of the motor. At present we have no reversing switch, but will probably fit one.

The connections (shown in plan of engine) are designed to allow of charging the accumulator without removing the deck. The drawings show how the switch works, so a short description will suffice. Wires lead from the accumulator terminals A to the charging terminals B, which are short lengths of brass tube, and thence to the switch springs C, and thence to the motor. The switch springs are made of two pieces of thin sheet brass, bent at right angles (plan of engine); the switch consists of a fibre block containing two brass plugs. To switch on, the handle D is raised sufficiently to clear the neutral holes E, turned through a right angle, and pushed home into C. To charge the accumulator, switch off by reversing above, remove foremost funnel, and pass charging switch down into the charging terminals B. The charging plug consists of a piece of fibre with two brass plugs having terminals for connecting with charging current.

The guns, five in number, are turned from brass rod, and mounted on conical brass mounting, and represent the Vickers-Maxim semi-automatic quick-firing guns; they have a recoil jacket and cylinder fitted underneath (Fig. 5) the rear end of the barrel. The mountings were turned to shape and the cradle cut out with files; each mount is provided with a pin 3-16ths in. diameter, and fits into a hole in deck (Fig 6).

The conning-tower and gun platform above it (Fig. 19) are built up of a piece of $\frac{3}{4}$-in. brass tube, with a thin sheet zinc disc soldered on to it; round this is soldered a strip of zinc to represent canvas weather-cloths, as it was practically impossible to fit railings into such thin material. The tube forming the conning-tower was cut from an old bicycle pump; it passes right through the foc'sle deck, and is bedded on to the upper deck and made a driving fit.

The ladders were—after much consideration—made of cardboard, seccotined together, and thoroughly painted to make them waterproof. This was the only way out of the difficulty that we could see (Fig. 10).



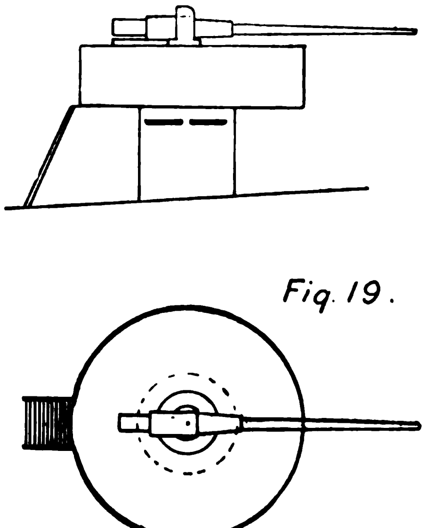
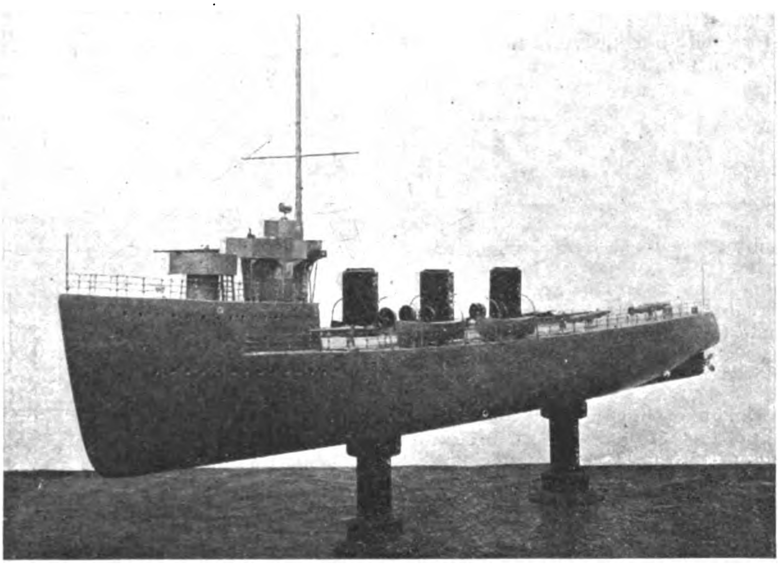


Fig. 19.

The charthouse and bridge (Fig. 17) are made of thin sheet zinc, with windows and doors cut. It is fitted over a block of wood, which is screwed to deck. The bridge forms the roof of the charthouse, and has sides made in the same way as the forward gun platform. It carries a red light bracket on the port side and a green one on the starboard. There is a binnacle, turned from hexagon brass rod (Fig. 3), and an engine-room telegraph (Fig. 4), turned from round rod. The bridge is reached through a hatch just forward of the charthouse. The searchlight platform stand is turned in two pieces of brass, with the platform between them (see Fig. 17). The sides are put on in the same way as those of the bridge. The upper piece of the stand is drilled 1-32nd in., as also is underside of the searchlight. Into these holes is fitted a piece of wire, as a pivot for the projector. The projector is turned from brass (Fig. 17).

The stanchions under each end of the bridge are made from thin tinned wire, pointed and driven into the sides of the foc'sle, and accurately gauged to height before the bridge was put on. The cross-pieces add greatly to its appearance, and are easily soldered.

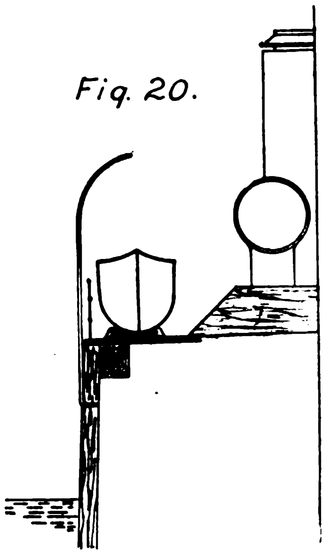
The mast was worked down from a piece of oak. It passes through a hole in a transverse beam (Fig. 22) supporting the deck, and fits into a block of wood screwed to the ship's bottom. The mast is vertical; it carries one crosstree and a small amount of rigging (Fig. 13) made of thread, and fixed to the ship's side by taking a twist round a small nail, which is then hammered in flush. Just abaft



Another View of Model Electric Torpedo boat Destroyer. By C. A. Willomes the mast—on either side—is a gun having an arc of fire of about 170 degs.

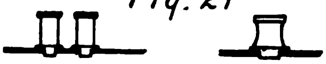
Down the deck for a distance of 14 ins. is a coaming, raised 5-16ths in. and 1½ ins. wide, over the "boiler" and engine-room; this provides access to the engines and accumulator. Under the coaming there is a hole cut in the deck (10 ins. by 1⅜ ins.). The coaming is fixed by its own shape,

Fig. 20.



by a recess fitting against the mast, and by a large screw passing through it into a block of wood fixed to the bottom of the boat, which, when tightened, gives it a fore-and-aft concavity, and makes a watertight job when painted.

Fig. 21



On to the coaming are fixed three engine- and boiler-room hatches (Fig. 9), three funnels, six ventilators, switch and charging aperture, and engine-room skylight, with six windows. The engine-room hatches are turned from brass rod, and have "tangs" left on them to make a driving fit. They are placed midway between the funnels on the keel line.

The funnels are made of pine and are oblong in section. The funnel tops are made of three layers of thin chestnut (1-16th-in.), the middle layer being larger than the top and bottom ones, and is bevelled. The ring round the bases of the funnels are made of cardboard and putty, and thoroughly painted.

