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Model Engineer
And Electrician.
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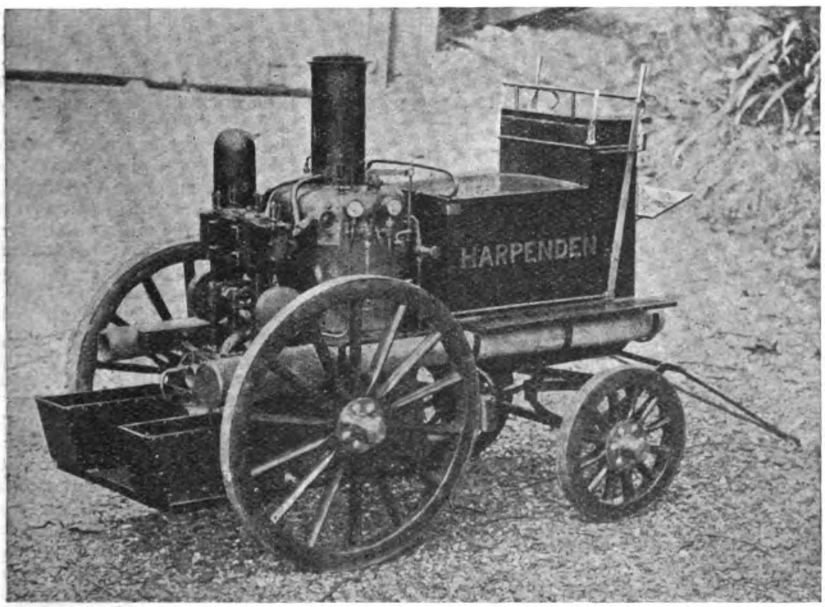
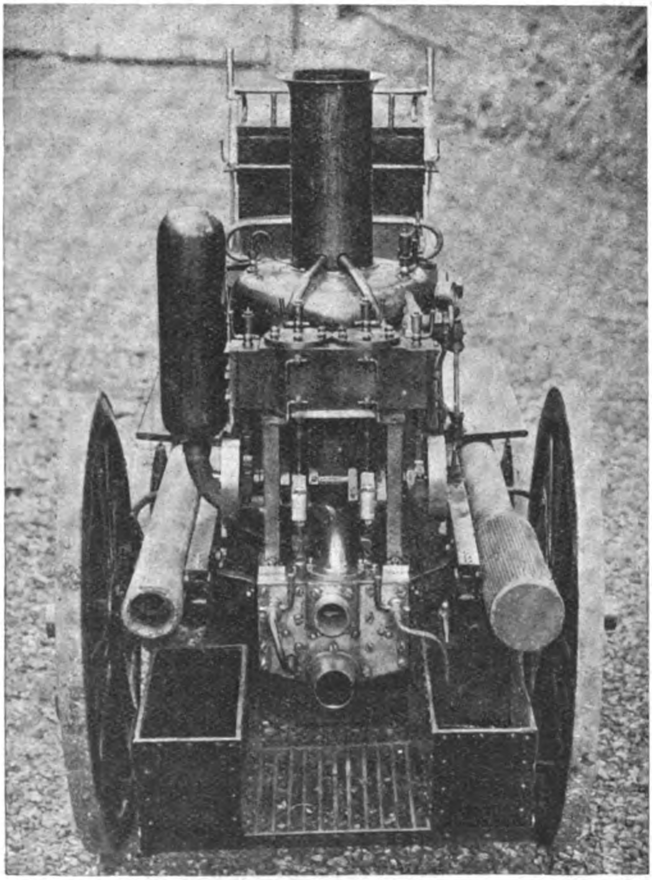
A Well-made Model Steam Fire Engine.

By R. A. BRIGGS.



MR. R. A. BRIGGS' MODEL STEAM FIRE ENGINE.

THE annexed views illustrate a model steam fire engine I have recently completed. As will be seen, it is of the well-known double vertical type. The engine is 3 ft. 6 ins. long over all by 1 ft. 8 ins. wide, and 2 ft. 4 ins. high to the top of the funnel. The boiler, which is of steel 3-16ths in. thick, lagged with asbestos, and cased with polished brass, is of the fire-tube type, 8 ins. in diameter by 15 ins. high, and contains forty-three ⅝-in. solid drawn copper tubes expanded at top and bottom. The firebox is surrounded with a continuous ¼-in. copper coil, through which the feed-water is pumped on its way to the boiler. Here it is delivered, certainly at boiling point, possibly considerably above. The usual working pressure is 100 lbs. to the square inch, but frequently it is 120 lbs. It steams freely, and maintains a full head of steam at full speed with the utmost ease. Steam is raised from "all cold" in less than five minutes with a wood fire. When the gauge moves a steam jet is turned on, and sprays paraffin oil into the firebox on to asbestos balls, which readily become incandescent. Steam is then rapidly made and maintained. At first it was found that when the engine developed its full power the boiler was inclined to surge and prime, with the result that water was carried over into the engine and the water in the gauge was so erratic as to be untrustworthy, and the feed could not be kept up. A superheater was therefore fitted, made of ⅛-in. bore iron tube, which was taken from the top of the boiler down one of the firetubes, turned two complete twists over the top of the fire, and thence up through a tube to the top of the boiler and to the engine, the result being that the feed-pump, which before was inadequate, is now only working about half its power and the burner, instead of being full on, is kept as low as it will burn. The water level in the boiler can be kept higher and perfectly steady, and the efficiency of the engine greatly improved; in fact, the first time the engine was tried with the superheater the jet was thrown at least 10 ft. higher. The two steam cylinders are 1½ ins. by 1½ ins., and operate the crankshaft on the slipper method, the only function of the crank being to keep the two cylinders in step and to work the eccentrics for the valves and feed-pump.



Rear View of Fire Engine, showing Engine and Pumps.

The main pump rods are of brass, and obtain the direct thrust of the steam cylinders; the pump pistons are of the inverted cup leather type; the pumps are double-acting, 1½ by 1¼ gun-metal, made in one solid casting, with large waterways cast in. The eight suction delivery valves are all in the front, and can be readily got at for the removal of the copper-plate. The valves are of gun-metal rubber faced. Some trouble was experienced with these at first, as the rubber became cut through, and on several occasions were forced out of the jet when working. This has been got over by using a good quality three-ply rubber and canvas. The suction hose is 1¾ ins. in diameter, and the delivery 1 in. Two 25-ft. lengths of the latter are carried on the engine; the branch pipe is of copper, and is provided with two jets, one about ¼ in., and the other 3-16ths-in. bore. The stream is steadied by a large polished copper air-vessel, and with the engine running at a steady speed, and with 120 lbs. of steam, a water pressure of 90 lbs. is registered by the gauge with the jet open, and the engine under these conditions throws a good solid stream over the top of our three-storey house. On a test it was found that 15 gallons per minute was delivered through the branch pipe with the jet off through a ⅜-in. outlet. The boiler is fitted with the usual mountings, comprising steam and water-pressure gauges, water gauge, test taps, spring balance safety valve (set to blow at 125 lbs.), whistle and steam blast, blow-off cock, and load-pressure valve. The engine has lubricators on each steam chest and cylinder and four drain taps. Two tanks are provided at the head of the engine, one for the feed-water, the other for the wood fuel for starting. The feed-water is supplied from the main pumps into the tank, and the feed-pump, which is low down on the right-hand side, draws from the tank, and delivers direct to the boiler, or back to the tank, or part to each, by means of the nose coil seen above the tank. The feed-pump is ½ in. by ⅝ in. The tap on the left side of the main pump chamber is for by-passing water from the delivery side back to the suction, so that the engine may be run at a steady speed when only a small supply of water is available. One of the chief difficulties is getting sufficient water to keep running. Two garden hose-pipes discharging into a tank will not keep her going, so recourse to the village pond is necessary for full-power trials, or a friendly neighbour's well to occasionally pump out. The engine has been kept running hard for an hour and a half pumping out a well 12 ft. deep, which she emptied in that time.

The engine, boiler, and body (the letters on which are cut out of brass plate, and fixed with countersunk screws) are carried on rolled steel angles, to which are attached the springs (all built up of spring steel), containing some eight or nine leaves each. The woodwork is of mahogany and the wheels of ash, mounted on artillery hubs on steel axles. Double brakes are fitted. A tank holding a gallon of paraffin is carried under the driver's seat. A pole has been provided for horse attachment. The engine, however, is shown with a draw-bar, by which it is hauled by our model traction engine (illustrated some time back), as the engine is too heavy to handle comfortably on our hills. The whole of the engine and boiler parts are bright, the woodwork red, and the iron carriage parts black.

A model of this type affords ample opportunity for good workmanship and finish. Its working parts are accessible, easily cleaned, and form distinctive features without being hidden away in out-of-the-way places.

The Borsig Locomotive Works.—During the month of October the 6000th locomotive built at these works was turned out of the shops. The engine is a four-cylindered combined rack and adhesion tank locomotive built to the order of the Prussian State Railways. Its weight in working order is about 58 tons, and it is intended for working trains over gradients of 1 in 16½ in the Rhine provinces. This firm employ altogether about 12,500 men. Some 4,500 of these are engaged at the engine works at Tegel, a suburb of Berlin. At these works the firm construct locomotives, gas engines, stationary steam engines, boilers, and air-compressing and refrigerating machinery. Eight thousand men are employed at Borsigwerk, in Upper Silesia, in the company's coal mines, steel foundries, mills, and in blast-furnace work.

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.]

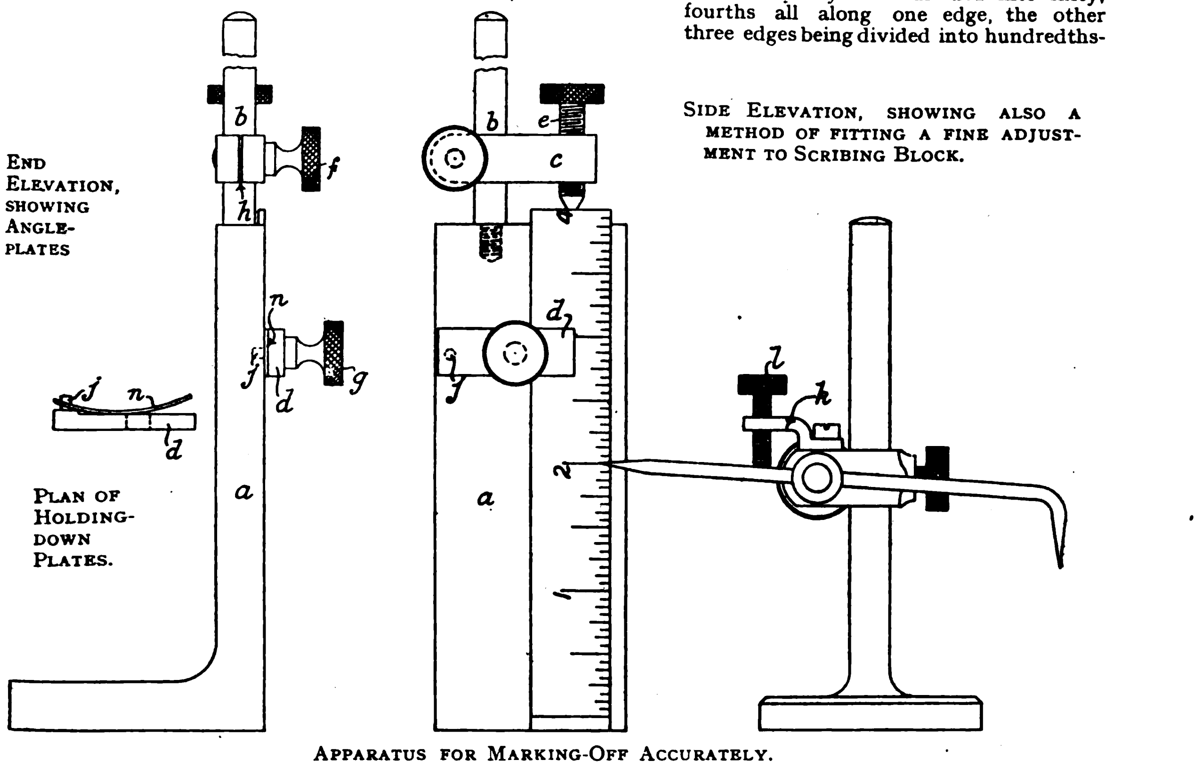
An Aid to Marking Off Accurately.

By A. C. Huskinson.

The model engineer who likes to line out his work accurately will find the appliance shown in the sketch to be well worth making.

It consists in an angle-plate of cast iron *a*, having a groove in its face to allow a 4-in. stub-rule to slide in it without shake, and should be of such a depth that the rule is almost flush with the face of the angle-plate.

The rule used by myself is divided into sixty-fourths all along one edge, the other three edges being divided into hundredths-



Apparatus for Marking-Off Accurately.

millimètres, and half-millimetres, also along their whole length; *d* is a mild steel holding down plate, with a hole to take the knurled screw *g*, which is tapped into the angle-plate; *j* is a small pin riveted into *d*, and fitting into a hole in *a* to keep *d* in position; a piece of clock spring *n* is cut to the same shape as *d*, and drilled to take the screw *g*, and pin *j*; its object being to allow the rule to move stiffly when *g* is not screwed quite up tight.

The rod *b* is made from ¼-in. silver steel, tapped into the top of *a*; it carries a sliding block *c* of mild steel.

This block is drilled and finished with a reamer, so as to be a good sliding fit on *b*; it is also drilled, tapped, and split, and a clamping screw *f* fitted; the other end being topped for the adjusting screw *e*. The height of the rod *b* should be such as to allow of the rule projecting about 2½ ins. above the top of *a* if necessary. The use of the appliance is as follows: When a casting has to be lined out, having a centre line, and a quantity of other lines at various distances above and below it, the centre line is first marked off in the usual way, the 2-in. mark on the rule is then set to the scriber point, using the screw *e* as a fine adjustment; the scriber can now be easily and accurately set so as to scribe lines at any distance from the centre line up to 2 ins.; if a watchmaker's lens is used, it is an easy matter to estimate one-quarter of one sixty-fourth of an inch, and to set the scriber thereto.

The sketch also shows an extremely simple method of fitting a fine adjustment to a scribing block; *k* is bent from ⅛-in. sheet steel, and is fastened to the top of the block with two small screws, it is tapped to take a knurled adjusting screw *l*, which bears upon the top of the scriber.

If the scriber clamping screw is adjusted so that the scriber works stiffly, and the point is set a little above the final position required, the screw *l* can be used to push it down to the exact position.

Boring the "M.E." Gas Engine Bedplate.

By W. H. C.

I began by drilling the ½-in. holes for the holding-down bolts; then lined out the casting and marked lines to file to for fitting bearing caps. This was rather troublesome, as my surface-plate is only 18 ins. by 12 ins.; but by using it and the lathe bed I got lines correct. I fitted the caps in their places, drilled them on angle-plate of lathe, 11-32nds-in. tapping size for 7-16ths-in. studs, and mounted foundation-plate on wooden stand (shown in Fig. 1). This was made up of 1-in. deal. The drilling machine not being high enough to get the work under, I made a table under it, on which the stand is resting. Having secured the caps in their places with wooden clamps, the lower catching under bosses for bearing brasses, I drilled holes for studs, guided by holes drilled in caps, tapped them, and after clearing out holes in caps to ½ in., temporarily bolted them down with square-headed bolts.

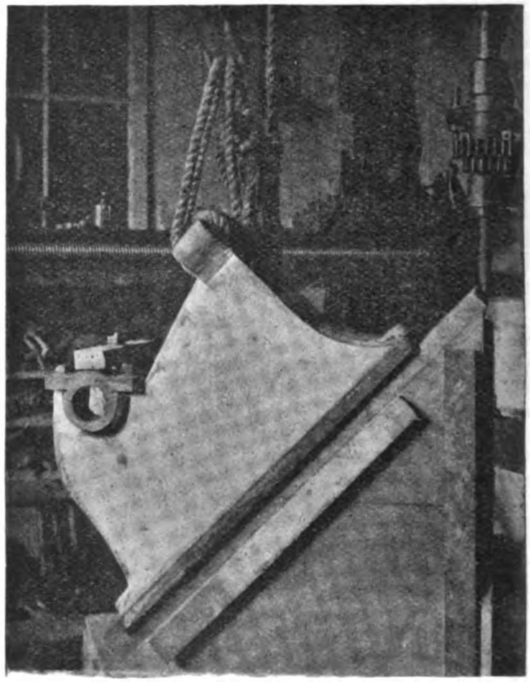


Fig. 1.—Mounting Gas Engine Bed on Wooden Stand for Drilling.

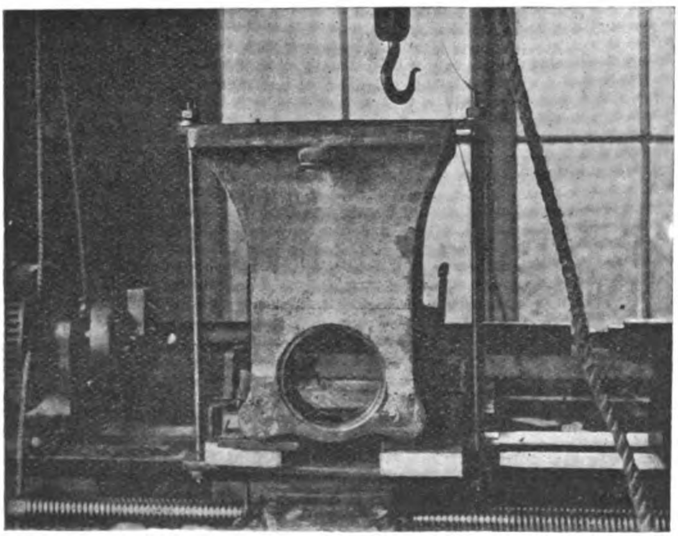


Fig 2.—Boring and Facing Gas Engine Bed.

I prepared cutters in boring bars for boring and facing the flanges of foundation. The facing cutters, after being fitted in their places, I trued up with emery wheel in slide-rest.

The foundation-plate was first mounted on slide-rest saddle to bore out the cylinder fitting, a couple of oak battens being bolted to saddle; the work was got into place, and packed up, then secured by iron clamps under the ends of battens. The method can be seen in Fig. 2. After boring and facing the plate for cylinder, I took a cut along the bearing flanges inside to give me a guide as to where to face them off to; re-marked the centres of bearings with a bent scriber in boring bar to make certain that bearing should be at right angles to cylinder bore, and remounted the plate as shown in Fig. 2. Bored for bearing brasses, and faced off flanges with cutters in boring bars. As the casting is rather heavy to lift about, I rigged up a tackle with two single blocks, the upper a patent one which holds the load in any position. A piece of 3-in. quartering across the workshop carried the upper block. The lathe on which work was done is 5-in. screw-cutting.

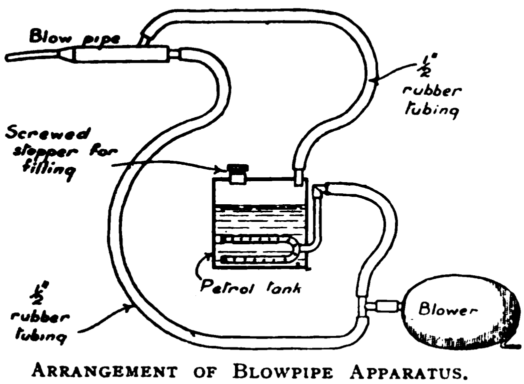
A Rubber Moulding Mixture.

The following mixture (says the *English Mechanic*) is one which can be used for making mould for rubber stamps, or special shapes of rubber, or for complicated, odd, or queer-shaped patterns, of small size, as the working must be done inside of ten minutes, and the surface takes a finish as smooth as glass if well rubbed. If an impression is to be made, the surface of the type or article to be impressed should be rubbed with a solution of kerosene and graphite. Plaster of Paris, 5 lbs.; French chalk, 2 lbs.; china clay, 2 lbs.; dextrine, ½ lb. Mix with dextrine water, which is made by dissolving 1 lb. of dextrine in 1 gallon of water

A Useful Blow-pipe Apparatus.

By A. G. Williams.

The sketch herewith shows a useful apparatus I made for tempering, light forging or brazing, heating soldering irons, etc. The blowpipe is converted from an old petroleum brazer, which did not answer; any blowpipe would do, I think. The apparatus consists of a foot blower, or a Chinese blower (as described in The Model Engineer for February 22nd, 1906) would do, and a tank, which I formed from a biscuit tin, making it thoroughly tight and inserting a piece of composite pipe, horse-shoe shape, at the bottom. One branch from the blower is taken through this into the petrol, which then issues as gas from the top of tank, thence to blowpipe. This burns just as coal gas, and is a most



Arrangement of Blowpipe Apparatus.

efficient substitute where former is not available. The horseshoe must be perforated to admit the air into petrol, and the end of horseshoe must be bent up above the level of petrol. Fill tank three-quarters full.

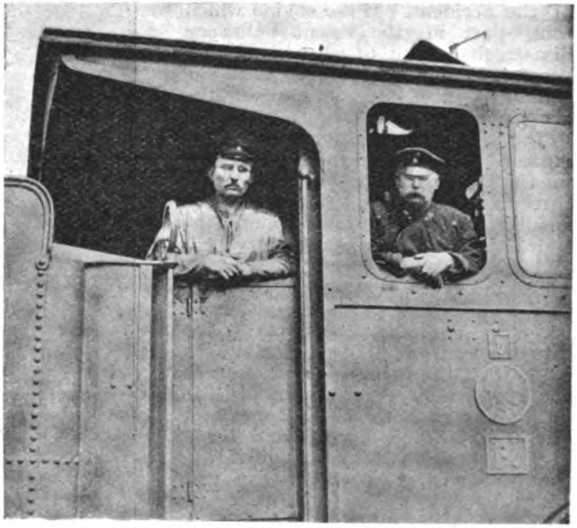
Using a New File on Babbitt Metal.

A contributor to *Popular Mechanics* gives the following hint: When using a new file, on babbitt or aluminium, rub it with a chalk or soap-stone. This fills the teeth of the file so that chips cannot stick in them and cut scores in the work.

A Model Engineers' Tramp Abroad.

(*Continued from page* 605, *Vol. XV.*)

The two types of locomotives illustrated in our last article, with the new Von Borries four-cylinder compound "Atlantic" locomotives, do most of the passenger work of the Prussian State railways in the districts we visited.



A German Engine-Driver and Fireman.

All these types are well illustrated in Mr. C. S. Lake's book, "The World's Locomotives," and do not need special description here. We understand that there are several locomotives of the De Glehn type in use, but we did not come across any.

The German locomotive lacks the attractive features of our own engines. They are not painted so well, and, the older types especially, look regular rattle-traps. Everything which has something to do can be seen and got at. This perhaps renders it much more easy for the engineman to keep themselves smart and clean. Even the four-cylinder compounds do not seem at all cramped underneath, but this is perhaps due to the use of outside valve gear only. The enginemen have in Prussia a semi-military uniform, as will be seen by the accompanying photograph.

The locomotive cabs are exceptionally roomy and well arranged, measuring on a four-coupled locomotive of the ordinary type no less than 9 ft. wide.

One of the most valuable accessories fitted in the cabs of all German passenger locomotives is the speed indicator or "Tachograph." There are several forms of this instrument, but they are all arranged to give warning when the regulation maximum speed is exceeded. In addition, they record the speed and time occupied in running the journey and the distance travelled in a strip of paper which is put in the indicator at the commencement of the day's work.

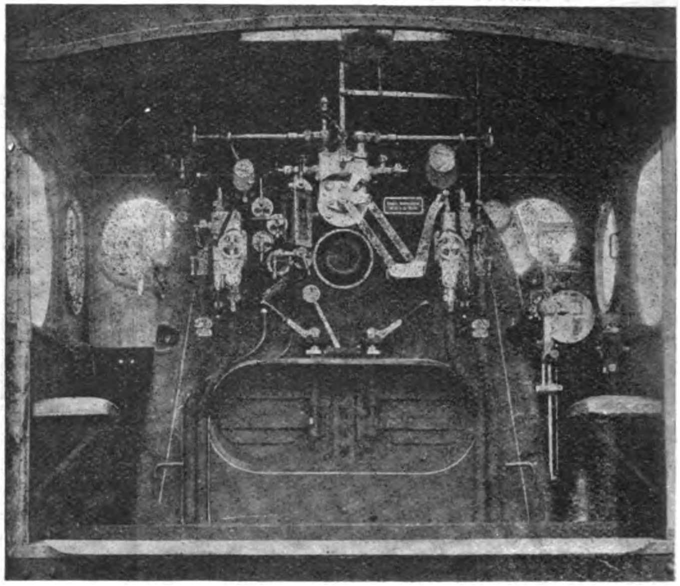
As a result of using this instrument, the German Railway Administration do not have those conflicts between locomotive and traffic departments as to the actual facts of the running of any particular trains, which so frequently occur in this country. Moreover, the use of the instrument saves all dispute in case of accident. The roll of paper in the instrument is not once in a thousand times destroyed in a smash up, and provides a true record of the conditions obtaining up to the moment of the accident. If the engine which took part in the recent Salisbury disaster had been fitted with such a speed indicator, no evidence as to the estimated speed at the time of the accident would have had to be called.

The Hausshälter instrument, which is named the "Trochometer," as shown in the accompanying diagram punctures a rolled strip of paper with small holes—one series recording the time, another the distance travelled, and the third the speed in miles (or kilos.) per hour. A sample of the strip, to a scale of two-thirds actual size, is included herewith. The paper is fed into the instrument at the rate of 2 or 4 mm. per minute, according to the circumstances of the case. The larger scale gives the clearest readings, but it requires a longer band for a given period of working. Ordinarily, the length is about 45 metres and width 50 mm. Along the top and bottom edges of the strip there is a row of holes, spaced about 6 mm. apart. Each space represents 1½ minutes. Just above the line of dots on the lower edge the distance in miles or kilometres traversed by the locomotive is shown by another row of dots, these being closer together or farther apart, according to the speed. When the locomotive stops, this row disappears, the interval marking the time the train remains at rest. The speed line rises with the rate of travel, the holes being punched by the mechanism once every 12 seconds (five per minute).

The instruments are arranged to run without winding up the clock mechanism for a period of 30 minutes; the locomotive, however, winds the clockwork automatically when it is running. When the speed rises to the predetermined limit, the alarm bell shown in the drawing rings.

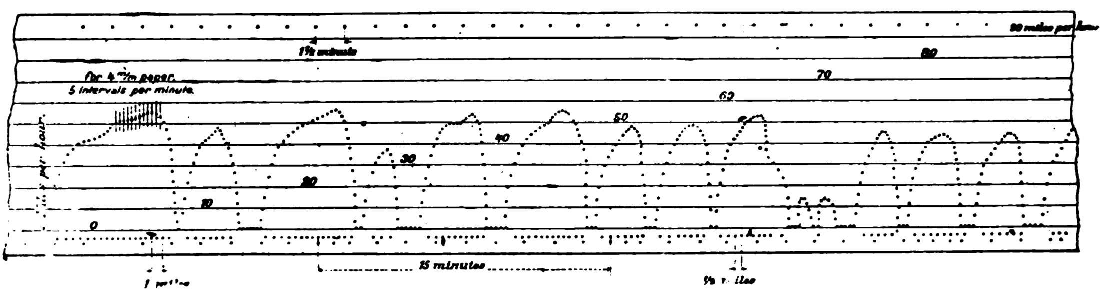
The mechanism is very strongly made, and, we understand, the instruments give very little trouble in everyday use. The graphic record of the speed discloses all the movements of the day's work of the locomotive—the rate of acceleration, the action of the brake, and reveals, also, the slipping of driving both at starting and at full speed. We understand that the device is being introduced in this country, and readers who are interested in the application of the trochometer can obtain full particulars from the London office of the makers—The Engineers' Agency, 63, Chancery Lane, W.C.

We shall have to say something further on the recent development of the locomotive in Germany in a later article, when dealing with the exhibition at Nuremberg. In the meantime, we will resume our journey. The district between Elberfeld and



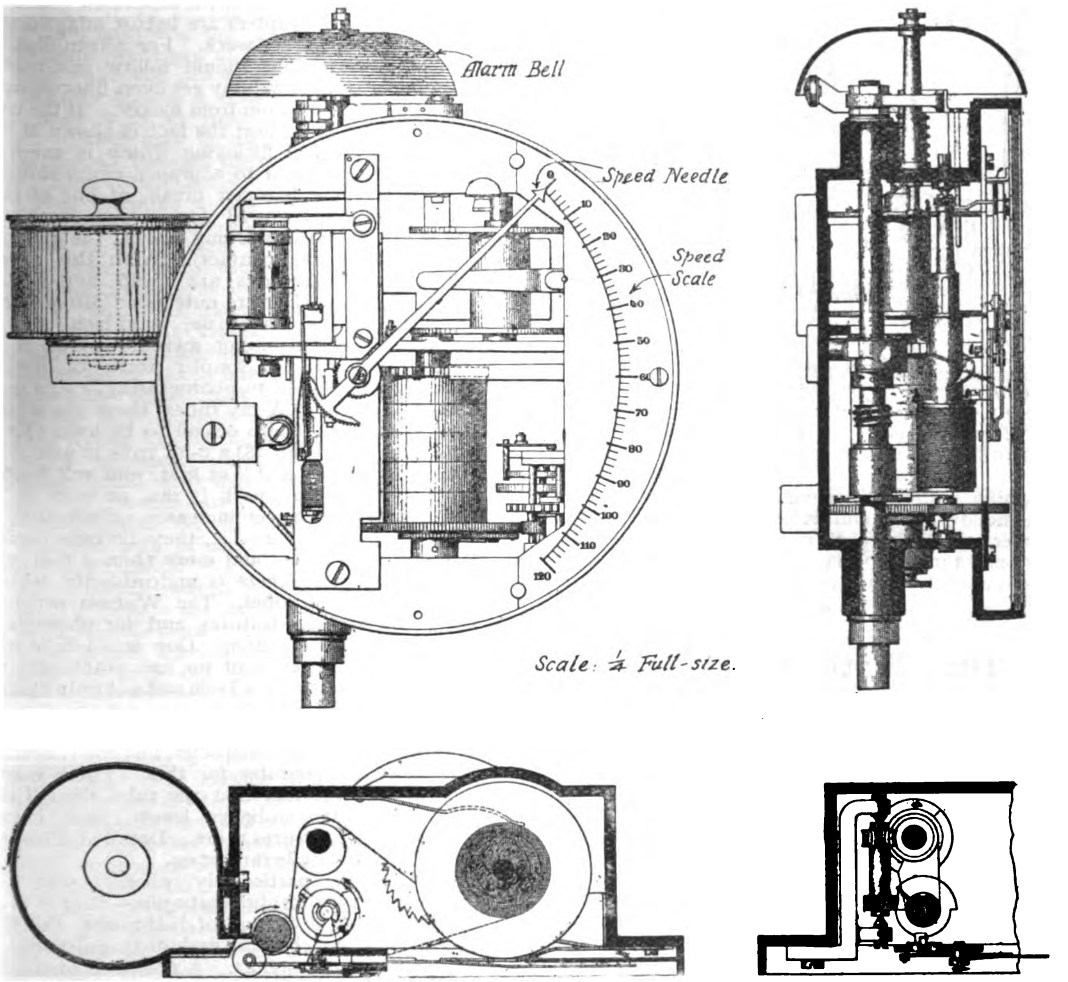
A Continental Locomotive Cab Interior.

(Note the seats, the speed indicator, and the double firedoors.)



A Locomotive Speed Record taken by the Hausshalter Trochometer.

Cassel is mainly a timber country; indeed, for the next 200 miles at least everybody seemed to be in the wood trade. The railway abounds in sharp curves and long inclines. It was common to run for ten or twelve miles with steam off approaching the regulation speed of 90 kilos. per hour (60 miles per hour) any excess being checked by means of the brakes, warning, we suppose, being given to the engine-driver by the speed-indicator in the cab our names and a long inscription as to where we had come from, the train we had travelled in, and a description of our party. We wondered what it was we had done, or what law we had transgressed; but a further inspection proved that it was a letter from Mr. Rompler, and, settling the question of our identity by producing our cards, we were allowed to take the letter. This custom of addressing letters to passengers *en route* is frequently



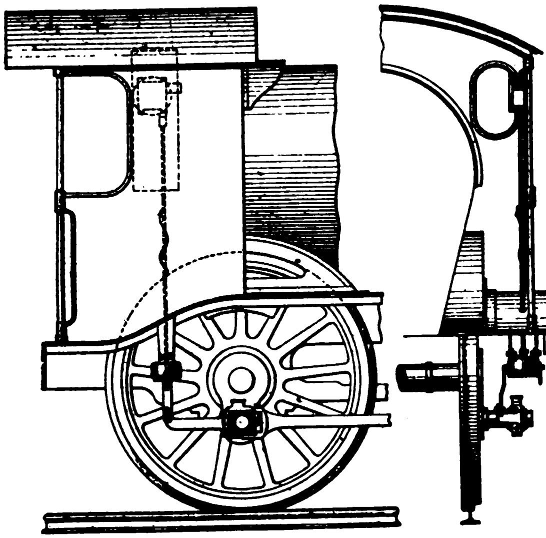
THE HAUSSHÄLTER TROCHOMETER.

This Instrument is used on German Locomotives, and records the Speed and Time occupied in Running and Distance Traversed during the Day's Run.)

Arriving at Cassel, after nearly twenty-four hours' travelling, an incident of considerable interest occurred, which shows the methods of the German Post Office in a very favourable light. We were making our way across the station square to the hotel we had selected *en route* from a guide, and we were approached by a smart youth in Post Office uniform. We took no notice, but the youth persisted, and, mentioning the name "Elberfeld," we stopped. He produced a letter bearing adopted and costs only a few pence more than a missive delivered in the ordinary way. It was certainly convenient in our case, but we are doubtful whether it would work well if applied in this country.

Next day we had two programmes open to us. One was to visit Messrs. Henschel & Sohn's large locomotive works or take a drive to the Versailles of Germany, the Wilhelmshöhe, and view its wonderful fountain, which throws a column of water 1 ft.

diameter and 200 ft. high, the cascade 900 ft. long, and the colossal statue which stands 1,300 ft. above the river level. This figure of Hercules is of copper



METHOD OF ATTACHING THE SPEED INDICATOR OR "TROCHOMETER" TO THE RUNNING GEAR OF THE LOCOMOTIVE.

30 ft. high, and eight persons can stand at one time in the hollow of the club it holds in its hand. We, however, chose the path of duty, if it may be so called, and turned up sharply at 9 a.m. at the offices of the Cassel Locomotive Works.

(To be continued.)

The Sixth "Gauge" Competition.

TO further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th.

Induction Coils for X-Ray and Other Purposes.

By JOHN PIKE.

(Continued from page 519, Vol. XV.)

XV.— Radiographic Work.

AS already alluded to in the article on "Breaks," certain interrupters are better adapted than others for *X*-ray work. For screen illumination the interruptions should follow one another very rapidly so that we may get even fluorescence—*i.e.*, the greatest freedom from flicker. If the break is not working at its best the fact is shown at once on the screen by a flickering which is annoying, if not altogether fatal to a proper examination of the subject. The hammer break, of one of those mentioned, answers well for screen work (but it must be in good working order, the platinum points making good contact). With this class of break the interruptions are rapid and regular, though of course they are outclassed altogether by the Wehnelt, the Mackenzie, Davidson, and the Turbine breaks. A motor mercury break is also satisfactory, but the simpler form of mercury break is better suited to photography, *e.g.*, Fig. 12.

On the matter of *X*-ray tubes, these are supplied to suit the spark length of coil to be used; for the coils (Figs. 5, 37, and 38) a 6-in. tube is used. The tubes are mostly "soft" at first, and will fluoresce with less than 6-in. spark (3 ins. or even 2), and their penetrative power increases considerably the longer they are in use—*i.e.*, they become harder—the vacuum is higher and more than a 6-in. spark will be required. There is undoubtedly considerable difference in tubes. The Watson penetrator tube has distinctive features, and for photographic purposes is an acquisition. One small tube which the writer possesses is of no use practically with the spark coil, but with a Tesla coil not only illumines the screen equal almost to the extent of a 6-in. tube, but acquires great penetrative power; the focus is of the diffused character, but the penetration more than compensates for this. There may be something in the fact that the tube though small is of more than ordinary length, and between the terminals measures 9 ins. Detailed allusion to the Tesla coil is made further on.

Some tubes, particularly when "soft," also display a quality for differentiation—that is to say, the negative will be full of half-tones, the bones perfectly distinct, but the flesh distinguishable and even some of the organs. A negative of the kind can hardly be termed "under exposed," so that the phenomenon must be explained in some other way. With the very same tube on occasion the writer has found nothing visible at all on the screen, the bones of the hand, for instance, being as transparent to the rays which were passing at the time as thin ebonite.

Smaller tubes can be worked from the large coil, but a rheostat must first be adjusted in circuit so that the spark is reduced to the length suitable for the tube; when these get hard and require a longer spark we are able to supply by readjustment of the resistance.

The usual discharging rods should be left *in situ*, to form an "equivalent spark-gap." Supposing that we are using a 4-in. tube, the latter will be connected to the secondary terminals direct; or (see Fig. 10), by attachment to a ring on the discharger pillar; a wire is, of course, carried from the opposite ring to the secondary. The discharger rods may then be placed 2 or 3 ins. apart. The discharge will always take the path of least resistance, and if sparks pass between the points of the dischargers, we can increase the distance between them until the discharge prefers to pass through the tube. If we get the characteristic fluorescence with the points 4 ins. apart, we say that the equivalent spark-gap of the tube is 4 ins., and for a small tube the probability is that it will prove to be fairly hard. A tube would be very soft if it fluoresced with an equivalent spark-gap of 1 or 2 ins. Tubes may be made harder if the current is discharged through them in the wrong direction, and a hard tube may be rendered softer by careful and even warming with a spirit flame.

Fluorescent screens may be of barium platinocyanide or of calcium tungstate. The universal opinion is in favour of the former, though the difference is not so great as some radiographers suggest. One of the latter fluorescent salt made by the writer gave great satisfaction. When the tube and coil were at their best there was very little to choose between them, but if the contrary then the barium salt easily took the palm. The outfit for *X*-ray work should include one of each, the barium screen for the fluoroscope or visual work, and the tungstate screen for photography. It has been found that this screen greatly assists in shortening the exposure when taking a radiograph; for this purpose the screen should be used with its sensitive side in contact with the film of the photographic plate.

The tungstate screen will be used not only to assist and reduce the exposure, but if backed up with a piece of black paper and put into a frame may be found serviceable in other ways. Held near to the tube and within the influence of the rays its faults will become apparent—most probably unevenness of surface—and may possibly be remedied by additional sprinkling of the fluorescent salt where required, but too liberal sprinkling is a mistake. The making of fluorescent screens is a piece of work which the mere amateur is not likely to succeed very well with; he will get something of course, but nothing comparable to the machine-coated article. However, an attempt may be made with calcium tungstate, in which case a sheet of ordinary cardboard may be used as a base; this is coated with a thin layer of gum and the salt sprinkled over the surface as evenly as possible. In place of the gum, collodion may be used or a solution of celluloid in amyl acetate, but as these dry very quickly, the former especially so, the operator has to lose no time in getting the salt well distributed—even with gum there is very little time to spare—a drop or two of glycerine added to the gum will overcome the difficulty to a small extent. Small strainers suitable may be bought for use as a sieve, or one can be made out of coarse muslin and a chip box (as used by druggists). The bottom of the box is pushed out and the top of the lid is also removed; this leaves a collar of suitable size to hold down a piece of the muslin stretched over the box.

There is little doubt that a rapid plate is best for photography with *X*-rays. The Imperial Extra Rapid will for ordinary work do excellently. No doubt any other with the same relative sensitiveness will answer as well. Considerations of price only prevent one from getting the very quickest plates for all purposes, and of course cases occur in which it will be imperative not to prolong the exposure: therefore the question may be put whether in all cases the quickest will not be the cheapest in the end.

Colour corrected or isochromatic plates are frequently suggested for use, but although the author has succeeded well with such it is doubtful if they are any better than a plate of the sensitiveness of "Paget's XXXXX," while the latter would be much easier to work. The isochromatic plates are sensitive to greens and yellows and reds; the development of them requires to be done almost in the dark, and the operation itself must be carried out with the care, deliberation, and resource which only experience in photographic manipulations will give.

Films are undoubtedly useful in some cases, for the reason that in a suitable envelope or covering they may be bent or curved round a limb or otherwise placed in closer contact with the part. As a rule also films are very sensitive, and they are certainly much better physically than they used to be. A film, however, will always retain the characteristics of a film, and these are for the most part rather of the negative variety; a developed film is rarely so clean and uniform as its compatriot on glass, and scratches and markings appear to be indigenous to films. These little faults, however, do not interfere in any way with their value for *X*-ray work. This point is mentioned because films are, as we have said, at times a decided acquisition. On the other hand a plea is entered here on behalf of a higher technical standard for radiographic photography generally. It is a fact that some men with access to apparatus of the best and an apparently blank cheque with regard to material continue to turn out extremely mediocre work. One does not require the whole range of photographic processes for the work, but considering the value of all radiographic records in surgery the operator should be a fairly expert photographer.

In the matter of exposures we are helped very much if we can see the effect first on the screen. The range of exposures varies considerably, and the following short table may be of use.

Coil giving 8-in. Spark.

Hand	Half to one minute.
Elbow	Two to three minutes.
Knee	Two to four minutes.
Thorax	Five to ten minutes.
Pelvis	Five to ten minutes.
Foot	One to two minutes.
Ankle	Two to four minutes.

There is in this class of work very small latitude in exposure—that is to say, the correct exposure being thirty seconds, an under exposure say equal to twenty seconds cannot be by alteration of the developer brought up to the level of the former. On the other hand an exposure of forty or even fifty seconds need not mean a failure.

A standard developer to which one is accustomed is the best to use. The Paget Prize Plate Company's developer is one which the writer has used for twenty years or so:

Stock Solutions.

P.	Pyrogallic acid	1 oz.
	Citric acid	60 grs.
	Soda sulphite (pure)	2½ ozs.
	Distilled water	20 ozs.
A.	Liquid ammonia ·880	1 oz.
	Ammonia bromide	80 grs.
	Distilled water	20 ozs.

For normal exposures the above are used in equal quantities of each, diluted with water. One part of each and ten parts of water—*i.e.*, twelve parts in all—of developer make a normal solution with which we may get full detail and correct density. Such a developer as this may be readily modified. The less water the more vigorous will be the resulting negative; but too little water involves danger of fog or a general reduction of the light affected image. If too much water be used then the image is thinner and flatter. Supposing an exposure to have been made, the exposed plate will, in the dark room or by ruby light, be placed in a dish and a sufficiency of the developer of normal strength—*i.e.*, P, 1 part; A, 1 part; water, 10 parts, poured over it. If properly or correctly exposed the image will appear and attain to full or at any rate satisfactory density in about five minutes; but if the detail appears very tardily, the appearance will indicate that something is on the film but wants accelerating; now pour off the developer and wash the partially developed plate in fresh water, return to the dish, which must also be clean, and pour over the plate a little of the "A" solution alone diluted with water (one part to nine or ten). Under the influence of this "accelerator" (which is the term usually given to the alkaline portion of a developer) the image will develop slowly but surely, though the effect is not so certain as with plates exposed to actinic light. The "A" solution may be, if necessary, poured off and a fresh supply poured on (owing to evaporation of the ammonia); but arrived at the limit when apparently no more can be got out of it, the accelerator is poured off finally and the normal solution again used. This will at once give us fair printing density. When the exposure has been knowingly and necessarily shortened, the best development is in a solution very much diluted (using distilled or boiled water). Stand development as it is called is usually carried out in a grooved tank fitted with a lid and the whole arrangement light proof. The developer is made to formula below:

Glycin	40 grs.
Sodium sulphite	200 grs.
Potassium carbonate	200 grs,
Potassium bromide	1 gr.
Water	40 ozs.

The plate is put into the tank and the solution poured in sufficient to completely cover it—the lid put on and the plate allowed to remain several hours. Whatever detail is impressed on the sensitive plate will be brought out by this method and density may be imparted to the image by a short immersion in the same developer of normal strength. An acid fixing bath should be used, *e.g.*—

Soda hyposulphite	4 ozs.
Water	20 ozs.
Potass meta bisulphite	1 oz.

The negatives obtained will often show plenty of detail, but may still be "thin"—*i.e.*, wanting a little in density. The brand of paper termed "P.O.P." suits such negatives very well, and pleasant tones can be got with it even when not fully printed out. But intensification with the usual mercury bath sometimes makes a very decided improvement. The well washed negative is immersed in—

Mercury bichloride	1 oz.
Water	20 ozs.

The salt, which is extremely poisonous, must be dissolved in hot water and the solution is ready for use when cold, and may be used many times before it is exhausted. Care should be taken to label it "poison," and to store it in a safe place. The plate becomes bleached in this bath, a compound of silver and mercurous chloride being formed. After more washing—several changes in addition to half-an-hour or so under running water—the film is treated to a bath of ammonia—

Sol. ammonia, ·880	1 oz.
Water	20 ozs.

and is at once blackened in the parts affected by the light, very considerable—in some cases—density being given to the image. This makes the negative a much better printer.

It may be mentioned that Edward's "Cathodral" plates are very sensitive to the rays, being coated (so it is said) with a fluorescent chemical which acts in the same way as, or takes the place of, the tungstate screen. These plates are the same price as the ordinary rapid commercial dry plate.

The tungstate screen used as described undoubtedly shortens the exposure very considerably, about one-fourth only of the usual time being necessary, but unless a really well-made screen—*i.e.*, very evenly and thinly coated—is used, the results will not be very good pictorially, coarseness of grain and unevenness will inevitably show, and somewhat obscure the picture, although the latter even with these faults may be of some use surgically.

Much difference of opinion exists as to the value of the Tesla transformer for working *X*-ray tubes. The writer can speak with only limited authority on the matter, as his experience is confined to a small apparatus which he made for his own use in 1897. The coil—fully described in THE MODEL ENGINEER AND ELECTRICIAN for May 28th, 1903—consists of a primary composed of No. 22 G.P. covered copper wire, one layer upon a cylinder or rod, glass or ebonite, 6 ins. long by 1 in. diameter; and a secondary, one layer of No. 36 double silk-covered wire (about 360 turns) upon a glass cylinder of 2 ins. diameter (an Argand or incandescent chimney about 6 ins. long will serve).

The turns of wire on the primary may be close together. Those on the secondary ought to be apart, the thickness of a strand of white sewing cotton, No. 36, intervening. It is not a very difficult matter to put the turns of wire and cotton on simultaneously, and the latter may be left *in situ*.

The primary is fixed centrally within the glass tube which carries the secondary, so that there is ½ in. of space all round it. The terminating wires from the primary are brought out on one side for connection to the coil, etc., to be used. Those from the secondary are brought up through ebonite pillars very thick and solid, and also connected to terminals and discharging rods. The primary and secondary require to be fitted within a small box filled with boiled linseed oil.

This done, the plan below (Fig. 42) shows the disposition of the parts and the arrangements for working.

For a Tesla coil of this size a quart Leyden jar suffices, and it may be worked from an induction coil giving a good 2-in. spark.

The writer uses a 3-in. *X*-ray tube of Jackson pattern (shown in the next figure). The tube fluoresces finely with the high frequency oscillation produced. The screen is illuminated very evenly, and the penetrative power of the tube (in this case) very much increased. The photograph reproduced on page 66 of Jan. 19, 1905, issue is one of many taken with it, and it will be seen that the results are not quite so clearly defined as with good tubes used connected direct to a coil, but the diffusion of focus is not unpleasing.

Fig. 42 shows on the right hand the spark coil to be used (a 2, 3, or 4-in.), the outside coating of the Leyden jar (J) is in electrical contact with a terminal T, through which passes a wire from the coil, thence to the primary (P) of the Tesla. The other wire from the coil goes to the spark gap (S.G.) and branches off to the inside coating of the Leyden jar, and across the gap to the other end of P. The terminating wires from S, the secondary winding of the Tesla, pass up the ebonite pillars provided and make contact with the terminals thereon; and finally the *X*-ray tube is connected as shown; some adjustment of the discharging rods is required. The balls forming the spark gap should be 1 in. diameter, mounted so that the distance between may be regulated, and kept highly polished.

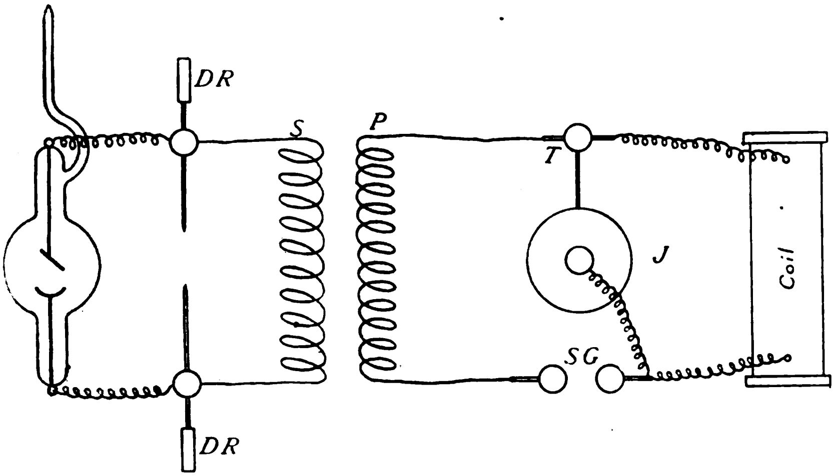


Fig. 42.—Diagram of Connections for Radiographic Work.

The spark gap being adjusted so that an air space of 1-10th in. or so is between the balls, and the coil started, the effect is to charge up the Leyden jar which then (fully charged) discharges across the gap and so passes through the primary P. The discharges follow each other with great rapidity and tremendous electrical energy is induced thereby in the secondary S. The discharges are oscillatory, alternately positive and negative, and extremely rapid. As is frequently the case with spark coils, the length of spark between the Tesla terminals is longer when the coil is connected to the battery in a certain way. This will be quickly determined on altering the flow of current by means of the commutator. The sparks also from the Tesla terminals are positive and negative, though much finer and more furry, but clearly distinguishable.

On grasping firmly the terminals of the Tesla or the pillars D R no pain is felt, though sparks may be drawn from them upon approaching a finger when a little shock will be experienced. Removing the short wire A B the circuit may be completed by the body, by grasping the terminal with the right hand and that on the *X*-ray tube with the left, the tube will fluoresce slightly. Geissler tubes placed near the case containing the coil flow without any actual contact, and a pretty experiment may be shown with a Gassiott's cascade tube by connecting one wire to the tube and—with one hand grasping a pillar—touching the top terminal of the cascade with a finger—the beautiful flow of light in the tube appears to come from the finger of the operator.

As some persons are more sensitive than others to these electrical discharges, it is well to be reasonably careful, and it will be sufficient for most people to make the contact with a pair of insulated dischargers or tongs.

(*To be continued.*)

Motor Vehicles in London.—During October last fifty-seven heavy motor vehicles were registered in the County of London, bringing the total up to 1,110, as against 12,456 pleasure motor-cars, and 6,448 motor cycles.

A Gas Engine as a Bird Trap.—A rather strange solution to a puzzling difficulty was found recently at Sutton-in-Ashfield, Notts, where a small gas engine built by Manlove, Alliott & Co., Ltd., of Nottingham, and supplied to the Council, had began to show signs of working in an unsatisfactory manner. One of Messrs. Manlove's fitters was sent from Nottingham, and on disconnecting the air-suction pipe, a small wild bird was found lodged in such a position that one of the wings had got under the gas valve, preventing it closing tightly. Apparently the grid at the mouth of the suction pipe had become displaced, and the bird, evidently of an investigating turn of mind, had got too close to the suction pipe and been drawn in by the inrush of air, carried round the bends and through the length of pipe till it lodged in the restricted area at the valve. Needless to say, the bird was dead. Instances have been known where experts have been called upon to make long journeys in order to investigate the reason why gas engines did not start, and the trouble turned out to be that the gas was not turned on at the meter; but the above is a still more unusual cause for a gas engine not working satisfactorily.

A Design for a 20-ft. Windmill.

(*See Coloured Supplement.*)

By F. E. Powell.

I.—Introductory.

FOR some reason windmills, as sources of power, do not appear to have met with so much favour in England as one might expect. It is true that an oil or gas engine is much more compact, generally less costly, and more reliable than a windmill, yet the latter has its points of superiority, quite sufficient to demand notice where small power is required. Not the least item—in the writer's estimation—is the interest attaching to this form of power-generator, particularly in regard to speed regulation, and beyond the first cost there is practically no outlay with the exception of a little oil for the bearings. On the whole, therefore, a windmill should appeal to those amateurs (professional and otherwise) whose aim is not merely to get through the work "as quickly as possible, and have done with it."

The wind-motor here described and illustrated in the special plate in this issue of The Model Engineer may be rated at 1 h.-p., although, as will presently be shown, such rating is rather a matter of convenience than of accuracy. In view of the fact that so large a machine may be beyond the capacity or the requirements of many readers, it may be remarked that by making every detail, say, three-quarters of the sizes given, they will serve equally well for a 15-ft. mill. A certain amount of judgment must be used, particularly in regard to thicknesses of castings, which should generally be not less than ⅜ in. Since the areas of circles vary as the squares of the diameters, the rating for the 15-ft. mill is practically ½ h.-p. This will, of course, serve the requirements of a very large number of readers.

Should a still smaller mill be needed, the diameter of sail-tips could be further reduced in proper proportion, the forms of sails being correctly retained; but it is very questionable whether the particular system of regulation, and the somewhat complicated castings employed in the movable head, would be worth while imitating. It must further be remarked that a much smaller mill might show a less degree of efficiency.

The design presented has many novel points both in disposition of sails and in the moving top and regulating gear. The form of the sails is adapted from the highly efficient designs most recently dealt with in the Danish Government windmill experiments. These really brilliant experiments appear to attract little attention either here or in America, which is apparently another illustration of our innate conservatism. As with suction-gas and reinforced concrete, English engineers will some day awake to the fact that we are behind Continental competitors in some things, and one of these is the humble, but none the less useful, windmill.

Dealing first with some of the more theoretical considerations of the windmill here described, many readers may be surprised that the common "American" system of employing a large number of small sails has not been adopted. There is a very good reason for this, and incidentally it may be remarked that the "American" mill does not show any very great advance in efficiency. All experimenting appears to prove the necessity for ample space between sails—no doubt to allow "clearance" for the spent wind. The closely fitted sails of modern windmills actually hinder this condition in many cases to such an extent that the removal of alternate sails will sometimes considerably *increase* the power of a mill.

The experiments already noted, carried on at Askov, in Denmark, certainly have proved the above-mentioned point, and perhaps the most highly efficient windmill ever built is one having six sails only. The proportions and shapes of these are matters also of considerable importance, and these I have followed as closely as possible consistent with simplicity of construction.

The conical, or concave, form taken by the sails as a whole is another deduction from the Danish investigations. Not only is this formation stronger mechanically, it is also more efficient. Certain curious and interesting curves given to the sails at Askov have not been adopted, merely because of the practical difficulties they presented.

I have already hinted that a 20-ft. windmill will not necessarily develop 1 h.-p. It will only do this when supplied with wind at the proper velocity, in which respect it is exactly on a par with a steam engine, which will only give its rated output when steam of the proper pressure and quantity is available. This minimum velocity of wind is very commonly assumed at about 15 miles an hour, and at that speed, or a very little over, our 20-ft. machine may be expected to provide its full number of foot-pounds per minute. On the other hand, it would obviously be dangerous to present the face of the sails square to the wind when the latter reaches "storm" velocity. Thirty miles an hour represents so sharp a gale that any automatic mill should be adjusted to be completely "edge on" when that speed is reached. Between these extremes, of course, the nearer the mill can be kept to its proper output the better, and this resolves itself practically into a matter of speed regulation.

It is not my intention to describe the hundred and one devices employed to "govern" modern windmills, and it must not for a moment be supposed that the method shown in the accompanying drawings is necessarily "the best." Nevertheless it is a good method, and one that commends itself to the present writer after a careful study of the other devices available. Simplicity is not its least recommendation.

(*To be continued.*)

Another Use for Compressed Air.—It is stated in the *Iron Age* that the general use of compressed air is being extended in some boiler shops to include the cleansing of crown bars and crown sheets with a sand blast. It is claimed that this gives much more satisfactory results than the old method of hammer and chisel. In a certain shop where the new method has been installed a dozen bars took a man ten hours under the discarded system, at a labour cost of 7s. With the sand blast a bar is cleaned in twenty or thirty minutes, or about half the former time, and the job is a cleaner one when done. The same shop uses the blast with satisfactory results for cleaning the crown sheet as well.

A Model G.N.R. Single Locomotive.

A 1¼-in. scale model locomotive makes almost an ideal size where the two desiderata are present, viz., that the locomotive must be capable of being made with an average amateur's equipment, and at the same time must be large enough to carry the driver in comfort. The model shown in the accompanying photograph was built for one of our most enthusiastic model locomotive readers, and, as will be seen, is a replica of an Ivatt 7 ft. 7 ins. bogie single engine.

The engine is 3 ft. 0¾ in. long over main frames; the bogie wheels are 4¼ ins., carrying tender wheels 5 ins., and driving wheels 9½ ins. diameter on tread. The cylinders are 1⅝ ins. by 2 ins. stroke. The boiler is of copper, 6 ins. diameter, and has sixteen tubes, ⅝ in. diameter. The working pressure is from 40 to 55 lbs. under actual running conditions. The engine was made by Messrs. Wright, Clark and Wallis, and is a very good working model, fulfilling the special conditions required by the owner. The engine is exceedingly flexible, and will traverse a curve 13 ft. radius. The gauge is 6¼ ins. between rails.

A Model 1¼-in. Scale G.N.R. Bogie Single Locomotive.

Model Yacht Building for Beginners.

By Arthur Rollesby.

Now that the winter is here, and the dark evenings prevent outdoor pastimes, mode yachtsmen—old and young—will doubtless be reviewing the season's racing and considering the ways and means of improving the old boat, or even building a new one to eclipse all records.

There can certainly be no more delightful and profitable way of using the winter hours than in constructing a model sailing yacht in a scientific spirit: not only will eye and hand be trained and ingenuity taxed in the actual building of the boat, but something will be learned of the principles of naval architecture—a useful acquisition to a citizen of an "Island Empire."

We intend, therefore, to devote a few pages to those of our junior model yachtsmen who may be wishing to possesss a racer of up-to-date design made by themselves, yet who have had little experience in the fascinating realms of model yacht designing and constructing.

We shall follow step by step the building of a little craft which actually proved a great success, and our juniors therefore may be certain of getting a good result for their labour. She is sloop-rigged, 33 ins. long, light, and easy to handle. Our seniors would be quite safe in building a much arger boat on the same plan.

In the first place, in order to gain some knowledge of the principles of designing, we will study the plan and "lines" of our boat given in this article.

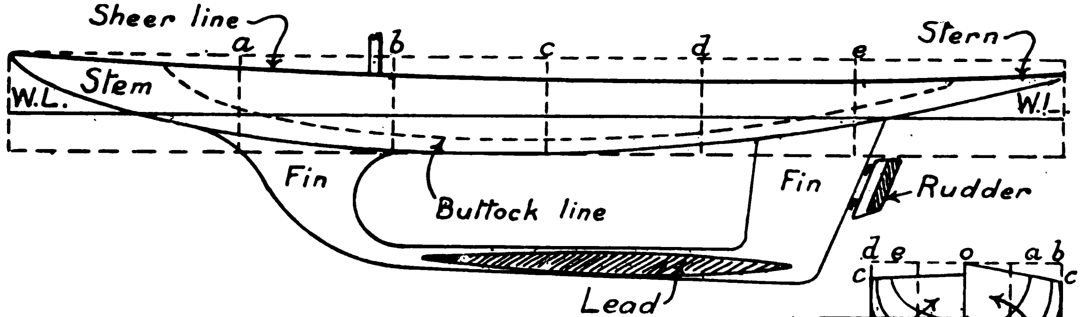
First, we have the *sheer plan*, which shows the boat as seen from the side; then the *half-breadth plan*, which represents her as seen from above: only half the boat is drawn, as both sides are of course exactly similar; lastly, the *body plan*, which is the view from bow or stern.

Our boat is of the most modern type; as you see from the photograph and the sheer plan, she looks almost like a floating spoon; and following the *water-line*, which shows the water level, you notice that there is very little of the hull indeed under the surface. The overhang is considerable water. The rudder is fixed at the after-edge of the fin.

When the vessel moves forward you will understand that the water passes round her, and its direction is modified by the sweep of the lines. Well, when you design for yourself, this is where you will have to use much thought, for you want your craft to slip along as easily as possible, yet at the same time to possess stability and good sea-going qualities, and the two things are in some ways contradictory. Now the most important lines of a boat are the *buttock lines* and the *water lines*, and their meaning must be thoroughly comprehended.

If you had a finished boat, and took a saw and sliced a section away all the way along parallel to a line drawn down the centre, you would have the remaining part showing a curve like the dotted one called "buttock line" in the sheer plan, and

Fig. 1.—Sheer Plan.



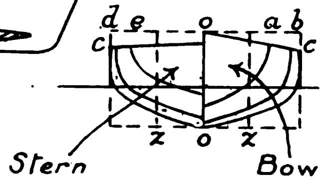


Fig. 3.—Body Plan.

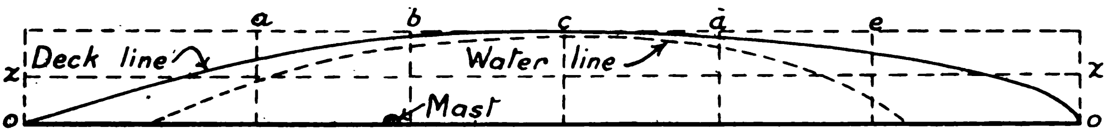


Fig. 2.—Half-Breadth Plan.

Lines for Building a Model Sailing Yacht.

at either end, and much of this extra length is immersed when the boat heels in sailing; but when she is on an even keel it does not touch the water, and therefore is not reckoned by the official measurer who takes length along the actual water-line. When you speak of the length of your boat, therefore, you will say she is 24 ins. water-line, not 33 ins., which is her total length, or *length over all*. The old-time racers were made to cut through the waves rather than ride over them; to see the changes in ideas you should look at yachting photographs or visit the South Kensington Museum, Model Ship Department.

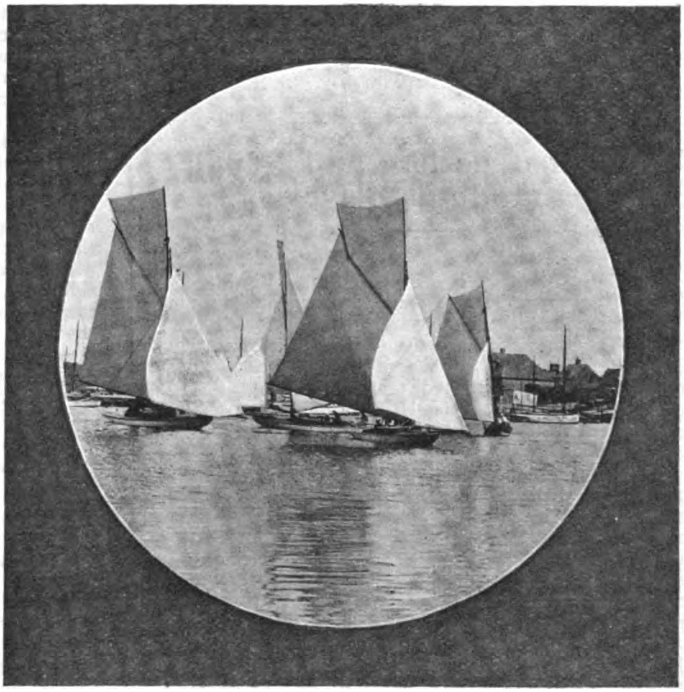
The keel of our boat is peculiar, and called a double fin; it supports the cigar-shaped bulb of lead, and prevents the boat being driven sideways by the wind, or making lee-way; the entire centre portion is cut away to lessen the friction of the indicating the path of an atom of water along *under* the boat. No vessel ever sailed well without beautifully sweeping buttock lines, which in designing are taken at various distances from the centre line. In the half-breadth plan you find the water lines, which indicate the path of an atom of water *round* the boat; first, there is the *deck line*, or view of the deck; then the water lines, which show the shape of slices taken parallel with the surface of the water, and naturally get smaller and sharper as they go deeper and there is less of the boat remaining.

The *body plan sections* show curves as if you took your saw and cut the boat straight across at right angles to the centre line; here, as in the half-breadth plan, only one side of the boat for bow and stern is shown.

The shape of the buttock lines, or general sweep of the boat fore-and-aft, has the greatest influence on the speed of the boat, and we know of many who pay no attention to the shape of the water lines in designing a modern craft. The greatest depth of the sweep of the buttock lines is, however, dependent on the shape of the midship or largest section of the body plan. Upon this section, therefore, special thought must be bestowed.

Generally speaking, a boat with small under-water sections, or small "displacement," needs less sail power to drive her at her highest speed, and this governs the design of boats built to race under sail-area measurement, *i.e.*, where every inch of sail is taxed. A boat with large sections needs large sails, but is better able to bear them, as the extra size not only gives more stability but enables extra ballast to be carried; large midship sections, heavy weight, and a great spread of canvas, therefore, characterise the boats built under a simple length measurement where weight and sail area are not taken.

Yet in both classes it is usually the moderate boat which is most successful all round, and this because heavy full-lined craft or fine-lined boats of very light displacement are only suited to special conditions of wind and wave. A moderate boat, with her buttock lines, an easy and uniform sweep, and not depending on her midship sections for stability, but carrying her fullness of body well to stern and bow, and having water lines without hollows or irregularities, is certain to be speedy, and, what is even more important, handy in all weathers and easy to steer. It must be remembered that the model has to steer herself, and we have seen many a splendidly built, but carelessly designed, boat committed to the lumber-room on account of being incurably erratic in steering.

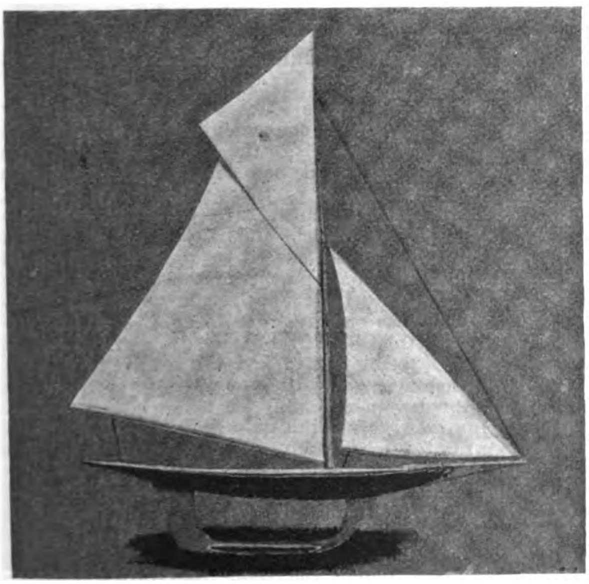


A Flying Start.

The correct proportion of breadth, or "beam," to length has been much debated. No rule can be laid down, as each case differs; the size of the boat, the measurement rule, and the conditions of water and weather to be faced, govern the matter. Generally speaking, a small boat should be broader and deeper, more powerful, than a large one; likewise, those which are to sail on the sea, river, or large areas of water, this mainly because of the greater wave disturbance. A breadth one-quarter the water-line length for a boat of moderate displacement has been found by the writer very suitable for quiet ponds 100 to 150 yards long.

The flatter the middle sections the greater the "initial stability" of the boat, *i.e.*, she will not so readily heel to the wind puffs; after a certain degree of heel is reached, however, the flat-bottomed boat will have a tendency to lie quite down at the squalls and refuse to move forward.

The boat with sharper sections heels more easily at first; her "sailing angle" is greater, but after that does not go farther, and sails fast through all the puffs; in addition, she is not so disturbed in rough water, as she does not "pound" the waves so much. The modern plan of putting the ballast deep by means of a "bulb" of lead and a fin has greatly increased the power of boats of all displacements.



The Finished Model.

In the next instalment we shall see the bearing of these theoretical considerations on the practical questions of draughting the lines and building.

(*To be continued.*)

The Construction and Repairing of Motor Bicycles.

By "SREGOR."

(*Continued from page* 511, *Vol. XV.*)

THE arrangements of the valve tappet on some types of motor cycles are of inferior design. The object of the designer of this, as with other details, especially where there are a number of small parts assembled together, should be to provide the main part as self-contained as possible. so that when it is necessary to dissemble the engine there will be fewer parts to handle in detail; the valve tappet affords an illustration of this. As is sometimes observed, the one half of the arrangement is detached from the outside of case, while it is necessary to disconnect the crank case to examine the other half. In the accompanying sketches is shown a design intended to fulfil these requirements; also to make the working parts as noiseless as possible. Referring to Fig. 56, the coil spring shown in section is intended to keep a constant contact between the faces of the tappet roller and the cam, so as to prevent the two faces knocking together every revolution of the cam. The top of the main guides form a steady and guide for the valve and ensures the valve dropping direct on its seat. When this end is exposed the unequal tension of the spring will tend to tip the valve stem to one side and wear the valve guide oval and tip the valve seat.

On the larger valve tappets, such as used on car engines, it is usual to provide the end of tappet with a screw adjustment and lock-nuts to adjust the wear of the faces, but it is not recommendable to provide same on the small type of tappets. In the present design this adjustment is substituted by a piece of cast steel hardened and tempered, and is made to correct thickness to compensate for any wear of the valve and tappet ends. This packing-piece is intended to be used when the end of tappet and valve is worn, and requires some adjustment. For this reason, the end of valve should be left a bit longer between the cotter slot and end, so that same can be filed off to provide for the packing, or adjustment-piece, which should be about $\frac{1}{8}$ in. to $\frac{1}{4}$ in. thick and hardened. When thin packing pieces are used, they soon get hammered to a larger diameter, and consequently become difficult to remove from the hole in guide; also it being impracticable to harden the thin pieces effectively.

Referring to the sketch (Fig. 56), which is a sectional elevation showing the complete arrangement assembled, the tappet shell is screwed into top of crank case, and as will readily be seen the lot can be removed by unscrewing the outer shell. The hardened steel roller takes the bearing on the cam; the roller does not receive a proper rolling action, from the fact that its movement is around its own centre instead of being around a circle, but should make a much better wearing contact than a plain rubbing surface. The hole into which the roller works should be reamered sightly larger than the diameter of roller, which will allow it to take a point bearing at the top, and the clearance at the sides will readily allow oil to circulate around it.

The roller is fixed in the tappet so that it cannot fall out when the tappet is removed from its working position. This is accomplished by drilling the hole as shown, cutting away only sufficient to allow the roller to project so that the portion of metal below the centre of hole holds it in position vertically, while the split cotter prevents it falling out sideways. A groove must be provided at the centre and around it, into which the lower part of the split cotter fits, but allows the roller to move freely.

Another feature of this design is the provision for lubrication. From Fig. 56 it will readily

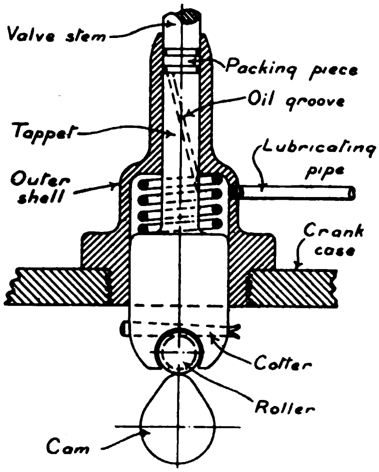


FIG. 56.

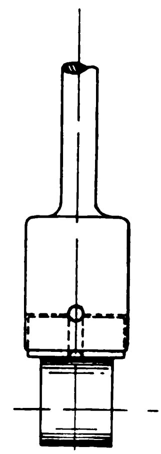


FIG. 57.

SHOWING ARRANGEMENT OF VALVE TAPPET.

be observed that the space which is occupied by the spring offers a convenient receiver for oil to lubricate the two ends of the tappet spindle. This receiver may be fed occasionally through holes drilled in the upper part, not shown in the sketch. The arrangement shown herewith is intended to be automatic in action, and is fed from the crank case by the pressure caused by the down stroke of the piston, a small pipe communicating with the inside of case to the tappet as shown. The hole in the crank case only requires to be of small dimensions, but this should be finally decided by trial, a small hole being drilled and the result noted, and if an insufficient quantity of oil is forced through pipe the hole can readily be made larger to suit. In any case, this detail only requires a very small quantity of lubrication, and this method secures this result automatically. Probably it will be found necessary to place a small spiral spring on top of the ball in the ball valve to increase the pressure necessary to lift it, which will increase the tendency for the air (which is saturated with oil) to pass along the small lubricating pipe to tappet. A groove is shown along face of tappet spindle to allow the saturated air to pass, which will suffice to lubricate this part. The top of shell is tapered, which effects a neat finish, and also forms a less area to receive dirt and dust. The bottom portion of valve stem, being a good working fit, prevents same working down. When this detail is only lubricated by an occasional drop from the oil can, it often happens that this is poured on top of the accumulated dust and works its way down the spindle, with disastrous effect to the bearing. Some method must be used to prevent the tappet spindle turning round, which will cause the face of roller to be out of parallel with the face of cam; this must be determined to suit the individual engine. Fig. 57 shows other side of tappet spindle.

(*To be continued.*)

A Steam Engine Indicator.

By G. R. J.

A FIRST-CLASS indicator in the hands of an engineer is a useful piece of apparatus for many purposes. It records the varying pressures in an engine cylinder, with which it is connected; also the setting of the valves indicating pretty clearly the opening and closing of the ports. The cost of an indicator is beyond the reach of many of us, and I send herewith a few particulars, with photograph and sketch, showing indicator cylinder in section, of one made by me some time ago. Although it has not the high-class finish and accuracy of a modern instrument, it will do its work fairly well, and is useful for any ordinary steam-engine work. The main body of the indicator is made from a gun-metal casting, bored and turned, filed up and polished all over. The casting for this was made at a local foundry from my own pattern, and cost me 2s. 6d. It might have been made cheaper by coring out the body of the cylinder

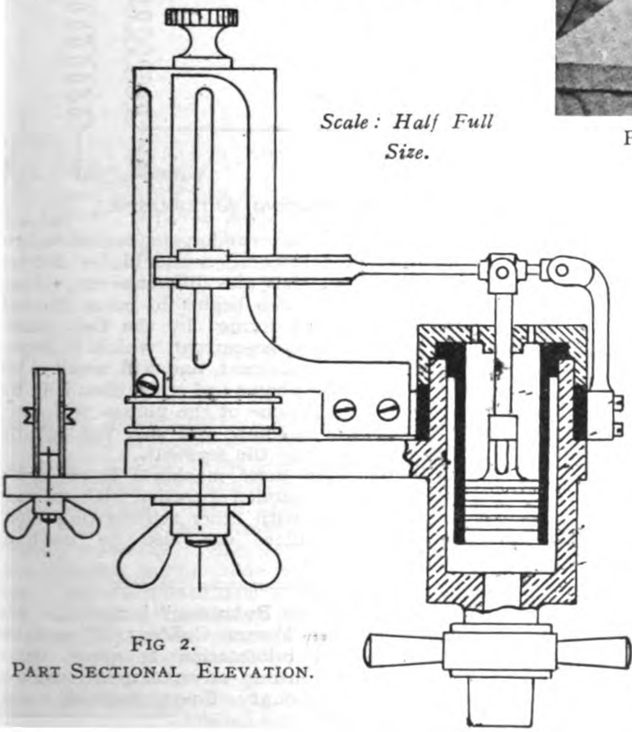


FIG 2.
PART SECTIONAL ELEVATION.

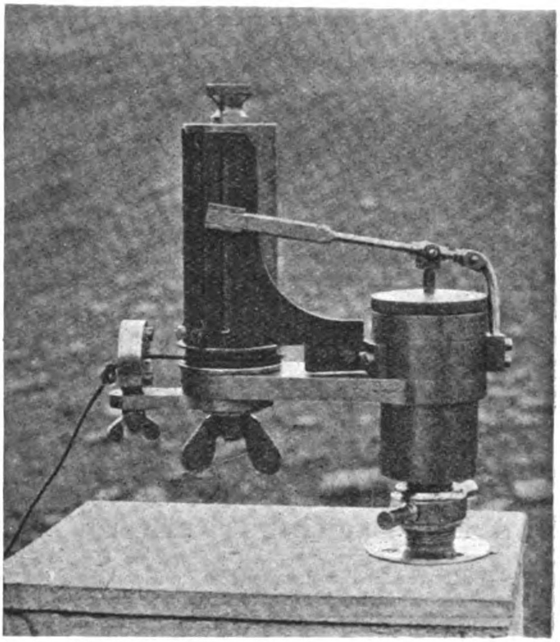


FIG. 1.—A STEAM ENGINE INDICATOR.

instead of boring out from the solid, as I did with mine. The other parts being of small size, can be made from solid bar, etc., with the exception of the paper drum. This is made from a piece of solid drawn brass tube, 1½ ins. diameter by 3¼ ins. long. This is bored out to take the cord pulley at the bottom end and to receive the cap at the top end, and afterwards turned up true outside on its own spindle, which makes a nice job of it. This drum is fitted inside with a spiral and adjustable spring for altering the cord tension to suit engines of varying speeds. There is fitted, also, an arrangement for leading the cord on to the drum from any driving position. The indicator cylinder is bored out 1⅛ ins., and is fitted with a close-grained cast-iron liner, having a bore of 51-64ths in., approximately equal to an area of ½ sq. in. There is a small space left all round this liner which forms a jacket, keeping the working barrel at a uniform temperature when in use. The liner is also free to expand in length, and can easily and at small cost be replaced when worn out. This is fitted with a steel piston turned out inside the body as thin as possible, consistent with strength, to make it lighter to reduce the momentum of the moving parts as far as possible. The more this is done, the accuracy of your diagram will be improved. The piston-rod also is bored out for the greater part of its length, and tapped out with a fine thread ¼ in. diameter, into which fits the fork carrying the swivelling joint of the pencil movement. This fork can be screwed in or out, and by its means the height of the atmospheric line raised or lowered at will, which will adapt it for engines working above or below the atmospheric pressure. The movement of the pencil is six times that of the piston, and the pencil-arm is made as light as possible, consistent with strength, and is of the best steel to give additional strength. The pencil is caused to move in a straight line vertically by means of the slot in the steel plate. The pencil-holder being free to slide along the end of lever of movement. This is a nice piece of work: the pencil-holder is made from a small piece of brass, it is first bored to take a small solid lead, and afterwards turned up on a small mandrel to form a round boss, which works in the vertical slot in the steel plate. It is then slotted out to fit the pencil lever by means of dovetail slot; the idea can be grasped from the sketch forwarded with this article. The indicating papers are held on the drum by means of two brass spring clips, the ends of the papers being passed under them. The springs in the cylinder are best when bought and calibrated to stated pressure ready for use. These being the most expensive item to consider; otherwise, I feel well repaid for my labour.

A Self-Exciting Alternator.

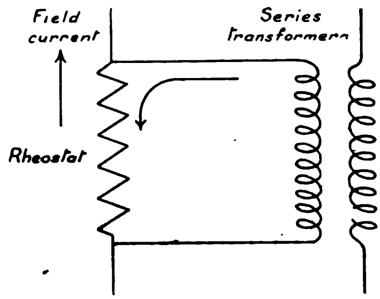
An interesting development in connection with apparatus for the generation of alternating current was described by Mr. E. F. Alexanderson, at a recent meeting of the American Institute of Electrical Engineers, the practical features embodied in the construction of the machine being detailed in the *Electrical World of New York*.

The apparatus consists of a self-exciting alternator and a revolving field with a segmental rectifying commutator. The field poles and their windings differ in no respect from what are used with any ordinary type of alternating-current generator. The commutator is built on a straight shell, and the segments are held together by two steel rings shrunk on the ends of the bars. These rings serve as an electrical connection between the different segments, one of the rings being connected to every other segment, and the other ring to the rest of the segments. The two terminals of the field winding are connected to two segments of opposite polarity, and consequently to the respective end rings. In this way the end rings can be used at any time as collector rings for separate excitation.

The current which passes through the commutator to the field winding is derived from a special exciting winding placed in the same slots with the main armature winding. The exciting winding is of the three-phase type and is connected in "star," the neutral point of which is formed by a three-part rheostat. Thus, in series with each coil of the exciting winding is connected a certain resistance, the effective value of which is varied automatically according to the load. Each section of this rheostat is in effect connected in circuit also with one coil of a three-phase series transformer, the primary of which carries the load current.

The circuits as joined to one section of the rheostat are indicated in the accompanying figure. The series transformer sends a current through the rheostat in a direction more or less opposite to the field current, thereby eliminating the proper proportion of the voltage drop in the rheostat. The elimination of the voltage drop in the rheostat changes over more or less of the field current from the rheostat to the series transformer. The secondary current of the series transformer is in phase with the line current, while the field current is practically in phase with the voltage. The amount of boosting in the field current will, therefore, depend not only upon the value of the secondary current, but also upon the power factor of the load. A function of the rheostat which is just as important as the field control is its influence on the commutation. As far as the latter is concerned, the full resistance of the rheostat may be considered as always being in circuit, although the larger part of the field current may flow through the series transformer.

The commutation consists in changing over the direct current from one phase of the exciting circuits to another, and should occur a little later than at the moment in which the induced voltages



Self-Exciting Alternator.

are equal in the two phases undergoing commutation. The moment of commutation should be delayed to such an extent that the difference in voltage between the two phases begins to force through the completed circuit formed by the two phases and the rheostat a cross-current, which is superimposed on the field current, and will weaken the current in one of the phases and strengthen it in the other phases, so that one of the phases will carry the entire current and none will pass through the brush which is leaving the segment.

It is stated that these machines have shown favourable results in parallel operation with ordinary machines, and also with other self-exciting alternators. The machines can also be used as synchronous motors.

"How to do More Business," is the title of a shilling book which Messrs. Guilbert Pitman are publishing. Useful information is given on a systematic office routine, advertisement writing, proof correcting, County Court matters, mail order business, etc.

Power from Niagara Falls.—The first electrical power derived from Niagara Falls for the use of Toronto was available for use on December 19th, and will be used for lighting and power purposes of all kinds. The present amount available is equal to that of 40,000 h.-p.

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 intended for publication.]*

To Obtain a Steady Course in Model Steamboats.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Under "Queries and Replies" in your issue for December 6th, 1906, page 551, one of your correspondents was seeking information as to overcoming the difficulty of "direction" in single screw model boats. Perhaps my experiences may help him and others in the same predicament.

My model is made to the design for a torpedo-boat destroyer, given in Handbook No. 12 on "Model Steamer Building," with the exception that she has a single instead of twin propellers.