The ventilators were a stumbling-block, and for some time we did not see how to make them of satisfactory appearance, as they are so small; but, after considerable trial, the following way was used, which turned out very satisfactory: a block of brass had a ⅜-in. hole drilled into it for about 1 in.; this was held upright in the vice. A piece of sheet copper (1-32nd-in.) was softened and held over the hole; the ball pane of a small hammer was held over the hole and given several smart blows on its face with the side of another hammer; then the copper was annealed and the process repeated. It was found necessary to anneal eight to ten times for each ventilator. When sufficiently beaten, they were sawn off the sheet and

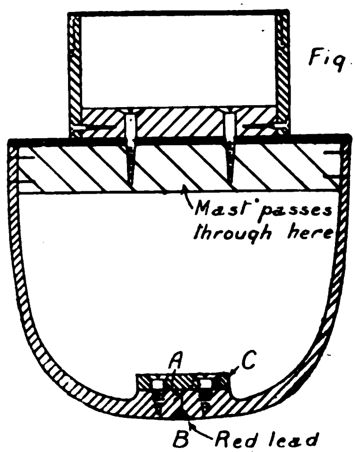
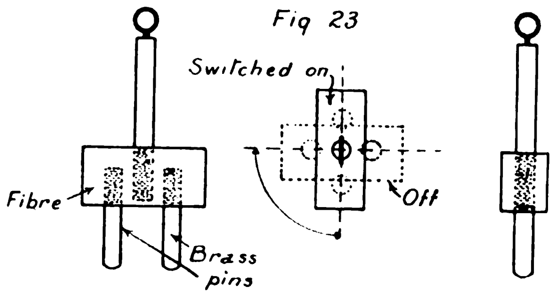


Fig. 22

finished off to a nice curve by beating them on the pane of the hammer held in the vice; then filed off smooth and soldered to short lengths of ¼-in. compo. pipe filed up and "emeryed" to a polish. They are painted signal red inside and grey outside. They are secured to the coaming by pegs of wood fitting tight into them and into the coaming. In the above description the word "coaming" is scarcely correct, but most convenient, and can, with the drawings, be fully understood.

The skylight is built out of sheet zinc, both sides and ends being cut in one and soldered at the corners. Small lugs are left on the lower edge to fix down by; the top, with windows, is soldered on afterwards.

Fig 23



Opposite each funnel, on the extreme edge of the deck (see J in plan) are two round hatches—bunker hatches—made of brass and fitted to the deck in the same way as the engine-room hatches.

The boats (four in number) are carved out of American whitewood and hollowed to about 1-16th in. all over. They are fitted with thwarts made of cardboard and thoroughly painted; each boat is supported upon two chocks made of chestnut.

The davits are made of thin wire—tapered at one end with a fine file and emery cloth, bent to a pattern, and bent at right angles at the lower end (Fig. 20). Up to the present we have no "falls" for the boats, as we see no satisfactory way of making them—the blocks have to be so small.

Just abaft the after funnel, on the deck, are placed two more guns.

On the after-deck are two torpedo tubes. They are turned from brass and drilled 3-16ths in. for lightness, and then filed the correct shape at the muzzle end. They are mounted on conical brass mountings, the same as the guns, only shorter and stouter. Two brass bollards are fitted right aft, and a brass capstan is mounted centrally on the foc'sle.

The railings are made by driving in pins with their heads cut off and the burrs removed by rubbing on a stone, into the deck, and gauged to height and fitted with three strands of thread fixed on by passing the end round the pin and under itself, found again and over, and so on. The crossing of the thread, painted, gives the appearance of "knobs," such as real railings have.

Anchors were made of sheet lead, but were too light in appearance, and one made of brass was too clumsy; so for the present we are minus them.

The propellers originally fitted were cut from sheet brass, and the blades bent to shape, but on account of their small size they were unsatisfactory, and we are now experimenting with propellers having the blades sweated on to the boss. The rudder now shown in the photograph is sheet zinc, and is controlled merely by being a tight fit.

The boat is finished off light grey and block funnels, and has quite a smart appearance.

In conclusion, we would venture to give this advice to anyone intending to build a model destroyer. Buy about a dozen picture post-cards (photographs) of ships of the class to be copied, in all positions, work out the details from them, and check by each other. So frequently model boats have their appearance ruined by being out of proportion.

(*To be continued.*)

Workshop Notes and Notions.

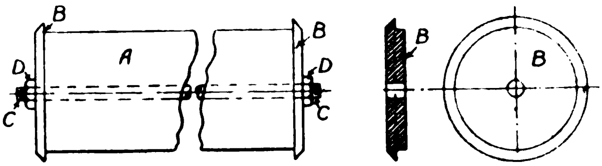
*[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "*WORKSHOP*" on the envelope.]*

Petrol or Oil Tanks for Motor Cycles.

By W. ISLIP.

The drawing illustrates a method of making round petrol or oil tanks for motor cycles, a big advantage being—no seams and no soldering. In the case of accumulator ignition, it is better to make a rectangular tank for the petrol, coil, and accumulator, and a round tank for the oil. A machine with magneto ignition looks very well indeed with round tanks. The construction of the tanks is very simple indeed. A is a piece of copper tube cut to the length required; BB are end plates, with flanges turned to fit the inside of the tube tight; C is a staybolt screwed each end; and DD are nuts to clamp the whole up tight. The staybolt C should be 5-16ths in. steel rod, and the flanges about ½ in. thick, ¼ in. to be inside tube. When building up, the flange should have about four turns of cotton steeped in oil, also the staybolt where the nuts fit. All connections in these tanks should be made in the end plates and should be screwed in position.

The oil tank should be placed on the seat down tube; the tanks should be held in position by copper bands, 1 in. wide and 1-16th in. thick—two for an oil tank and three for a petrol tank. A petrol tank should have a filling plug let in the tube and soldered round or, better, riveted in position, and the petrol pipe taken from the bottom of the flange seat pillar end. On no account use rubber washers

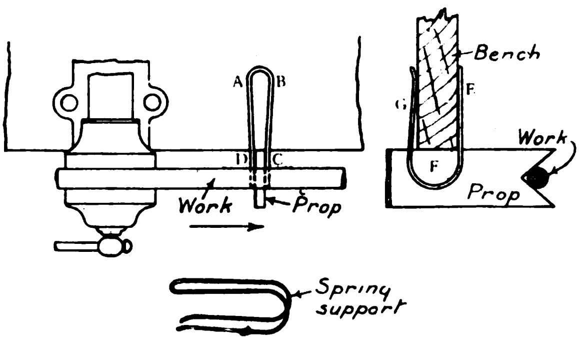


for packing the flanges, a turn or two of cotton being quite sufficient if the flanges fit the tube tight, and will stand any amount of vibration without leaking. A useful size oil tank is 8 ins. long by 2½ ins. tube petrol tank length to fit under top tube, and diameter according to power and size of machine. Copper tube looks very well indeed, but is more expensive than steel tube, but it is worth the extra money on account of its appearance and need not be enamelled. A big advantage of a tank built on this principle is that it can be taken apart if necessary for cleaning.

A Carrier for a Vice Prop.

By SYDNEY KAY.

This contrivance is made out of ⅛-in. iron. The spring of the metal holds the prop to the bench,



thus supporting the prop after the work has been removed from the vice for examination. The bend A B (side elevation E) and the ends G (under the bench) grip the bench, whilst the two bends D and C (in side elevation F) grip the prop.

THE THORNYCROFT HYDROPLANE.—The hull of Mr. Tom Thornycroft's hydroplane, which has been built by Maynard, is now at Chiswick. The step is said to be slightly aft of amidships. The beam is 8 ins. less right aft than it is amidships, and the sides have considerable flare. The length of the "boat" is 14 ft., and the maximum beam 4 ft. 6 ins.

Locomotive Notes.

By Chas. S. Lake, A.M.I.Mech.E.

A German-built Compound for Switzerland.

The large six-coupled, four-cylinder compound locomotive illustrated on the opposite page is one of a series recently built at the well-known works of J. A. Maffei, of Munich, for the St. Gothard Railway. The wheel arrangement, as seen, is 4—6—0, with the leading coupled wheels as drivers. The four cylinders are carried in line across the bogie centre, with the L.-P. outside and the H.-P. between the frames.

The steam-distributing valves are piston type, worked by Heusinger valve motion, and each piston valve distributes steam to a pair of cylinders, consequently there are only two valves and two valve gears for the four cylinders. A large and high-pitched boiler is fitted; the firebox is of the narrow type, but of considerable length, and an extension smokebox is provided. The boiler contains a "steam-drier," which, as its name implies, effects drying of the steam before the latter reaches the cylinders, and incidentally adds 50 sq. ft. to the heating surface. The coupled wheels are unprovided with any form of splasher or covering except what is afforded by the running board, which is carried along above them in a straight line about 2 ft. higher.

The tender is of the six-wheeled pattern, with outside framing. All the wheels of both engine and tender are fitted with brake-blocks, actuated by continuous brake appliances.

The general dimensions of the locomotive are as follows:—

- Cylinders: Diameter—H.-P., 16½ ins.; L.-P., 25½ ins.; piston stroke, 25½ ins.
- Coupled wheels: Diameter, 5 ft. 4½ ins.; wheelbase, 13 ft.
- Total heating surface, 2,549 sq. ft.
- Grate area, 33 sq. ft.
- Working pressure, 210 lbs.
- Weight of engine in working order, 79 tons.
- Weight of engine and tender in working order, 117 tons.
- Capacity of water tank, 2,700 gallons.
- Capacity of coal space, 5 tons.

Slipping Driving Wheels.

The writer has now had an opportunity of personally investigating the matter of locomotive driving wheels slipping after steam has been shut off, a subject which has formed the basis of a correspondence still proceeding in these columns.

By courtesy of the chief mechanical engineer of one of the trunk lines running into London several trips were made, both on passenger and goods locomotives, while engaged in actual service under normal and ordinary conditions, and, although out of deference to the wishes of the chief mechanical engineer in question, it is not possible to give the name of the railway or the localities in which the tests were conducted, there is nothing to prevent publication of the facts as they occurred.

It may be stated at the outset that in no one instance did anything which could be definitely set down as slipping of the wheels occur, although what might passably have been mistaken for such took place on two occasions—once with a four-coupled express engine, and once with a six-coupled goods, and, further, only one out of nine drivers had ever experienced slip unless with steam on the pistons. The two occasions on which it might have been thought that slip *did* occur were when the engines were passing round curves at fair speed, when rather more than the usual amount of vertical oscillation and some clattering of the side-rods became noticeable. The writer, however, who was riding on the running board at the rear of the smokebox, can say with certainty that there was no actual slip of the wheels.

Trip No. 1 was with a six-coupled express engine attached to a North-bound corridor train. Average speed over first 100 miles, 53 m.p.h. On reaching a tunnel on falling grade, and running at 56 m.p.h., steam was shut off, and, on rounding the curve the conditions referred to above were set up, and might, under other circumstances, have quite well been taken for slipping. The same engine ran down a bank of 1 in 220, and just before reaching the adjoining up-grade, steam was cut off, but there was no sign whatever of any acceleration of the driving wheels when taking the change of grade, Indeed, as would be expected, the opposite was the case.

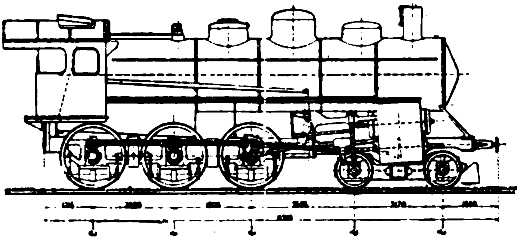
In the second trip a six-coupled goods engine, with train of 650 tons, approached an up-grade at 22 m.p.h., and before reaching the top, speed had fallen to about 19 m.p.h. On the falling grade beyond a maximum speed of 29 m.p.h. was reached, and during the passage round the curve at the bottom—when steam was off and the train pushing at the rear—there was a good deal of oscillation and clanking of the side-rods, but no actual slip of the wheels.

Other tests were with four-coupled (4—4—0) express "Atlantic" type expresses and eight-coupled goods locomotives, and everything was done to try to get them to slip without steam being on, but it certainly did *not* occur on any one occasion, either on up-grade, down-grade, or on the level. The driver, who believed that slipping does occur under the conditions we have in view, thought he could certainly give a demonstration, and indicated a precise spot at which the phenomenon would be likely to occur. With a greasy rail and other conditions favourable to the contingency, however, the engine, an "Atlantic" type, was as steady as a rock, and beyond a little oscillation gave no sign of the anticipated occurrence. Still, this particular driver remains unconvinced, and, in the face of all that has been communicated, both verbally and by letter to the writer on the subject, the latter, despite the tests recorded above, now possesses an open mind, although confessing that when the subject was first mooted a fixed belief in the unlikelihood of such a thing was his established conviction. In fact, it is rather a disappointment to the writer that none of the tests resulted in establishing a definite outcome.

Replies to Correspondents.

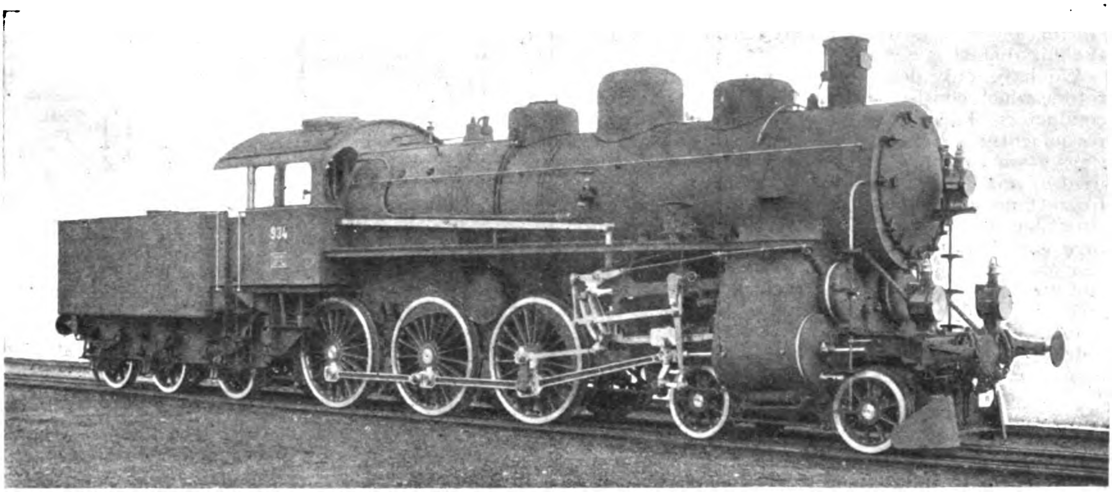
To the correspondent who wishes for some information regarding the new eight-coupled, eight-cylinder goods locomotive of the Midland Railway the writer would reply that there is nothing at the present moment to be said on the subject, although a promise may be given that when the official decree has gone forth that no objection exists to the publication of photographs and details of the engine this journal will be among the first to deal with the subject.

It has been alleged by another correspondent that the "Pacific" type locomotive, "The Great Bear" of the Great Western Railway, has proved unsuitable for the work it was designed to perform, the precise allegation being that the "Board of Trade



SIDE ELEVATION FOUR-CYLINDER COMPOUND: ST. GOTHARD RAILWAY.

has condemned the engine as unsafe on account of lack of flexibility of wheelbase." This is quite a new function surely for the Board of Trade, viz., to assume the determination of locomotive fitness, and the writer has no information on the matter viewed from that standpoint. It is true that rumours of a more or less reliable nature are current that the reason why the "Great Bear" did not for a time perform regular express duty is because there was something unsatisfactory about the trailing wheel arrangement, which at first proved stiff and unsuitable on curves at the higher speeds; but the writer believes it to be the fact that the engine is at present regularly hauling express trains between Paddington and Bristol. In any case, it would not take them long at Swindon to rectify any evil that exhibited itself; for, after all, locomotives costing what this one cost are not built for the amusement of the thing, neither are they introduced for the purpose of doing work which less expensive and lighter ones can do equally as well; More, *re* this, later.



NEW FOUR-CYLINDER COMPOUND LOCOMOTIVE: ST. GOTHARD RAILWAY.

Induction Motors, and How They Work.

By NORMAN E. NOBLE.

(Concluded from page 609.)