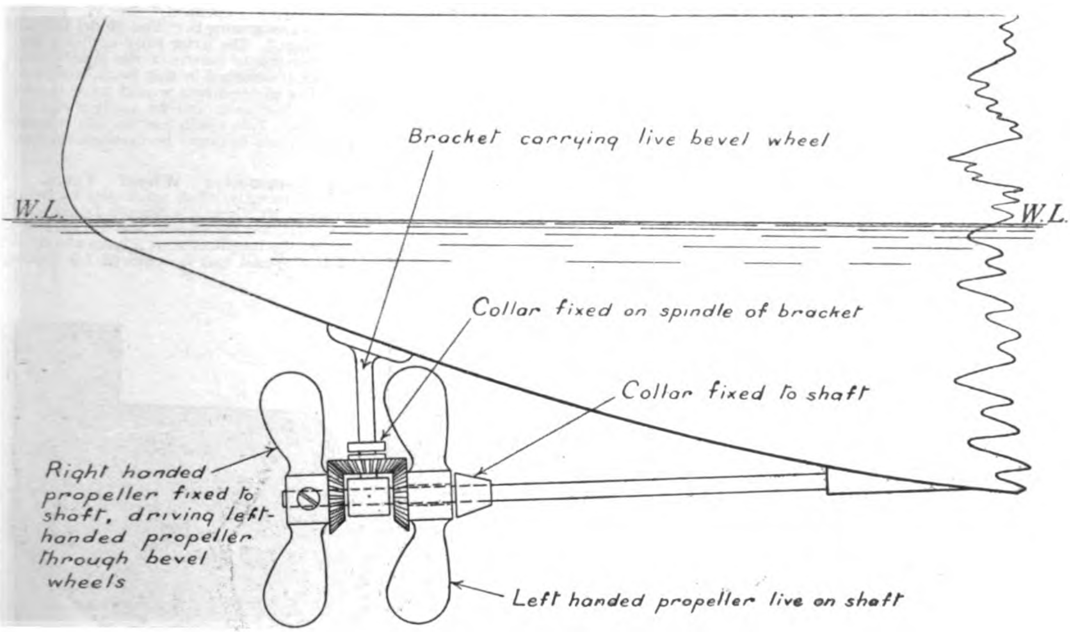
With a water-tube boiler working at 45 lbs., and a two-cylinder engine (slide-valve) ½ in. by ¼ in. stroke, I have obtained over 4 m.p.h. in still water.

With a single three-bladed propeller, total blade area 4·1 sq. ins., when running at full speed she had a heavy list to starboard (right-handed propeller), due to the torque on the shaft.

The water acting on the starboard bow, as it does in sailing boats, necessitated port helm to counteract the turning force; and the amount of this, besides detracting from the speed, should vary with the engine speed. Weighted rudders, I found, failed, though I did not pursue the experiments with them.

I decided to adopt two propellers on the same shaft, revolving in opposite directions, fitted as shown in the sketch.

With a blade area distributed over six blades of 4·9 sq. ins., and the same pitch as in the single screw, I found the boat maintained her course admirably on an even keel and lost nothing in speed.—Yours truly, JACK A. SHORE.



ARRANGEMENT OF PROPELLERS ON A SINGLE SHAFT, FOR STEADYING THE COURSE OF MODEL STEAMBOATS.

Cutting Bottles for Leyden Jars.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I read Mr. Green's letter in THE MODEL ENGINEER for December 6th about cutting bottles for making Leyden jars, and I think that the following would be an improvement on his method: Fill the bottle to the mark where the crack is required with mineral oil (paraffin will do); then heat a poker to a bright red, and plunge it into the oil. The bottle will crack at the surface of the oil.—Yours truly, Ὁ σοφὸς νεανίας.

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.

AN ordinary meeting of the Society was held at the Cripplegate Institute, Golden Lane, E.C., on Friday, December 14th, 1906, the chair being taken by Mr. Sanderson, and upwards of sixty members being present.

The minutes of the previous ordinary meeting having been read and signed, the Chairman announced the dates of future meetings and visits as under, specially asking members to exhibit models in course of construction at the forthcoming conversazione.

Mr. John O'Neill then proceeded to give a demonstration of moulding and casting, and, with the aid of a few small patterns and type metal for casting, gave the members many valuable hints in overcoming many of the difficulties of producing sound castings. His remarks were listened to with much attention, and a large number of questions asked and answered.

Mr. M. H. Hudson introduced and showed the uses of a new soldering compound known as "Tinol," the essential features of which are its ability to unite practically any two metallic surfaces without their being in any way previously cleaned, the heat necessary being obtained by means of a small spirit lamp, or even a lighted match, the resulting joint being remarkably strong and sound. Mr. Hudson stated the compound would shortly be put on the market and sold in tubes at a low figure.

Mr. H. Delger exhibited a fine piece of work in the shape of a partly finished ⅛-in. scale locomotive, fitted with Joy's valve gear. The model was much admired.

FUTURE MEETINGS.—Saturday, January 12th, 1907: Annual Conversazione at the Cripplegate Institute. Tickets, price 2s. 6d. each (including refreshments, etc.), may be obtained beforehand on application to the Secretary, as at foot, or at the doors on the evening at 6.30. Saturday, January 26th: Visit to Great Western Railway Engine-sheds at Old Oak Common. Members wishing to attend are requested to notify the Secretary. Wednesday, January 30th: Meeting at the Cripplegate Institute at 7 o'clock. Lecture by Mr. W. J. Tennant, M.I.Mech.E., on "Some Mechanisms."—HERBERT G. RIDDLE, Hon. Sec., 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:—

[16,933] **10-watt Motor Electric Brakes.** F. H. (West Kilburn) writes: I have finished building a model electric motor, as sketch (not reproduced), to drive a model locomotive, 2-in. gauge through a worm gear. (1) Would you mind telling me if 6 volts would drive the locomotive? (2) What size wire, and what quantity shall I wind the armature and field-magnet with, the armature being tripolar and the field-magnet made of wrought iron? (3) Will you kindly send me a sketch of a simple magnetic brake for the locomotive wheels? The locomotive is a four-wheeled locomotive.

(1) Six volts and 2 or 2½ amps. would drive motor. (2) Armature wind with No. 23 S.W.G. full, and field-magnets with same gauge; about ¼ lb. will be required for fields. (3) See page 76, August 15th, 1902; page 141, September 15th, 1902; page 188, October 15th, 1902; page 236, November 15th, 1902.

[16,671A] **Locomotive Running.** J. C. (Barnsbury) writes: Assuming that an express train was travelling at a high rate of speed and all the brakes having failed, recourse was made to the reversing lever as a means of stopping her, what would be the effect on the locomotive when the driver had drawn the lever into the vertical position? I have your handbooks, "Slide-valve" and "Locomotives Simply Explained," but do not seem to be able to satisfy myself on the question—How can the motion be reversed while the locomotive is running?

Practically none, except that the steam entering the cylinder would be reduced to the minimum quantity. The valve would still be open to "lead," and the locomotive, premising the valve setting was good, would continue to run in the same direction. See "The Slide-valve Simply Explained," by W. J. Tennant, and also the chapter on valve gearing in "The Model Locomotive: Its Design and Construction." The latter fully explains the point, and we would recommend you to construct the simple valve-gear model (or working diagram) described in this book, and everything will be clear to you. The engine-driver would have to bring the reverse lever slightly into back-gear and to apply steam to make the motion act as a brake. This would not do the cylinders any good, as cinders and dirt would be drawn in through the blast pipe from the smokebox.

[16,671] **Turning Locomotive Wheel Tyres.** J. C. (London) writes: I have recently taken up model engineering as a hobby, and have chosen Mr. Greenly's Simple Locomotive as a first attempt. I have purchased the wheels, and am writing to ask you if you would give me the benefit of your advice about marking out the wheels, and if a special tool is required for turning the tyres to shape.

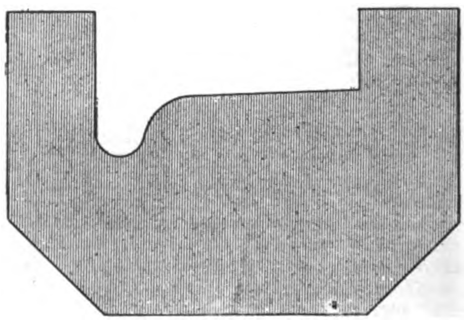


FIG. 1.—TEMPLATE FOR LOCOMOTIVE TYRES.

FIG. 2.—TURNING LOCOMOTIVE WHEEL TYRES.

We do not quite understand your difficulty *re* marking out the wheels. You will be able to turn the tyre quite easily and accurately by hand if you first make a little template in tinplate, as shown herewith, to the shape of the tyres given on the original drawing. You will have to be careful to get the coupled wheels all the same diameter on the tread. This will be the most difficult thing to do and at the same time preserve the correct section. To guide you, scribe a line on the face of the tyre to the correct diameter whilst the wheel is in the lathe and before you start to turn up the tyres.

[16,990] **Power for Water Wheels.** S. P. (Douglas) writes: I will be much obliged if you will answer the following query. Shall I get enough horse-power to drive a 250-watt dynamo

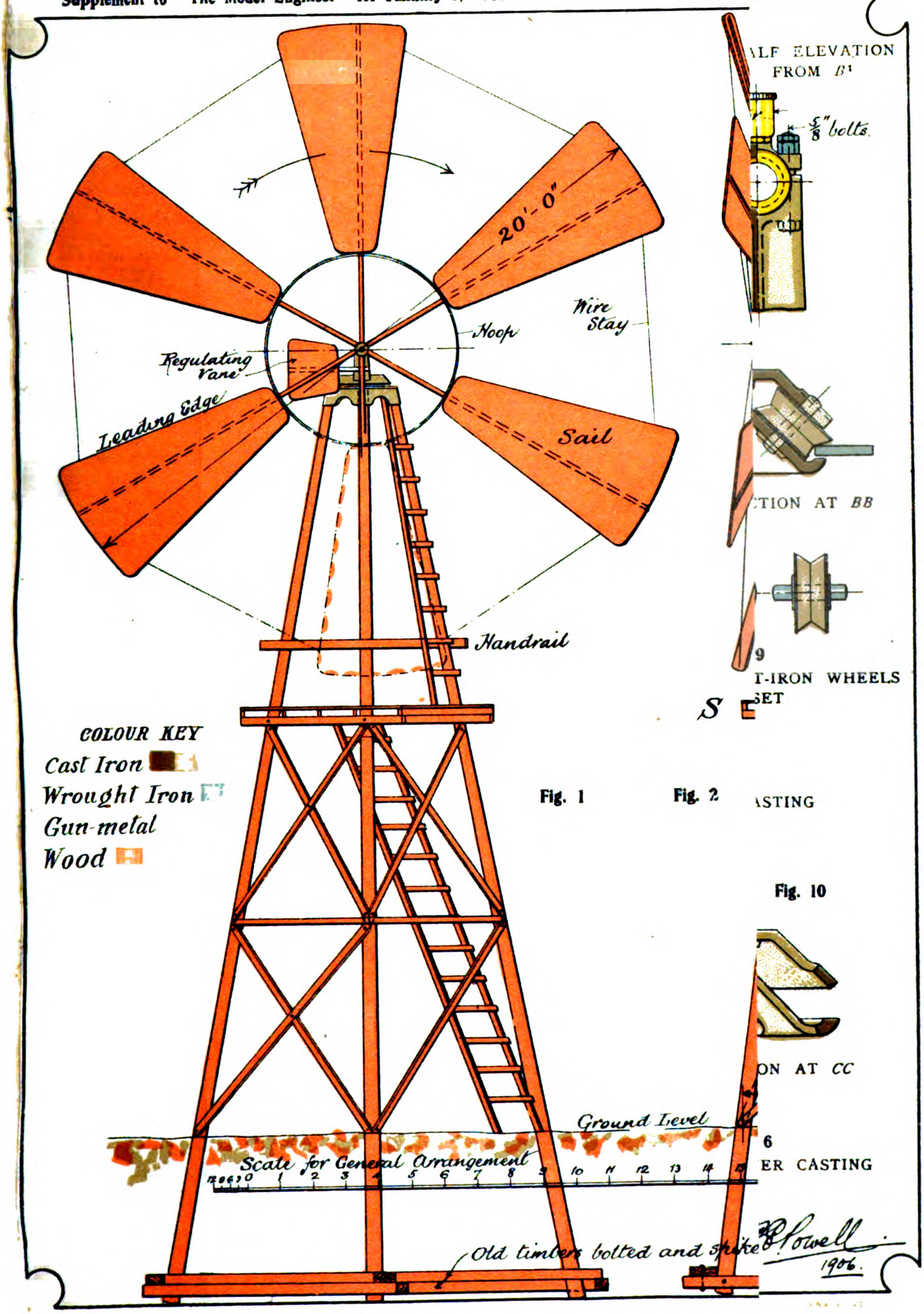


Fig. 1

Fig. 2

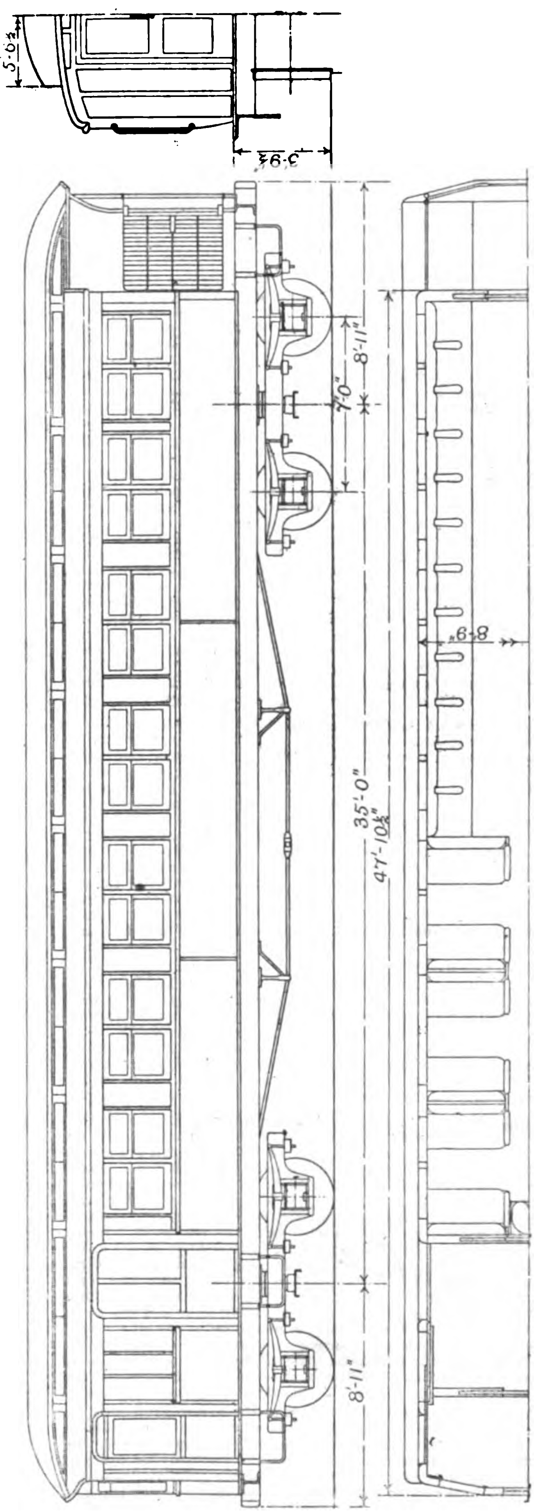
Fig. 10

from a Pelton wheel with ¾ in. inside diameter pipe with a head of 10 ft. If so, please give me diameter of wheel and inlet and outlet. If it is not possible to get sufficient power from a 10-ft. head, let me know what head I shall require and also diameter of wheel?

With 10-ft. head and jet of ¾ in. diameter and a 12-in. wheel, you should get about 1-10th h.-p. You would need at least ½ h.-p. to drive a 250-watt machine. A head of 40 ft. would give about this, and would take 14 cubic ft. of water per minute.

[16,767A] **Electric Motor Coach.** F. G. A. (London) writes: Will you kindly publish a drawing of the driving carriage of a Metropolitan Railway electric train?

We include herewith a drawing of a Metropolitan Railway electric motor coach. The trailer carriages are of much the same design as the rear end of this carriage. The scale of the drawing is ⅛-in. to the foot, approximately.



Metropolitan Railway Electric Motor Coach.

[16,946] **Battery Queries.** A. W. B. (Burton-on-Trent) writes: I have Mr. Bottone's book, "The Amateur Electrician's Workshop." He gives instructions for making a modification of the Lalande-Chaperon battery. How long (*i.e.*, how many charges) does the copper oxide plate last? Does it not soon get all copper? Is the copper oxide powder expensive; also, the caustic soda? I cannot get either here. Is the caustic soda solution strong enough to hurt the skin, if accidentally spilt on it? Six cells give 4·2 volts and 11 amps. on short circuit. A 4-volt lamp takes about ½ amp., I believe. Would the six cells light twenty-two lamps in parallel? If not, why not? Mr. Bottone says a chromic acid battery plate, 6 by 2½ ins., gives 40 amps. on short circuit. Therefore, two cells would light eighty lamps (4-volt). But they only light two or three. Kindly explain. I have your book, "Electric Lighting for Amateurs" (6d.) Why do you have four Leclanchés, or 6 volts for a 4-volt lamp? If battery is close to lamp, would not lamp be fused? What determines voltage and candle-power of a lamp, the thickness or length of the filament? Will you kindly recommend a book giving fully *the theory* of various kinds of batteries—why the voltage resistance differs, why they soon polarise, and what the chemical action is? Also, a book that answers similar questions to those above? I know a little about electricity, and would like to know a lot more, but very few people seem to know anything about it, although in such general use. I must apologise for the number of my questions.

Some information concerning Lalande cells was given in June 21st, 1906, page 598. No, neither are expensive; Whitneys, 117, City Road, would supply you. Yes; strong caustic soda will make a rather nasty burn. The cells, output, and capacity can be found by reckoning: capacity, 15 to 20 amp.-hours per square foot of positive plate, output (maximum discharge rate), not more than 6 amps. per sq. foot positive plate. You do not mention candle-power of 4-volt lamp. Current taken depends on this, as we have repeatedly stated in these columns. You do not give size of cells. Discharge rate must not be too heavy, or plates will heat up and buckle, and perhaps paste drop out. On a short circuit there is no resistance, hence a large current will momentarily flow. When you put lamps in circuit you introduce resistance, and the voltage of cells, etc., is not enough to send a similar current as it would on short circuit. Study Ohm's Law, explained in any text-book on electricity:

$$C = \frac{E}{R}.$$

Both thickness, length, and material are factors of the resistance of a lamp's filament. See "Primary Batteries," by Cooper, 11s. post free. "Galvanic Batteries," by Bottone, would also interest you—price 5s. 4d. post free. We trust these details will help you—if still in difficulties, write us again.

[16,997] **Model Boilers.** A. W. T. (Wandsworth) writes: I have a compound engine of 2½ × 1½ × 1½ stroke; it is supposed to develop 3½ h.-p. I have a piece of steel tube of 10 ins. diameter and 36 ins. long. If this was made into a Cornish boiler, with tubes in the flue, would it be large enough? If so, what size furnace tube, and how many tubes in it? Or, if I made one as Fig. 16 in "Model Boiler-making," how much bigger steam drum and water drum, also how many more tubes, should I want? I want to work at about 60 or 80 lbs. pressure and at about 1,000 r.p.m.

A Cornish boiler will not satisfactorily run the engine at 80 lbs. pressure and 300 r.p.m. It requires 500 sq. ins. of heating surface. As a Cornish boiler with a 5-in. flue and water, you will get about 300 sq. ins., and therefore we suggest a boiler as shown in "Model Boiler-making" (new edition), Fig 3 B, page 22, with about five tubes 1½ diameter. This will give good results with the least trouble. Practical difficulties are in the way of making a reliable "Yarrow" type boiler. However, you may get over most of these by using union joints for the tubes. See THE MODEL ENGINEER for November 8th last, page 446. The engine will not develop anything near 3½ h.-p. with the above boiler—more likely about ½ h.-p. The "Yarrow" boiler, of course, would be much more powerful.

[16,944] **Working Models with Compressed Air.** "READER" (Liverpool) writes: I have been building a model locomotive to a scale of 1½ ins. to a foot, and as steam is too much bother, and I have not a very great length of time, I wished to know if

it would be possible to drive it by compressed air. I could obtain the compressed air and I could store it in the tender, like I could water, and feed the boiler in the same way? I am fitting an exact model brake, and if I use the automatic vacuum brake—which has a steam ejector on the locomotive—could I obtain a vacuum by letting air through the ejector the same way as I can with steam Should I use the Westinghouse brake?

In reply to your letter—no, it will not prove practical to work the locomotive from compressed air, using the boiler and tender as storage reservoirs. You will find that the engine would only run for about half a minute at the most. A simple pressure air-brake would be the best to use in such a case. Automatic brakes are rather complicated. However, you must have a larger storage capacity if you wish to run your locomotive by compressed air.

[16,740] **Model Locomotives.** A. J. K. (Walthamstow) writes: I am about to commence making a small model locomotive —gauge 1½ ins. or 2 ins. As it is a first attempt at engineering, I think it would be best to have a single-action oscillating cylinders inside the frames. I should be very much obliged if you could kindly give me an idea of the size of cylinders required and also dimensions of boiler. I may mention that the boiler is my chief difficulty, as it must be soldered up (riveting or brazing being beyond me), and I am desirous of having an inside flame, so that the engine may be used out of doors. Boiler would be lagged. Any information or suggestions as to design of boiler, etc., which you could give me, would be most gratefully received; also, where I could get single-action oscillating cylinders with some simple reversing attachment.

Everything depends on the class of locomotive you wish to make. For a light model (such as is sold ready-made) you may use single-acting oscillating cylinders, but you will find the cheap fixed cylinders, with piston-valves and self-contained reversing device, suit you very much better, as it is difficult to fit up a reversing plate for single oscillating cylinders between the frames of a small model. With these cylinders and light parts you should have no difficulty in making a good working model, but we do not think this class of work is suitable for anything but an outside fired boiler. Before you spend any money on materials, we would recommend you the two books, "Model Steam Engines," price 6d. net, 7d. post free, and the larger text-book, "The Model Locomotive: Its Design and Construction," price 6s. net, 6s. 5d. post free, which contains complete information on the subject of model locomotive building and nine folding plates of working drawings.

[16,880] **Small Accumulators.** A. C. (Glasgow) writes: May I ask your kind consideration of the following queries. I intend to make up a set of accumulators, as per MODEL ENGINEER Handbook No. 1, for intermittent lighting; eight open cells of 6 amp.-hours capacity to light four 2½ c.-p. lamps at 15 volts. On an average one lamp at a time will be used, but on certain occasions it might be necessary to light the four for a few minutes. Would this be too sore on the cells? I want to reduce the number of plates per cell to a minimum compatible with efficiency. Would two negatives and one positive, each 4 by 3 by 3-16ths, be sufficient? the negatives pasted on one side only. I intend to use red lead for the positive plates and litharge for the negatives. With a current of 1 amp. passing through the cells, will it take about thirty hours to "form" the plates? The only other difficulty I have is about the proper quantity of acid to use per cell; or, rather, what should be the size or capacity of the jars?

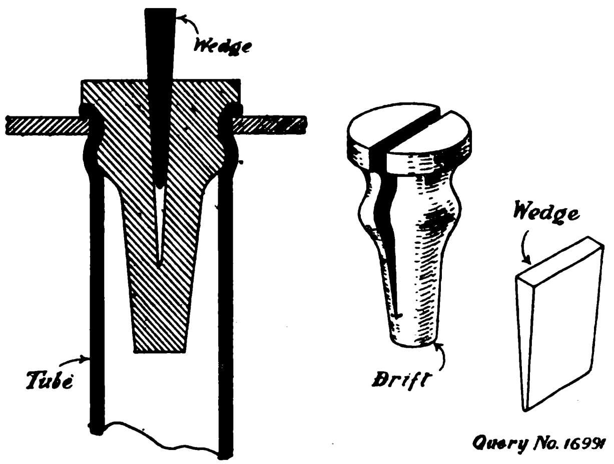
You can reckon on lamps taking 3½ or 4 watts per candle-power. The discharge rate of cells should not exceed 6 amps. per sq. foot of positive plate surface. Reckon also about 15 amp.-hours capacity per sq. foot of positive plate. Many take more than thirty hours to get them really into good condition. Repeated charges and discharges will steadily improve the efficiency. Give plates about ½-in. clearance at sides of cell; but distance between plates should be about ¼ in. But be careful they do not touch each other.

[17,010] **Model "Atlantic" Locomotive.** L. C. (Dublin) writes: I shall feel very much obliged if you will kindly help me with reply to the following queries *re* Great Northern Railway "Atlantic" type No. 251. I am thinking of building a model ¾-in. scale, same as design in "The Model Locomotive," but I want to alter the gauge to 4 ins., which is about ¾ scale for the Irish gauge. Would ⅜ in. be the proper increased width between frames? Would this widening entail any change in the motion? I mean, would the eccentrics be fixed 3-16ths in. further apart on the axle? I particularly wish to fit a Belpaire firebox instead of a Wooten, as shown in drawings. What would be the best dimensions for a Belpaire firebox for this model, and would solid fuel or a Primus burner be best? Can I arrange the reversing lever and rod to go above footplate, as I want to arrange wheel and screw gear in cab, if possible Can I manage the main frames to go full length, or will it be necessary to widen them behind the driving wheels so as to allow wider firebox? Will the widening of frames lower the centre of boiler ⅜ in.? This I could add to height of chimney.

Without making elaborate drawings of the parts affected, we do not see that you need do anything but extend the frames, steam chest, flange, saddle, footplates, and axles. Only extend the footplates 3-16ths in. on each side, but the rest may be widened to exactly the difference in the gauge—less 1-32nd in., perhaps. With regard to the valve gear, if you are possessed of any castings of the steam chest or wish to order the stock size, do not bother to shift the valve gear. With a narrow firebox, the reversing lever can be arranged above the frame in the usual manner and coupled direct to the lever or screw in the cab. A Belpaire firebox gives no great advantage and necessitates more joints. You will find particulars of a suitable design in the book mentioned. We do not think you will be able to get in anything but a flush-topped box with the G.N.R. style of cab, but you will soon see this when you make your drawings. Yes, it is possible to have only inside frames throughout or to extend the inside frames to the back buffer plank, retaining the outside frames without axleboxes: this is how the original is built. With regard to lowering the boiler, this will make it possible for you to provide a higher Belpaire firebox, but the effect of such alteration (and also lengthening the chimney) can only be judged when you have made your drawings. You might send these for our criticism.

[16,991] **Fixing Boiler Tubes.** W. H. A. (Croydon) writes: I am making a boiler with six ½-in. copper tubes, and I want to know how to fix those tubes in the end plates. Shall I braze them or expand them? If expand them, how shall I do it, as I have no tools for that? The boiler is 9 ins. long, 3 ins. diam., and is to work at a pressure of 30 lbs.

There are several methods of fixing tubes. The simplest, but least trustworthy, is to fit them as tightly as possible into the holes in the tube plates, and simply solder the joints with an "iron." It is not often practicable to braze or silver solder the tubes into a boiler of any size owing to the difficulty of heating the boiler and the risk of burning the part being operated on. Everything depends upon your skill as a coppersmith. At the furnace end of, say, a locomotive boiler, a good way is to taper the hole and also the end of the tube, drive in the tube and bead it over with a light hammer. Soften the tube before fixing



FIXING SMALL BOILER TUBES.

or it may split, and solder to obtain a tight joint. Another method is to expand them in. At a demonstration before one of the meetings of the London S.M.E., one of the members, Mr. E. W. Fraser, showed how he used a specially made drift for the purpose. We illustrate one designed on similar lines. It should be made of steel and consists of two parts—the drift or expander, and the wedge piece. The tubes are fitted into their respective places projecting about 1-16th in. beyond the tube plates. The drift is inserted, and the wedge driven home. Afterwards remove the wedge and turn the expander round through an arc of 90 degs., so that you can expand the tube in a direction exactly across that previously accomplished. The tube can be beaded over and the other end treated in a similar manner. For tubes larger than ½ in., we prefer a roller expander of the ordinary type. Tubes may be screwed into the tube plate at the furnace end and expanded in at the other. This method is more suitable for locomotive boilers, as in the smaller sizes it is practically impossible to do anything in the way of tube expanding in the firebox, especially when water tubes are used. Instead of expanding ferrules may be used at the smokebox end.

[16,722] **Model Locomotive Valve Gears.** A. H. W. N. (Cornwall) writes: I am very anxious to complete a locomotive which I have in hand (it being my first attempt). The castings were bought from a firm who advertise in your paper. The model is on the lines somewhat of the "County" type. Cylinders, 1-in. by 2 ins.; gauge, 4½ ins.; length of locomotive, 22 ins. with tender. There is no reversing gear provided. I wish to fit on some kind, but not the ordinary Stephenson type, nor Joy's, etc. Some years ago I bought a small locomotive in town (I think foreign make),

well finished, but chiefly soldered together. This engine (about 2-in. gauge) was fitted with reversing gear and self-reversing catch under the frame near the buffers. I am unable to recall the principle on which it worked.

In reply to your query, the reversing gears for the type of engines you describe is detailed in our little sixpenny handbook—" Model Steam Engines." The reversing gear used in the model locomotives and stationary engines of small size cannot very well be enlarged to suit a 4½-in. gauge locomotive. The principle on which they work may be adopted, but not the exact mechanism. No sliding surfaces which may leak to open air can be successfully employed, owing to the difficulty in keeping them tight in the larger sizes. If you will send a drawing we will suggest a suitable gear, but, in the meantime, we refer you to " The Model Locomotive," by Greenly, price 6s. net, 6s. 5d. post free.

[16,813] **Electric Motor for Boat and Accumulators for Same.** R. P. M. (Woolston) writes : Could you please supply me with information with respect to motor I am now constructing to fit in a boat 3 ft. 4 ins. long. As I am working to a total weight of 7½ lbs., I am trying to keep weight down as much as possible. The weight of the boat is 1 lb., and the motor approximately 2 lbs.; this leaves a weight of 4½ lbs. for my accumulators. I should like to know the number of sections for the armature and the way to wind same ; also the field-magnets, and with what size wire to obtain best results. The fields are supported by ⅛-in. C.I. studs, so I should like to know diameter to wind bobbins. Please say if the 4½ lbs. for the accumulators will be sufficient to produce power to drive motor. If it is possible, I should like to fit two accumulators so as to be able to turn the boat.

Armature of eight sections and wound as per handbook— " Small Dynamos and Motors," Figs. 8 and 9, 10-watt scale. Full directions for winding 8-section armatures is given therein. Wind for voltage to suit your accumulators. No. 22 gauge on armature, and No. 24 for field coils. Four and a half pounds is not much, but a 6-volt cell of this weight would supply enough current for motor for an hour or two. Use two 6-volt cells in parallel, each having plates, say, 2 ins. by 1½ ins. That is, there will be nine plates in each 6-volt accumulator, three in each cell.

[17,014] **Model Boiler-making Silver Soldering.** D. M. H. (Evesham) writes : I am building a ½-in. scale locomotive from castings. The boiler is supplied already brazed, but I should be glad of your advice *re* the fittings (safety valve, whistle, gauges, etc.). These I bought finished, and each is supplied screwed into a ferrule, and I presume this should be soldered into the boiler. I want to know if it is necessary to use silver solder for this. The fittings are brass, and the boiler copper. I was just about to undertake the work when I read in the " Notes on Sheet Metal Work," in the current issue of THE MODEL ENGINEER, of the difficulty of joining brass to copper. Never having done any hard soldering, I am afraid my chances of making a good job of it would be very slight. Should I discard the ferrules, and screw the fittings direct into the boiler, running soft solder round the joints ? The steam pressure will be 45 lbs.

Personally, we have not experienced any difficulty in silver soldering brass ferrules or pad pieces on to copper boiler shells. We presume that the boiler ends are of brass, and are silver-soldered into the shell. Except in the case of the safety valve, which may require to be removed, and is affixed to a circular face, we should discard the ferrules and tap the boiler for the fittings, and see that the threads are good tight ones. Any fittings which are not required to be removed, sweat with soft solder. You should then have no trouble, even if the boiler runs short of water. If you can arrange a filling plug elsewhere, possibly you may be able to arrange the safety valve in a similar way ; but this depends on its design and whether—if so fixed—you can get the inner barrel into the outer shell. Otherwise, silver-solder the ferrule or a similarly tapped pad piece on to the boiler barrel. The initial difficulty in such a large job is getting the work hot, and until you have gained sufficient experience on smaller pieces of work, do not attempt it.

[16,930] **Water Cooling for Petrol Motor.** A. S. (Woking) writes : I have a 1½ h.-p. air-cooled petrol motor, which I want to drive a 160-watt dynamo. It works perfectly, but gets exceedingly hot. I therefore cannot run it for long for fear of piston seizing. What would you suggest to remedy this ? I have wound compo tubing (⅜) round cylinder, and have connected same to water tank, but this does not appear to answer. I would prefer to water-cool it somehow, as it is not convenient to work a fan. I want engine to run from six to eight hours at a time for charging. The name of engine is the "Ixion." How hot are these engines supposed to get on a bicycle ? Also, why does blue smoke come out of exhaust ?

The only way is to fit some form of water jacket to cylinder. If necessary, chip away some or all of the fins or ribs ; then fit a pair of copper rings with grooves. They could be screwed on to top and bottom of cylinder, making water-tight joint. See page 286, September 21st, 1905, issue. Under ordinary conditions the cylinders of these engines get very hot, but not so hot that they begin to lose power or pull up. Smoke from exhaust points to incomplete combustion—too rich a mixture, or it may be due to vaporisation of the lubricating oil in cylinder.

[16,102] **Model Water-tube Boiler.** W. D. (Stratford, E.) writes : Would you kindly answer me the following questions : I am thinking of making a water-tube boiler of steel : top drum, 4 ins. diameter ; water tubes, ⅜ in. or ¼ in. diameter. I should want the tube very thin, about 1-16th in. thick, or as thin as I can get to stand a reasonable pressure. It will only be a model boiler, but I want it to make steam quickly.

The use of steel is not to be recommended for such a small boiler, and we would in any case anticipate that you would have some difficulty in obtaining the tube in small quantities. A solid-drawn copper tube is advised with all the joints of the water-tubes and drums silver soldered. See " Model Boiler Making " for a suitable design. You will find copper a better conductor of heat and considerably help you in the attainment of the desired result.

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 the asterisk have been based on actual Editorial inspection of the goods noticed.*

* High-class Electrical Apparatus.

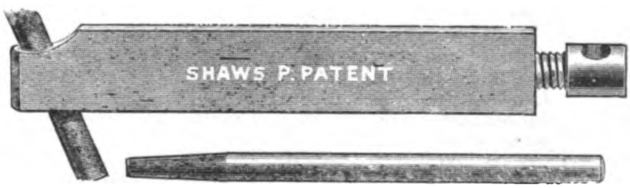
We have recently inspected some samples of electric apparatu manufactured by Mr. John Cole, West Norwood Electrical Works Chapel Road, West Norwood, S.E., and have been very pleased with the excellent workmanship and finish of the appliances placed before us. Mr. Cole, who has been manufacturing electrical goods for a number of years past, makes a feature of building small motors and dynamos to special requirements, and would be pleased to hear from any of our readers requiring such articles who cannot find exactly what they want on the market. He also makes measuring instruments, coils, and all classes of electrical apparatus for which he will be pleased to quote on receipt of enquiry.

A Business Change.

We are informed that Mr. G. Hallas, who has had a wide experience in the making of lathes, planing machines, gas, steam and oil engines, etc., has joined the firm of Messrs. MacMillan and Co., of Alloa. The firm will add the manufacture of the foregoing specialities to their present well-known lines.

The "Shaw" Toolholder.

The toolholder illustrated herewith was designed by an expert toolmaker for use in his own works, and has been severely tested under ordinary working conditions on high-speed steel, etc., giving exceptional results. The use of this toolholder, it is claimed, makes it possible to get the utmost result from the use of high-speed steels at a minimum cost for steel. The chief advantages



THE "SHAW" TOOL HOLDER.

are rigidity, tool adjustment doing away with packing bits of steel underneath, the angle of tool gives quick and free cutting, and the tools are made from high-speed steel of round section, no forging required. By grinding the tool to shape this toolholder forms an ideal screwcutter. Particulars of sizes and prices can be obtained of Cotton & Johnson, Gerrard Street, Soho, London.

New Catalogues and Lists.

Woodfall & Morris, 341, Queen's Road, New Cross, London, S.E., have sent us a fully illustrated catalogue of electrical apparatus which they supply. The list includes bells, telephones, small dynamos and motors, cores, wires, and cables, experimental apparatus, motor-car accessories, electrical novelties, etc., and will be sent to readers of THE MODEL ENGINEER post free upon application.

The Editor's Page.

TO our readers one and all we give hearty good wishes for health and prosperity in the New Year.

* * *

The coloured plate which we present with this issue is rather a departure from model work, but a windmill such as is depicted is well within the scope of an amateur mechanic of moderate ability, and we have had so many enquiries from time to time for drawings of such a contrivance that we think the present supplement will be welcome to quite a number of our readers, and particularly so to those in country districts. It will be noted that the design is by our old contributor, Mr. Frank E. Powell, who is now settled in New Zealand, where he is finding ample scope for his exceptional engineering abilities. Though so far away, he still takes a keen interest in the pages of THE MODEL ENGINEER, as his present contribution witnesses.

* * *

We may, perhaps, point out to new readers that bound copies of the last volume of THE MODEL ENGINEER can now be obtained, price 6s. 6d. net, or 6s. 10d. post free, while binding or reading cases can be obtained price 1s. each, or post free 1s. 3d. A limited number of some of the earlier bound volumes are still available, but these are gradually becoming exhausted.

Answers to Correspondents.

M. H. CARNE.—You wrote us about some accumulators for car work, and enclosed stamp and gave your name, but carefully omitted to mention your address. The reply to your inquiry is waiting for you.

G. C. M.—Some useful data will be found on page 222, September 3rd, 1903, issue. See also recent articles on the subject within the last few months. See July 5th, August 23rd, and subsequent issues of this year for articles on water motors.

J. D. R. (Portsmouth).—Particulars of the construction of a small transformer will be found in February 26th, 1903, issue of this Journal.

J. W. R. (Stoke-on-Trent).—You can obtain suitable brass tubing from Messrs. Smith & Son, St. John's Square, Clerkenwell, E.C.

N. McC. (New York, U.S.A.).—Your query is much beyond our scope. See the book on "Steam Turbines," by Carl C. Thomas, published in your city by John Wiley & Sons, price 15s. net.

J. B. L. (Kirkcaldy).—We have a letter of yours in hand, but cannot decipher the writing. It has something to do with 3½ volt lamps and model villa; but exactly what, we cannot say.

G. W. W. (Llanelly).—See the "Electro-platers' Handbook," by Bonney, 3s. 3d. post free; or, "Handbook of Electro-plating," to be had from W. Canning & Co., Birmingham.

W. J. (Bolton).—Capacity about 15 amp.-hours per sq. ft. of positive plate surface. Discharge rate not more than 6 amps. per sq. ft. of positive plate surface. Yes; each cell is 2 volts, and if joined to others in series add the voltages. Cells for charging should give 25 per cent. higher voltage than accumulators to be charged.

C. J. T. (Ross).—Hardy & Padmore, Ltd., would supply you.

C. B. (Birmingham).—Your last reply gave full instructions what to do. See also query on the subject in March 5th, 1903, issue.

J. T. (Coatbridge).—Wind armature with 6 ozs. No. 23 S.W.G. and field-magnet with 2¾ lbs. No. 22. Output should be about 40 to 50 watts.

F. T. M. (Sevenoaks).—You will find a method of arranging an oscillating cylinder to reverse in our issue of March 15th, 1902. This number is still in print.

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

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THE

Model Engineer

And Electrician.

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

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A 50-watt Charging Dynamo.

By J. W. T.

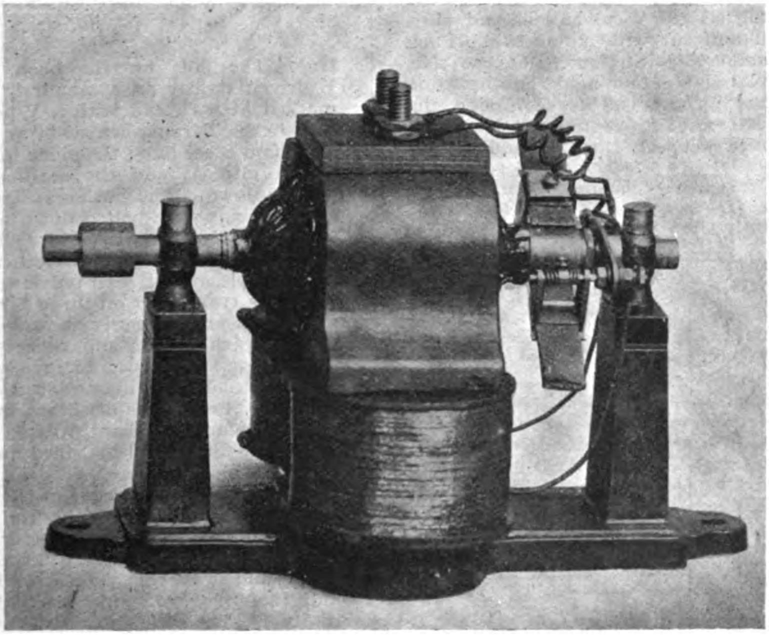


FIG. 1.—A 50-WATT DYNAMO FOR CHARGING ACCUMULATORS.

THE illustration represents a 50-watt charging dynamo I have made, and I have pleasure in giving our readers some details of its construction. Only the base, magnets, and armature stampings came into my hands, and the bearings, brush gear, and commutator are entirely built up from what may be termed "scrap." The armature is 2½ ins. diameter by 2¼ ins. in length, and has twelve slots ⅜ in. by ⅜ in. At each end of the armature plates was placed a piece of ⅛-in. well-shellaced card to prevent the wire insulation being cut by the edges of the last plate. A brass washer was put over the card, and the core was tightly bolted together with gun-metal nuts on shaft (thread 40 to the inch), and the thread burred up to prevent nuts moving. The nuts and plates were then bevelled to interfere as little as possible with neat winding. The ends were insulated with three layers of well-shellaced calico, pressed smooth with a hot iron. The slots were insulated with linen between two pieces of paper. I wound the armature with thirty-six turns per slot, No. 20's, as I considered this would be suitable for about 8 amps. at 10 volts. I intended using a six-segment commutator, and wound the armature in twelve sections, leaving commutator connectors in each two sections. The wire was not cut from start to finish, the commutator connectors being formed by twisting about 3 ins. of the wire together and well insulating it with silk to prevent abrasion of insulation against other wires, as, when a machine s running, the connectors are subject to considerable vibration, and the cotton covering is soon rubbed through, and the coils consequently shorted. Every section was also carefully insulated at the ends with silk and thin card in the slots. Great care was taken to get every wire firm and well placed, and to get the armature as perfectly as possible mechanically balanced, in which respect it turned out so well that it can be driven at a high speed without vibration.

The commutator is 1¼ ins. long by 1¼ ins. diameter, and was made from solid pieces of gun-metal. It is fixed together and on shaft by one nut, as I found I had not room for two. The piece for the segment was bored and turned, the V cut at each end, then carefully divided and cut with a fine saw. Each segment was numbered with punch dots, so that they could be placed together again in the same order, and tinned at one end for soldering the armature connectors. The segments were put together with mica between them, bound tightly

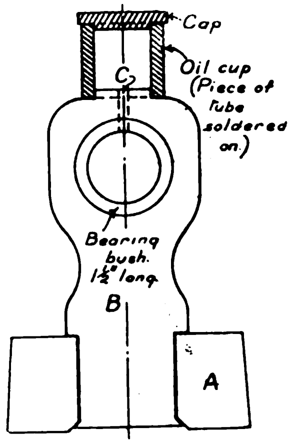


Fig. 2.—Section of Bearing Pillar.
(*Full size.*)

together with wire, and the mica cut to shape. They were insulated from the V rings with thin card rings, which were softened, pressed to shape over the V's, well shellaced and dried.

The commutator was screwed up firm and true, and each segment was carefully tested with a battery and lamp before the armature wires were soldered on. The ends of the shaft were turned to fit ⅜-in. brass tube bushes.

The magnets were clamped together to file the yoke seatings parallel and flat. The height from bearing seatings to the centre of bore was then carefully measured for centre of bearing bushes.

I built the bearing blocks as shown in Fig. 2. The bottom piece A was sawn from 1 in. by ½ in. iron bar, bored to take the pillar B and the holding-down bolts. The pillar B was turned from ⅞-in. round iron. Having no angle-plate, I adopted the following method of construction to get the bush

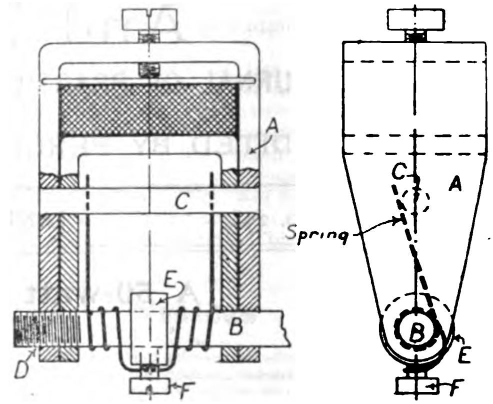


Fig. 3.—Details of Brush Holder.
(½ *full size.*)

true. The hole for the bush was drilled first. B driven tightly on a mandrel, and a centre line marked at each end with a V-pointed tool in the slide-rest. Turning centres were then marked and drilled on these lines, the pillar turned to shape and driven into A, and the seating turned true for bolting down. The bush was then fitted, and the two bearings were bolted down and carefully lined horizontally with the armature shaft. Then A and B were soldered and riveted, oil-cup and cap fitted, and oil hole drilled. To prevent oil getting on the armature two V's or oil-throws were turned on the shaft, and are distinctly shown in the illustration.

The brush-holders and rocker were made from sheet brass, and have an extremely neat appearance. The brush-holder is illustrated in Fig. 3. To make holder A, two pieces of brass were bent together over a square iron bar, sweated together, leaving ¼ in. space for the brush, drilled for the rocker-pin B, and then filed to shape. A ⅛-in. wire C was then riveted in to take the ends of the spring. To keep the holder in position, the end of the pin and corresponding side of the holder were screwed as shown at D. The spring arrangement is very simple and effective. On the pin B is a loose ring E, and the fixing screw F also holds the spring in position. The spring was made of phosphor-bronze wire, looped in the middle, the loop then caught over the screw F, and each end given three turns round the pin B. By shifting the position of the screw F, any desired tension can be given to the spring. The brushes are seven layers of copper gauze.

The exciting coils are wound on iron bobbins with brass top plates, and I intended winding them with as much No. 17's B.W.G. as I could get on which I find will be about 7 lbs.; but at present there is only half that quantity on (which was all I had). The dynamo, however, runs very well, excites very easily, and brilliantly lights a 10-volt lamp. With full coils, I think the dynamo will nicely give about 5 amps. at 10 volts.

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.*]

Finishing Brasswork.

By S. BETTS.

Many amateurs in electrical work have, doubtless, admired the very pretty effect of " mottling " seen on shop-made brass instruments. I refer to the sort of veining, something like the veins in marble, running over the surface of the brasswork.

A smooth finished brass surface readily shows up scratches, and is difficult to lacquer perfectly, evenly, and free from brush marks. On the mottled surface lack of skill is not so noticeable.

The " mottling " is really a series of very fine circles running into one another scratched on the surface of the brass. But the amateur will readily see for himself if he tries the following dodge.

Take a small round piece of wood (a piece of a penholder or pencil will do), put it in a drill chuck or self-centreing chuck, leaving an inch or so projecting. Start the lathe, and with a smooth file

FIG. 1.

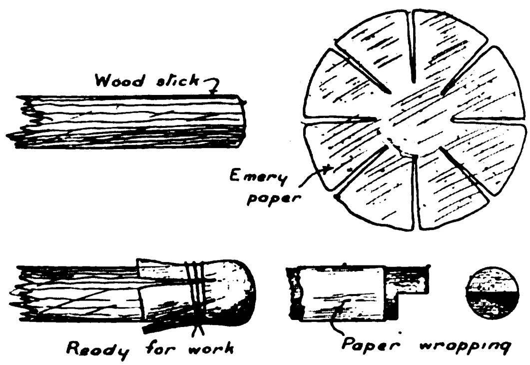


FIG. 2. FIG. 3.

A DEVICE FOR " MOTTLING " BRASSWORK.

make the end very slightly convex. From a piece of the very finest emery paper cut a circle about an inch or so in diameter. With scissors cut lines radially towards the centre, leaving intact in the middle a piece the same diameter as the end of the prepared stick of wood (Fig. 1).

Place the paper against the wood and bring the cut portion over and secure with some stout cotton (Fig. 2).

Now, holding the piece of brasswork in the right hand (it is necessary to have a piece of paper between the brass and the fingers, the grease from the fingers prevents lacquering afterwards), the work being finished to a good surface, run the lathe as fast as possible, press the work lightly against the emery covered wood, moving it steadily forward at right angles, and a sort of shaded vein will be seen where the rotating emery has cut lightly into the brass. You may follow any pattern you please—say, work diagonally from corner to corner, with other veins crossing at intervals; but the worker will soon be able to obtain some very nice results, and designs will suggest themselves to him.

If two or three diameters of wood are used, the veining may be of different widths. Different grades of emery may also be used, but anything like a coarse grain is useless. Do *not* use emery *cloth*, use only the finest emery *paper*, such as is used for polishing.

The orthodox method is to have sticks of emery composition, with the ends shaped by an old file, as in Fig. 3. This is over-wrapped with paper to strengthen.

A stick of wood may be prepared to this shape, the end then dipped into thin glue, and afterwards fine emery powder, and allowed to dry.

A composition stick may be made by thoroughly incorporating about equal quantities of resin, shellac, and fine emery powder, moistening with methylated spirits, forming it into a thick paste, and ramming into a mould to dry, and then wrapping round with paper.

A wood mould may be made as follows:—Plane one surface each of two small convenient pieces of wood, so that the planed surfaces lie perfectly flat on one another, fix them together by a screw at each corner. On the joint line, as centre, drill three holes, so that when the pieces of wood are taken apart half a hole or trough is left on each surface; the planed surfaces are the parting line. Blacklead these holes thoroughly, so as to prevent the composition sticking, screw together again, and ram in tight as much composition in each hole as you can. When dry, take the wood apart, and out drop the sticks. Shape up the business ends with an old knife and file. The holes may be an inch or more in length, and three-sixteenths, one-eighth, and one-sixteenth in diameter, the last size serving for very small jobs.

Commutator bars, levers of switches, etc., look nice mottled. Do not lacquer any surfaces where electrical contact is to be made, and do not touch with the fingers. When the piece of brass to be lacquered is put into a clean flame (such as the flame of a spirit lamp) it sweats, and a cloud of moisture appears on the surface; as the metal gets hotter, this passes gradually away, and the moment it has all gone is the time to apply the lacquer (of course, away from the flame). Go over once only as evenly and smoothly as possible. Clean brushes, clean lacquer, and a light, firm hand, and all is well.

If the first attempt is not very good, take off the lacquer with a clean cloth dipped in spirits and try again.

Fitting Ball Thrust to Plain Back Centre Lathe.

By J. C. KERRY.

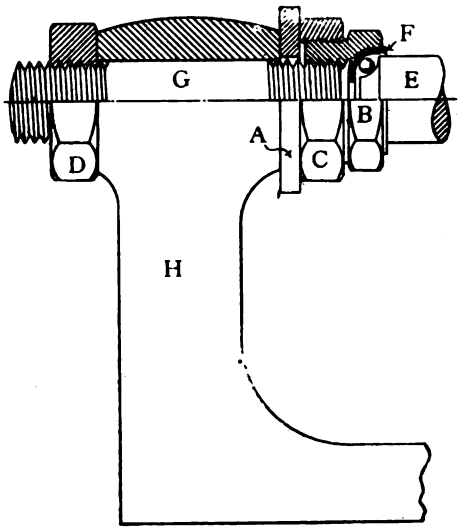
Those readers who have not a screw-cutting lathe will find that the following means for converting a plain back centre into a ball thrust will be worth adopting.

Take a hexagon nut B, the same size and threat as thrust spindle G is screwed. Chuck it, so that thread runs true. Face end, and box it out to take a plain cycle cup F, 1 1-16th ins. outside diameter, that is, if your thrust spindle is about ⅜ in. diameter; otherwise you must get cup to suit. Turn over nut for halfway along its length, and screw to fit the nearest size gas-pipe locknut C. Lathe mandre

E must now be turned down at the end, as shown in drawing.

If another lathe is not available, the only way to do the job is to rig up a temporary rest on headstock, and get an obliging friend on the treadle. Do not forget after turning mandrel to harden again for the balls to work against.

The centre point of thrust spindle should be softened and filed off, for another thrust spindle can be made, and the other one can be kept by in case the old style should want to be used again. Get balls to suit, and fit the cup in the socket, and arrangement is then ready for fitting together.



SHOWING METHOD OF FITTING BALL THRUST TO A PLAIN BACK-CENTRE LATHE.

A collar A will have to be placed between headstock and socket. For those who can have the use of a screw-cutting lathe, I recommend turning thrust socket from a piece of round steel, and screw-cutting thread in the same. Although the other way is quite satisfactory, I can vouch from personal experience that the gain in ease at high speeds repays with great interest for the work necessary to make the device.

Case Hardening.

A quick method for case-hardening consists in heating the material to be hardened to a red heat and submerging in a bath of molten cyanide of potassium, leaving it from one to five hours, according to the size of the article to be hardened. Cyanide of potassium gives off poisonous fumes, consequently the vessel containing it should be placed in a furnace with a draught.

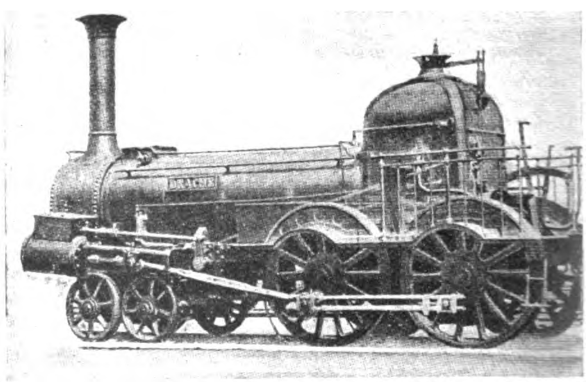
TURBINES *v.* PISTON ENGINES.—Experiments made with the German cruisers *Luebeck* and *Hamburg*, the former using turbines and the latter piston engines, have (states the *Engineer*) proved the superiority of the turbines, but they showed at the same time certain disadvantages, as the turbines were unable to stop quickly enough when going at full speed.

A Model Engineers' Tramp Abroad.

(*Continued from page 8.*)

THE locomotive and machinery works of Messrs. Henschel & Son are one of the oldest established concerns existing in the world for the construction of machinery. They were founded in 1817 by Anton Henschel for the building of steam boilers, engines, pumps, etc.; but it was not until 1848 that the firm commenced their first locomotive. This branch of the work grew with great rapidity, and now assumes paramount importance. The hundredth locomotive was delivered in 1866, the thousandth in 1899, and in 1904 No. 7,000 was passed. The output is now about eight locomotives a week.

The first locomotive made by the firm, together with one of the latest—the 4—6—0 type engine, built on the De Glehn system for the Bagdad Railways—are shown in the accompanying photographs. Amongst the notable locomotives designed and built at Cassel are the huge 4—6—4 tank locomotive designed for taking heavy trains up grades of 1 in 100 at speeds up to 47 miles per hour, and the 4—4—4 high-speed locomotive used in connection wth the famous trials on the experimental Marienfelds-Zossen line near Berlin. Both these locomotives have remarkable features. The tank engine is provided with a covered-in cab each end, whilst the express locomotive was originally built with a covering extending over both engine and tender.* It has since been altered, but still retains the prow-shaped cab in front of the smokebox. The engine is a three-cylinder compound, and has coupled wheels 7 ft.



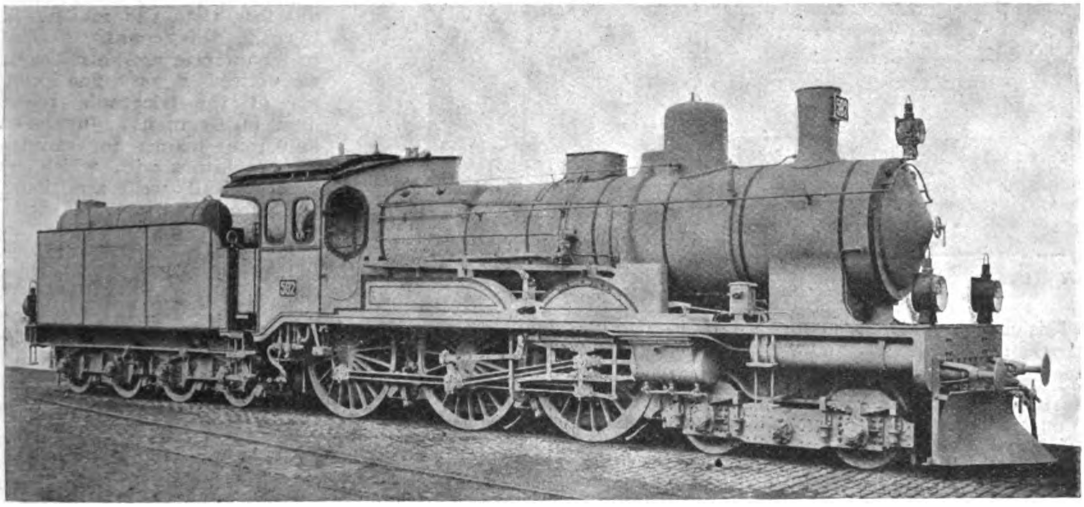
THE FIRST LOCOMOTIVE BUILT BY MESSRS. HENSCHEL & SON, 1848.

2½ ins. diameter, the boiler having just on 2,800 sq. ft. of heating surface.

The firm are the largest suppliers of locomotives to the Prussian State Railways, and export to Argentina, Denmark, Holland, Spain, Egypt, and

* See Mr. C. S. Lake's "World's Locomotives."

Japan. At the time of our visit we saw several locomotives for the first-named country being packed up for shipment. One of these engines was in course of painting for photographic purposes. The colour used is a dull (not shiny) grey colour, and, as will be seen by the photograph of the Bagdad Railway locomotive reproduced on this page, this



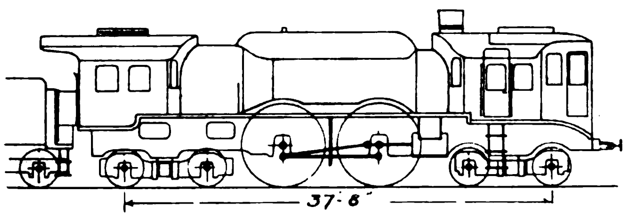
A Four-cylinder Compound Locomotive built by Messrs. Henschel & Son for the Bagdad Railways.

gives most beautiful results. Only one half of the engine is painted. We suggest that many model engineers would do well to adopt this idea in taking pictures of their work. Enamel should not be used, as this does not photograph well, but either a water paint or a coat of ordinary lead colour.

Messrs. Henschel's works are divided, the boiler and frame shops being situate at Rothenditmold, some two miles outside the town of Cassel. Our time being limited, we contented ourselves with an inspection of the Cassel factory, in which, perhaps, the most interesting work to the visitor—viz., cylinders, motion work, the erection, painting, etc.—is done. This is the main factory, and covers an area of about 60 acres. The works are excellently arranged, and are lighted throughout with electricity, the machines also deriving their power from the same source. The power station is a separate building, and has four generators with an aggregate of 2,600 h.-p. The boilers of this installation also supply the necessary steam for heating the works.

After a perusal of these particulars, readers will have little difficulty in understanding us when we say that we were at once surprised and delighted with the cleanly and bright appearance of the entire factory. Smoke, dirt, and rusty scrap iron would ordinarily appear to be inseparable from a locomotive works, but Messrs. Henschel prove that this state is not necessary to the production of locomotives and other machines on a commercial scale. Order and cleanliness also obtains amongst the employees. We were told by our guide that it is a rule that no workman shall leave the works dirty or in his working clothes. Cupboards are provided in which the outdoor attire is stored during the day, and proper arrangements are made so that the men may wash speedily and in comfort before they leave the factory. We regret that we had to admit that this desirable state of things which is not only to be seen in the Cassel works, was not more general in this country. We noticed also tha the men tending planing and other machines of the kind wore clogs to protect their boots from damage from the metal shavings lying about the floor.

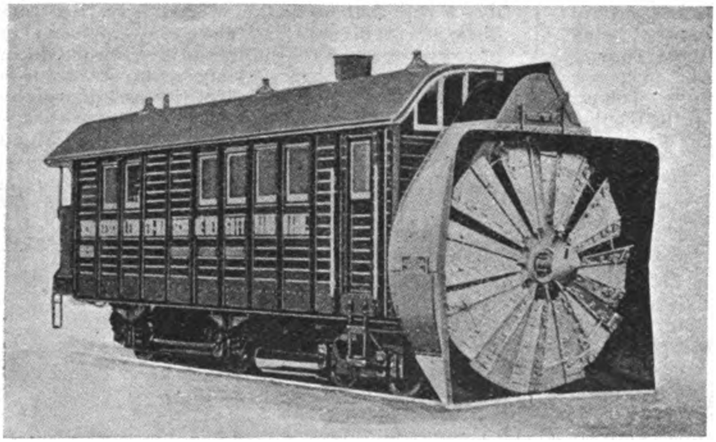
The administration department of the firm is splendidly housed. The drawing office, in which eighty draughtsmen are employed, contains similar arrangements for storing hats and coats to those



The Henschel High-speed Locomotive as altered: No. 562, Prussian State Railways.

in use in the shops. In the entrance hall there is a very fine model of a horizontal engine which was made by the young proprietor of the works during his apprenticeship some twelve years ago, and we much regret that we have no photograph of this engine to show our readers.

The machinery employed is of the most modern description. One of the machine tools which impressed us most was a large vertical boring mill, the table, which revolved in a horizontal direction, being about 15 ft. in diameter. Upon this table



A Rotary Steam Snow Plough built by Messrs. Henschel and Son, Cassel, for the St. Gothard Line.

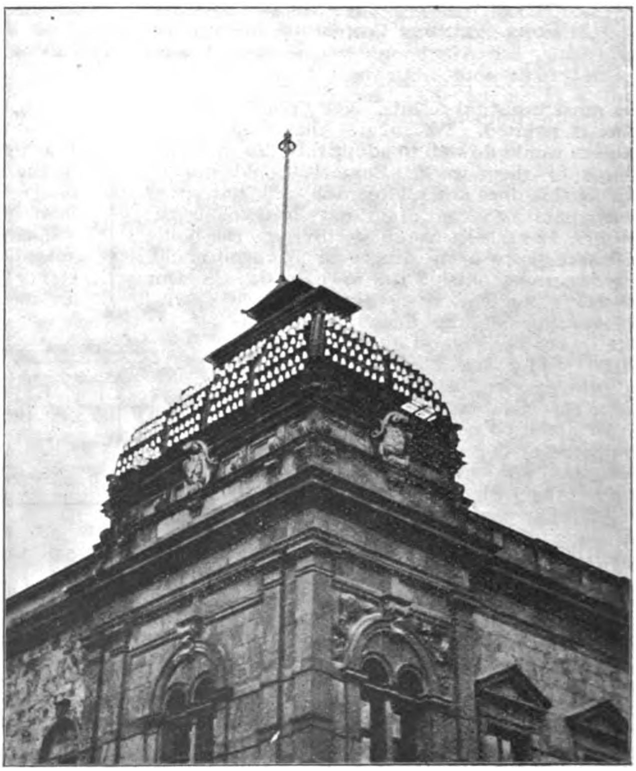
(This machine is pushed forward by locomotives, and comprises only the necessary boiler and engine for driving the rotary snow cutter.)

was mounted the combined cylinders and saddle of one of the large Schmidt superheater goods engines, the tool machining the curved flange of the saddle (upon which the smokebox of the locomotive would eventually rest) in a similar manner to that which would be employed in machining the joint of a model locomotive saddle upon the face plate of the lathe. Other tools of interest were the double spindle boring machines, which were operating on the two cylinders simultaneously and the electric riveters. The workshops are fitted throughout with the best measuring tools and gauges, and hand labour is to the greatest possible extent avoided by the use of special machinery. A well-stocked tool shop supplies all the rimers, drills, taps, cutters, and other tools, and machines are installed to make all the files required in the fitting shops.

The number of men employed by the firm amounts in round figures to 4,500. Apart from the State pension system, a fund exists for making provision for the invalids, widows and orphans of the workmen, which is established on a scientific basis, and is subscribed to by the firm and the men. Flats have been erected by the firm in different parts of the town (to avoid the evil effects of an isolated colony), the rents of which are about half the local value. Other institutions are kept up by the firm to the general advantage of the worker.

Preparing ourselves for sightseeing other than that connected with engineering work, we left Cassel by a midday train for Luther's town of Eisenach, which stands on the very threshold of the dark forest clad mountains of Thüringia. We visited, amongst other places, the famous Castle in which the great Reformer was incarcerated; also the fairy glen at Annathal. Later we spent a few hours in Gotha. A detailed description of German towns is out of our scope; however, we must mention that for the most part they are cleaner and appear better managed, lacking any squalid quarters, than the majority of towns in this country devoted to manufacturing. At Weimar we noticed a very fine example of the telegraph towers used in Germany. Instead of ugly iron frames for carrying the insulators with which we here are all well acquainted, the structures are of architectural design. They are built in various styles to suit that of the building upon which they are erected, but they all provide for bringing the wires inside the post office or telephone exchange building in a neat and workmanlike manner. In the example shown there are two towers, one at each end of the building.

(*To be continued.*)



A Typical German Insulator Tower: Weimar General Post Office.

A Model Aeroplane Competition.

THE Executive Committee of the Aero Club have, at the request of the *Daily Mail*, drafted the rules and regulations which are to govern the competition at the Royal Agricultural Hall next April (6th to the 13th) for the three best working models of an aeroplane, for which the proprietors of the above newspaper have offered £250. This sum will be divided as follows:—First prize, £150; second, £75; third, £25.

The conditions of the competitions are as follows:

The prizes are offered for model flying machines weighing when in flight not more than 50 lbs.

No machine weighing, when in flight, less than 2 lbs. to be eligible for the first and second prizes.

Minimum flight under its own power to be 50 ft. in a direct line, measured on the ground.

The starting point to be not more than 5 ft. above the ground.

Independent power may be used for starting.

No portion of the machine during flight to have any contact with the ground.

No gas to be used to assist in lifting power.

The judges in awarding the prizes will take into consideration:

1. Length of flight.
2. Practicability.
3. Stability.
4. Steering power, horizontal and vertical.
5. Speed.
6. Excellence of design.
7. Excellence of construction.
8. Method of commencing flight.
9. Available lifting power.

The judges reserve the right to make practical tests of the models, both under cover and in the open.

The judges reserve the right not to award the prizes if in their opinion the models are not of sufficient merit.

No entrance fee or charge for space is made.

Full particulars may be obtained from the Secretary, Aero Club, 166, Piccadilly, London, W.

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 ENCYCLOPÆDIA OF PRACTICAL ENGINEERING. Volume IV. Edited by Joseph G. Horner, A.M.I.Mech.E. London: Virtue & Co. Price 7s. 6d.; postage 5d.

The present volume of this extensive work maintains the excellent characteristics of its predecessors. Among the more important articles are those on compound engines, concrete mixers, condensers, core-making, crane drums, crank forging, crucible furnaces, destructors, dies, Diesel engine, dredgers, drills, Dürr boiler, dynamos, economisers, electric driving, electric motors, excavators, expansion devices, factory arrangement, fans, feed-water heaters, feed-waters, etc. The illustrations are excellent, both as regards the subjects selected and the manner of reproduction.

The Latest in Engineering.

Large Railway Signalling Installation for Glasgow.—The Caledonian Railway Company have decided upon the installation of electro-pneumatic power for operating the signals and the points at the Glasgow Central Station. It is intended to work the whole of the traffic from one cabin fitted with no fewer than 347 levers. The Westinghouse electric pneumatic signals will be used, and the installation, which is to be carried out by Messrs. M'Kenzie & Holland, Ltd., Worcester, will rank as the largest interlocking signalling plant ever erected.

A Large Weighing Machine.—What is claimed to be the largest single weighing machine yet constructed was tested recently at the Kidsgrove Works of Henry Pooley & Son, Ltd., of Temple Street, Birmingham. The machine was built to the order of Cammell, Laird & Co., Ltd., and is to be fitted at the entrance to that Company's works at Sheffield, where, in addition to the ordinary general traffic, it will be used for weighing the heavy steel ingots manufactured there. It is a self-contained type, and has been designed to deal with loads up to 160 tons. The weighbridge is 14 ft. long by 7 ft. wide, with steel rails 4 ft. 8½ ins. gauge. The self-contained frame or box is cast with returned ends, to take the cast steel swinging fulcra links from which the weighing levers are suspended. This allows the full area of the rail beams to come well up to the permanent way leading on rails. The large end V weighing levers are of cast steel. The rails are bolted direct on to steel double compound girders. The steelyard, or weight indicator, registers to the full load of 160 tons without the use of loose proportional weights. The machine is designed to take the full load of 160 tons on a wheelbase of 5 ft. 6 ins., placed at any part of the weighing machine. It is said to be very sensitive, and to give readings correct to less than a pound.

Screw Tug Rigged as a Schooner.—A small screw tug named the *Viking*, has recently been built by Philip & Sons, Ltd., of Dartmouth, to the order of a firm at Pernambuco, to which port, or rather to a point 150 miles south of it, she has just made the voyage successfully under sail. For convenience sake, after she had passed her steam and other trials, her propeller was unshipped, and she was rigged as a schooner for the voyage out. This was necessary, as she was too small to take sufficient coal for steaming the distance. The following are her chief dimensions:—Length overall, 48 ft.; breadth, 12 ft.; depth moulded, 6 ft. 3 ins. Her machinery consists of a set of compound surface-condensing engines of 75 i.h.-p., the cylinders being 8 ins. and 16 ins. in diameter, and the stroke 9 ins. The working pressure of her boilers is 120 lbs. per sq. in. With an English crew of five hands, she left Dartmouth on Wednesday afternoon, September 26th last. She is believed to be the smallest vessel that has ever sailed from English shores on such a long voyage, the distance being nearly 5,000 miles. She arrived on Saturday, November 24th, the voyage having lasted fifty-nine days.

which gives an average of nearly 84¾ miles a day—an exceedingly good record reflecting credit not only on her builders, but on those who sailed her.

Geipel's New Type of Steam-trap.—This new type is called the "Rapidity" trap, and several distinct advantages are claimed for it, such as, quickness of action, etc. The arrangement of the valve, being held on its seat by the steam pressure, enables a valve of much larger area to be used than when the valve is closed against the steam pressure, as in the ordinary Geipel trap. The valve also is of the rotating type, so that every time a discharge takes place the valve tends to grind itself in. When blowing through, the valve, by its special construction, is forced well off its seat to give a large opening; but in order to prevent the noise, as well as the straining and cutting due to having a large opening, an arrangement is provided which automatically reduces the velocity of the water. This throttle, however, only comes into action under high pressure, and is inoperative at low pressures. The usual form of hand blow-through is provided, and the valve may easily be got at for cleaning and inspection. There is also another advantage claimed for the new trap, which should be of no small importance; this is, that the trap will work without readjustment under considerably greater ranges of pressure than the ordinary Geipel trap. In appearance the new trap is very much like the old one.

All-steel Rolling-Stock.—The Pennsylvania Railroad Company, according to *Engineering*, will shortly instal 100 all-steel non-inflammable passenger cars, which will be the first lot of such equipment built in accordance with the Company's intention to construct no more wooden cars. This decision has been hastened by the progress of the New York tunnel, through which the Company will not run anything but absolutely fireproof cars. One experimental passenger car has already been built by the Pennsylvania Railroad, but the new cars will embody many improvements. The Company's shops at Altona will complete shortly an all-steel baggage-car, which is in course of construction, as well as an all-steel postal car—the first constructed by any railroad. The motive power department has also approved designs for an all-steel dining-car and the Pullman Company is at work upon an all-steel non-inflammable sleeping-car.

An Ice Locomotive, propelled by steam engines and resting upon four large steel helices, one at each corner of the body, has been successfully tested upon Lake Calhoun, Minn. The helices are arranged with axes horizontal, being of right and left-hand pitch on the opposite sides. The outer edges of the coils are fashioned like skate blades in order to grip the ice. Each spiral is connected to a separate steam engine; and the apparatus can be driven forwards, backwards, sideways, or at any desired oblique angle. The model tested is 22 ft. long, weighs 4½ tons, has engines aggregating 42 h.-p., and uses steel screws 27 ins. in diameter. The steering is by means of two semi-circular steel discs at each end of the body, operated by compressed air.

Model Yacht Building for Beginners.

By ARTHUR ROLLESBY.

(*Continued from page 16.*)

NOW that you know something of the various parts of a design we will make a full-sized representation of our boat on paper, or "draught the lines." It is always best to do this before starting actual work, as you can correct errors easily, but you cannot do it when you have gone wrong in the wood, and you do not want your

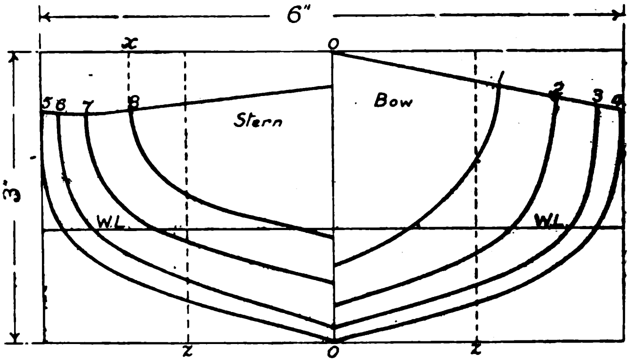


FIG. 4.—BODY PLAN. (*Half scale.*)

clipper to be lop-sided, and sail in perpetual circles for the amusement of your friends.

With this article you have a full-sized body plan, and from this you can get all other lines; you should also have the smaller plans in the first chapter in front of you for reference. If the printer has not made the square for the body plan 6 ins. broad and 3 ins. deep, you must make it exactly so in your copy—that is, the breadth and depth of the boat.

You will need a pair of compasses, a long marked ruler, a pencil, and a sheet of cheap cartridge paper. Draw a line 33 ins. long parallel with the edge of your paper, and work down from this, taking great care to have all lines perpendicular or at right angles. Utilising your first line, draw the square for the sheer plan, 33 × 3; then that for the half-breadth plan, exactly beneath and the same size; finally, the body plan square, 6 × 3. Draw the water-line in sheer plan and body plan. In sheer plan and half-breadth plan put eight perpendicular lines, corresponding to *a*, *b*, and *c*, etc. (but not spaced as these, which are merely specimens); they mark the place of the numbered sections of the body plan; No. 1 is 6 ins. from the bow, No. 2 and following 3 ins. apart, and No. 8, 6 ins. from the end of stern. In the full-sized body plan draw the perpendicular line *z*, dividing each half into two portions, and indicating a buttock line.

After all that, you have got over the preliminary work, and you can copy the curves with comfort. First, the body plan, measuring across from the centre line or down from the top line with compasses, and ticking off conveniently along water line or buttock line; join the ticks with curving lines, watching the copy, and you have the series

of sections complete. One thing you will notice, that the lines of the sections do not go up to the top of the square, but are cut off by a sloping line; this appears as the *sheer line* in the sheer plan. It is a graceful sweep of the deck fore and aft, preventing the boat from looking humpbacked.

Now fill in the main curve of the sheer plan, measuring down the centre line of your *body plan* for each section, and then ticking off on the perpendicular line similarly numbered in the sheer plan. Join the ticks, and you have the sweep of your boat along the deepest part, *i.e.*, her centre line. It is not altogether well to trust to the eye alone in making the long curves, but you will be aided by a batten, or long strip of easily bent wood, such as a cut-down kite spline; this you can pin into position, making it touch the ticks at each section, and use as a ruler.

Sometimes you will find a small hump or hollow in your curve, and this will mean an error somewhere. To correct such mistakes we must make the lines undergo the operation of "fairing"; this is where the buttock lines come in useful. You can make as many lines corresponding to "*z*" as you like, drawing them preferably at equal intervals from one another; then, measuring down these in the body plan, transferring to the sheer plan, and joining the ticks as before indicated, you get a series of long curves, which, if your design is correct, will be in an even progression from smaller to greater, something like the rings of a tree stump; they are a little steeper at the bow, or "cutwater," and flatter at the stern, or "run." The sheer line is found by measuring the distance of each body-plan section from the horizontal line, and transferring to sheer plan.

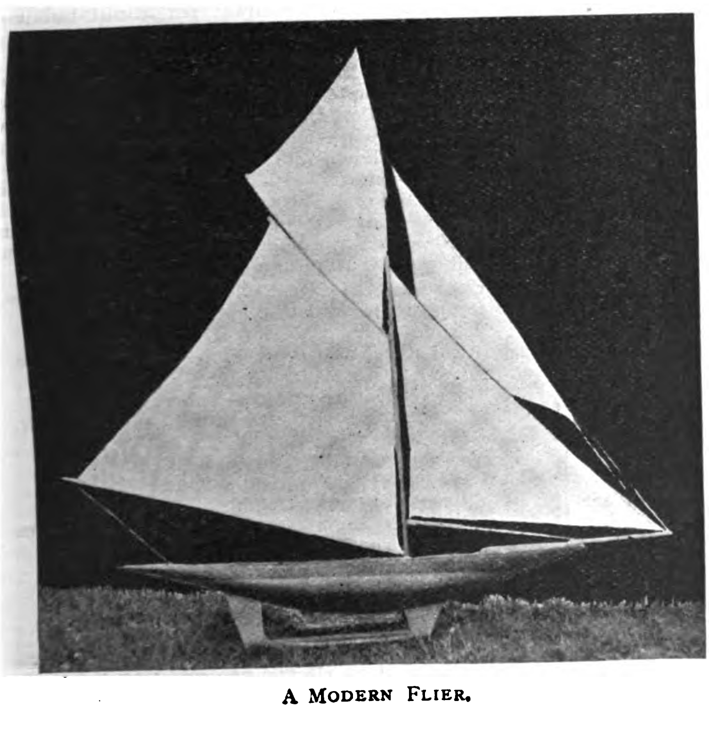
The curves of the half-breadth plan are obtained from the body plan by a similar method, the measurements in this case being, of course, made outward from the centre line along the water lines. you likewise draw a number of the latter for the process of "fairing." By the way, you will find it useful to show the place of the buttock lines, as *z*, on this plan, for where they cut the deck line indicates the point they meet the sheer line in the sheer plan.

As to "fairing" the lines, it simply means you must make every curve symmetrical and in harmony with its neighbours; it is interesting to notice how a minute alteration of one line alters all the others; take care over your design for it is better to use up india-rubber now than buy a new block of wood later on.

Finally, copy the fi which is 5¼ ins. greatest depth, and your draught de sign is complete.

By this time you will be eager to get to business, so come along to a timber-yard and buy your wood. Look out a nice piece of yellow or white pine, free from knots and splits, measuring 33 × 6 × 3 when you have had the rough surface taken off; also, a board of soft white pine 33 ins. × 6 ins., and about ¼ in. thick when planed down smooth: this is for the deck. If you can get your wood through a friend, you will be less likely to be charged unduly.

Then, of course, you must get your tools—the chief expense really, but it will be remembered that they



A Modern Flier.

will last a long time, and so the outlay will not appear so large.

Here is an estimate of the expenses; some of the items we will speak about later:—

	s.	d.
Wood for boat	2	0
Deck	0	6
Fin and rudders	0	9
Lead	0	4
Spars	0	6
Sails	1	0
Cord, wire, etc.	1	5
Gouge (medium)	1	0
Spokeshave (medium)	1	6
Small American iron plane.. ..	1	0
Oilstone	1	0
Total	11	0

By looking about you may be able to lessen this sum a little; lead for melting is generally found in a household—old piping or buttons; pliers, a metal file, a screwdriver, and a knife will no doubt be handy, and possibly an oilstone. At any rate the expenditure is little compared with that for a bicycle or camera, and your boat should have a saleable value of 15s. to £1.

Next week—from the rough block of wood—we shall carve the graceful vessel which is to "walk the waters like a thing of life."

(*To be continued.*)

Locomotive Notes.

By Chas. S. Lake.

The Marshall Patent Valve Gear.

The writer was recently privileged to make an extended trip on the footplate of a locomotive fitted with Marshall's patent valve gear, and to test it in comparison with an engine of the same design, but having ordinary link motion. The two locomotives in question are radial 0—6—2 type tank engines of large size engaged in working heavy coal trains between Langwith (Lancashire, Derbyshire and East Coast Railway) and Grimsby (*via* Great Central route). The trains normally consist of thirty-seven 10-ton shipping wagons, and a 15-ton goods brake, representing a load, exclusive of engine, of not less than 580 tons, and several heavy grades have to be negotiated *en route*, especially the one met with shortly after passing through Lincoln station.

The engine fitted with the Marshall gear proved itself capable of hauling a load 20 per cent. greater than that dealt with by the other engine. It took without difficulty, forty-five loaded wagons and a 15-ton brake, whereas the one with Allan link motion could only be safely relied upon to haul thirty-seven wagons and brake. The coal and water consumption were equal in both cases, and the time occupied in performing the journey was approximately the same.

The engines are handsomely proportioned. They have inside cylinders and Belpaire boilers. The cab is very comfortably arranged, there being sliding shutters at the sides which can be easily adjusted to afford additional protection from the weather when desired. The window spaces are very ample, and the gangways on both sides of the engine are provided with hinged doors. The engines are very amply "braked" in view of the heavy loads and steep gradients. Automatic vacuum, steam and hand brakes are fitted, and steam sanding gear is also provided. The driver had the train at all times completely under control, even on the steepest grade, with the rails in a very slippery condition.

New Engines for Home Railways.

Locomotives turned out of the various railway and locomotive workshops of the United Kingdom shortly before the close of the past year, included several of the heavy 0—8—2 type tank engines used for suburban traffic on the Great Northern Railway. Ten of these engines, numbered 147 to 156, were completed at Doncaster Works at the commencement of December. On the Great Western Railway a number of "County" class 4—4—0 type express passenger locomotives were finished about the same time at Swindon; and Mr. Geo. Whale, chief mechanical engineer of the London & North-Western Railway, built at Crewe a number of "Experiment" 4—6—0 type passenger locomotives.

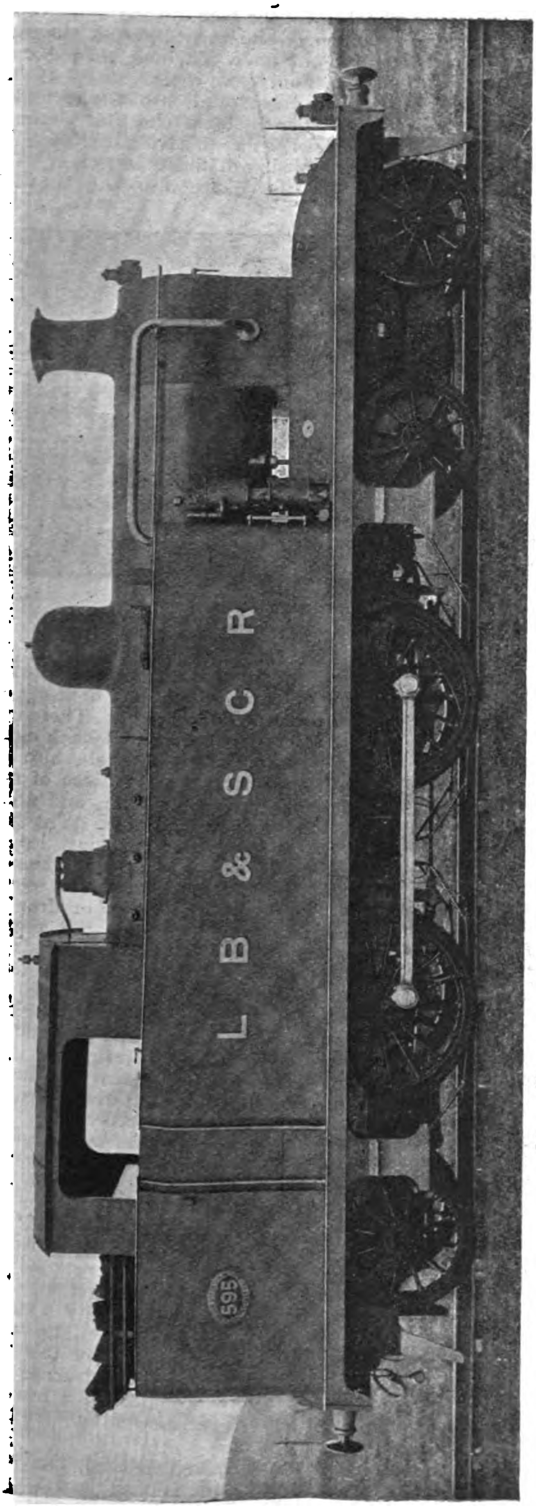
Mr. D. Earle Marsh, on the Brighton & South-Coast Railway, added another 4—4—2 type tank engine, in which a few modifications from the design of the first engine of this class were incorporated. The South-Eastern & Chatham Railway increased their locomotive stock by building some more of the standard passenger tank locomotives, and the North British Railway set about building a new series of 4—4—0 type mixed traffic locomotives.

The Neath and Brecon Railway Company have recently accepted delivery from Messrs. Robert Stephenson & Co., Ltd., of Darlington, of a new tank locomotive specially designed for the mineral traffic of the line. The engine has the 0—6—2 wheel arrangement, with radial trailing wheels below the bunker. The boiler is of large size, with Belpaire firebox. Stephenson link motion is employed for distributing steam to the cylinders. The following are some leading dimensions:—

Cylinders, 18½ ins. diameter by 26-in. stroke.
Coupled wheels, 4 ft. 6 ins. diameter.
Trailing radial wheels, 3 ft. 6 ins. diameter.
Rigid wheelbase, 15 ft. 3 ins.; total wheelbase, 21 ft. 9 ins.
Boiler: Heating surface—Tubes, 1156·5 sq. ft.; firebox, 122 sq. ft.: total, 1278·5 sq. ft.
Grate area, 21·5 sq. ft.
Working steam pressure, 165 lbs.
Capacity of tanks, 1,600 gallons.
Capacity of bunker, 3 tons.
Weight of engine in working order, 61 tons 14 cwts.

A Locomotive Tug-of-War.

A curious test of strength between a steam locomotive and an electric one was recently made in the United States. The two engines were



New Ten-wheeled 4—4—2 Type Tank Locomotive, L.B. & S.C.R.

theoretically of equal power and they were hitched on to one another back to back on the level and power applied to both simultaneously. The steam locomotive promptly walked off with its more up-to-date rival, which made but a poor show of resistance.

The competitors were then brought back to their original position, and the electric locomotive was allowed to start before steam was admitted to the cylinders of the opposing engine, but in a very few seconds the ordinary locomotive brought the electric one to a stand, and then set off once more along the track dragging its rival with it.

If, as an actual fact, the two locomotives *were* of equal power, the result becomes more or less of a mystery, because one of the chief advantages of the electric locomotive lies in its power of rapidly accelerating loads from a dead stand.

The New L.B. & S.C.R. Tank Engines.

The writer has been favoured by Mr. D. Earle Marsh, M.Inst.C.E., locomotive superintendent of the L.B. & S.C. Railway, with a photograph of the new ten-wheeled (4—4—2 type) tank locomotive No. 595, already mentioned in these columns. The neat and substantial appearance of the new engine is well seen in the accompanying illustration, and the dimensions given below show that the new design is suitably proportioned for hauling of heavy local and suburban passenger traffic. The leading dimensions are :—

Cylinders : Diameter, 17½ ins. ; piston stroke, 26 ins.

Bogie wheels diameter, 3 ft. 6 ins.

Coupled wheels diameter, 5 ft. 6 ins.

Trailing wheels diameter, 4 ft.

Wheelbase : Coupled, 8 ft. 9 ins. ; total, 28 ft. 11½ ins.

Boiler : Diameter (outside), 4 ft. 3 ins. ; length, 10 ft. 10½ ins.

Heating surface : Tubes, 947·63 sq. ft. ; firebox, 93·25 sq. ft. : total heating surface, 1040·88 sq. ft.

Grate area, 1,743 sq. ft.

Working pressure, 170 lbs. per sq. in.

Weight on coupled wheels, 36 tons 12 cwts. ; weight of engine in working order, with 1,983 gallons of water and 3 tons 5 cwts. of coal, 68 tons 6 cwts.

Tractive force, 18,720 lbs.

A pretty compliment was recently paid to early British engineers in a ceremony which took place at Munich on October 23rd. This event was the occasion of the formal handing over by the Union of Railway Administrations to the German Museum at Munich of an exact reproduction of "Puffing Billy," the oldest locomotive in existence, now preserved in the South Kensington Museum. The Munich engine is an exact counterpart of the original, and has been tested under steam, when a train load of 38½ tons was hauled at upwards of six miles per hour. The work was carried out at the central shops of the Royal Bavarian State Railways at Munich.—*Engineering*.

A Small Donkey Pump for Boiler Feeding.

By A. H. Clark.

THE following is a short description of a small donkey pump for boiler feeding which I have made, and found to be a useful fitting to a small power boiler. Whilst perhaps not being very original in some respects, it makes a very substantial pump. The design being settled on, the drawings were prepared, and patterns made for the requisite castings. The whole set being in gun-metal the cylinder was chucked in a Cushman, and bored and finished with a half-round bit, thus ensuring a parallel and smooth bore. Then it was mounted on a mandrel, and the ends faced and edges of flanges turned. The top and bottom covers were turned to fit the cylinder, tenon pieces being cast on for convenience of chucking, and whilst the front cover was being turned the stuffing-box was screwed out and the gland screwed to fit it, and the hole drilled out for the piston-rod; also, the holes for the screws for covers were marked off whilst in the chuck. Next, these were drilled, and the flanges marked off from them and drilled and tapped. The piston was turned up and rod fitted. The rod, being screwed ⅛-in. Whitworth both ends, the steam face of cylinder is next filed up and marked off (one port and half the exhaust being shown in the drawing), then drilled out with two holes for the steamways, and cut out with a small chisel on the face, one large hole being cut for the exhaust, and being cut rectangular on the face; this being done,

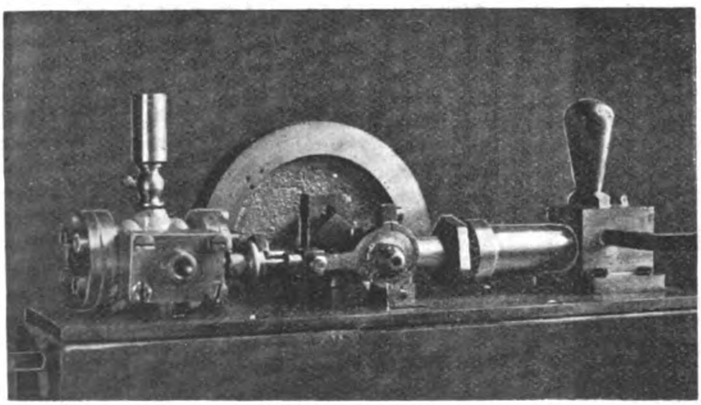


Fig. 1.—Mr. A. H. Clark's Small Donkey Pump.

the face was ground flat on a surface. The valve was filed all over and the port cut out the proper size also a cross-slot cut in the back for the valve rod and its nut; then the face was ground flat. The steam chest was cast with a tenon piece opposite the stuffing-box, and chucked by that, and the stuffing-box drilled and tapped out and gland fitted, the chest now being filed up all over. The cover, chucked by the boss, drilled and tapped to suit the steam pipe, and turned across the face, then screwed and put on a pin, and turned over boss and front. Four screwholes were drilled through the cover, chest, and into the cylinder. The faces of cover and steam chest are ground as the face of cylinder, so as to save packing. The edges were then filed off flush together. The exhaust was now tapped out, also the lugs for

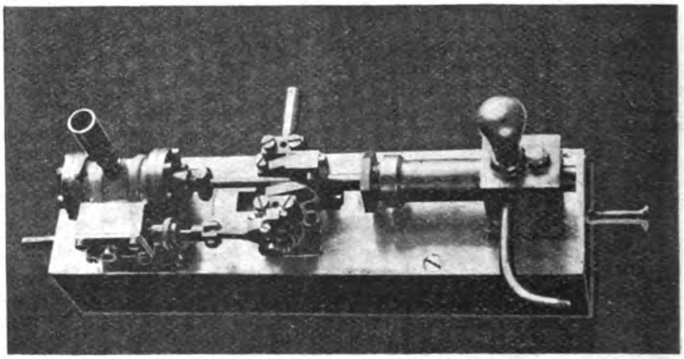


Fig. 2.—Showing Plan of Pump.

holding down cylinder. The bearings were filed up and holes drilled for holding down, also for screws for holding on caps, which were next cut off, after marking off the necessary height. These were then cleared for screws to be screwed back again, and the hole for shaft drilled through, also oil-holes. The shaft was made from a piece of mild steel filed to size to cut the webs from, and drilled to take the shaft through on the edge. The shaft being brazed in the gap, was cut out, leaving the pin to be turned up and the sides of the webs. The crosshead was of the frame type, as shown in drawing. This was filed up, and the centres marked midway between the ends for the piston-rod and pump-plunger, and drilled and tapped. One side was then sawn apart, and the inside filed to suit thickness of crank pin, and the side screwed back in its place. The eccentric strap was taken and turned out, with a recess to fit over a projecting edge left on the eccentric; also. this was split and screwed together before turning out. It was then filed up on the lug edges, a small lead being turned out of a piece of wire and tapped to suit valve rod, the other end being slotted to receive the lug on eccentric, and a screw and nut fitted to join them together. The eccentric was chucked by a tenon cast on it, and turned to suit the strap. It was then reversed and chucked by the shaft boss, and the tenon cut off and faced across and drilled to fit shaft, then mounted on a mandrel and boss turned up and setscrew fitted, finishing this part.

The pump was next taken in hand, the barrel being bored through, and stuffing-gland screwed and fitted. It was then driven lightly on a mandrel and turned outside, and the end screwed, leaving a shoulder to screw up to. The body of valve chamber was then held by tenon and turned out, and screwed to fit barrel. Next it was filed up all over, and centres for the waterways, also the valve seats, drilled and countersunk, ball valves being used. The air-chamber was next turned up and screwed to fit body, also a plug for inlet valve being made with a stem to prevent valve lifting too far. The inlet and delivery holes were now tapped out, and holes for holding down to bedplate. The plunger was turned up to fit the barrel and tapped to fit the crosshead, and the barrel was soldered to body.

The bedplate was then marked out, holes drilled and tapped, also slot cut to clear crosshead the full length of travel. The valve, being adjusted and tried under steam, was found to run very well. For those with a boiler pressure below about 30 lbs. a ¼-in. ram would perhaps be required, as it is rather large for the size cylinder unless having a good pressure behind it. The drawings are reproduced to a scale.

The cylinder is 1 in. by ⅝ in. Flywheel was altered in size to 3 ins. diameter with the large ram; 3-16ths-in. ball valves; steam ports, 1-16th in. by 5-32nds in.; exhaust, ⅛ in. by 5-32nds in.; piston-rod, ⅛ in. diameter; crankshaft, ¼ in. diameter; the webs, 5-32nds in. by 5-16ths in. by 13-16ths in.; crank pin, ⅛ in.; the bedplate, 1¾ ins. by 7¾ ins by ⅛ in. thick.

The flywheel shown in the photograph is one which was used in the first instance of trying, but was found rather small for a ⅜-in. ram. It was photographed so as to conform with the drawing, which has a 5-16ths-in. ram; but for a ⅜-in. ram, one of 3½ ins. diameter was found satisfactory; also, there was a screw put into a hole in the back of the pump which is not needed, but only put there for experimental purposes, so is not shown in drawing.

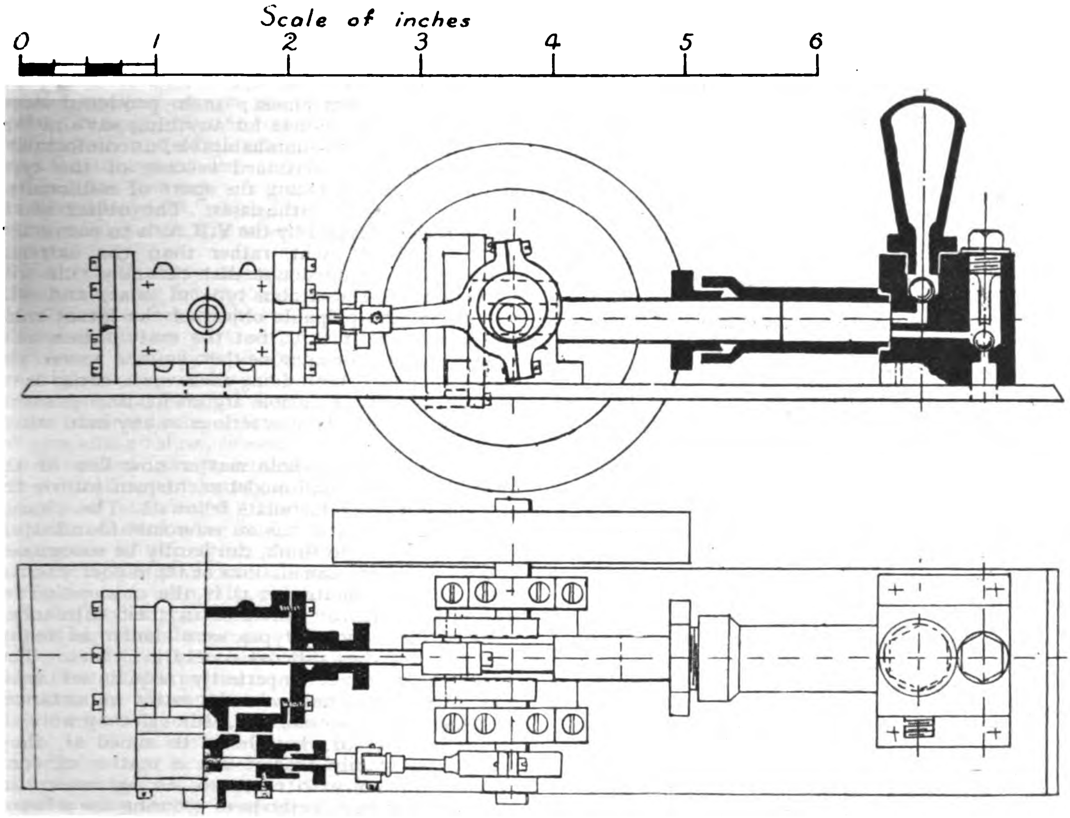


FIG. 3.—PLAN AND ELEVATION OF SMALL DONKEY PUMP FOR BOILER FEEDING.

THE LAUNCH OF AN OIL ENGINE.—There was launched, on November 29th, from the yard of Messrs. Napier & Miller, on the Clyde, a sailing vessel specially designed for the carriage of oil in bulk. The vessel is named the *Sunlight*, and has been built to the order of Messrs. Lever Brothers, the soapmakers, Birkenhead. She is 230 ft. long by 37 ft. beam, and is divided by bulkheads into ten oil compartments, additional to which is a certain space for general cargo The vessel carries two powerful duplex pumps for dealing with oil cargoes, and steam winches for handling general goods. She will be rigged as a barque.

A Plea for a National Model Yacht Racing Association.

By W. G. Brittain
(Hon. Sec., Alexandra Model Yacht Club, Victoria Park, London).

MODEL yachtsmen have reason to be proud of the signal triumph achieved by their "big brethren." From the point of view of the advocates of the thorough-going adoption of a purely racing machine, the recommendations of the International Conference are disappointing. These recommendations relate to the "racer-cruiser" type, so that if there should be on the part of model yachtsmen any widespread tendency to follow this example, the new type will be extensively in evidence, and will be a standing challenge to the old ten-rater as retained in the majority of model yacht clubs. It is obvious already that the changes will not be confined to the regulations emanating from the head-quarters of the Y.R.A. and the Berlin Conference alone. The fashion will be set, and for a time there will be a disposition in some quarters to conform to it. The fact, nevertheless, remains that a definite step has been at last taken by the premier branch of the yachting world in the direction of *unification*, and this affords a striking answer to the many critics who have so confidently assured us for some time that model yachting unification and cohesion in points of law and regulations is a hopelessly impracticable idea, an idea impossible of fulfilment.

The forces making for this reform are neither few nor despicable. Quietly and unobtrusively a mass of unorganised opinion in favour of a change has come into existence, and he would be a bold man who should venture to predict how far it will lead us within the next year or two. Strong protests there will be against any innovation, for prejudice dies hard, and the influence of established custom is great.

It is an advantage that the newest experiment is to be tried in the bigger vessels; it will afford time for model yachtsmen to discover whether the defects and disadvantages of the new type (as applied to models) are entirely imaginary.

Permanent reforms move slowly. Some of the attempts in the past to realise reforms were premature, some of the methods adopted were mistaken, yet the efforts were not wasted. We are now on the threshold of an era, in which it is safe to say that the proposals of the once despised reformers will receive the thoughtful consideration which has, hitherto, except by the few, been denied them.

Without doubt, measurement rules have originated in the necessity of obliterating the factor of mere size, in order that victory shall be secured by virtue of superior speed only. The yachts which win shall be those which are fastest for their size. This then seems to be the ideal principle governing the compilation of an effective measurement rule. But, unfortunately, owing to the "misconstruction" developed under various rules, the models evolved owed their success to their evasion of the legitimate rules—measurement cheats—rather than to inherent speed qualities.

A change of principle is now introduced as a new factor in yacht construction—that is, *habitability*. The hitherto primary aim of yacht racing becomes subservient to this new element—the development of the speediest model becomes now the "comfort" of the yachtsman. But these two factors are antagonistic—the combining of speed with good sea-keeping qualities a mass of concession and sacrifice; hence the evolution of the *linear rater*, its *raison d'être* being the necessity of securing a certain habitability of vessel. While many have the inclination, few have the wherewithal to enable them to build racing yachts pure and simple. Control becomes necessary if the sport is to be kept available to a man of moderate income. The racing yacht became a distinct species, and a gradual sacrifice to speed of all the details necessary to comfort and seaworthiness; such produced most expensive yachts, useless for anything save racing on sheltered waters—uninhabitable, uncomfortable, and unsafe. The continued success of the type would make yacht racing the sport of millionaires and the despair of enthusiasts. The object of all the legislation devised by the Y.R.A. is to encourage the comfortable yacht, rather than the extreme racer. There is no doubt that the new rule will produce a most desirable type of boat, and will conform to the palpable object of the latest rules evolved by the Y.R.A., but the craft ceases as a "racer." She becomes neither *quite a racer*, nor "*quite a cruiser*," both doing their work, some aver, badly. This is a plausible argument, and possibly true; or, is it a fallacy as serious as any into which we can fall?

The crux of the whole matter now lies in the query: How far shall model yachtsmen follow the lead of their more fortunate fellows? The change desired by the latter has an economic foundation, which, I venture to think, can hardly be recognised as a factor in the calculations of the model yachtsman. The 12 metre (39·4) is the conception of associations, almost universal in their influence; most of the national types were similar in many respects, but they differed widely in others. The delegates were but imperfectly acquainted with each other, or, what was of greater importance, with each other's views; and, although they were all of one mind as to what should be aimed at, they understood readily that it was a matter of considerable difficulty to come to an agreement in respect of the best methods of securing the advantages which were desired, as likely to enhance the adaptability, and to ensure the lasting prosperity of the sport; they emphasise the opinion that, as the outcome of the international understanding, far different and more profitable results may be confidently expected in the future than have been realised for many years past. Many voices have been raised in eloquent vindication of the change. That these benefits are very real and very considerable there can be no doubt; being, also, a more accurate means of determining real value.

Influences of this importance have been, and are, operating in such a manner as to bring about, if not reformation, a thorough revolution in the organisation of the sport. I do not say that many of the objects sought by the various clubs are not extravagant and impracticable, but I do state that it is impossible that such influence can exist without advancing, in some degree, the interest of, and in, the sport. It would be idle to deny that, notwithstanding our pleasure, a great amount of dissatisfaction exists; but this is only the natura consequences of sudden change. Let us hope that in this instance at any rate, it may be but the indispensable preliminary stage in the cure of a deep-seated disease.

The fact of the applicability to the purpose to which it is intended must bring the new rule to the attention of yachtsmen, and as it is admirably subservient to the general objects of the Conference, no doubt most, if not all, yacht clubs will be induced to support the change, thus being placed under the supervision of a recognised authority who can advise and assist them. The decision to me is tantamount to saying, "Elegance and beauty are most important things in their way, but, after all, a yacht is a place to live in." A racing yacht, if successful, was fit only for racing; if unsuccessful by the smallest margin, she was practically worthless. Cruisers, on the other hand, will always realise well, and are much more economical. This consideration prevailed, and the racing yacht pure has become defunct. A cruiser must be an easy, comfortable yacht, which decree demands elements wholly alien to the true racer, and totally undesirable in a mode.

I am particularly desirous that any observations I make bearing on the adoption of the new rules should not be interpreted as indicating any doubt whatever on my part with regard to their great usefulness and efficacy. On the contrary, I have the highest respect for the excellent work that has been done, and I regard them as absolutely essential to the maintenance of future yachting; but there yet remains a refuse, *in model yachting*, which might be described as presenting the appearance of "mutilated ropes, knotty and sticky, choked with sticks and dead leaves," that practical men almost despair of destroying and containing ingredients dangerous to the sport. I refer to the habitual introduction of plans and schemes, with the avowed intention of evading the popular meaning of a rule and the strict grammatical signification of words, forgetting that the proper interpretation of every instrument is that which makes it speak the intention of the parties at the time it was made. To those to whom these facts must be well known, it is unnecessary that I should mention them, but I do so from the conviction that, though this knowledge must be general, the lessons which these facts teach are not always so thoroughly appreciated as they should be, even by those most familiar with the facts themselves. Hence the oft-repeated cry that the ten-rating rule has had a long innings, and has run to seed. Untaxed elements in a rule will, naturally, be exaggerated, until in time it becomes out of proportion, and admits the concomitant evils—*lack of type, and lack of uniformity in size;* and, although the model ten-rater has never really become a "freak," as the extreme prototypes produced by the L. & S.A. rule, many have factors which are absolutely unnecessary. It must be admitted that there are creditable exceptions to this policy of "cheating" measurement, but these exceptions only serve to accentuate the folly of the majority. There is a strong feeling now that this danger should be guarded against. The changes, however, which have so far been made in this direction are of a very limited extent compared with what is required, and there is still left to be done much work if the ten-rater is not to be deprived of its hold on model yachtsmen generally. This matter is one which merits the most careful attention of all interested in the preservation of the ten-rater model, as against the newer 39·4. Personally, I confess to a dislike to the latter and the 42 L.R. *as models*.

It is astonishing how inadequately yachting matters generally are appreciated by the average model yachtsman. The introduction of new principles finds him totally unprepared to cope with the difficulties attending the disturbing of the order of things by change of type. Never before has there been so much apathy displayed at the commencement of a season; everyone appears to be on the tenter-hooks of expectation and in positive doubt as to how to act. Up to the end of last season, only a few clubs were specially affected, but the contagion seems now to have spread on all sides.

One of the most extraordinary phases of the recent movement has been the demand for an association that shall initiate the reforms and improvements which are so pressing and necessary, and which will eventually strengthen and assure the success of the sport. Interviews on the subject denote concurrence. Meanwhile, our efforts must be directed towards the further development of our sport, and with a common policy in view we shall compel action likely to lead to important results in the near future. Certainly, the only hope of model yachting lies in this direction.

It is worth preserving, for model yachting is an educative sport, a sport that in the course of its study and pursuit confers a real mental discipline such as is calculated to render the mind better fitted to deal with general problems than before. It is impossible to master the principles of design without having gone through a process that in all respects is a process of scientific training. The advantages of merely meeting together periodically to talk over questions in which all are interested, to discuss methods of work, difficulties that arise in the pursuit of the one occupation common to all, and to call to remembrance the varied experiences —these benefits are real. But interest wanes. Probably the true cause is that familiarity with our boats dulls our power of observation; and yet, the very multitude of opportunities for studying them ought to be a perpetual incitement to us to master them; retrospectively glancing at their origin, and following their progress towards success. The study is, in fact, a fascinating one. Yachting itself offers an interesting scope for diversity of opinion and practice as regards details. An enthusiast will soon find his attention attracted by the curious divergences of practice that accompany adherence to a few fundamental principles. But, I fear, these are not *strange* enough, *exceptional* enough, or *striking* enough to compel our attention.

It was not intended that the recent legislation should extend to models, and it is a fallacy to argue that what is good and desirable for the one, must necessarily be so for the other. The new rule will classify and standardise the racing yacht of the future, likewise the 12 metre (39·4) model yacht—the ten-rater models generally are now a class *in name* only—but the rule is not "understandable" by the ordinary lay mind, or the average model yachtsman, and for that reason, I fear, will not become popular.

The popular demand is not so much for a new type as for a re-modelling of the ten-rater class, with the formulation of stringent laws that shall prevent and prohibit *distortions*, completely efface the "brute," and remedy the evils now existing which threaten ultimately to cause the downfall of this popular type.

I am convinced that model yachtsmen, generally, are true sportsmen—born to the title—and are prepared to sink their individual predilections for the common weal, and the majority will agree when I state that the *best type* is that which will bring model yachtsmen into line, and that will give "equality of opportunity" to every man, whether it be by the new 39·4, the older ten-rater, or any other type of improved formula that may be subsequently evolved to suit the exigencies of model yachting.

Induction Coils for X-Ray and other Purposes.

By John Pike.

(*Continued from page* 11.)

XVI.—The Repair of Sectionally Wound Spark Coils.

THE repair of a coil which suddenly fails to give the correct or standard length of spark is not the serious operation it has been in years by no means distant, provided, of course, that it is wound in sections.

Supposing the spark length be reduced considerably—from 6 ins., say, to 1 or 2 ins.—it will be safe to conclude, if break, battery, and condenser are in good working order, that there is a decided breakdown in the insulation; the question will be, where?

Condensers can best be tested when the coil is or can be fitted with a hammer break. We mean that if the condenser is one made as in Article 5, where 10, 20, 30, and so on to 70 sheets of foil may be utilised, the variations in spark length obtained are more noticeable with an Apps break or a "Vril" than with the mercury break. A spare condenser is desirable, if not absolutely necessary; it can be cheaply made, and, neatly covered and cased in with thin mahogany, is an ornamental and useful accessory.

But supposing again that the 6-in. spark is reduced to 3 or 4 ins.; that with the same battery power, as tested by volt and ampere meters, the break being in its normal condition no more than 3 or 4 ins. are available, then it is probable that the insulation has broken down, in all probability *at the ends*—one or both—of the secondary, between the first few sections and the primary.

In the first place, and before attempting to dismount the coil, the ebonite cover should be removed, the wax covering being exposed fully to view. Then the coil should be worked in the dark, and the outside of secondary closely inspected: there may be leakage from one section to another in the outside turns if by any mischance any of them have been filled too full of wire. This leakage would be demonstrated by flashes of light in and through the wax, and clearly visible. This must not be confused with a faint brush discharge, due to air bubbles in wax next turns of wire. Any such places should be at once marked, the coil disconnected from the battery, and the place, or places, investigated.

A clean soldering iron made quite hot will very quickly run all the wax off at the particular spot and reveal the mischief, which may be the result of two wires adjoining having become bared of covering, or possibly a leak from one section to another. Such a fault as this indicates at once the measures to be adopted to remedy the same; the wax should be run off all round by careful and painstaking use of the hot iron until the section, and one or two adjoining, are laid open and the wire exposed to view; it is a by no means difficult matter to take off several turns of the wire from the faulty sections, but the coil would have to be dismounted, and mounted afresh between a couple of strong wooden standards. Fig. 37 shows what is meant, a very useful accessory when building coils for temporarily mounting the secondary bobbins (see Article 13, page 416). This stand, if made so that when the coil is placed in the supports there is room for a shallow tin tray to stand beneath it, as already described, enables us to turn the bobbin round and, practically, baste off the wax at any point or section. If wire is to be taken off—and if there has been sparking there will be clear evidence of the same in the shape of blackened turns of wire—we must clear a space wide enough to allow of a careful search for the joint or joints between the section and its neighbour on either side. By keeping the place *uniformly hot* we can easily do this. The joint should be found, separated, a turn or two of wire taken off, and a temporary joint made at once. It is most important not to lose sight and touch of the joint. But suppose one section only is at fault—say, for instance, the one marked "1st" (Fig. 31)—it will be seen from that drawing that it will be an easy matter to take off several turns or layers, and to then make a fresh joint; and similarly on the other side, if that requires treatment also.

Any fault, such as above outlined, will make a decided difference to the output of the coil, and if left untouched would certainly get worse and possibly involve other sections.

It may be mentioned here, though the careful worker will have noticed it possibly for himself, when covering with wax the secondary windings in the manner described on page 416, that nothing succeeds better for getting the wax *off the bobbin*—even the whole of it—than pouring hot wax *over it*. For instance, if the tin casing were placed round the bobbin and heat applied it would be a long and tedious business to melt the jacket of wax, but if several small holes are drilled in the bottom of this cover—if, moreover, the cover be fixed so that an interval of ¼ in. all round is made between it and the wax, easily achieved by packing (with long narrow strips of cardboard or leather) the two wood discs (Fig. 36), then on pouring in any hot wax through the slit at the top—catching it in the tray beneath—we can easily and quickly run off all the wax covering the sections, and they will be left entirely bare. It would, indeed, be a wise measure to adopt this plan, and then to thoroughly and systematically examine the outside turns of every section.

The outside of coil may demonstrate the symptoms described, and the defect being remedied, the further testing of the work—by connecting with condenser, break, and battery—will probably show that a cure has been effected. If, however, the output is still below the standard, it is likely that there is a leak between *the first turns* of a section and the primary. One of the advantages of a movable core is that this fault can soon be discovered, as by looking in at the ends of the tube —while the coil is being worked—it can be clearly *seen* if there is any sparking on to the primary, and it will no doubt be *heard* before it is seen. We learn by failures, and a coil built by the writer broke down badly in this way: the core, which was an easy fit, was withdrawn, and a turn of thin brown paper put round it; again inserted and the coil operated: smoke issued first from one, and then from both the ends. Removing the core again, it was found that at two places the paper had been singed, and looking through the tube—by holding the entire coil up to a good light—smoked patches were easily seen, and in the centre of each a hole in the ebonite tube. Repairs were effected, and the coil was very efficiently restored by working as follows:—

The coil, removed of course from the condenser box, must be *partially*, at any rate, re-built. This may sound a serious business, but need not be made so. Firstly, the bobbin should be mounted in the stand above referred to and slowly turned in front of a hot fire, all the outside covering of wax run off. Secondly, having a tripod stand (it must be a foot high) and a Bunsen burner ready for use, the bobbin is placed end up on the tripod and a small jet of gas allowed to send up heat through the ebonite tube. Very soon we are able to warm the tube throughout—assisted by reversing the bobbins—and before long make it hot enough to melt the wax surrounding it; the result is that the tube may be drawn out intact.

Having arrived at this stage we may see by looking through the cylindrical space where the fault lies. In the case referred to, having measured the distances, we were able to ascertain at the first glance, and there were two places, visual proof being given by black patches, denoting where the faulty sections were to be found.

It must be remarked here that we are rather at the mercy of manufacturers in the matter of efficient covering of wire and uniform density of the ebonite. If the ebonite tube be defective—if, moreover, it happens that two small bare patches in the wire, possibly only a fraction of an inch, come together—then it is a matter of time only for the coil to break down.

Now, the bobbin should be replaced on the tripod and the Bunsen again brought into requisition for the purpose of running as much wax as possible out of the *inner* turns. As a fact, in working with heat suitably applied inside and out, it is possible, with the minimum of damage and loss, to separate with a knife every double section; but this is rarely necessary. Having located the fault, we work down to the section or sections involved, but bearing in mind that all have to be replaced upon a new tube, it is a good plan to remove them all in blocks of, say, four *double* sections each, but not much more than 1 in. in total thickness.

To come to the faulty sections. These may be very easily treated by adopting the method here suggested. No re-winding is necessary. Have ready several blotting-paper discs of suitable size, and make the double sections warm enough to enable one to—having cut the inner tubes which joins them—easily separate the two. They should be at once placed between new insulating discs; then, having cooled, pull out enough of the inner turns to remove entirely all the implicated wire; leave an inch or two for joining, and run a little hot wax into the first few turns to hold these tightly. Now pair the two sections again exactly as they were, so that the two short lengths of wire are opposite one another. Some means should be adopted to secure the two sections one to the other, *e.g.*, by warming the inner and outer edges of the blotting-paper insulating discs, and, this done, the double section may be held firmly enough, but without undue pressure, on a vice the jaws of which have been covered with pieces of thin wood. This is not absolutely necessary; but it is an advantage to have the double section firmly held in a vertical position, so that both the operator's hands are free. The two separating discs (or double discs) of blotting-paper should, of course, as previously described, have their central aperture smaller by at least ⅛ in. all round than the annulus of wire. The new joint between the two sections is now to be made on the edge of this; the two opposing wire ends are carefully bared of covering to this point, twisted together,

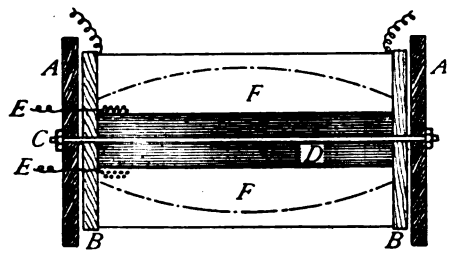


FIG. 43.

soldered, cut down, the joint insulated with a small piece of waxed silk, and either tucked in or left resting on the edge; the latter is perfectly safe; the joint is bent down to rest on, and partly in, the soft paper, the silk patch is placed over it—like a saddle—and if a needle and thread are at hand very safely tied there.

Thus we are able, as will be seen by the thoughtful reader, to repair the coil by inserting a new tube (or to rebuild upon one which may be thicker in section), with some pains certainly, but very trifling loss. It is very rarely necessary to re-wind the sections, as, even if too small or tight a fit for a new tube, it is easier, and probably cheaper, to simply remove a few of the inner turns. Care must be taken to ensure that the repaired sections are wound in the same direction as the remainder, and all connected once more, so that the wire runs in exactly the same direction throughout, and all—including those which may have removed in blocks of four or five—should be properly tested with the galvanometer for continuity before starting to re-build.

While the secondary bobbin is quite hot, as it will be if the treatment above has been followed, it will not be a difficult matter to remove the ebonite ends, and, after mounting the coil upon the upright stand (the tripod), to thoroughly warm up and treat with fresh wax each of the ends, endeavouring at the same time to get as much pressure as possible.

exerted so as to press the sections closer together. Considering the thickness and porosity of the blotting-paper insulation, there is no doubt that, given sufficient pressure, the secondary bobbin may be reduced from 12 to 11 ins. certainly, if not to less than 11 ins., and there is reason to believe that the result would be advantageous.

The cheap quality of spark coils of Continental make will probably not trouble many readers. They are effective enough used with the requisite E.M.F. and rheostat, and they have the merit of cheapness; as a rule, they cannot be relied upon for a greater spark length than the nominal, and when they break down, as they may do when using greater battery power than usual (as referred to previously), they are returned by the dealer marked "Cannot repair!" The owner of such a coil may possibly achieve the repair of the instrument by treating it in the manner to be described.

The construction of the coil will probably be as in the diagram (Fig. 43), and it will be presumed that the operator has tested the primary and secondary windings respectively for continuity.

The coil, being removed from its base and the cover removed, is further dismounted or separated without much trouble.

Having unscrewed the two secondary terminals and released the fine wire ends, straighten the two primary wire ends; then unscrew the nut on the end of the rod C, which may then be withdrawn. The bobbin cheeks A A are now to be removed—they are supposed to be fixed, but they may be gently and carefully prized off with a flat knife. This leaves a bobbin or reel, of which B B are the ends, and the core D of fine iron wires readily falls out. The primary and secondary are wound on the reel B B, this being turned in one piece, not built up as a tube and two discs, and the winding is bedded in wax and resin, mostly the latter. By melting some of this insulation off the ends, it will be found that the secondary winding takes the form indicated by the dotted lines.

Now, supposing that the fault has been caused—as extremely probable—by a leakage between the two windings, the reel B B should be stopped at each end by inserted well-fitting corks and a tin cylinder made to exactly fit the reel. What we have in view is to *thoroughly melt* the resinous insulation, and, this done, allow it to re-set. The ends of B B are fairly thick, and a good fit can be made by bending tin plate round it; or, by having a tin made which will make a good fit. The writer found the job rather messy and irksome, but had the satisfaction of restoring the coil to its first condition at no more cost than that of the tin cover. There will be a little waste of the resinous compound, which can be made up by the use of paraffin wax to make up the deficiency.

The coil being once more put together and tested will be found greatly improved if not entirely restored, this being dependent probably upon the time allowed for the resinous insulation to melt completely.

It may be observed that the coil treated as above was found to be precisely as figured—the secondary in layers; it was, also, interesting to note that the wire was cotton-covered, and that the quantity could not have been more than about 3 lbs. for a coil which gave 3 to 3½-in. spark.

(*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 intended for publication.*]

Proposed Open-air Track for the Society of Model Engineers

To the Editor of *The Model Engineer*.

SIR,—If a permanent outdoor track be decided upon by the Society, I would say do not spare a little extra expense to make it really permanent. The outlay will be well repaid by the small cost of repairs and the safety and steadiness with which the model engines will run upon it. My own railway (most of it) has been down for about twelve years; the rest of it for, perhaps, seven years. It is in as good condition now as when new, except that the woodwork requires painting. At any time I can run my engine round the 42-ft. circle at 8 miles an hour with perfect safety.

The points to be observed are: (1) Do not have the rails less than 3 ft. above the ground. (2) Make the pillars of pieces of 3-in. or 4-in. cast-iron rain-water pipe fixed in holes about 18 ins. deep, filled in with Portland cement concrete. Pillars, say, 10 ft. apart on the straight, 7 ft. 6 ins. or 8 ft. apart on curves of from 20 to 30 ft. radius. (3) Provide loose capitals of cast-iron fixed by a *gun-metal* set-screw to each. By this means the process of levelling the tops of the capitals occupies a very short time. (4) Make the horizontal beams of wood (oak by preference, but sound pine well painted will do), bolted to side flanges on the capitals, two beams to each span, galvanised iron bolts and nuts. (5) Make the cross-sleepers of oak for choice, nailed down by copper nails arranged to miss the chairs. Leave spaces of ½ in. between the sleepers to let the rain fall through. (6) Paint all the woodwork two coats before fixing, and one coat afterwards. (7) Make the rails of copper. I can get them drawn here in lengths of, say, 7 ft. at a very moderate price. By all means have bull-head rails, they are so much easier to straighten and to bend to curves than flanged rails. (8) Lay them in type-metal chairs, which are very cheap, and can be made a good sliding fit so as to dispense with keys. (9) Provide hard-drawn copper fish-plates, drilled with one hole in each and secured by copper square-head screws passing through holes in the rails formed by filing a half round notch in the end of the web of each rail. Be sure to use a box spanner for these. It saves such a large amount of time. (10) On the curves have the wooden sleepers (machine planed) taper in thickness so as to give some super-elevation. (11) Rub the upper surfaces of the copper rails with a chump of polishing felt, served with a mixture of graphite and water. Rain will not wash it off, and it preserves a fine running surface. (12) Arrange the track in a circle or oval, and do not trouble to make points or signals. For testing the running power of models the simpler the track the better, and expense will be saved.

My pillars are of 3-in. rain-water pipe, about 3½ ins. outside diameter. I have a pattern of the capital, with core boxes, and shall be very pleased to lend it to the Society if the Track Committee would like to borrow it. I would also provide a drawing of the track formation if so desired.

The foregoing may seem a rather elaborate matter, but do not be dismayed. In ten or twelve years' time the members will be thankful to have a track as good as the day it was put down.—Yours truly, HENRY LEA.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to the proposed outdoor locomotive track for the S.M.E., I hope the scheme will be successful, as it is doubtless a good one.

Both of the rail arrangements, given in your issue of November 1st, 1906, seem good, but I certainly consider that the 2½-in. gauge should be included.

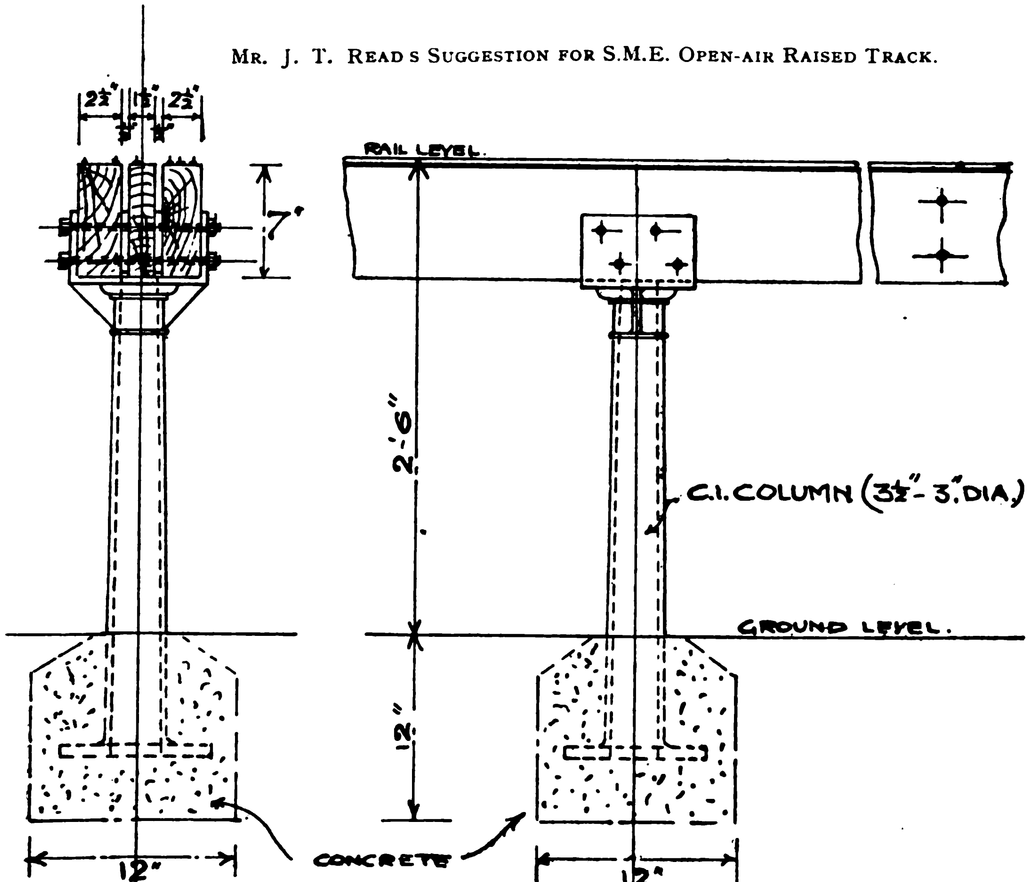
However, I do not consider it would be advisable to build the track in the ground, as shown by Mr. Twining's sketch, as it would, doubtless, entail a lot of kneeling to attend to the engines, and, consequently, make it a tedious and rather back-aching job.

I enclose herewith a sketch, showing the track built above ground, and I think that by doing it this way, a sound and strong structure would be obtained, and at the same time the engines would be more easily manipulated, and, also kept clear of dirt and grit.

As regards cost, I do not think it would come out to anything unreasonable, as the columns are not very expensive items; and, I believe, the sizes of timber shown are stock sizes.

I should be interested to hear any criticism on this arrangement.—Yours faithfully, J. T. READ.

MR. J. T. READ'S SUGGESTION FOR S.M.E. OPEN-AIR RAISED TRACK.



Gas and Oil Engines for Chaff-cutting.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—*Re* your reply to "J. W. R." in THE MODEL ENGINEER of last week, if you will kindly allow me, I should like to give you my experience with a similar plant. I certainly think that the querist's engine would be quite inadequate for the purpose, and have no doubt that Richmond and Chandler mean nominal when they recommend that size of chaff-cutter to be driven by a ½ h.-p. engine.

Having a Crossley's (than whose I think there is not much better) horizontal ½ h.-p. nominal engine, which develops about 2¼ brake, driving the same size of chaff-cutter as the querist, also a corn crusher which Richmond & Chandler tabulates as requiring 1 h.-p., I find that I could quite easily stop the engine by feeding the corn crusher to its full capacity, which shows that Richmond and Chandler rather under-estimate the power required for their machines; and, when driving the chaff-cutter, I find that there is not a great deal of power to spare. I would recommend "J. W. R." to rather have a little power in hand than have too little.—Yours truly,

Ardrossan. JOHN ALLAN.

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.—Saturday, January 12th, 1907: Annual Conversazione at the Cripplegate Institute. Tickets, price 2s. 6d. each (including refreshments, etc.), may be obtained beforehand on application to the Secretary, as at foot, or at the doors on the evening at 6.30. Saturday, January 26th: Visit to Great Western Railway Engine-sheds at Old Oak Common. A limited number of ladies will be permitted to attend. Notifications should reach the Secretary on or before January 23rd. Wednesday, January 30th: Meeting at the Cripplegate Institute at seven o'clock. Lecture by Mr. W. J. Tennant on "Some Mechanisms." Applications for particulars and all enquiries relating to the Society should be addressed to HERBERT J. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

Sefton Model Steamer Club.

The undersigned will be pleased to hear from any readers in Liverpool and district who wish to join the above Club. Prospective members will be heartily welcomed.—S. COXON, Hon. Secretary, 32, Lomond Road, Liverpool.

The Sixth "Gauge" Competition.

TO further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th, 1907.

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:—

[17,021] **Model Steam Plant for Dynamo Driving.** L. E. V. (Stoke Newington) writes: (1) Would you kindly tell me the size of the bore, etc., of a horizontal engine and dimensions of boiler I should require to drive a dynamo of 30 volts 5 amps.? (2) Which would be the cheaper and better to heat water in boiler—spirit, or gas? (3) Which would be the better to feed the boiler—a force pump or a donkey pump, so that I could leave it for a while?

(1) We recommend an engine with a cylinder about 2½-in. bore by 2½-in. stroke, the engine being of the high-speed type. The speed of the engine should be at least 400 r.p.m., and the boiler pressure 45 to 50 lbs. per sq. in. Gas firing will prove best, if coal is not possible. The boiler should be about 14 or 15 ins. diameter by 26 ins. high, without water space, and firebox. About sixty tubes should be fitted, each ½ in. in diameter outside. You may be able to obtain a suitable gas ring of Fletcher's make for the purpose. The shell should be of steel 5-32nds in. thick, with double-riveted longitudinal seam. The ends may be 3-16ths in. with advantage, and be stayed with three stays, ⅜ in. diameter, of bronze. The tubes should be expanded in. (2) Methylated spirit is practically out of the question where plants are to be used for dynamo driving. (3) We would prefer a force feed-pump driven by gearing from the engine. Run the pump at about 150 revs. maximum. This pump should be ⅜ in. diameter, and have a stroke of ¾ in. It should be fitted with a by-pass cock to adjust the feed. With good fitting and careful attention to the regulation the pump should run for a considerable time at a stretch without re-adjustment where the load is at all constant.

[17,017] **Model Yacht Building, &c.** F. E. C. (Leeds) writes: I am building a model yacht to the design of the 10-rater described on page 131 of THE MODEL ENGINEER, Vol. VII, No. 81. The mode of construction was as follows:—I first cut out the sheer plan in ¾-in. pine, then two of each of the half-sections shown in the body plan on the page previously mentioned in ½-in. pine. The half-section and a stern piece were then fastened in their proper places to the sheer. I have thus got a skeleton model of the yacht. My intention is to cover this with two or three thicknesses of strong calico. I may say I have employed this method before and found it very satisfactory. The edges of the calico will be fastened by means of gimp-pins to the edge of the deck. I have cut the deck out of a piece of ½-in. walnut. I am afraid now the model will be too heavy, and I should be grateful for your advice. Weight of skeleton as described, 3¾ lbs.; weight of walnut deck, 2¾ lbs. (1) Are either of these too heavy? (2) What is the most the skeleton model ought to weigh, and what is the most the deck ought to weigh? (3) Would the deck be light enough if planed down to ¼ in.? I suppose—if reduced to that thickness—it would be impossible to take the skin of the hull to the edge of the deck. (4) Is walnut too heavy a wood to use for decks? If so, what is the best kind to use? (5) Will ½-in. walnut be strong enough for the fins? Taking into consideration the method of construction

of the model, what is the best way to fasten the fins to the sheer? Could I use thin metal fishplates? (6) About what weight of lead will be required for the keel? (7) What ought the hull to weigh oughly) when complete? (8) Under the 6,000 rule of measurement, if I were to fit a rudder to the boat, would it increase the L.W.L.?

(1) The deck is rather too heavy; 3-16ths-in. pine or cedar would be better. (2) The weight of the skeleton will not be too heavy at 3½ lbs. unless the displacement is very light indeed. The deck will come out about right if made as in answer to question 1. (3) If the deck is found too thin to fasten the skin of hull to the edge of it, could it not be brought over the edge of the deck a little way and then tacked on, which could be afterwards covered up by the rail? (4) Walnut could be used for the deck; personally, we prefer pine, cedar, or mahogany. (5) ¼-in. walnut will be strong enough for fins. If—by reducing the top of fins to ⅛ in.—you could get them through a slot in the keel, letting them come through about ⅜ in., then screw a piece of wood each side of fin and also to keel inside the boat; this will keep them firm. If unable to do this, try the metal plates. (6) To find what weight the keel must be, put the boat in a bath and weight her down to the L.W.L., then note carefully the weight taken to do this, which will give the amount for keel. (7) There is no hard-and-fast rule what the hull should weigh; the only thing is to keep it as light as possible, thus getting the maximum amount of lead on keel. If by this question you mean the weight of the whole lot complete, i.e., boat, keel, spars, etc., this must equal the displacement; otherwise, the boat will not float to her designed water-line. (8) No; fitting a rudder will *not* make any difference to her rating.

[16,936] **Small Water Motor.** C. R. (Blaina) writes: *Re* the article in THE MODEL ENGINEER, August 30th, I do not understand the tables on horse-power. I am thinking of making a water motor to key direct on the shaft of a 60-watt dynamo to run from the tap. The pressure is between 150 to 200 lbs. per sq. in. What size wheel and what size nozzle shall I require?

About ⅛ h.-p. is required. With head of 150 ft. and a 12 ins. diameter wheel and ⅛ in. jet, you should get about ·4 h.-p.

[16,932] **Small Gas Engine Trouble.** "TINKER" writes: I shall be pleased if you would again help me out of a difficulty. My ½ h.-p. gas engine (tube ignition) I have had to pieces to clean, etc., and I can get it to work, but not to drive my dynamo which it used to do before. The compression is good, piston rings all right. Flywheels and piston work as easy as possible. Ignition tube all correct. The only thing I cannot understand is, when I take exhaust valve out, the valve top is slightly sooty (just a film). What is the cause of this and remedy? Also the exhaust pipes seem to get full of water very quickly. Engine goes fine when not coupled to dynamo. Is it better to have silencing-box near as possible to engine?

From soot depositing in cylinder it appears that the mixture is too rich. Try adjusting it whilst engine is running, beginning with very little gas, and gradually increasing the supply till best effect is obtained. Water in exhaust pipe is fatal. Find out where it comes from, and take steps to stop it. Is there much? It may be the liner joint is leaking, or a faulty place in casting. Wipe out cylinder dry, and watch to see if you can find a leak. Exhaust-box may be anywhere, but preferably at the lowest level, and fitted with a plug for draining pipes of water. Perhaps the whole pipe, or some of the bends, need cleaning. See "Gas and Oil Engines," by Runciman, 7d. post free; it will help you.

[16,970] **Partial Failure of a Lighting Dynamo.** A. B. B. (Manchester) writes: I have a 100-volt 5-6 amp. dynamo (shunt wound), ring armature, bipolar, overtype; speed, 2,000. Machine builds up to 115 volts without load. On closing the circuit and switching on a 16 c.-p. lamp there is a drop in the voltage to 110 volts. When a further 16 c.-p. lamp is put in the voltage drops to 100. When all lamps are switched on (six), all 16 c.-p., the voltage is down at 70. The distance from dynamo to lamps is 10 yds. The main leads are 7/16's. Lamps are, of course, in parallel. The lamps are arranged two on a 16 gauge feeder. Can you explain this great drop in voltage? I was informed by an electrician that 7/16 wire would carry easily 20 amps. I may say that the dynamo is driven by a 1½ h.-p. gas engine, and the speed of the dynamo does not alter in the least. I at first thought that perhaps the speed dropped through belt slip, but this does not appear to be so, as speed counter indicates same speed with load on or off. I have tested armature and fields for leaks, but find none. I may add that the machine has been a motor and is professionally made, but I do not know maker's name, but think it is a "Gramme." The machine, I am told, should light ten 16 c.-p. lights.

The fields are not getting enough current to cope with the supply. Have you no resistance coils in series with them? All shunt machines for lighting, etc., should have this regulating resistance, as when the load is put on the main circuit resistance drops, and the fields do not get the required proportion of current for excitation at the heavier load; 7/16's will carry 20 amps, well.

[16,978] **Magneto Machine Failure.** (J. C. (Rochester) writes: Thanking you for prompt reply to my last query, I venture to again ask your assistance. I am repairing a magneto electric machine, such as are used for nervous disorders. I have put it together as I thought to be the proper way, but cannot get a shock from it. I have set them as close to the magnet as possible without touching. As far as I can see, the two ends of the wire are just looped on to the spindle. On the end of spindle nearest the magnet, close to where the wire is looped on, there are two little mica washers. What are they for? When I turn the machine there is a lot of sparking at the contact-breaker, which is just a curved piece of steel spring, screwed to the brass frame and rubbing on a square on the spindle.

The fault probably lies in the contact-breaker *not* breaking contact as it should. It should only touch at intervals—at each corner, and *not* continuously all the way round. Alter this and you may find the shock will appear.

[16,954] **Power of Model Boilers.** E. V. R. (London) writes: I am sending a dimensioned sketch (not reproduced) of a 6-in. by 12-in. vertical multitubular boiler. The firebox is 5½ ins. by 5 ins., and tubes ⅜ in. in diameter and eighteen in number. Will you please tell me if it is of sufficient size to drive at *full power* a horizontal engine, 1½-in. bore by 2½-in. stroke at 300 r.p.m., and with a gauge pressure of about 70 lbs. per sq. in. I intended to fire it with coal. The dimensions I obtained by calculation, but I am not sure whether the method I employed is applicable to small models.

No, the boiler will not do the duty you expect of it. It will run the engine, with the boiler working under an induced draught, at about 300 revolutions and 30 lbs. per sq. in. boiler pressure. The steam should be dried by a coil in the smokebox. We would advise a firebox 6 ins. deep instead of 5 ins. shown on your drawings.

[16,925] **Model Electric Launch.** F. F. W. (Rhyl writes: I have a No. 1 (1-50th h.-p.) Exceptional undertype motor (price 10s.), 4 to 6 volts and 2·2 to 2·4 amps. The information *re* amperes is not certain. With this motor and a 4 or 6-volt accumulator, I propose to drive a model electric launch. (1) Would this arrangement suit a boat 3 ft. long, 4½ ins. deep, and 7 ins. beam? (2) If not, what dimensions would it suit? (3) How would the design shown on pages 372 and 373 (Figs. 6, 7, and 8) of your issue of October 18th, 1906—reduced, of course—suit? I require a very good sea boat, as it will most probably be sailed on a large marine lake. (4) I have got a brass three-blade propeller, the dimensions of which you will see from sketch. Would this suit the boat? The weight of the motor is 1½ lbs. I do not know the weight of the accumulator yet as I have not fixed on one.

Yes. If motor takes 6 volts and 2 amps., use a 6-volt accumulator of as large capacity as boat will carry. Kind of hull is a matter of choice. This design would do very well. It is a matter of trial to see what size cell you can get the hull to carry. Find out, then get cells to suit. Propeller is quite large enough. For rough water we should advise a craft with more beam and fuller lines at the bow. The craft you refer to would never ride well, but would be always smothering herself.]

[16,959] **Small Multi-cylinder Petrol Engine.** J. C. (Streatham)) writes: The following are the particulars of an engine (petrol) about which I seek information. Cylinders: 1½-in. by 1½-in. (six, horizontal, three opposite one another). Steel tube, 3-32nds in. thick. Connecting-rods: Forged chrome-nickel steel. Crankshaft: Vanadium steel, cut from solid and oil tempered, ⅝ in. diameter. Crank chamber: Aluminium. Cylinders, combustion heads well water-cooled. Coil ignition. Speed, 2,000 r.p.m. (1) Would aluminium be strong enough for the cylinder heads? Would it stand the explosions and vibrations? Thickness, ⅛ in. then ⅛ in. water space, then 1-16th in. covering, all cast in one piece, or would gun-metal be more suitable? (2) What size centrifugal pump should I require for circulating, and what speed should it be run at? (3) Should the water connections to cylinders be in series or parallel, or series-parallel? (4) What size water pipes? (5) Should exhaust pipes be water-cooled? (6) What should be the order of firing? (7) What is the maximum speed I could run at? (8) What is the maximum power I could expect?

(1) Replying to your letter *re* six-cylinder petrol engine, we should advise that the combustion chamber heads be made in iron or steel. You would find it difficult to cast 1-16th in. thick sides for water jacket satisfactorily, although it could be cast heavier and machined up. (2) Pump could be about 1½ ins. diameter and driven at less than half speed of motor. (3) Parallel, to get uniform cooling effect. (4) ⅜ in. (5) Not necessarily. (6) The form of your crank will decide this. Every charge must be fired at top of stroke, and, as far as possible, opposite cylinders should be fired at same time to obtain the least possible vibration. But for an even turning movement, arrange to fire each of the six in turn, one after the other. (7 and 8) Maximum speed is a matter for trial, and maximum power also. There is not much previous experience to go upon, but as an approximate estimate, we should say something near ¾ h.-p. if you can get everything to run wel at a high speed. If you are not using a very high compression, you might use an aluminium head—not less than ⅛ in. material—and uniform.

[17,028] **80-watt Dynamo.** W. R. (Leigh) writes: Will you please send me a sketch of dynamo about 80 volts 1 amp.? The voltage must not be less than 80, and 1 amp. will be quite sufficient, and the machine as small as possible. I have made several small dynamos from your Handbook.

Use 60-watt design (Fig. 8) in Handbook, but make armature (and, of course, field-magnet pole pieces) 2½ ins. long instead of only 1¾ ins. Wind armature with No. 25 S.W.G., and field-magnet with same gauge; about 7 ozs. for armature and 3 lbs. for field-magnet.

[17,009] **Small Gas Engine Trouble.** B. P. (Reading) writes: I should be much obliged if you could give me some suggestions as to the working of a small ¼ h.-p. gas engine. It is one which I have made myself from castings supplied by Macmillan and Co. about two years ago; it is about 1½-in. bore and 3½-in. stroke. My trouble is in the explosion. On turning the flywheel round a few times, I get a weak, or very small, explosion. This immediately makes the flywheels fly back, and when the explosion takes place—whilst turning flywheel backwards way—they immediately fly forward. This happens in whatever position the cam is set. Can you inform me what to do with it? It has tube ignition; would electric be better? The two flywheels weigh about 21 lbs. between them, exhaust valve underneath, inlet cylinder of gas and air at the back valve in a horizontal position. I have not been taking in THE MODEL ENGINEER long (a few numbers from May and now from October), and so have not seen if you have mentioned anything of the kind before. But should be much obliged if you could give me a few ideas as to what to do.

If you read our handbook, "Gas and Oil Engines," by Runciman, 7d. post free, you will be in a position to deal with and investigate your trouble yourself. It is difficult to say from a brief description exactly what is the cause of bad or miss firing. It rests with the ignition arrangements and the adjustment of the mixture. Read also the query replies on this subject in back numbers of this Journal. If you still are in a difficulty after this, write us again, and we shall be pleased to assist you further.

[17,042] **Small Model Road Loco.** J. W. (Ayr) writes: What size and type of boiler would be required to run a model road loco.—cylinder, ¾ in. by 1½ ins.—at 25 lbs. pressure. For a steam roller what diameter and breadth of front and side rollers would you advise? Also, what method of firing would you recommend?

We would advise you to make a water-tube boiler for your model and use a plain methylated spirit lamp. The general proportions—as shown in the accompanying sketch. For a steam roller throw the leading wheels or rollers forward another 2 ins., and fix a pivot bracket on the top of the smokebox. Make the front rollers in two, the total width being 3¾ ins. The side rollers may be 1¾ ins. wide.

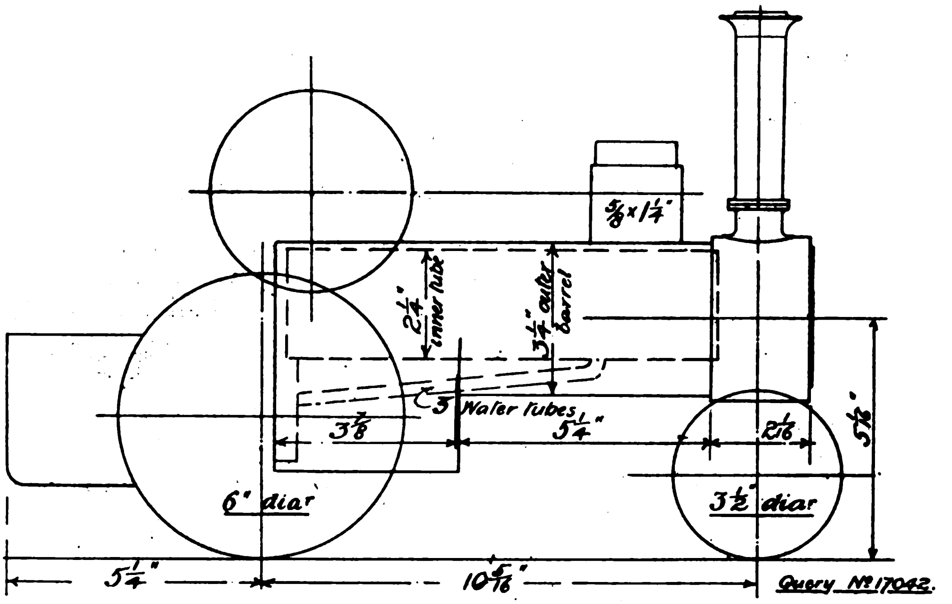


DIAGRAM GIVING LEADING DIMENSIONS FOR MODEL STEAM ROAD LOCOMOTIVE.

[17,030] **Miscellany.** D. W. H. (Ilford) writes: I am very sorry to trouble you so soon, but as my electric locomotive was made too small, I am building another—2-in. gauge—with bogies, much after the style of E. W. Twining's in a recent issue of the *M.E.*, so will be extremely obliged for answers to the following miscellaneous queries. (1) I am going to make two batteries giving 2 volts 3–4 amps. for 10–12 hours at a stretch. How many 4-volt ½-amp. H.E. lamps can I light from these cells in series? (2) I am going to run my electric locomotive with two 2-volt "Hustler" motors (friction gear). What amperage do these motors take each? Should I run them in parallel or in series? (3) I want to make an accumulator to put on locomotive, so as to work the field-magnet coils as in Mr. E. W. Twining's locomotive. How many plates—3 ins. by 1½ ins.—should I need to work above field-magnet coils for about three hours? (4) Will I be able to charge above accumulator with one of the batteries in query 1? If so, how long must accumulator be connected to battery? (5) How many plates would I need for an accumulator to drive a 4-volt 3-amp. motor for 3–4 hours—plates about 3½ ins. by 2½ ins.? (6) What amount of wire will I need—of gauge 16—to wind on solenoid of ammeter mentioned in a recent issue of THE MODEL ENGINEER, so that it will work from 0–15 amps.? (7) What amount of current will I need to charge accumulator in query 5? What resistance is there in a yard of gauge 36 wire? (8) Will a wooden switchboard do for a current of 4 volts 8 amps. or 2 volts 16 amps.?

(1) Cells must be coupled up in series to give 4 volts if 4-volt lamps are to be used. By doing this you will halve the amp.-hour capacity, so if you take ½ amp. per lamp total number you can run in parallel will be about 6. (2) We cannot say exactly; as far as we remember, about 4 to 6 volts. (3) Reckon 15 amp.-hours capacity per sq. ft. of positive plate surface. Discharge rate not to exceed 5 to 6 amps. per sq. ft. You can calculate from this if you know what current is required. (4) Yes, but depends upon its size; 25 per cent. higher voltage is needed than the accumulator to be charged. (5) See (3). (6) No references given. (7) See (3). 36 S.W.G. resistance—·54 ohm per yard. (8) A wooden base. Yes.

[17,029] **From Apprentice to Draughtsman.** W. D. H. (Leeds) writes: I should be much obliged if you would give me a little advice on the following matter:—I am seventeen years of age, working in one of the fitting departments of an engineering firm making textile machinery. I want to get into the drawing office; up to the present I have served two years in the works. How long would you advise me to stay in the works before going into the office? I am attending evening classes at a technical school, and what subjects would you specially recommend me to study? What are the wages usually obtained by a draughtsman? Is it worth while following the study up till you obtain a certificate for the I.M.E.? If so, could you tell me of one or two positions that could be obtained by holding such a certificate.

When you are thoroughly familiar with the practical work, and the construction and build of the machines, etc., you are working upon, then go into the drawing office; meantime, practise draughting in the evening classes, etc. Study mechanics, mathematics machine construction, some physics, and the elements of electricity and magnetism. Wages cannot be stated, as they vary enormously, according to ability, etc., from 25s. to £3 or £4 per week. No examination is held for entrance to I.M.E. You have to be introduced by someone, and then elected by the members. Your fitness to become a member is based on your experience in engineering work.

[17,035] **Charging from Town's Mains through a Rectifier.** C. F. S. (Bournemouth) writes: I am thinking of getting apparatus to enable me to charge small ignition accumulators from the 200-volt alternating current lighting mains which we are fortunate enough to have in this town. The rate per unit here is 7d. (rather high, I think), so that I would have to get a transformer, because to charge, say, a 50 amp.-hour cell (charging rate 5 amps. for ten hours), using ten 32 c.-p. lamps in parallel, together with the rectifier described in No. 283 of THE MODEL ENGINEER, would cost at the above rate per unit no less than 5s. 10d., which would be ruinous. If a transformer is used to transform down to 10 volts, the cost for charging would then be 3½d. I have not yet purchased anything, but before doing so I should be much obliged if you will answer the following questions:—(1) Would the rectifier work with 10 volts, or is this too low? If so, what is the lowest voltage? (2) What is the greatest current the rectifier will pass? (3) Where can I get the transformer? also, please state price. Also, where can I purchase the sheet aluminium, and what price? I found the cost for charging the accumulator in this way: One Board of Trade unit—1,000 watts for one hour. With 200 volts a current of 5 amps. for one hour would equal 1 unit. Charging rate 5 amps. for ten hours, so that cell would be taking 1 unit per hour. In ten hours this would be 10 units at 7d. per unit—this would make seventy pence—5s. 10d. If voltage is transformed down to 10 volts, then 100 amps. per hour would—1 unit. Cell requires—at 10 volts—50 watts per hour; 50 watts—1-20th unit, so that the cell would consume 1 unit in twenty hours. In ten hours, it would consume ½ unit—3½d. Is this correct? If not, please state cost at 10 volts.

(1) For rectified current the voltage required should be at least double that of the accumulators to be charged. If your accumulator has four cells, it would be advisable to have about 30 volts available, so as to allow a drop of a few volts in the rectifier. The transformer secondary could be wound in, say, three sections, so as to give 20, 25, and 30 volts (see "How It Works: A Transformer," in THE MODEL ENGINEER back numbers). You could then use a small amount of resistance between the cells and the rectifier, and regulate the current to the desired amount. (2) Depends upon the size of the rectifier cells and plates; they have been made large enough to pass 50 amps. You will find some data to go upon in THE MODEL ENGINEER for September 27th, 1906, page 304. The cells and plates should be large rather than too small, as an excess of current causes the liquid to heat and then the efficiency falls rapidly. (3) Messrs. Marshall & Woods, Avenue Works, Park Road, Acton, W. London, for the transformer; for the aluminium, one of the advertisers of sundries in THE MODEL ENGINEER will probably supply it; there is no difficulty in obtaining sheet aluminium, it is an ordinary commodity now. Your calculations are correct, except that there will be a small loss in watts for the transformer and rectifier. The transformer method will effect a great saving when full allowance is made for all losses.

[16,979] **Model Locomotive Design.** W. P. (Ripon) writes: (1) Which is the most correct or suitable dimensions of cylinders for a ¾-in. scale model of an up-to-date inside cylinder express locomotive, 3½-in. gauge, 20 ins. long? (2) Is 4½ ins. proper diameter of driving and coupled wheels, and 1¾ ins. or 2 1-16th ins., bogie? (3) What is the correct centre height of buffer line from top of rail, also boiler level? (4) Will 3½-in. gauge and 20-in. frames—from buffer beam to buffer beam—be the correct length? (5) What length will the connecting-rod centres be? (6) What diameter of circle will be required to work such a model on rigid wheelbase, being 5½ ins., and engine 4—4—0 type? (7) Would a 4—4—2 type work out 24 ins. long, and turn on same diameter of rails?

(1) ⅝ in. by 1¼ ins. to 11-16ths in. by 1⅜ ins. Use the latter if you provide means of drying the steam by a superheater coil passing through the flame. With a tubular boiler and no superheater, adopt the smaller size of cylinder. (2) There is no proper diameter—4 to 4½ is an average diameter. Bogie wheels, 2 1-16th minimum; carrying and tender wheels, 2¼ ins. (3) Buffer level, 2¾ ins. from rail level. Distance apart, 3⅝ ins. Boiler centre depends on design. (4) This depends on design. (5) This depends on design also. About 4½ ins. average. (6) About 10 to 12-ft. radius. (7) An "Atlantic," with outside cylinders and the trailing carrying wheel mounted on a pony truck or given plenty of side play, will do better on a curve than a four-coupled bogie locomotive (4—4—0 type) of modern proportions. An inside cylinder "Atlantic," like the L.Y.R. No. 1,400 class, will not prove quite so flexible. As you are evidently in need of information on the design and construction of model locomotives, we strongly recommend you to obtain our book, "The Model Locomotive," by H. Greenly, price 6s. net, 6s. 5d. post free. This book contains over 300 illustrations and nine folding plates of working drawings. For general proportions of the various types and their selection as prototypes for models see Chapter II.

[16,995] **Electro-plating.** J. P. (Sheffield) writes: I have a 4-volt 100-amp. dynamo, suitable for electro-plating. Kindly tell me the chemicals that are used in electro-plating, also directions for using with this machine.

For full details of this subject please refer to Bonney's "Electro-platers' Handbook," 3s. 3d. post free, or the recent articles in THE MODEL ENGINEER. See issues for August 16th, 23rd, September 20th, October 4th and 25th, 1906.

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 the asterisk have been based on actual Editorial inspection of the goods noticed.*

Small Drilling Machine.

To meet the demand of amateur engineers for a substantial yet sensitive drill at a comparatively low price, F. B. Goodwin, of Picton Street, Leek, has placed on the market a tool which is illustrated herewith, and is of the following dimensions:—Distance

F. B. GOODMAN'S 9-IN. SENSITIVE BENCH DRILLING MACHINE.

from column to centre of spindle, 4½ ins.; maximum distance from spindle to table, 8 ins.; size of table 7¼ ins. by 7¼ ins.; travel of spindle, 1⅜ ins. The tool has a ball-bearing thrust, and will drill holes up to a ¼-in. diameter. The table adjusts vertically, and will swing round the column. The approximate weight is 50 lbs. The price is extremely moderate, and readers in want of such a machine should write for further particulars to the above address.

New Catalogues and Lists.

Wm. F. Bond, 86, Bishopsgate Street Without, London, E.C.—The fully illustrated catalogue issued by this firm includes numerous types of model steam and clockwork locomotives, railway passenger coaches, goods trucks and other rolling-stock, electric tramcars and tramway systems, model railway tracks, including the new large radius curves with screw-up locking clamp—all made in standard gauges. Signals and other accessories. Model stationary engines and boilers and miniature machine tools are also listed. The list will be sent to readers of this Journal post free upon application.

Henry Butler, Whiston Street Works, Derby, has sent us a copy of his latest list of "Hercules" motors for marine and stationary purposes. The list gives particulars and prices of small pumping sets, accumulator charging sets, and ignition accessories; prices of castings and drawings, as well as the finished "Hercules" gas and oil engines, also of the "Hercules" dynamos, are included. The list will be sent to readers of THE MODEL ENGINEER post free upon receipt of fourpence in stamps.

The Editor's Page

FOR our three competitions which closed on December 31st, viz., those for speed boats, for launch boiler design, and for description of making model bolts and nuts, we have received a good number of entries. These are all being carefully examined at the time of going to press, and we hope to announce the results in each case in our next issue.

* * *

Our "How it Works" column has proved so popular that we have been moved to project a companion column under the title of "How it is Done." Under this heading we propose to insert articles describing the thousand and one workshop operations and processes which the model engineer ought to know. While many of these contributions will deal with the more difficult and least understood problems of the workshop, we shall not neglect the beginner, and shall consider nothing as being too elementary to be included within the scope of this new feature. To enable us to make this column as widely useful as possible, we want our readers to co-operate in two ways: (1) By those in want of help sending us a line to say what particular workshop matters they would like to see explained; (2) by those who are able to instruct others sending us suitable notes for publication, which, if accepted, will be paid for. With regard to the latter invitation, we may say that we have already arranged with several workshop experts to write some notes to get the column started; but we shall, none the less, welcome other practical items from writers not on our regular staff. We should further like it to be clearly understood that plain practical instruction should be the keynote of such contributions. Inexperience in writing or drawing need be no bar to would-be contributors who have useful information to impart, for we are quite willing to put rough and ready notes or sketches into proper shape for publication if need be.

* * *

We desire to thank the many readers who have sent us their opinions on the most useful method of conducting our "Queries and Replies" Department. The majority of our correspondents are decidedly in favour of keeping to the present order of things, wherein the replies are all furnished by our own staff, although quite a number have asked us to throw open the column for general replies. After carefully thinking the whole matter over, we feel inclined to try a compromise as an experiment. Our plan is to carry on the column on precisely the present lines, but to allot an additional space under the heading "Reader's Replies," wherein any reader can, if he is able and willing, supplement the replies we give in the ordinary way. The principle underlying this supplementary column of replies being essentially that of mutual help, we do not propose to offer any remuneration for replies which readers may send in, but shall regard such items as may be sent for insertion as being prompted by a friendly wish to help some fellow reader out of a difficulty. At the same time, we shall naturally subject such replies to Editorial scrutiny before insertion, and can only undertake to publish such communications as appear likely to be really helpful to the querist's or to our readers at large. This reservation is necessary to ensure against any misuse of our space, whether unintentional or otherwise. Perhaps, therefore, those who wish to make themselves useful to their fellow-readers will now look through the queries in the present or recent issues and let us have any information they think likely to be of service. The number of the query referred to should in all cases be quoted, and replies to separate querists should be written on separate sheets of paper.

Notices

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

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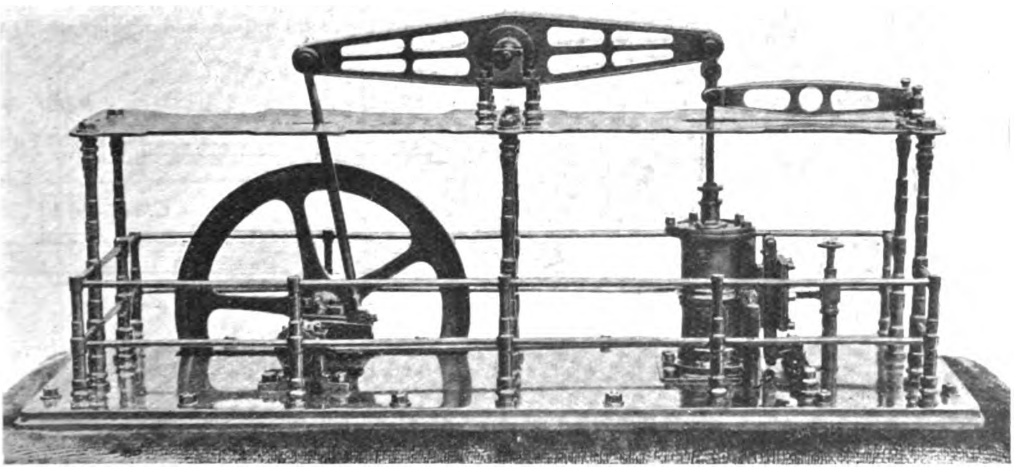
An Interesting Model Beam Engine.

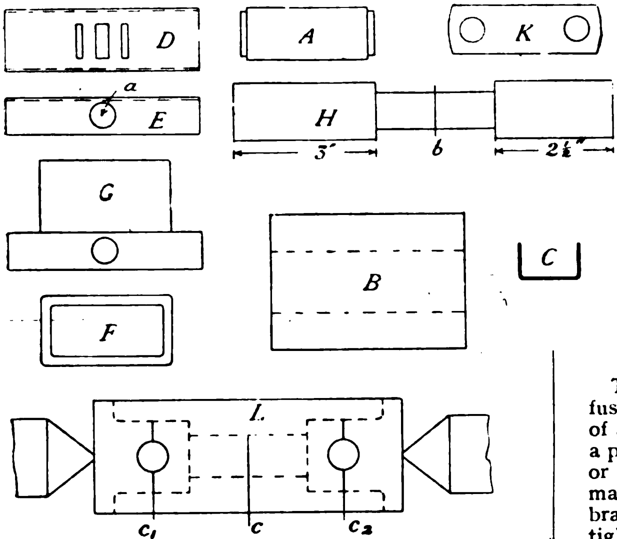
By FRANK WATSON.



MR. FRANK WATSON'S MODEL BEAM ENGINE.

THE model herewith illustrated took ten months of my spare time to build, commencing with the preparation of full-size drawings, from which I subsequently worked.

The bedplate is a casting from a pattern which I made, being 11 ins. long, 4 ins. wide, and ⅜ in. deep. To build up the cylinder I got a piece of solid-drawn brass tube ⅝-in. bore, 1¼ ins. long; then made a mandrel to fit inside of tube, mounted it between the centres of lathe, and squared the ends of tube and reduced the ends to take flanges as shown at A. The flanges were made from ⅛-in. sheet brass, cut out with hacksaw, and soldered to brass faceplate. In the lathe the centre of the plates were cut out to fit reduced ends of tube. After being cut out, they and tube ends were tinned and put together between the jaws of a parallel vice along with a hot iron and forced on up to the shoulders of tube, making a neat job. The cylinder was then put on mandrel and flange turned true. For the steamways a piece of sheet brass B 1-16th in. thick, ¾ in. wide, was cut to fit between flanges of cylinders. This plate was bent on dotted lines (as at B) to form a channel C; the steam ports were then cut through, as shown at D. The plate was then turned on its side, as at E, and hole *a*, the size of exhaust pipe, drilled. The exhaust pipe was then filed flat on one side for a distance of ¼ in., then put in hole *a* and sweated in, dividing exhaust port from steam ports at same time. It is then put in between flanges of cylinders and sweated in. The steam chest is from a piece of the same tube as cylinder first softened in the fire, then hammered on a mandrel the same size as outside of channel piece till it formed the shape of F, and then fitted on to plate B, as shown at G. The flange, the size of outside of box, was cut out and sweated on, then cover fitted. The crank-



Details in the Construction of Model Beam Engine.

shaft was made of five pieces. The first piece was turned up in the lathe, as at H then cut in two at *b*, and the two webs cut from 3-16ths-in. sheet brass, and two holes in each drilled in the positions shown at K; the crankpin was turned and put between webs and pinned, then all sweated at the joints, which made a neat crankshaft. The bearings are turned between centres of lathe from a piece of brass 5-16ths in. thick, 3 ins. long, shown at L. They are turned on two sides and two ¼-in. holes drilled for shaft and parted at C1 and C2, and oil cups drilled. The six pillars to carry the beams are turned from 5-16ths-in. round brass, and are 3½ ins. long and fitted with nuts and washers at top. The eccentric sheave is turned from a piece of 3-16ths-in. sheet brass, first soldered on brass faceplate and turned true and groove turned for strap, then taken off faceplate and ¼-in. hole drilled through, 1-16th-in. out of centre, and keyed on shaft at right angles to crank. The connecting-rod is turned from 5-16ths-in. round brass, and has a double-eye at beam end, and strap, keys, and brasses at crank-end. The beams and links are cut from sheet brass 1-16th-in. thick, and have a strip of brass soldered right round them; the small beam is half the length of big beam; the plate to hold top-motion is 3-32nds in. thick. The ten pillars are turned from ¼-in. brass rod, and the handrails are 1-16th-in. round brass wire. The eccentric strap and rod and quadrant are made from brass. The flywheel is 3¾ ins. diameter. This model engine is very highly polished, and has taken prizes all over the County of Durham. It was made on a 2-in. centre Britannia lathe. This model engine is fitted to run with steam or compressed air, and is fitted as an electric "penny-in-the-slot" engine. There is an electric motor underneath stand running on flywheel. When penny is dropped in slot, it closes the circuit, and sets the engine in motion and runs twenty revolutions; then drives penny off slot and engine stops. The model—in glass case—measures 15 ins. long, 7½ ins. wide, 13 ins. high, over all.

Workshop Notes and Notions.