WE shall now have to make some provision for making single-phase motors self-starting; in small motors that can easily be started by hand no difficulty will be experienced, but with larger motors it is very troublesome. If we could by any means introduce another current at starting which differed in phase from the main current a quarter of a period, or even less, and pass this extra current through an auxiliary winding on the stator, we should get a rotating field which would start the motor without trouble. This auxiliary starting phase could be connected to the starter in such a manner that it would be cut out on the last notch and the motor would be running as a single-phase machine. This auxiliary phase must be provided from the single-phase mains, the way it is produced being as follows: The auxiliary winding is put on the stator and produces a field nearly perpendicular to the main field and out of phase with it, the amount of phase difference between the two fields depending on the phase difference of the currents; of course, the winding is in series with a choking coil, and the whole lot in parallel with the main phase and then to the supply (see Fig. 19). The choking consists of the usual laminated core round which a coil of wire is wound, the high self-induction of the choker causes a phase difference between the volts and current in the auxiliary winding. There is, of course, a phase difference between the volts and current in the main phase due to self-induction in same, but is small compared with that in the starting phase caused by the choker; thus, it will be seen that there must exist under these conditions a phase difference between the current in the main phase windings and the current in the starting or auxiliary phase windings; but the difference is never a full quarter of a period at any time; so we do not get a true rotating field, but one having rather an elliptical motion. This, however, is quite sufficient to start the motor, and as the lever is moved on to the last stud, the choker and auxiliary winding are cut out of circuit and the main phase runs the motor. We could, of course, get the same result if we substituted a capacity for the choker, but, generally speaking, choking coils are mostly used. There are other methods besides those mentioned, but they all depend on the same idea, and that being a phase difference to be created at starting and cut-out when full speed is attained.

Single-phase motors suffer from two disadvantages, that is, they have a low starting torque, whereas two- and three-phase motors have a starting torque capable of dealing with even an overload, single-phase motors only exerting one-half, or even less, than full load torque. For this reason, if the starting load is high, fast and loose driving pulleys are provided on the machine or shaft, the belt being put on to the fast pulley when full speed has been reached. The other disadvantage is that single-phase motors cannot be overloaded like two- and three-phase motors.

The reversing of alternating-current motors can be effected by interchanging the connections of any one phase in two- and three-phase motors, and by interchanging either the auxiliary phase or the main phase, but not both in a single-phase motor. Single-phase motors, without an auxiliary or starting phase, will rotate in that direction in which the initial start is given.

We have only dealt, so far, with squirrel cage rotors, which consist of a number of short-circuited conductors, laid in slots, the conductors being permanently short-circuited by means of copper rings (see Fig. 11). This type of rotor is only used in small motors, or motors which do not have to start up under load. Let us carefully consider what happens when a motor having a squirrel cage is started up. Immediately the main switch is closed the stator field revolves at full speed, and (leaving the rotor out of consideration for a moment) this revolving field cuts the stator and induces an opposition or back E.M.F., which reduces the supply voltage and allows only the necessary magnetising current to flow (similar to a transformer with open secondary winding). Now, considering the rotor, the stator revolving field cuts the conductors of same and induces a current; now the rotor is stationary for an instant, and then starts and gathers speed, but it is a short time before it reaches a speed sufficiently high enough to reduce the relative velocity between itself and the rotating field. During this time the revolving field is cutting the rotor conductors at a very high velocity, thus inducing a large current in them, and producing a strong magnetic field in the rotor. This rotor magnetic field weakens the stator field (being in opposition to it) and reduces the back E.M.F. in stator winding, thus allowing a large current to flow from the mains. This is very objectionable from a supply company's point, as it causes a fairly large phase difference between the current and volts, hence a low power factor. If we could put a resistance in series with the rotor conductors, it would help to keep the currents from attaining large values, but this is impossible with squirrel cage rotors because of the conductors being permanently short-circuited. To get over this difficulty a different kind of rotor is employed (constructional), but the principle remains the same. In place of the short-circuited conductors we use coils wound on the rotor, the ends being connected either in star or in mesh to three slip rings, in the case of a three-phase motor, or four rings in a two-phase (four mains) motor, and two in a single-phase motor; brushes running on the slip rings convey the rotor currents to regulating resistances (a resistance for each phase); Fig. 20 shows a general arrangement of a three-phase starting resistance. When the stator is switched on to the supply, under these conditions only, the necessary magnetising current flows in the stator windings because the rotor circuits are open (the starting levers being on the dead studs—see Fig. 20), and no current can flow to produce an opposition field to the stator field, which would weaken same. The stator field is now revolving at full speed round the stationary rotor. As we pass the starting levers on to the first stud, the rotor circuits are complete, and a current will flow in them, but cannot attain a high value because of the resistances in the circuits; the magnetic field in the rotor is produced, which starts the motor, and as we cut out the resistances the speed increases, and on the last studs it will be

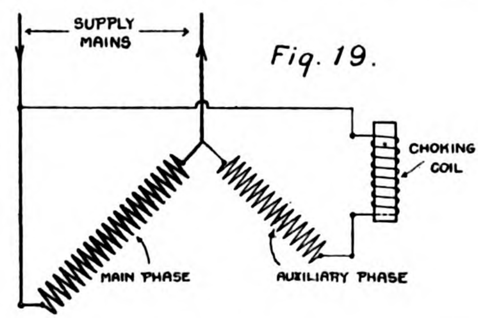


Fig. 19.

seen that the rotor windings are short-circuited, and rotor runs exactly as if it were a squirrel cage rotor. For the purpose of cutting the starting resistances clear of the motor a special device is mounted on the slip-ring end of rotor shaft, which takes the form of a knob running loose on the shaft, which, when pushed in, connects the slip rings to one another, thus short-circuiting the rotor windings and allowing the starting lever to be put back ready for starting up again without interfering with the motor. In some starting devices the short-circuiting knob, when pushed in, cuts the last resistance steps out, instead of cutting it all out with the starter. Fig. 20 shows the previous method, the short-circuiting knob simply cutting the starter clear of motor. In some cases, where motors are to be put in inaccessible positions, where the short-circuiting knob would be difficult to get at, it is dispensed with, and the starting levers being on the last stud, short-circuits the windings, and they are left in that position as long as the motor is running. Fig. 20 shows this last method. The only objection to this type is that we depend on the brush contact on slip rings for keeping the rotor windings short-circuited; if anything should occur by which one phase of winding became disconnected—for instance, a carbon or brush breaking—we should get an uneven field in the rotor and the speed of motor would drop very considerably. However, it is not very often that it does happen, and with care and periodical inspection of brush gear very little trouble should occur. In those motors which have the slip short-circuiting device, care must be taken never to start the motor without ascertaining that the short-circuiting knob is pulled out; otherwise, we have a short-circuited rotor, and on closing the main switch a tremendous rush of current would take place; and then, again, the starting resistances would be useless, as they would be cut out, owing to the slip rings being short-circuited. The introduction of resistance in the rotor circuits at starting has another great advantage, namely, that it causes the motor to exert a large starting torque; the proof of this fact is rather too mathematical to enter into here, so it must be taken for granted. It has

rotor currents and slip of an induction motor. If a two-phase four-pole motor takes current from a 50 periods supply, the speed of the stator field will be 1,500 r.p.m., and the rotor speed will be something less than field speed; if it were possible for the rotor to attain the same speed as the field, we should get no rotor currents induced, because the conductors would not be cut by the revolving field; therefore, the rotor is bound to run at a less speed than the field; the difference between the two speeds is called the slip. Suppose that in the above case the rotor speed was 1,480 r.p.m., then the slip would be 20 r.p.m., that is, per cent $\text{slip} = \frac{20 \times 100}{1500} = \frac{4}{3} = 1\cdot\dot{3}$ per cent. If we increase the load on the motor, the rotor speed will drop slightly, thus increasing the slip, which in turn causes the revolving field to cut the conductors