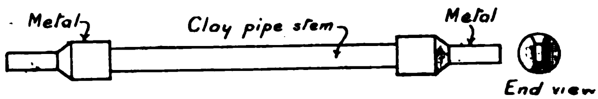
*[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked "*Workshop*" on the envelope.]*

Small Tubular Holders for Fuses.

By D. W. Hardy.

The following may prove useful to anyone making fuses for a small switchboard:—Procure the stem of a clay pipe and cut to the length required. Fix a piece of lead or other metal on each end by casting or otherwise, shaped as in Fig. 1. Drill a hole to make a pretty tight fit for fuse wire, then fix two brass clamps on switchboard so as to receive tightly the metal ends of holder (Fig. 2). If wire fits

Fig. 1.



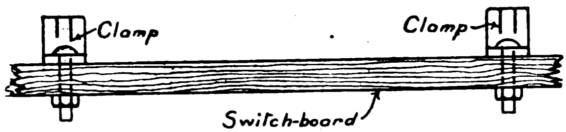


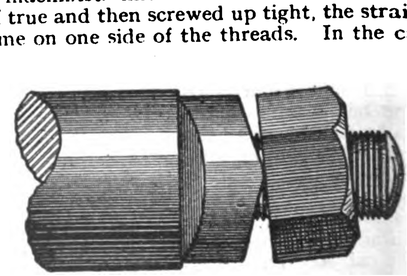
Fig. 2.

Small Tubular Holders for Fuses

loosely, bend round end and the pressure of the clamp will ensure good contact.

Washer for Inaccurate Nuts.

All machinists know that when a nut is tapped out of true and then screwed up tight, the strain will all come on one side of the threads. In the case of



Washer for Inaccurate Nuts.

milling machine arbors and other devices requiring great accuracy, the threaded portion is liable to be damaged, either by being sprung, or by having the threads stripped.

To prevent this happening, says a contributor to *Popular Mechanics*, I devised the washer shown in the sketch, which is drawn greatly exaggerated, in order to make it plain. Each face of the washer is bevelled off at two opposite edges, leaving a ridge across the middle, the ridges on each side being at right angles to each other, so that only one shows in the sketch. The hole in the washer being a little larger than the screw allows the washer to swing, and thus take up the inaccuracy of the nut.

A Useful Grinding Device.

By J. E. C.

Many readers will have, like myself, spoilt both work and temper owing to lack of efficient means for sharpening tools. The writer's work and temper have greatly improved since adopting a

FIG. 2.

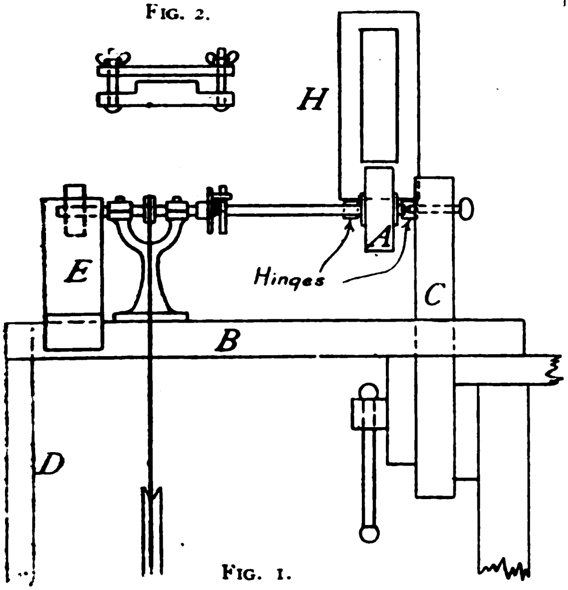


FIG. 1.

ARRANGEMENT OF GRINDING DEVICE.

grinding device, which is mounted in the manner shown in the accompanying sketch.

The metal wheel A carries a strip of emery or corundum cloth, kept taut by a spring arrangement. The wheel cannot get out of truth, and the cloth can be renewed when necessary. This wheel, 5 ins. diameter, with about 1 doz. strips of cloth, cost about 15s. complete with driving spindle.

To keep grinding operations clear, my lathe was mounted, the wheel on a wooden frame made of 3-in. by 2-in. pine. The bed B is 2 ft. 6 ins. long, and the tailstock C is in one piece, with a corresponding length below the bed, which is gripped in the bench. The whole affair can thus be put up in a moment, and after use be put out of the way. The support D is a 1½-in. square piece, and wood cut to the right height and with a shoulder at one end to slip into gap at end of bedpiece.

The headstock, a small polishing head, is driven by a foot-wheel fixed to the floor, and carries a driven chuck at one end and a small emery wheel, for roughing, at the other. E is a rest for use with this wheel; it is made of wood, faced with iron, and is screwed to the bed.

The rest for the wheel A is the frame H, which is fixed to the wall by strong hinges, and is lowered over the wheel when required. The tool to be ground is fixed to this with a clamp made of wood and faced with iron (Fig. 2).

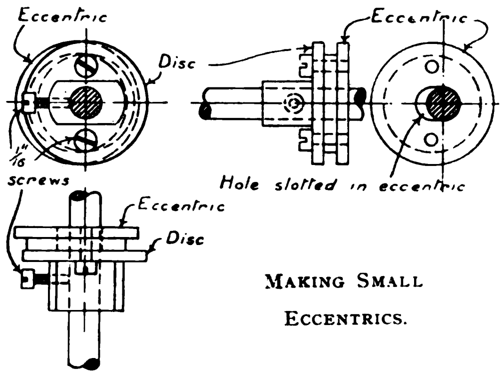
The grinding of plane-irons and chisels used to be well nigh impossible, but with this contrivance I can get them quite true.

A Simple Method of Making Small Eccentrics.

By G. W. HALPIN.

Not feeling competent to make eccentrics, ½ in. diameter, on a 3-16ths-in. shaft, with 1-16th-in. throw, with any chance of their turning out right, I hit upon the following method, of which I give a sketch.

I made a disc ¾ in. diameter with boss, the boss



MAKING SMALL ECCENTRICS.

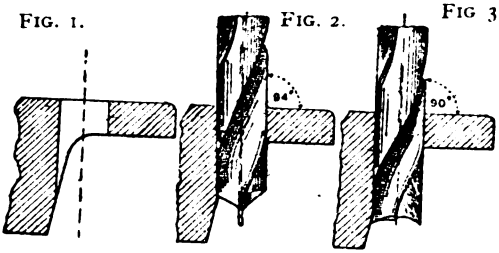
having two flats, to allow of 1-16th-in. screws passing through slotted holes, and screwing into body of eccentric, which has the hole for shaft elongated, to get the 1-16th-in. throw.

The eccentric has only one flange, the disc serving for the other, and so I have an eccentric that can be set to any angle on the shaft and adjusted to any throw, and, unless wished, the strap need not be in halves.

Twist Drill for Special Jobs.

A correspondent of *Work* gives the following useful hint:—In many cases where castings and the like have to be drilled, it happens that certain holes,

FIG. 1. FIG. 2. FIG 3.



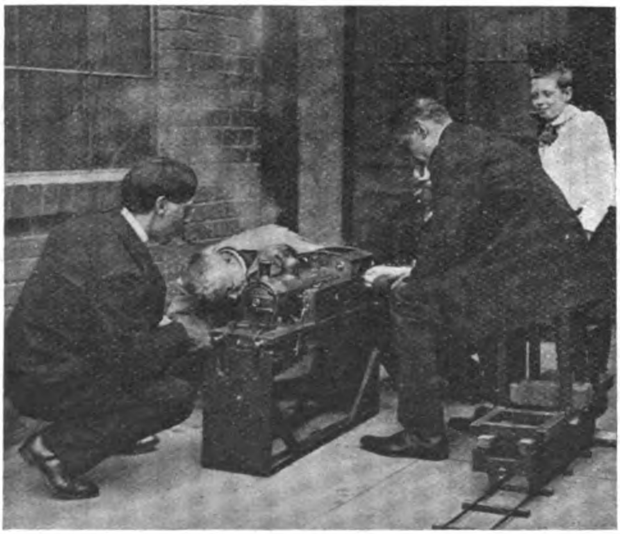
A TWIST DRILL FOR SPECIAL JOBS.

when marked off, come foul with the casting, and the drill has to cut both metal and air. In the accompanying illustrations, Fig. 1 shows where such a thing would occur. If this were to be drilled with an ordinary twist drill, the drill point would shy away from the metal, or, in other words, run out of truth, as shown by Fig. 2. In order to overcome this, grind the drill as shown in Fig. 3, and no difficulty will be experienced in drilling a perfectly straight and true hole. It is, however, necessary to use an ordinary drill first, drilling just deep enough to allow the blades of the specially ground drill to enter the hole. An alternative method is to use a gig, when the hole can be started and finished with the specially ground drill. It is possible, by using a drill ground as stated above, to drill holes when more than half the drill is cutting air. For holes under ¼ in. great care has to be exercised, otherwise a broken drill will be the result.

A Model Engineers' Tramp Abroad.

(*Continued from page* 30.)

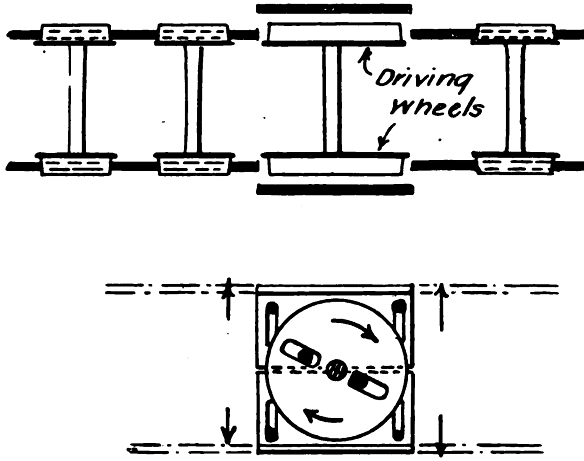
ARRIVING at Erfurt on the Saturday evening —forty-eight hours from the time we left London—we were greeted by Mr. Carl Rompler. Mr. Rompler, as most of our readers know, is a member of the Society of Model Engineers —the only one residing in the Fatherland. His contributions to the science of model engineering have been recorded from time to time in the pages



STEAM-RAISING STAND FOR MODEL L.T.S.R. LOCOMOTIVE.

of this Journal, notably in the description by the Editor of his visit to Mr. Rompler in the issue of October 29th, 1903. For those who have not read this, however, we may say that he is an ardent model locomotive builder, having built three small 3½ and 3¼ gauge models and a splendid inch-scale London, Tilbury & Southend tank locomotive, which was illustrated in THE MODEL ENGINEER for April 20th, 1905.

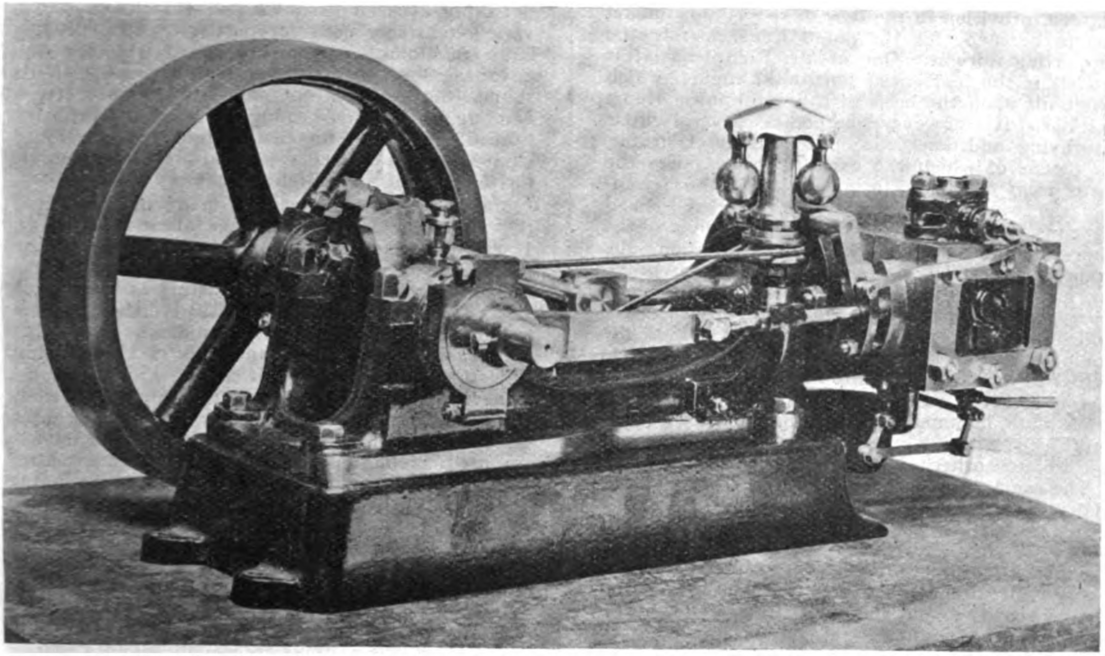
Plans were soon made; we were to spend the following morning in the workshop and in running some of the model locomotives, the afternoon being devoted to a motor-car trip in the Thüringian Wald. The model locomotives acquitted themselves very well, in spite of their having had a previous long spell of disuse.

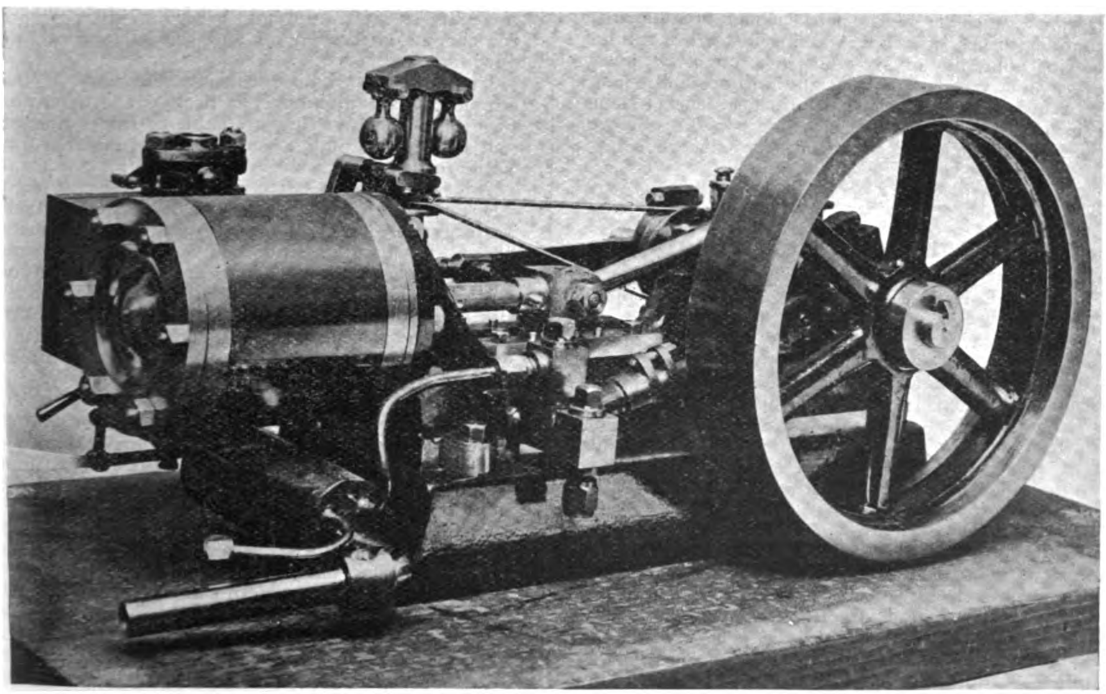


MR. ROMPLER'S DEVICE FOR ALLOWING DRIVING WHEELS OF LOCOMOTIVE TO RUN FREE WHILST WARMING UP.

Two devices, both used in connection with steam raising, are worthy of mention. With the small gauge railway the steam is raised on a branch line, which ends in a shed (see article in issue of April 20th, 1905). To clear the water from the cylinders it was necessary previous to the fitting up of the arrangement we are about to describe to lift the locomotive principally used in connection with this model railway (a single-wheeled engine), and, first assisting the wheels by hand, to let it run "light" for a few moments until the cylinders were thoroughly warmed and the steam from the exhaust appeared quite dry. By means of the shifting rail device shown in the accompanying sketch, the lifting up of the engine is rendered quite unnecessary. The model is placed with the driving wheels over the moving rail, and at the proper time by two turnpins fixed to the revolving disc underneath the boards supporting the track are given a twist, these operating the slotted plates to which the moving rails are attached. Two views —one with the rail in position, and the other showing the driving wheels free to revolve without causing the engine to travel —are included in the sketch herewith.

The other device is shown in the photograph. The track for the 1-in. scale locomotive is a portable one, and is usually laid on the paving running alongside Mr. Rompler's factory. All those who have tried to raise steam in a model locomotive on the ground know its drawbacks, and to save grovelling in the dirt Mr. Rompler has made a rough but serviceable wooden stand, which supports each buffer beam and on which all the operations necessary to steam raising—burner lighting and cleaning.





TWO VIEWS OF MR. CARL ROMPLER'S MODEL HIGH-SPEED HORIZONTAL ENGINE.

For description] [*see page* 53.

tank filling and warming up—can be performed with lesser degree of personal discomfort. As will be seen, provision in the case of the Tilbury model has to be made for the guard irons clearing the supporting upright. One of Mr. Rompler's latest models is the high-speed horizontal engine, which was built upon the basis of the well-known Stuart castings. It, however embodies several little improving additions, viz., the feed-water heater, by means of which the exhaust steam raises the water from the pump to boiling point, thus lessening the evaporative work of the boiler. Model oil cups, with glass containers, also enhance the appearance of the model, and in addition, the drain cocks, which were made from scrap brass, are arranged to work simultaneously by the one lever. The bedplate and the guide surfaces were milled out, and to face the circular end of the guide to receive the cylinder a special angle-plate bolted to the lathe faceplate had to be made. The piston is fitted with a single ring made of ⅛-in. brass plate, hammered, bent round roughly to size, and turned with the inside and outside circles excentric to each other.

The engine is an excellent worker, and is capable of driving, with 50 lbs. boiler pressure, Mr. Rompler's 4½-in. centre Barnes' lathe direct on to the cone pulley, so that with the back-gear and an 120 to the inch self-act, a cut 3-32nds in. deep can be taken easily. Mr. Rompler also reports that the governor is very sensitive, and the pump throws more water than is really required.

Our motor-car trip was a typical one, and comprised most of the known delights of the sport—glorious weather, high speed, slight breakdowns, thunderstorms, side slips, walking instead of riding, getting home five or six hours late, etc. It, however, was very enjoyable, and will no doubt long be remembered by those concerned; space alone prevents us recounting the many kindnesses we received at the hands of our host and hostess.

(To be continued.)

Pattern-making Metals.

METAL is used for making patterns in place of wood on account of its greater durability, the fact that it keeps its shape better, and also on account of the fact that more complicated designs can be executed than in wood. Among wooden patterns we find two materials used: pine for the heavier and more common patterns, and mahogany for the more expensive and more delicate patterns, and especially for those which will be in almost constant use.

Turning to metal pattern-making, we find an almost infinite variety of metals used. Where but few metal patterns are used in a shop, and the work is not extremely exact, so that slight variations in the size of pieces do not make much difference, it is common practice to pour the metal patterns from any metal which is being used in the foundry at the time. Castings which are made in this hazardous fashion are usually finished in the same happy-go-lucky way (says H. Malone in the *Pattern-maker*), and the castings made from these patterns certainly show it.

The different metals used for making patterns may be divided into iron and alloys. The alloys may be again sub-divided into hard and soft alloys or into brasses, bronzes, and white metals.

Taking up iron first, we find that cast iron is very extensively used for patterns, especially for large moulding machine patterns. It has the advantages of cheapness and ability to keep its shape—that is, it is not only stiff so as to resist bending, but it is hard enough to resist any ordinary bruises. The iron for casting patterns should be what is known as a close-grained grey iron suitable for the general run of light machinery castings.

Master-patterns are usually made in wood, and the necessary double shrinkage allowances made. If the pattern is to be of exact size, it is also necessary to make the finish allowances in the master-pattern. The pattern casting is then taken to the machine shop and finished either by machining or filing. All pattern-makers know that iron rusts very readily, and this is the greatest objection to the use of iron castings, as they must of necessity be in contact with the damp sand when in use. To protect the surface of the iron from corrosion a number of different methods or devices are used. Sometimes the finished surface is rusted, either by dampening with salt water and allowing it to rust, of by dampening with water containing acid or sal-ammoniac. The pattern is then warmed to dry it thoroughly, and the extra rust brushed off with a soft brush. It takes several hours for the rust to penetrate deep enough to make a good surface, and in many cases the castings are left overnight. After the surplus rust has been brushed off, the castings are usually given a coating of wax; sometimes this is accomplished by heating the pattern and applying beeswax, after which the surplus is scraped off and the surface rubbed down smooth.

Iron patterns require considerable care in the storage and maintenance, as if they are neglected for even a few days they are liable to rust seriously, and if there are any loose pieces or pins they are liable to rust fast.

As stated, iron patterns are frequently used where relatively large work is to be made. If such patterns were cast solid they would be extremely heavy to handle, and consequently they are generally cast hollow. Here, again, the nature of cast iron lends itself very well indeed to the necessities of the case; on account of the stiffness of the metal very thin patterns can be made, especially when any flat surfaces are supported by suitable ribs.

Cast-iron patterns are not suitable for small, light work for several reasons. One reason is that it is difficult to form delicate and complicated outlines in cast iron, and to prevent these from becoming injured through the corrosion of the metal.

Very frequently, indeed, an order comes into the foundry for quite a large number of castings, for which only one pattern is furnished. Where the pieces are small, the pattern can frequently be used for a master-pattern from which to make a number of other patterns, thus enabling the foundryman to turn out the work much more rapidly. One of the white metals is generally used for producing such patterns as this. An alloy commonly used is made of equal parts of tin and zinc. This alloy will only shrink about 1-64ths in. per foot, and hence, especially in the case of small castings, there will be practically no difference between the size of the master-pattern and the other patterns made from it—in fact, in some cases the shaking of the master-pattern enlarges the mould to such an extent that the other patterns are actually larger than the master-pattern, and may require trimming down.

The alloy composed of equal parts of tin and zinc is rather soft, bends fairly easily, and is liable to injury. To overcome these difficulties, some pattern-makers prefer to use an alloy composed of 85 per cent. tin and 15 per cent. antimony. This is quite an expensive alloy, but is surprisingly stiff and hard, and so makes a fairly good metal for a gate of patterns from which only a relatively small number of castings are required. The shrinkage of the tin-antimony alloy mentioned is about 1-16th in. per foot, but in small work the rapping of the master-pattern will more than compensate for this.

In brass foundries the tin-zinc alloys are very largely used for temporary patterns on account of the fact that the old patterns can be melted down and used in making any alloy containing the above-mentioned metals. The tin-antimony alloy is not as good for brass foundries on account of the fact that antimony is not wanted in many standard alloys.

When aluminium first came into use, everyone thought it would make very fine patterns; but its use has not been so extensive as was hoped for. There are several reasons for this, one being that aluminium will not solder as other metals do. The reason for this is that the oxide of aluminium which forms on the surface cannot be dissolved by any of the ordinary fluxes, nor can it be reduced by the aid of any fluxing agent known; also, it is practically impossible to get any solder to adhere to aluminium. White metal containing aluminium in any considerable proportions, and, in fact, in relatively small proportions, partakes of the nature of aluminium to such an extent that it cannot be soldered. It will readily be seen that this will rule out aluminium and aluminium alloys for use as pattern metals in most cases. Another great disadvantage of aluminium is that it cannot be melted in an iron pot, nor can it be melted and poured as readily as ordinary alloys, and hence it requires a regular melting furnace and the services of an experienced melter. The other white metals mentioned can all be melted in iron pots with comparatively little deterioration of the quality of the metal.

A soft white alloy used by many pattern-makers is made by taking standard Babbitt metal as a base, the metal being made in the following proportions:—Babbitt metal, 1 lb.; tin, 1 lb.; lead, 1 lb. The standard or original Babbitt is composed of tin, 50 lbs.; copper, 2 lbs.; antimony, 4 lbs.; or, in other words, 89·3 per cent. tin, 3·6 per cent. copper, and 7·1 per cent. antimony. Another authority gives the following composition for the original Babbitt:—83·3 per cent. tin, 8·3 per cent. copper, and 8·3 per cent. lead.

It will readily be seen that the effect of using Babbitt in the pattern alloy is to add a small percentage of copper and antimony, both of which have a tendency to harden and stiffen the metal. The large percentage of lead, however, makes the working of the metal easy.

One advantage of the softer white metals is that they are soft enough to be chipped, filed, or scraped with ease, and this greatly reduces the work necessary in making patterns. Not one of the white metals is stiff enough to give good service as gates: the antimony-tin alloy mentioned is sometimes used in cases where the gates are cast on the patterns for a temporary job; but in practically all cases white metal patterns should be provided with gates made from cast or rolled brass. Hand-rolled brass is to be preferred for this, on account of its greater density and consequent stiffness.

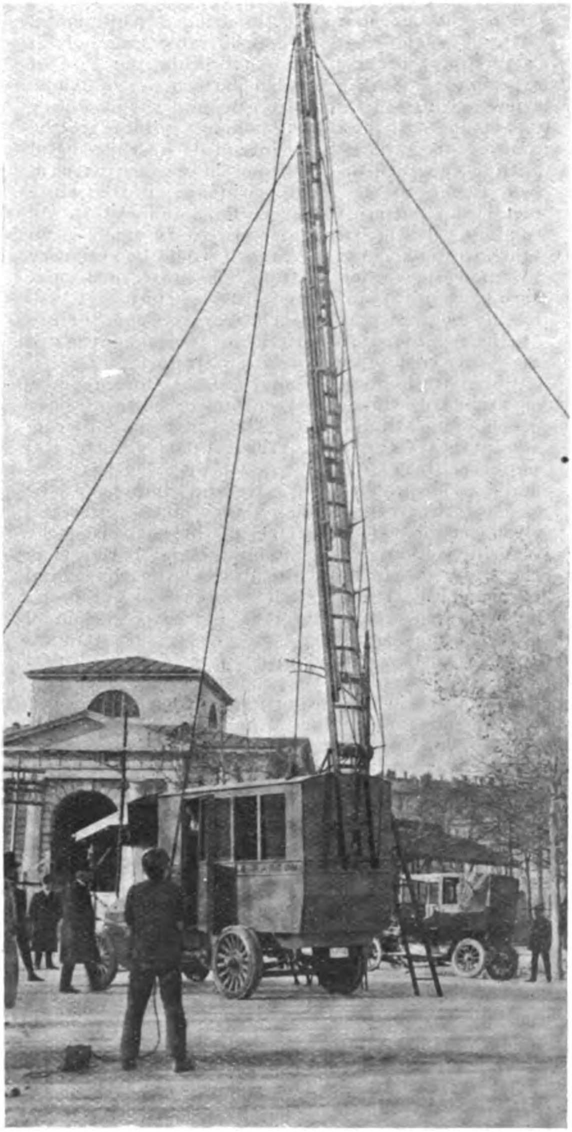
There is one advantage in using a white-metal pattern, even where a considerable number of castings are to be made—that is, in the case of experimental work a wooden pattern can be made, a few castings produced from it, and the necessary tests made. If the casting is found suitable for the purpose for which it is intended, a white-metal pattern can then be cast from the wooden pattern, and, owing to the small shrinkage of the white metal, this pattern will serve for making all future castings. If the patterns were to be made from brass or bronze, in many cases it would be necessary to make a wooden pattern, as brass or bronze shrinks more than the desired pattern. It will readily be seen that in such a case as this the use of the white-metal pattern for permanent work saves the cost of one wooden pattern.

For patterns for continual use, as, for instance, on standard work, brass or bronze patterns have become almost universal. They have the following advantages: They are stiffer than white metal patterns, the gates can be cast with the patterns, and in some cases both gates and runners can be cast together, thus making a very much better and stronger job. The surface of brass resists the scouring action of the moulding sand better than the white metals, and also draws from the mould more freely. A good grade of bronze or gun-metal is very much superior to brass, and hence gun-metal or bronze makes the best patterns. A good standard gun-metal is composed of 32 parts copper, 1 part zinc, and 3 parts tin. A good bronze may be made with the following proportions:—16 parts copper, 1 part tin, 1 part zinc, ½ part lead. The exact composition of either of these alloys, however, is not an absolute essential; a good high grade gun-metal or bronze will certainly make the best pattern metal available. Common yellow brass, which is composed of 16 parts copper, 8 parts zinc, and ½ part lead, is frequently used as a pattern metal. As already stated, when any of these metals is used it is necessary first to make a pattern from which the metal pattern is to be cast. If the piece is large or chunky, this pattern may be made of wood; while if it is delicate in design, the master-pattern should be made of brass or bronze, sheet metal being generally employed for this purpose. The highest grade of bronze or gun-metal patterns needs no lacquer to make it draw from the sand freely. High-grade bronze patterns are frequently finished by chasing. This is especially true in the case of art work or leaf designs.

Magnet windings of uninsulated wire are said to have proved feasible by the use of aluminium wire, the natural oxide upon which forms an effective insulation for moderate voltages. For over 200 volts, paper wound wet between the layers is effective: and for higher potentials, extra oxidisation has to be secured by dipping in a chemical bath.

The Latest in Engineering.

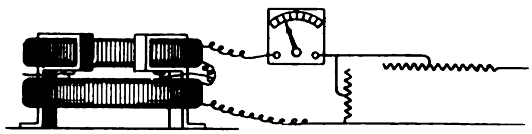
Marconi's New Movable Radio-Telegraphic Station.—This is an automobile, designed by Marquis Solari, secretary to Signor Marconi. The vehicle carries a special apparatus for utilising the motor either for traction or for generating electric



MARCONI'S NEW MOVABLE RADIO-TELEGRAPHIC STATION.

energy for radio-telegraphic transmission, as also for rapidly raising the pole fixed to the roof of the automobile itself. In about ten minutes this station can be made ready for action to its utmost distance (150 kilometres, or about 93 miles); but for small distances it can act whilst in motion at about half speed. It has the advantage of allowing the use of a single car to carry pole, alternator, apparatus and staff; and does not require the use of balloons, which are very inconvenient when it is windy. By means of a station of this description, it will be possible rapidly to establish relief radio-telegraphic lines in case of breakdown of commercial wire telegraphic lines; and, above all, will offer a rapid and convenient means for establishing radio-telegraphy in the Italian colonies. This new important application of wireless telegraphy is intended chiefly for the Italian army. It has been patented in the name of Marquis Solari, the manufacturing company have the exclusive building of the cars.

Standard Current Meter.—A simple form of current-measuring instrument, designed for use as a secondary standard, is described in an American patent issued September 25th to Carl Hering. The instrument, which is illustrated herewith, consists of two coils placed one above the other; the upper coil is fixed and the lower is movable. The movable one is held up against the lower side of the fixed one by the attraction due to the currents in the two coils. The lower coil is so mounted that when the current, which passes through the two coils in series, exceeds a certain definite value, this coil is held against the upper one, but when the current is less than this amount, the lower coil at once drops away from the upper. The instrument is essentially one for indicating a single chosen value of current.



THE HERING STANDARD CURRENT METER.

To use the instrument, the current in the circuit with it and the instrument to be calibrated is first made greater than the standard value, the movable coil being thereby held in its upper position. The current is then diminished very gradually until the movable coil drops. It is stated that the only correction required at any time, when the instrument is used as a secondary standard, is that for the variations of the force of gravity due to the difference of latitude and elevation. When extreme accuracy is desired, these variations can be allowed for.—*Electrical World.*

SHORT LIFE OF MODERN HEAVY ORDNANCE.—The annual report of General Crozier, Chief of Ordnance, gives a startling idea of the short life of the 12-in. guns now in place in most of the coast fortifications of the United States. The report states that a 12-in. gun, firing a projectile with a muzzle velocity of 2,500 ft. per second, will last for only about 60 rounds, after which the accuracy of fire is seriously impaired by erosion, which wears away and destroys the rifling. It is pointed out that the guns in any of the important fortified works of the United States would last less than two hours in an engagement requiring rapid firing. General Crozier's suggestion to reduce velocities and use larger calibres is one which will, perhaps, not be favourably received by military authorities in general.—*Machinery.*

A Design for a 20-ft. Windmill.

By F. E. Powell.

(*Continued from page 12.*)

II.—Timber Framework.

The impatient reader is by this time anxious to get to practical consideration of the drawings, and this—now that generalities have been discussed—may at once be done.

Figs. 1 and 2 in the Coloured Plate show two elevations of the whole mill to a small scale, and these must be carefully studied by the intending builder. In the first view the sails are shown "full on," the bottom one being slightly outlined only, so as to leave the framework as clear as possible. A view at right angles to this is given in Fig. 2, showing the general disposition of sails, bearings, gear wheels, etc.

The framework, or tower, is also shown in two elevations, but these are not at right angles to one another, since that would have helped the reader very little. Fig. 2 shows the tower "square on," but in Fig. 1 the spectator looks end on a diagonal of the framework. In order to avoid confusion, very few dimensions appear on the drawing, and a scale is provided instead.

The timbers proposed for the main uprights of the framework are four scaffold-poles of larch, each about 30 ft. in length, fully 6 ft. of which must be sunk into the ground to ensure stability. These poles must be carefully selected, thoroughly sound, straight, and with ends particularly free from defects. The size and taper are not of great importance, but a minimum of about 3½ ins. diameter at the thin end, and 5½ ins. at the butt, is certainly necessary.

All braces and diagonals, which must be very soundly spiked or bolted to uprights, may be of 3 × 2 or even 3 × 1½ sound Norway pine. They need not be halved, but one diagonal may be fixed inside and the other outside any pair of uprights. A packing-piece should then be placed between them where they cross, and a ½-in. bolt, dipped into hot tar, put through the three timbers and screwed tight.

The ladder sides may also be formed of 3 × 2 pine, the rungs being not less than 3 × 1½, fixed with one 4-in. spike at each end.

A really sound foundation for the mill is an absolute necessity. On no account must there be any scamping in this part of the work, as a tall, light structure such as this will be exposed to very severe stresses in high winds. Such a foundation may be secured by digging out a 6-ft. trench (care being taken to either timber the sides or cut the walls to a batter, if necessary, to prevent accident), the butts of the poles going in the four corners, where holes a foot or two deeper may be sunk to receive them. Any heavy old timbers may then be bolted or securely fixed with heavy spikes from pole to pole, somewhat as indicated in the drawing, and the earth filled in and soundly rammed at intervals as the filling proceeds.

Another method of securing stability would be to dig four holes for the poles, say about 5 ft. deep, and about 3 ft. × 2 ft. in area. Into the centres of these the poles may be inserted, two or three ½ in. or ¾ in. iron rods, about 12 ins. long, having been put through the butts at intervals to form a key with the concrete with which the holes should be filled. This concrete might be a fairly "poor" mixture of about 1 of Portland cement to 10 of sand and stone, but a fortnight or more should elapse before the sails or top gear are put on the mill, to give the concrete every opportunity to set hard.

Whatever method is adopted for fixing down the framework, every care must be taken to prevent rotting of the timbers buried in the ground. Perhaps the very best methods of doing this—such as creosoting, soaking in sulphite, or iron, or copper etc.—are not available for the amateur, although liberal applications of creosote given on the dry wood in hot weather might prove as efficacious as anything that may be mentioned. Hot coal-tar, applied in two or three coats, however, will be the cheapest and simplest substitute, and if in addition the parts are encased in thin sheet zinc, closely wrapped and nailed with galvanised clouts at close intervals, the timber will last a very long time. Every part of the timber buried underground must be treated, and if this is not done, a few years may see the downfall of the whole structure. Care must be taken when heating tar for this work. It should be done out of doors, and the flames of the fire not allowed to reach the surface of the boiling tar.

At rather more than half the height of the tower may be seen (at S) a platform, shown separately in plan in Fig. 3. This is to be fixed just below and clear of the sails, and enables them to be attended to in case of damage and in erecting. Two stringers will carry the small joists for this platform—and may be all stringers and joists—of 3 × 2 stuff. The platform itself may be of any 1-in. boards, not necessarily close-laid, unless the shelter so obtainable is desired. Note that a manhole opening is to be left where lower ladder rises, and this also allows for a bearing for vertical shaft and renders it easy to attend to same.

Some extra security is given to the platform by a couple of handrails of 4-in. × 1-in. stuff, nailed across each pair of uprights two or three feet above the platform, care being taken that these are not long enough to foul the sails.

The diagonal braces are provided on all four sides of the tower, and cross both ways except where it is required to have easy access to the lower ladder.

At least half of this bracing could be omitted if the sides are boarded in or covered with galvanised iron sheets to form a shed, providing either form of covering were well and closely nailed. Thus a useful, though not very commodious, place might be made, and might be extended in any direction desired outside the actual framework. In this case the platform at S should be given some inclination, and should be water-tight, preferably being well tarred. The opening would require a trap door, well fitted over a coaming.

The top of the framework is secured to a substantial iron casting, which carries on its upper surface an annular disc of wrought iron, shown in section in Fig. 4. This cap casting will receive attention later, but the revolving head, consisting of two principal castings, shown in Figs. 4 to 10, may now be considered.

III.—The Revolving Head.

Since it is necessary for the sails of a windmill to face the wind, means must be adopted to enable the rotary motion of the "wind-shaft" to be always transmittable to the vertical shaft. In the present design the common practice of employing two bevel wheels is followed. One, the larger, is mounted on the wind-shaft (see Fig. 4) and revolves with it. The other is carried by the top of the vertical shaft which it drives. Both are carried by bearings in the double set of castings mentioned, the two latter being bolted together (as shown in Fig. 4), revolving with the sails as the latter alter their position with regard to the wind.

Both castings should be made as thin as possible—say 7-16ths in. in all parts not specially strengthened. The bearings, or pedestals, for the windshaft may be of any approved pattern, but, as shown in Figs. 4 and 7, the lower parts are in one with the large upper casting, and are fitted with cast-iron caps with side horns in the usual way. Split brasses may be fitted if thought desirable, but plain brass bushes are shown, and should prove serviceable and are easily renewed. All that need be said of them is that they should be about ⅜ in. in thickness, and should be provided with shoulder and flange at front (or sail) end to take thrust.

Lubrication must be well attended to in these bearings. The simple cup lubrications shown will be suitable, and some soft or semi-solid lubricator used. Graphite is a good material in such a position, but should be mixed with vaseline and machine oil to the right consistency. A cover must, of course, be fitted to the lubricator in each case. The bearing caps are bolted down with two ⅝-in. bolts with locknuts fitted.

In Fig. 4 one bearing is shown in side elevation, the other in section. Fig. 7 also gives two views, the left-hand half looking at back, and right-hand half at *front*—or sail end—of the bearing.

The remainder of the casting, of which the lower part of the bearings form a portion, should be carefully studied. The right-hand half of Fig. 4 shows it in elevation, the left-hand in part section. Fig. 5 is a plan of it, one end having the bearing cut off at D D (Fig. 4) to show the T-section of its support. Figs. 8 and 10 also provide additional sections through this casting at certain specified positions.

The top part of the casting is flat, and is machined to fit neatly over the lower casting, to which it is secured by the six ½-in. bolts shown. The remainder is conical shaped, sloping down at 45 degs., and has six slots in the edge, all somewhat strengthened by extra thickness of metal around them. In these slots will run the journals of the little grooved wheels to be seen in Fig. 8, the other journals of which are carried by suitable holes in the lower casting. Four spaces O O are cut away to lighten the upper casting. They should be well bevelled to leave the sand freely, no cored holes being required in this pattern, although a three-part box will be needed to mould it.

Only one other point need be mentioned in connection with this casting, and this has reference to the two lugs seen on the back-bearing pedestal in Figs. 4 and 5. These lugs carry the hinge-pin for tail, which is not in this case a fixture.

The lower casting, whose principal objects are to prevent lifting of the whole of the revolving gear and to carry a bearing for vertical shaft, is shown partly in section and partly in elevation in Fig. 4. It is shown in plan in Fig. 6, the part broken away being precisely like the opposite side. It is again shown in various defined sections in Figs. 8 and 10.

The pattern for this casting is again somewhat awkward, but essentially consists of an annular joined to a central boss by six flat arms, and to an outer turned-up rim by six downwardly radiating arms. The outer rim, as seen by Figs. 4 and 8, performs the duty of preventing any lifting by revolving underneath, but very close to the fixed wrought-iron ring. It may touch this at times, but normally the six wheels (Fig. 8, etc.) will run on the square edge of ring and take all the pressure. Considerable care is required in making the requisite patterns to avoid either too great or too small a diameter in each case, as machinery should be kept down to a minimum.

Where the top and lower castings are bolted together, the surfaces must be machined, as shown by the letters M M. Holes for bolts and wheel journals must be drilled (Fig. 8), the latter being carefully marked off from the positions of slots in top casting, *after* bolting the two castings together. The central hole, into which a brass bush must be fitted for the vertical shaft, will have to be bored out. The bush is shown secured by a small set-screw, but may be equally well fixed by boring the hole very slightly taper, and turning outside of bush to same taper, the small end, of course, being downward. The pressure on top will cause the two to grip.

Lubrication of this bearing must be provided for by drilling one or two ⅛-in. holes diagonally through the web of bevel wheel and again through the collar shown under it. Oil will thus find its way readily to the bearing. The collar is merely a distance-piece, used to make up the requisite height of gear wheel, and its thickness will therefore depend upon the boss of the wheel chosen.

The small runner wheels (Fig. 9) will be of cast iron, with the spindle cast in. The spindle should be of mild steel, ¾ in. diameter, turned down at the bearings to 11-16ths in. diam., and left black or rough turned at the middle to afford a hold to the cast iron. The groove in wheel may possibly be good enough as cast, but will be all the better for being turned.

(*To be continued.*)

Model Steam Cargo Boat.

By H. G. Mugford.

The photograph represents my model steam cargo boat, which is 5 ft. long by 10 ins. beam and 9 ins. deep. She is built up of twelve pieces of copper. For the keel I had a long strip of ½-in. by ½-in. brass, to which I fastened by means of rivets the twelve pieces of copper. Starting from the bows and working aft I beat each piece of copper to its right shape. The joints down the side were secured by means of pieces of zinc 1 in. in width, laid on the two joints and soldered. After all the pieces were in their place, solder was run in the joints outside, and then the joints were all filed off smooth.

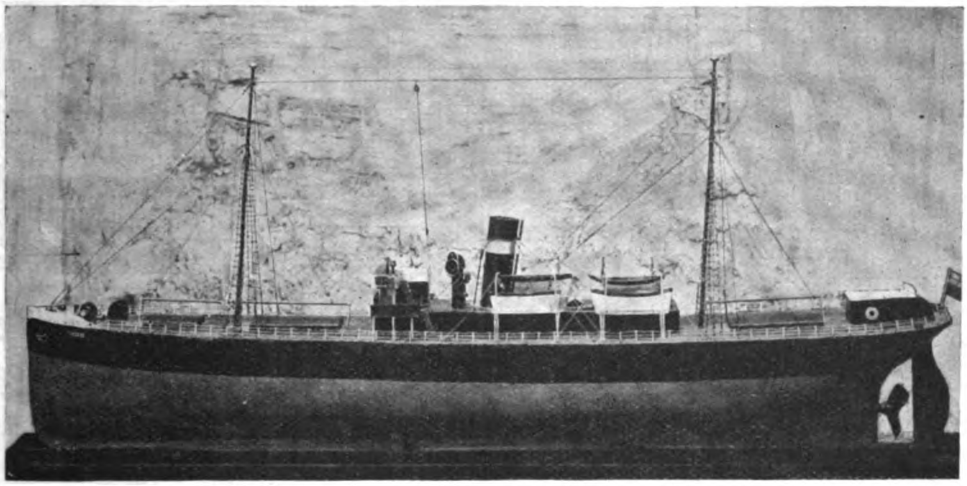
The deck is in one piece, and was made from an ordinary piece of deal ¼ in. in thickness. The deck houses, funnel, boats, bridges, and hatches are made of zinc. The main hatch is made to take off in order to get at the lamp, and also to see the water in the boiler. The boats are built up of strips of zinc to represent lifeboats. The railings are 1-in. wire nails, driven in ¾ in. apart for stanchions, around which is put very fine copper wire. The top rail is soldered to the top of each nail; the lower rails being only secured by means of a turn around each nail, the wire being kept tight and secured forward.

The masts and derrick poles are made from knitting needles, the rigging and stays being made of wire, as used for hanging pictures. For the ratlines I used carpet thread. The ventilators are made of copper; the steam capstan (which is not shown in the photographs, being put on board after) was made with the wheels of an old clock; the lifebuoys are rubber rings.

The boat is driven by means of a twin-cylinder vertical engine, ⅜-in. bore by ¾-in. stroke. The only castings were for the cylinders, which I obtained from a London firm, the rest of the engine being worked up from scrap. The cylinders and balance-wheel I had to get a friend to turn for me, as I have no lathe and very few tools.

The boiler was built to plans taken from The Model Engineer Handbook, "Machinery for Model Steamers," with the exception that it has no tubes. It is copper-riveted, and the ends are secured by means of two ¼-in. stays right through the boiler. It is lagged with three pieces of flannel, and covered with sheet tin, and secured by means of three brass bands. The boiler is fitted with steam and water gauges, safety valve, and force pump. The steam gauge is fixed between the ventilators, so that it can easily be seen.

Steam is raised by means of a spirit blow-lamp, which is made of two tins, and takes about fifteen minutes. She will then keep 15 lbs. of steam and drive the ship at a good speed for thirty minutes without any attention. I may state that it has taken me two years of my spare time to complete it.



Mr. H. G. Mugford's Model Steam Cargo Boat.

A Design for a Small Vertical High-speed Steam Engine.

(Supplementary.)

By R. M. de Vignier.

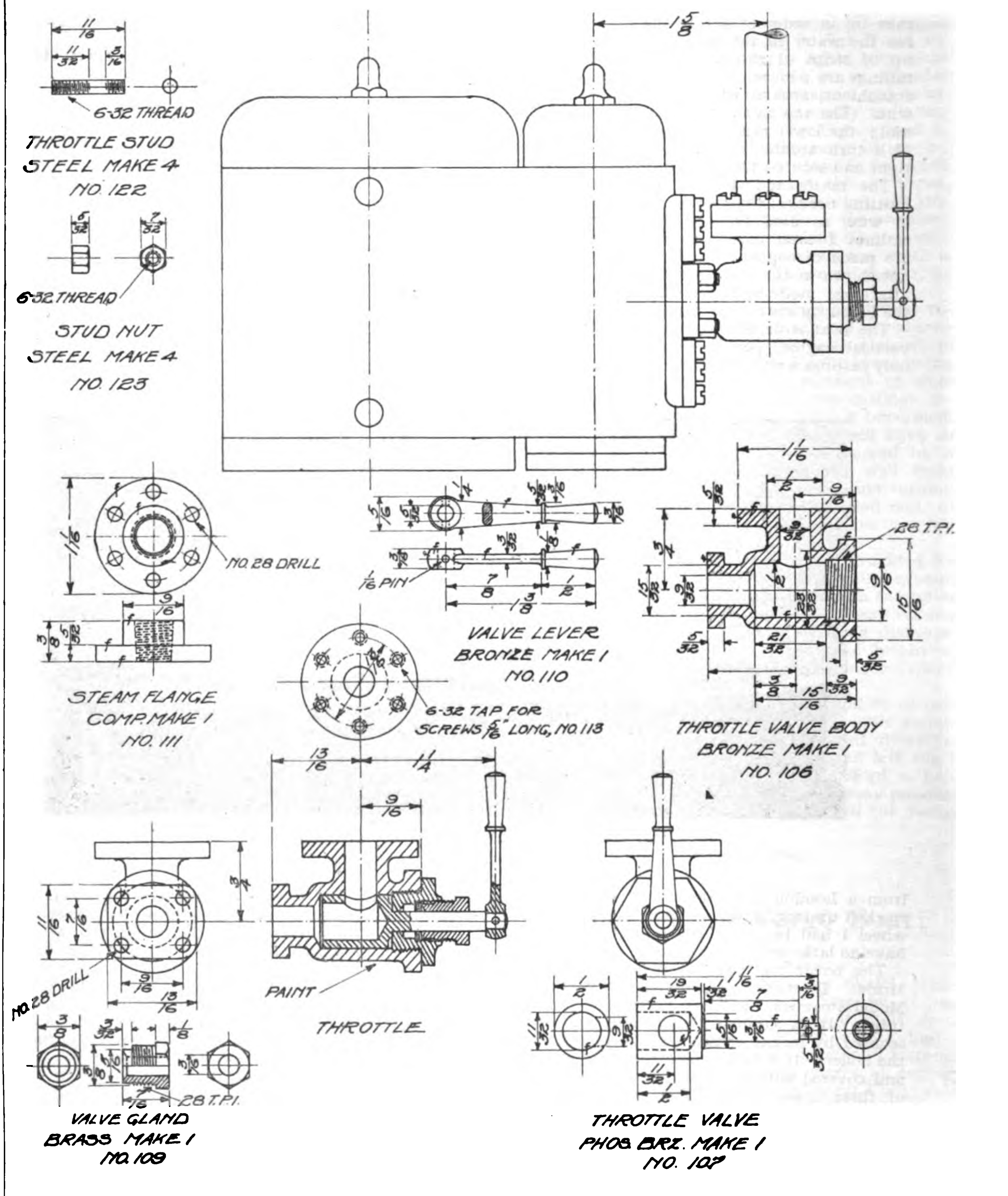
Since completing the design for a small vertical steam engine which appeared in The Model Engineer for Nov. 30, Dec. 7, 14, 21, and 28, 1905, Vol. XIII, the author has been requested to design a suitable throttle valve, the argument being that the ⅛-in. "Globe" valves on the market would appear cumbrous and out of proportion.

To meet this suggestion the accompanying design has been prepared, and in addition special drain cocks for both cylinder and valve-chest have been added.

Their use obviously enhances the attractiveness of the engine, and it is hoped that those readers who may have in mind the building of the engine will appreciate the effort which has been made to keep the supplementary parts as simple as possible.

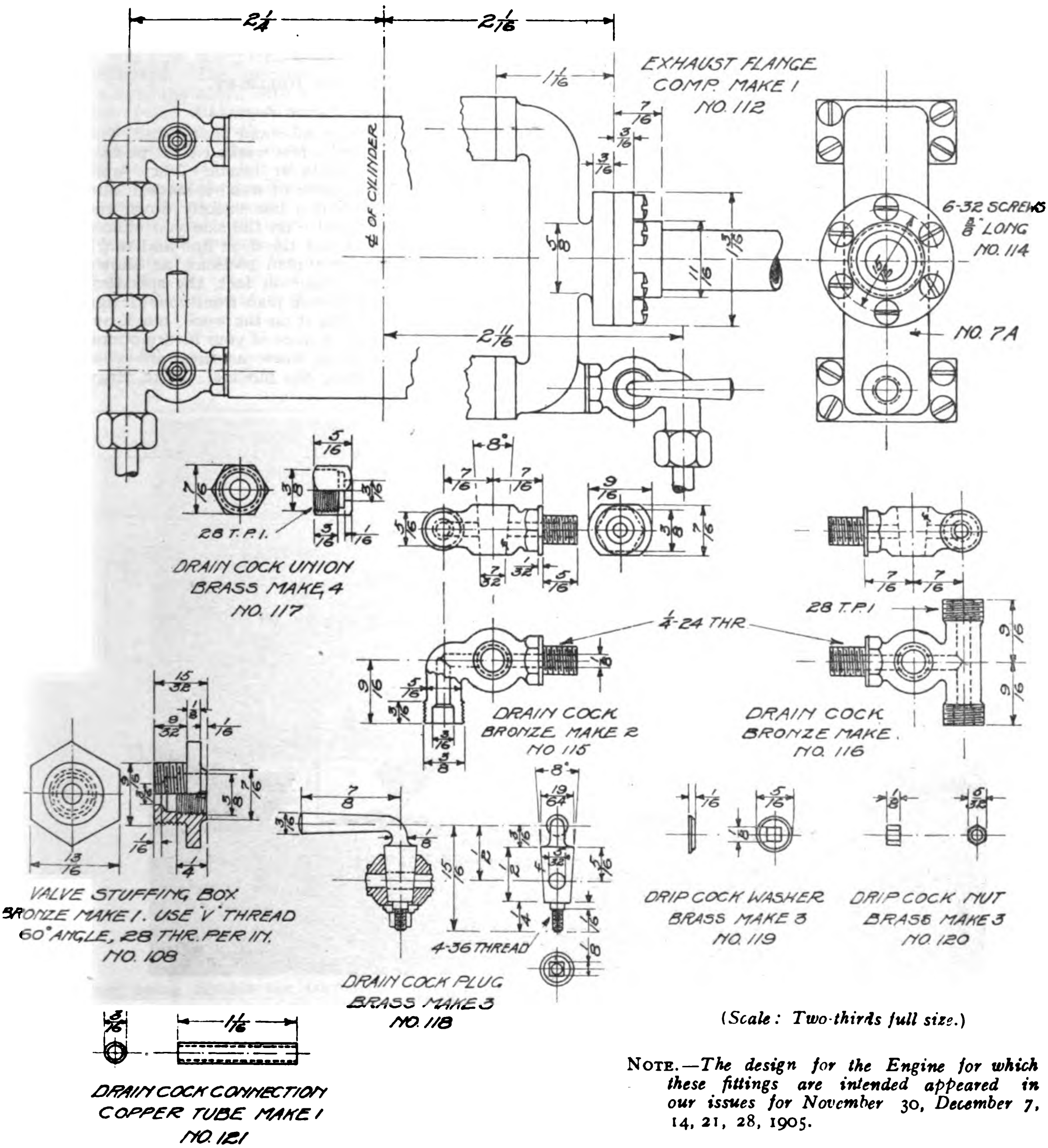
It will be noticed by a reference to the drawings that it has been no easy matter to bolt on a flanged valve in the small space between the peep-hole covers. In order to use the valve shown herewith, it will be necessary to omit the tapping of the hole for steam pipe in valve-chest casting, laying out instead four holes to the dimensions given in the rectangular flange of throttle valve, and tapping them with 6/32 thread to suit the four studs, No. 122.

The drawings clearly show method of attaching throttle, which, it will be seen, is of a standard type, and the details of which are such that a detailed description is superfluous. The valve proper should be ground into the body of the valve, and the friction of the packing will maintain the lever in any position.



DESIGN FOR A THROTTLE VALVE AND FITTINGS SUITABLE FOR A

For description]



(*Scale: Two-thirds full size.*)

NOTE.—*The design for the Engine for which these fittings are intended appeared in our issues for November* 30, *December* 7, 14, 21, 28, 1905.

SMALL VERTICAL HIGH-SPEED STEAM ENGINE BY R. M. DE VIGNIER.

[*see pages* 59 *and* 62.

It will be noticed that a revised drawing is given of the exhaust connection, No. 7, and is numbered No. 7A. This is necessary in order to preserve harmony of design, as the type of throttle chosen is flanged, and as it would be poor design to adopt a flanged steam pipe and a screwed exhaust unless the reasons for so doing were good.

Little need be said in regard to the drain cocks, except that one pattern will serve for all three, being made to suit No 116, and subsequently altered for the two castings of No 115, or the necessary alteration may be made in the rough casting with a hacksaw and file. The drain cock connection, No 121, is to be slipped into place much as one would insert a small gauge-glass, and after being properly packed with asbestos string, the unions will make a tight joint.

The other piping should be of brass or copper, 3-16ths in. outside diameter, and brazed or soldered to small ferrules with a shoulder to be gripped by union nut, as in the case of feed-pump connections. These tubes may be bent in to follow down the sides of standard, and should empty into the pan provided to catch drip from base.

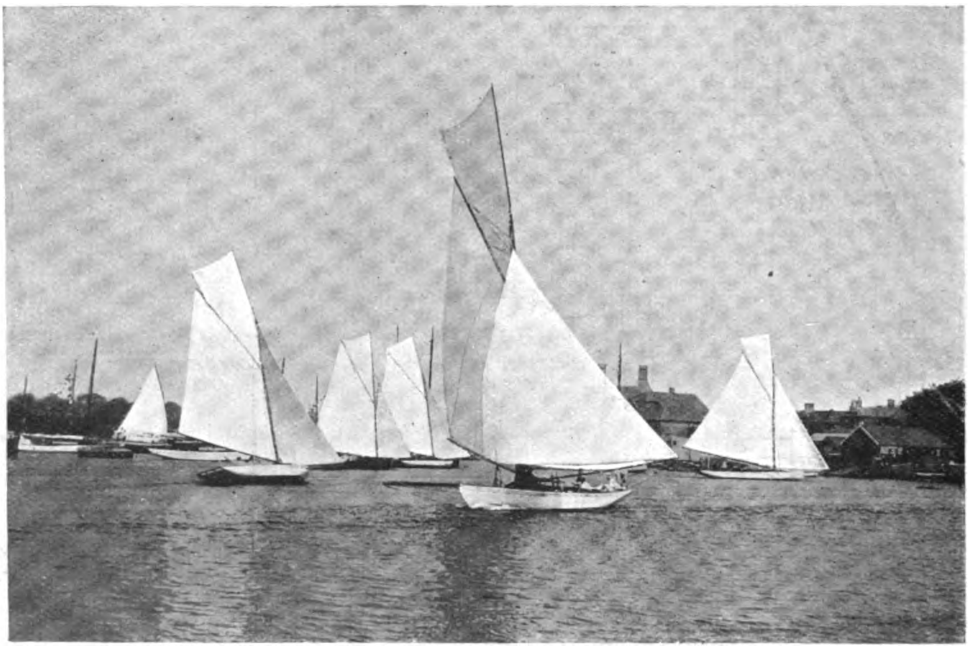
In regard to the concrete sub-base, a further word may not come amiss. This should be composed of a mixture of one part by bulk of good Portland cement to three parts of bank gravel of a sufficient fineness to pass a ¼-in. mesh sieve. This gravel will be found to contain sufficient sand for the mixture. The cement should be well stirred and "worked," and of a sufficiently "soupy" consistency to show a light film of water on its surface after being poured. It should be well rammed in mould, and allowed to harden until thoroughly set before attempting to break mould apart.

Model Yacht Building for Beginners.

By Arthur Rollesby.

(*Continued from page 34.*)

YOUR tools then are nice and sharp, and you have secured for a few weeks entire possession of small table or bench. Very well, now to work! Your block of wood is smooth and quite square; draw first a line exactly down the centre all the way round; on the side you choose to be uppermost trace out the deck line and mark the position of the body-plan sections, as shown in your half-breadth plan; in fact, the speediest way is to cut out your deck plan from your design with scissors, and, laying it on the wood, mark out with pencil; take care in none of your future operations to obliterate these lines, as they are your only guides when fitting the moulds. Next, draw on either side the curve of your boat fore and aft, as shown in the sheer plan. The appearance of your block should be as in Fig. 5. Now saw away the corners, x first and y last; if you have no saw, get a carpenter to do it cleanly for 2d. With your spokeshave pare away the sides till you have your deck shape in the wood absolutely the same as your paper pattern and design. Turn your block-deck down on the bench, and round away the edges left at the bottom by the saw till you have roughly the spoon-shaped outline of the vessel. Next, in order to get the lowest sweep along the centre line exactly like that in the sheer plan, cut a cardboard mould, obtaining the curve by tracing from the plan (the mould will,



Sloops racing on Oulton Broad.

of course, show the curve concave, not convex, as in the plan), and fit it down over the wood along the centre line, cutting away till the shape is accurate.

We will now also prepare the body-plan moulds in cardboard. The quickest plan is to put your design over the board with a piece of carbon tissue between (used in any office for duplicating), and trace the outline with a hard point. The point of intersection of the curves with the sheer line should be marked, but the section should from there be carried *perpendicularly* to the top line of the square, for at present the sheer is not to be cut in the wood; you are shown how to do this in the body plan at *x*, section 8.

The method of using the moulds is clearly indicated in Fig. 6; your boat is bottom up on the bench; put the point *a* of the particular mould

useful. As the boat gets thinner be careful you do not strike the gouge through the side; $\frac{1}{4}$ to $\frac{1}{8}$ in. is about the right final thickness for the boat; wait until you have quite finished the outside before you complete the hollowing. The wood at the top and along the centre line at the bottom may be left a little thicker for the deck and keel fastenings. You can now mark the sheer line curve and cut down the wood to it.

Now for the fin keel. You may make this of wood or sheet iron, as suits you best. If the former, get a piece of $\frac{1}{4}$-in. oak, or other strong wood, from a fretwood store, and cut it to the shape of the design, using a paper pattern; perhaps you will be able to do this with a fretsaw. Have eight brass angles made at an ironmonger's; screw these

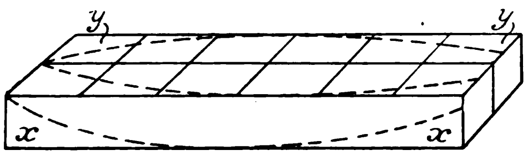


FIG. 5.

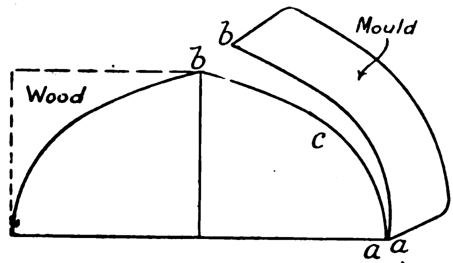


FIG. 6.

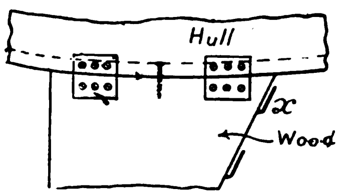


FIG. 7.

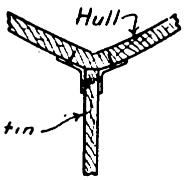


FIG. 8.

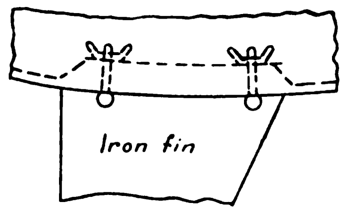


FIG. 9.

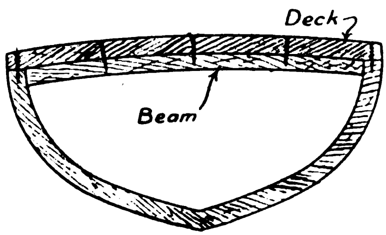


FIG. 10.

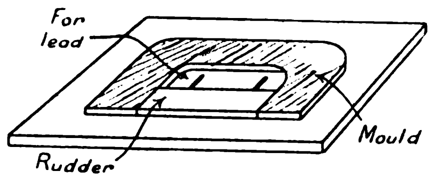


FIG. 11.

DETAILS OF MODEL YACHT CONSTRUCTION FOR BEGINNERS.

you are using against the corresponding point *a* of the boat (formed by the cross line meeting the deck line), and fit the point *b* down to point *b* on the centre line, cutting away the wood with your spokeshave at *c*; *a* and *b* are, of course, *perpendicular* to each other, and to make sure of having this so you should mark the place of each section along your bottom centre line. When you have fitted all the moulds you will have the outside of your boat completed in the rough. By the way, you will find a small block of wood screwed on the bench useful to steady the boat when you are working; you can also put the ends of spars, etc., against it when you are planing.

Next, you must hollow out your vessel. This is done with the gouge; for the rougher work you will find a mallet, or hammer with a wooden head,

first to the fin and then to the hull, with brass screws. To make the fin still more secure, pass through from inside two or three long screws; the method is shown in Figs. 7 and 8.

If you desire the iron fin, get an ironmonger to cut it from sheet-iron, and solder to it four stout "butterfly" screws and the rudder pintles *x*, and also drill two holes for the rivets of the lead bulb. To fix it, drill holes through the bottom of the boat (of course, exactly perpendicularly) for the threads of the screws, and jam tightly with the flanged heads (see Fig. 9). This method will cost you a little more, but is really more satisfactory than the wooden fin, owing to the difficulty in fixing the latter firmly.

Now put two beams across the boat—one at the mast and one midway between that and the stern, as shown in Fig. 10. They may be cut from any hard piece of wood, and should be somewhat curved to increase the air capacity of the boat; they support the deck and strengthen the hull.

Next the deck: mark out by turning the hull down on it, cut out, and make a hole through it for the mast; give it a coat of white paint, and do likewise to the inside of the boat (see that the holes for the fine screws are made water-tight with white lead); fasten it down with short brass screws to sides and beams, with a layer of white lead between.

Now, with your little iron plane, go over the entire outside of the vessel, taking away any lumps and unevenness, and planing the edge of the deck level with the side; and, finally, give a coat of white paint all over.

The lead bulb remains. Float the boat in a bath, placing weight on deck till she sinks to the water line, which should first be marked in pencil; you will thus learn the weight of lead required, subtracting ½ lb. for weight of spars. The bulb is made in halves. Prepare a wooden model of half the cigar-shape shown, put some sand in a box, press the shape into it and withdraw, taking care the top is level. Melt your lead in a ladle, and pour carefully into the two hollow moulds. Mind the sand is not too damp, or you may have an explosion, and take care not to spill any of the lead on the carpet. Tie the two halves to the fin with string, and putting your ship in the water, shift them backward and forward till the correct water line is reached, planing away the bulbs if over weight, and seeing that their shape remains regular and their weight equal. Finally, drill holes opposite those already made in the fin, and rivet or put wooden pegs through, taking care not to bend the iron support.

Now that the lead is hot make three rudders. Their shape is shown in the sheer plan, and Fig. 4 tells you how to set to work; the part next the fin is of any thin wood; into it you fix brass screw-eyes opposite the rudder-pins on the fin. The weight of the rudders should be about ½ oz., 1 oz., and 4 ozs.

And at last you can take a breath, for there is your boat, looking still a little unfinished, but very workmanlike. In the next article we shall rig her, and adorn her suitably for her entry into the polite society of yachting circles.

(To be continued.)

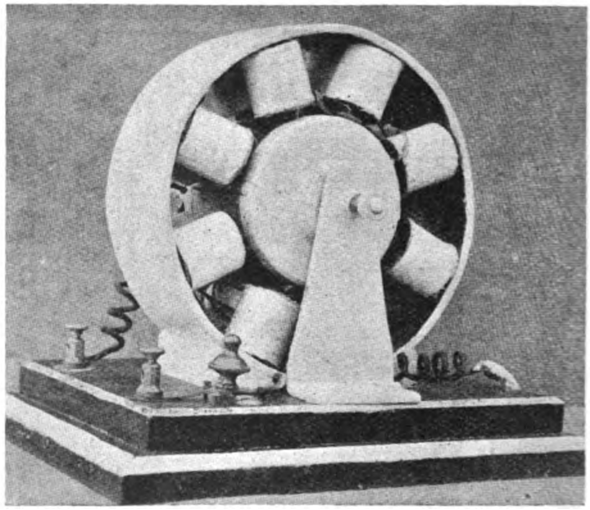
The Sixth "Gauge" Competition.

To further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th.

A Small 16-Pole Magnetic Electro Motor.

By E. J. Sladden.

The principle of this motor is taken from the small model tram car motor described in The Model Engineer handbook, "Simple Electrical Working Models." This motor, which I have made, works splendidly (hums round with



A Small 16-pole Electro Motor.

4 volts), although the magnets are only made from 3-16ths-in. galvanised iron wire. Materials bought were as follows:

1 ft 8 ins. iron hooping, 2½ ins. by ⅛ in., for ring of field-magnet; 1 ft. iron hooping, 2 ins. by ⅛ in., for bearing standards; 2 ft. 6 ins. ½-in. round iron, for field-magnet poles; 1 ft. 8 ins. iron, for armature, ¼ in. by ⅜ in. I used ⅜ in. by ¼ in., and cut it down the centre. One lb. No. 26 s.c.c. copper wire for bobbins—1 oz. on each; 7 yds. bell wire, for connections.

The field-magnet was made first. The 2½-in. hooping was marked off, as in Fig. 3, and drilled with sixteen holes ⅜ in., and two small holes at each end for fixing to base. The next I cut sixteen pieces of the ½-in. round iron 1 9-16ths ins. long. A shoulder is required on each. I used the lathe-rest for this, taking out the T-piece; a piece of wood was put in the hole so as to allow the iron pieces to stand up about 3-16ths in., using a file to make the shoulder with. The tightening screw formed a clamp. The iron ring has the ends filed square and bevelled on the inside, as shown in Fig. 1. The rounding of the ring was done by hammering between the holes, starting at each end and working to the middle with the ball end of hammer, being trued to a cardboard disc 6 ins. diameter. After the pole-pieces are all riveted tight, the whole lot is put into a fire to get red hot, and left to cool in the ashes. After it had cooled (which took all night) I filed it up clear and filled the V-joint with solder. The armature was made next. This is a piece of wood turned, and eight pieces of iron (which had been softened), ¼-in. by ⅜-in. by 2⅜-in. long, let in. The grain of the wood should run with the spindle, this being much the best way, as it is easiest for working. The end view of this is shown in Fig. 1. The length is 3½ ins. including pulley, which is 1½ ins. diameter by ½ in. The spindle is a piece of ¼-in. steel 5½ ins. long.

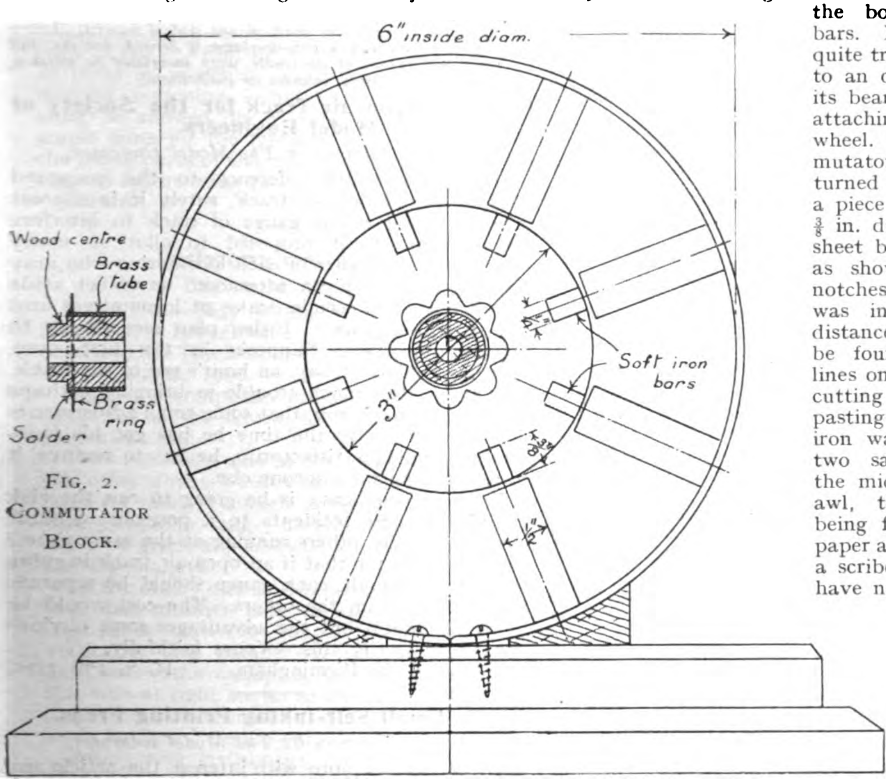


FIG. 2. COMMUTATOR BLOCK.

FIG. 1.—SECTIONAL ELEVATION OF MOTOR. (*Half full size.*)

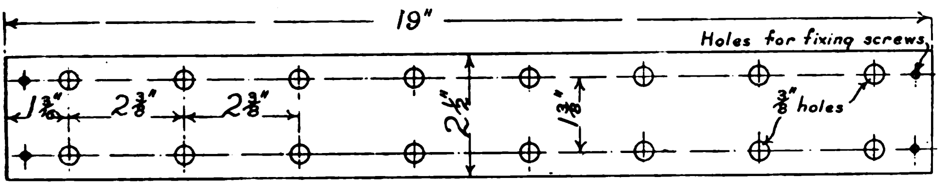


FIG. 3.—MARKING-OFF FOR FIELD-MAGNET. (*Quarter full size.*)

The armature is set on the spindle 1⅛ ins. from the commutator end. The bearings are made as shown in Fig. 5. The pieces of brass tube are 9-16ths in. in length. Two holes are drilled in the bottom for fixing to bars. If the armature is not quite true it may be screwed to an odd piece of board in its bearings and revolved by attaching a cord to the lathe wheel. When true, the commutator block is put on and turned to the right size for a piece of brass tube about ⅝ in. diameter. A ring of sheet brass was soldered on as shown in Fig. 2, the notches being filed after it was in place. The right distance for the notches can be found by drawing the lines on a piece of paper and cutting the centre out, then pasting it on the brass. The iron was let in by making two saw-cuts and getting the middle out with a bradawl, the correct positions being found by a piece of paper as before. If you have a scriber, all the better. I have not, so I used a pair of ringed compasses the same way, to mark the lines across the wood for the iron to be let in. The base is of wood 9 ins. long by 7½ ins. wide and about 1 in. thick. Two bevel pieces are made to fit the ring, as in Fig. 3. Sixteen bobbins are made ot brown paper tube with cardboard ends, 1 oz. of No. 26 wire on each bobbin. I wound them with a coil-winding machine, as described in THE MODEL ENGINEER, August 17th, 1905, page 160. The coils are put on the cores and

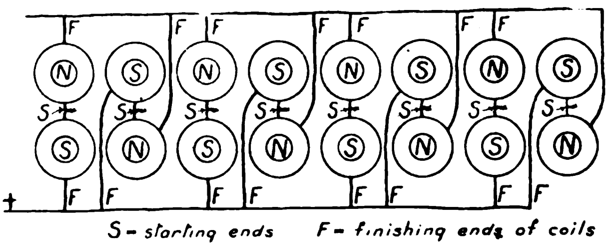


FIG. 6.—DIAGRAM OF CONNECTIONS.

fixed with a little glue, connections being made as Fig. 6. The brush-holder is made and cut out after hole has been bored to fit on bearing tube,

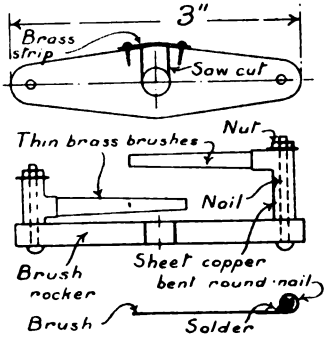


FIG. 4. BRUSH HOLDER.

as shown in Fig. 4. A piece of brass on the top holds it firm. The armature and bearings are set in place. One brush presses on the plain brass tube and the other on the ring. This saves the current having to find its way through the bearing.

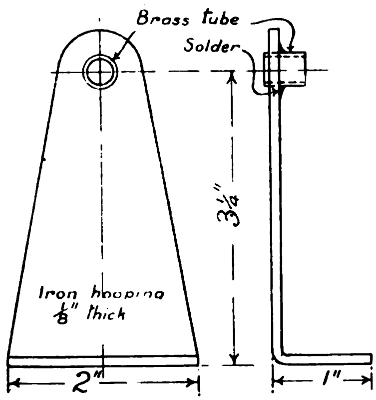


FIG. 5. BEARINGS.

A nut is put on the opposite end of the spindle to prevent end play. A switch is fitted, as shown in the photograph. This motor works well, about 650 r.p.m. with 4 volts. The direction of running may be reversed by moving the brush-rocker.

For the Bookshelf.

THE JUNIOR INSTITUTION OF ENGINEERS: JOURNAL AND RECORD OF TRANSACTIONS, 1905–1906. Vol. XVI. London: Percival Marshall and Co. Price 10s. 6d.: postage 5d.

This volume contains the papers, and discussions of the Twenty-fifth Session of the Institution. From amongst them, the following may be mentioned: "Some Notes on Boiler Trials," "Electric Oscillations and Wireless Telegraphy," "Some Recent Electrical Measuring Instruments," "Gas Engine Indicators," and others. Reports of visits to works, inspections, etc., financial statements, correspondence, and other miscellaneous items are recorded. The volume is full of interesting matter.

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 intended for publication.]*

Proposed Open-air Track for the Society of Model Engineers.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—With reference to the proposed outdoor model railway track, surely it is a great mistake to allow one gauge of track to interfere with others. Is it proposed to allot so many minutes to the owner of each locomotive who may turn up on any given afternoon, or to set aside certain days for certain scales of locomotives and run several at once? Either plan seems open to serious objections. Suppose, in the first case, someone is allowed, say, an hour's use of the track, and finds, after much trouble in bringing perhaps a heavy engine to run, that some small adjustments are necessary. By the time he has got his locomotive running satisfactorily, he has to remove it to make room for someone else.

In the second case, is he going to run the risk of collision and accidents to a possibly valuable locomotive with others running at the same time?

It seems to me that if an open-air track is going to be made at all, each gauge should be separate and distinct from the others. The cost would be more, no doubt, but the advantages seem obvious enough to justify this.—Yours faithfully,

Solihull, near Birmingham. H. S. PHILLIPS.

Re Small Self-inking Printing Press.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I note with interest the article and illustrations by Mr. J. R. Brown, which appeared in THE MODEL ENGINEER a short time back, and am pleased to find that there are at least a few "live" printers (if amateurs) amongst your readers. Although a printer myself (and this must be my excuse for writing), I take a great interest in your valuable paper, and through the medium of THE MODEL ENGINEER I ask Mr. J. R. Brown if he will kindly answer the following questions. He states that "there are several small printing machines on the market, but they only can be used with 'special sized type,' and, having plenty of 'full-sized type' . . . I set to work to design one for addressing envelopes and post-cards." Now, I may say that I have seen many small machines, such as the "Excelsior" (of which this seems to be a pattern), also the "Model," "Cropper Hand-press," "Simplisimus," etc., but I have never seen one that will not take "full-sized" type.

I should be very glad if Mr. J. R. Brown would inform me the names of the machines that will not take "full-sized type," also what is "full-sized type"? I note, also, that he allows six months for seasoning rollers; surely, he means six weeks?—Yours truly, "TYPO."

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In reply to "Typo," *re* Self-inking Printing Press: (1) The description of printing machines referred to are to be found in D Catalogue, pages 87–88, of "Wiles' Model Dockyard," 36-38, Market Street, Manchester, and are called "American Presses." (2) Before commencing my machine I wrote to Mr. Wiles asking if the American machines mentioned in his catalogue would take full-sized type, and the answer came back "No." Full-sized type I presume to be 15-16ths in. in depth. (3) With respect to the six months' seasoning, I said "*were allowed*," and *not* must be allowed, for I understand three weeks is ample time for the purpose. Being engaged with the other parts of the machine, six or eight months elapsed before using the rollers.—Yours truly,

Bolton. J. R. BROWN.

Reflecting Galvanometer.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—May I suggest an improvement in Mr. Delves-Broughton's reflecting galvanometer, described in THE MODEL ENGINEER for December 13th and 27th, 1906.

Make the compound needle ¼ in. longer than is suggested in the sketch, the addition being to the suspension end.

Bore *two* holes, one at the end for the fibre and the other about 3-16ths in. lower, this hole to be large (or small ?) enough to take a piece of 20 G. Al. wire 5-16ths in. long; note that the flattened wire must be given a ¼-in. twist between this hole and the top magnet.

In the centre of the distance bolt, just above top coil, drill another hole to take another piece of aluminium wire (20 gauge), this wire to hang vertically, and parallel to the suspension fibre. Just below the crosspiece in "needle bar," bend this wire at right angles to itself, towards "needle bar," and form a small (3-16ths in.) loop at end, so as to encircle "needle bar."

After using instrument, unwind fibre by means of milled bead and allow weight of needle to be supported by ring.

In the instrument which I intend making on the lines of this excellent article (please let us have a few more from the same source), I shall, in addition to the above fitment, also use a piece of fur, or suchlike stuff, to catch the damping vane when lowered, and so make the galvanometer long lived in a world of domestic cleanings up.—Yours truly,

Middlesbrough, Yorks. LEE SHEPPARD.

An Exhibitor's Grievance.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Thinking my experiences at a recent exhibition (advertised in this paper), and which took place in November, might be of interest to a good many readers, with the Editor's kind permission, I will enumerate some of my grievances *re* the treatment o models entrusted to them for exhibition.

The model exhibited by the writer was a small centrifugal pumping engine, described recently in this paper. Great care was taken in packing the model, so that it was impossible for it to get damaged when despatched by me, the complete model being screwed by two screws firmly to the bottom of the case and paper packed tightly round it. But when it was returned, only one screw was inserted, and that was not screwed up so as to keep the model down to the bottom, with the result that the engine was wrenched off the stand and the stand chipped. This may have been the cause of the damage, but I have very good reason to believe that the model had been dropped previous to being placed in the case, as the cylinder lubricator was bent in two places, and I am certain this could not have been done while it was in the box, as the engine could only have had a 1½-in. play in the box, badly packed as it was. To do this damage a considerable blow would be required.

When compensation was claimed, they had the audacity to say that the model was packed better than when they received it. Surely this disgraceful treatment is enough to discourage anyone from sending a decent model. In conclusion, I may say that I hope model makers who read this may take this as a warning and think twice before entrusting valuable models with, so-called, industrial exhibitions. I trust that readers will not think this is a prejudiced letter, written because I was not satisfied with a prize. I may say that it was "highly commended," at which I was fully satisfied, there being no less than 1,400 entries.—Yours truly,

W. T. W. ROLLS.

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 Thursday evening, January 3rd, a limited number of the members participated in a visit to the printing office of the *Daily Mail*, and under the guidance of Mr. Holdon, were shown the last few thousand copies of the last edition of the *Evening News* being struck off the presses. Those members who had not before seen a modern newspaper press were much astonished at the speed at which newspapers are printed, the paper in question being printed, folded, counted, and delivered in quires by the press at the rate of 96,000 an hour, the paper traversing the machine at the rate of between 35 and 40 miles an hour, to the accompaniment of such noise as to render talking an absolute impossibility. The presses are direct-connected to electric motors, each of 60 h.-p., and the starting and stopping gear was worked and examined with much interest, as also the method of dealing with and placing in position the enormous rolls of paper and the conveying of the papers to the clamouring throng of newsboys waiting to receive them. The party was then handed over to Mr. Griffin, under whose guidance the members examined a large number of Linotype machines at work, one of the operators kindly dissecting a great portion of his machine and explaining its wonderful construction and the uses of its many intricate parts. Visits were then made to the stereotyping and advertisement composing departments, and a most interesting visit brought to a close.

FUTURE MEETINGS, ETC.—Saturday, January 26th: Visit to the Great Western Railway engine sheds at Old Oak Common. Members wishing to participate should inform the Secretary at once. Ladies will be allowed to join the party. Last date for joining party, January 23rd. Wednesday, January 30th: Meeting at the Cripplegate Institute at 7 p.m. Paper by Mr. W. J. Tennant on "Some Mechanisms."—Particulars of the Society and forms of application for membership may be obtained from Herbert G. Riddle, Hon. Sec., 37, Minard Road, Hither Green, S.E.

American Society.

New York.—The regular monthly meeting of this Society was held at the Berkeley Lyceum, N.Y. The paper of the evening was read by Mr. F. A. Tuttle, of Newark, on "Gas Appliances for the Machine-shop." He commenced by describing the two forms—natural draught and forced gas furnaces—then took up the various forms of furnaces for smelting, case hardening, tempering, brazing, colouring, and enamelling, covering almost every industry from the blacksmith's shop to the manufacturing jeweller, and concluding a most interesting paper with reference to gas burner furnaces most suitable for the model engineer's workshop. The paper at the next meeting will be read by Mr. R. M. de Vignier on the "Designing of Model Steam Engines." For further particulars of the Society address the Secretary, Mr. W. E. Spon, 123, Liberty Street, New York, U.S.A.

Catalogues from any foreign house will be gladly accepted, but senders must put on sufficient postage, otherwise they will be refused.

Junior Institution of Engineers.—On Saturday, January 19th, at 2.30 p.m., a party will visit the Royal Naval College, Greenwich, for inspection of the new engineering laboratory.

Model Yachting Correspondence

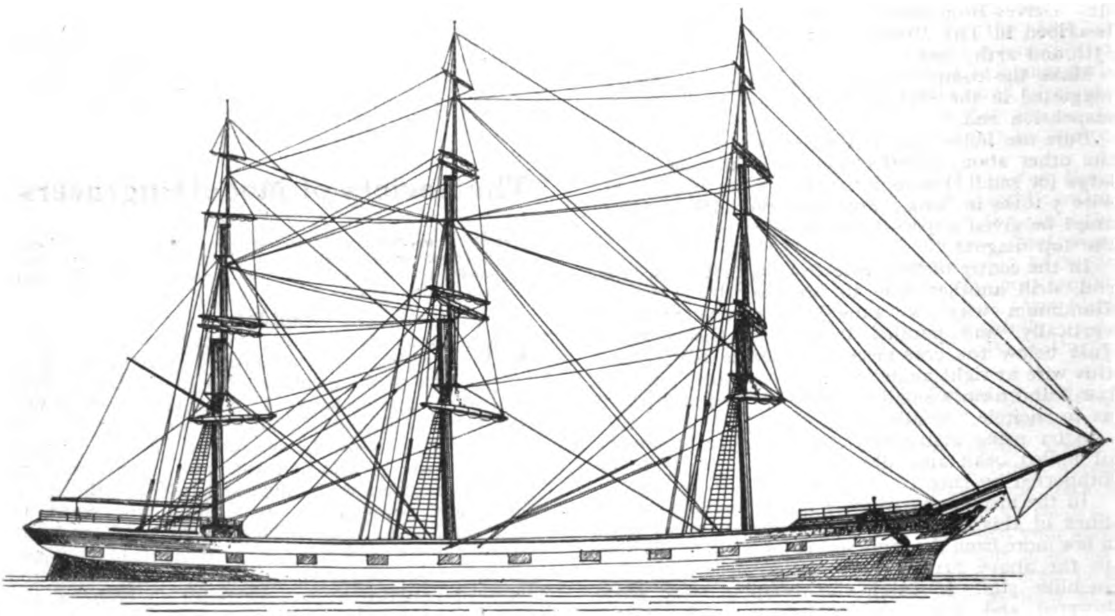
Model Full-rigged Ships.

To the Editor of *The Model Engineer.*

Dear Sir,—The photographs that appeared in December 13th issue of The Model Engineer were of considerable interest to me, and I judge it is of this class of sailing craft that "W. H. T." wishes to build a model.

I am sending a sketch of a full-rigged ship, very similar to the *Macquarie*, in so much as she carries double gallant yards.

The sketch is intended to show the running rigging. I have modified the rigging, but have left sufficient to give a realistic appearance without being very troublesome to handle.



Modified Sketch of a Full-rigged Ship.

I have shown all the back stays that are necessary, also the ties of the upper topsail yards, and the lower gallant yards. I will explain these ties in the course of a few weeks. The slack lines under the fore, main, and mizzen stays are for jibs and stay-sails.

If any reader would like, I should be pleased to send a sketch of a four-masted barque carrying double gallant yards with sails set for a fair wind.

I may also say that I am just finishing a foremast of a full-rigged ship, with sails, standing and running rigging, etc., and if it is of any interest to "W. H. T.," I would be pleased to lend it to him for inspection if he will send me his address.

The sketch herewith is not drawn to a scale, but is fairly proportionate.—Yours truly,

Manchester. Tom Hardy.

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:—

[17,093] **Voltage of Accumulator Cells.** C. L. J. (Stratford) writes: I am making an 8-volt accumulator. I have a glass case by me which I want to divide into four parts. What I want to know is, what preparation can I use for sticking the partitions in with? They are made of glass. I have your handbook on Accumulators, but you do not state this. I have tried several glues, but the sulphuric acid burns it away. Will you also tell me how many parts of water to an ounce of chloride of lime would be required for the forming of accumulator plates?

(1) This cannot be effected satisfactorily, as the slightest leak from one cell to the other brings the voltage down to that of *one* cell, viz., 2 volts. We advise you to obtain other cells, or else be content with the lower voltage. (2) Make a saturated solution—*i.e.*, dissolve as much as a given quantity of water will hold in solution.

[17,098] **Special Daniell Batteries.** E. C. (Leeds) writes: I am desirous of making a Daniell battery in the form of a trough, five cells in each trough. I purpose making the trough of wood, separating each cell by wooden partitions, and the zinc from the copper by a porous plate. If I coat the woodwork well with tar, will this arrangement make an efficient battery? I am at some loss where to obtain porous plates for the cells, but have seen the arrangement many a time. Kindly give me name of firm from whom I may obtain same. Size of porous plates about 4 ins. by 4 ins. The Midland Railway Company use Daniell cells made up in this manner.

Whitney or Thompson would supply you. Drop them a card asking for quotation.—117, City Road, E.C., and 28, Deptford Bridge, Greenwich, respectively.

[17,099] **Running Small Motors from High Voltage Supply.** J. K. (Park Lane, W.) writes: I have a "Don" motor which runs well with a current of 4 volts 4 amps. I wish to run it from a 200-volt continuous main, but estimate that six or eight 16 c.-p lamps would be used, which is very extravagant. I should like to know if it would be possible to wind this motor to take less current at a higher voltage, and, if so, what size wire would be required to run it, with as few lamps as possible? I have several twopenny tube electric locomotives which take about 4 volts 4 amps., and one specially wound which runs beautifully in series with one 16 c.-p. lamp. Could I wind the others to work like this? Am I right in supposing that by winding the field-magnets with very thick wire, and the armature with very fine wire, the voltage at which it will run is increased with a proportional reduction in current? If this is not the case, would you tell me how to regulate the current consumption? Is it possible to reverse small motors like the "Don"?

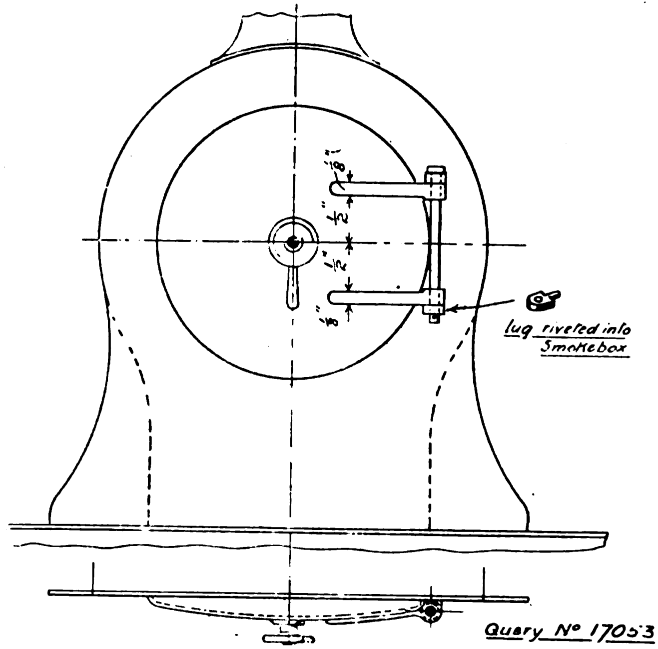
If you rewind armature and fields with a fine gauge, say No. 30 S.W.G., machine will take less current. Do this, and then try it with first one 16 c.-p. lamp, then add more in parallel if required. If machine is shunt wound, use fine wire on the fields. If series wound, probably more turns of the same size will be required. To reverse, alter the direction of flow of current in either the field or the armature, bnt not both.

[17,066] **Brake Horse-power of Small Oil Engine.** A. E. J. (Sittingbourne) writes: I have an oil engine, 3-in. bore, 6-in. stroke, fitted with two flywheels, 17½ ins. diameter, 2-in. face, running at 350 revolutions. Engine is also fitted with governors. Would the 500-watt machine given in "A B C Dynamo Design," by Avery (third edition), be suitable for this engine? The engine is at present working a 3½-in. lathe. The idea is to light workshop whilst lathe is in use, and then to be able to switch on extra lights when lathe is at rest.

If engine is of good design and well up to its work, it might just manage to do this, but speed would have to be increased to about 500 probably. Your best plan is to make a brake test of the engine, and find out exactly what power it will give. The 500-watt dynamo will take 1 b.h.-p. to drive it. An article in the November issue of *The Engineer-in-Charge*, 3d. post free, gives full details of how to make a brake test. See also "Gas and Oil Engines," by Runciman, 7d. post free.

[17,053] **Smokebox Door for "Dunalastair" Locomotive.** H. A. S. (Ayr) writes: Kindly give rough sketch of hinges of smokebox door, and of their attachment to front plate.

We herewith publish a drawing of the smokebox door and hinges for the model ¾ scale "Dunalastair" locomotive to a scale of half full size. Where the smokebox door is made of plate dished out, you will have to attach steel strip with eyed-ends to the door to form the hinges. You can, however, make a wooden or metal pattern of the door (which will incidentally save you the equal trouble of making dies or blocks to perform the dishing operations), and attach the strips and centre boss to the pattern, taking an iron casting, which can now be obtained remarkably clean, from the whole.



DETAILS OF SMOKEBOX DOOR AND HINGES FOR ¾-SCALE MODEL "DUNALASTAIR" LOCOMOTIVE. (*Half full size.*)

File and polish the strips, drill the holes for the hinge pin, face the centre boss and the seating of the door, and you will have a perfect and substantial door. Take a recessing cut on the smokebox front to ensure an airtight joint. The hinge brackets on the front plate may be made out of steel, and riveted on as indicated in the drawing. Any further particulars we shall be pleased to supply.

[17,111] **Miscellany.** T. G. G. B. (Penzance) writes: Could you please answer the following questions:—(1) I have been running a 4-volt 4 c.-p. "Osram" lamp with 2 volts. Has this any advantage over a 2-volt 2 c.-p. lamp? Do I get more light or save any current? (2) Does the capacity of an accumulator depend on the area of positive or negative plates, or both? (3) What current does a quart size Daniell cell give? (4) How many amp.-hours does the above cell give? (5) Would four Daniel cells be more suitable for lighting a 4-volt 4 c.-p. "Osram" lamp

than the non-polarising bichromate described in your handbook or any other (primary) cell? The light will be used once a day for two hours. (6) How many amp.-hours would a quart size battery like the above give? (7) What has to be replenished when it runs down? (8) What are the advantages of using in a Daniell zinc sulphate instead of sulphuric acid? What chemical change takes place? Is copper deposited on the copper plate? Is the zinc wasted? What needs replenishing when it runs down? (9) Is it true that dry cells will only furnish a current for short stretches of time? I have my 4-volt 4 c.-p. "Osram" lamp worked by two moderate-sized dry cells for an hour on end, and can hardly perceive any alteration of light. (10) Are there such things as watt meters? How do they work? (11) Is there a dry form of the Daniell cell? Is it constant? (12) Is the single fluid bichromate suitable for electric light? How many amp.-hours does it give on one charge? Which solution gives best results—the bichromate of potash or chromic acid?

(1) If you get a greater candle-power, of course you obtain more light. It is a matter of observation or test. (2) Both; but one generally works upon the positive. See previous reply. (3) Depends on resistance of circuit and internal resistance of cell. (4) Find by trial. (5) No. (6) See above (4). (7) Usually the copper sulphate. (8) Some are claimed but cannot be fully explained here. See "Primary Batteries," by Cooper. (9) Yes, if a heavy current is taken from them. (10) See text-books on Electricity (11) No. (12) Yes; on a very small scale.

[16,987] **Very Small Electric Motor Launches.** F. B. (Surbiton) writes: May I respectfully ask your valuable advice on the following? What would be practically the *smallest* size model launch I could work with an electric motor and accumulator?—say, 12 ins. or 14 ins. long. What style of motor should I model from to get the greatest power for the size you recommend; also, accumulator? I shall try with several small propellers to obtain the greatest speed (consistent with the lines I model), as I am trying hard to make the smallest boat to do a great speed. I am finishing my steam launch, which I have got to 20 ins. long, so far very satisfactory. I thought the electric power cleaner and more compact for still smaller trials. I should be glad to give you results in due time for your Paper, and thank you for any suggestions.

The matter is one for experiment. A hull 12 ins. or 14 ins. long and of fair beam and draught, say 4-in. beam and 3½ in. draught, should carry a 5 or 6 amp.-hour accumulator capable of driving a 5-watt motor fairly well. Your best plan is first to get your hull, then see what weight it will carry, then buy your cells and motor to suit. You will find it a difficult matter to get high speed out of a small craft, and nothing but experimenting will help you. The one drawback to electric power is, of course, the weight of cells. Thompson, of Greenwich, would make you a small efficient motor.

[16,889] **Electric Bell System for Three Rooms.** S. B. (Liverpool) writes: Will you kindly furnish me with a diagram of the wiring for three rooms (A, B, and C) with electric bells, so

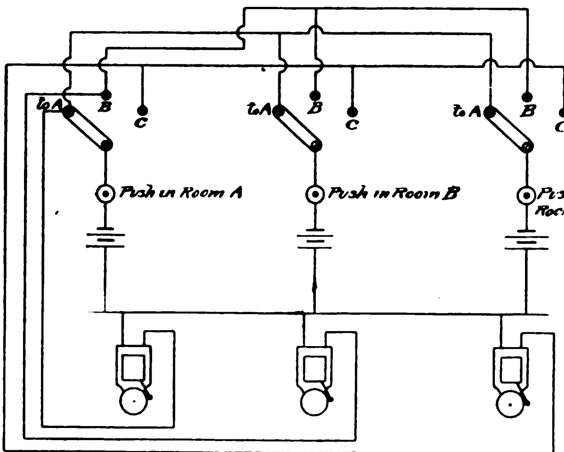


DIAGRAM OF ELECTRIC BELL CURRENT FOR THREE ROOMS.

that each room will have a bell and a push. Also that C shall have a switch in order to control the other two rooms, so that A and B can ring to C, or C can ring to A cutting off B, or C can ring to B cutting A off. Also, if the switch is left in a certain position A can ring to B.

To enable one push in each of three separate rooms to ring at will one of any three bells, the system of wiring shown in sketch will be required.

[17,002] **Charging Switchboard** "PERPLEXED" writes: I enclose rough sketch (not reproduced) of charging board. Will you kindly favour me with connections for wire. I want to use it for charging accumulator from dynamo giving 25 volts 4 amps.

Even this diagram is not much clearer than the last you sent us, but the necessary connections for wiring up accumulators from dynamo will be as sketch. The voltmeter may be connected

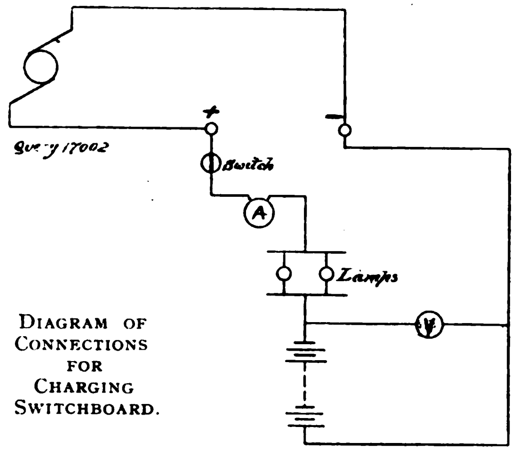


DIAGRAM OF CONNECTIONS FOR CHARGING SWITCHBOARD.

across either at the dynamo terminals, or at cell terminals, as you choose. Although you show lamps on your sketch, these will not be necessary if voltage of dynamo is well suited to the requirements of the case—*i.e.*, is about 25 per cent. higher than that of cells to be charged.

[16,977] **Tesla Coil Work.** W. H. (Anerley) writes: I have constructed a Tesla coil, to work with a small induction coil giving ½-in. spark, from the instructions given in THE MODEL ENGINEER during May, 1906. It is an exact copy of the one described in the article except for the fact that I have used No. 36 wire instead of the wire stated in the article (No. 28, I think), and I have not varnished the pasteboard tube nor the secondary coil. On connecting up the coil as per the instructions given, and on presenting my knuckle to the top secondary terminal, I certainly got a spark, but it was very weak and thin—about 1-16th of an inch in length. And, on fastening a point in the terminal, it required me to place my hand about a ¼ of an inch away before the brush discharge appeared. There was a very bright spark at the spark-gap. Would it have the desired effect if I substituted No. 28 wire instead of the 36? Is there a book published dealing with the experiments of Tesla? I do not want to spend more than 10s. on the book, if possible. What exposure should I give (approximate) to obtain a photograph of a brush discharge from a Tesla coil using a plate of a speed 180 by Watkins' manual? Can I charge an ordinary Leyden jar by holding it to the secondary terminal of a Tesla coil?

We do not think that the use of No. 36 wire instead of No. 28 ought to produce the effect which you describe, though it would be easy to re-wind the coil to try. Great care should be taken in insulating the coil, as the Tesla discharge has great piercing power. Beyond this, we cannot say much without inspecting the coil. The best publication with which we are acquainted is our series of articles in THE MODEL ENGINEER by Mr. R. P. Howgrave-Graham. We can give the dates of the numbers in which they have appeared on application. These articles will eventually appear in book form. For getting good photographs of brush discharges it is necessary to make the exposure as short as possible and to use extremely rapid lens and plates and a powerful developer. If the exposure includes more than one or two sparks the brushes get confused and give a general appearance of exaggerated luminosity, with none of the beautiful branch-like effects which are seen in reality. Thus the effect produced is false and worthless. It is not easy to get very good brush discharge photographs except by using very powerful Tesla coils. The photographs which illustrate Mr. Graham's article were taken with a lens the aperture of which was 5·6; the plates were Imperial Flashlight, and the developer was pyro-metol. Even the photographs only give a very inadequate idea of the effects which they are intended to record. You cannot charge a Leyden jar from a Tesla coil, the discharge from which is alternating.

[16,867] **Repairing Small Motor Casting.** L. P. B. (Ipswich) writes: Will you please answer the following queries. I have the castings for a "Don" electric motor, the field-magnet of which is broken, as sketch (not reproduced). Can I in any way repair

same? If not, can you tell me a firm who supplies the field-magnet castings alone? *Re* accumulator: I am making a 4-volt accumulator, 4 ins. by 2½ ins. by 1¼ ins., three plates per cell. Will you tell me the capacity of same. I have got the negative grids for above accumulator. What is the substance used for pasting the negative plates? Where can I purchase same? What will it have to be mixed with? If magnet casting could be repaired, could you do same through your Expert Service Department? If so, how much would it cost? There are two holes drilled and tapped, one in each piece of magnet.

You could repair it by putting on a small plate thus, with small screws. Screws should be entered slantwise so as to pull the two parts together. But it is a question whether it is worth your while, and we do not know that these particular castings can be had unwound. Ask at the place where you bought it. *Re* accumulator capacity: Reckon 15 amp.-hours per sq. ft. of positive plate surface. Use litharge for pasting negatives. See handbook—"Small Accumulators," 7d. post free. *Re* cost of mending magnet casting: Cheapest way would be to take it to some local engineer's shop. It would cost more than the motor is worth to send it up here for us to get it done for you.

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.]

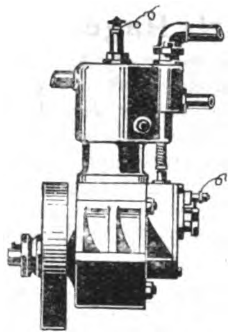
**Reviews distinguished by the asterisk have been based on actual Editorial inspection of the goods noticed.*

*Set Square for Dimetric Projection.

Model engineers who practice or have anything to do with mechanical drawing will be pleased to know that the instrument for dimetric projection, which we fully described in our issue of December 6th last, has now been placed on the market. Mr. Arthur Gray, of 68, Buckingham Gate, London, S.W., who also supplies general draughtsman's materials, is producing this special set square in transparent celluloid, the size being 11½ ins. on its longest side. We have tried the "square," and find that it answers all the requirements laid down by the writer of the article, and, therefore, we can recommend it to those interested with perfect confidence.

A Small Water-cooled Petrol Motor.

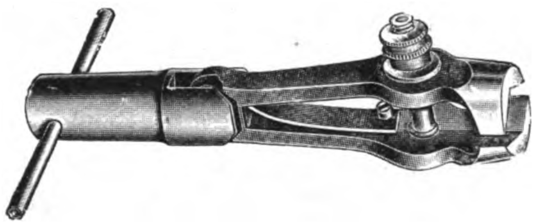
In view of the many uses to which a small water-cooled petrol motor can be put, Messrs. H. Heckman & Co., of 27, Quinton Street, Earlsfield, London, S.W., have just produced a new motor, which will give ¼ h.-p. on the brake, having a water-cooled cylinder 2-in. bore by 2-in. stroke. The design is very straightforward in all its constructive details, and no amateur purchasing a set of the castings should find any difficulty in machining and erecting the various parts. We have inspected a finished engine, and can heartily recommend it for both workmanship and finish. The crank chamber is of cast iron, in two halves, and is provided with lugs for fixing down in the workshop to a special base for direct dynamo driving, or in a river launch. The connecting-rod is made of phosphor-bronze, balanced cranks of cast steel, the inlet valve casing, guide for exhaust valve rod, contact plate, and gear case cover being cast in gun-metal. The gears are *machine* cut from the solid, and all parts of the engine requiring the same are properly hardened. Further particulars can be obtained from the special list issued by Messrs. Heckman and Co., from the before-mentioned address, and any reader who is in doubt as to what type or kind of engine he shall instal in his workshop should send for the leaflet without delay.



Messrs. H. Heckman and Co.'s Small Petrol Motor.

*Auto-adjustable Box Spanner.

The new auto-adjustable box spanner, which we illustrate herewith, is just the thing for motorists. It is easily adjusted to any size or shape of nut within its range, at the same time maintaining its strength and rigidity. The handle being adjustable also facilitates its use in inaccessible places. The tool, thus taking the place of a set of box spanners, makes a great saving in space and weight. Further particulars may be obtained of the manufacturers, Messrs. Avery & Roberts, Ltd., 64, Stanley Street Liverpool.

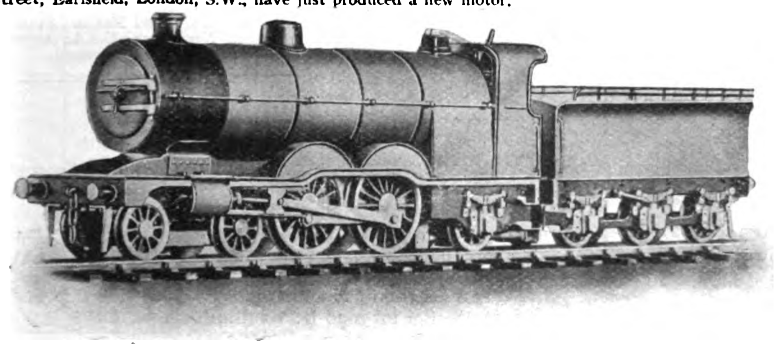


Avery & Roberts' Auto-adjustable Box Spanner.

We regret to have to record the death, from pneumonia, of the wife of Mr. Francis A. Darton, of Messrs. F. Darton & Co., 142, St. John Street, Clerkenwell, E.C. Mrs. Darton passed away on December 24th last, at Clare Lodge, Woodford, Essex.

New Catalogues and Lists.

W. J. Bassett-Lowke & Co., 20, Kingswell Street, Northampton.—We have received Sections A and C of this firm's catalogue, the former including prices and particulars of their stationary engines, steamboats, racing yachts, locomotives, coaches, rails, points, railway accessories, electrical goods, etc. Section C is splendidly got up and well illustrated, including scale model locomotives, carriages, wagons, signals, and other railway accessories. Amongst the new things we noticed are the six-coupled goods engines, eight-coupled model L.N.W.R. goods locomotive of Mr. Whale's latest design, model motor coaches, new wagons and railway fittings, and the well-proportioned 2-in. gauge model G.N.R. "Atlantic" locomotive shown in the accompanying photographic illustration. We have no misgivings in recommending this list to every reader who is interested in model railway work of the most modern description.



W. J. Bassett-Lowke & Co.s 2 in. Gauge Model G.N.R. Atlantic Type Locomotive.

Madison Manufacturing Co., 9, Woolrych Street, Derby.—The list B of this firm's catalogue gives prices for sets of castings and parts for the "Madison" gas and oil engines, also for the finished engines. High speed launch motors are illustrated, also dynamos suitable for lighting shops, houses, &c., and motors for driving sewing machines, lathes, &c., &c. Model petrol boat motors are included. List will be sent post free for four penny stamps upon application.

The Editor's Page.

IN fulfilment of our promise in last week's issue, we print below the results of the 1906 Model Speed Boat Competition. The records are eminently satisfactory, and show an appreciable amount of progress in racing models. In the larger class Mr. Weaver again takes the silver medal with his steamer *Era*, a boat which gained the leading place in the competition of 1903. The petrol boat made by Mr. Arkell is second, and gains a bronze medal. In the Class B (boats under 4 ft. 6 ins. on water-line) we have now records not before officially obtained. The list of competing boats is as follows:

1906 SPEED BOAT COMPETITION.

CLASS A (4 ft. 6 ins. to 7 ft.).

(1) Mr. W. R. Weaver's *Era* (6 ft. 11¾ ins. L.O.A.), 8·766 miles per hour (*Silver Medal*).
(2) Mr. H. Arkell's petrol boat *Moraima* (5 ft.), 7·95 miles per hour (*Bronze Medal*).
(3) Mr. W. Rimmer's *Wolf* (6 ft. 10½ ins.), 7·67 miles per hour (*Certificate of Merit*).
(4) Mr. F. Coxon's *Ades* (6 ft. 1½ ins.), 3·334 miles per hour.

CLASS B (4 ft. 6 ins. and under).

(1) Mr. J. Tillett's *Doris* (4 ft. 5 ins.), 6·136 miles per hour (*Silver Medal*).
(2) Mr. T. Bowman Duff's *Ena* (3 ft. 3⅜ ins.), 5·336 miles per hour (*Bronze Medal*).
(3) Mr. T. J. Davies' *Vincent* (4 ft. 2 ins.), 4·352 miles per hour (*Certificate of Merit*).
(4) Mr. W. Hughes' *Albert* (4 ft. 4½ ins.), 2·922 miles per hour.

We shall deal with the competition more fully in a later issue; in the meantime we may mention that we received a notification from an intending competitor, Mr. H. Teague, of Florence, Italy, that his boat was quite ready, but that owing to severe river floods he was unable to make the necessary speed trials over the measured course. He wished us to leave the matter open for a few days, and guaranteed that in the meantime he would not make the slightest alteration to the boat. Up to the time of going to press, however, we have not received particulars of any trial. Should our correspondent's boat prove exceptionally successful, we may feel justified in making some special recognition of the performance, although we are unable to include it in the competition.

* * *

The competition for the best design for a model steamer boiler has also proved very gratifying in its results. The three leading entries are all good, and are only separated by a small margin of merit. We are awarding the prize of £2 2s. to

Mr. DAVID SCOTT,
1, Madeira Place, Leith, N.B.,

for his excellent design of water-tube boiler. In addition, we are giving extra prizes of £1 1s. each to

Mr. W. V. DELVES-BROUGHTON,
10, Anerley Hill, Upper Norwood,

who sent in a highly ingenious design for a semi-flash boiler; and

Mr. E. FITZGERALD,
New Road, High Barnet,

for his well-arranged design for a water-tube boiler. We highly commend T. W. Geary (Twickenham). A. Peddie, jun. (Sunderland). Other entries worthy of mention were received from—F. H. Souden (Preston), R. Thimbleby (Edmonton), N. H. Statham (Wimbledon), and E. Wilson (West Hartlepool). We may use some of the ideas embodied in these designs, and shall be pleased to remunerate such competitors according to the merit and space occupied by their contributions.

* * *

With reference to the results of the "Nuts and Bolts" Competition, exigencies of space compel us to hold these over until next week.

Notices.

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

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THE
Model Engineer
And Electrician.
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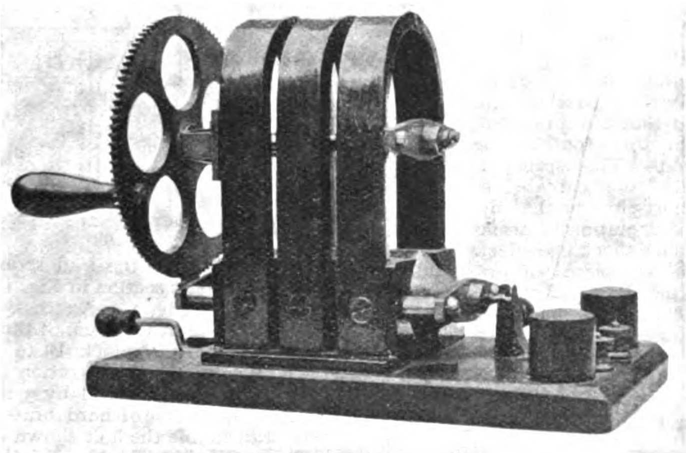
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XVI. No. 300 JANUARY 24, 1907. PUBLISHED WEEKLY

A Magneto Shocking Machine.

By "A DABBLER."



A MAGNETO SHOCKING MACHINE.

HEREWITH is a description of a magneto machine which I have recently constructed. As will be seen from photograph, the machine is similar to a telephone magneto. Field-magnets consist of three permanent magnets bent from cast-steel bar, as used for making files, ¾ in. by ¼ in., straight portions of limbs 4 ins. long and 2⅛ ins. apart. Holes were drilled and tapped to fix on bearings for driving gear and pole-pieces. The magnets were left dead hard and magnetised in this manner. Two sheet zinc bobbins were made to slip on limbs and wound with five layers each of No. 18 D.C.C. wire, and current passed from an old 4-volt accumulator for a few seconds, which was repeated about twenty times. A piece of soft iron was placed across poles and magnets, rapped with a mallet while current was on, thus strongly permanently magnetising them. The pole-pieces are of soft cast iron from my own patterns, and form armature tunnel 1½-in. bore. Brass studs are screwed into ends of these pole-pieces to carry armature bearings. All bearings are made from 3-16ths-in. sheet brass, with gun-metal bosses sweated on.

The armature is of the ordinary Siemens H pattern, built up of stampings on a ¼-in. steel spindle, and is 3 ins. long by 1 7-16ths ins. diameter. The winding space was carefully covered with linesman's "sticky" insulating tape, and is filled with No. 36 silk-covered wire. The starting end of wire is connected by an insulated screw to an insulated brass rod, driven into an ebonite bushed hole, drilled axially in one end of armature spindle and which projects ⅜ in. from end of axle and has a three-toothed cogwheel soldered on it. The finishing end of wire is soldered to end lamination. The other end of armature spindle has a keyway to carry pulley.

The driving gear originally consisted of two gun-metal cogs, geared 1 to 8, but made a very objectionable noise when working, so I have lately turned off all the teeth of large cog and substituted for the small one a gun-metal pulley, with a ring of india-rubber, cut from a piece of ⅜-in. gas tubing, stretched round its circumference, an arrangement similar to the spool-winding attachment on a sewing machine, and which gives an almost silent drive, with a good grip and little undue friction.

Current is taken from machine in this way: One terminal is connected to carcase of machine, which, in turn, is connected, *via* bearings and spindle, to end of armature wire. The other terminal is connected to a brass spring, which presses on end of insulated brass rod fixed axially in armature spindle, and thence to starting end of armature wire. Another brass spring is fitted up with a regulating screw like an ordinary contact breaker of an induction coil, and fixed on baseboard in a vertical position, so that the spring can touch the teeth of the three-toothed cog on insulated brass rod. This spring is connected electrically to carcase of machine, and thus short-circuits the current three times, each revolution of armature giving the peculiar shocking effect. Handles, consisting of two pieces of brass tubing 5 ins. long by ¼ in. diameter, are connected by flexible cord to the two terminals, and when not in use stand on the two short wooden pillars. Shocks can be regulated to some extent by adjusting the pressure of spring on three-toothed cog, but principally by speed of revolution and sliding a soft-iron slab across underside of pole-pieces, a recess being cut in baseboard to take this slab, which has a bent rod and knob attached to it for convenience in handling it. This machine will give from quite a mild shock to one unbearable. By adjusting screw so that spring misses the cog, the machine becomes a high-tension alternating current dynamo, and at full power I find it will light fully a 3½-volt pea-lamp. Magnets are enamelled dark green, pole-pieces black, and brasswork polished and mounted in mahogany; the baseboard is French polished.

The world's probable output of iron, according to Messrs. Stadman, Crowther & Co.'s metal report for 1906, is likely to figure out at about 60,000,000 tons. Of this total, the United States share probably amounts to 26,000,000 tons, that of Germany to some 12½ million tons, and that of England to about 10 millions.

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 Quick-gripping Vice.

By A. P. White.

The following is a description of my attempt at making a quick-gripping vice. The vice itself is similar to an ordinary vice, with the exception of the back jaw. The stand and front jaw were cast in one piece, together with the strengthening piece

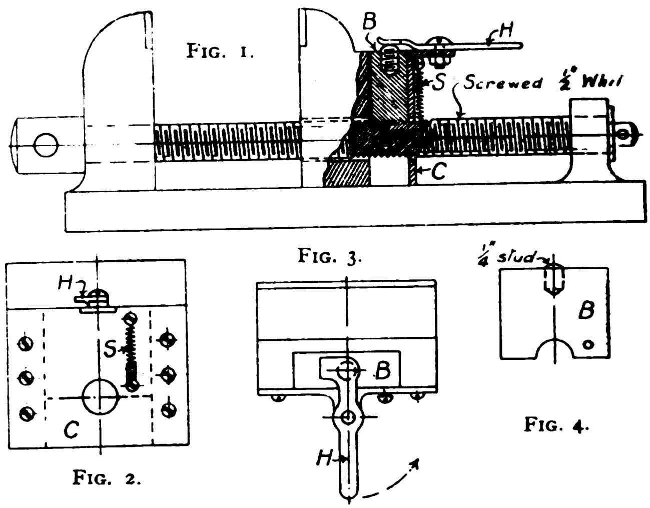


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Quick-gripping Vice. (*Scale: ⅜ths full size*)

at the back for the lead screw. The back jaw is shown in part section in Fig. 1, back view in Fig. 2, and plan in Fig. 3. A recess, 1½ ins. wide and ½ in. in, is cast in at the back of the jaw, for the purpose of allowing the block B to slide up and down. The block is kept in position by a covering plate C (Fig. 2), which is held by 3-16ths-in. screws. The block B is made of hard brass. Enough material is used to enable the hole shown in Fig. 4 to be drilled. Then the block is sawn through as indicated in the figure. A slot is let in covering plate C to allow the block about ¼ in. upward and downward movement, which is controlled by spring V. Both covering plate and lever H are made ⅛-in. steel plate. The action of the vice is this:—As soon as the lever H is pushed round in direction of the arrow (Fig. 3), so as to let the block free to rise, by the action of spring, clear of the lead screw, then the back jaw may be slid backwards and forwards at will. The job is then put in the vice. The jaw is slid up to the job, and the lever H is pulled back to its original position on top of the stud, pressing down the block B as before, and at the same time giving the handle of the vice a turn. The lead screw engages with the thread in the block, and the vice is tightened in about half a turn. Of course, the hole for the lead screw, in both jaws, is a clearing hole. I have not given dimensions, but the drawings are to a scale of $\frac{3}{8}$ths full size. The jaws are $2\frac{1}{2}$ ins. wide, and will take work about 4 ins. by $1\frac{1}{2}$ ins. deep. The vice will not grip as instantaneous as the expensive ones, but it saves a lot of trouble in running the jam in and out by the screw.

Making Blowlamp Burner Prickers.

By "A Dabbler."

A strip of stout tin, say $3\frac{1}{2}$ ins. long by $\frac{3}{8}$ in. wide, has one end doubled over on itself about $\frac{1}{2}$ in. A short length of fine steel wire is laid in the bend, one end projecting 5-16ths in. from the strip and at right angles to it, and then gripped by hammering the bent piece down flat, and then giving it a blow with a nail-punch, resting the tin on the jaws of a vice, slightly open, and striking where the wire lies, which gives it a kink, thus preventing wire being pushed out of the tin-holder. Suitable wire can be got from an old Bowden brake cable, to be had for the asking of any cycle repairer. This, I find, is just the gauge for No. 4 Primus silent burner and similar ones. The wire can be easily cut in this manner. One end is gripped in vice and strained tightly with left-hand, and then severed with ordinary metal shears while under tension, giving a clean cut without that annoying kinking and jamming between the blades, as often happens when wire is not strained. The slight burr must be removed by stroking end of wire on a piece of emery cloth stretched on a board. Wire will then enter nipple without tendency to enlarge the hole. The wire can be quickly reduced in diameter to enter acetylene burners by scraping it while under tension as above with an old scissors blade and rubbing with emery cloth.

The various stages of making are shown in the accompanying sketches (not to scale). Fig. 1: Tin bent and wire A in position for fixing. Fig. 2: Tin hammered flat. Fig. 3: Method of forming kink with blow from nail punch struck with hammer. Fig. 4: Kink formed at B; wire shown bent by dotted line. Fig. 5: Pricker with piece cut out of handle part to enable wire to be raised high enough to enter nipples of some burners. Fig. 6: First step in making pricker with wire in a straight line with handle; the tin is cut about halfway across, as at C. Fig. 7: Finishing stages; tin is bent over, wire inserted, then tin hammered flat and kinked with punch at D.

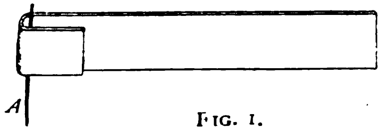


Fig. 1.

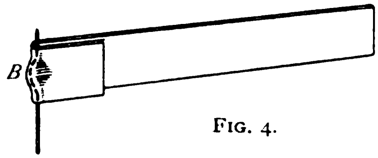


Fig. 4.

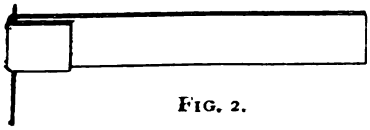


Fig. 2.

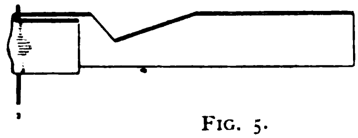


Fig. 5.

Fig. 3.

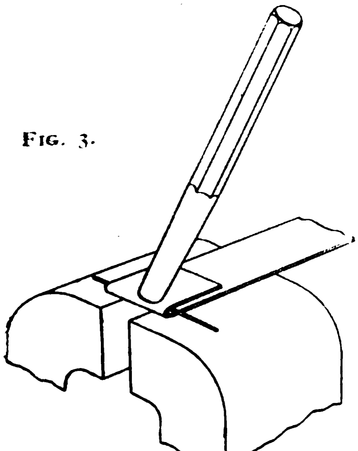


Fig. 6.

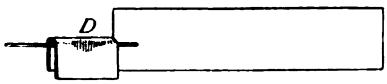


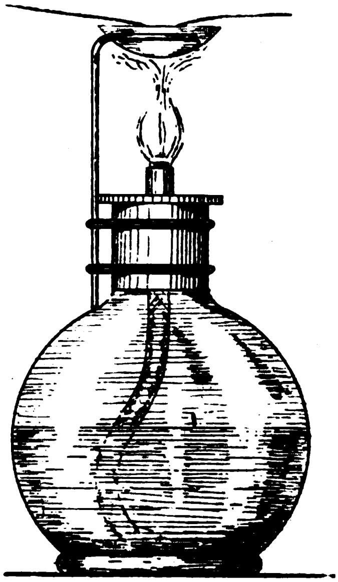
Fig. 7.

Showing Method of Making Blowlamp Burner Prickers.

A Method of Soldering Wire Connections.

By Bruce Gregor.

The sketch below shows apparatus for soldering joints in bell fitting work and small wire connections. The soldering of small wires is very troublesome at times, but I have found this arrangement very useful. The whole tool consists of a small methylated spirit lamp, and the saucer-shaped vessel is of copper, attached to the lamp by means of a wire having two spring clasps, by which it is attached to the lamp. A little solder is placed in the vessel and the lamp lit. The wires to be soldered are dipped amongst the solder.



Soldering Wire Connections.

A Model Engineers' Tramp Abroad.

By H. Greenly.

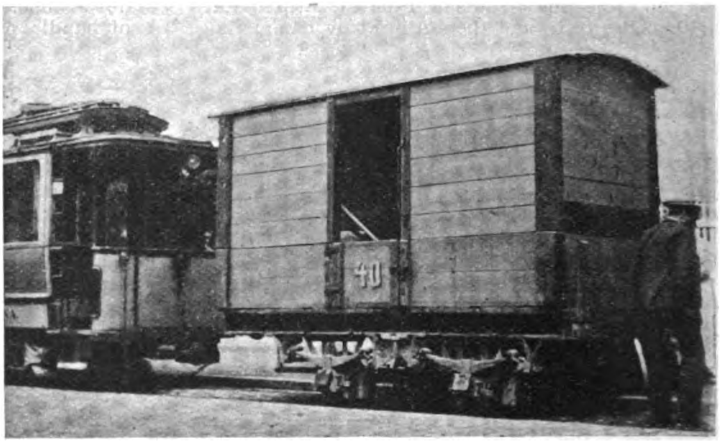
(*Continued from page* 54.)

FROM the foregoing account of Mr. Rompler's work some readers might think that model engineering is as widely practised in the land of the Kaiser as it is in this country; but this is not so. The German is not naturally inclined to take up a hobby involving handicraft of any kind, such as model-making, photography, fret-working, etc. First and foremost comes his business, the hours of which are usually longer than we are accustomed to; his idea of recreation is ease and comfort; he likes good food, pleasant walks, and good music, in the pursuit of all of which delights he is well provided for. For these reasons, therefore, the few who do go in for model work have nothing like the facilities in obtaining the necessary information and supplies that we here enjoy. It is not to be wondered at, therefore, that Mr. Rompler has but few friends in the town in which he resides who have kindred tastes. The advent of the motor cycle and the auto-car, however, may eventually make some difference.

Electric Tram-cars at Nuremberg, showing a Typical Tram-way Station with Waiting-room, a Summer Trailing-car, and the Glass Weather-board for the Car Driver.

Referring again to the towns of Germany, we must not forget the development of the electric tramway systems. As will be seen by the accompanying photographs, single-deck cars of small capacity are the general rule. Instead of using large cars running at long intervals, a greater number of small cars are employed. Where the traffic is heavy, an additional car is attached at the rear. These trailers are—in the summer—quite open, the arrangement being a series of garden seats placed transversely across the car, with a roof over them supported only by uprights.

The cars being single-deckers, smokers and others who do not want to sit down may ride on the outside platforms with the driver or the conductor. This is very pleasant in good weather, and enables a visitor to see more of the town in less time than otherwise would be the case. The new cars in Nuremberg are very well appointed, and, as will be noticed in the photograph herewith, the driver is protected from wind and rain by the glazed front provided. Some of the cars are provided with air-brakes like those used on railways (except that they are "simple" instead of automatic).



A Produce Car on the Electric Tramway.

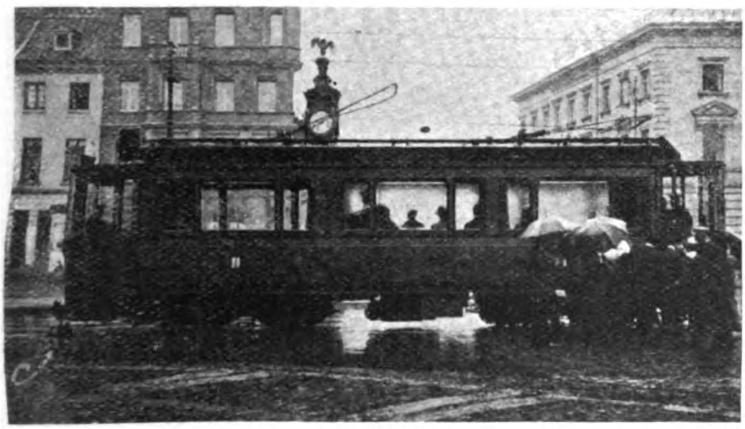
Another feature of the street cars of Germany is the use of the system for other purposes than passenger transport. On market day in Jena we passed a street car with a covered goods truck full of produce attached to it (see photograph), which evidently had come from one of the urban districts of the town. At Frankfort the tram lines lead from the railway station right into the General Post Office, and the mails are brought to and fro with utmost ease and despatch.

The majority of the systems are of the overhead trolley type. In Munich, however, accumulator loco cars haul the ordinary passenger trolley cars through the heart of the city. When the outskirts are reached, this car is detached and runs into a siding, the trolley car raising its pole to make contact with the overhead wire and proceeding to its destination. The accumulator car also has a trolley pole, and during the time it is waiting for the car collects current from the wire overhead to recharge the accumulators.

In some of the manufacturing districts where several large towns are clustered together, they are linked together with tramways upon which the cars travel at good speeds. Between Neuss and Düsseldorf the trams are of the single-deck double-bogie type, with first and second class compartments. Overhead wires with double-bow collectors are used for the major portion of the journey, and a change is made over to the conduit system just before entering the busier portions of the town. This transformation is the work of a few seconds only; the driver takes the collecting-plough, puts it into the conduit, which, by the way, is not a separate slot centrally between the rails but is directly under one of the running rails, and then places the insulated leads in suitable plug-holes. When this is done, the car is ready to proceed under the new *regime*.

Although the cars are patronised by all classes, vehicles we call cabs may be hired in the usual way. For the most part, however, they are fitted with a taxameter, so that no dispute as to the fare is possible. This instrument is shown in the accompanying photograph, for which we are indebted to the London agents, 63, Chancery Lane, W.C.

The portions which concern the passenger and the driver are clearly shown. The metal flag with the word "Frei" (free) painted on it is used not only to denote whether the cab is disengaged, but it actuates some of the mechanism. When this is in the position shown, the cab is ready for hire. As soon as a passenger has been obtained, the driver,

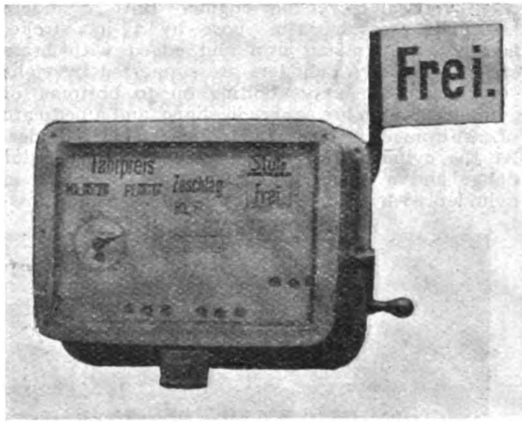


A LONG-DISTANCE ELECTRIC TRAMCAR.

finding out how far he wants to go, puts the lever which supports the flag into one or another position, according to the zone in which the journey is to be made. This shows on the indicator under the heading "Tariff" the basis of the fare; for a journey to the outskirts of the town the rate of charge being higher than in the centre of the town.

Extra payments are shown under the heading "Zuschlag," and include for extra baggage, etc., whilst the number of kilometres travelled is shown on the distance dial.

The indicator labelled "Fahrpreis" shows a first the minimum fare (6d.), and adds to this penn by penny as the cab proceeds. If you keep thy



A VIEW OF A CAB TAXAMETER.

cab waiting for any length of time while making a call, a clockwork device causes a certain predetermined amount to be added to the total. Not only does the instrument do all this, but it adds up the distance travelled, the fares and extras received, and in this way controls the monetary relations of the cabman and the cab-owner. Thus, all round, there is no possibility of dispute. On your dismissing the cab the driver will point to the instrument and say, "There is the fare, but don't forget the driver"—as it is not the taxameter that governs the amount of the tip!

(*To be continued.*)

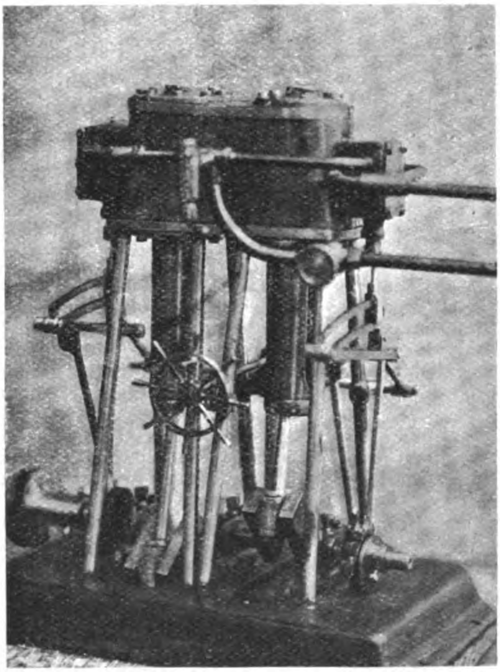
MECHANICAL POWER STORAGE BRAKE FOR TRAMCARS.—Some interesting tests on tramcar brakes have recently been carried out by Mr. E. A. Paris, managing director, and Mr. R. C. Goldston, engineer, of the Yorkshire (Woollen District) Electric Tramways Company. Three ordinary double-deck cars were used, one being equipped with a new track brake designed by Mr. Edwin Freund, of 39, Victoria Street, Westminster, the second with a modern magnetic brake, and the third with a hand-brake. The Freund brake was found to stop the car under all circumstances quicker than the hand-brake, and also beat the magnetic brake, except on freshly washed rails. The new brake acts on the principle of storing the power of the car by means of springs.

A Model High-Speed Two-cylinder Reversing Engine.

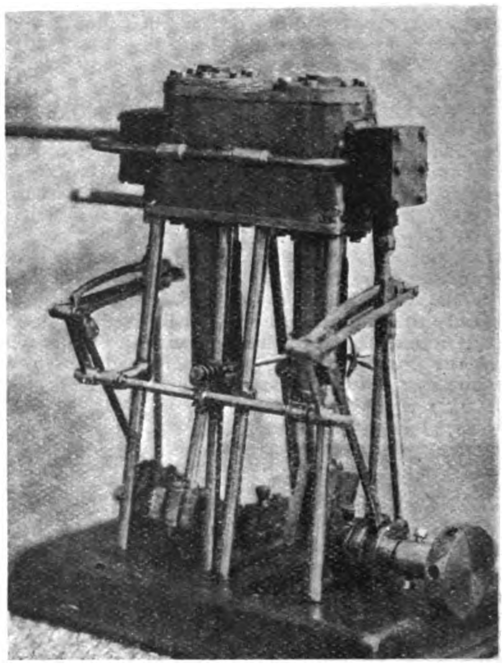
By W. Deval.

THE photographs shown with this description are the front and back views of a model vertical reversing engine. Both cylinders are high pressure, 1-in. bore by 1¼-in. stroke, lagged with Russian iron and edged with brass strips. The two cylinders are supported by eight steel stays, the stays bolting on to bottoms of cylinders, which are square in shape, and a bedplate of cast iron. The crosshead guides are bored guides. At the cylinder end of guide there is a circular flange and a spigot. The spigot fits a recess in cylinder, so by this means both cylinder and cross-

For reversing the engine, is a built-up wheel shown in photograph of the front view. This wheel is keyed to a shaft running between the stays at right angles to crankshaft. This shaft is supported in two bearings; the bearings being clipped and supported by the vertical cylinder stays. On the other end of shaft at back of engine (shown in photo of back view) a worm is fixed. The worm was made from a piece of an ordinary wood screw, a hole being bored in it to suit shaft. Gearing with worm is a worm-wheel which is keyed on to a lay shaft. The lay shaft runs parallel with crankshaft, and is supported by two bearings clipped to the vertical cylinder stays. At each end of lay shaft an arm is fixed. These arms connect on to drag links. Then by turning the lay shaft through the worm gearing both quadrants are drawn over at the same time. The cylinders are lubricated



Front View.



Rear View.

Mr. W. Deval's Model High-Speed Reversing Steam Engine.

head guide are dead in line. Through the flange, screws pass for bolting guide to cylinder. The same end of guide is bored and screwed inside for a piston-rod gland. The crankshaft is of steel, 5-16ths in. diameter, made from a forging. The cranks are at right angles with each other. The connecting-rods are of steel, forked at one end to suit crosshead and fitted with brasses and end plate held on to rod by two bolts at crank-pin end. The main bearings and caps are of steel, three in number, each being fitted with brass. The four eccentric rods, two valve rods, two sets of drag links, and two quadrants are of steel—all cut from the solid. The eccentric rods are forked at one end for fixing to the ends of quadrants. The eccentric straps and sheaves are of gun-metal and made from castings.

by a model displacement lubricator. The engine has fitted to it a screw-down steam valve. The engine runs and reverses well *without* any flywheel.

By a slight modification of the Pollak-Virag apparatus, which permits of transmitting 40,000 words per hour in ordinary writing characters, Dr. Morage has succeeded in reproducing and transmitting the image of human speech. A microphone is substituted for the manipulator; the sounds cause a mirror to vibrate, and luminous rays representing the acoustic vibrations act upon sensitised paper, vowels and consonants being transmitted by more or less thick strokes of special form.

The Latest in Engineering.

Electrically Controlled Tramway Points.—For many years there has been a need of some apparatus on electric tramway lines to do away with the services of the point-boy. This problem has now been successfully solved by the electric point shifter, described below, which has been in operation on the Dublin tramway system for some time past. Besides being of interest as a well-designed apparatus, the writer hopes that it may appeal in a special manner to owners of model electric railways. On a track fitted with this device cars could be made to take different routes without touching the points or even removing the hand from the regulating switch. The equipment of the point is shown (Fig. 1), and consists of two solenoids A and B placed in cast-iron boxes, one on either side of the line. When a current passes round a solenoid winding, the plunger P is drawn in towards the rail, which in doing so acts on a lever C, fixed to a vertical spindle S, this in turn forces outward the pin R, and so shoves over the point. Fig. 2 shows the method of control. About 48 ft. from the point, in the direction from which the tram comes, a short strip of the trolley wire X is insulated, and a swinging contact Y, also insulated, is arranged to make contact with the side of the trolley head of every car while it is passing under the strip. The contact Y is connected to one end of the winding of solenoid A, the other end of winding being brought to the "live" trolley wire, as shown at T. It will be easily seen that when the trolley of a car passes on to the insulated strip, the current (if any) which the motors are taking must first pass through solenoid A, and hence move the point over to the right. If the motor-man desires to move the point, therefore, he has only to keep his controller in one of the "on" positions while the trolley is on the insulation; or, again, if he wishes the point to remain unchanged, he switches off for the moment he is passing under X. Now, a second swinging contact H, insulated from the trolley wire, is placed on the far side of the point, and connected to one end of the solenoid winding B, the other end of which goes to earth. A car, let us suppose, having moved the point as before described, passes under the second contact, and H is made "alive" by touching the trolley-head, causing a current to flow through solenoid B, and so bring the point back to its first position. It should be noticed that it does not matter whether the controller on car is in the "on" or "off" position while passing under H. Three coloured lamps (Fig. 3) are fixed to the nearest post, which in the dark indicate the position of the point to the driver, two only lighting at one time. They are worked by a special switch in one of the solenoid boxes, and are actuated directly by the tongue of the point; the order is, of course, green to right of red = right line clear, and green

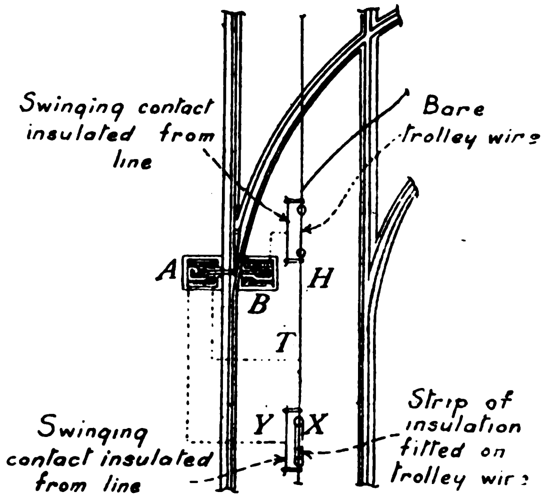


FIG. 2.

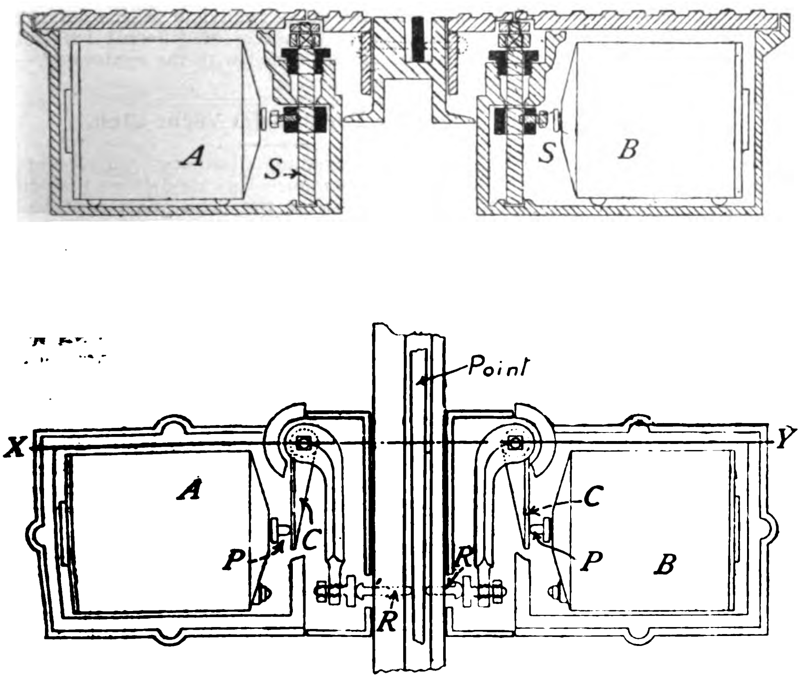


FIG. 1.

to left of red = left line clear; should the point stick in the middle, the lamps go out, and hence warn the driver. The chief advantages claimed by the inventors for this device are as follows: (1) No alteration necessary on cars. (2) Ease in putting down solenoids, as boxes measure only 14 ins. by 12 ins. by 9 ins. (deep). (3) The fact of shifter being fitted does not interfere with the moving of the point by hand, if necessary. Although designed first

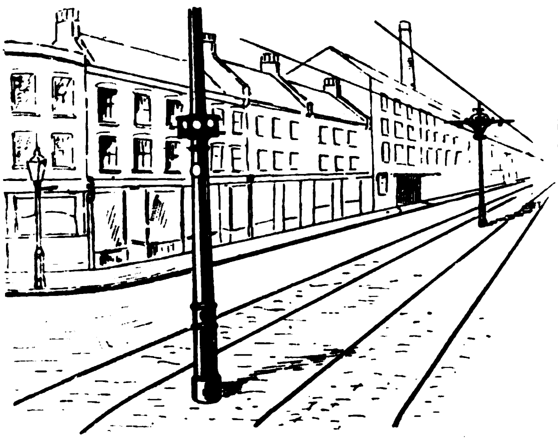
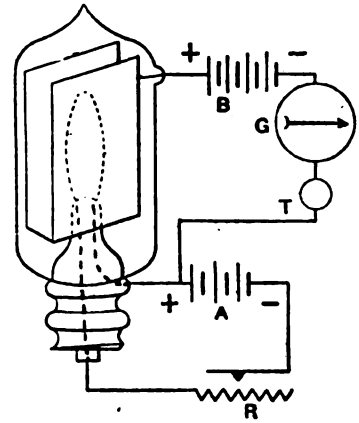


FIG. 3.

for the overhead system, this apparatus is quite applicable to all other methods of electric traction. It is naturally a great saving to have the points on a line shifted automatically, especially where there are numerous branches; for instance, it is hoped to effect a saving of about £18 per week, formerly paid to point-boys, when all the points are electrically controlled.

A New Receiver for Wireless Telegraphy.—At the meeting of the American Institute of Electrical Engineers held recently, Dr. Lee de Forest read a paper dealing with the "Audion," a new receiver for wireless telegraphy. Several forms of the instrument were described, the instrument exhibited being of the form illustrated diagrammatically herewith. A low-voltage carbon incandescent lamp is connected to a source of current consisting of a battery of dry cells, a rheostat serving for varying the current at will. Within the exhausted globe of the lamp are placed two platinum wings parallel to the plane of the bowed filament and about 2 mm. on either side of it. A second battery of dry cells is connected between the positive end of the filament and the platinum, the latter being connected to the positive pole of the battery. Due to the electrification produced in the neighbourhood of the incandescent filament, a positive leakage discharge current will pass from the platinum wings through the attenuated gas to the filament. The electrification has been found to depend upon the temperature and nature of the filament and on the nature and pressure of the gas, and upon the electric and magnetic forces to which the vessel is subjected. The shape and area of the plate or plates, the condition of its surface and edges, as well as its distance from the filament, are also very important factors. The conductivity of the gas between the wings and the filament increases rapidly with increase of the heating current through the filament. When the audion is connected either inductively or conductively in an oscillation circuit of a wireless telegraph receiver, it forms an extremely sensitive detector of Hertzian waves, giving responses in the telephone receiver (in circuit B) several times as loud as any other known form of wireless receiver when subjected to the



A NEW WIRELESS TELEGRAPHIC RECEIVER.

same impulses. It is stated that the device is extremely selective in its behaviour with reference to its sensitiveness to waves of different lengths, and it can be closely tuned with the syntoniser.—*Electrical Magazine.*

Stanley Park Model Yacht Club.

ON Saturday evening, January 5th, before a large attendance of model yachtsmen from the local clubs, at the head-quarters of the Stanley Park Club, Mr. G. H. Willmer read a paper on the "New International Yacht Measurement Rule."

The lecturer described the various rules which had been in use during the last century. He showed how the old *tonnage* rules had been discarded because they encouraged a narrow boat, in favour of the length and sail-area rule, which, in turn, was discarded for producing too light a vessel. The first *girth* rule which followed was a failure because very light vessels continued to win, and overhangs became longer and more undesirable than ever. The "1901" or second girth rule certainly encouraged a deeper body and more weight, but was rather too drastic in this respect, while the forward end of the boat remained more splashy than was desirable. The lecturer then showed how the *new* rule, by taxing the "flare" of the overhangs, would produce a "healthier" boat, while the more moderate taxes on girth and sail area would allow more elasticity in design than former rules.

He was followed by Mr. Foster (official measurer to the Y.R.A.), who explained with great lucidity the details of measuring a yacht for a certificate under the new rule. Three new boats, built to the 39·4-in. class of the new rule, were exhibited.—NORMAN SMITH, Hon. Secretary, 34, Exeter Road, Bootle, Liverpool.

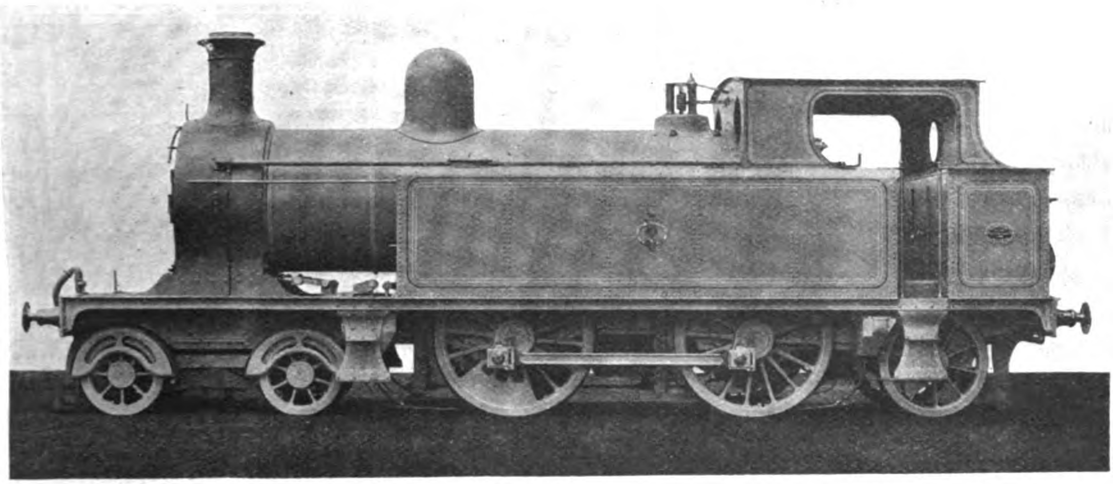
Locomotive Notes.

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

Tank Locomotives on the Taff Vale Railway.

The Taff Vale Railway Company has had in service for upwards of twenty years past a number of side-tank locomotives of the 4—4—2 type, one of which is illustrated herewith. The engines were designed by Mr. T. Hurry Riches, M.Inst.C.E., who is still with the Company as locomotive, carriage, and wagon superintendent, and they were built in 1888 by the Vulcan Foundry Company, Ltd., of Newton-le-Willows, Lancs. The engines were among the first to have the 4—4—2 wheel arrangement in this country, and they are still doing good work, for the coupling rods of British locomotives; and in all his later engines Mr. Riches employs the customary form of rod-end. The leading dimensions of the engines are given below :—

Cylinders: Diameter, 17½ ins.; stroke, 26 ins.
Diameter of bogie wheels, 2 ft. 9½ ins.; driving wheels, 5 ft. 3 ins.; trailing wheels, 5 ft. 3 ins.; radial wheels, 3 ft. 8¾ ins.
Bogie wheelbase, 5 ft. 9 ins.; trailing bogie wheels to driving wheels, 6 ft. 11½ ins.; driving wheels to coupled trailing wheels, 7 ft. 10 ins.; coupled trailing wheels to radial wheels, 6 ft.; total wheelbase, 26 ft. 6½ ins.; total length over buffers, 34 ft. 10 ins.
Tubes: Number, 210; diameter (outside), 1¾ ins.; thickness, Nos. 11 and 13 B.W.G
Heating surface: Tubes, 958·7 sq. ft.; firebox, 83·3 sq. ft.: total, 1,042·0 sq. ft.



4—4—2 Type Tank Locomotive, Taff Vale Railway.

with apparently a long lease of useful life yet before them. They present an unusually smart appearance, the chimney cap, dome, and covering to the base of the safety valves being of brass, kept well polished, and the lining out of the wheels and other parts is in very good taste and adds much to the good effect produced by taking external finish of the engines. The cylinders are placed inside the frames, with the slide-valves working on top of them off a rocking shaft actuated by Stephenson link motion. The bogie wheels, as will be seen, are provided with splashers, a system not much in vogue in later practice, but, nevertheless, a good one. The cab is conveniently arranged, and the engine is fitted with automatic vacuum, steam and hand-brakes. The writer, when recently in South Wales, noted some very smart performances by these engines, and in view of their attractive external appearance would commend the design strongly to the attention of model engineers as a prototype. It will be noticed that the side-rods are strap ended, instead of having the solid bushed type of end. It is not often that the former method is employed nowadays

Grate area, 19 sq. ft.
Boiler pressure, 160 lbs. per sq. in.
Capacity of tanks, 1,500 galls.
Capacity of coal bunker, 30 cwts.
Weights :—

	t.	c.	q.
Leading bogie wheel	6	2	0
Trailing ,, ,, ...	6	2	0
Driving wheel	12	16	0
Trailing ,, ...	12	2	0
Radial ,, ...	7	18	0
Total weight (empty) ..	45	0	0

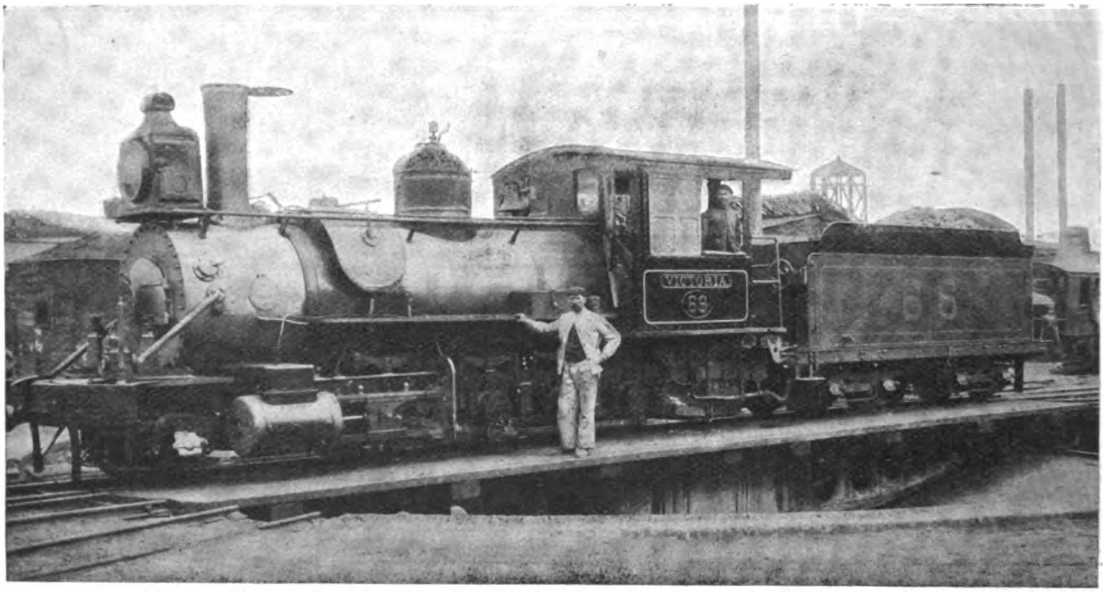
	t.	c.	q.
Leading bogie wheel	7	15	0
Trailing ,, ,, ...	7	15	0
Driving wheel	16	2	0
Trailing ,, ...	15	8	0
Radial ,, ...	10	12	0
Total weight (working order)	57	12	0

A Narrow Gauge Locomotive for Bolivian Railways.

In striking contrast to the symmetry of the locomotive last described is the design of the one shown in the second illustration. This is a "Consolidation" 2—8—0 type engine employed on the 2-ft. 6-in. gauge lines of the Bolivian railways. For the photograph, from which the illustration of this engine has been prepared, the writer is indebted to an unknown correspondent, who describes himself as "an enthusiastic reader of The Model Engineer, with a particular eye to the 'Locomotive Notes,'" and who, as a member of the resident engineer's staff at Antafogasta, has, of course, exceptional facilities for photographing the engines in use on the railways in this somewhat remote portion of South America. Unfortunately, the correspondent has omitted to forward any dimensions, or to give any particulars of the work on which the engine is engaged. It is obvious, however, from the photograph that it was built at the Baldwin Works, Philadelphia, as on the smokebox can be discerned the familiar circular nameplate of this well-known American firm. The engine has outside cylinders and cranks, bar-framing, and a system of equalising which connects the springs together in pairs. The sandbox, located between the chimney and steam dome laps over the top of the boiler, and presents a curiously similar appearance to a saddle on the back of a horse. The cab roof is extended back over the front part of the tender, and has very deep side-sheets with sliding, quartered windows.

The cab, also, has doors at the front, which provide a means of access to the running board on each side of the engine. The tender runs upon two four-wheeled bogies, and is obviously of high capacity, from which it may be gathered that facilities for coaling and watering are few and far between on the Bolivian railways. The design, taken collectively, would require a good deal of beating if downright ugliness were the standard of comparison; but, doubtless, the engines are good workers, in spite of their indifferent maintenance.

There are, also, in use upon the Bolivian railways some 4—6—0 type locomotives, built in France, and some 0—6—4 type tank engines, built in Leeds. The latter have outside Walschaerts valve gearing, and are a decided improvement so far as appearance goes upon their American and French contemporaries.



"Consolidation" (2—8—0) Type Locomotive, Bolivian Railways

The Latest Great Central Locomotives.

The latest additions to the locomotive stock of the Great Central Railway are some 4—6—0 type mixed traffic engines of the same general design as the other six-coupled bogie locomotives on the same railway. The principal difference between the mixed traffic engines and the others is that the former have coupled wheels only 5 ft. 3 ins. diameter as compared with 6 ft., 6 ft. 6 ins., and 6 ft. 9 ins.

The new engines have 19½ ins. by 26 ins. cylinders, 14 ft. rigid, and 26 ft. 1½ ins. total wheelbase. The total heating surface is 1909·5 sq. ft., grate area 23·4 sq. ft., and working pressure 200 lbs. per sq. in.

The boiler has its centre line 8 ft. 3 ins. above rail level, as compared with 8 ft. 6 ins. of the six-coupled passenger engines.

The *Turbinia*, the little vessel upon which the applicability of the steam turbine to marine propulsion was worked out, started with one shaft and one propeller, driven by one turbine, and ended with three shafts and nine propellers, driven by three turbines. Sir. W White suggests that the little vessel be preserved somewhere as a record of one of the greatest events in modern marine engineering.

Small Electro-magnet Motors.

By Stewart Betts.

In that class of small electro-magnetic motor (where the rotary motion is produced by the periodic attraction of a series of soft iron bars) no doubt familiar to the majority of readers, the most unsatisfactory point is the method of making and breaking the electrical circuit usually employed.

The passage of the current through the coils of the electro-magnet is controlled by a piece of metal (rigidly attached to the armature shaft), with projecting teeth equal in number to the soft iron bars. The piece of metal is so adjusted on the shaft that, as the armature revolves and a soft iron bar approaches the poles of the electro-magnet, the corresponding tooth makes electrical contact with a metal brush, the current flows through the coils of the electro-magnet, and the bar is drawn opposite its poles. But at this instant the tooth ceases to make contact with the metal brush, the electro-magnet ceases to attract, and momentum carries the bar forward. The same thing happens with each bar, momentum maintaining the rotary motion during the periods of electrical disconnection.

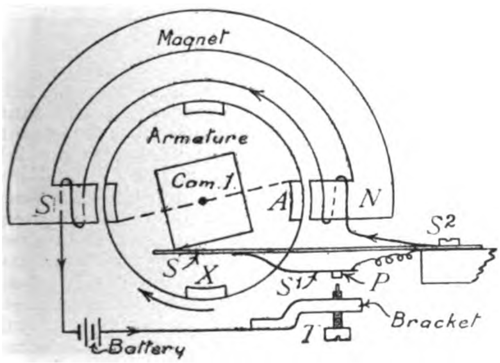


Fig. 1.

After a time the projecting teeth get worn irregularly and destroyed by the passage of the small spark, which takes place whenever contact is made or broken. The whole arrangement becomes electrically very inefficient, and, in any case, is not easily adjustable.

Platinum does not readily oxidise under these circumstances, and is used for purposes of make and break in electrical work. As it is very expensive, only the smallest quantity is used. But it is not so simple a job as many amateurs think, to effectively mount platinum tips on the above-mentioned teeth.

This type of motor is extensively used in submarine telegraph work, and with an efficient make and break, is simple, steady running, and powerful enough for the purpose, and requires little attention. It is economical as the current is intermittent.

I propose to describe a modification of the contact-breaker employed. Several designs are in use, but the principle is the same.

On the armature shaft (Fig. 1) is mounted a cam: its function is purely mechanical. As in a gas or petrol-vapour engine, the cams operate the necessary valves; in our case, we may say the cam operates the electrical valve.

A four-bar motor is shown, and the shape of the cam is square; a six-bar motor would have a hexagon cam, an eight-bar an octagonal, and so on. The pawl S is made of a piece of clock spring, softened to enable holes to be drilled. S^1 is a smaller piece of spring, softened, shaped, and

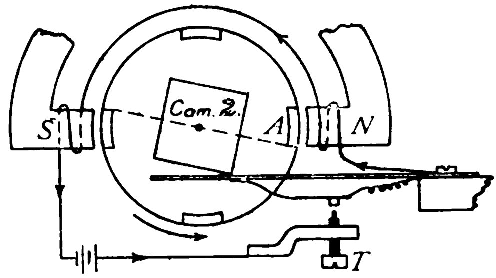


Fig. 2.

riveted to S. A small piece of platinum is mounted at P, the best way being to drill a hole and rivet in the platinum. Between P and S a piece of very flexible copper wire may be soldered: this ensures good electrical connection. The hammering when riveting will serve to re-temper the springs; their strength and flexibility must suit the size of the machine.

T is a platinum-tipped screw: a hole is drilled in the end of the screw and a small piece of platinum wire driven in a tight fit. This screw must work stiffly in the tapped hole in the bracket, so that when screwed backwards or forwards for purposes of adjustment it will remain firm. The electrical connections are shown in Fig. 1, and are simple. Most instrument makers will supply such screws and a piece of platinum (taken from old instrument) for a small sum. A very fine adjustment may be made by the screw T, a fraction of a turn being usually sufficient, and at the point where the cam works against the pawl S a touch of oil will practically eliminate all friction. Of course, a

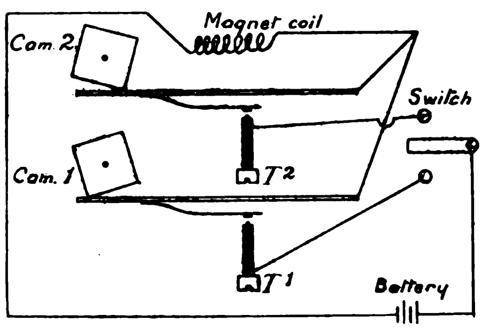


Fig. 3.

more elaborate mechanism may be developed from this idea.

Fig. 1 shows the rotation of the armature as clockwise. Let us follow the course of the iron bar A: the electrical circuit should be broken just before it comes exactly opposite the north pole of the magnet, and it is then free to be carried past by momentum. The electrical circuit must not be completed again till the bar has passed the point X, so that of the two magnet poles, the attraction of the south pole will be strongest as the bar is nearer to it. Suppose circuit to be made when the bar A is exactly at the point X, and hence equi-distant from the north and south poles, an exactly equal pull in opposite directions would be exerted on the bar, and it would remain stationary. Therefore, in Fig. 1 the corners of the cam lag behind their respective bars, and no sticking at the magnet poles results.

Of course, it is not necessary to have magnet poles diametrically opposite. An ordinary electric bell magnet, placed one side only, would do; but the opposite poles act better, as twice the number of impulses will result during each revolution of the armature.

Fig. 2 shows the cam with its corners slightly in advance of their respective bars, and the armature will rotate counter clockwise, or in the reverse direction to Fig. 1. Hence, with two cams mounted on the shaft (one with an angle of lag and the other an angle of lead), each cam working a separate contact-breaker, and a simple switch to introduce either one or the other into the circuit (see Fig. 3), we may obtain a reversible motor, and remove one of the amateur's objections to this type of machine.

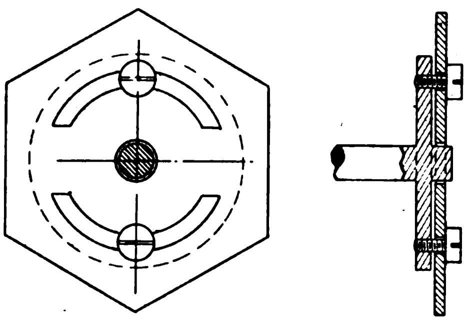


FIG. 5.

Such a motor is not so compact and powerful as a well-designed coil-wound armature machine, but it is much easier to construct. Its speed is very uniform, and I think it would prove satisfactory for running gramaphones, and such work. Small model locomotives, 1-in. gauge to 3-in. or so, can be made very easily and work well; the writer at one time had some tiny models less than 1-in. gauge of rails, which hauled about little cardboard trucks, and proved very amusing and very cheap to construct.

This type of motor is not, strictly speaking, self-starting, but with a six-bar armature there is nearly always a bar in position to be attracted.

Several forms of electro-magnet would suggest themselves to the reader (Fig. 4). In designing aim at keeping the magnetic circuit as short as possible and the cross-section of the iron reasonably large. In many amateur machines the magnetic design is inefficient, and considerable reluctance results. Good magnetic design is most important; put your intelligence and best work into the job.

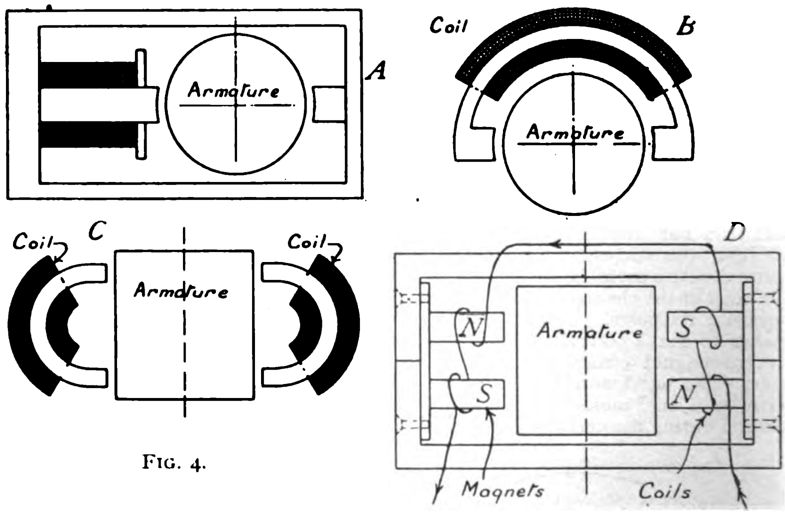


FIG. 4.

The armature bars may be mounted on an iron disc, and as two diametrically opposite bars come under the influence of the electro-magnet they tend to mutually assist each other's induced magnetism, the magnetic flux passing through the iron disc. Of course, the bars may be mounted on a wood cylinder, or any other suitable non-magnetic substance. The bars must be spaced exactly equidistant on the periphery of the armature. Keep the cam reasonably large: a wide range of adjustment may be made at the contact screw T. Should the amateur make such a machine, he will very readily grasp the points necessary for the best working conditions. Make the cam of steel, and a tight fit on the shaft; place it as nearly as possible in the correct position and test the machine, slightly shifting the cam till the true position is found: a touch of solder will secure it permanently, and it will last a lifetime. Needless to say, it must run quite true.

Let the armature run as fast as possible: more power will result. If used in a small locomotive, an old alarm clock supplies very suitable spur gear: with small driving wheels, and a good reduction between the armature shaft and driving axle, considerable tractive force may be obtained.

The current being intermittent, Leclanché cells may be used, and for this purpose should appeal to the amateur; they require little attention to keep in order. These notes are intended for the amateur who has not many tools at his disposal and little spare time in which to use them, and the reader who thoroughly digests the contents of THE MODEL ENGINEER should be able to bring to a successful conclusion most mechanical and electrical jobs he meets with. I omitted to add that should the contacts of the make and break spark, it is due probably to the presence of a little dirt. To remedy, place a small piece of clean paper between the contacts, and, while rotating the armature by hand, work the paper backwards and forwards.