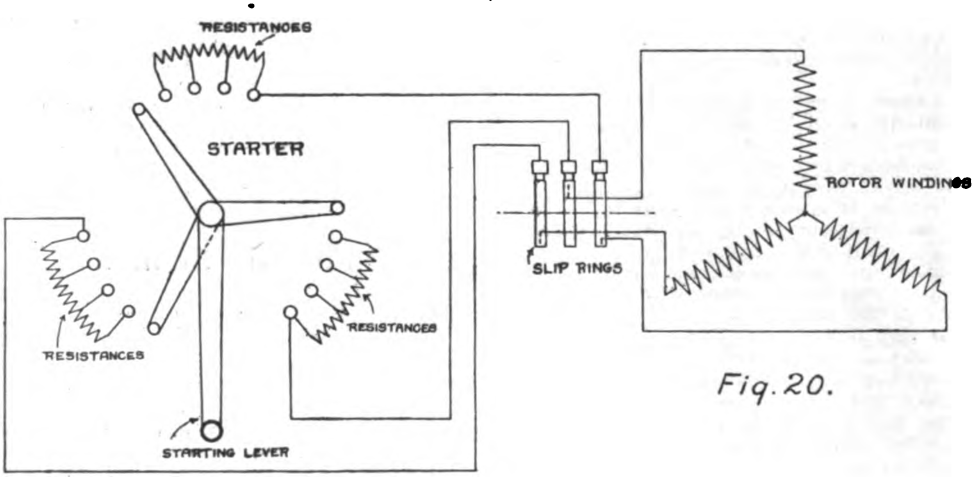


Fig. 20.

been proved that for small values of slip, such as light load, that the torque is proportional to the $\frac{\text{slip}}{\text{resistance of rotor circuits}}$ and that for large values of slip the torque is proportional to the $\frac{\text{resistance of rotor circuits}}{\text{slip}}$. From this it is evident that if we increase the resistance of rotor circuit at starting, we can get an increased torque, which is just what is required.

Another method of starting induction motors of the squirrel cage type, so as to avoid large currents at starting, is by means of what is known as a starting transformer. The starting switch is of the throw-over type; the main current is fed to the starting transformer, and one side of the switch takes a current from the transformer, which has generally about half the voltage of the mains. This gives the motor a chance of getting some speed up before full voltage is switched on. After the motor has gained speed the switch is thrown over to the running side, which cuts the transformer out of circuit and puts the mains directly in connection with the motor. But even with this appliance induction motors of the squirrel cage type are not suitable for starting under a load.

We will just give a short consideration to the

at a quicker rate and produces extra current to deal with the increased load. In first-class motors the slip seldom exceeds 5 per cent. at full load, except in very small motors, where the slip may be as large as 10 per cent., or even more. The currents in the rotor of an induction motor are alternating in character, the frequency of them depending on the amount of slip. Referring to the above case of the two-phase motor, where the slip was 20 r.p.m., we should get the same effect if the field was revolving at 20 r.p.m., and the rotor was stationary; this would give us rotor currents having a periodicity of 40 per *minute*. The periodicity of the rotor currents can easily be calculated, knowing the slip and field speed, from the same formula as we calculated field speeds, viz.:—

$$\text{Speed of field} = \frac{\text{Periodicity}}{\text{Number of pairs of poles}}$$

from which we get

Periodicity = speed of field × number of pairs of poles.

Putting the values in for the case under consideration, we have—

Periodicity = 20 r.p.m. × 2 = 40 periods per *minute*

The reader must not confuse the field speed in the last equation with the stator field speed what is meant is—the field speed relative to the rotor. Another way of putting the equation would be :—

Periodicity = slip × pairs of poles.

the former equation being used to show the derivation. In making experiments, a tachometer is used to get the rotor speed, and the field speed being calculated. There is an disadvantage in using a tachometer for the rotor speed, and that is—tachometers, as a rule, are only capable of reading within about 2 per cent., so that for small values of slip this method is hardly suitable. The method which gives the best results for small values of slip is by inserting an ammeter (preferably one with the zero in the middle) in one phase of the rotor windings, which, as the currents alternate, shows a deflection to the right and then to the left, one complete swing of the needle (*i.e.*, from left to right, and then back again) corresponding to one period variation of the current. This method loses its advantage when the rotor currents alternate quickly, as, with a large value of slip, then the oscillations of the needle become too rapid to be easily counted; then we have to resort to the tachometer method.

In cases where a motor is required to run at two different speeds on the same supply a special switch is provided in the stator windings, which alters the numbers of pole of the field, thus changing the speed. With regard to speed variation of induction motors, it is safe to say that there are at present no satisfactory means for that purpose, beyond that mentioned. Inserting a resistance in the rotor circuits whilst under load has an effect upon the speed, but is accompanied by a decrease in efficiency of the motor; and then, again, the variation is very limited.

The efficiency of induction motors (two- and three-phase) at full load is generally about 85 per cent., and decreases with an overload; at light load, the efficiency is low, owing to a low power factor. Single-phase motors on full load do not show quite as high an efficiency, generally speaking.

The advantages of induction motors over all other alternating-current motors are numerous, and in drawing this article to a close, I think they may be enumerated with benefit: (1) Simplicity in construction and working parts, more particularly with squirrel rotors, there being no starting resistances required, hence no slip rings; (2) these motors (excepting single-phase) can deal with very large overloads, and are capable of starting under full load; (3) owing to the fact that the current is led to stationary windings, much higher voltages can be employed, as the insulation is not impaired by having to withstand mechanical strain; (4) they do not require to be run up to speed by external means before being switched on to the supply, as synchronous motors do, but at the same time the speed is not absolutely constant, but varies with the load. With regard to single-phase motors and advantage No. 2, they are not capable of dealing with big overloads and starting up under load as two- and three-phase motors are. This is a point to which much attention has been given by engineers. Many things have been tried to produce a single-phase motor having the advantages of two- and three-phase motors; one of the latest productions on the market being a single-phase motor which can be used for crane-work, where a large starting torque is necessary. This motor is not a true induction at starting, but depends for its large torque on the principle of repulsion motors, which is a large torque at starting, which diminishes as the speed increases (just the opposite to an induction motor); when a certain speed has been attained, the armature (which is similar to a direct-current motor, but having short-circuited brushes placed midway between the maximum and minimum voltage positions) conductors are short-circuited, and the motor then operates as an induction motor. I have, however, had no opportunity for seeing these motors working, and consequently cannot make any statement of their efficiency; it is quite evident that they are not exactly as simple as ordinary induction motors.

There are a number of points which have not been dealt with, for the reason that it would necessitate a considerable amount of mathematics, thus preventing this article from serving its intended purpose, which is a description of induction motors suitable for amateur electrician readers to study without going too deeply into the matter. Nothing has been mentioned about the methods of winding, as this requires to be separately treated. Should any readers require more technical information, I should be only too pleased, with the Editor's permission, to make a continuance of this interesting subject, or to answer individual enquiries through THE MODEL ENGINEER.

For the Bookshelf.

[Any book reviewed under this heading may be obtained from THE MODEL ENGINEER *Book Department, 26-29, Poppin's Court, Fleet Street, London, E.C., by remitting the published price and the cost of postage.]*

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC, 1909. Edited by Geo. E. Brown, F.I.C. London: Henry Greenwood & Co., 1s. net. Postage 5d.

In the forty-eighth annual issue of this publication a new feature is embodied which should be appreciated by the reader: it is a classified index to the numerous articles advertised. The matter is arranged under subject headings, of which there are about 120. A directory of the photographic trade, giving telegraphic addresses and telephone numbers, is also provided. As in previous years, the volume provides a record of the year's progress in photography in all its phases, reviews of the most modern apparatus and formulæ, and tables representing current practice and methods are also included. It should prove a compilation of high value to those interested in photography.

TIN-PLATE WORKING. By H. R. Clarke. London: The Technical Publishing Company, Ltd. Price 1s. 6d. net.