For the Bookshelf.

The Practical Electrician's Pocket Book and Diary, 1907. London: S. Rentell and Co., Ltd. Price: cloth, 1s. net; and leather 1s. 6d. net; postage, 2d.

This new edition has been thoroughly revised and considerably enlarged, new chapters having been added dealing with Laying Mains, Testing with the Bridge Megger and the Ohmer, Lightning Conductors, Condensers, Electric Clocks, etc. There is also a useful article explaining the direction of the flow of current by means of the well-known hand diagrams, of which there are no less than five examples, whilst a new and most important chapter, entitled "Electrical Tramcar Notes," is from the pen of Mr. W. A. Agnew, who is well known as the author of "The Electrical Tramcar Handbook." This section should appeal to electric tramcar drivers, quite apart from the utility of the book as a cheap, reliable work, full of sound, practical information.

Induction Coils for X-Ray and Other Purposes.

By John Pike.

(*Concluded from page* 42.)

XVII.—Electrographic Work.

Photographic records of electric discharges are extremely interesting from their variety and beauty of outline; they are, also, by no means difficult to produce, neither is a spark coil of large size necessary. As a fact, the large coil produces, relatively, no better pictures than the small, while the cost in dry plates would be rather high.

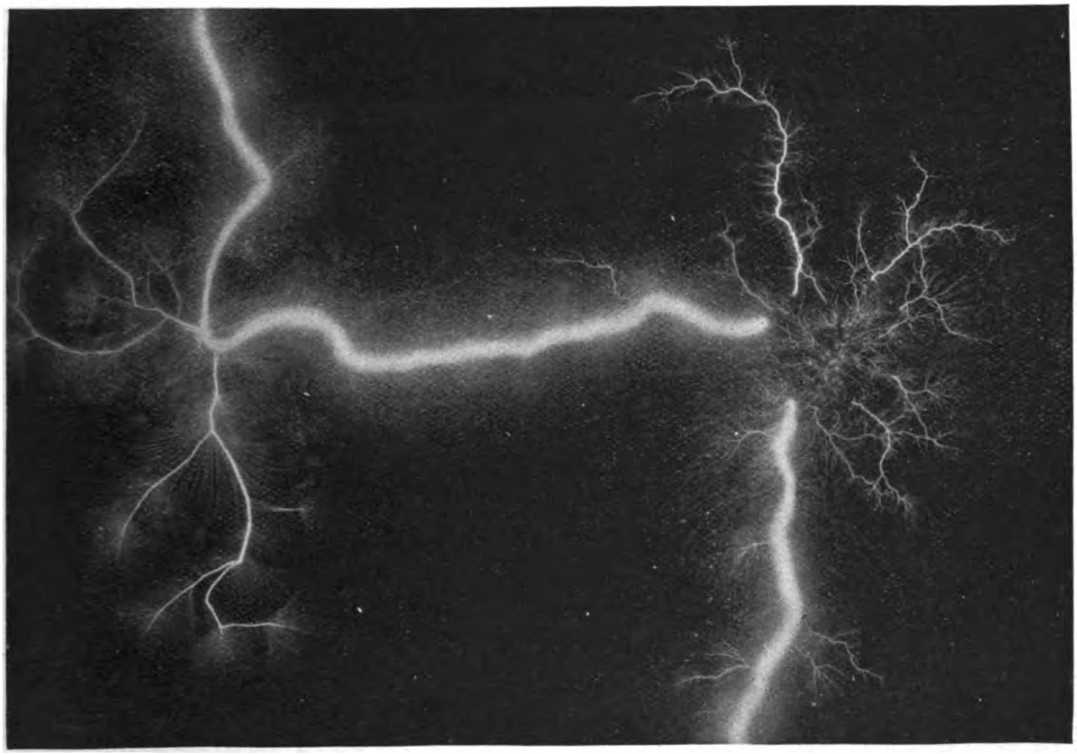


Fig. 44.

The photograph (Fig. 44) is that of a 4½-in. spark: the two terminals from the secondary are allowed to rest on the surface of a sensitive plate, and, two or three sparks being allowed to pass, the result is as illustrated. In this case the back of the plate was coated with tinfoil, *i.e.*, a piece of foil 4½ ins. by 1 in. was fixed to the plate at the back and centrally; the result is shown in the formation of the figure, which is compact, few lines radiating beyond the limit of the metal zone. By covering the back entirely with tinfoil, or resting the plate upon a metal plate of similar size, sparking under the same conditions as before brings out typical positive and negative figures more clearly; but unless the plate is of large size, so that the terminals are beyond sparking distance of the edges, the beauty of the picture will be marred by stray sparks over the edge to the metal underneath ; this is seen in the photograph.

If, now, we place one of the secondary terminals under the sensitive plate and in contact with the metal plate, one terminal only resting on the sensitive surface, the result after sparking and development of the image is much more remarkable and clearly defined. Fig. 45 is the positive figure so produced. In this instance the secondary wire resting on the plate terminated in a brass ball. If the result of the first exposure is as Fig. 45, then the wires are merely reversed to get the negative effect. The *shape* of the metal backing has some bearing on the direction taken by the sparks, *e.g.*, if a disc is used the radiations do not go much beyond the periphery of the disc, and if a metal ring is used, a somewhat similar effect is produced, with rather less of the branchings in the centre.

Very similar results, again, are obtainable from the terminals of the small Tesla coil. The difference here is that the lines are much finer, *i.e.*, very furry, but there are always sufficient indications of the negative and positive figures. Numerous similar photographs were reproduced in the pages of The Model Engineer dated May 5th and 12th, 1904.

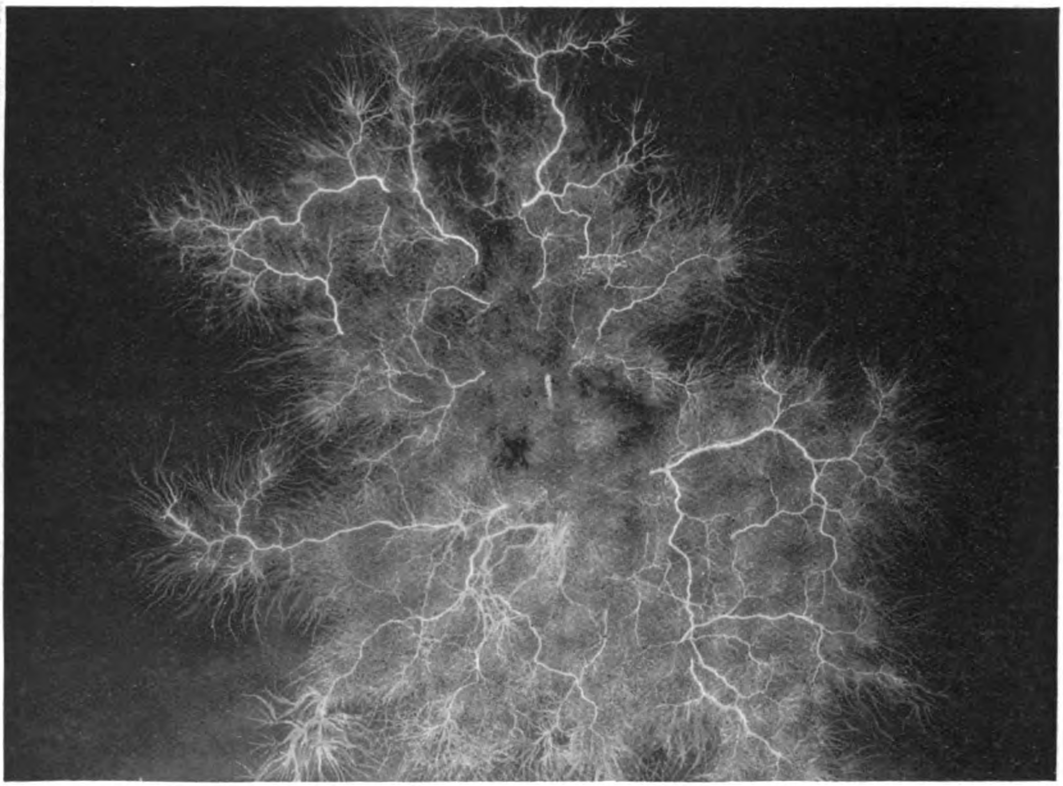


Fig. 45.

The sensitive plate may be used enclosed in a light proof envelope ; or, if the operating room can be made quite dark, this precaution may be dispensed with : there is little or no difference in results. The envelope is a safeguard against "light fog," and when a coil is worked in the dark, there is a fair amount of light emitted. The main point is to allow no direct light rays to fall on the sensitive surface.

Model Yacht Building for Beginners.

By Arthur Rollesby.

(*Continued from page* 64.)

FIRST then we will paint our boat. Make the surface of the hull perfectly smooth, scraping first with broken glass and finishing off with sandpaper ; smooth also the bulb, and make the edges of the fin like a knife. See that the join of the deck is made water-tight with white lead. Give the "topsides" of the boat—from the deck to ½ in. above the water line—two coats of white or black enamel, also the deck with white ; give the bottom of the boat, and the fin, and bulb, coats of chocolate-coloured enamel. You can get this paint in 1d. tins. Be sure to get the line where the two colours meet quite straight. Draw a pencil line round the deck parallel with its edge about ½ in. distant, and also, inside this, draw a series of parallel straight lines in imitation of a ship's planking.

Now for the spars; these should be made from strips of evenly grained wood. Dimensions are as follows:—Mast (from deck to top of tube), 21 ins.: bowsprit, 13 ins. (outside stem, 9 ins.); topmast, 15 ins.; boom, 22 ins.; gaff, 17½ ins.; jib-boom, 13 ins. A piece of ½-in. board, 2 ft. long, sawn into strip, will do very well.

For fitting out you will need: Some fine cord, such as is used for fishing-lines, brass screw-eyes (from any ironmonger), brass wire for making hooks, and brass sheet slips (from any model dockyard), a metal file, and pliers.

The diagrams with this article are very full, and hardly need much explanation.

First, the *mast*.—Take care this is placed as in the design, *i.e.*, 11¼ ins. from the stem head. To make your spar exactly round, first square with the useful iron plane, take off the corners of the square, and yet once again smooth away the corners; finish with glass and sandpaper. The mast, which should slope slightly towards the stern, rests in a piece of brass tube, which passes through the deck and is secured to the bottom by a screw passing through a wooden plug in its lower end. The masthead carries a smaller tube to receive the end of the topmast, Fig. 13, *a*; the fitting being like that of fishing-rod joints. The mast tapers from bottom to top. Slip over the mast four small curtain rings for securing the mainsail, and screw into it near the deck a brass hook for the boom, Fig. 14, *a*; fasten on the shrouds just below the topmast tube, Figs. 12 and 13, and lead down to a screw-eye at the edge of the deck on each side; use a brass sliding slip for tightening (for method of fitting slips see diagram.) The *topmast* is a light, tapering spar, with a single stay leading from the top to the bowsprit.

The *main-boom*, as well as the other spars, is thinner than the mast; make it thickest in the middle, where the strain comes. At the inner end put a screw-eye to meet the hook in the mast, first drawing on a piece of tube to prevent splitting. Fit the main-sheet as in Fig. 12; it is hooked to a screw-eye in the deck just under the outer eye in the boom through which the sheet runs.

The *gaff* should be made quite lightly; the jaws are of wire (see diagram) and clasp the mast; eyes are fixed for peak and main halyards.

The *bowsprit* should be strong; its fittings are shown in Fig. 15: *b* is a large screw-eye through which the spar passes; *a* is brass tubing receiving the end, and strengthened by a block of mahogany; *d* is a sliding ring, or traveller, and the cord attached passes through a hole and thence inwards to the deck; *e* is the bobstay, serving to keep the bowsprit down.

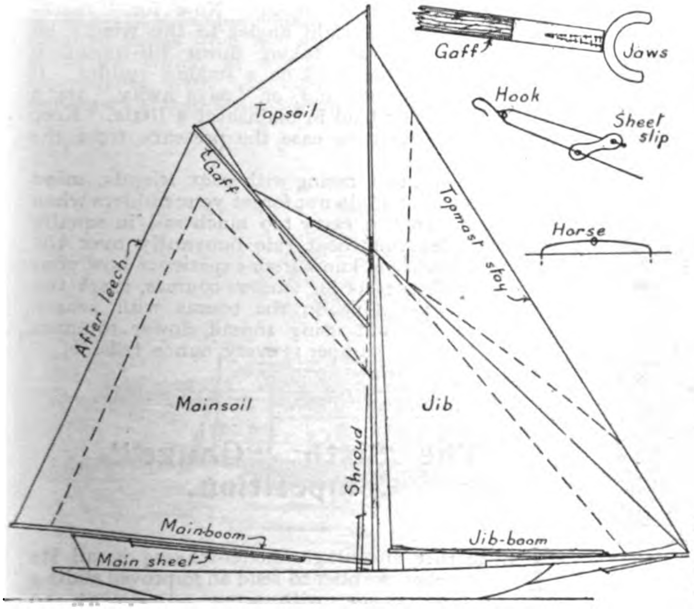
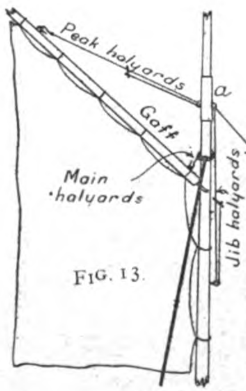
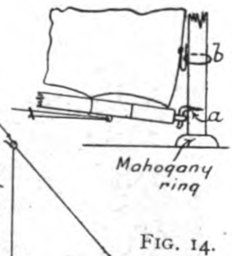


FIG. 12.—SAIL PLAN.





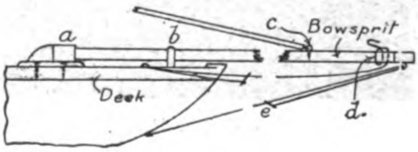


FIG. 15.

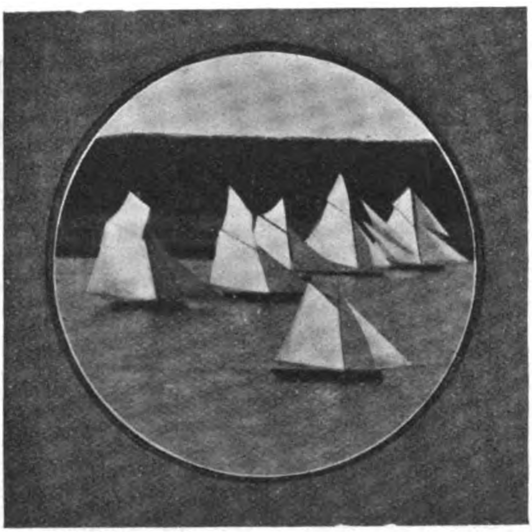
The *jib-boom* is fastened to the bowsprit at *c*, and swings just clear of the mast; the sheet is fitted like the main-sheet, but leads down to a sliding ring on the "horse" (see diagram), which is placed across the deck; a little hook is put at the inner end for hooking to the jib.

Finally, give all the spars and the *deck* a coat of white varnish.

And now for the SAILS. Buy 1½ yds. of the finest calico you can get, and stretch it well by damping and getting another fellow to take the opposite edge and see-saw it with you over the smooth bar of a bed—pulling hard. Cut paper patterns of the sails, put them down on the calico, and use sharp scissors, allowing ½ in. for hem. The after-edge, or "after-leech," of each sail should be the "selvedge edge" of the cloth, as this needs no hemming; the "foot," or bottom, of the jibs should be cut round. Get somebody's sister to do the sewing for you, and you are ready to "fit out."

Mainsail.—Along the edge nearest the mast sew four long hooks into which the brass rings are slipped (Fig. 14, *b*); this to keep the sail close to the mast and also to permit it to be readily unfastened. Lace the upper and lower edges to gaff and boom with strong white thread, Fig. 13; fit peak-halyards, Fig. 13, and main-halyards (just like jib-halyards, Fig. 13); set sail and hook mainsheet to deck.

Jib.—Put a tiny ring at each corner for hooking to jib-halyards, traveller, and the hook at the inner end of the jib-boom. Pull the bobstay taut till the bowsprit curves downward. You will find that pulling on the jib-halyards will bring the mast upright; be careful, therefore, not to make



A Close Race.

the length of the jib along the "weather" (top of mast to bowsprit end) too great.

Topsail.—First, a small cord ring to slip over end of topmast, prevented from going lower by fastening of topmast stay; a ring, hooking to outer end of gaff; a cord at the lower corner, with a hook and slip attached leading to a screw-eye in the mast; along the edge at the mast *sew* two or three small rings; these are slipped over the lower end of the topmast before setting the sail.

You will find a smaller jib essential for windy weather; fit a large jib, and cut as in dotted line; to set, haul in the traveller a few inches. A second mainsail you will find useful later on; cut also as dotted line in sail plan. You may also like a "flying jib," fastened to the topmast stay, its sheet heading to the main-boom end.

But—before going in for these luxuries—we will give our boat a trial trip, and we shall learn her needs more exactly.

You will find your boat has as many moods and as much individuality as a human being, and practice only will enable you to get good behaviour from her at all times.

But before we part company, we will see her safely on her first voyage.

A smart breeze, and our boat will have as much canvas as she wants with the three sails. The puffs travel straight down the pond, and to get to the other end you must "beat to windward," *i.e.*, get forward by a zigzag method from side to side. Haul in main and jib sheets fairly flat; you need put no rudder on. Ha! she flies ahead bravely for a few seconds, then turns directly into the wind; her sails flap helplessly, and she drifts astern! Mainsheet too tight! that's better! Experiment to see how near the wind she will sail without losing her forward motion. And now, to return, or "run," before the wind; put on your heaviest rudder, slack away mainsheet till the boom is right across the deck, ease off jib-sheet; if not too squally, hoist jib-topsail. Now for "reaching," or sailing, at right angles to the wind; let out sheets half-way, taking down jib-topsail if not a slight breeze, hook on a smaller rudder. If she turns from the wind, or "pays away," try a lighter rudder or haul in mainsheet a little. Keep the jib well flying to ease the pressure from the bow.

When you start racing with your friends, mind you keep cool, and do not forget your rudders when necessary. Do not carry too much sail in squally weather; let your boat ride buoyantly over the waves. When you know from experience how your craft likes the sheets for various courses, mark the position of the slips on the booms with pencil. When you are not using topsail, lower topmast also to save top-hamper: every ounce tells.

The Sixth "Gauge" Competition.

To further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th, 1907.

Some American Steamer Notes.

By "Atlas."

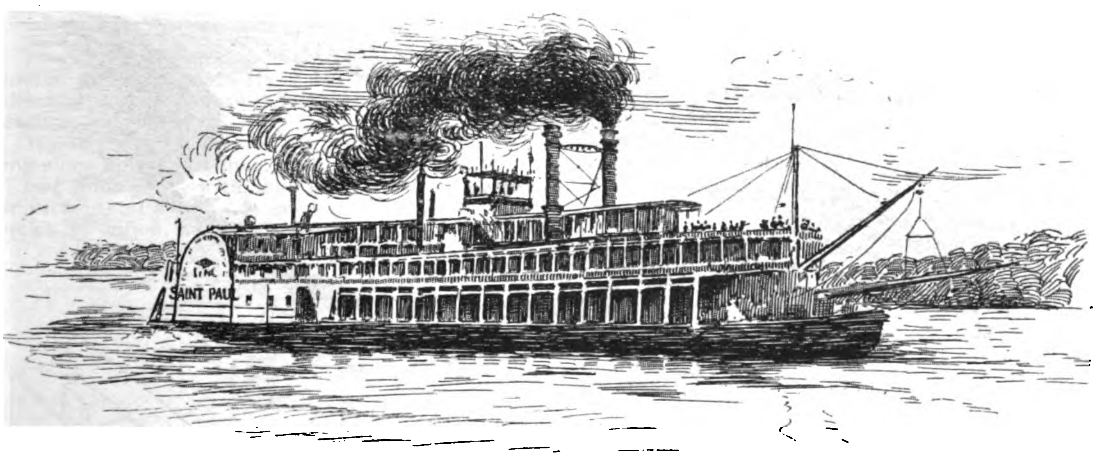
I.—On the Mississippi.

Picture to yourself a broad shallow track of very muddy water winding its way onwards to the sea through cliffs and hills, through vast expanses of woods and forests, past busy towns and mills, under swing bridges, through cotton fields and swamps, for the long, long stretch of three-and-twenty hundred miles, and you have a mental vision of the famous Mississippi River. It twists and bends and turns, it broadens out almost into a lake, it bubbles over shallows and it swirls round snags and boulders. At times of heavy rains it overflows its banks and returns to the surrounding lands a goodly portion of the earth it has previously washed away. Fifteen hundred miles from the sea it has dwindled to a streamlet which in width and colour is fairly comparable with our own old Father Thames well down towards Gravesend. For 800 miles more —from St. Louis to St. Paul—it is still lusty enough to bear its share of passengers and freight until the Minnehaha Falls put an impassable barrier in the way of navigation.

Such a river has a population quite its own. Its characteristics and its needs call for craft which – to the eyes of the Britisher— are, to say the least, peculiar. But peculiarity is quite compatible with efficiency, and indeed is only a matter of comparison after all; for the handsome steamers of the Clyde, the Solent, or the Thames would be as much a wonder on the "Mississip" as the stern and side wheelers of that famous stream would be in the waters of the British Isles. The workers in the Mississippi boatyards excel in the construction of steamers of shallow draught, and it is recorded in the writings of one authority that they can build a vessel which will sail across a meadow after a heavy dew! Be that as it may, it is a solid fact that there are steamboats in regular service there which, with a length of over 250 ft. and a beam of 40 ft., draw less than 30 ins. of water.

Such a boat is the saloon steamer *St. Paul* of the famous Diamond Jo line, trading regularly between St. Louis and St. Paul. She actually measures 277 ft. over all in length, 68 ft. over all in width, and 42 ft. beam on lower deck. She draws 30 ins. when light and 3 ft. when loaded with over 300 passengers and some 1,400 tons of freight. Against the stream she makes a steady 9 miles an hour, but when coming down the river she reels off a respectable 15 to 16 miles per hour with ease.

It is quite a novel feeling to be on the upper deck of such a boat as this. It is like being on the roof of a huge houseboat, save for the presence of the twin smokestacks, which alternately emit dense clouds of smoke and exhaust steam, and remind one of the existence below of the source of motive power. It takes the inexperienced passenger quite a little time to accustom his ears to the "Woosh!" "Woosh!" of the exhaust as it rushes away to the sky above. On this upper deck is the wheelhouse, where the pilot reigns supreme and directs the course of the vessel through the veritable maze which the many hidden perils of this river provide. There is no bridge for the skipper to patrol. He strolls around, when free from the active exercise of his many duties and chats, to the passengers until a town or village comes in sight. He then takes charge from the front end of the deck, signalling his commands through the medium of a large ship's bell. There is no manœuvring to run the vessel alongside a quay or pier, for she merely runs her nose on to the river bank, a rope is made fast, a gangway swung across to the shore, and the unloading or loading begins. Then, for once, the niggers work, for the cargo is shifted on and off by a crew of darkies, or "roustabouts," as they are locally termed, and an incessant ebb and flow of perspiring ebony is kept up till the last box or parcel is put ashore and the last bale or bundle brought aboard. The bell rings, the "Swoosh!" "Swoosh!" of the exhaust is heard, the huge side wheels revolve, and off she goes again. The "roustabouts" relapse once more into their



The Diamond Jo Saloon Steamer, "Saint Paul."

regulation inactivity or return to their gossip and gambling in out-of-the-way corners of the cargo deck, and the passengers settle down to their books and papers, or to their inspection of the riverside scenes. An up-to-date and distinctly impressive touch is supplied at night by the turning on of a powerful electric searchlight for picking up the landmarks for the pilot.

The machinery which propels this huge vessel is—in quaintness—quite in keeping with its surroundings. The steam power is derived from four attenuated cylindrical boilers each 28 ft. long and 3 ft. 8 ins. diameter. These are arranged in a row over one external firegrate, 5 ft. long and 20 ft. wide. In each boiler there are three return flues of 8 ins. diameter and three of 12 ins. diameter. The boilers are spaced 9 ins. apart, and are set in brickwork with their undersides 14 ins. above the surface of the firegrate. The working pressure is about 160 lbs. per square inch. The coal consumption is about 800 bushels per twenty-four hours.

The engines are of the horizontal type, and two in number, arranged fore and aft, one on each side driving direct on to the side paddle wheels, the latter being placed quite close to the stern end of the boat. Each engine is double-acting, and has a cylinder 7 feet stroke by 22 ins. bore. The connecting-rods are proportionately huge, but being mostly composed of wood are not excessively heavy. The crank-pin is 7 ins. diameter, and the shaft on which the paddle wheels are carried is 12 ins. diameter in the journal at the bearings and 10 ins. diameter elsewhere. Each paddle wheel is 28 ft. in diameter and 9 ft. wide. The wheels are slightly elliptical in shape, the floats or paddles being of varying lengths. The latter are from 10 ins. to 34 ins. in length, and are so arranged that the longest floats are in the water when the engine crank is at its position of maximum turning effort.

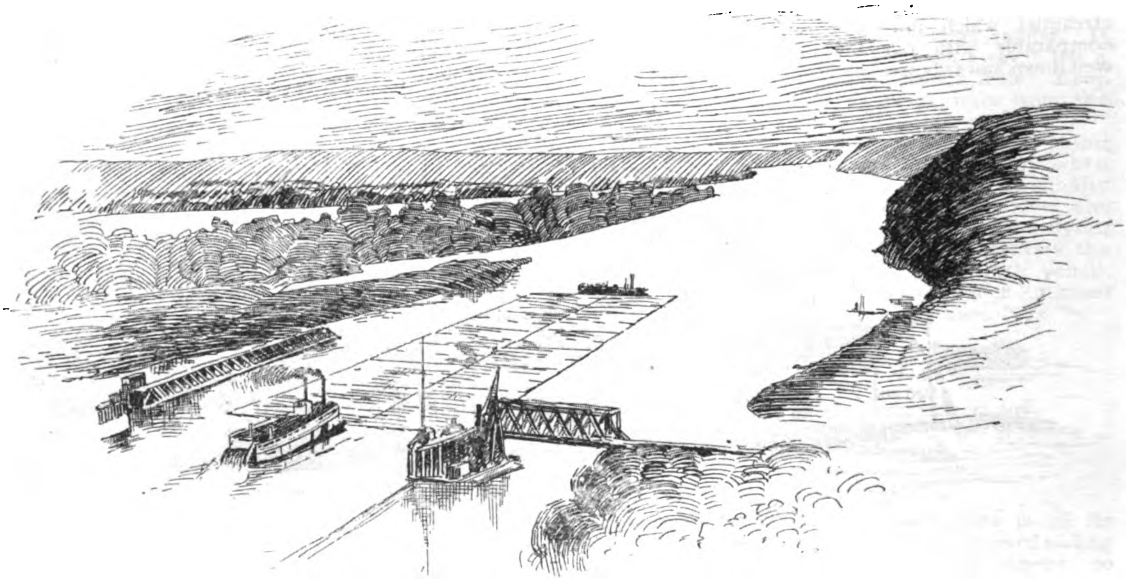
The officers and crew of such a vessel as this number quite a fair-sized crowd. The following is the official list of those carried by the *St. Paul*:

Captain, two mates, two pilots, first and second engineers, two assistant engineers (termed "strikers"), four firemen, two clerks, one carpenter, two roof watchmen, one main cabin watchman, one main deck watchman, twenty-eight deck hands or "roustabouts," first and second stewards, and from thirty to forty waiters or "boys."

The chief duty of the various watchmen is to patrol the ship at night-time in case of fire, a very desirable precaution in view of the very inflammable nature of the whole ship's structure. The waiters or "boys" are like the "roustabouts," of the coloured variety, and vary in number according to the state of the passenger list.

The *St. Paul* was built at the Dubuque Boat and Boiler Works, Dubuque, Iowa, under the personal supervision of Captain John Killeen, the president of the concern, and one of the most experienced captains on the Mississippi River. The writer had the pleasure of accompanying him on one of the early trips of the *St. Paul* when he was putting her through her paces, and is indebted to him for the various details of equipment here set forth.

While the *St. Paul* is an excellent example of the big up-river passenger steamer, there are numerous stern and side wheelers similar in general appearance, but smaller in build, to be seen in service. Not the least interesting sight on the Mississippi is the navigation of the huge timber rafts which during the logging season bring the logs in thousands to the saw mills and lumber yards along the river banks. These rafts are simply huge collections of tree logs roped together in regular order, and steered by two stern-wheel steamers—one at each end. The steamer in front is fixed athwart the raft and anchored thereto, so that



NAVIGATING A TIMBER RAFT ON THE MISSISSIPPI.

by going ahead or astern the end of the raft is pulled to one side or the other, and so steered in the required direction. The steamer behind the raft is attached end on, so that it can assist or retard the onward movement with the flowing stream. A sketch of such a raft is appended to these notes, and shows one of the railway swing bridges duly open for its passage.

Altogether, the steamers are of a class apart. As an example of locally specialised construction they are of much interest, and many of them have filled long and honourable periods of active and useful service.

(*To be continued.*)

Practical Letters from our Readers.

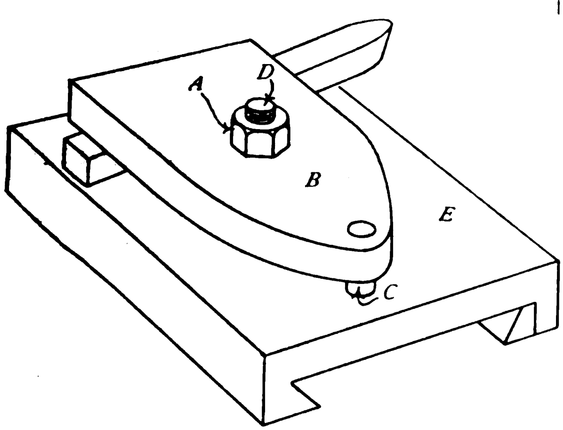
[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily intended for publication.*]

Simple Device for Holding Tools in Slide-rest.

To the Editor of *The Model Engineer*.

Dear Sir,—Thinking the following would be useful to model engineers, I herewith attempt to describe a simple, yet effective, device to hold tools in the slide-rest.

Having seen that all the slide-rests in an engineering shop in the neighbourhood were fitted with it, I had mine fitted with the same, and have found it very useful so far. It saves much time, is very quick in action, and holds the tool very firmly.



Holding Tool in Slide-rest.

D is a stud from 4 to 5 ins. in length, which is tightly screwed into E and passing through the piece of steel plate B, which is shaped as shown.

A small spiral spring should be placed over the stud D, and should be about the same length as the foot C. This spring keeps the plate B at a distance, so that a tool can be placed—as per sketch—without lifting B up by hand. The foot C is screwed or riveted into B to act as packing when the tool is nipped up by the nut A.—Yours truly,

C. V. B.

Charging Accumulators with a Dynamo having an H-armature.

To the Editor of *The Model Engineer*.

Dear Sir,—The following struck me as a simple and probably feasible method of charging accumulators by a dynamo with an H-armature.

Introduce in the circuit a rectifier, or what is known as "Nodon's valve"; this will prevent the accumulators discharging themselves through the commutator of the dynamo when short-circuited by the brushes, owing to the peculiarity of this apparatus passing current in one direction only.

Care must be exercised in connecting up to see that the positive terminal of the dynamo is joined to the proper terminal of the rectifier, which should

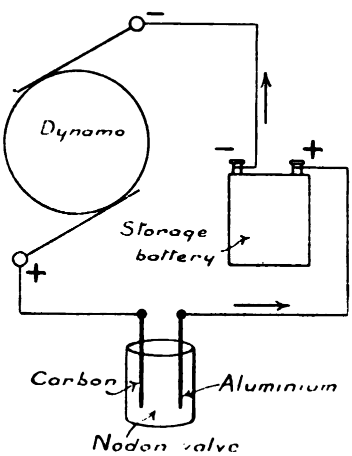


Diagram for Charging Accumulator.

be the carbon or iron plate. The aluminium plate ought to be connected to the positive pole of the cell to be charged.

There are many owners of small dynamos with the above type of armature who are debarred from charging cells at present. Perhaps some of them will try the suggestion and let us hear their results.—Yours truly, M. J. McVittie.

Newcastle-on-Tyne.

An Improved Spanner.

To the Editor of *The Model Engineer*.

Dear Sir,—I enclose a sketch and description of a new spanner which I have invented, and which I think will be of interest to your readers.

The invention consists of a spanner composed of two portions pivoted at *c*, as shown in Fig. 1.

The end *a* of one piece is made with an angle of 120 degs., to fit hexagonal nuts. The end *b* of the other piece is formed with a curve described in detail below.

This curve on *b* (Fig. 2) is a portion of an involute spiral, and is such that at any position of *b* relative to *a*, the line bisecting the angle of the piece *a* will be perpendicular to the tangent to the curve at the point of intersection of the bisector and the aforesaid curve, that is to say, the notches which are now formed to engage with the corner of nuts of various sizes will be opposite exactly to the angle A for every nut.

When the spanner is turned in the direction of the arrow (Fig. 1), the natural tendency of the two portions is to grip the nut more tightly, with increase of turning moment, as is the case with pipe-wrenches.

This is a great feature of the invention, as it prevents any liability of slipping with the consequent damage to the corners of the nut; it also renders the implement quite efficient in the hands of any person, however weak or inexperienced he may be. For this reason, and because of the fact

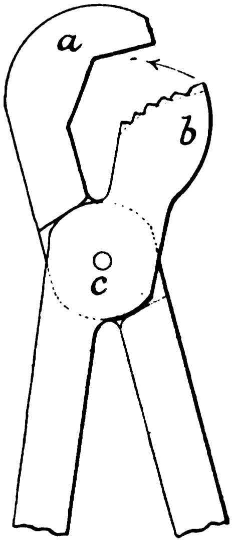
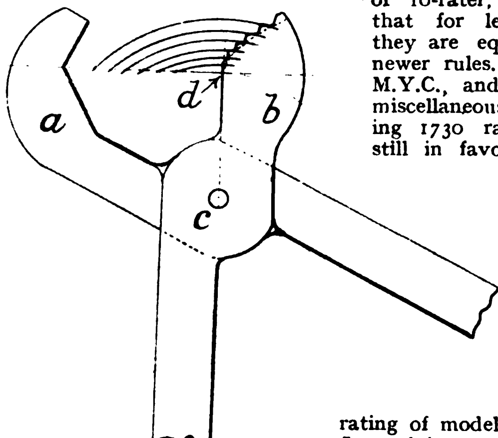


Fig. 1.

Fig. 2.



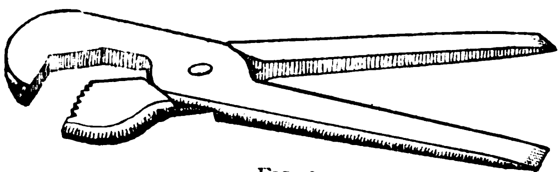


Fig. 3.

An Improved Spanner.

that when accurately designed no damage whatever is done to plated nuts, it is of special advantage to cyclists.

I have recently patented this invention in Great Britain, and am about to take out Letters Patent in the Colonies and in the principal foreign countries.

Should any of The Model Engineer readers feel interested in this spanner, I shall be pleased to answer any letters addressed to me.—Yours truly, Thos. F. Hargreaves.

22, Upton Lane, Forest Gate, E.

To facilitate the demolition of the big wheel at Earl's Court, a wooden model has been made with each part detachable, and the men before going aloft are shown by the model the exact portion they have to remove next.

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 intended for publication.]*

A National Model Yacht Racing Association.

To the Editor of *The Model Engineer.*

Dear Sir,—I have read the article of Mr. Brittain in a recent issue of The Model Engineer with great interest, and for one should be pleased to conform to the ruling of a governing body for all model yacht clubs. I think from his article that he is in favour of a healthy type of 10-rater, and from my own experience that for length of W.L., S.A., and weight they are equal to any designed under the newer rules. I am a member of the Leeds M.Y.C., and at present we have rather a miscellaneous collection of models, comprising 1730 raters and linear raters, but am still in favour of the old rater; but, personally, I would build to any class, provided it was one adopted by the majority of clubs. We, the Leeds Club, have adopted for the present season (1907) the L.W.L. and S.A. rules. I think that the ambition of most model yachtsmen is to have a fast boat, and they are not particular whether it conforms to the latest rule of the Y.R.A. or not. The rating of models was fairly well gone into in this Journal in 1899 and 1901, but the interest died down without anything satisfactory being adopted.—Yours truly, S. D. Cooper.

Haworth, Yorks.

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, etc.—Saturday, January 26th: Visit to the Great Western Railway engine sheds at Old Oak Common. Wednesday, January 30th: Meeting at the Cripplegate Institute at 7 p.m. Paper by Mr. W. J. Tennant on "Some Mechanisms." — Particulars of the Society and forms of application for membership may be obtained from Herbert G. Riddle, Hon. Sec., 37, Minard Road, Hither Green, S.E.

Provincial Society.

Crook, co. Durham.—A meeting will be held at the Temperance Club, Crook, on Wednesday, January 30th, at 7.30 p.m. All model engineers and others interested who reside in the district are invited to attend.—Hon. Secretary, E. L. Whitfield, 1, Bridge Street, Crook, R.S.O., co. Durham.

Queries and Replies.

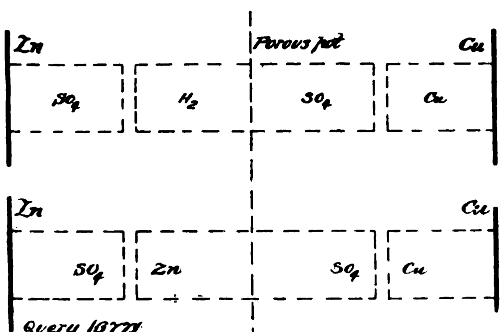
[Attention is especially directed to the first condition given below and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to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

[16,771] **Daniell Cell.** R. E. D. (Highgate) writes: I intend making a small lighting installation, similar to that described in "Electric Lighting for Amateurs." The accumulators are to be constantly charged by gravity Daniell cells. Having been disgusted by nearly all other cells, except the Fuller, I made up one gravity cell to test. I used $ZnSO_4$ instead of dilute H_2SO_4, and have found the saving in zinc very considerable. I have had this cell in a circuit (magnetising an electric bell magnet) for three days running, and am completely satisfied with results, except that the zinc becomes coated with copper. Why is this and how prevented? I have not shaken up the solution in any way, and liquid is quite clear above the $CuSO_4$. What is action of cell? I suppose some free H_2SO_4 is necessary in the zinc solution, acting on zinc forming $ZnSO_4$ and H_2. In the handbook on Batteries, you say this *free* hydrogen passes through the porous pot. Is not this hydrogen nascent and not exactly in the free form?

The deposit of copper on the zinc plate is caused by diffusion of the copper salt which deposits copper as soon as it reaches the zinc plate. Hydrogen is set free by the decomposition of the sulphuric acid, and this forms a molecule of acid by its interaction with a molecule of the copper sulphate; thus a copper ion is set free, and *this* is deposited upon the copper plate instead of the



DANIELL BATTERY.

hydrogen. The exchange of Cu for H takes place at their surface of separation. The two reactions may be expressed by the following:—

$$Zn + H_2SO_4 = ZnSO_4 + H_2.$$

Then the hydrogen reacts electrolytically with the copper sulphate—

$$H_2 + CuSO_4 = H_2SO_4 + Cu.$$

The exchange of copper for hydrogen takes place at their surface of separation so long as the acid and sulphate are kept separate. But diffusion takes place with both the acid and zinc sulphate that is formed. In time the acid reaches the copper plate and hydrogen is evolved, causing polarisation. Zinc may also be deposited. The copper sulphate also diffuses in the direction of the zinc plate and deposits copper upon it.

[17,077] **Hardening Lathe Crankshaft Pivots.** P. B. (St. Albans) writes: Will you give me directions on how to harden the ends of a lathe crankshaft, and also how to harden the points of two mild steel bolts on which the above crankshaft runs on?

You can harden the ends of the crankshaft, which we presume is of wrought iron or mild steel, by the use of yellow prussiate of potash. Obtain some of this compound at the chemists. *Note.* It is poisonous and, therefore, do not leave it about or inhale any fumes from it). Powder it in the generally approved manner, and then heat the end of the crankshaft to redness. Dip it into the prussiate of potash, and, where a good depth of hard skin is necessary, repeat before plunging it into cold water. If the work cools down during the process of coating with the prussiate of potash, sprinkle some powder on the end and re-heat to a bright redness. The pivot bolts may be treated in the same way.

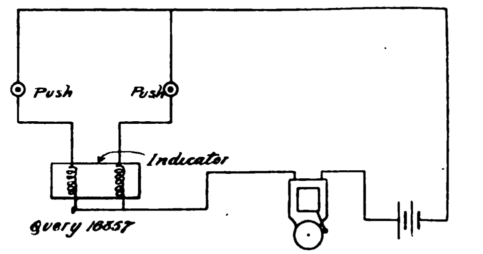


DIAGRAM OF CONNECTIONS FOR AN ELECTRIC BELL INDICATOR.

[16,857] **Electric Bell Indicator Connections.** W. L. (Abertillery) writes: I should feel greatly obliged if you would show me how to connect two pushes with a two-pole indicator.

Diagram above shows connections required.

[16,992] **Lighting from Small Primary Cells.** T. B. (Coventry) writes: I shall be obliged if you will kindly advise me on following: I want to connect six 4- or 5-volt lamps to one battery, which in the case of some of the lamps will be a good distance away, say, 8 yds. I want to be able to have a light for, say, one hour at a time, and perhaps also to occasionally have a second light for a minute or so whilst one is alight. My present battery consists of four cells, ¾ pint of solution in each, connected in series: solution I use: bichromate of potash, to which I add sulphuric acid. I get 6 volts for an hour or so after battery has had fresh sulphuric acid added and a good light, but after then the voltage drops back to about four, and when a lamp is switched on it (the voltage) gradually drops back to about two, taking three or four minutes to do this, and that is the end of the light. After an hour or two's rest it will again repeat this performance. After one or two days' rest it will not go back to about 4 to 5 volts unless fresh acid is added. Is it correct that I should have to add fresh acid after about one hour's light? Battery has one carbon (3-in. by 1½ by ½) and one zinc (3 by 1½ by ½). After about four hours' light the zincs are nearly worn out. Can I use anything cheaper to maintain battery, that will give desired results and one that does not want all the zinc put in and out each time a light is wanted? Can I get a battery where the zincs can remain in and the light be always available without interfering with battery? Kindly advise type and how many cells. Would an accumulator be better? What volt accumulator for lighting a 5-volt lamp at end of 8 yds. from accumulator? How many lamps at one time could be lit?

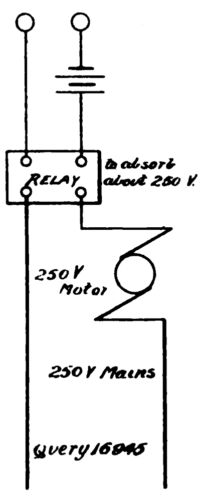
The only effectual remedy is using larger cells, but, of course, this would be more expensive. We are afraid you are expecting too much from a small battery. Accumulators—if you can get them recharged easily—would be preferable. *Re* zincs. The main thing is to keep them well amalgamated. For a 5-volt lamp a 6-volt accumulator would do, but lamps would burn rather brightly and perhaps not last long. Better use 6-volt lamps. See recent replies on this subject.

[16,994] **Windings for 25-watt Dynamo.** S. H. (Bristol) writes: I have a small dynamo, the field-magnet of which is made out of soft wrought iron in three forgings as drawing, which is full size (not reproduced). The armature is 1½ ins. diameter, with eight slots, ¼ in. × ½ in., to be wound in eight sections with an eight-part commutator. What I want to know is:—(1) Could I get 40 watts out of it (8 volts 5 amps.)? (2) If not, how many could I get at full load? I do not want the voltage to be below 8 or above 10. (3) What gauge and amount of wire should I want for field-magnet and armature? (4) What speed should I have to drive it at?

(1) No. (2) About 25 watts. (3) Armature: No. 22 S.W.G.; wind full. Field-magnets: No. 22; about 14 ozs. (4) Speed, 3,200 (about), but this can be varied to get exactly voltage required. A trial is necessary.

[16,945] **On Running Motors from Mains and Cells.** J. K. T. (Paisley) writes: (1) Would you kindly answer the following question, as I am exceedingly anxious to know, either through the

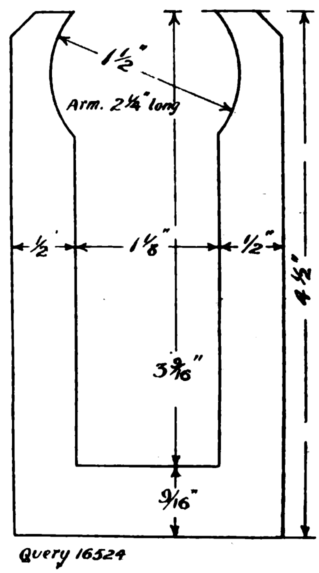
columns of THE MODEL ENGINEER, or per enclosed stamped envelope. What is the best way to connect a small motor of about 1,600 r.p.m. to a continuous current of 250 volts, so that pressure will fall on motor only and be relieved at switch where there will be no voltage of sufficient strength to cause handling by fingers dangerous? I hear of such a thing as a relay, which, when connected, will absorb the high voltage and prevent it from going to switch. To make my question plain, I have sent a rough sketch, which you will observe contains switch, current passing through it is 10 volts, which makes it harmless in handling. Please understand I do not want any insulation there (as this is the crux of the whole question). I am not at all clear on the question of this volt resistance in circuit, and would like very much if you would enlighten me on this matter and tell me where I can get it supplied, both with motor, relay, and battery complete, and probable cost of same. If I can procure this and find that it works satisfactorily, I may require a great number, as it is an entirely new patent of my own invention. The above is not the motor mentioned in question No. 2, but one which will be strong enough to stand the 250 volt. (2) I possess a very small motor (tripolar type), which runs very satisfactorily and answers my requirements admirably. It takes from 8 to 10 volts to drive it at a speed from 1,000 to 1,600 r.p.m., the exact speed being immaterial, so long as it is between those two figures. But what I want to ask you particularly is—how am I to procure a battery to drive it? I have already tested it with small dry batteries, but it exhausts them in about ten minutes or so. I do not ask it to be driven continuously without stopping. What I want is a battery (which, of course, will take up as little space as possible) to keep is going for about a quarter of a minute at a time, then switch off, and again start in about two or three minutes by switching on. This to continue for about seven or eight hours per day. If you can tell me where I can get a battery to do this, I shall be very glad. I am thinking about purchasing some Leclanché cells, as I understand they will last longer and give less trouble in recharging than the bichromate cell, but I am at a loss to know the exact quantity of cells to purchase; perhaps you will advise me, or you might know of something better. (3) Would you kindly advise me of the best and simplest method for electro-plating? I have a set of golf clubs, five of which I would like to electro-plate. Kindly inform me what kind of battery and what strength will be required? What is the probable length of time it will take to electro-plate one club? What is the probable cost of electroplating one club? (4) Can I work a small tripolar armature motor with Leclanché cells (self-starting)? A 1-volt dry cell works it beautifully. I know that the above Leclanché cell works an H armature, but there is a dead-point which makes it not self-starting and which on no account can serve my purpose. I have solicited advice from a good many electricians, but not one of them can give me a clear answer on the matter. I have tried half-a-dozen small tripolar armature motors of various makes (self-starting) with twelve Leclanché cells, but they would not move. At the same time, each one of them started right away when I applied a 1-volt dry cell. To put my question clear, is it possible for me to work a self-starting motor off a Leclanché cell? If not, what is the best battery, and the longest duration which will work this tripolar armature motor?



This practically amounts to a resistance placed in the circuit. A suitable coil can be had from any of our electrical advertisers, such as Whitney. State the current your motor is to take and the supply voltage, and makers could supply you with coil of suitable resistance. A full explanation of the matter is to be found in No. 8,106, March 5th, 1903, issue. The only way a relay could be used in order to avoid touching a switch operating the 250-volt supply, would be to use a low voltage supply of current to work it; it (the relay) in turn releasing or engaging the contacts to complete or break the 250-volt circuit. *Re* battery for small motor: Would not Daniell cells do? Any electrical firm would supply you. You do not say what current motor will take. Leclanché cells are only suitable for very small current output. The output in the first place for electro-plating would be the heaviest item. You must refer to one of the various books on the subject (see Bonney's "Electro-plater's Handbook," 3s. 3d. post free). The subject is fully explained. See also recent articles on the subject in this Journal. *Re* your repeat question *re* motor: The Leclanché is probably unable to supply enough current—it polarises too quickly. Try Daniell or bichromate cells.

[16,524] **Windings for 5 c. p. Dynamo.** H. C. (Outwood) writes: I send sketch of a small dynamo (cast-iron). Please tell me how much wire I shall want for same and what gauge? I should like it to be an 8-cog drum armature. Will you tell me diameter of commutator, and also what output shall I be able to get from it, and how many 4-volt lamps it will light? I have your small book on Dynamos.

Wind armature with No. 24 gauge D.S.C. copper wire, eight coils, two in each slot; get on as many turns as you can in each; about 4 ozs. of wire will be required. Commutator to have eight sections 1 in. diameter over-all, and useful length (¾ in. approximately) to take a ½-in. wide brush. Wind field-magnet with No. 20 gauge s.c.c. copper wire; get on as much as you can—about ½ lb. on each core—connect in shunt to brushes as 1 A, page 12, of our handbook on "Small Dynamos and Motors." Depends upon candle



OVERTYPE DYNAMO FIELD-MAGNETS.

power of lamps. Output about 4 volts 4 amps., perhaps lighting half-a-dozen 4-volt 1 c.-p. lamps or two 2½ c.-p. lamps. Voltage can be adjusted to some extent by running at higher or lower speed; try 3,000 r.p.m.

[17,112] **Penny-in-the-Slot Shocking Coil.** V. M. L. (Camberwell) writes: I should be extremely obliged if you could kindly give me a rough sketch of the mechanism required in order to get a shock from an induction coil and two dry batteries by the insertion of a penny-in-a-slot.

See page 358, Vol. XV of this Journal.

[17,141] **Converting Model Clockwork Railway to Electric.** J. F. (Edinburgh) writes: I have a model clockwork railway, No. 1 gauge, with locomotive and four coaches. I wish to electrify the railway by fitting in an insulated centre roll or conductor, and the present rails to act as the return. I will make an electric locomotive which I wish to reverse by changing the direction of current from the centre to outer rail or *vice versa*, without touching the locomotive, by a reversing switch from a battery of from four to six cells. Could you let me know what kind of motor I should use, and the electrical connections of the motor, as the ordinary motors sold do not reverse by changing the direction of current; also the size it would require to be to start the train? The space available for motor is about 6 ins. long, 2½ ins. broad, and 3 ins. high. The electric railways sold seem to have only one insulated centre rail.

The most convenient way to do this is to use a permanent magnet motor—*i.e.*, with permanent field-magnets. Then, by reversing the direction of current in the armature, you reverse the direction of rotation. Thompson, of 28, Deptford Bridge, Greenwich, could supply you with a suitable motor. For reversing a series motor, see query reply No. 8,543 in April 16th, 1903 issue. See also June 4th, 1903 issue, page 543. A motor taking about 10 or 12 watts would be large enough if well made, and suitable gear is used for transmission of power to driving wheels.

[17,090] **Locomotive Type Boiler.** S. W. (Swalwell) writes: Please tell me what size boiler (locomotive type) will drive

an engine 1½ ins. by 1½ ins., high-speed. Also state size of rivets, thickness of mild steel plate, etc., which will be required to obtain a working pressure of 100 lbs. per sq. in.?

Everything depends on what power you require, and also the conditions under which the boiler will have to work. For light work, a stationary locomotive type boiler, with a 5½-in. diameter by 14-in. barrel, twelve tubes ⅜ in. diameter, and a firebox 6½ ins. by 6 ins., should do very well. For full power, adopt a boiler with the following dimensions: Diameter of barrel, 6½ ins.; length of barrel, 15 ins. Firebox: Length, 8½ ins.; width, 7 ins. Tubes: Twelve, ⅜ in. diameter. Material: mild steel, 3-16ths in. thick. Rivets, ⅜ in. or 11-32nds in. diameter.

[17,148] **Resistance for Arc Lamp.** W. H. D. (Reddish) writes: Having purchased an arc lamp for lantern use, and wishing to use it for a cinematograph, I should be obliged if you would inform me what amount, gauge, etc., of thick wire for the resistance to use with same. What is a good wire to use (not very expensive)? I have made the frame 2 ft. by 1 ft. The top carbon is very thick, and is, I understand, the positive (+). The voltage is 230.

The arc will take about 45 volts, but you do not mention what current it is supposed to take. Assuming that it is 10 amps., a resistance of about 20 ohms will be required, and 4½ lbs. No. 16 platinoid resistance wire will give this; 27 yards to go to the lb.

[17,170] **Match Igniter.** W. L. F. (Bristol) writes: Could you tell me where I could obtain the information necessary for constructing an electrical contrivance for cigar and cigarette lighting. I want to be able to work same from a push some distance away, say, at the end of 30 yds. of wire, and I want it just strong enough to ignite an ordinary match. If the information should be contained in a back number of the weekly MODEL ENGINEER, or one of your small handbooks, I should be greatly indebted to you if you would forward the same and I will immediately remit cost. What I really want the article for is to try the experiment of lighting the kitchen fire from the bedroom.

Use a small piece of platinum wire of, say, No. 38 gauge, and an inch or two long, and supply current to it from a few batterie —large Leclanchés would do. If wire does not heat up sufficiently add more cells till you get the required results.

Further Replies from Readers.

[17,035] **Charging from Town's Mains through a Rectifier.** I have been using a rectifier for over two years now for charging accumulators. Perhaps my experiences may be helpful to "C. F. S." In the first place, the efficiency of the apparatus is a very variable quantity, and I have never succeeded in getting a net efficiency of more than 30 per cent. under most favourable conditions. By this, I mean the ratio of watts flowing into cells as compared with watts taken from mains. Roughly speaking, I find that when charging only two cells, the efficiency may be about 7 to 10 per cent. The greater the number of cells the greater the efficiency. The reason of this is that the rectifier works best when difference of potentials between A.C. terminals is about 140 volts, and the efficiency falls off rapidly as this voltage is lowered. I work with a transformer off 200-volt mains, the secondary being divided to give from 5 to 90 volts by steps. If the number of cells to be charged is small, then it is a good plan to insert a small choke coil in the circuit in series with the cells; in this way one is enabled to work with higher voltage on A.C. side of rectifier. The choke coil should have at least 600 turns of wire—better have twice that number in two sections. My rectifier consists of four 2-lb. jam jars with aluminium strips about 1½ ins. wide, cut from sheet metal, and dipping about ¾ in. to 1 in. in fluid; the other plates are carbon battery plates. The total cost of setting up rectifier was about 5s. I use Rochelle salts—2 lbs. of salts for the four cells—and this will last for months of fairly continuous work. I should recommend "C. F. S." to make or buy transformer with divided secondary, giving 30, 50, 70, 90, 100, 120, 130, 140 volts as required; make rectifier; make choke coil, and to arrange to charge as many cells at a time as possible. I usually charge ten to eighteen cells at once all in series. My rectifier is rather too small, and only passes 2 amps. without undue heating.—PH. MULHOLLAND.

[16,671A] **Locomotive Valve Gear.** I would like to point out what I think to be a mistake in your reply to the above query in the issue of January 3rd. You say that bringing the reversing lever into the upright position will have no braking effect on the engine, and that the driver must move the lever back past the central position into back-gear and turn on steam before the motion acts as a brake. Now, having driven traction engines, this is contrary to my experience, as I find that even with the reversing lever in the first notch in the direction which the engine is running there is a braking effect with steam turned off, and this is much increased by bringing it into the central position; whilst by putting it into full back-gear, the engine will form a very powerful brake, sufficient to pull it up with a load on any ordinary hill, and this without turning on steam at all. I think you will find this is confirmed by any driver, the majority of whom use their engines as brakes in this way—indeed, having no other to use.—H. KING.

[We may point out that as locomotives (express locomotives, in particular) are generally provided with an ample amount of lead, and as this lead is increased in mid-gear where the Stephenson motion with open rods is fitted, an engine may continue to run, under light load, with the lever placed in mid-gear. Since receiving the above letter, we have experimented with a full-size model valve gear which we have installed in the office, and find that without considering the angularity of the rods, steam is admitted for about 9 per cent. of the stroke with a valve and valve setting common to ordinary locomotive practice. While the compression and the friction of the machine are more than counterbalanced by the work done by this steam, the engine will continue to run. Of course, the slightest variance will upset this state of things, but we contend that where the valve has "lead" without an excessive degree of compression, and where the valve setting is accurate, the reversing lever cannot be relied on as a brake until the lever is moved into back-gear. With steam off the conditions are altered. There are several possibilities, and negative work may be obtained. During the compression stage the valves may be forced off their seatings, as is so noticeable by the clatter the little Great Western Rly. 2—4—0 tank engines make when they run into a station with steam off during the short interval which elapses between shutting the regulator and dropping the lever into full gear. —ED. *M.E. & E.*]

[17,017] **Model Yacht Building, Etc.** I think if F.B.C. paid a visit to the pond at Kirkstall Abbey he would have the opportunity of seeing one or two 10-raters, whose hulls, fully planked, but minus deck, which came out under 2½ lbs., but are capable of standing a fair amount of rough usage, and should be pleased to show him mine and give him any particulars he cared to have. I should imagine that his, with the weights he mentions, will be too heavy in hull. My new 10-rater ready for sailing comes out at 23 lbs., of which 16 lbs. is in fins and keel.—S. D. C.

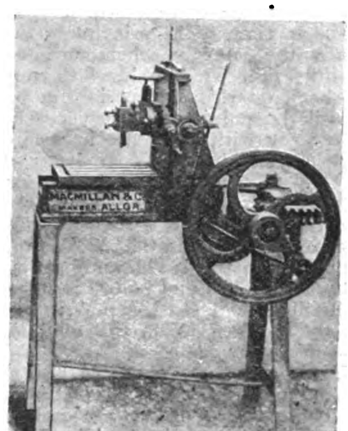
The News of the Trade.

[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 the asterisk have been based on actual Editorial inspection of the goods noticed.*

Small Planing Machines.

We illustrate herewith the "Ideal" Planing Machine, manufactured by W. Macmillan & Co., Mar Street, Alloa, N.B. The table is operated by a worm and worm-wheel, with connecting-rod, adjustable for different lengths of travel. Work



MACMILLAN & CO.'S PLANING MACHINE.

can be planed up to the following sizes—16 ins. by 8½ ins. by 9 ins. high, and tools up to ½ in. square can be used. The hinged tool box can be set to any angle independent of swivel slide-rest. Readers in want of a small power planing machine should write for further particulars to the above firm.

The Editor's Page.

THE competition announced in our issue of December 13th last for the best article describing the home production of small bolts and nuts has, we regret to say, not resulted in our receiving exactly the kind of article we had in mind when offering the prize. Many of the competitors have sent in very good hints, and in accordance with our usual custom we will pick out a few of them for publication following the appearance of the prize article, and will duly remunerate the contributors for the trouble they have taken in the matter. The article which comes nearest to our requirements was sent in by—

Mr. P. W. PILCHER,
74, Abbey Foregate,
Shrewsbury,

to whom we have awarded the prize of £1 1s. We take this opportunity of highly commending—H. B. (Kingsley), S. R. (Cranbrook), A. A. (Leicester), and A. C. (Sherburne), for their efforts in connection with the competition.

Answers to Correspondents.

S. D. F. (Cheshire).—We cannot say from the few details you supply. Evidently there is a faulty connection, which you will discover on examination; see handbook "Telephones and Microphones," 7d. post free (sixth edition).

F. C. A. (London).—You can obtain brass rack and pinion wire to suit from Messrs. Lonsdale Bros., West Street, Sheffield.

H. B. (Gravesend).—Rails should be of copper, or brass preferably. Sketches and diagrams of various models have appeared in these pages from time to time. The principle of working is practically the same as when current is taken from a third rail. *Re* Wireless Telegraphy. We have a book on this subject in the press now, and it will be published in a very short time. Please comply with our rules in future.

L. W. B. (Birmingham).—Your letter has been replied to. See also recent issues for various replies to similar matters.

L. W. G. (Ilford).—Make a scale to the reduced dimensions, and work to that. We presume you know how to do this? The proportions will be much the same. To find ballast required, weight the hull till it floats to the L.W.L. Then note the weight required to do this, and make your ballast—keel—the same.

A. E. H. (Emsworth).—We have not any other matter of yours in hand. The lathe could, no doubt, be made to do very useful and fairly accurate work. See "Metal Turning," by P. Marshall, price 2s. 3d. post free. It will help you considerably.

S. P. (Peckham).—You will find all you require to know in the chapters on Valve Gearing and Motion Details in "The Model Locomotive," by Greenly, price 6s. net; 6s. 5d. post free from this office.

J. H. C. (Rhondda).—You had better write to the makers concerning your instrument. We have no details of it.

A. J. L. (Holloway).—We thank you for your letter, but regret it is not suitable for our "Workshop Notes" page.

C. T. (Devon).—These small machines often run well as motors, but refuse to generate. Perhaps your belt is slipping, and the speed therefore too low. Read the chapter on "Hints and Repairs" in handbook "Small Dynamos and Motors," 7d. post free.

E. B. (Accrington).—If you refer to recent query replies you will find some useful information on the subject. Use 1 to 8 acid for the negative paste.

V. H. W.—Use bichromate cells alone preferably, or add more dry cells in parallel.

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, etc., 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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THE

Model Engineer

And Electrician.

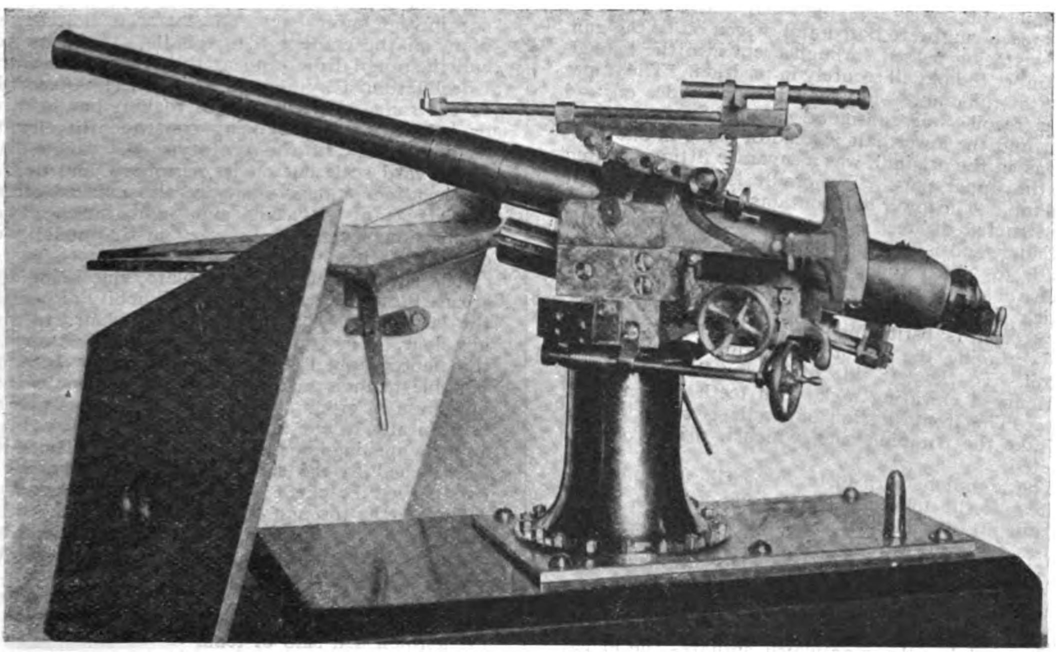
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVI. NO. 301. JANUARY 31, 1907. PUBLISHED WEEKLY.

A Miniature 12-pounder Quick-firing Gun.

By W. HELEY.



MR. W. HELEY'S MINIATURE 12-POUNDER QUICK-FIRING GUN.

THE model gun illustrated in this issue is a miniature reproduction of a 12-pounder quick-firer built by the writer in his spare time during the past six months. It is built generally to a scale of 1 in. to the foot, and is a working model in almost every particular. It is fitted with "single-motion breech-closing mechanism," telescopic rocking-bar sights, recoil cylinder, fast and slow traversing gear, and adjustable shield. The metal used in its construction is as far as practicable the same as in the real gun. The elevation and depression allowed for, viz., 20 degs. and 10 degs. respectively, is also the same, and the cartridge used—a ·22 central fire—is only 3-100ths of an in. less in diameter than it should be. The gun itself is slightly over 10 ins. long, formed of a saloon rifle barrel. The bore of this was, however, too small for the cartridge, and was reamered out to size. The barrel also, not being of sufficient diameter at the breech end, was increased by a piece of steel tube about 3 ins. long being driven on. The whole was then turned down to correct shape and dimensions. The tube was allowed to overlap the barrel, making a recess to accommodate a screwed bush forming the breech chamber. The screwed portion was divided into six equal parallel divisions, and the threads of the three alternate parts cut away. The breech-block is a finely screw, and was prepared in the same way as the bush. This permits the block to be inserted and locked in a sixth of a turn. The single motion referred to is effected by means of a sliding block on the carrier which supports the breech-screw, the carrier being hinged to the breech-ring. A lever, to which the sliding block is pivoted, is also hinged to the breech-ring. When the lever is pulled to the rear, the sliding block is moved to the right, and this acting upon a stud projecting from the rear face of breech-screw, turns the latter, which is then withdrawn from the gun by a sustained pull on the lever. The reverse action, of course, takes place after loading the gun.

The breech-ring, which in the real gun is made in one piece, is in the model formed of two, one piece having a lug on the right side prepared for the hinge pin, and the other a lug in a downward direction, to which the ram of recoil cylinder and running-out rods are connected. The two parts of breech-ring were bored and driven on to the gun, screws being passed through them into the breech-chamber to hold all securely in position. The upper part of the cradle—in which the gun slides on and after recoil—was gun-metal casing, bored to fit the gun, and the lower half, instead of being in one with it, as in the original, was a separate fitting sweated to the upper part. The cradle is partly open at the top. The lower half contains the recoil cylinder, constructed of steel. The ram passes through the cylinder, and is fitted at its forward end to a cross-head, to which the ends of the two running-out rods are screwed. The ram is encircled by a spring, which serves the double purpose of absorbing the recoil (substituting oil, as in the real gun) and bringing the gun to the firing position after recoil. To the left side of the cradle is attached the curved elevating rack, with teeth cut on front face. The front portion of cradle is turned down to take the trunnion ring, which is driven on and riveted.

The trunnions turn in brass bearings in the side-plates of the forked-shaped under-carriage, which is built up of mild steel. The pivot of the carriage passes vertically through the pedestal, and revolves in a steel ring on the bottom place, which is also of steel.

To the left side plate of carriage is screwed a long steel bracket, to which is bolted the brass box containing the gear which actuates the elevation and depression of the gun. This movement is a combination of bevel, worm, and pinion, gearing with the rack on the cradle. The action is governed by a hand-wheel, exactly as in the original gun. I think this and the breech mechanism were the most patience trying jobs in the whole construction of the model. The reader will realise this when I mention that the bevel wheels referred to were taken from a keyless watch, and that a cubic inch will contain no less than twenty-two breech-blocks the size of the one in the model.

To the lid of the gearbox is fitted a projection supporting the shoulder-piece. The latter is adjustable to suit the height and width of gun-layer. The shoulder-piece is of mahogany, with a short piece of solid rubber of round section fixed to it with seccotine. The gun-layer is protected from the recoil of the gun by a curved brass plate screwed to the cradle. The pedestal supporting the whole mounting is fastened to the baseplate by eighteen 1-16th in. bolts and nuts. To the top is fitted a worm-wheel, which is free to move on the pedestal when the gun is traversed rapidly from the shoulder-piece. When, however, it is required to be moved less quickly, the worm wheel is rigidly fixed to the pedestal. This is done by a lever to which a short screw is attached pressing upon a taper pin and throwing the latter out of perpendicular, fouling the worm-wheel, and preventing it revolving. The wheel is then controlled by a hand-wheel.

The rocking-bar sights are fitted to the cradle just above the trunnions, as will be seen in the photograph. The telescope, which is, of course, a dummy, fits into two holders on the sight-bar. The latter (of steel rod) is pivoted at about its centre to the rocking bar. The fore-sight is of steel, having a sharp point, and the rear-sight consists of a small steel plate with a V-shaped notch cut in it. Fitted to the under side of rocking bar at the rear end is a small curved rack, with which gears a pinion centrally fixed on a spindle and working in a vertical slot cut in the lower bar. The latter is bolted to a plate on the cradle. The spindle has on its near end the range drum, and at the other end a worm-wheel actuated by a small hand-wheel. According to the range the rear end of rocking-bar is raised or lowered, the gun being consequently elevated or depressed. In the prototype the range drum has a yard scale cut on its periphery, and degrees of elevation or depression are also marked on the rear faces of elevating and sight racks. These graduations being unnecessary in the model, were dispensed with.

The shield is of ⅛-in. zinc plate, zinc being substituted for steel because of the difficulty of bending the latter and because of its resemblance to steel in colour. The top shield, which is shown open in the photograph, is of ⅛-in. brass plate. It is adjustable to give an extensive field of view, with a minimum of risk to the gun's crew. It is pivoted horizontally to the inner sides of the lower shield, and the opening is regulated by a lever. The shield is attached to the side plates of gun-carriage by two curved brackets. It is painted a dark slate colour on the top and outside, and enamelled white inside, the edges being left bright. The gun cradle is enamelled a light grey, the beading round the upper edge polished, and the rubber portion of shoulder-piece enamelled white. The rest of the model is simply polished. It is mounted on a French-polished slab of teak.

This model gained a second prize in an open competition at Lincoln recently.

THE ALEXANDRA MODEL YACHT CLUB'S PRESENTATION CHALLENGE CUP.—The first competition in the above fixture will be held at the end of the second week of March (open to 10-raters of any recognised model yacht club). The two representative boats of the winning club will each be awarded a silver medal, suitably inscribed, given by the members of the A.M.Y.C. *No* entrance fee. A hearty invitation to all model yacht clubs.—Further particulars from W. G. BRITTAIN, Hon. Sec., 84, Clinton Road, Grove Road, Bow, E.

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 "W·RKSHOP" on the envelope.]

A Small Scribing Block.

By W. Sawyer.

In order to get well to the bottom of such work as tools, jigs, etc., I have found this tool extremely handy—most blocks are so far from the base. This tool consists of a block of mild steel or cast

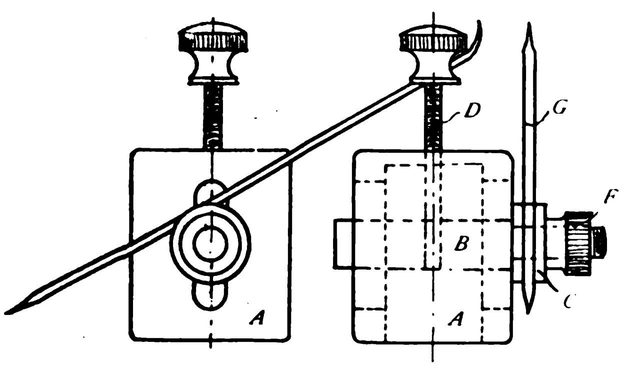


Fig. 1.—General Arrangement of Scribing Block.

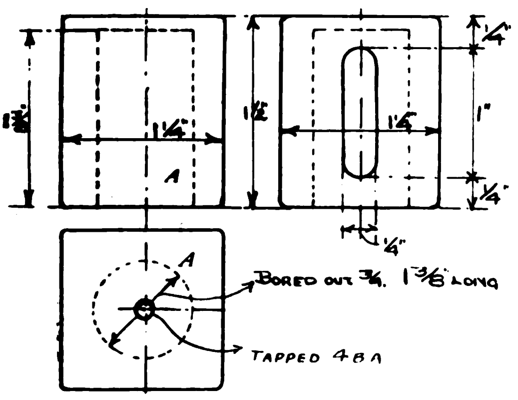


Fig. 2.—Detail of Block.

iron, $1\frac{1}{4}$ ins. wide, $1\frac{3}{8}$ ins. in height, bored up $\frac{3}{4}$ in. diameter, $1\frac{3}{8}$ ins. long (A, Figs. 1 and 2). It is slotted nearly to the bottom—right through; in fact, it can come through to the bottom, for the adjusting screw D will prevent the falling of the spindle B, which is the scriber carrier. The spindle is mild steel; a piece of steel 2 1-16th ins. long, filed $\frac{1}{4}$ in. to suit slot, leaving $\frac{1}{8}$ in. for the head; the remaining part screwed $\frac{1}{4}$ in. for clamping locknut F. D, Fig. 4, is adjusting screw; the block is drilled dead central with spindle; the screw is left plain one end, pushed in, and burred over well, just so that the screw will go round quite easily.

An Efficient Emery Cloth Wheel.

By John Heyes.

Gluing emery powder or cloth on to a wooden disc is a troublesome method of making an emery grinder. This led me to think of a method to dis-

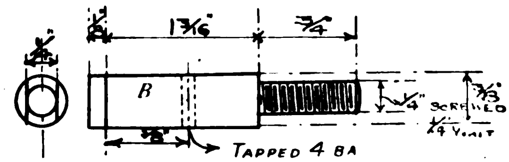


Fig. 3.—Spindle.

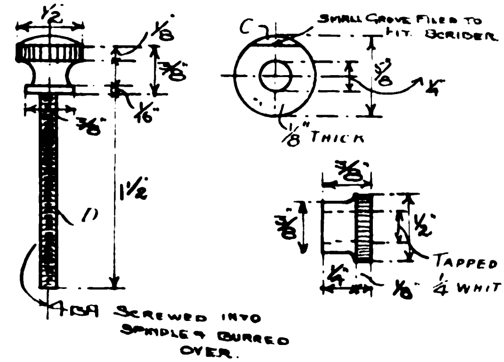


Fig. 4.—Details of Adjusting Screw, Locknuts, and Washer.

pense with the glue altogether. I therefore cut a saw-nick about an inch deep (*a*, Fig. 2); one end of the emery cloth was pushed down this cut, the cloth was taken round the disc, and the other end pushed down to sawcut. A wooden wedge was then driven in the nick between the ends of the emery cloth. I found that this method would not act perfectly, as the slack in the emery cloth rolled just in front of the article being ground.

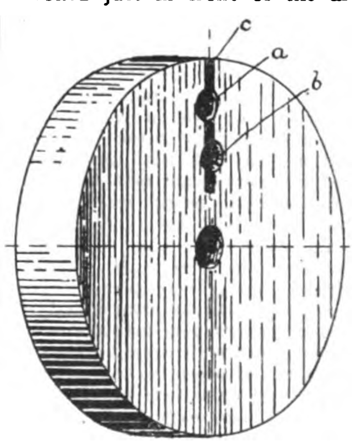


Fig. 1.

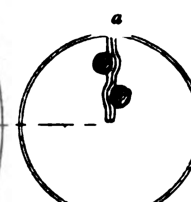


Fig. 2.

Fig. 3.

An Emery Cloth Wheel.

Also, the cloth slipped off owing to this slackness. To provide means by which the cloth could be tightened I bored two holes (*a b*, Fig. 1) at a convenient distance apart and the centres about 1-16th in. to the right and left of the centre line. I then cut the slit (*c*, Fig. 1). Two taper wood plugs (Fig. 3), with the ends bevelled as shown, were made to fit the holes. To fit the cloth, one end is pushed to bottom of slit, lapped round the disc, and the other end is also pushed to bottom of slit. The slit should be only wide enough to take the cloth ends. The cloth is pulled tight by pulling on each side of the slit with the finger and thumb, and then the bottom plug is pushed in tight, and the cloth is tightened up by pushing in the top plug.

Fig. 2 shows the action of the plugs on the cloth. When the cloth has got glazed with use it should be put carefully away, as it will be useful for polishing work.

A Model Engineers' Tramp Abroad.

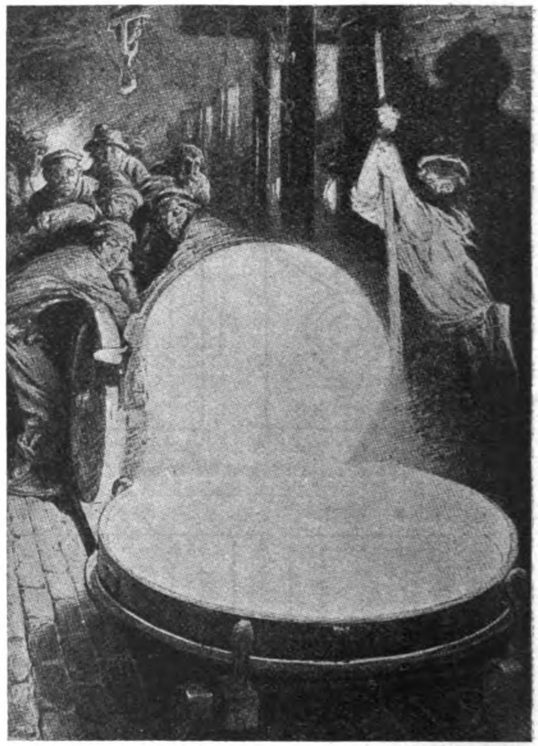
(*Continued from page 77.*)

ENTERING the old town of Jena one is either reminded of the famous Napoleon or the manufacture of glass and fine lenses. While the writers do not despise the lessons to be learnt from the history of the great little man, we placed all aspirations to hero-worship on one side to accept the kind offer of a visit to the works of the well-known firm of Carl Ziess, for not only is the organisation of this firm so novel, but we expected a time of real enjoyment in the inspection of the many interesting processes necessary to the production of a modern lens.

The firm was started in 1846 by Carl Ziess, who was born in September, 1816, at Weimar. He was a son of a toy-shop proprietor who had at one time acted as instructor of turning to Grand Duke Frederick. Carl Ziess, after a moderately complete classical education, was apprenticed to the mechanical and engineering trade—such as it was at that date. His business was at first very small, but he was induced by a famous biologist to devote himself to the study of optics. He did not at first succeed in producing any great improvement in the microscope as at the time ordinarily manufactured, but in 1866 became acquainted with Ernst Abbe, son of a foreman in a spinning mill, who was then a University tutor in Jena. By their collaboration the old trial and error method was replaced by more exact mathematical determinations, and by this means instruments were produced free from all but unavoidable defects. In Abbe and Ziess there was a combination of two forces which has resulted in the magnificent factory of which Jena is now proud. The formulæ adopted by the partners of course had to be supported by a like accuracy in measurement, and the use of the phenomenon known as Newton rings, which can be observed when two surfaces of slightly different degrees of curvature are laid together, was employed on the suggestion of Ziess' oldest foreman, August Löber. In testing the curvature of lens, these rings do not appear if the lens being tried is of the exact counter-curvature of the standard test-piece. The apparatus used has, of course, improved with time, and includes devices tor testing thicknesses, the centreing of lenses, the flatness of surfaces, and the distance apart of lens when mounted.

A scientific dissertation is, however, out of our scope, and, therefore, we will get on with our impression of the works.

Again we were up early—perforce, we have to admit—as we were staying at a hotel in the market-place, and it was alive at 6 a.m. Knocking at the office door of one of Germany's greatest industrial concerns, we were cordially received by the head of the firm, and were placed under the guidance of

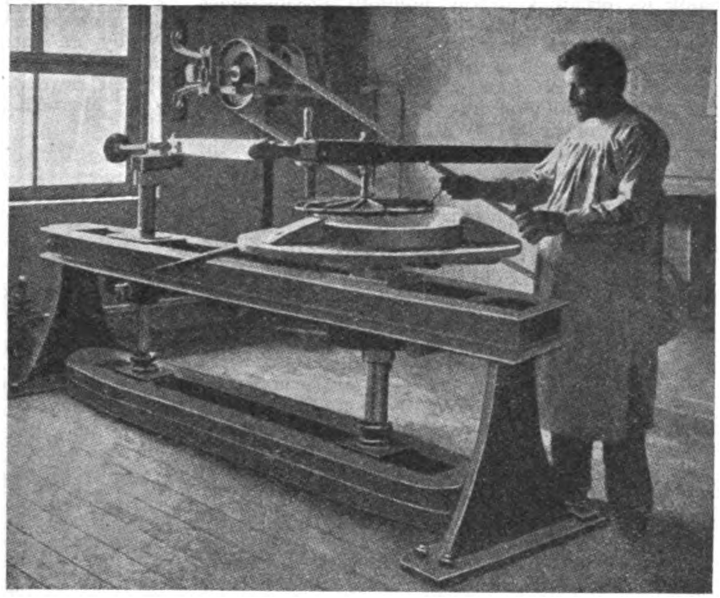


CASTING A LARGE TELESCOPE LENS.

the one English technical assistant in the works, Mr. Wardall, and Mr. Max Poser, the English technical manager, who happened to be in Jena at the time.

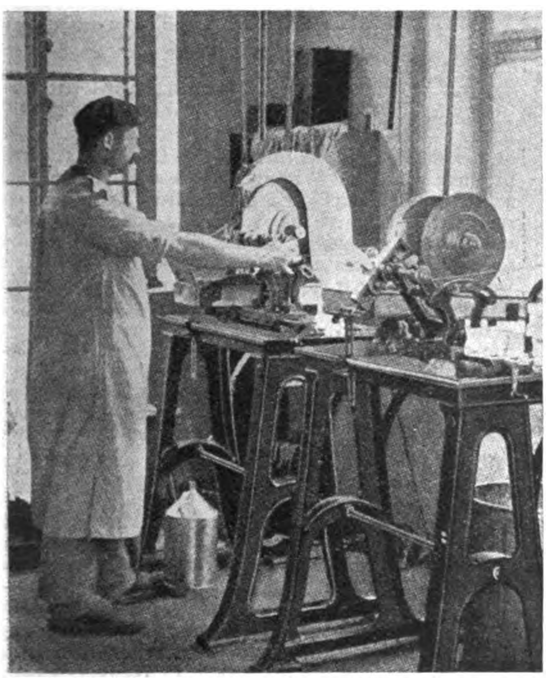
Time would not permit us to visit the kindred firm of Messrs. Schott and Genossen, where the famous Jena glass is made, so we went straight to the portion of the factory devoted to first processes in the manufacture of the lens. The accompanying picture shows a glass-slitting machine in operation. The glass is for the most part cast in slabs, which for purposes of examination for possible flaws are ground and polished on two opposite sides. Only the largest astronomical object-glasses are cast to shape in open moulds.

The slabs for the smaller lenses are cut in a species of lathe, the glass being held in holder, which is pressed up against the slitting disc by the workman. The discs are made of thin sheet iron, and are run at a very high speed. The edges are charged with diamond dust, and the work is freely lubricated with paraffin. Next we passed into the rooms where the prisms and lenses are ground. All prisms and lenses, with the exception of the giant lenses, which are ground and polished separately, pass through these rooms. Others are operated in batches up to as many as fifty. For this purpose the glasses are cemented to one curved support, in such a manner that the curvature of the spherical surface formed by the whole of the lenses is the same as that of one lens when finished. Over these lenses is pressed a driving cup, driven electrically, which has a rotary rolling or pitching motion. The operator, by experience, knows exactly when to increase or decrease the pressure, and from time to time he interrupts the work to test by the Newton's rings method, as before mentioned, in which the variation in the thickness of the layer of air between the worked surface and the test-plate from one ring to the next of the same colour amounts to less than ·0003 mm., or ·000011 inch. Some small lenses like microscopic objectives, however, require more delicate manipulation, and do not pass through so many hands. Some of them are made entirely by hand.



A Visit to Carl Ziess' Optical Works: A Machine for Polishing Large Lenses.

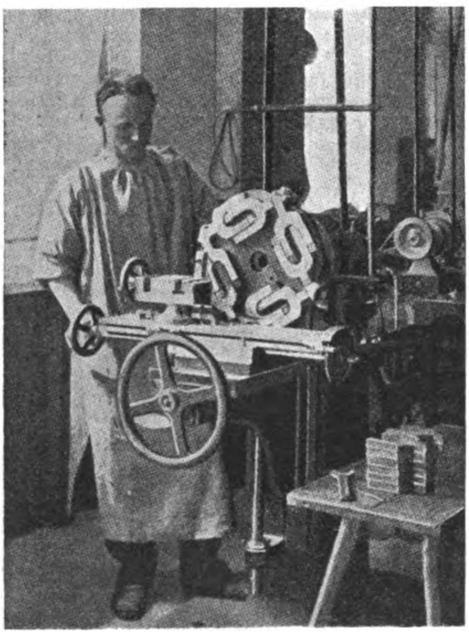
Leaving for a time the purely optical departments, we visited the foundry. This, contrary to the usual practice, was almost as clean as, say a laundry, and, moreover, was situated on an upper floor. The metals cast are principally alloys of copper, tin, and zinc, not forgetting aluminium, which during the last ten years has leaped into favour owing to its special adaptability for use in optical instruments. The metallurgical laboratory connected with this foundry — and which was started a few years ago under the direction of Dr. Herschkowitsch—has proved so successful in the manufacture of both well-known and special alloys, that the products of the foundry rank amongst the highest of any made in the country. This degree of scientific excellence has, owing to numerous and persistent requests, led to the firm undertaking outside orders for castings. We understand that more than one "new metal" which has been boomed of late has had its origin in researches made in this well equipped and well managed foundry.



Glass-slitting at Carl Ziess' Works.

From the foundry we proceeded through the storehouse, from which the castings are distributed to the machine shops to be shaped, turned, milled, etc., and where they are returned before being sent out to the erecting and fitting departments. Adjoining the storehouse are the turning shops. The lathes used here are many and various; nearly all the larger ones being modern capstan lathes. In the next shop we found the milling and shaping machines, which comprise several highly ingenious tools which have been designed and constructed *in the works* to suit special purposes for which they are required. We were much interested in the method of getting a lens to run truly in the lathe. Instead of employing any special appliances, use is made of the fact that when the lens is accurately centred, the reflected image of surrounding objects —which may always be observed in a polished lens —does not move in the slightest degree.

In the erecting shops the various parts of the instruments are collected from the storehouse, after having been tested by the foreman of each shop for accuracy to the standard specifications, and assembled. They are then taken apart and sent—each piece being duly ticketed with its serial number—to be cleansed, coloured, or oxydised, and finally polished and lacquered. In every shop we found cleanliness, order, and methods based on scientific knowledge. We had explained to us the mechanism and underlying principles of many of the new optical instruments made by the firm, amongst the most interesting of which were the stereo telescopes, rangefinders, and the stereo comparator. The rangefinder is designed to take advantage of the distance between the two lenses of the camera as a base line for what is really a photographic survey. To understand the principle upon which the instrument works, imagine a stereo-telescope with its eyepieces fitted with two scales. These scales may be considered as a pair of stereoscopic photographs of a long line of measuring posts (or ranging poles) placed over an indefinitely extended plane. Looking through such an instrument the scales are stereoscopically combined, and virtually appear as if they were hanging in space. You then adjust the scales to ascertain the distance of, say, a church steeple in the view, until the pointer seems to hang over this object in the stereo picture. When it does so, a reference to the scale gives the required distance. The



Machining Horseshoe Bases of Microscopes in Batches.

accuracy of the instrument depends on the distance apart of the lenses (the base line of the triangulated optical survey) and the degree of magnification. With a large model having a base of 1½ metres (4 ft. 11 ins.) the error in the observed distance, with a magnifying power of 23, is only about 12 ft. to 16 ft. in a distance of over 1,000 yds. The stereo-comparator is based on similar fundamental principles, but it works on the finished stereo-photographs, the stereo-effect of which is enhanced by an increase in the distance at which the two views are taken. The instrument may be used for astronomical as well as topographical surveys.

Measuring instruments are another feature

Mounting Microscopic-objective Lenses.

Note.—The bed of the lathe is turned up at an angle to suit the convenience of the worker.

of the firm's manufactures. The Carl Ziess works produce a thickness gauge which will measure to a thousandth part of a millimetre; however, we regret that time at the works and space here prevented and prevents us dealing with the many scientific wonders to be found at the Carl Ziess works. We must not, however, forget the almost Utopian constitution of the firm, which creation—the work of Ernst Abbe—is, we submit, one of the things this age may be justly proud of. Our questions as to the ownership and direction of the works were met by the startling statement that the enterprise is its own proprietor and is also managed by the community interested in it. But more of this anon.

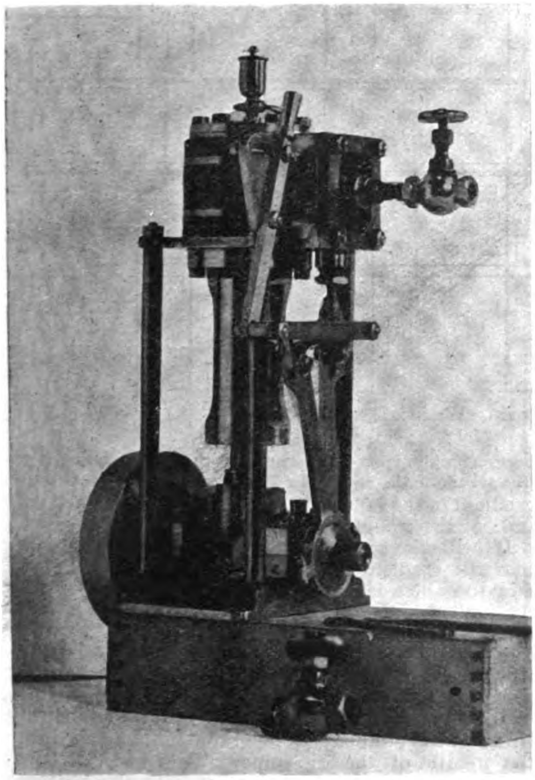
(To be continued.)

Clacton Model Yacht Club.—This club has recently been formed for model yachtsmen who are residents in Clacton-on-Sea, Great Clacton, or Little Clacton. The club is divided into two sections—(1) Mechanically-driven models; (2) sailing models. The first club race will take place on Easter Monday next, for which a large number of entries have been already received.—Hon. Sec., J. W. Goldsmith, "Southwood," St. Osyth Road, Clacton-on-Sea.

A Neat Model Launch Engine.

By E. F. Box.

THE design of the model launch engine illustrated herewith, will be familiar to many readers of THE MODEL ENGINEER. The castings were purchased from a well-known advertiser in this journal, together with a blue-print working drawing. I did not work precisely to the drawing, excepting in the most important parts. The following are the principal features of construction, and may be of interest to others:—Cylinder is ⅞-in. bore by ⅞-in. stroke, and is lagged with mahogany. The connecting-rod is made out of the solid (mild steel) and fitted with adjustable brasses. The eccentric sheaves are also of mild steel, fixed to the shaft by means of sunk-in grub screws. The standards (between cylinder and bedplate), piston and valve rods, gudgeon pins for eccentric straps, etc., and all studs, were turned from ¼-in. French nails. I find that for making small studs, etc., nothing can equal French nails: they "turn" beautifully, are tough, and wear well—quite as good, in my opinion, as the best mild steel.



MR. E. F. BOX'S MODEL MARINE ENGINE.

The main bearing, oil cups, cylinder lubricator, and stop valve were all made from brass rod. The latter was rather a tedious piece of work, the spindle being only 3-32nds in. in diameter. All the above work was done on a rather heavy 4½-in. lathe (screw-cutting) driven by a small gas engine. The model has been tested under air pressure to 60 lbs. per square inch and ran very satisfactorily.

The Latest in Engineering.

Motor Starting Device.—An ingenious device has recently been patented for starting internal combustion motors in America. It consists of a cylinder with two pistons connected by a rack, which engages a pinion on the end of the engine shaft. Compressed air, or other gas, is stored in a

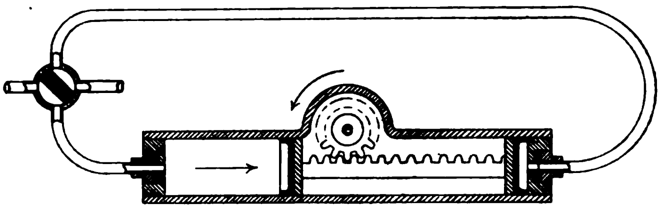


DIAGRAM OF MOTOR STARTING DEVICE.

suitable reservoir, and by means of a four-way cock, which permits of either end of the cylinder being connected with the storage reservoir or the atmosphere, the rack can be moved and the engine started. The drawing published in a contemporary, with the abridged specification, does not show any provision for "free-wheeling" when the engine has been started. We suggest that for engines which run either way (of course, there are no such examples of internal combustion engines in general use at present), a portion of the rack should be cut away at each end to allow the pinion to disengage, and for one-direction motors the pinion should be provided with a ratchet or some other "free-wheel" arrangement.

Lighting Safety Lamps in Mines.—A new portable electrical apparatus has just been constructed at Cardiff for the purpose of lighting miners' safety lamps in any part of the colliery. The invention is based upon results obtained from experiments made with low-tension high-frequency currents made by Dr. J. C. Bowie, of Cardiff. The appliance is capable of lighting twenty lamps per minute, but if intended for use in the lamp room, several lamps may be lighted simultaneously. A main feature of the apparatus is that it is impossible for any electric discharge to pass from it into the atmosphere of the mine.

MESSRS. HARPER & BROTHERS have added another volume to their series of Electrical Handbooks—"Elements of Electric Traction for Motormen and Others," by L. W. Gant. It is primarily intended for motormen, depôt foremen, inspectors, apprentices, and others employed on electric tramway systems; to serve also as an elementary text-book for students beginning the study of electric traction. In this work the fundamental, mechanical, and electric principles underlying electric tramway traction, are dealt with in a simple and concise manner, and in such a way as to enable a motorman to obtain a definite and practical knowledge of the working and running of a car and the underlying reasons. The work is illustrated by specially prepared diagrams.

How It Works.

VIII.—Water Pick-up Apparatus for Locomotives.

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

THE use of water pick-up apparatus on the railways of this country dates back to the year 1860. In that year the late Mr. John Ramsbottom, who at the time was locomotive superintendent of the London and North-Western Railway, patented a device which he had invented for the purpose—as the original specification sets forth—of supplying the tenders and tanks of locomotive engines with water without requiring the stoppage of the train, and consisting of a trough or long tank laid longitudinally between or alongside the rails of the permanent way, which trough contains the water which is to supply the tender or tank of the locomotive.

The accompanying drawings (Figs. 1 to 10) show the precise form of the apparatus in its earliest application on a British railway, and the succeeding illustrations make equally clear the improvements which have been effected in the design and working of the apparatus, which is now employed by many of the principal railways throughout the country. No better way could perhaps be adopted in describing the original Ramsbottom gear than to quote from the patent specification of 1860, adhering in so doing—as nearly as possible—to the language therein employed and to the use of the same lettering for indicating the various parts of the apparatus on the drawings.

The water is conveyed from the track trough to the tender or tank of the engine by means of a dip pipe connected with such tender or tank, and curved slightly forward at its lower end so that as the train is passing along it will cause the water to be forced up the pipe into the tender or engine tank. For low speeds the dip pipe may open into the bottom of the tender or engine tank, and should then be provided with an ordinary clack valve opening upwards to prevent the return of the water, but in the case of high speeds the dip pipe may open into the tank above the top water level, in which case the clack valve may be dispensed with. Suitable provision is made for raising the lower end of the dip pipe when not in use, so as to be out of the way of ballast or any other obstruction. The bottom of the long trough or tank is inclined upwards towards each end, and the rails are inclined or set to about the same gradient, so that the dip pipe may gradually enter and leave the water.

Fig. 1 of the accompanying drawings represents the application of this system of supplying feed-water to the tender of a locomotive, and Fig. 2 shows the same as applied to a tank engine. In both figures A A represent the feeding nozzles or movable dip pipes, and B the water supply trough into which the pipe A dips as the engine or tender passes over it.

Fig. 3 represents a longitudinal sectional diagram of a portion of a line of railway provided with a water supply trough placed between or alongside the rails of the permanent way. When placed alongside the rails the trough may be at any convenient elevation, and the diagram is drawn at a distorted scale in order the better to show the gradient of the rails and gradually sloping or inclined ends of the trough.

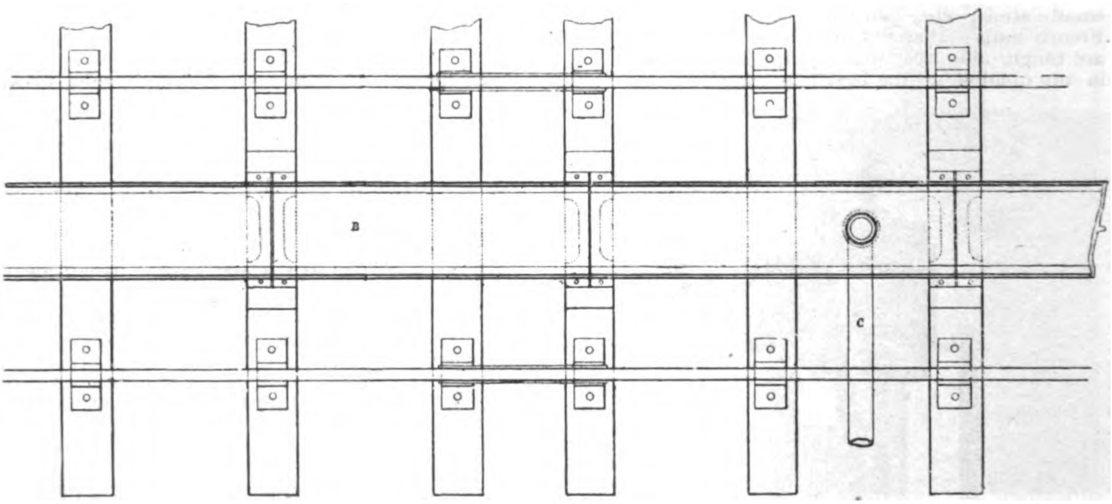


Fig. 4.—Plan of Track showing Water Trough.

It will be seen on referring to this diagram that the gradients at *a a*, which are here given as 1 in 100—or a fall of 6 ins. in 50 ft.—coincide with the inclination of the ends *d d* of the trough, and that the surface of the length *c* of the rail between the two gradients coincides with the middle of the trough, as regards its depth, when the trough is placed between the rails. By this means an engine or tender passing over the line will, on arriving at either of the gradients *a*, be gradually lowered until the mouth of the dip pipe is fairly within the trough but not in actual contact with the bottom thereof, and the reverse action will take place on arriving at the ascending gradient, where the dip pipe is gradually raised out of the trough. The troughs are made in sections jointed together, as shown in the plan drawing (Fig. 4), and resting on cross sleepers, each joint being maintained

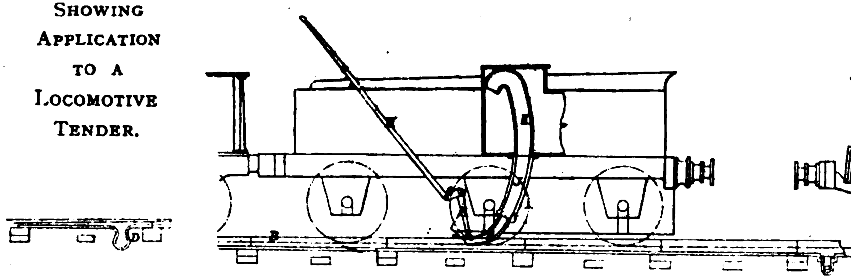


FIG. 1. SHOWING APPLICATION TO A LOCOMOTIVE TENDER.

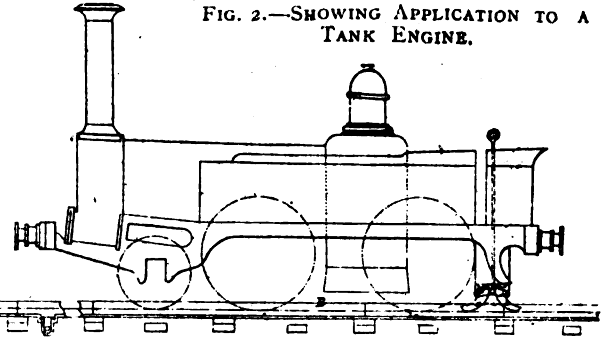


FIG. 2.—SHOWING APPLICATION TO A TANK ENGINE.

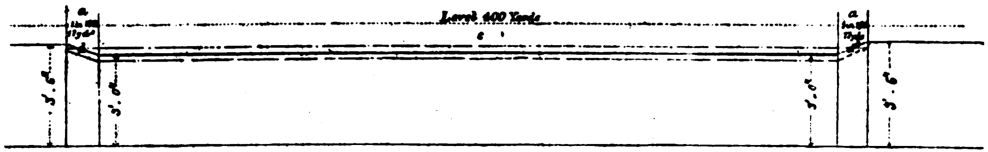


FIG. 3.—DIAGRAM SHOWING PORTION OF LINE WITH WATER TROUGH.

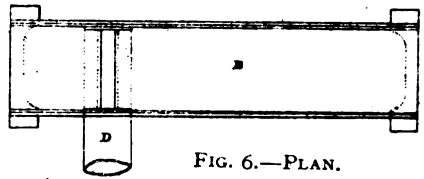


FIG. 6.—PLAN.

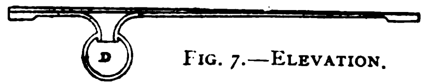


FIG. 7.—ELEVATION.

INCLINED END OF WATER TROUGH.

FIG. 8.—LONGITUDINAL SECTION.

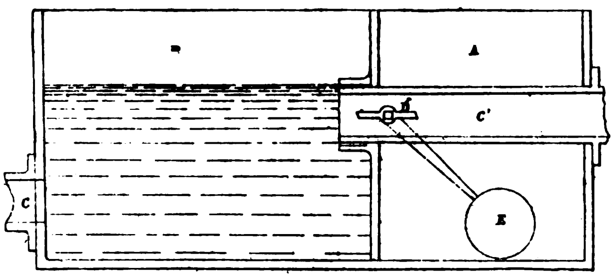
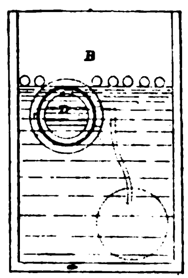


FIG. 9. CROSS-SECTION.



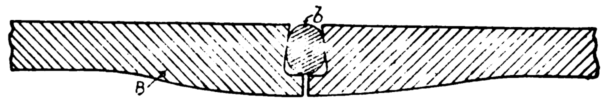


FIG. 5.—CROSS-SECTION THROUGH JOINT OF TROUGH. (*Full size.*)

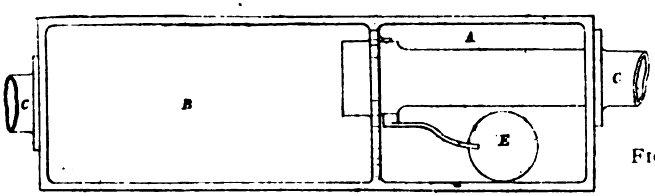


FIG. 10.—PLAN.

SELF-ACTING WATER SUPPLY REGULATOR AND TANK.

THE "RAMSBOTTOM" WATER PICK-UP APPARATUS FOR LOCOMOTIVES.

For description] [*see opposite page.*

water-tight by interposing, between the abutting ends of the lengths or sections, a packing of vulcanised indiarubber which is contained in a chamber formed by recessing the ends to be joined, as shown at *b* in the sectional detail of one of such joints given in Fig. 5. This arrangement admits of the free expansion and contraction of the trough, which, as a rule, will be about ¼ mile in length, and still maintains the several joints water-tight.

The trough may be supplied with water in any convenient manner, either from natural sources, such as local streams or springs allowed to flow therein, or by artificial means, such as pumps. In Fig. 2 C represents the pipe through which water reaches the trough. and D is an overflow pipe, situated on one or both of the inclined ends of the trough, both sets of pipes opening into the bottom of the trough, as shown more clearly in the enlarged views, Figs. 4, 6, and 7, which two last-mentioned figures represent respectively a plan and longitudinal vertical section of one of the lengths forming the extreme or inclined end of the trough.

Figs. 8, 9, and 10 illustrate a self-acting water supply regulator which Mr. Ramsbottom provided for the purpose of economising water in localities wherein the latter was scarce. The regulator consists of two tanks A and B, and the water from the source of supply is allowed to enter by the pipe C1, which is provided with a throttle valve D worked by the ball float E in the tank A. The water passes from the tank B by the pipe C, which leads direct to the trough, the level of the water in this tank B corresponding with the level of the water in the trough. In order to prevent too much water entering the trough, a row of overflow holes is made in the division-plate between the tanks A and B at the proper water level, and an outfall of less area is made in the tank A. On the water reaching its proper level, any incoming excess will flow into the tank A and raise the ball float and close the throttle valve thus cutting off the supply, this raising of the ball float being effected by the excess of water entering the tank A, as compared with what escapes through the comparatively small outfall. On the level of the water being lowered by the passage of an engine over the trough, the water in the tank B will be lowered also, and will cease to overflow into the tank A. The tank consequently gradually empties through its outfall, and allows the valve to open again for a further supply. The drawing (Fig. 1) shows that as originally arranged the scoop was manipulated from the footplate of the engine by means of a couple of levers, the mechanism for raising and lowering of the pipe being thus of the simplest character and operated entirely by hand. Further reference to this portion of the gear appears later.

The drawing also shows what appears to be a supplementary frame or sheathing-plate extending from the front of the intermediate axle of the tender to the hind buffer plate, doubtless with a view to preventing wasting of water from lateral splashing. It is not certain whether this plan was actually ever brought into use or not, but no doubt it was tried on some of the engines first fitted with the water pick-up apparatus.

In the drawing of the tank engine (Fig. 2) the gear is shown as being provided with double scoops for use when running in either direction, a feature of construction which is always adopted in present-day practice where tank engines are fitted with apparatus for taking up water whilst running.

The patent specification of Mr. Ramsbottom sets forth several different methods of operating the scoop, but that most commonly fitted on L. and N.W.R. locomotives was the one shown in the first illustration (Fig. 1). The scoop or dip pipe A is connected at its lower end to a lever arm E fast on a rocking shaft F, which is provided with a short arm G jointed to the lower end of the connecting-rod H. The upper end of this rod is jointed to a hand-lever I, which works on a fixed centre, and the upper end of the dip pipe A fits inside the fixed pipe J, which latter is secured to the bottom of the tank or tender.

By suitably moving the handle I the dip pipe A will be slid up the inside of the pipe J, the arrangement thus forming a telescopic dip pipe. K is a pipe which is secured to the bottom of the tank or tender, and placed inside the same so as to form a continuation of the dip pipe, and the top of this fixed pipe is continued to a point above the highest water level, and is then bent or curved downwards, as shown, so that the water which is forced up the dip pipe by the passage of that pipe along the trough will be directed into the tank or tender. In order to reduce the velocity of the jet the pipes are made of a gradually increasing area towards the upper or delivery end, as seen on the drawings.

(To be continued.)

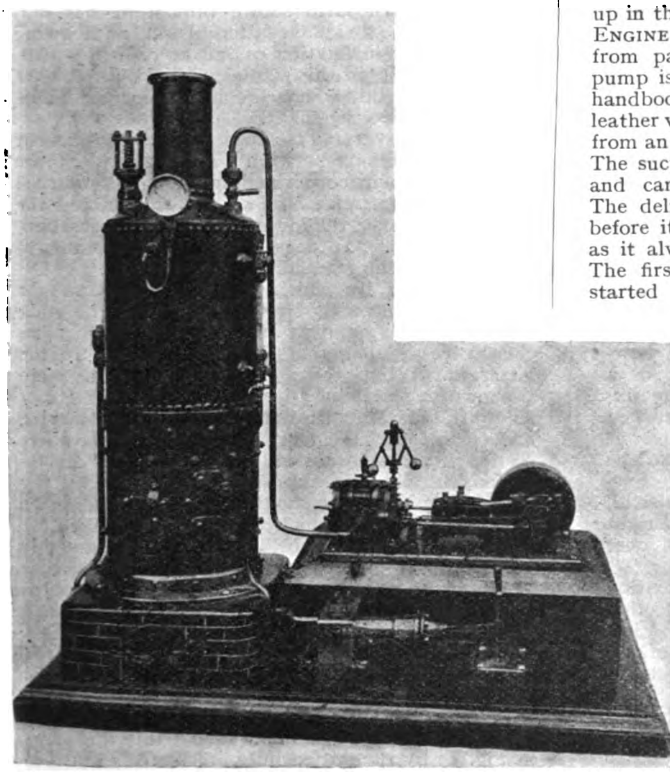
How I Made a Model Steam Engine and Boiler.

By Wm. Ballantyne.

The photograph shown herewith is of a model steam engine and boiler which I made in about one year of my spare time. The boiler I made from a design in The Model Engineer for July 2nd and 9th, 1903 (a full description of boiler, with drawings, will be found in the above issues.) I made the crown and tube plates from 1-16th-in. copper sheet, but I found a better way for making the inside flanges of the uptake than that described in the article. I tried to make them by punching a ¾-in. hole in centre and flanging out to 1½ ins., but found that the edges split before I could get them out to full size. I first turned hardwood formers, as described, annealed the copper discs, clamped them between the wood formers, without making any hole in centre; then, with a boxwood plug, I hammered the copper down into the 1½-in. hole in the former. I had to anneal the discs several times before I got them enough for a 5-16ths-in. flange; this formed a sort of cup in the centre of the discs, the bottom of which, after being cut out, left 1½-in. hole with 5-16ths-in. flange. This made a first-class job. I riveted all the seams with 3-32nds-in. copper rivets, then sweated with soft solder. The pressure and water gauges I bought, but the other fittings were home-made. I tested the boiler to 190 lbs. hydraulic pressure, and left it under that pressure for one hour, after which time it showed not the least signs of a leak or weakness. With a Swedish brazing lamp I can raise 50 lbs. steam pressure in five minutes.

The engine I made from a design and drawings of my own, and entirely without castings, with the exception of the bedplate, for which I made a pattern and had it cast at a local foundry. The cylinders I made from a piece of solid brass 2 ins. diameter by 3 ins. long. The dimensions of cylinder are 1-in. bore by 1¼-in. stroke; steam ports, 7-64ths in.; exhaust ports, 9-64ths in.; piston rod, 3-32nds in.; valve rod, 1-16th in. To make the cylinder I first drilled a ¾-in. hole through the piece of brass, drove it tight on a mandrel, and turned it between the centres to the right length; then I reduced both ends to 1¼ ins. diameter for flanges. Before taking it off the mandrel I cut out the metal between the flanges with the aid of a hacksaw and some good files. I also used a small parallel shank milling cutter to form a square on one side for steam chest; this formed what was just like a partly finished casting of a cylinder. I then took out the mandrel, mounted the cylinder in a self-centreing chuck, and bored it out to 1 in. full size, after which I filed up the outside in the usual manner. The steam chest I made from a piece of 1-in. round brass rod by 1½ ins. long. I turned one end for stuffing gland, then filed the remainder square to fit closely on the square left on the side of the cylinder. I then bolted it to the slide-rest of my lathe, and milled out the inside for slide-valve with milling cutter gripped in a drill chuck. I used small bolts and nuts throughout. The cylinder is lagged with small strips of walnut bound with two brass straps, which gives it a very neat appearance. I made small imitation oil cups for the bearings, guides, etc., which greatly improves the appearance of the model. The connecting-rod I turned from a piece of ⅜-in. brass rod with both ends left full size and afterwards filed to fit crank-pin and cross-head.

I had a lot of old brass weights from which I made some of the parts. The cylinder covers were 4-oz. weights originally; the guides were made from an 8-oz. weight cut in two halves, then filed to shape; the recess for the crossheads I made by drilling a row of holes, then cut out the remaining metal with a chisel, and filed true; also the bearings, governor frame, flywheel, etc., had done duty in various ways. The double-web crank is built up in the same manner as described in THE MODEL ENGINEER some time ago. The eccentric I made from part of an old pump plunger. The hand-pump is from a design in THE MODEL ENGINEER handbook, "Model Boiler-making," but instead of leather valves I used phosphor-bronze balls, procured from an advertiser, and I find they work splendidly. The suction pipe comes out underneath the stand, and can be connected to any suitable supply. The delivery pipe goes right through the firebox before it reaches the boiler, which is a good idea, as it always supplies the boiler with warm water. The first time I tried the engine with steam it started off at a high rate without needing the slightest adjustment. It will run at any pressure from 5 lbs. up to 60 lbs. In conclusion, I may say that I obtained nearly all my information from THE MODEL ENGINEER and the handbooks.



MR. WM. BALLANTYNE'S MODEL ENGINE AND BOILER.

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 MANAGEMENT OF ELECTRICAL MACHINERY. By Francis B. Crocker, E.M., Ph.D., and Schuyler S. Wheeler, D.Sc. London: E. and F. N. Spon, Ltd. New York: D. Van Nostrand Company. Price 4s. 6d. net; postage, 3d.

In the sixth edition of this work the authors have brought it abreast of the times by eliminating much obsolete matter and adding much that is new and fresh; but the general character of the book remains the same. In the first two chapters the principles of motors and generators is briefly dealt with, and some notes on the selection of dynamo electric machinery are given. The following chapters treat of testing in different ways; the Localisation and Remedy of "Troubles" (a most useful feature of the book) is rightly given a considerable number of pages, and will be appreciated by young station engineers. Constant current (arc) generators are illustrated and described, and the concluding chapter is on the Management of Railway Motors.

A Design for a 20-ft. Windmill.

By F. E. Powell.

(*Continued from page* 58.)

IV.—Sails and Windshaft.

The sails and shaft may now claim attention. Dealing with the latter first, it is here shown as a piece of steel tubing, 2 ins. in outside diameter, with a bore of 1½ ins.—thickness being ¼ in. A tube is preferable to a smaller solid shaft in a case like this, where the overhang of sails calls into play stiffness as well as strength in the shafting.

The tube must be of good material, straight, sound, and round. If it answers to these requirements, in all probability turning may be dispensed with, a little cleaning up with a fine file being perhaps sufficient to bed it satisfactorily to the bearings. The big bevel wheel is to be bored to slide along shaft, to which it may be fixed by a "flat" key, or by a couple of set-screws having good points slightly entering corresponding indentations in shaft. Collars, also fixed by set-screws, are shown in Fig. 4 in their proper positions, the one as a thrust-bearing to take up the pressure due to wind, the other as a distance-piece between a bevel wheel and shaft. There should be practically no end play in this shaft.

The tail-end of shaft will be left plain, being cut off just behind back bearing. The sail end, however, is to be screwed with a fine thread for a distance of 6 ins. along. This is to take the six-armed casting shown in Fig. 11, which is screwed into place and secured by a circular locknut in front and by a flat backnut behind in the event of the threaded portion being carried too far along. Further security is desirable in the shape of a small set-pin, 3-16ths or ¼ in. diameter, driven right through boss and shaft and slightly riveted over the ends.

Before detailing the spider-casting, mention may be made of the smaller tube seen projecting from the end of shaft in Fig. 11. This tube, 1½ ins. diameter, serves to carry the inner ends of six training wires from tips of sails, and so to stiffen the whole sail arrangement. It is driven firmly into end of shaft tube, about 2 ins., secured by a ¼-in. pin, and must run straight and true with it, if for the sake of appearance only. The outer end is to be fitted with a flange, which may be an ordinary gas-fitting flange screwed on, with six equidistant holes, ¼ in. diameter, drilled on the edges for ends of straining-wires.

The cast-iron spider, which is shown in front elevation in Fig. 11, carries the six sail arms. which are bolted to it with three ⅜-in. galvanised bolts. These are shown in a part sectional view through one of the arms in lower half in Fig. 11. The upper half of this same figure, of course, shows the true side elevation of two of the arms.

All the metal of the spider should be as light as possible, a maximum of ⅜ in. being allowable near the boss, thinning out to ¼ in. at the extremities. The boss should be a little more substantial, and may be cored to 1½ ins. diameter to save some tedious drilling and boring. The tapping should be done in the lathe to ensure that the whole spider runs true with shaft. Particular attention should be paid to getting all the arms to radiate equally and to the right amount of 15 degs., otherwise the sails may possibly foul the framework of mill.

The sails, or, rather, the arms carrying them, are perhaps somewhat troublesome to understand. They are certainly not easy to draw in such a manner as to be read at a glance, but a careful study of the illustrations will, I hope, make all clear. It must be remembered that the sails are literally nothing but sections of a huge screw, having a rather fine pitch, but almost identical in principle with a ship's propeller.

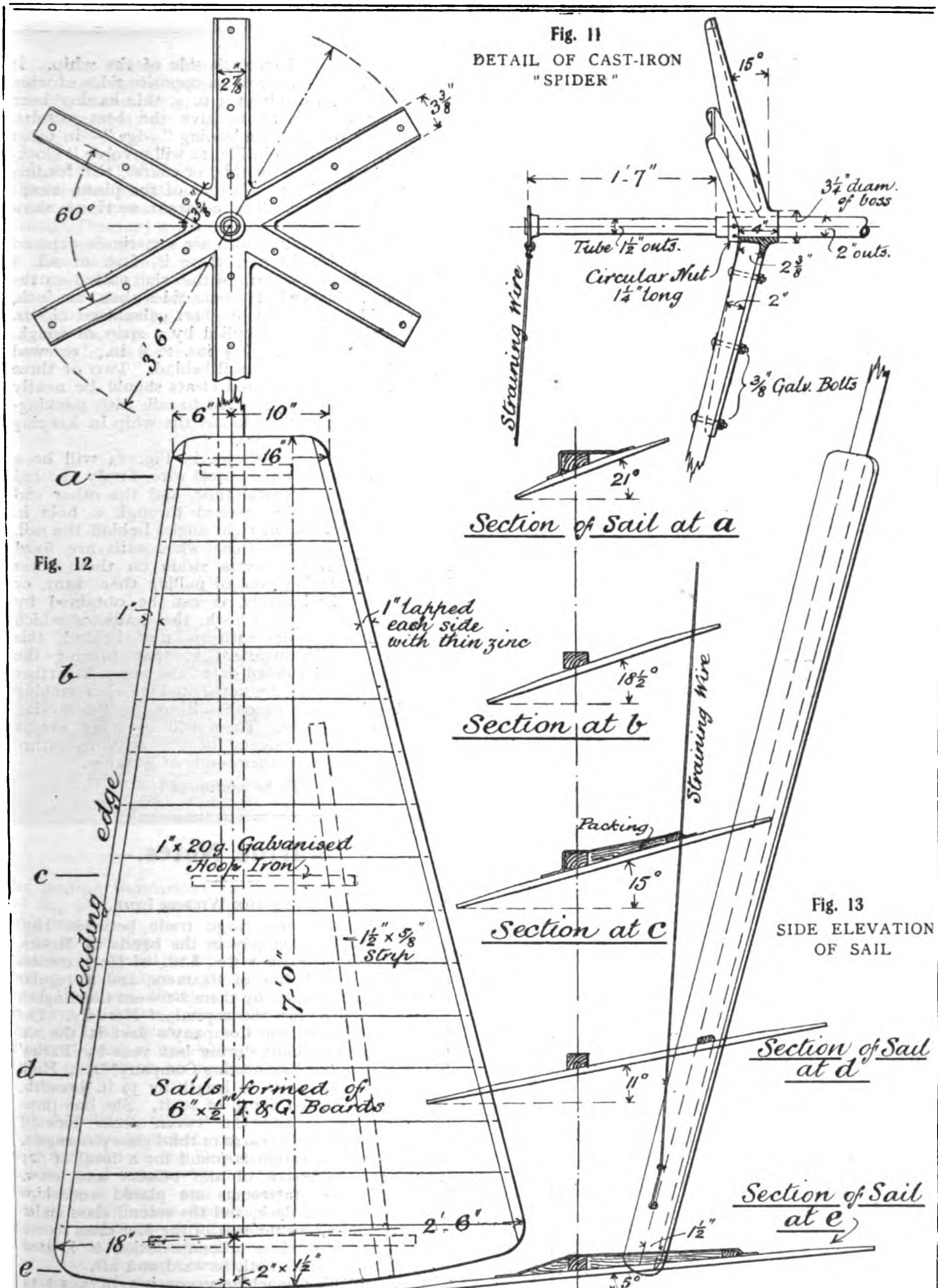
Fig. 12 shows the shape of sail and the position of arm (technically the "whip") behind it. In Fig. 13 appears a side elevation of sail and arm, detached for sake of space from its proper position as a part of the arm shown broken in Fig. 11. This is a "true" side elevation of sail, and, owing to the greater inclination of sail at its inner end, it appears *wider* in this side elevation than it does at the other end, where the inclination to plane of revolution is very slight.

To show the varying inclination of sail at different points the sections between Figs. 12 and 13 are given, and their corresponding positions marked by means of letters *a b c d e*; the side facing the wind is, of course, the lower side in the illustration, and the figures, 21 degs. gradually flattening to 5 degs., show the gradually changing pitch.

The method by which this change is brought about is shown partly by the sections of the whip between Figs. 12 and 13 aforesaid, but much more clearly by the diagrams, Figs. 14 and 15. In the latter illustration the whole length of the whip is shown to a scale of ¾ ins. to a foot, and the four sides are separately drawn to indicate the marking and cutting that must be done. Fig. 14 gives five sections, drawn to a 3-in. scale, and fully dimensioned, in the same positions as indicated by *a*—*e* in Fig. 12. The shading in Fig. 15 shows the bevelled surface to which the sail will be fixed.

These whips are to be formed from thoroughly good straight-grained seasoned timber, such as Northern or yellow pine, 3 ins. × 2 ins. in section, 10 ft. long. They should be planed or cleaned up all alike, which will reduce them to about 2¾ ins. × 1¾ ins. A couple of feet at the inner end may be left at that size, but from that point to the outer end a tapering piece should be sawn off, making the section at tip of sail only 1¾ ins. × 1¼ ins., as shown in 5, Fig. 14, and in two of the views in Fig. 15 by the dotted lines. The arms can then be all marked off alike at the correct distances in order to cut away the bevelled portions, which will eventually give the proper "cant" to the sails. If care be taken, the reader can hardly go wrong over this, as not only are the sections given in Fig. 14, but the corresponding sides of the whip are marked *a b c d* to help to make matters clear. The bevelling should not be more than that allowed for, or the whip may be seriously weakened. If less, there is less certainty of giving the proper angle to the sails.

Practically all the information required for constructing the sails can be gathered from Fig. 12. They may be made of any quite thin wood that is not likely to warp, and if the tongue and groove boarding prevents the sail from setting itself to the proper angles, a few of the "tongues" may be split off. Care must be taken to adhere to the proportions given, particularly with regard to the



DESIGN FOR A 20-FT. WINDMILL.

By F. E. Powell.

For description] [see pages 108–110.

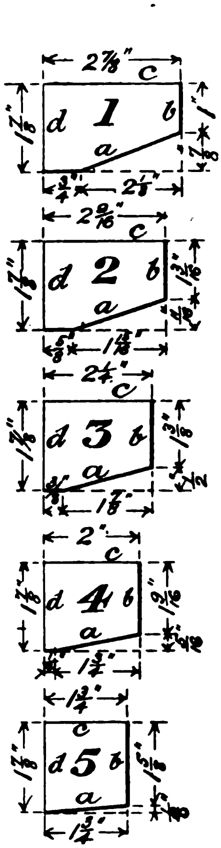


FIG. 14.

FIG. 15

SAIL CONSTRUCTION DETAILS FOR 20-FT WINDMILL.

(*For description see page* 108.)

amount of the sail on each side of the whip. It will be seen that the areas on opposite sides of whip are in the ratio of about 3 to 5, this having been found by experiment to give the best results. The narrow side has the leading "edge"—in other words, the sail shown in Fig. 12 will revolve "clockwise." In order to do this, of course, the leading edge is necessarily in advance of the plane swept out by the whips. The adjacent sections show this.

To stiffen the sails, which are sometimes exposed to considerable violence, there is, first of all, a binding of a narrow strip of thin zinc nailed on the long edges. This will lap both sides about an inch, and should be fastened by short galvanised clouts. Further stiffening is supplied by a strip of tough, straight timber, about 1½ ins. × ⅝ in., screwed on to the larger part of sail behind. Two or three stout galvanised hoop-iron cleats should be neatly fitted over whip and screwed to sail, with packing-pieces where necessary to aid the whip in keeping the sail to correct angles.

The straining wire shown in Fig. 13 will be a piece of No. 8 galvanised steel wire, firmly secured to the flange on central tube, and the other end bent at right angles, passed through a hole in sail, and again bent at right angles behind the sail. All this can only be done when sails are fixed in position. If any extra strain on these wires is desirable for the sake of pulling them taut, or to set the sails inwards, it can be obtained by means of a small screwhook, the shank of which passes through sail, with a nut behind, this screwhook to be arranged so that turning the nut pulls the wire down on to the sail. A further series of wires may be noted in Fig. 1, stretching from leading edge of one sail to the "following edge" of the next. These will to some extent counteract any tendency of the sails to either increase or decrease their angle of weather.

(*To be continued.*)

Marine Notes.

A NEW STEAMER FOR THE WILSON LINE.

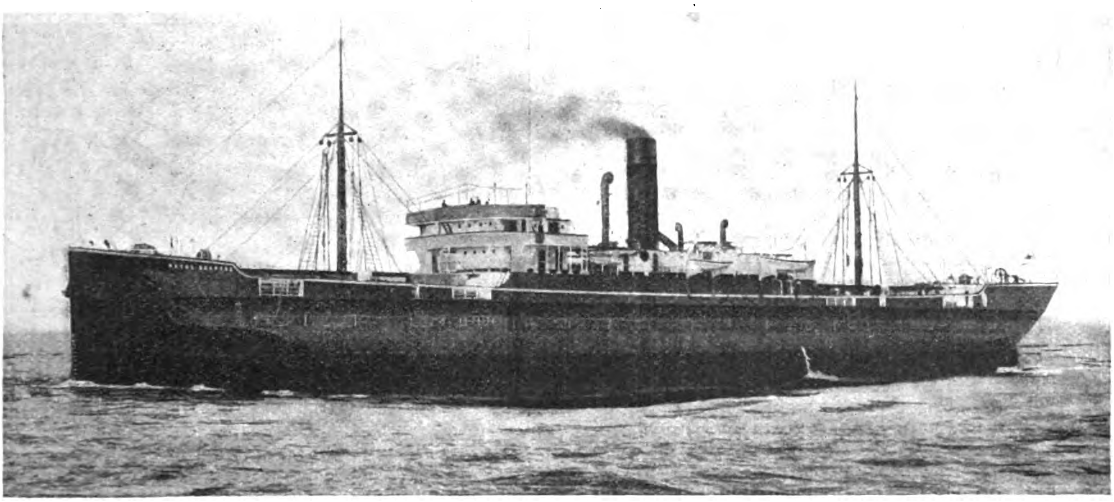
The passenger and cargo trade between Hull and Christiania is largely in the hands of Messrs. Thomas Wilson, Sons & Co., Ltd., of Hull, owners of the "Wilson" line of steamers, and a regular service is maintained by them between the English port mentioned and the capital of Norway. The latest addition to the Company's fleet is the s.s. *Oslo*, which was built during last year by Earles' Shipbuilding and Engineering Company, Ltd., Hull.

The vessel is 290 ft. in length by 39 ft. breadth, and has a moulded depth of 20 ft. She has three holds for cargo, and the 'tween decks forward are designed for either cargo or third class passengers. In all, accommodation is found for a total of 621 passengers, exclusive of the officers and crew. The first class staterooms are placed amidships under the awning deck, and the second class under the awning deck to the rear of the first class rooms whilst the third class accommodation is located in the 'tween decks both forward and aft.

The propelling machinery consists of a set of triple expansion surface-condensing engines, with cylinders 22 ins., 36 ins., and 60 ins. diameter, by 42-in. stroke, steam being supplied by two large single-ended boilers, working at a steam pressure of 180 lbs. per sq. in., and fitted with Howden's forced draught.

THE NEW TURRET STEAMER, "ROYAL SCEPTRE."

Reference has already been made in these columns to the above vessel, which has been built by Messrs. William Doxford & Sons, Ltd., of Pallion Shipyard, Sunderland, to the order of Mr. James L. Knott, of Newcastle-on-Tyne. The steamer is, by the courtesy of the builders, illustrated herewith. She is of the latest turret type, built with clear holds, devoid of beams and stanchions, for facilitating the stowage of cargo, and carries 6,600 tons deadweight on the moderate draught of 21 ft. 8 ins.



THE TURRET STEAMER, "ROYAL SCEPTRE."

Her leading dimensions are 350 ft. by 50 ft. by 26½ ft., and her total capacity is about 370,000 cubic feet.

The turret type of vessel offers, among other advantages, special facilities for loading or unloading from or into lighters at places such as some of those round the Cape, Natal, and Madras coasts, where no quays or docking accommodation are available. The principal advantage of this type of vessel is, of course, that of its ability to convey large deadweight cargoes on an exceptionally light draught.

NEW AMERICAN TURBINE STEAMERS.

There was launched on December 1st, 1906, from the yard of the Delaware River Iron Shipbuilding and Engine Works, Chester, Pa., U.S.A., the *Yale*, a large and powerful turbine-driven steamer, which has been specially designed for express passenger service along the American Atlantic coast between New York and Boston. The distance by sea between the two cities is approximately 345 statute miles, and the *Yale* and her sister-ship the *Harvard* are intended to make the trip in fifteen hours. To do this they will have to maintain an average speed of about 23 statute miles per hour, no mean performance even for vessels fitted, as these two are, with the most modern and powerful turbine machinery.

The two ships are of steel double-hull construction, with a complete arrangement of water-tight bulkheads and double bottoms, and the passenger accommodation is of the most comfortable and even luxurious description. There are forty parlours and bathroom suites and about 275 other staterooms, whilst on the hurricane deck there will be located an attractive writing and smoking-room and even a café. The decorations and furnishings of the main saloons will be finished in the colours of the Universities after which the two ships are respectively named.

The principal dimensions are as follows:—

Length over all, 407 ft.; breadth over all, 63 ft.; draught of water (loaded), 16 ft; space between inner and outer bottoms, 3 ft.; accommodation for passengers, 800; the motive power consists of triple-screw Parsons steam turbines, developing 10,000 h.-p.

LAUNCH OF AN ELDER-DEMPSTER STEAMER.

Messrs. Workman, Clark & Co., Ltd., Belfast, recently launched from their South yard to the order of Messrs. Elder, Dempster & Co., of Liverpool, the new steamer, *Salaga*, 395 ft. long, with a gross tonnage of about 4,000. The four cargo holds have been specially arranged for the reception of the largest type of consignment, such as boilers, locomotives, and general machinery, being almost quite free from obstruction, and having large hatchways. Each of these hatches is equipped with two winches of the largest and most powerful type, and three strong derricks are swung from the masts. The bottom of the vessel has been constructed on the double-bottom system, which adds to the strength and safety of the vessel in case of grounding, and is also available for carrying water ballast for trimming purposes. Accommodation for first class passengers is arranged in the bridge-house. The staterooms are placed at each side of the vessel. An entrance hall and lounge, with a comfortable smoking-room adjoining, has been arranged on the bridge deck, and is approached by a stairway from the saloon passage. Apartments for second class passengers, including saloon and staterooms are arranged further aft on the upper deck. Rooms for the officers and engineers are placed along each side of the vessel at the after end of the bridge space. The engines and boilers, consisting of a set of triple-expansion engines with all the latest improvements and three single-ended boilers, have been constructed in Messrs. Workman, Clark & Co.'s Queen's Road Works.

TRIAL OF A NEW "HALL" LINER.

The new steamer, *Denbigh Hall*, built by Messrs. Barclay, Curle & Co., Ltd., of Glasgow, for the Hall line branch of the Ellerman Lines, Ltd., successfully ran her trials on the Firth of Clyde during November last. She will trade between this country and India, and no passengers will be carried on board. The vessel conveys the large dead weight of 8,300 tons on a moderate draught and with a low registered tonnage. The machinery, which was constructed by the builders, consists of a set of triple expansion engines, and the speed for which the ship has been designed is eleven knots. The boilers are worked on Howden's system of forced draught.

ANOTHER TURRET LAUNCH.

On December 18th, Messrs. Wm. Doxford and Sons, Ltd., Pallion, launched the well-modelled turret steamer, *Euphorbia*, built to the order of the Stag Line, Ltd. (J. Robinson & Sons), North Shields. The vessel is specially designed for the free stowage of cargo in bulk or piece, and is constructed on the clear hold principle. The dimensions are: Length, 366 ft.; breadth, 50 ft.; moulded depth, 26¼ ft. The deadweight of cargo and bunkers carried is 6,600 tons on a draught of 21 ft. 9 ins.

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 intended for publication.]*

Miniature Model Yacht.

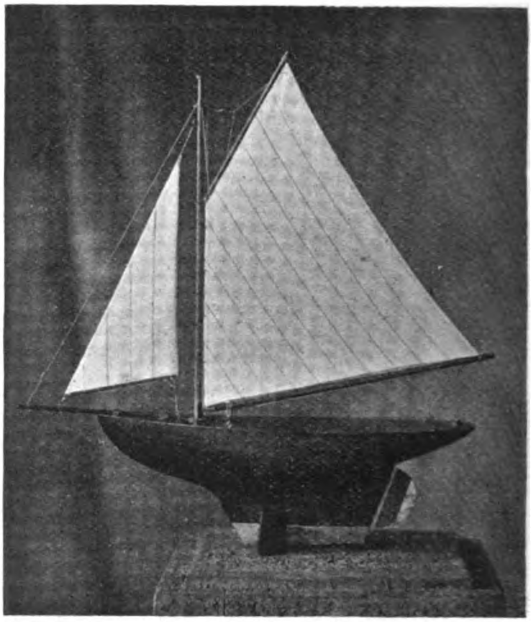
TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Herewith I send you a photograph of a miniature model yacht I have built from the design given in your issue for May 1st, 1902, by the late Mr. W. H. Wilson Theobald, M.A. (this is my first attempt at model yacht building).

The hull, deck, and spars (except the bowsprit, which is hardwood) are of yellow pine. The rudder is of ⅛-in. thick mahogany, and is weighted with ½ oz. of lead to make it self-acting, and all are French polished

The hull and deck weigh 6 ozs. The sails, spars, and other fittings 2 ozs.; leaving 7½ ozs. for the lead keel. This is much larger and heavier than shown on the plan, and to bring her down to the water-line required a keel 13-16ths in. deep forward and 11-16ths in. aft. This made the draught greater forward than aft, so I raised it by taking off ¼ in. from the wood keel forward and running it out to nothing aft before fixing the lead.

I also found the suit of sails, 166 sq ins. (actual



A MINIATURE MODEL YACHT.

area, 154 sq. ins.), much too large, except for a very light wind, and have made a suit with 100 sq. ins. (actual area), which I think is quite sufficient.

I have only had it on the water a few times, but it is, so far as I am able to judge, a good sea-boat. If any other reader of "Ours" has built a model from the same design, it would be interesting to know his experience.—Yours truly,

West Kirby. C. T. P.

Model Full-rigged Ships.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—*Re* correspondence on full-rigged sailing models. As a boy I could sail them very well. I had a full-rigged ship (3 ft. long), a brig about the same size, a brigantine (2 ft. 6 ins.), and a topsail schooner about the same size, and they all sailed well. Besides these, I had a number of fore-and-afters, of all sizes and rigs. My object in writing this is to say that a book given me at that time gave me many good hints on making and rigging them; it was called "The History of a Ship from its Cradle to its Grave." I do not remember the name of author or publisher, but others may, or a visit to the British Museum may unearth something. It was well got up, with many drawings and pictures.—Yours truly,

Spain. GEO. W. HALPIN.

Working Drawings for Model Yachts.

To the Editor of *The Model Engineer*.

Dear Sir,—I should like to avail myself of the kind offer of your correspondent, "A. W.," in The Model Engineer of June 14th, 1906, who offers to assist any reader wishing a sail plan for Mr. Lochore's design in issue of July 20th, 1905, and also of your correspondent, "A. N.," in The Model Engineer for August 1st, 1902, who then offered to supply information concerning a smart 30-in. model, sketch plans of which were given, to another correspondent, "Mr. McK.," if the offer is yet available. I should have built from these lines long ago had offsets been available, and seeing Mr. Begbie's article in Vol. XIII dealing with two 30-in. models built by him from Mr. A. Noble's designs, I thought it an excellent opportunity to try my luck. Perhaps one or other of the gentlemen would be kind enough to assist me.

Would Mr. Lochore and Mr. Kitchingman kindly favour me with offsets for their respective designs (Vols. XIII and XIV), and also with particulars of the steering gear of the latter boat? If I may be permitted to make a suggestion, I think it would be immensely helpful to readers interested in this particular subject if offsets, displacement, weight of ballast, dimensions of spars, and sail plans to scale could be given with designs; and further, details of running gear and how adjusted; also manner of steering by the patent gears that are just touched upon from time to time, where they can be bought, or dimensioned sketches, so that one could get them made. The most satisfactory explanation of a steering gear is that of the lugger in Vol. XI, so far as I have seen.

This country is a long way from England, and one has no opportunity of seeing anything of the kind except in the pages of your admirable journal. Your little handbook gives some capital information, but it assumes apparently that we know all about the methods of controlling running gear, and how to devise the bending of sails, so that a storm suit can be quickly set, etc., but I for one must plead entire ignorance on the matter, and would very much like to be informed.—Yours faithfully,

"Plymleigh," F. J. Martyn Roberts.
Gladstone Road, S. Brisbane.

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 intended for publication.*]

The Johnstone Compound Locomotive.

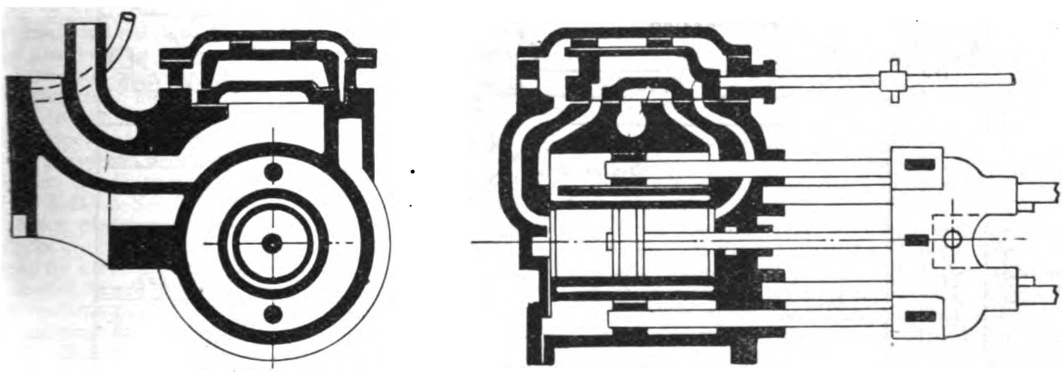
To the Editor of *The Model Engineer*.

Dear Sir,—Thinking your numerous readers may be further interested in the peculiar locomotive illustrated in the issue of December 6th, 1906, and especially as I happen to have some of the dimensions at hand, I beg to send you them as under, taken from Vol. LXVIII, page 135, of the *Scientific American* for March 4th, 1893. I regret I cannot give the dimensions of the driving wheels, but the other dimensions are as follows:—Cylinders: H.P., 13 ins. diameter; L.P., 28 ins.; stroke, 2 ft. Boiler: "Otis" steel 9-16ths in. diameter, 54½ ins., with 201 2-in. tubes, 15 ft. 9⅛ ins. long; Belpaire fireboxes, 56 ins. long by 36 ins. wide. Working pressure, 180 lbs. per sq. in. It is said that the engineer sits on one side of the cab with the fireman, who has to be assisted by a coal passer on the other. The toal weight is given at 130 tons.

In the *Mechanical World* for July 18th, 1891 (Vol. X, page 26), there is also an illustration of a very powerful engine on Mr. Johnstone's system; but in this case the engine is of the usual construction, and the intermediate levers shown on the larger engine are not employed.

From the account in the *Mechanical World* it appears that in Mexico coal is extremely dear, costing on this line (the Mexican Central) as much as 46s. per ton.

I have always understood that with an annular piston there has always been a difficulty in keeping the *internal* packing tight, from the naturally difficult problem of fitting a satisfactory piston packing to expand *inwards*. Of course, the designer of the engine has presumably calculated for this matter, for it is evident the large engines illustrated in your valuable paper are replicas of those built in 1893. Perhaps the smooth action of the double



Cross-section. Longitudinal Section.

Cylinder Arrangement of the Johnstone Compound Locomotive.

connecting-rods may have something to do with it, together with the undoubted advantages of the curious valve gear (or more properly, valve) employed.

The slide-valve, which is a very important feature of this design, distributes steam to both high and low-pressure cylinders, requiring but one valve rod, which is actuated by the link motion, as previously used. The valve is made in two sections, the outer portion distributing steam to the H.-P. cylinder and the inner section to the L.-P. cylinder. The inner section is carried by the outer, and has 1 in. less travel, the outer travelling 6 ins., the inner travelling 5 ins. The object of this is to retard the point of cut-off to the L.-P. cylinder and also to reduce the compression on the front of the H.-P. piston. This has been accomplished in a very satisfactory manner. For instance—when the H.-P. admission is cut off at 9 ins., the L.-P. continues open to the admission of steam for 17 ins. On the other hand, the compression on the top piston (which would begin at 9 ins. piston travel were both sections of valve made to move together with the same point of cut-off) does not take place until 17 ins. in the H.-P. piston and 19 ins. in the L.-P. piston. With 14 ins. cut-off in the H.-P. cylinder, there is 20 ins. cut-off in the L.-P. cylinder, compression beginning at 20 ins. in the H.-P. and 22 ins. in the L.-P.

The ratio of the cylinders is given as 3—6—1, a very unusual arrangement, but doubtless unavoidable in the design adopted. The drawing shows a steam jacket around the H.-P. cylinder which appears to be hardly necessary. Nothing is said on the most important point of all, viz.—how the annular piston is kept steam-tight.—I am, Sir, yours faithfully,

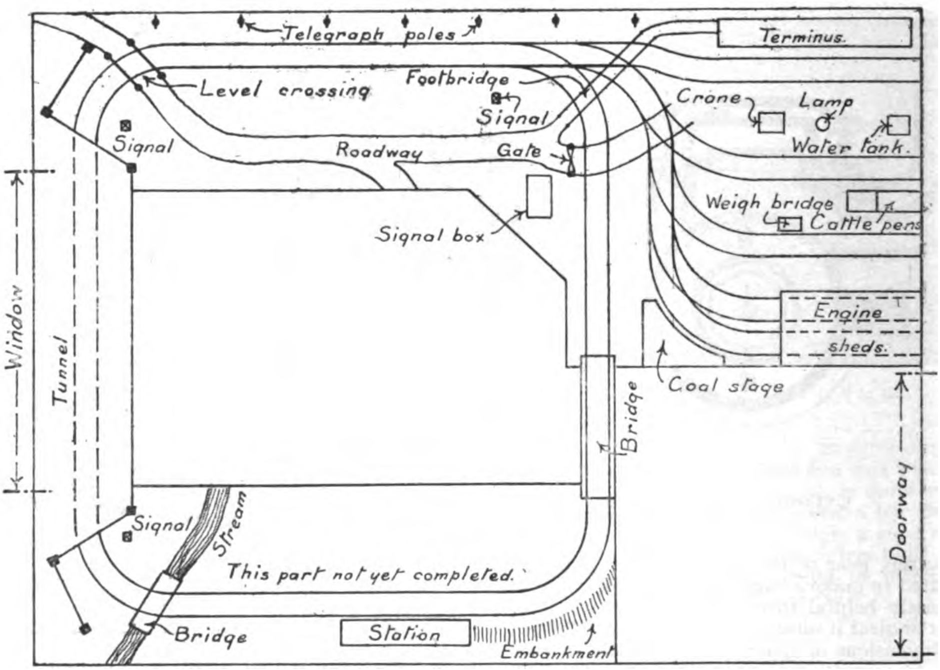
Cranbrook, SIDNEY RUSSELL.

A Model Railway Plan.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Happening to have a MODEL ENGINEER put into my hands some time ago by a friend of mine who has been taking it in for some time, and was then building an electric car from a model he had seen in it, and seeing some photographs of model railways, I thought I would like to try my hand at building one.

The general plan is as shown in the accompanying illustration. The railway is built on trestles 2 ft. 6 ins. high. It has a terminus station and goods yard, which occupies the space behind the door, and is pretty well equipped, comprising an engine-shed with two roads and coal stage, two goods sidings (on one of which is a truck weighbridge, and on the other cattle pens), automatic crane, and truck load gauge, water tank, with column on platform of station, and is lit up by three arc lamps burning oil.



GENERAL PLAN OF MR. A. R. BOYNES' MODEL RAILWAY.

From platform of station is a small pathway leading to bridge crossing lines to roadway, with cab-stand at bottom of steps.

The signal-box is fitted with six levers, and is connected up to signals, two of which, with signal box, we made ourselves. The back of box has been taken off to show levers, telegraph instrument, etc. There are four switches in goods yard, which we also made, worked by levers on ground frames. I bought most of the rails, and some I made, laying them on wooden and tin sleepers.

The level crossing and goods yard gates, cattle pen sides, side of path from platform to bridge, and the side rails of bridge connecting the two stays at doorway were all cut with fretsaw, and are painted to represent the originals as nearly as possible.

The rolling-stock consists of Bassett-Lowke's "City of Bath" type clockwork engine, with scale model coach and guard's van, also two other engines and several wagons.—Yours truly,

A. R. Boynes.

The Society of Model Engineers' Eighth Annual Conversazione.

Although we have to admit that the interesting function held at Cripplegate Institute under the auspices of the London Society of Model Engineers was somewhat congested owing to the large number of visitors present and the small size of the various rooms used for the exhibits, on the whole the Conversazione will rank as one of the most successful the Society has as yet put before us. The musical entertainment was really excellent, also the lecture by Mr. Herbert Sanderson, the chairman of the S.M.E., on his foreign travels, and the demonstrations by Mr. Harding with solid carbonic acid gas. In addition, Mr. O'Neill very much interested those present by his practical demonstrations in the art of moulding and casting of metals.

The exhibits were both numerous and choice. The amateur members and friends responded very well to the invitations of the Committee, and in the upper rooms quite a nice collection of models was provided for the delectation of the visitors. Dr. A. C. Hovenden exhibited a ¼ scale model of a L.B. & S.C.R. locomotive buffer beam, with a piece of framing and a headlamp. Mr. C. W. Pidcock showed his model battleship—the one recently illustrated in these pages—and, in addition, a model steam turbine. Mr. H. Clayton brought his working model hydraulic capstan, and Mr. Door an old-time vertical engine.

Mr. Henry Lea, M.I.C.E., sent a screw-cut rod 3-16ths in. diameter and 2 ft. in length, screwed thirty threads to the inch, under which was appended a notice that he was prepared to offer a prize of 20s. to the amateur member of the S.M.E. producing the best example of a similarly proportioned rod. Mr. S. G. Ferreira exhibited the engines and boiler of his model steam launch. Mr. A. M. H. Solomon showed his model T.B.D. and one of his old-fashioned model locomotives.

One of the most admired marine models was the 6-ft. model paddle steamer made by Mr. H. J. Dawson. A photograph of this boat appeared in our issue of August 23rd, 1906, but since that time the maker has fitted a perfect working model of a steam winch on the fore deck. Other ship models of equal calibre were exhibited by Messrs. O. Tiefenböck and E. W. Hobbs.

A well-made model steam engine and centrifugal pump was shown by Mr. W. T. W. Rolls. Mr. A. H. Bird exhibited a model locomotive, Mr. H. C. Sprange a vertical steam engine, Mr. Sharman an electric clock, Mr. E. L. Pearce a ½-in. scale model single express locomotive, Mr. C. G. Harrison two ½-in. scale G.W.R. locomotives and a 1-in. scale brake van, Mr. J. Barker traction engine wheels, Mr. John Wills, jun., a model rail motor coach, Mr. C. Blazdell a set of model compound paddle-boat engines, Mr. W. T. Bashford model G.W.R. and Caledonian locomotives, Mr. W. G. Roblin a very fine model 1-in. scale goods locomotive and a boiler for a N.E.R. "Atlantic" engine of the same size. Mr. Hy. R. W. Bruce showed an interesting model of the novel "Palindrome" rotary engine, in which he is interested. Mr. A. J. R. Lamb exhibited a model vertical high-speed engine.

In one of the class-rooms Messrs. Riddle and Hildersby arranged by means of their dynamo and motor and a battery of accumulators a moving shaft, to which many of the exhibits were connected by bands, and shown running. Mr. Hildersley also demonstrated the use of an eccentric chuck for ornamental turning on his small home-made lathe. The Society's track was in operation, and Mr. Barrett ran his six-coupled goods locomotive, Mr. E. W. Twining a model 3½-in. gauge express engine, Mr. Harrison a model Stirling single express locomotive, and Messrs. Bassett-Lowke & Co. several of their latest models. Other private exhibitors were Mr. Heley, who showed a splendid model naval gun; Mr. J. Hay, a small power 2-in. by 2-in. high-speed engine; Mr. A. T. Hart, a model 1903 undertype engine; and Mr. C. Rompler, a model Stuart high-speed engine.

Messrs. Bennett, Russell, Waller, and Mitchell also provided several locomotive exhibits of real interest, and Mr. Greenfield sent a steam motor-car engine which could be put in motion by a handle at the side, the movement of the valves being simultaneously observed. The use of the new pocket calculating machines were also demonstrated by two charming young ladies from Messrs. Dickinson & Shields, of Stoke Newington.

The trade was very well represented in every branch. Of the tool-makers, Messrs. Drummond Bros. exhibited and demonstrated the possibilities of their splendid little 3½-in. screw-cutting lathes and handshapers, and also showed their latest tool, the new 5-in. heavy screw-cutting and surfacing lathe, specially designed for small engineering and motor-car work, of which we have already published full particulars.

Messrs. Cotton & Johnson, of Soho, showed a case of gear wheels, a small lathe, and other materials and accessories useful to the amateur. The Auto Controller Company demonstrated the use of their "Fluxite" soldering paste.

The Engineers' Supply Stores, Sumner Street, Southwark, were represented by samples of their excellent overalls, and the members of the Track Committee being kindly provided with suits, wore them during the time they were attending to the various models at work on the track.

Messrs. Lehmann Bros., makers of the highest class of taps, dies, and other small screwing tackle, showed some of their excellent wares.

Messrs. Burton Griffiths & Co., of Ludgate Square, exhibited a case of fine tools; Mr. C. W. Franklin, of Cleveland Road, Uxbridge, photographs of his boring carriages; Messrs. Crosier Stephens, of Collingwood Street, Newcastle-on-Tyne, being represented by a very fine small hand-shaping machine. A sensitive bench-drilling machine and a "Gem" twist drill grinder were sent by Messrs. S. Holmes and Co., Bradford, Messrs. Henry Milnes, of the same town, exhibiting very good examples of his tool holders and other machine tool cutters. The Macintire combination lathe was also shown, together with samples of the work capable of being performed by the aid of this ingeniously arranged tool. Messrs. H. Heckman & Co., of 27, Quinton Street, Earlsfield, showed their new miniature petrol motors and castings. Messrs. T. W. Thompson & Co., of Greenwich, had a fine show of electrical specialities—dynamos, motors, accumulators, etc. The well-known firm of Messrs. Whitney also fitted up an excellent stall comprising electrical goods in general, model steam engines and pumps, and other fittings useful to the model engineer.

The accumulator specialists, Messrs. Armstrong and Co., of Twickenham, showed various types of cells—cells for ignition purposes, for the pocket, for model boats and locomotives, and also specimens of their portable electric hand lamps. Mr. John Cole, of West Norwood, exhibited several small motors and electrical measuring instruments; Messrs. F. Darton & Co., a great variety of small dynamos and motors, batteries, instruments, influence machines, and electrical novelties.

The British Mica Company illustrated the manufacture of mica goods by a set of samples showing the mineral in the raw state and in the various stages of manufacture.

Model Railway work was well represented by the splendid model railway set, specially built for the Conversazione by Messrs. W. J. Bassett-Lowke & Co. This railway comprised a station with four roads and a siding, with the usual crossovers, properly interlocked signal box, and trains of both goods and passenger engines and rolling stock. The whole of the line was built in G.N.R. style, and the engines, which were absolutely correct models of a G.N.R. eight-coupled engine and a bogie single, and were controlled from the signal box by electrical means, were shown shunting and performing other evolutions common to railway practice.

We must not forget to mention the well-arranged stall by Messrs. Stuart Turner, Ltd. This stall comprised examples or parts of most of the productions of this firm, viz., small power and model high-speed engines, gas engines, petrol electric lighting sets, model launch engines, water-tube stationary boilers, one of the latter being shown working a standard 1 in. by 1 in. vertical engine throughout the evening.

Messrs. Carson & Co., Ltd., exhibited a fine model of a L.N.W.R. tank locomotive, and Mr. W. H. Dearden exhibited some of his best work. The Engineers' Agency, of 63, Chancery Lane, E.C., showed one of the speed indicators mentioned in the recent articles on Germany, and also the cab taxameter, as used almost universally on the Continent. In addition, this firm showed samples of piston-rod, packing and jointing material. Messrs. Calipe, Dettmer & Co. were present with samples of their foot-blowers, blow pipes, and other soldering appliances, small tools, amateur jewellers' outfits, and other devices suitable to the home-workers. W. H. Harling, the well-known mathematical instrument maker, of 47, Finsbury Pavement, had an interesting stall, and demonstrated during the evening the use of various instruments.

S. F. Edge, Ltd., were represented by a very good collection of Napier motor parts of the most interesting order; indeed, altogether the Conversazione incorporated as fine a show of models and model engineering appliances as one could possibly expect, and the thanks of all those present are due to the Committee of the Society for providing such a pleasant and instructive evening's entertainment.

The Sixth "Gauge" Competition.

To further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th, 1907.

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:—

[17,068] **Grouping of Cells.** J. A. B. (Redhill) writes Will you please let me know what current I could expect from twenty Daniell cells (approximately) on continuously closed circuit, as they give 1 volt per cell? The twenty being in series, could I expect 20 watts—that is, 1 amp. 20 volts?

The current given by any cell or groups of cells depends upon the internal and external resistance. To obtain the largest current output they should be coupled in parallel, when the external resistance is less than the internal resistance. When the external exceeds the internal, then, generally speaking, they are coupled in series. The maximum flow of current in amperes is obtained when the external equals the internal resistance. For practical purposes, you can use the formula:—

Watts required by external circuit $W - C_2 R$.

Maximum that each cell can give $w - \frac{E_2}{4r}$

Therefore, $\frac{W}{w}$ — number of cells required.

[17,189] **Small Dry Batteries.** J. F. P. (Bo'ness) writes: I have a small electric hand lamp, which is supplied with electricity by a dry battery inside. These batteries are usually sold at 1s. One of the batteries, which was exhausted, I took to pieces. After taking off the cardboard I found the battery was composed of three round cells, made of either zinc or tin. The three cells were all connected to one another and each contained a salt or powder unknown to me. Now, I would like if you could kindly inform me how I could recharge by this battery, and what salts or powder I should require? I may say the lamp cost me 2s. 6d.

Sal-ammoniac crushed to a powder is used. The construction s practically the same as for the dry battery described in handbook. "Electric Batteries," 7d. post free, to which please refer.

[17,174] **Small Electric Locomotive Motor.** B. B. Manchester) writes: I have nearly completed a ½-in. scale locomotive, which is to be driven by a No. 2B Thompson's motor. I have fitted the motor in and it is geared 20–1 by a worm and wheel, but on connecting the motor to a bichromate battery (connected in series) of three 1-gallon jars with 6×3×½ in. zincs and carbons, I find that the motor will not move the locomotive at all. The locomotive at present only weighs 7½ lbs., and the motor is wound for 6 volts at 2½ to 3 amps. Will you please tell me (1) What current the above battery should give? (2) Would it spoil the motor to work it at 8 volts instead of 6 volts? (3) Is the gearing ratio right? (4) Should the worm-wheel be insulated from the axle of locomotive? (5) Would the bichromate battery described in your handbook No. 5, only with six cells instead of eight, half of which would be connected in series and the other half n parallel, be powerful enough to drive the above locomotive?

(1) Should give a good 1½ or 2 amps. at least for an hour or two. (2) No. Try it with 8 volts. (3) Yes. Probably it is the gearing that is stiff and absorbs too much power. (4) We do not understand this. The gear wheels are not part of the circuit. (5) Try the motor running light—*i.e.*, disconnected from gearing, etc., then you will know whether it is the cells or the motor, or the transmission gear which is at fault. Find out this before going to the expense and trouble of a new battery.

[17,225] **Marine Engineering.** A. J. A. (Castle Douglas) writes: I shall be greatly obliged if you will kindly advise me on the following points: I am serving my time to engineering in a small country engineering shop here and have now completed three years. I am not bound, but, of course, I intend to serve the usual five years. (1) What branch of engineering would you advise me to take up, which would offer reasonable chances of advancement to a responsible position? I may say that I have been well educated at a college in England, and have, since leaving, attended evening classes. (2) I have had the notion that I should like marine engineering. Is this a good profession? If so, would you tell me what is necessary before I could get to sea? Also where I could get full particulars, and, if possible, samples of papers set for examinations for seconds and chiefs. (3) Is it the case that before I could go to sea I must have twelve months' experience in a marine shop? Would twelve months of apprenticeship count as this? If so, would you advise me to leave the firm I am with at present at the end of my fourth year and try to enter some marine shop as a fifth year apprentice? Is this possible, and what firms would be likely to take me on such terms?

(1) The whole matter depends on personal inclination and ability, and also on the particular circumstances of the case. In the first place, you should try to get employment in that particular branch of engineering you like best. Of course, it is necessary to have a good all-round knowledge of each branch in the elementary stages, and then to specialise afterwards. (2) Yes, if you like the sea, and are sure it is not merely a passing fancy. Get the "Regulations Relating to the Examinations of Engineers in the Mercantile Marine," 7d. post free from Eyre & Spottiswoode, East Harding Street, Fleet Street, E.C. See also "Reed's Engineer's Handbook for Marine Engineers," 12s. 6d. or 13s. post free from this office. (3) See above. You do not mention the kind of work you are engaged upon. It is necessary to serve so many years at the making or repairing of steam engines and boilers *before* you put in *one year's* sea time. You could go to sea at once (if you could get a job), but in that case the term of sea service would be greatly increased before you could sit for your examination to pass for second engineer. Any of the North-East Coast or West Coast ship and engine builders would take you as an improver if they had a vacancy, provided you had a good knowledge of ordinary fitting, etc.

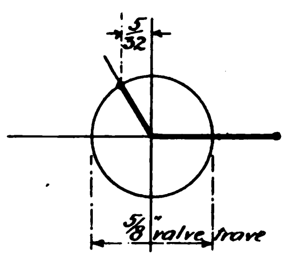
[17,041A] **Miscellany.** F. C. (Wollaston) writes: I beg to thank you for your kind replies to my Query No. 17,041, *re* outdoor bell circuit. I much regret omitting to mention the length of the circuit in above query. (1) It is 200 ft. single run. Kindly say what size wire would be required, and should it be hard or soft-drawn? (2) *Re* my former query of fixing same to a brick wall, please say what method should be adopted, at the same time keeping the wires insulated from each other. (3) Please can you tell me how to find out the speed of any given shaft or wheel? (4) How can I find out the resistance of any circuit in ohms?

(1) No. 18 would have a resistance of 1·8 ohms approximately for the 134 yards lead and return. Use a group of cells giving about 5 or 6 volts. Use high conductivity wire. (2) A well insulated and covered wire will be best. If fixed to woodwork that is all that will be required, only be careful not to destroy the insulation when fixing with staples or nails. (3) Use a speed counter—can be had from Geo. Adams or Burton Griffiths, or other advertisers. (4) Use a Wheatstone Bridge or other form of testing apparatus. See text-books on Electricity, such as "Lessons in Electricity and Magnetism," by S. P. Thompson, 4s. 9d. post free. Also articles in back numbers.

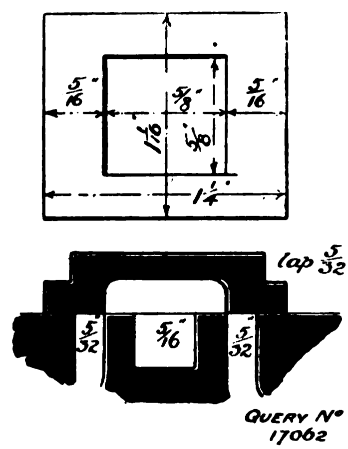
[17,062] **Valve Proportions.** T. C. (Burton Lane) writes: I have made the cylinders of my horizontal engine 1½ ins. diameter by 2½-in. stroke, and I shall be very much obliged if you could tell me the stroke of the valve (slide-valve); also outside and inside lap and lead, assuming cut-off is ¾ in. of the stroke of engine piston, and could you give me a suitable dimension for length of connecting-rod for 2½-in. stroke of piston?

In reply to queries with steam ports 5-32nds in. by ⅞ in. and exhaust ports 5-16ths in. by ⅞ in.—the port bar being 5-32nds in. wide—a cut-off of ¾-in; stroke can be obtained by making the lap equal to the port opening, which, by the way, in this case, should be the full port width. Lead and inside lap are hardly necessary unless you are going to run the engine very fast, when you may advance the eccentric a little more (say, 1-32nd in.) than shown in the drawing. This will, of course, give a slightly earlier point of cut-off, but nothing to take any notice of. If the latter is objectionable, make the lap ⅛ in. and the advance of the eccentric

Diagram of Eccentric Travel and Advance.



Plan of Underside of Valve.



Valve Proportions.

5-32nds in. With regard to the length of the connecting-rod, it depends on the type of engine you are modelling. If it is a Lancashire mill engine, about 7½ ins. long; for an overhung cylinder high-speed engine, a connecting-rod 5¼ to 5½ ins. between centres will work well.

[10,246] **The Electric Circuit.** M. H. D. (Newcastle-on-Tyne) writes: Would you please let me have a reply to the following questions. It is understood that, in the case of a tramway, the rail forms the return to the power-house—*i.e.*, the rail if "earthed" all the way, will be at earth, or zero, potential. Am I correct in this supposition? Is this the explanation of not being able to get a shock when crossing any tram rail—the fact of the whole track being earthed? If I am correct in this, how is it that there is not a series, if I may put it that way, of "shorts" when current is put on to the line in the case of an electrified railway? When I say line, I mean the two rails forming the return, not the third rail.

A perusal of Query columns of March 5th, 1903 issue, will help you in this difficulty; but if this does not clear them up, let us know what remains unsolved, and we will assist you further. When one is standing on the return rail one is not part of the circuit.

[17,163] **Size of Sails for Model Yachts.** L. W. G. (Ilford) writes: I am building a yacht to the drawing and particulars given by you in your little book—" Model Yacht Sailing," pages 43–63, but to slightly different sizes, *i.e.*, my L.W.L. will be 25 ins. long. May I ask you to give me the revised sizes for the sails, etc., in same manner as that you show on page 100? Also please state diameter of base of mast required? Do you think keel of following sizes shown would be sufficient (sketch not reproduced).

On page 91 of " Model Sailing Yachts " will be found an equation showing how to keep the proportion correct when enlarging, etc. Bore of mast about ⅝ in. diameter. To get right weight of lead for keel, put the boat in a bath and weight it down to the right L.W.L.; then make a note of weight taken to do this. This will be the weight of keel.

[17,040] **Accumulator Charging.** A. W. K. (Retford) writes: I have three 2-volt accumulators for intermittent lighting (" Osram " lamps) in country house. I have to take the accumulators into town each time they require charging. I should be greatly obliged if you would kindly give me particulars how to erect a battery at home—to charge these one at a time—with articles required, and the cost of same all complete. I may add I am a reader of your paper and have got a friend to take it also.

It is very inefficient to employ such a method as you propose—viz., to erect a primary battery to charge accumulators to light small lamps. Why not connect the lamps direct to the battery of primary cells, and save 40 per cent. loss. Still, if you prefer to use accumulators, you can use either Bunsen or bichromate or Daniell cells for charging. Two in series for the 2-volt accumulator. You do not mention capacity of accumulators, but the charging rate may be taken as anything up to 5 amps. per sq. ft. of positive plate surface. Use as large cells for charging as possible; or, if small ones are used, connect a few up in parallel. Prices can be had from any electrical firm advertising in our Journal, and details of construction of various cells are given in " Electric Batteries," 7d. post free.

[17,019] **Charging Board for Small Battery.** T. W. A. (St. Leonards) writes: I beg to thank you for your reply of November 30th, and for offer of further assistance. I want to wire switchboard with two lamps (ampere and volt meters) and two switches so that I can charge one or more motor cycle accumulators from dynamo, so that current enters top of board, goes through two lamps (in parallel), voltmeter and amperemeter, showing what current the amperemeter and voltmeter passes (1) through lamp, (2) into accumulator, and to be able to switch off either lamps or voltmeter or accumulator from dynamo, I think I could wire it without lamps or switches, but these two puzzle me.