In tin-plate work we have the first of a series, the "Popular" Technical Manuals. It is a volume of some forty-four pages, and includes several large plates illustrating the subject the author deals with. The scheme of work set forth is intended as a course of instruction for students preparing for the City and Guilds' Examination in manual training metal work. The first ten exercises provide all the work required by first-year students, and the remaining ten for final year students. We might suggest that the volume, though limited in its scope, will afford practical workers in metal many useful hints, and afford them an opportunity of learning how to set out their work and manipulate their material to the best advantage. The work is well illustrated by a number of half-tone reproductions. It is, in short, one of the best manuals for the purpose for which it was written that we have yet met with.

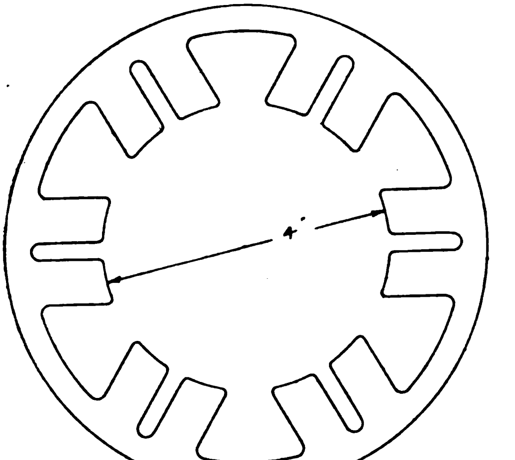
Queries and Replies.

Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed, and also a "Queries and Replies Coupon" cut out from the advertisement pages of the current issue. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *26–29, Poppin's Court, Fleet Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[20,295] **Converting Induction Motor to Dynamo** S. J. S. (Balham) writes: Can you give me any advice as to the possibility of converting the motor as sketch herewith into a dynamo? It is, I believe, an induction motor of the G.E. Company's. It has laminated magnets of six double poles, and as the wire is covered up, I cannot easily trace the method of winding (perhaps you would know.) Length of armature tunnel, 1½ ins. Would



QUERY N° 20295

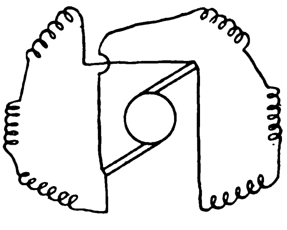
a sixteen-pole cogged drum make a satisfactory armature? What wire would be most suitable? Wire used is about 26 and 28 W.G. What would be the possible output? Maker's plate states 100 volts. I should like, of course, to retain the present wire on magnets. What book do you recommend on small dynamos that would be of assistance to me?

This machine may work as a dynamo; it is just a question as to whether it will excite; probably it would do so. Sixteen slots is rather few for an armature to work in a six-pole field-magnet. We advise a greater number, say thirty-six slots, each 5-32nds in. wide by ⅛ in. deep approximately. Wind with No. 26-gauge D.S.C. copper wire, two coils in each slot, on the plan shown by diagram 49 in our Handbook No. 10; commutator to have thirty-six sections, and should be at least 2 ins. diameter. Instead of winding into slots, one-quarter of the circumference apart, however, you must wind into slots which are one-sixth of the circumference apart, and connect the commutator segments at distances of one-third of the circumference. That is, section No. 1 would be connected to sections Nos. 13 and 25, No. 2 would be connected to sections 14 and 26, and so on, if you are going to use only one pair of brushes, which may be placed at diametrically opposite points or at places one-sixth of the circumference apart. As an alternative, you can avoid cross-connecting the commutator by using six brushes and connecting alternate brushes together. The better plan will be to rewind the field-magnet with No. 24-gauge S.C.C. copper wire for a shunt winding; probably about 7 ozs. will go on each pole. You could then use some of the old field-magnet wire for the armature. If you care to try the present winding, connect it as two circuits in parallel and in shunt to the brushes; it will be necessary to see that you obtain the correct polarity for the poles; probably this will be the way (as sketch). Output, possibly about 30 volts 5 amps, at 2,000 r.p.m., but the speed must be determined by trial; it may come less. Get as much wire as you can on to the armature. We have no book on small multipolar machines, but our "Practical Manual" (No. 5), post free 1s. 3d., and our Handbook No. 10, post free 7d., will assist you.

[20,763] **Spelter for Brass; Electrical Queries.** W. A. P. (Shirebrook) writes: I should be glad if you will kindly inform me what spelter to use for brazing brass, such, for instance, as is used for such things as buttons (brazing the shanks on), joining brass buckles, etc. I sent for some once which was supposed to do, but the job melted as soon as the spelter. (2) I have a 50-volt 10-amp. dynamo using 50-volt lamps; how many would it light? Can you tell me of a cheap book on dynamos? Those I have do not tell me whether I put accumulators to charge on the positive or negative side of resistance lamps.

(1) To make the spelter, melt 5 parts of copper, add 2 parts of zinc, and 2 of silver, then immediately stir the mixture well. Cast in a small ingot mould, and afterwards roll into a sheet, from which you can cut a piece when required. (2) The number of lamps your dynamo will light depends upon the candle-power and efficiency of the lamps. On the subject of dynamos, see our Handbook, "Small Dynamos and Motors" (7d. post free from our office), and on accumulators our Handbook, "Small Accumulators" (7d. post free). You would do well to study a good elementary treatise on electrical engineering, such as Slingo and Brooker's or Tyson Sewell's.

[20,733] **Electrical Formulæ.** **W. E. H. (Leytonstone)** writes: I have a motor which I intend using to drive a boat. It is a 4-volt motor using 1½ amps. My accumulator is one of 4 volts 6 amps. Will you please tell me how long my accumulator will drive the motor, and if you can give me the formulæ for working out same I shall be obliged. Is there any book published on electrical formulæ?



We expect that by a 4-volt 6-amp. accumulator you mean a 4-volt accumulator of 6 amp.-hours' capacity. Accumulators are usually marked with their capacity in "amp.-hours," which tells you at once for how long they will supply a certain current. If yours is a 6 amp.-hour accumulator, it will give 1½ amps. for four hours (4×1½=6). For electrical formulæ you cannot do better than get one of the electrical "Pocket Books." That published by the *Practical Engineer* is a good one (price 1s. 2d. post free from our publishing office).

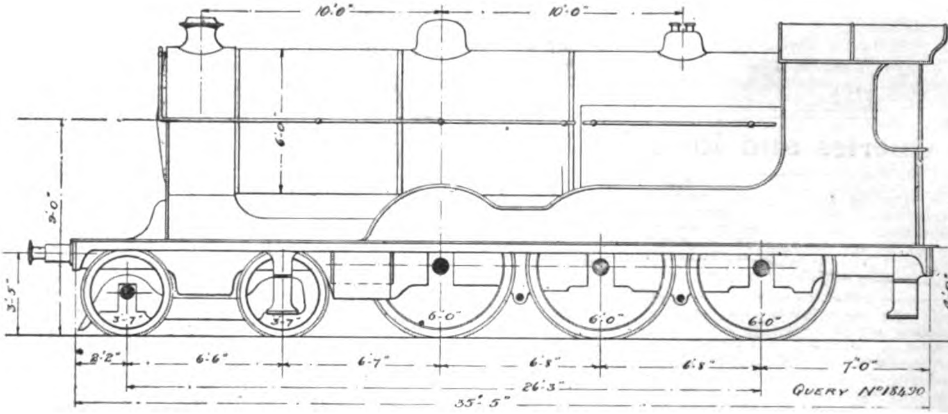
[20,785] **Electric Alarm.** W. S. (Middlesbrough) writes: Having gone by instructions given in THE MODEL ENGINEER Handbook No. 3, as to the making of an ordinary alarm clock into an electric alarm, what is the reason the bell should start to ring as soon as I put the switch on?

The contact trigger is probably not properly insulated. We suspect that the screws which hold down the arc-shaped stips are causing a short-circuit.

[20,756] **Lamp for Tool Hardening.** S. E. A. (Southampton) writes: I should be much obliged if you would kindly give me any information as to how to make a simple lamp to burn paraffi, suitable for heating a soldering-iron or hardening drills (up to ¼ in.), or lathe tools (same size).

We recommend a blowlamp with Ætna burner. See our issue of Feb. 18th, 1904, for a good design.

[18,490] **L.S.W.R. Six-Coupled Express Locomotive No. 330.** A. B. (London) writes: Kindly publish, if possible, the leading dimensions of the above locomotive.



L. & S.W.R. 4—6—0 TYPE FOUR-CYLINDER EXPRESS LOCOMOTIVE (No. 330 CLASS).

We append an outline drawing of No. 330, and would mention that the later class of engine has a different valve gear for the outside cylinders and holes in the leading splashers. You can obtain a photograph to help you, should you require to model No. 335, instead of No. 330.

[20,790] **Resistance; Gas Engine Exhaust Silencer.** H. B. H. (Liverpool) writes: (1) What quantity and gauge of German silver wire will I require to pass a current of 3 amps. on a 230-volt circuit? (2) How can I make an effective silencer for 2-in. bore gas engine?

(1) Nearly 6 ozs. No. 24 S.W.G. German silver wire. (2) We recommend leading the exhaust into a box of broken coke. A suitable size for your engine would be about 1 ft. square.

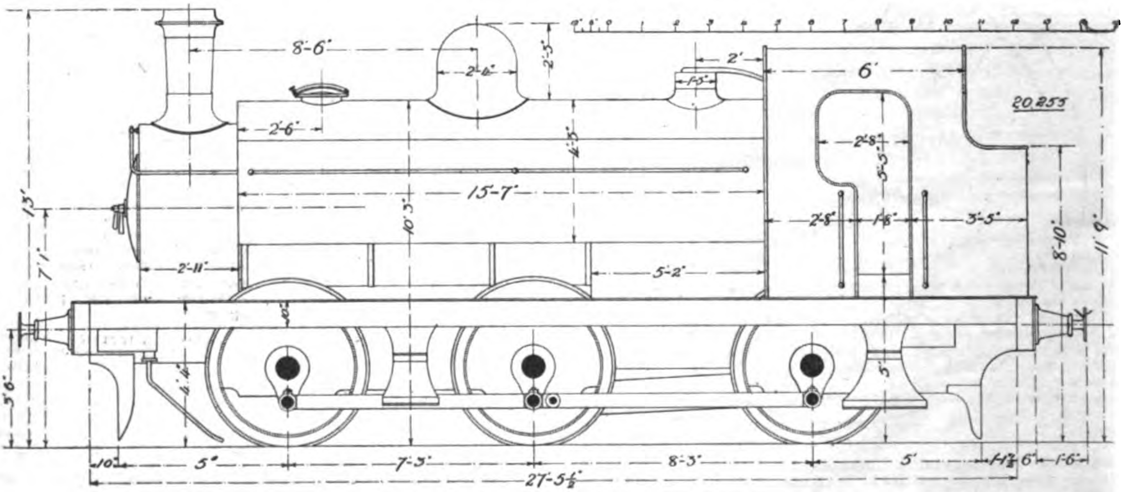
[20,255] **G.N.R. Coupled Saddle Tank Locomotives.** H. G. (Sheffield) writes: Could you kindly publish in THE MODEL ENGINEER, at your earliest convenience, an outline drawing of a Great Northern six-wheel coupled saddle tank locomotive, with the leading dimensions? Thanking you in anticipation.

[20,783] **Voltage Reduction; Fuses.** W. A. W. (Bayswater) writes: Would you be kind enough to answer me the following queries? I have only taken THE MODEL ENGINEER for a short time, and have not many back numbers. I wish to construct a resistance board to run a model electric tram off 200-volt mains. (1) What size (in candle-power and amps.) lamp (carbon filament) shall I require to bring down 200 volts to 8 volts 2 amps. and 4 volts 2 amps.? (2) On which wire should I fix a fuse on a resistance board, as illustrated on page 41 in Handbook No. 1 series? (3) What size fuse wire shall I require for above tram, taking 2 amps.? (4) What length and what size iron wire shall I require to bring 8 volts to 2 volts?

(1 and 4) This question of reduction of voltage is one which has frequently been dealt with in our columns. Please refer to Query Reply No. 20,123, in our issue of August 6th, 1908. For designing resistance you will find the lists at the end of our Handbook, "Small Electric Motors," very useful. (2) It is of no consequence on which side the fuse is placed. (3) A tin fuse of No. 26 S.W.G. wire.

[20,788] **Horizontal Steam Engine.** E. J. M. (Stowmarket) writes: I have a model horizontal slide-valve engine, 1¼-in. bore by 2½-in. stroke. Will you please inform me what power it would develop at 50 lbs. pressure, and number of revolutions per minute it would make? Also the smallest size boiler which would keep it running for two hours at one time (using feed-water pump connected by eccentric to engine) and using ordinary spirit lamp?

About 1-10th i.h.-p. The revolutions per minute will depend upon the output of the boiler. At about 50 lbs. pressure,



G.N.R. COUPLED SADDLE TANK LOCOMOTIVE.

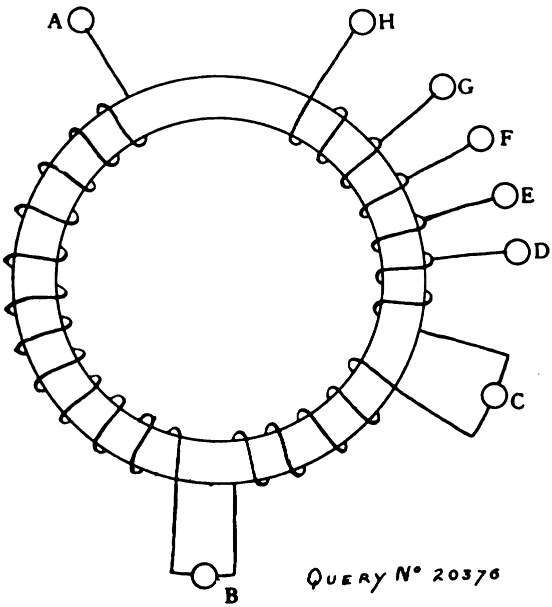
We append herewith a drawing of Mr. Ivatt's six-coupled saddle tanks on the Great Northern Railway. The engine is one of the class numbered 1,220. The front views may be compiled by the possession of a photograph which at the time of writing we cannot obtain. The saddle tanks are square-sided.

speed might be 300 r.p.m. Use a vertical multitubular boiler at least about 7 ins. diameter by 13 ins. high.

[20,782] **Dividing in Milling Machine.** T. K. (Swansea) writes: Would you kindly explain the method adopted to work out a dividing head on a milling machine for wheel cutting, to find the right number of holes in dividing-plate? I may say the *dividing head* is geared 40 to 1.

Knowing the number of teeth to be cut, select a convenient set of holes, into which that number divides evenly and if you work out the division sum: $\frac{\text{No. of holes in dividing head}}{\text{No. of teeth in wheel}}$, the resulting number will give you the number of holes per tooth.

[20,376] **Transformer Winding.** I have read with interest the article on auto-transformers in *The Engineer-in-Charge* and on transformers in some back numbers of THE MODEL ENGINEER. I wish to make an auto-transformer for working a large coil taking 12 amps. off an alternating-current circuit of either 210 volts or 105 volts, 50 ~ circuits and as I am not going to work with a very high-speed interrupter, I would like to have the auto-transformer tapped to give 50, 40, 30, 20, and 10 volts with 12 amps. I should be much obliged if you would advise me the size of core, wire, and turns. I could make the core of thin charcoal iron plates, the shape of those in *The Engineer-in-Charge*, or procure gramme ring armature stampings. I should like also to know what you think of the R.F. electrolytic interrupter. I think the G.E.C. Company make it.



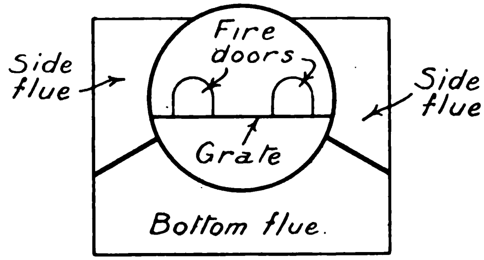
We advise you to make a transformer having ring core and three graduated windings; a convenient size could be made having windings giving three turns per volt. Core to be plain ring stamping, 7 ins. external diameter by 4½ ins. internal diameter, depth about 2 ins. There is no objection, however, if you prefer to make a rectangular shaped core with an equivalent cross-section of iron. From A to B, 315 turns No. 18-gauge D.C.C. copper wire; from B to C, 165 turns No. 16-gauge D.C.C. copper wire; from C to H, a total of 150 turns No. 14-gauge D.C.C. copper wire. When working from 210-volt main, connect the main to terminals A and H. When working from 105-volt mains, connect the main to terminals B and H. The coil to be connected to any pair of terminals D to H, each pair representing 10 volts. The winding should be in a continuous coil, as indicated. It may cover the whole of the core, and one part may be over the other, if convenient. No. 18-gauge wire is about 48 yds., No. 16-gauge about 27 yds., and No. 14-gauge about 18 yds. per lb. This will assist you to order approximately the required quantity of wire. We have no experience with the interrupter.

[20,607] **Caledonian Railway Crest.** W. P. (South Wales) writes: Could you tell me where to have the coat-of-arms for the model "Dunalastair" locomotive? I believe they can be had, as I have seen models with them on.

These have, we think, only been imitations; we mean that only a general effect has been provided. The best thing you can do is to obtain a good photograph of one of the Caledonian Railway tenders. Perhaps one of our northern readers who can take a good detailed photograph would send us a print for publication in our columns, with notes as to the colouring. The photograph should fill up a quarter-plate. Of course, a focussing camera will have to be used.

Further Replies from Readers.

[20,324] **Cornish Boiler.** H. J. C. (Somerset) would get the best result from his boiler by setting it in brickwork and by working the draught through the tubes, then underneath the bottom of boiler, then along the sides. I have been a first-hand stoker for a number of years on boilers of this sort, and find the best result



by working the draught this way. The superheater pipes should run down back of boiler into the bottom flue, where they get all the heat and dry the steam. I have sent you a little sketch, and trust this may be useful to those using Cornish boilers.—J. T. G. (Pontardawe).

The News of the Trade.

• Non-Rusting Steel Rails.

We have received from the Clyde Model Dockyard, Argyll Arcade, Glasgow, a sample of a new non-rusting steel rail they have lately introduced. This is supplied in 3-ft. straight lengths, bored for fishplates, suitable for any gauge. Chairs, fishplates, sleepers, and point-rails are also supplied, enabling model permanent-way of excellent quality and realistic appearance to be laid down at a low cost with a minimum of trouble. The depth of the rail section is 5-16ths in. A sample set, consisting of 1-ft. rail, two chairs, fishplate and screws, and sleeper, will be sent to any reader post free for 6d.

New Catalogues and Lists.

Shaw & Brother, Leabrooks, Alfreton, Derbyshire.—A useful catalogue of workshop tools and accessories has reached us from this firm. It includes lathes, small planing machine, sensitive drilling machine, angle-plate, machine vices and clamps, vee-blocks, surface-plates, faceplates, milling attachment, and many useful sundries—all of which bear the impress of good and convenient design.

W. J. Bassett-Lowke & Co., Northampton.—This year Messrs. Bassett-Lowke have decided to issue their new catalogues in one volume, and a very substantial production it makes, running to well over 300 pages. As usual, model railway work is the leading feature, and several novelties are included. Among these are some new cheap locomotives, of which a working model of the "Rocket," with rolling-stock is, perhaps, the most striking. There is also a new scale model G.W.R. locomotive, No. 3,410, to a 1½-in. gauge; a new G.W. model of the "Albion" class, 2-in. gauge, and particulars of the 1½-in. scale Great Central model recently referred to in our pages. Electrically driven locomotives are strongly represented, while the rolling-stock and permanent-way section of the list is particularly complete. A coloured plate shows how realistic is the appearance of the latest scale coaches. Stationary engines and boilers, steam fittings, castings and parts, tools, model yachts, and many other lines make up a particularly interesting list. It will be sent post free anywhere for 7d. or may be had for 6d. on application at the firm's London branch.

Arthur Firth, Cleckheaton, Yorks.—The new catalogue just issued by Mr. Arthur Firth is got up in excellent style, and is full of interest to the amateur with a workshop. It deals with lathes, chucks, bench drills, lathe castings and parts, planing and shaping machines, change wheels, drill grinders, slide-rests, and turning tools, cycle motors, engines, hacksaws, lathe shaping attachments, and numerous small tools and accessories. The contents have evidently been arranged with a good knowledge of the amateur's requirements, and as they cover 86 pages the selection is a wide one. The list is priced at 6d. post free, but this amount is refunded in the first order of 7s. 6d. in value.

The Editor's Page.

IT has always seemed a pity to us that greater interest has not hitherto been displayed by the governing authorities of the great cities of our country in the formation of collections of engineering models for the public benefit. It is true that in London—at South Kensington—we have the finest collection in the world, while in Edinburgh also, as recent articles in our pages testify, another very excellent permanent display is to be found. There are, however, other great centres of industry and learning, such as Manchester, Liverpool, Newcastle, Leeds, Birmingham, Bristol, and elsewhere, in which a public model museum might well find a place, especially if the particular industries of the district were adequately represented. Why, for instance, should not Liverpool have its gallery of ship models and marine engineering exhibits; Crewe, Doncaster, and Derby, their locomotive models; and Manchester its exhibit of textile machinery in miniature? The fact that the burden of support of such public enterprise might fall on the ratepayers would no doubt be a more or less potent objection, but we think that public money spent in such a cause would be just as well laid out as it is in supporting public libraries and art galleries. We are inclined to think, however, that, apart from the cost of housing and supervising the models, the expenses would be very small, for the enthusiasm of model builders is so great that excellent loan, and even presentation, collections could in time be got together without any appreciable difficulty. If proper provision for showing models were made in the various local centres, the South Kensington authorities could, no doubt, be prevailed upon to send some of their many available models on tour, and thus afford an opportunity of pleasure and instruction to many who through force of circumstances are unable to see them in their usual place. Railway companies and large engineering firms would doubtless also temporarily contribute many excellent models to such collections, while the amateur workers of high-class ability who could assist are to be found on every hand. It seems that here is an opportunity for some energetic society of model engineers to make a move and organise a loan exhibit of models in their city under the auspices of and with the assistance of the municipal authorities. This step being successfully accomplished, the question of making a permanent official collection might well be brought forward. Perhaps some of our readers who hold municipal office in one or other of our big industrial centres might think the suggestion over.

* * *

We are asked to announce that the Annual Rummage Sale of the London S.M.E. will take place on January 8th. Members bringing articles for inclusion in the sale are requested to be at the hall, Cripplegate Institute, Golden Lane, E.C., by 6.45 p.m.

Answers to Correspondents.

F. A. D. (Southsea).—See our issue of July 2nd, 1908.

J. G. (Edgbaston).—See "Model Boiler Making" (7d., post free). A suitable design will be found on pages 56–59.

J. M. (Crossgar).—Write Petrolite, Ltd., 202, High Holborn, London, W.C.

C. A. (Sunderland).—See our issue of April 25th, 1907.

J. S. (Shaw).—See article "Making Surface Plates" in our issue of May 5th, 1904.

B. K. (Portsmouth).—The gearing must be such that the number of impulses per revolution of road-wheel given to the cyclometer when on the bicycle shall bear the same ratio to the number of impulses when on the car as the diameter of bicycle tyre bears to diameter of car tyre.

E. P. (Wickford).—You will find complete design of engine in our issue of January 15th, 1903. This (somewhat adapted, perhaps) should meet your requirements.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 26—29, Poppin's Court, Fleet Street, London, E.C.

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

[*The asterisk* (*) *denotes that the subject is illustrated.*]