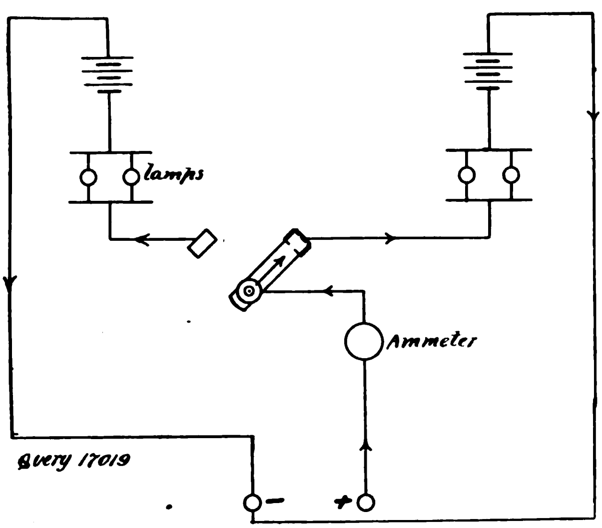
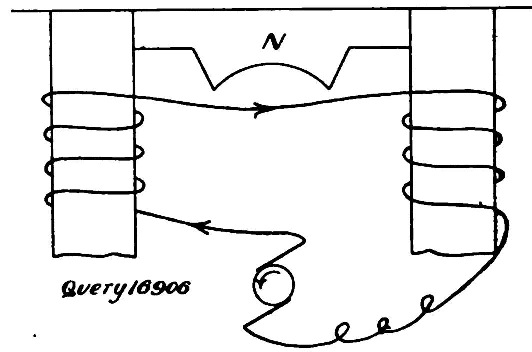


DIAGRAM OF CONNECTIONS FOR CHARGING BOARD FOR SMALL BATTERY.

We seem to have been at cross purposes for some little time now. However, we think our recent reply will put you on the right track. Your switch may be constructed in a variety of ways, and we give you another sketch herewith showing how to arrange for two sets of cells being charged alternately. Voltmeter can be connected anywhere across the mains.

[16,906] **150-watt Dynamo Connections and Windings.** H. C. (Outwood) writes: I have got some machined castings of a Manchester type dynamo, also 4 lbs. of wire (sample enclosed). Will it do for the field coils? If not, please say what gauge and how much; also how much shall I want for armature and what gauge? I have all your books on Dynamos, also " A B C of Dynamo Design." (1) Does it make any difference in the core, as I have got one flange ⅛ in. thick, and the other 3-32nds in.? (2) How many watts will this machine give, and what volts and amps.? I want it for lighting and to charge an accumulator sometimes. (3) Should I start winding the field coils from the bottom as per



150-WATT DYNAMO CONNECTIONS.

sketch—one overhand the other underhand? Which two wires shall I take to the brushes? (4) Which wire should I connect to positive of accumulator for exciting? (5) Which way should it run when looking at commutator? (6) What size wire shall I want to take to lamps about 4 yards off?

(1) Yes. One slightly less than the other in thickness does not matter. (2) Approximately 150 watts, 50 volts 3 amps. (3) Yes. See diagram in handbook, Fig. 2. (4, 5, and 6) No. 20. Sample is No. 22, and will do for fields. Use No. 21 gauge for armature. About 1½ lbs. for armature, and about 6 lbs. for fields. See article in January 1st, 1903, issue.

[17,076] **12-in. Spark Coils.** A. B. K. (London, N.) writes: I am sorry to trouble you, but would like to ask your advice *re* a 12-in. spark coil. I have made the core 16 ins. long by 1½ ins. in diameter, and wound primary with two layers (173 and 174 turns respectively) of No. 14 D.S.C. wire. This is placed in an ebonite tube, 20 ins. long, 2 ins. internal diameter, and the walls ¼ in. thick. I am rather uncertain as to the secondary winding. I propose to make 120 sections of No. 36 D.C.C. wire, 1-16th in. thick by 9½ ins. in diameter over all. These sections, together with insulating discs (1-16th in. thick) make up a length of about 15½ ins. Condenser is to be composed of 200 sheets tinfoil, 9 ins. by 9 ins. Will you please tell me (1) If dimensions of secondary sections are right; and, if not, what are the dimensions? (2) What voltage would give best results with mercury break, as in your Handbook No. 11. (3) What weight of secondary wire, No. 36 D.C.C., wil be required to wind the coil, approximately?

(1) Outside diameter of secondary sections appears rather great. We should say it would work out about 6½ ins. diameter. The sections towards each end should get less in diameter—to say 5½ ins. outside and correspondingly greater inside diameter. (2) A small 4-volt cell, or even 2 volts, would operate the electro-magnets of the mercury break. (3) Weight of secondary will be about 18 lbs. in all.

[17,041] **Miscellany.** F. C. (Wollaston) writes: I shall be glad if you will give me information on the following:—(1) What size bare copper wire should I require for an outdoor bell circuit, using lead and return wires; and what method of fixing same to a brick wall should I adopt, at the same time keeping the wires insulated from each other? (2) How many No. 2 Leclanché cells would be required to work a 3-in. bell on the above cicruit? (3) When testing the current from a dynamo or accumulator, is the voltmeter or ammeter connected in series or parallel? (4) What is the amperage of a 4-volt pocket accumulator? (5) What are the voltages required for charging a 4-volt and a 6-volt accumulator separately? (6) Does it matter about the amperes if the volts are right? (7) When charging two cells together, are they connected in series or in parallel? (8) What size wire is necessary to carry a current of 10 volts 2 amps., and is it necessary to have any casing over it? (9) Is it necessary to use fuses in conjunction with an accumulator? (10) How many 4-volt lamps would a 4-volt pocket accumulator light? (11) Can a small accumulator be charged from a larger one? (12) What is the cause of lights flickering when worked off an accumulator? (13) Is there any danger of lightning affecting outdoor bare bell wires? If so, How can it be prevented? (14) Where does the danger of fire lie with the use of electricity? (15) I read in a book

that there is no danger from touching electric wires up to 2,000 volts. Is this correct? (16) Is there any way of finding out by electricity or magnetism the exact position of an iron pipe under the ground? (17) Is there any device for holding a Goodell drill chuck in the lathe so that it will not turn round? The chuck does not screw on, but simply fits into the mandrel nose in the place of the centre. (18) What size wire does 70/40 denote, and why is it expressed in this manner other than by the ordinary mark of S.W.G. or B.W.G.?

(1) Depends on length of circuit—*i.e.*, distance of bell from battery, etc. (2) Close at hand, two would probably do. (3) The ammeter generally in series, and the voltmeter shunted across the mains. (4) Depends upon size of plates. You do not read our Query columns. This has been dealt with very frequently lately. (5) 25 per cent. above cells to be charged. (6) The one is dependent on the other. We prefer to note the current flowing, by means of an ammeter. (7) Either, according to the circumstances of the case. (8) No. 22 S.W.G. carries 2 amps, at a current density of 4,000 amps. per sq. in. cross section of wire. Depends on circumstances. (9) Not very small ones. (10) Depends on its capacity, and the candle-power of the lamps to be used. (11) Yes, if voltage is suitable. (12) Probably a loose or faulty connection in some of the wires connecting lamps to cells. (13) No. (14) Faulty insulation generally. (15) No. (16) There may be. The question is not one that can be answered by a "yes" or a "no." (17) If the taper on chuck and mandrel is good, there should be enough grip for ordinary purposes. (18) Seventy strands of No. 40 S.W.G. (or other gauge).

[17,108] **Power for Small Circular Saw.** R. W. (West Hartlepool) writes: Will you kindly tell me what horse-power it would be likely to take to work a firewood cross-cutting circular saw, the firewood being mostly propwood scantlings? Also what kind of power would be most suitable? Would a petrol water-cooled motor do, or would a steam engine and boiler be the best?

For a small 12-in. saw, about 3½ or 4 b.h.-p. would answer your purpose. A great deal depends upon the rate of feed, the kind of wood, and the sharpness of the saw. A gas engine of reliable make would be the most economical and convenient for this purpose; but whoever you buy from, get a guarantee in writing that the engine will give its rated output in brake or actual horse-power. You could, of course, do with, say, 2 b.h.-p., but the rate of cutting, etc., would be slower.

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.]

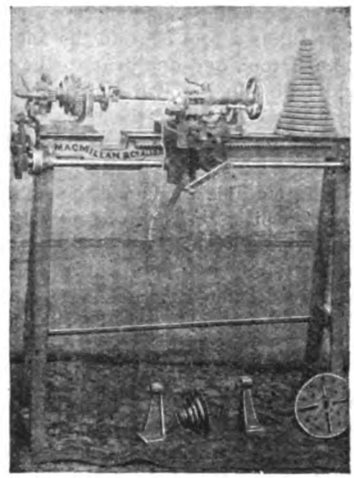
**Reviews distinguished by the asterisk have been based on actual Editorial inspection of the goods noticed.*

*Small Power Boiler Fittings.

As a specimen of the fittings suitable for small power steam and petrol work, which are supplied by The Liverpool Castings and Tool Supply Company, Church Lane, Liverpool, we have received a ¼-in. gunmetal steam cock, fitted with a screw collar for attachment to boiler or tank, and a union for delivery. Judging from the sample we may say that these fittings are well made, and are good value for money. Prices and further particulars may be obtained from the above address.

An Engineer's Lathe.

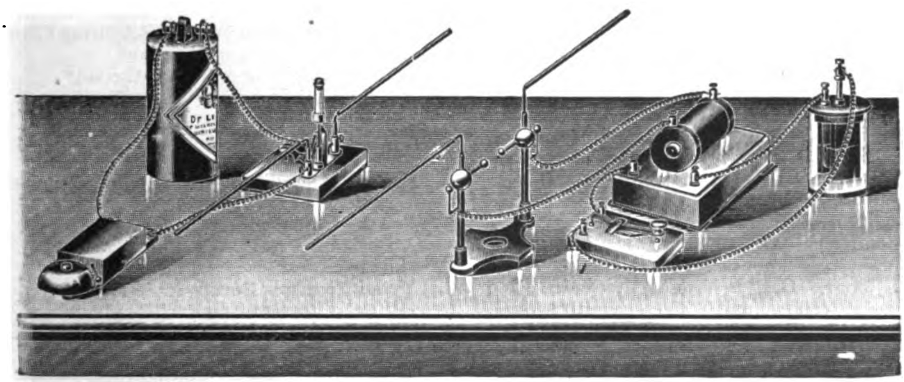
We illustrate herewith a screw-cutting lathe specially designed and made for heavy work by Messrs. W. Macmillan & Co. It is mounted on cast-iron standards, 2 ft. 8 ins. high, has 4-in



centres and a 3 ft. 6 in. gap-bed, and can be driven by either foot or engine power. For prices and particulars readers should apply to the above-named firm, whose address is Mar Street Alloa, N.B.

New Catalogues and Lists.

The Economic Electric Company, Twickenham, London, S.W.—The catalogue we have to hand from this firm illustrates a large variety of electrical apparatus and accessories. Special mention may be made of the "Amateur's" Wireless Telegraphy Set, which we illustrate herewith, and which transmits messages over a distance of from 6 to 10 yards. Amongst other items included in the list are volt and ammeters, small accumulators Osram lamps intermittent lighting sets, Wimshurst machines charging boards, medical coils, dynamos, motors and workshop tools. The list will be sent post free to all Model Engineer readers making application.



THE ECONOMIC ELECTRIC CO.'S "AMATEUR'S" WIRELESS TELEGRAPHY SET.

The Editor's Page.

A READER, "A. P. S." (Brockley) writes as follows:—"There seems to be some uncertainty among turners as to the correct use of the term 'right' and 'left' as applied to lathe tools. In 'Workshop Appliances,' by C. P. B. Shelley, one finds a tool bent to the left described as a left-hand tool, and one bent to the right as a right-hand tool. In Percival Marshall's 'Practical Lessons in Metal Turning' the reverse is stated—and correctly so—in these words, 'The terms right and left are here used to denote that the tools described are suitable for facing the right- or left-hand side of a piece of work respectively, and not in the sense that they are bent to the right or left.' A tool for cutting a right-hand thread, for instance, is inclined in the same direction as the cutting edge of a right-hand side tool. This is the argument I use to convince those who use the terms 'right' or 'left' to denote the direction of bend. I am a toolmaker, and the question often arises in serving out tools. By devoting a paragraph in your valuable paper to the subject you may settle the question for many amateurs and apprentices who are in doubt as to the correct terms to use." In reply to our correspondent we think that it is hardly fair to say that the one description or definition is more correct than the other, and we are not surprised to find that a difference of opinion exists. It seems to us to be largely a matter of the individual point of view as to whether the term applies to the bend of the tool or to the work to be done. Our own preference is for the latter as being the more logical use of the description, and this is the view we have adopted in our own writings on the subject of lathe work, and have always used in our own workshop practice. We hope "A. P. S." will be able to make many converts to the same way of thinking.

Answers to Correspondents.

W. R. B. (Derby).—It is a matter for personal inspection. We should say that some of the armature coils have "shorted." Also, that field coils are not getting the current they require, or the voltage would not drop as it has. Please comply with rules in future.

L. B. G. (London).—We can only suggest that you make these experiments. It is a matter for trial. *Re* boat. Oak is tougher to cut. Pine is lighter, *i.e.*, yellow pine. The strength of hull depends upon general construction. Reduce to scale, *i.e.*, make the *proportions* the same. Please comply with rules.

H. P. B. (Leicester).—The matter would appear to be one for an expert. It is entirely beyond the scope of a query, even if it could have been answered at all from the particulars you have sent.

W. P.—We do not know of such a device as yo refer to, but your description is not very clear. A sketch would have helped somewhat. You do not say what the arrangement is to be used for. Please comply with Rules in future.

W. H. D. (Leyton).—A correspondent is desirous of obtaining your present address to communicate concerning your overtype dynamo (see March, 1899 issue, Query columns) which you were then making. Please reply to J. B. Glace, Stuffywood, near Mansfield.

J. C. H. (Dewsbury).—We should advise you to try some local clockmaker, first of all. We cannot say that it will be possible to make the alteration you suggest.

A. K. (Coleshill).—See "Induction Coils," 7d. post free. No resistance coil is required. A core built up of iron wire magnetises and demagnetises much more readily than a solid one.

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, etc., 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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THE

Model Engineer

And Electrician.

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

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A Wimshurst Machine.

By W. A. Winkworth.

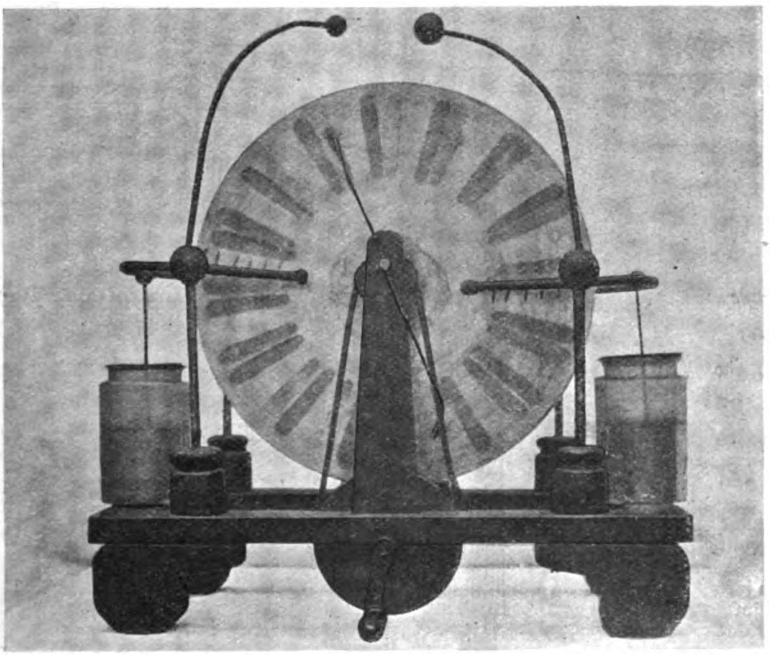


Fig. 1.—Mr. W. A. Winkworth's Wimshurst Machine.

To amuse myself during my spare time I decided to construct a Wimshurst influence machine, and the result proved very satisfactory.

The framework of wood is 22 ins. × 12 ins., 1 in. thick and 2 ins. wide, standing on wooden blocks so as to obtain a clearance for the driving wheels and handle. The uprights are 9½ ins. high, and tapering from 2½ ins. at the bottom to 1 in. at the top. Two circular glass plates were obtained 16 ins. in diameter, and a centre hole was cut 1 in. diameter by means of a sharpened iron tube, paraffin and sand, the tube revolving in a frame. Two bosses were next turned in a lathe, a hole bored through the centre of each, and a piece of brass tubing tightly fixed in the holes. The glass plates were then fixed to the inner portion of the bosses by means of shellac glue and also a thin, circular metal plate pressing against the plates and screwed to the bosses. A steel spindle passes through the bosses and plates, and also through holes near the top of the uprights. The supports for the insulated combs are solid glass rods, on which brass balls are fixed. To the brass balls I soldered pieces of brass tubing bent horseshoe shape, to the inner sides of which the collecting-combs are fixed and turned towards the revolving glass discs. The neutralising brushes are fixed to the ends of thick brass wire, the centre of which is supported by wooden uprights. The driving wheels are of mahogany 6 ins. in diameter, and grooved so as to admit the round leather belts. The wheels are fastened to a steel spindle passing through the centre, the handle being screwed to one end for driving. One of the belts is crossed to enable the plates to

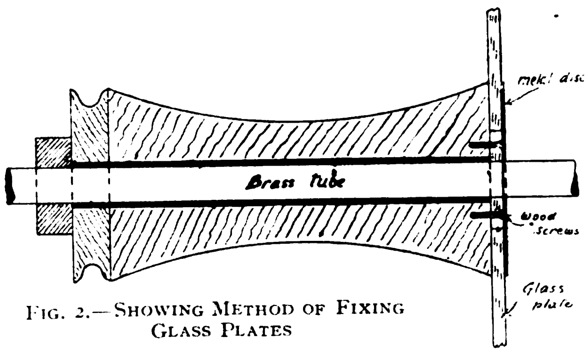


FIG. 2.—SHOWING METHOD OF FIXING GLASS PLATES

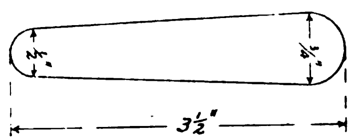


FIG. 3. SECTOR.

WIMSHURST MACHINE DETAILS.

revolve in opposite directions. The sectors, 3½ ins. long, are fastened to the plates with shellac varnish, and the plates and glass supports are also well coated with shellac varnish to prevent leakage.

The two Leyden jars are thin glass jars, coated inside and out with tinfoil to about half their height; a wood cover supports a brass rod; to the lower end a chain is soldered. The outer coverings of the jars are connected together by means of a fine wire passing beneath the wood framework.

When the machine was completed it proved very successful, as it excited itself after about two revolutions, and I obtained a 6-in. spark.

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.*]

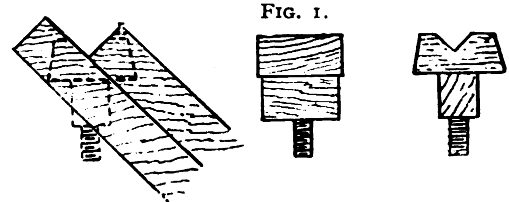
A Home-made Grinder for Twist Drills.

By A. WILSON.

The professional type of grinder may be made by any amateur who can do a little elementary woodworking along with his mechanical work, as the following will prove.

The photographs show clearly a twist-drill grinder I have made recently. The thought struck me that as there are no wearing parts

FIG. 1.



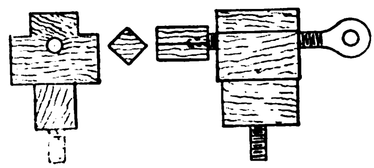


FIG. 2.

DETAILS OF CONSTRUCTION OF HOME-MADE TWIST-DRILL GRINDER.

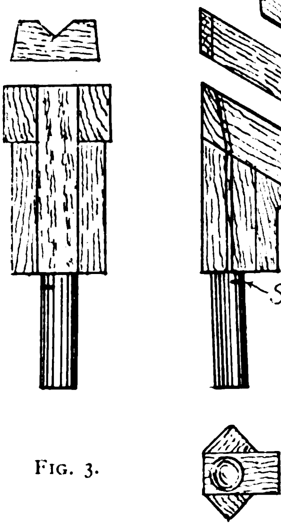


FIG. 3.

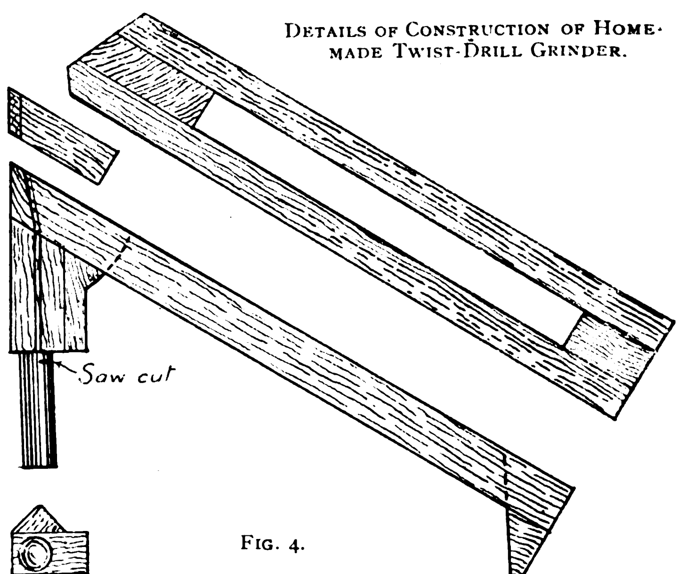


FIG. 4.

a grinding fitment made from hard wood ought to answer for the amateur, as, once a drill is properly ground, with careful use it will last months without regrinding.

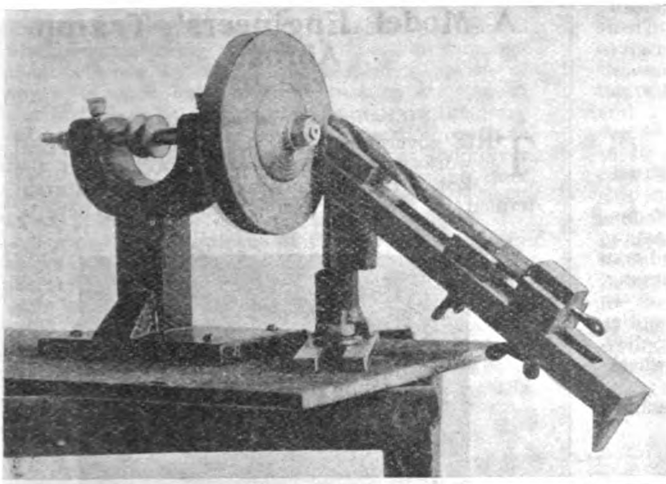


FIG. 5.—A TWIST DRILL IN PLACE READY FOR GRINDING.

I first made the grinding head and mounted on it a 5-ins. by ¾-in. corundum wheel, driving the same at 2,300 r.p.m. by means of a small gas engine.

The grinding fitment is made of oak, with an iron pivot which fits into a T-rest. Before I could obtain the necessary angle and clearance, I had to make a couple of saw cuts in the pivot (as shown in drawing, Figs. 3 and 4) and crank it a little in two directions; it is bent backwards towards the tail end of the fitment and also forwards as one looks at the photograph (Fig. 6).

I have ground drills from ⅛ in. up to ½ in., and find they are about the right angle, and that both lips cut. I do not say this home-made appliance will grind drills equal to the properly made professional grinder, but it does them to my own satisfaction, and, moreover, the drills can be ground without being tempered during the process. My drills were returned to me from a professional grinder with a blue streak along the cutting edges, showing they had been tempered in the grinding. When the fitment is mounted on the grinding bench, the V-shaped piece on the tail end of the grinder is placed against a stop, so that at the commencement of the grind the drills are all given the same angle of clearance, and are then gradually backed off.

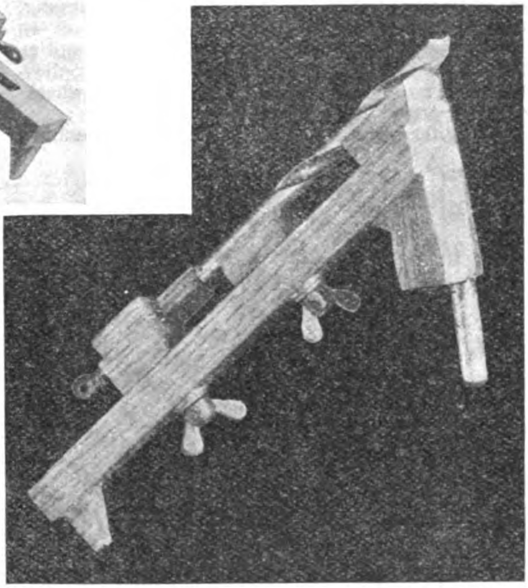


FIG. 6.—THE TWIST-DRILL GRINDING ATTACHMENT.

The photograph (Fig. 7) shows the corundum wheel fitted for grinding tools. The desk-like portion is friction-tight between the two uprights, and can be tilted up or down to give any angle to a tool. The diagonal lines on the desk are a help in replacing a tool in the same position as before for further grinding, if required, after withdrawal for examination.

The hood stops and collects most of the dust, and therefore keeps it free from flying about the workshop and settling on other tools, lathe, etc.

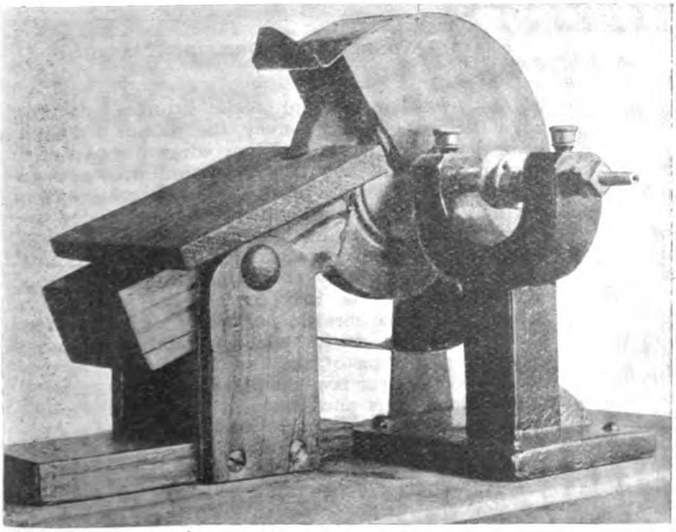


FIG. 7.—SHOWS CORUNDUM WHEEL FITTED FOR GRINDING TOOLS.

To Remove Discolouration from Iron and Steel.

When iron or steel has been coloured blue by exposure to heat, try rubbing it lightly with a sponge or rag dipped in sulphuric, nitric or hydrochloric acid, until the discolouration is removed. Then wash the metal, dry by rubbing, warm it, and give a coat of oil so it will not rust.—*Popular Mechanics.*

A Simple Drilling Machine.

A reader sends the following description of a home-made drilling machine, herewith illustrated. It consists of an old lathe, with triangular bed inverted and bolted to a piece of 3 ins. by 6 ins. wood quartering, there being no poppet. A casting was made and fixed to the part where the hand-rest was originally attached, and a table 5 ins. in diameter with a screw feed fitted in its place.

An American pattern chuck is fitted to the mandrel, and a $\frac{3}{4}$-in. flat belt passed round pulley and over two jockey pulleys on to the flywheel, which belonged to a sewing machine.

The writer witnessed the efficiency of the machine

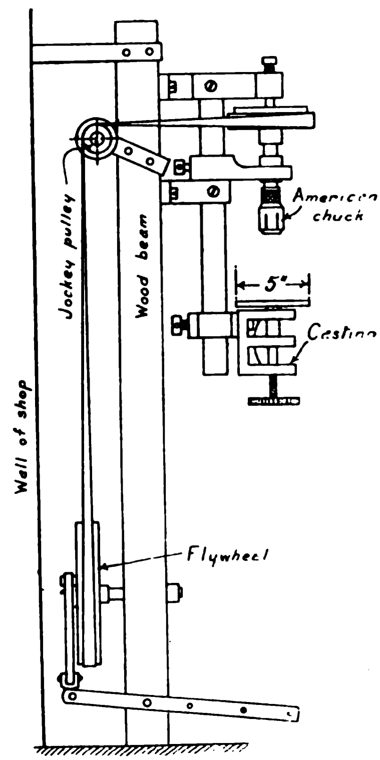


FIG. 1.—SHOWING ARRANGEMENT OF A SIMPLE DRILLING MACHINE.

drilling a $\frac{3}{8}$-in. diameter hole in $\frac{1}{2}$ in. steel. It will also take very small drills without breaking them, The whole machine takes up very little space, and is self-contained.

THE largest paddle steamer afloat, the *City of Cleveland*, was launched recently at Detroit, U.S.A. She is 444 ft. long, 96 ft. 6 ins. in total breadth, and 22 ft. deep.

A Model Engineers' Tramp Abroad.

(*Continued from page* 102.)

THE government of the Carl Zeiss optical works, which the writers described in the last article, is invested in an institution termed in the German—"Stiftung." There is,

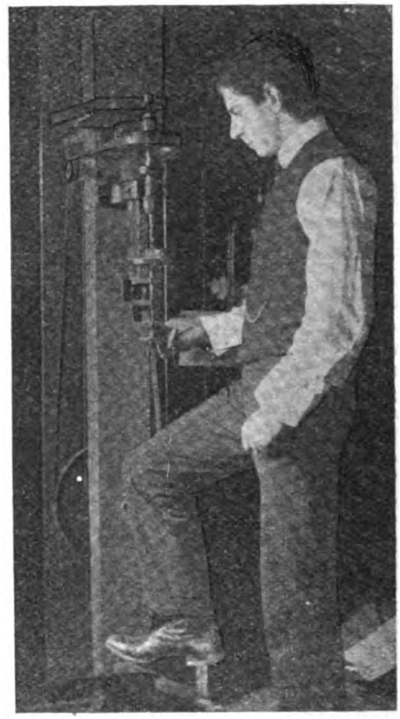


FIG. 2.—WORKING THE DRILLING MACHINE.

in our own language, no precise interpretation of what this word should convey, the name "trust" being hardly applicable. From what we gathered during our visit, the administration was set up by Ernst Abbe in 1891 after the decease of his partner. In this munificent act Abbe ceded all his proprietary rights in the firm in a manner calculated to perpetuate his own high social ideas and prevent the possibility of any arbitrary or unjust influences, such as are commonly known to arise when successors do not carry on a business in the same spirit as that which originally obtained.

The constitution of the Carl Zeiss Stiftung has the full force of the law, the parties concerned being —(1) the officials and workmen employed in the works, who have and who are contributing their share to the profits and capital value of the property; (2) the University of Jena, whose services in the past, as well as those to come, had to be recognised; and (3) the State, representing the community in which the Carl Zeiss works are situate.

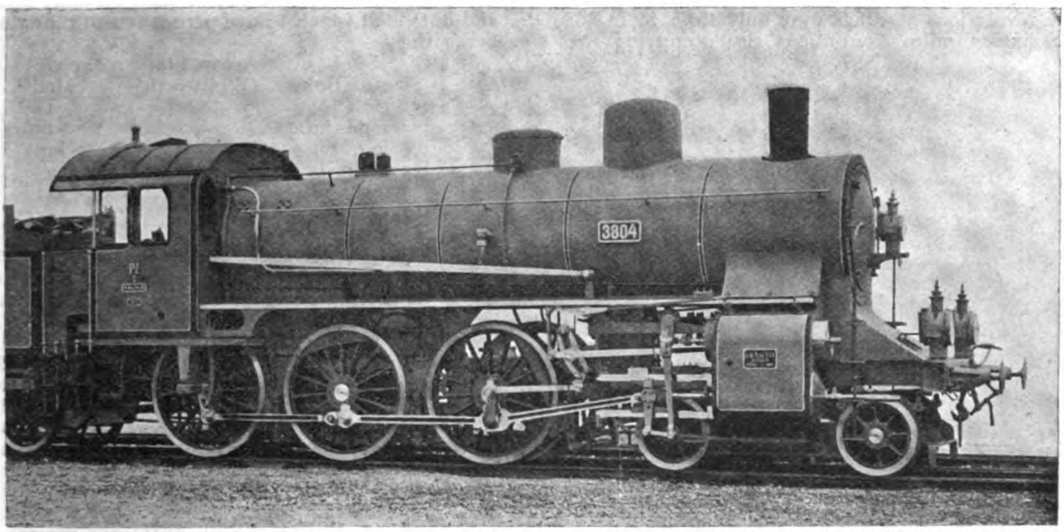
This authority has to see that the statutes of the Stiftung are carried out, the immediate control of the works being vested in a board of management elected by the employees, membership of which is open only to those persons engaged at the works. The seat on the board is an honorary office, and those occupying such a position continue as far as possible to fulfil their duties—whatever they may be—at the works. The position does not alter the status of the "manager"; indeed, as we shall see, he is under some disability.

The ordinary employee at the Carl Zeiss factory works under very favourable conditions. There are three classes of employee—the officials, who with the scientific, technical, and commercial staffs, clerks, and foremen have fixed salaries; the time-workers, who are in the minority; and the piece-workers. The latter, however, have a minimum wage calculated on a time basis, and the highest official cannot receive over a certain salary, based on the proportion of ten times that of a young worker of 24, whose average salary is about £75 to £90 per annum. There is, however, an addition due to profit-sharing. An employee who is doing piece-work may then receive (1) a fixed amount calculated on the time basis, (2) an additional wage for piece-work, which will vary according to the amount of work he does, and (3) a payment depending on the result of the year's trading. The only persons who do not participate in the last amount (the profit-sharing) are the members of the board of management. This prevents the management "rigging" the profit and loss account to suit their own ends. Special rewards are made for valuable proposals for the advancement of the business. These suggestions have to be made in writing, and are at the outset identified by a motto only, so that they are examined on merit alone.

Much more might be said about the wonderful system of the works, but we will conclude with a few notes about the working day. In summer the works run from seven to five o'clock, with two hours for dinner, and in the winter from 8 to 12, and 1.30 to 5.30 p.m. Holidays are granted to every worker, a sick fund provides for illness, there is a pension, and compensation is made in case of dismissal. Ordinary cold baths, vapour and shower baths, are provided free, and each man is allowed half-hour weekly out of his working time to avail himself of this institution. In addition, there is a "People's Institute," built by the Carl Zeiss Stiftung at the cost of £50,000, which provides for the intellectual pursuits and for the amusement of the workers. Such are the conditions under which optical instruments of the finest character are produced, at a profit, in the old-world town of Jena.

There was much to interest us in the town apart from the foregoing, but we cannot, owing to the limited scope of this Journal, deal with such matters here. We, therefore, will proceed. Our next goal was the ancient city of Nuremberg, and, joining the fast Berlin-Munich express at Jena, we had a very pleasant journey over the mountains into the rich province of Bavaria.

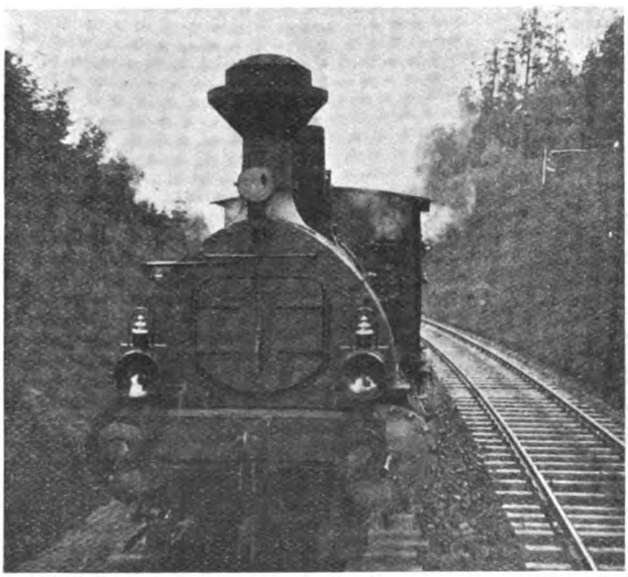
Mountain climbing in a railway train is always attended by interesting occurrences, and this trip was no exception to the rule. Arriving at Probstzella, the train was headed by one of the latest four-cylinder compounds made by Maffei, of the pattern shown in the photograph herewith. We were travelling in the end coach, and the door at the rear of the train (which would lead into the corridor flexible connection, if another coach were attached) being glazed we could easily watch the efforts of the "affix" to the train in the shape of the powerful, but not handsome, banking engine which accompanied us from thence.



ONE OF THE LATEST TYPE OF FOUR-CYLINDER COMPOUND EXPRESS LOCOMOTIVES USED FOR MOUNTAINOUS DISTRICTS ON THE BAVARIAN STATE RAILWAYS.

(Designed by Mr. Weiss and built by Messrs. Maffei, of Munich.)

This engine, which we snapped just as it was leaving the train at the top of the hill, was a two-cylinder compound, with cylinders—as nearly as we could judge—about 18 ins. by 24 ins. diameter by the usual stroke. It had eight coupled wheels about 4 ft. 6 ins. diameter, and, as will be seen in the photograph, a huge spark-arresting chimney. The latter appeared very necessary, as the gradients we traversed were very severe, the incline being 16 miles long and rising about 830 ft. to an altitude of 1,948 ft. above sea level, which, including the level stretches, means an average inclination of 1 in 110. The beats of the engine were therefore very heavy, and without some protection of the sort damage would no doubt be done to the surrounding woodlands. The engine was fired with briquettes, the furnace being banked up at the commencement of the journey. With the regulator full open and the lever in mid-gear, readers will imagine the noise and the amount of smoke the engine emitted as it laboured up the bank. The revolutions at times were only from 70 to 80, the sixteen miles' continuous rise occupying the best part of an hour. Once over the summit, it was nothing but a glide down the other side for many miles, so much so that one had difficulty in keeping one's food from spilling whilst seated in the excellent restaurant car on the train. We arrived in Nuremberg about 4.30 p.m., and spent the evening in the exhibition.



BANKING ENGINE, BAVARIAN STATE RAILWAYS.

(*To be continued.*)

A DIMINUTIVE rotary air drill, recently made in Chicago, is illustrated in the *Iron Age*. It weighs about 2¼ lbs. The overall length from the top of the breast plate to the end of the spindle is 7½ ins., and the housing is 2 ins. in diameter. The air motor runs at a speed of about 22,000 revs. per minute, at which speed the spindle makes 2,000 revs. per minute. The tool is capable of drilling up to and including 3-16ths in. holes in steel.

Notes on Making Small Hexagon Bolts and Nuts.*

Mr. P. W. Pilcher.

Small hexagon nuts and bolts may be made in several different ways, and the quickest method is largely dependent on the appliances at hand. They may be made of round or hexagon steel, but the use of the latter, which is now easily obtainable, saves much time and secures that uniformity necessary in using spanners on the nuts.

Figs. 1 and 2 show views of a nut to Whitworth's scale, and it may be mentioned that the proportions apply also to a bolt head for general purposes. It will be noticed that to dimensions across flats and corners ⅛ in. is added. This, of course, applies to large nuts, and in model sizes is best neglected. Mr. Hesketh Walker, of the Liverpool Castings Company, formulated a list of sizes for bolt heads and nuts, and which I have permission to reproduce herewith :—

Size of Bolt.	Across Flats. (Whitworth)	Across Flats. Model.
1-16th in.	—	·125
3-32nds in.	—	·156
⅛ in.	·338	·187
5-32nds in.	·359	·25
3-16ths in.	·448	·312
7-32nds in.	·453	·375
¼ in.	·525	·400

The "model sizes" here given are to be recommended, as in most model work the Whitworth scale nuts give a clumsy appearance.

In making bolts from round steel it is quite possible to do the work in the lathe with a graver, following on a round-nose tool, or with a graver alone, but if a slide-rest is fitted the work is easier in every way. Choose a piece of mild steel which will just clean up to the correct size of a bolt head across the corners ; fix this, for choice, in a self-centreing chuck, leaving just enough rod projecting from the chuck to give the necessary length, and turn down to the proper diameter for bolt head. Next turn down the shank for screwing, and as the ordinary round-nose tool will leave what is in effect a chamfer, or countersunk, at the end of its cut, a second tool must be put in the slide-rest and the underside of the bolt head faced up square with the shank.

If the lathe is fitted with a division-plate and index pointer, the hexagon surfaces can be marked off with a sharp-pointed V-tool, laying on its side in the rest, by traversing the slide along. If, on the other hand, there is no division-plate, it is quite worth while to divide the right-hand face of the fast mandrel gear wheel in a back-geared lathe, or the pulley in a single-geared lathe, into six and four divisions, fitting the necessary index pointer. If either of these appliances are at hand, the facets must be filed up with the aid of a 120 deg. gauge. There is no question, however, as to the time saved by the former method.

* This article was awarded a prize of one guinea in connection with the Competition, results of which were announced in the issue of January 24th.

The shank of the bolt may now be screwed, preferably with one of the modern circular dies held in a stock. The lathe belt must be thrown off and the lathe pulley revolved very slowly with the left hand while the right hand holds the die stock. In screwing bolts from 5-32nds-in. to ¼ in., the right hand may turn the die in the reverse direction to the lathe—the contrary motion giving a quicker feed; but with work under this size a bent bolt will probably be the result.

In dealing with delicate tools, such as 1-16th in. and 3-32nds in., the greatest care is necessary to keep the rod true; it should not be moved more than about a sixth of a revolution at a time without backing off. It is quite possible to turn up a bolt ⅛ in. diameter and over 1 in. long under the head without the support of the back-centre, provided the tool is keen; and in extra long bolts, where support is necessary, the end may be tapered to run in a small female centre held in the tailstock. After screwing, the end may be slightly

FIG. 1.

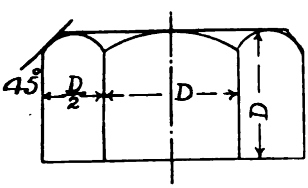
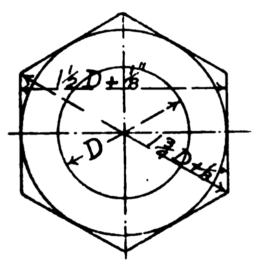


FIG. 2.



WHITWORTH STANDARD NUT.

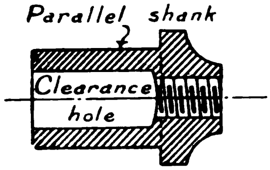


FIG. 3.
A CHUCK FOR BOLT-HEADS.

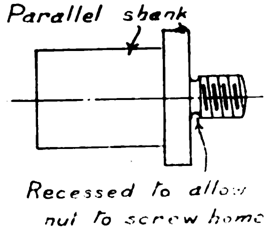


FIG. 4.—A CHUCK FOR NUTS.

chamfered and the bolt removed from the lathe to file up the hexagon faces to the marked lines. It is now complete, except to face and chamfer the head.

At this stage two small chucks may be made for each size of thread. Fig. 3 is for bolt heads; Fig. 4 for nuts. They fit in a self-centreing chuck or their shanks are turned down to fit some chuck in ordinary use.

Run the bolt into the special chuck, face up the head, and chamfer the edge to 45 degs. Where many bolts of one size are being made, it is best to do the facing and chamfering after the requisite number have been turned down and screwed. In cases where bolts, very long in proportion to their diameter, have to be made, they may be built up, *i.e.*, a length of wire is screwed and a nut soldered or brazed on afterwards to form the head.

In using hexagon instead of round steel, some of the details of machining are omitted, but the chief advantage of its use lies in the uniformity of bolt heads and nuts. Small nuts do not allow of much slackness in the fit of the spanners, and the facets are easily spoilt.

Another method applicable to making bolts is to use a rose cutter. This was fully described in THE MODEL ENGINEER for October 29th, 1903.

In making nuts from round steel, chuck and turn down for greatest diameter of the nut as before. The length of rod which can be treated in one operation varies with the drill used for tapping. No. 49 twist drill is a tapping size for 3-32nds-in. bolt. The cutting portion of this drill is just over 1 in. long. No 38 is the drill for ⅛-in. thread; here the cutting portion is 1 7-16ths in. long, and the overhang of the rod is allowed to suit this. The next thing to be done is to centre the work with a square, or other cutting centre, in the tailstock, and a Slocombe drill run down until the countersink has fairly entered will probably help the succeeding twist drill to run true.

In drilling comparatively deep holes with small twist drills, it is often difficult to keep the hole truly central, even if the drill is constantly withdrawn to clear away the cuttings; but it will be found, if a rod is fixed in the tool rest and just allowed to butt up against the drill which is being fed into the work with the tailstock, that this will steady it, and there will be but little error if the drill is truly started. Drill down as far the cutting portion of the drill allows, and mark off the hexagon lines to this distance, as in the case of the bolt. Remove from the lathe and file to form the facets; short pieces are now sawn off to form the nuts, leaving enough metal on each to face up to the correct thickness on the chuck shown in Fig. 4.

The nuts are, of course, faced and chamfered one by one. Lock nuts are generally half the thickness of standard nuts, and are often chamfered on both sides; and there are also nuts used for special purposes thicker than the standard Whitworth nut. The modern castellated nut, so much used on motor-cars, and to a certain extent on locomotives, is occasionally of service in small sizes where split pins are used and there is much wear.

It may be remarked that these notes refer chiefly to sizes of ⅛ in. and under; there is no question but that these are more difficult to make, and the methods described are quite applicable to any work up to ¼ in. diameter.

To make a box-spanner to fit small nuts, take a piece of hexagon steel, file the end, taper, and case-harden it. A piece of round steel is now turned up to form the spanner, and drilled so that the taper end of the case-hardened steel will barely enter; the latter is then drifted in. Care must be taken to drill fairly deeply to avoid splitting the metal when drifting, also too much metal must not be left round the hole; for ⅛-in. bolt, 1-32nd in. is quite enough.

(*To be continued.*)

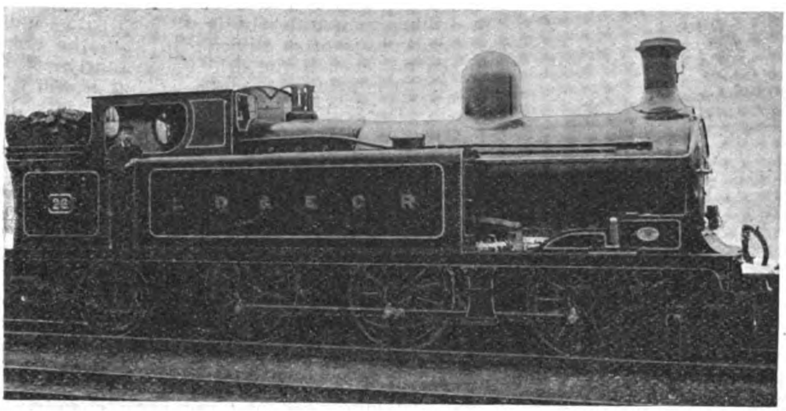
A NEW municipal electric generating station is now nearing completion at Johannesburg. It is to operate the tramways and furnish light and power over an area of 100 square miles. Producer gas is to be used, and two gas engines of 1,000 horse-power and 2,000 horse-power respectively have been installed.

Locomotive Notes.

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

L.D. & E.C.R. Tank Engines.

A correspondent who read the "note" published on page 34 of The Model Engineer for January 10th, and which had reference to the writer's experience of the Marshall valve gear whilst travelling upon the footplate of a tank engine belonging to the late L.D. & E.C. Railway,* asks for the principal dimensions and, if possible, a photograph of the locomotive in question. By the courtesy of Mr. H. Willmott, general manager of the Lancashire, Derbyshire, and East Coast Railway throughout the career of that line as an independent concern, a photograph and dimensions of the particular engine, *i.e.*, No. 26, which was specially referred to on the earlier occasion, are given herewith. This engine was generally selected for working the King's train between Tuxford (G.N.R. main line) and Ollerton on the occasions of His Majesty's visits to Lord Saville at Rufford Abbey.



Tank Locomotive, L.D. & E.C. Railway.

The leading dimensions of the engine are:—

- Cylinders, 18 ins. by 26 ins.
- Coupled wheels diameter, 4 ft. 9 ins.; radial wheels diameter, 3 ft 9 ins.; rigid wheelbase, 15 ft.: total wheelbase, 22 ft. 6 ins.
- Side-play each side of radial axle-boxes, 3 ins.
- Heating surface: Tubes, 1,142 sq. ft.; firebox, 107 sq. ft.: total, 1,249 sq. ft.
- Grate area, 21 sq. ft.
- Working steam pressure, 170 lbs.
- Water capacity of tanks, 1,825 gallons.
- Coal capacity of bunker, 2½ tons.
- Weight (in working order), 58 tons 4 cwts.

From these figures it will be seen that the engines are of powerful design, there being ample heating surface and grate area, a relatively high steam pressure and large cylinder capacity. These and other locomotives belonging to the L.D. & E.C. Company when that concern was taken over on January 1st of this year by the Great Central Railway have now, as a matter of course, gone to swell the numerical strength of the latter Company's locomotive stock.

*This line has now become part of the Great Central Railway.

English Locomotives Abroad.

The writer has been favoured by Messrs. Kitson and Co., Ltd., the well-known locomotive builders, of Airedale Foundry, Leeds, with photographs and particulars of two noteworthy locomotives which they have built for service abroad. Both are reproduced herewith, together with dimensions.

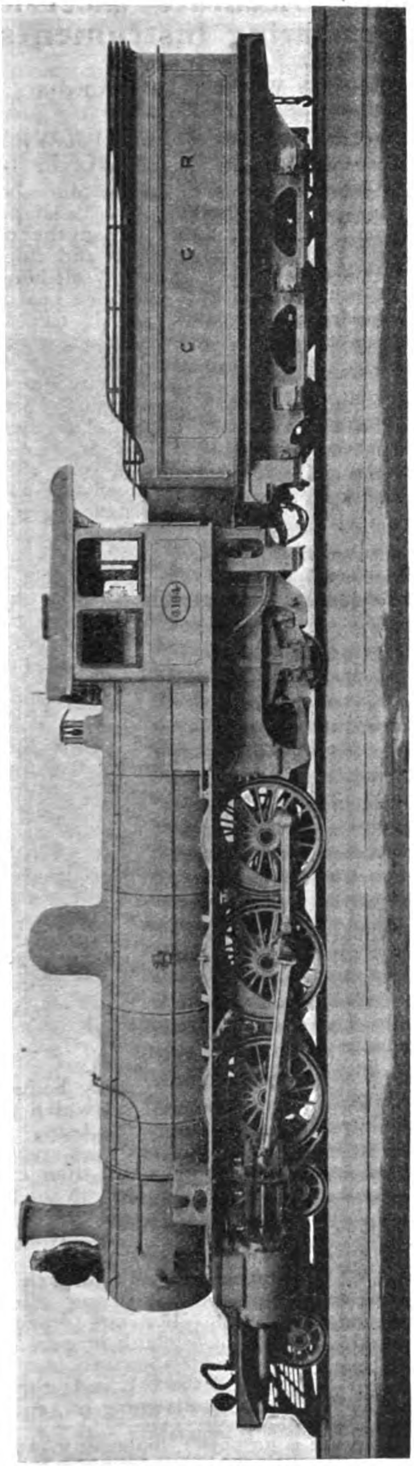
The 4—6—2, or "Pacific" type, engine is one of a number supplied to the Cape Government Railways. It has very large proportions for a narrow gauge locomotive, and the design is collectively a remarkable one under the circumstances.

The cylinders are located outside the frames, with steam chests above them, and the connecting-rods act on crank-pins in the intermediate pair of coupled wheels. The front end of the engine is carried upon a four-wheeled bogie, and the trailing end upon a pair of radial wheels arranged as a two-wheeled trunk with outside framing. The three pairs of coupled wheels are grouped underneath the barrel of the boiler between the smokebox and the firebox, so that although the total wheelbase is a long one, the coupled base is well restricted. The boiler is provided with a large-sized steam-dome; the smokebox is extended, and a widened firebox is fitted. The cab is of very commodious design, and the tender is of the six-wheeled variety, with outside framing.

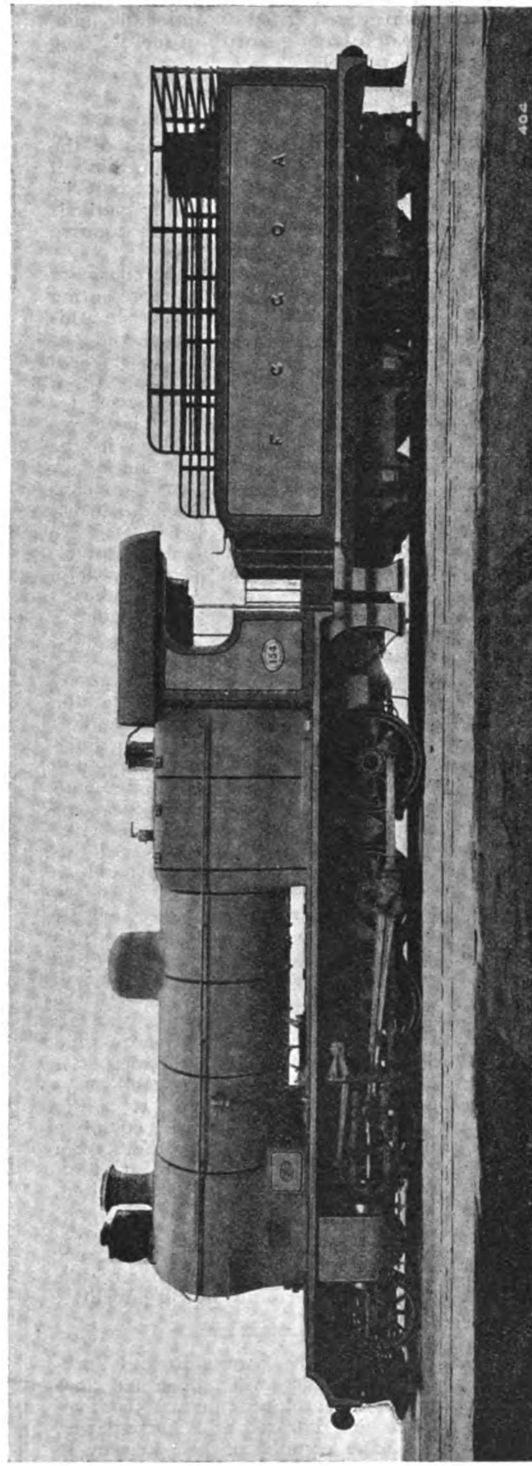
The second engine is a large and powerful one of the "Consolidation" (2—8—0) type, with outside cylinders and Walschaerts valve gear. It was built with others of the same design for the Ferro Carril Gran Oeste Argentino (the Great Western Railway of Argentina), which line is constructed upon the 5-ft. 6-in. gauge. The boiler has a Belpaire firebox, and a well-extended smokebox is provided.

The leading dimensions of the engines are as follows:—

	C.G.R. Engine.	Argentine Engine.
Cylinders	18½" × 26"	20" × 26"
Truck wheels diameter	2' 4½"	3' 5"
Coupled wheels ,,	5' 0"	4' 7½"
Coupled wheelbase	10' 10"	16' 0½"
Engine ,,	28' 2½"	24' 2½"
Heating surface: Tubes	1,317 sq.ft.	2,165 sq.ft.
Firebox	110 ,,	190 ,,
Total	1,427 ,,	2,355 ,,
Grate area	26 ,,	37 ,,
Weight in working order (engine only)	60 t. 2 c.	72½ tons.
Adhesion weight	39 t. 7 c.	64½ tons.



"Pacific" (4—6—2) Type Passenger Locomotive: Cape Government Railways.



"Consolidation" (2—8—0) Type Locomotive: Argentine Great Western Railway.

The tender runs upon two four-wheeled bogies, and the top railings are carried exceptionally high, so that stacking of a large quantity of fuel for long runs is rendered possible.

Criticising the Locomotive Engineer.

A correspondent writing in the columns of the *Engineer* on a recent occasion, and styling himself "Progress," gave expression to what can only be regarded as a direct onslaught upon the methods adopted by locomotive engineers in this country in designing modern locomotives.

If all that "Progress" asserts in the course of his lengthy letter is to be accepted as representing the truth, then locomotive engineering in this country has indeed fallen on evil times, and the sooner our chief mechanical engineers take a leaf out of the book of their professional brethren on the Continent and in America the better for our national prestige in the matter. The correspondent referred to sees, or affects to see, in the more intricately designed machines which find favour on the other side of the English Channel a means of increasing—by no one knows how much per cent.—locomotive efficiency in this country. In summing up his opinion of English locomotives, he refers to them as "highly painted inefficiencies on wheels," and says that "whereas our engineers found the locomotive an economical machine, they have truly succeeded in making it the most uneconomical prime mover on record."

Given a certain class of temperament, everyone knows how easy it is to become cynical, after the manner of "Progress," when reviewing the actions of others and those actions happen to be in opposition to the line which one would themselves take in the same circumstances; but all the cynicisms in the world will not alter the fact that some of the very best and most economical locomotives are to be found at work on the railways of this country, where results are being obtained which are the envy of many a foreign engineer. Far be it from the present writer's purpose to belittle foreign locomotive design and construction. In many ways practice in this branch of engineering has been developed abroad on more rapid and scientific lines than here, but to condemn the British locomotive and its designers' methods as antiquated and inefficient is only to throw mud for the sake of throwing it, and not because it is deserved. With much that "Progress" says the present writer is in agreement. It is, for instance, certain that the compound locomotive has *not* been fairly treated in this country, and foreign engineers have undoubtedly passed us in this respect, but there is no reason why it should be attributed, as is done by the correspondent of the *Engineer*, to "blind prejudice, insular objections to innovations, and sheer, utter incapacity." Indulgence in such diatribes as these looks uncommonly like spiteful prejudice. It is certainly not argument.

At a level crossing of the Lancashire and Yorkshire Railway there are gates which open and close electrically. The motor employed runs at 1,500 revolutions per minute, and is rated at 2 horse-power. When the gates have completed their journey in either direction the current is automatically cut off. Each operation takes about 15 seconds.

Some Accurate Electrical Measuring Instruments.

By V. W. Delves-Broughton.

(*Continued from page* 610, *Vol. XV.*)

Wheatstone Bridge and Resistance Boxes.

The next requirement is a resistance box and a Wheatstone bridge. The resistance box consists of a number of lengths of high resistance wire of varying lengths and thicknesses wound double so as to obliterate "self-induction."

As the construction of a resistance box requires the comparison with a standard, the simplest manner of effecting this is to first make a small box containing the following resistances: 1 ohm, 10 ohms, 100 ohms, obtaining the wire cut off to the required lengths by some reliable firm using the published resistance tables. The wire used should be about No. 18 S.W.G. for the 1 ohm, 26 S.W.G. for the 10 ohm, and No. 36 for the 100 ohm resistance—German silver, platinoid, eurica, or any of the new resistance metals may be used.

The wire must be taken as received from the maker, opened out, doubled over in the middle, and wound double on empty cotton reels, first securely tying the bent portion to the reels and winding up towards the loose ends, which are passed through a pair of holes bored in one of the flanges of the reel and fixed to terminals, these in turn being fixed to the ebonite inner cover of the box. These terminals should be of substantial dimensions, especially for the low resistances, and if any wire is used in connecting the resistance wire to the terminals it should be very thick (three pieces of No. 18 copper for the 1 ohm), and all joints soldered.

This resistance box can now be sent to be tested and the exact values of the different resistances obtained.

I believe that the charge made for calibrating all instruments by the Board of Trade laboratory in Whitehall is 2s. 6d., which is not excessive when it is considered that it enables the merest tyro to construct accurate electrical measuring instruments. If it is intended to retain this instrument, the bobbins containing the wire, after being wound, should be thoroughly boiled in wax.

Whilst this resistance box is away being tested, we can proceed with the "bridge," which will take the form of a "metre bridge," that being the most convenient type for general purposes, requiring a much less elaborate resistance box than the other forms of this instrument. For this we shall require a piece of American whitewood, 6 ins. wide, 2 ft. 6 ins. long by ¾ in. thick.* Accurately plane this up and chamfer the upper edges, or finish off with any suitable moulding worked all round, thoroughly glasspaper and stain with a strong solution of permanganate of potash. If a large enough tray is at hand, boil the whole plank in paraffin wax. If not, make a tin trough about 10 ins. high by 7 ins. by 1 in., and boil the two ends thoroughly. Whilst this boiling process is going on, cut a piece

* If expense is no object, mahogany, walnut, or other hardwood is better, and better still a slab of enamelled slate.

of American whitewood exactly 50 centimetres long by 3 ins. wide by ¾ in. thick, and glue a piece of good drawing paper on to one of the faces and accurately draw a scale of centimetres. This can be done very conveniently in a screw-cutting lathe by fixing the scale between the centres and revolving the leading screw through a certain predetermined number of revolutions for each division, a straight edge being fixed in the slide-rest in such a manner that the lines can be conveniently drawn with a ruling pen.

It should here be observed that any convenient scale can be used (say, ¼ in. per division), provided that the spaces are accurate and the total length of the scale is 50 divisions.

the scale and ebonite blocks carrying the brass plates are screwed on the upper side. The terminals are then fixed in position, using ebonite washers and bushes, so that the metal does not come into actual contact with the wood in any place,* and the connections made between the various parts, using strips of No. 16 gauge copper sheet about ¼ in. wide to minimise the resistance as much as possible, all connections being thoroughly soldered. If the copper strips pass over one another (which can be avoided, as shown in the drawings), insert small pieces of ebonite and use small wedges of the same material to keep the strips from actual contact with the wood. Next test all the connections to see that there is no

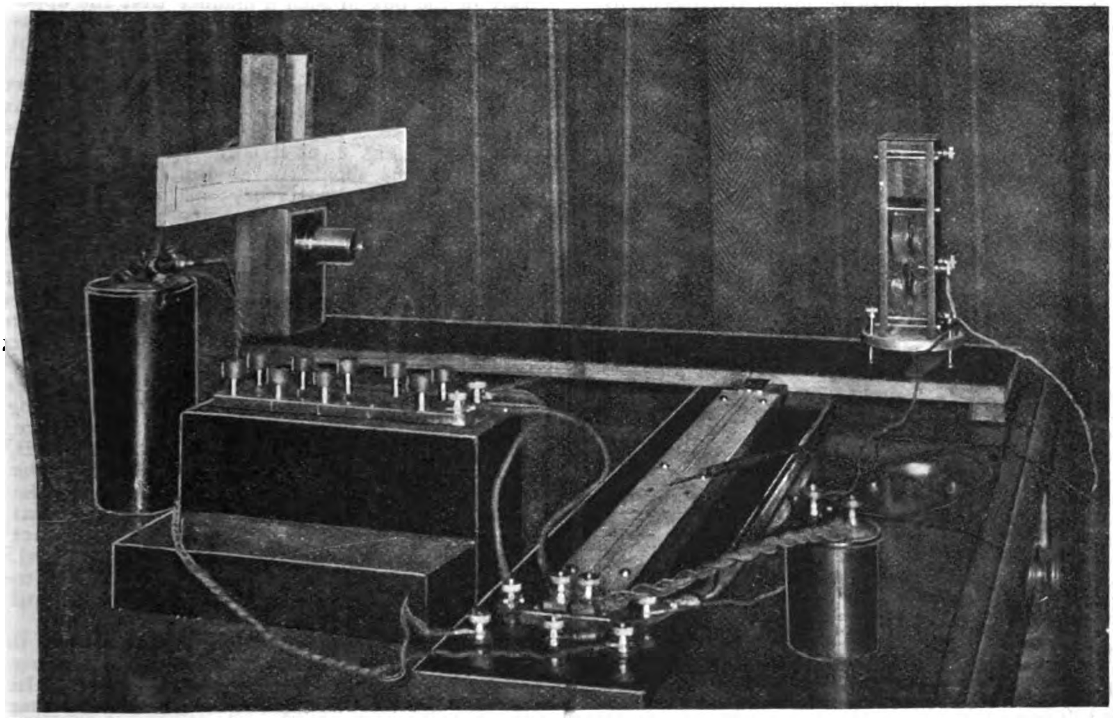


FIG. 1.—SHOWING TESTING TABLE WITH REFLECTING GALVANOMETER, SCALE METRE BRIDGE, AND RESISTANCE BOX IN POSITION.

Next take two plates of brass, 2 ins. by ¾ in. by 3-16ths in., and one 1½ ins. by 1½ ins. by 3-16ths in., and file up, square, drill, and tap as shown in drawing, and screw to two blocks of ebonite, 3 ins. by 2½ ins. by ¼ in.

The base board, having been boiled in wax and allowed to cool down in the wax to the point of solidification, is removed and scraped clean, using a piece of wood for the purpose, held to the fire for a few seconds, to melt the wax on the surface, and thoroughly wiped with a rag.

Next thoroughly polish the top and sides of the board and give the underside two or three coats of shellac varnish. Three small feet are next screwed to the underside (pieces of thick cork carpet, cut out with a wad punch answer perfectly), and holes and chases being cut on the underside, undesired contact between the various parts, using the reflecting galvanometer for the purpose.

Next slight notches are cut in the brass plates and two high resistance wires, No. 28 gauge, are soldered in position, drawing them up as taut as possible without stretching them.

The connections are clearly shown on the drawing. The terminal B is connected to the terminals P′ and T′.; the terminal A to the brass plate carrying P; and the terminal C to the brass plate carrying T.

* In making up my metre bridge I was greatly worried by finding a minute leakage of current, which was finally traced to one of the connecting strips touching the wood, which, although thoroughly seasoned and well boiled in wax, still allowed a minute leakage through its pores.

In using the instrument the following connections are made: A and C to the battery, P and P′ to unknown resistance, T and T′ to known resistance, B to galvanometer terminal, and the other terminal of the galvanometer to the copper knife, the construction of which is clearly shown in the sketch (see Fig. 4).

The value of the unknown resistance (x) is found by the formula—

$$x = \left(\frac{100}{\text{Scale reading}} - 1 \right) a$$

where a is the known resistance.

The scale reading is found by sliding the copper knife along the wire till a point be found where no deflection is given by the galvanometer.

For quick work it may be found convenient to use a less accurate galvanometer, such as that illustrated on page 12 of No. 24 MODEL ENGINEER handbooks, to approximate the reading, and then by means of suitable keys to cut out the first galvanometer and connect up the reflecting galvanometer, the key being designed to switch on the light for the latter at one operation.

If more accuracy is required than that given by the scale on the metre bridge, a short scale, divided to 1-1000 may be laid on the portion of the scale used, and the reading made in 1,000ths instead of 100ths, the formula will then be

$$x = \left(\frac{1000}{\text{Scale reading}} - 1 \right) a.$$

The resistance box by this time will have been returned from testing duly marked with the true value of the various resistances—these resistances will probably not be round numbers, and if they are to be extensively used, it will be found very inconvenient to have to use a, perhaps, large decimal function for the value (a) in the above formula. It will, therefore, be advisable to construct a secondary standard resistance box, as shown in Figs. 5 and 6.

Theoretically, a known resistance of any one value should be sufficient with a metre bridge, but practically it will be found convenient to use a resistance as nearly equal to the unknown resistance as possible, never exceeding a proportion of 10 to 1 if extreme accuracy is required. For this reason I have made my box with the following resistances, 0·1, 0·5, 1, 5, 10, 20, 50, 100, 500, and 1,000 ohms, and besides this I have an independent resistance of 10,000 ohms, as illustrated in Fig. 7.

In making the large resistance box, a piece of ebonite, 7 ins. by 3 ins. by ½ in., and a U-shaped piece of brass of the dimensions given in the drawing is filed up, drilled, and tapped, and secured to the ebonite block by brass studs and nuts as shown, two studs being used between each plug hole.

In the first instance, a piece of thick cardboard is interposed between the brass and the ebonite to prevent the latter becoming marked in the process of cutting through the brass U piece.

Next turn ten plugs slightly conical and make a reamer of the same taper, and ream out the holes to fit the plugs. The ebonite heads for the plugs are filed out of a strip of ebonite 5 ins. by ¾ in. by ⅜ in., and subsequently cut off into the required lengths, polished, drilled, tapped, and screwed on to the upper end of the plugs.

The U piece is sawn through, as shown in the drawing, burrs and corners filed off the sections, the cardboard removed, and the whole screwed down tightly and permanently. The plugs should now be ground into the holes, using a little fine emery and paraffin.

The box to contain the coils is made in one piece, neatly dovetailed, and cut in two to form the body and cover. The coils are wound on empty cotton reels, as previously explained, and the ends soldered to the studs used to attach the brass U piece to the ebonite, in such a manner that each coil bridges the interval between adjacent blocks.

Previous to joining up, the coils should be thoroughly boiled in wax to exclude moisture.

Two terminals are fixed to the extremities of the U piece, and the ebonite block is screwed into the body of the box in such a manner that the upper surface projects about ¼ in., forming a rebate which serves to steady the cover or lid when not in use.

It is advisable to make up a number of short pieces of flexible cable, to join the resistance box and bridge, etc., with flat brass or copper ends, as shown in Fig. 8, as it is most important that all connections should be absolutely perfect. It would be better to use mercury cups for this purpose, but for the fact that the mercury is liable to get spilt on and amalgamate with the brass work of valuable instruments.

Before beginning any test all the plugs should be put in position and the whole appliance tested for absence of resistance, as grit, etc., is liable to get into the connections and prevent perfect contact.

Fig. 7 shows a resistance box of 10,000 ohms constructed for insulation tests, etc., consisting of a double coil of No. 42 manganin wire, an ebonite bobbin formed of two discs, B and B, and a tube threaded on the brass spindle, C. The end, B, is made a loose fit, and B′ is screwed into the tube, D. The ebonite washer, E, is used to prevent all except the ends of the wires forming a contact with the terminal nuts to which they are soldered. C was left projecting, as shown in drawing, to chuck in lathe during the winding process, and subsequently cut off.

It is sometimes objected that a metre bridge is not accurate as it depends upon the wire being of equal resistance throughout its length. In putting in a new wire this can be tested by drawing the wire over a pair of notched screws fastened to a block of ebonite about 2 ins. apart and comparing the resistance of a piece of the same wire 2 ins. long, using the reflecting galvanometer to make the test. Then any sudden deflection of the bead of light as the wire is drawn over the notches will indicate any faulty place in the wire.

The wire when fixed can be tested by reversing the connections, *i.e.*, placing the known resistance in the place of the unknown resistance, and *vice versa*, when the reading will be taken on another part of the wire. If the difference is slight, the mean can be taken; if, however, there is a great difference, the wires should be replaced and a new trial made.

The great cause of inaccuracy is the liability of the wires to oxidise; therefore, when not in use the metre bridge should be covered up in an air-tight case or wrapped in paraffin paper, and stored in a dry place.

(*To be continued.*)

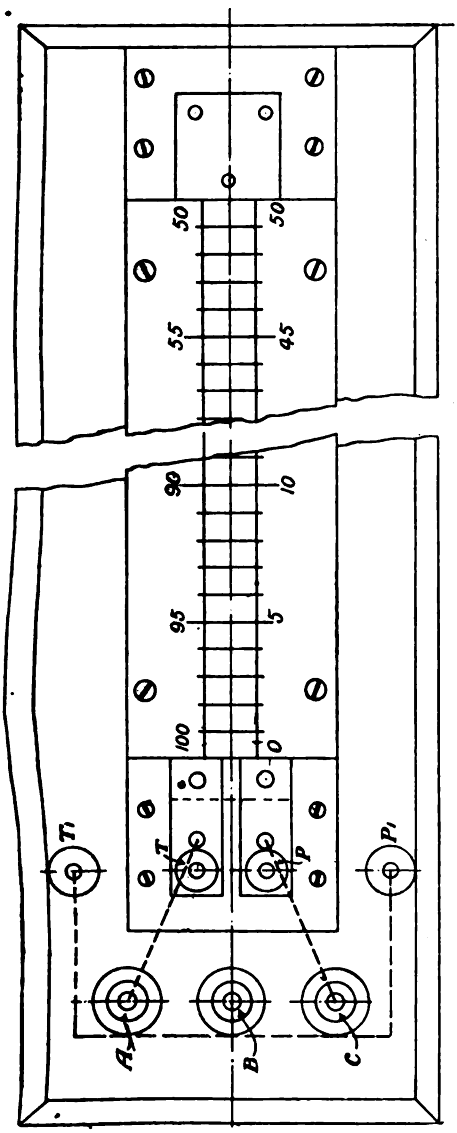


FIG. 2.—PLAN OF METER BRIDGE.

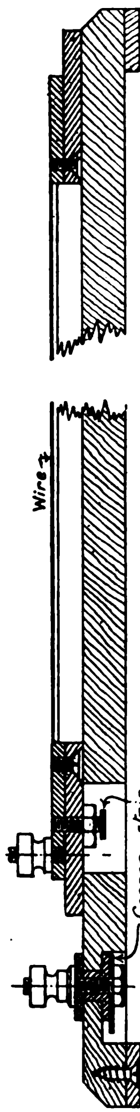


FIG. 3.—LONGITUDINAL SECTION OF METER BRIDGE.

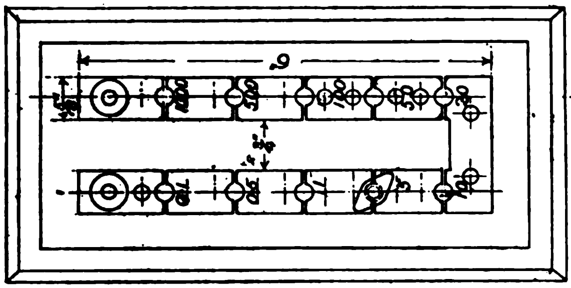


FIG. 5.—PLAN OF LARGE RESISTANCE BOX.

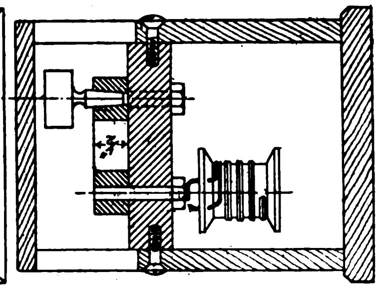


FIG. 6.—SECTION THROUGH RESISTANCE BOX.

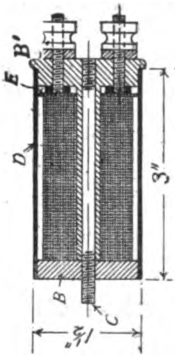


FIG. 7.—SECTION THROUGH SINGLE RESISTANCE BOX.

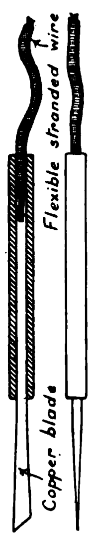


FIG. 4.—DETAILS OF COPPER-BLADED KNIFE.

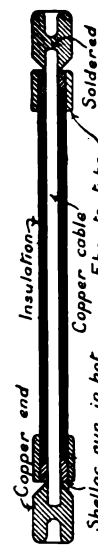


FIG. 8.—CABLE CONNECTOR.

DETAILS OF WHEATSTONE BRIDGE AND RESISTANCE BOXES.

For description] [See pages 130-132.

The Sixth "Gauge" Competition.

TO further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th.

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.*]

PROJECTILE THROWING ENGINES OF THE ANCIENTS. By Sir Ralph Payne-Gallwey, Bt. London: Longmans, Green & Co. Price 5s. net.

The catapult, the balista, and the trebuchet, described in detail by the author, seem weird and uncouth weapons in comparison with the magnificent productions of modern ordnance factories; but that they were effective in the circumstances under which they were employed one can have no doubt after reading this highly interesting volume. The various engines of warfare constructed by the ancients were not only ingenious in design, but in many cases of striking merit from a constructive point of view, and Sir Ralph Payne-Gallwey has earned the gratitude of those who have a leaning towards things historical by the skilful way in which he has selected and collated the available information on this subject and presented it in attractive form to his readers. The illustrations have been very carefully prepared, and show clearly the mechanical details of the various weapons described. The book concludes with a treatise on Turkish and other Oriental bows, a subject on which Sir Ralph is admittedly a pre-eminent authority. The marvellous shooting powers of the Turkish bow in particular are referred to, and the causes of the superiority of this type of weapon are fully analysed and explained. Altogether, the volume is one which can be read with the certainty of an agreeable and instructive result.

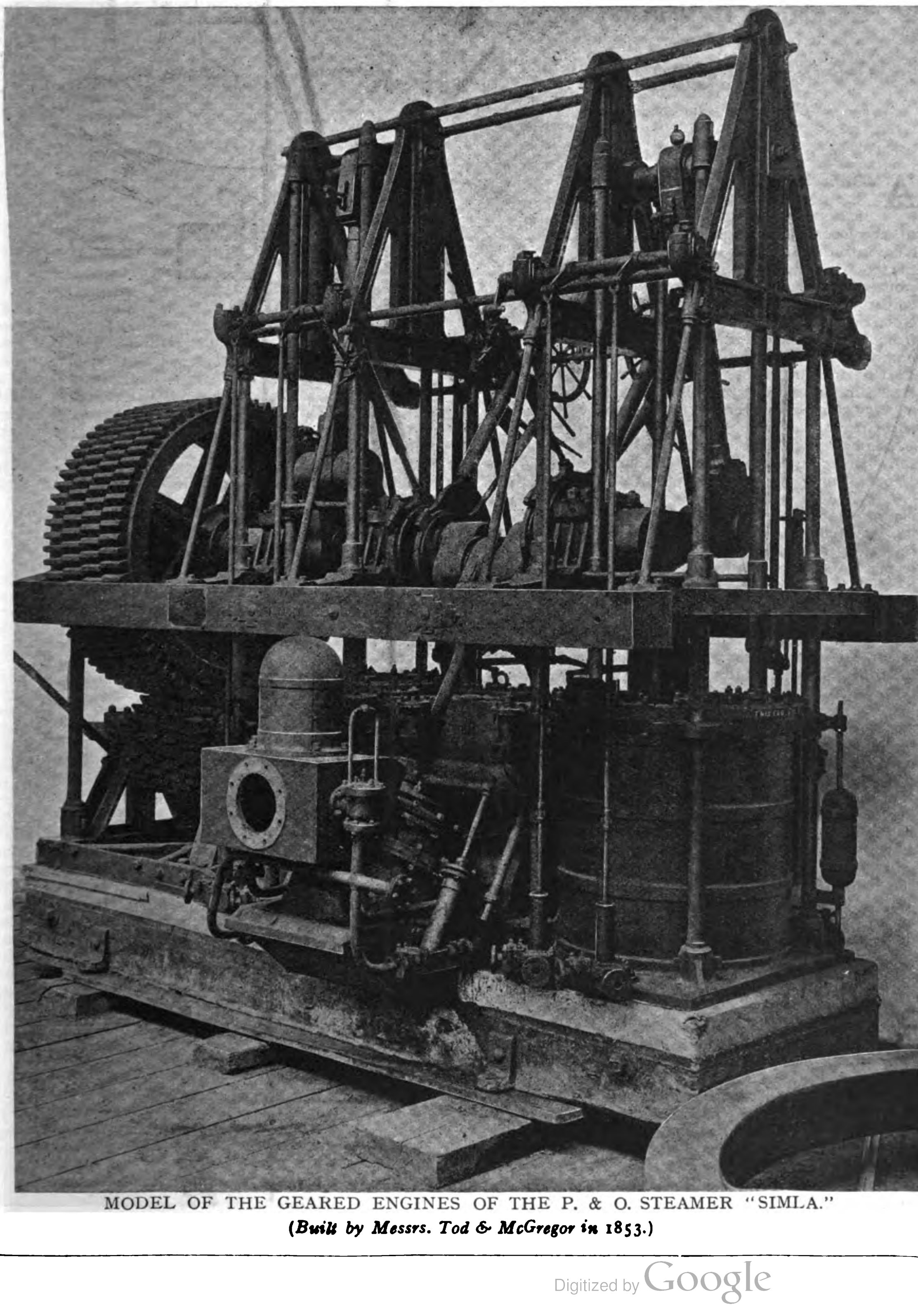
Interesting Model of an Early P. & O. Steamer's Geared Engines.

WE are able—by the courtesy of Mr. G. Des Vignes, of the West London Engineering Works, Gunnersbury—to illustrate an extremely interesting model engine. This model, which was constructed on a scale of 3 ins. to the foot, by Messrs. Tod and McGregor in the year 1853, is probably the finest marine engine model ever constructed. It was exhibited in the Paris Exposition Universelle in 1855, and was specially mentioned and awarded the Médaille d'Honneur by the judges. As an exponent of the beginning of good mechanical work the model is unrivalled, and at the present day would be difficult to surpass.

The engines are of the four piston-rod steeple type, and are geared at a ratio of 2¾ to 1, the spur wheel being a mortise wheel, and the pinion being a fine piece of work. It is in four steps, and all in one exceptionally clean casting. There are four gun-metal bilge pumps with clack valves, worked from diagonal rods from the expansion eccentric straps, these pumps being constructed to throw out of gear in pairs by a very ingenious sheave on the rods which work the rocker shafts by which the pumps are driven. Between the cylinders is the hot-well, on either side of which are the air-pumps at an angle of 45 degs.; these are driven from the main crankshaft by connecting-rods working in trunks. There are two feed-pumps of the plunger type, which are driven on either side of the starboard air-pump by a crosshead affixed to the trunk.

The reversing gear is of the balanced slip sheave description, the throwing over being accomplished by a hand-wheel and geared quadrant for each engine separately; the expansion valves are driven by separate sheaves with throw-out lever gear, which actuates the rocker shaft. The guides are constructed in three pieces in a very ingenious manner for taking up wear. The model, says the *Engineer*, was exhibited in London in 1862, and found its way to the Crystal Palace. It stood for many years in the Ivory Turning Court. It was then moved upstairs, and until recently it remained neglected and covered with dust close to the engines generating the electric light for the Palace.

The model represents on a fairly large scale the very best practice of the period when it was made. It was taken as proved that the proper piston speed for a marine engine was 240 ft. per minute, and as this did not give a sufficient number of revolutions to the screw, gearing was introduced. The *Simla* was a P. & O. boat, one of the first in which screw propulsion was used. The nominal power of the engine was 600, but it probably worked up to about 2,500 i.h.-p. This model is, so far as we know, the only one in existence of geared screw engine. It cost over £4,000. The workmanship is exceptionally fine. Mr. Des Vignes, having purchased the model, has cleaned it and put it in order. It will be a matter of everlasting regret if it is not bought by some science college or museum. It is impossible to get anything more typical of engineering thought and practice at a time when Great Britain still led the world in the mechanical arts.



MODEL OF THE GEARED ENGINES OF THE P. & O. STEAMER "SIMLA."

(Built by Messrs. Tod & McGregor in 1853.)

How It Works.

VIII.—Water Pick-up Apparatus for Locomotives.

(*Continued from page* 106.)

By CHAS. S. LAKE, A.M.I.Mech.E.

AMONG those railways upon which the use of water pick-up apparatus for locomotives is resorted to, the locomotive engineers of a few have introduced methods for operating the scoop by auxiliary power mechanism worked by steam or compressed air, whilst on one line, viz., the Great Northern, recourse is had to the water from the trough itself for the purpose named. This last-named method was devised by Mr. H. A. Ivatt, locomotive superintendent, and is fitted to a very large number of engines on the G.N.R.

The drawings (Figs. 11 to 13) clearly show the construction and the mode of operation, which are as follows:—

A cylinder having its axis inclined to the horizontal is located to the rear of the delivery pipe and in communication therewith, and a deflector is provided whereby some of the water ascending within the delivery pipe at its rearward side will be deflected into the cylinder so as to actuate its piston, which is connected by a slotted rod passing through a slot in the front portion of the delivery pipe to a toggle or equivalent arrangement that is connected to another rod to a hand-lever which is suitably placed for the purpose of raising or lowering the scoop. In another arrangement patented by Mr. Ivatt, the cylinder is placed vertically, as shown in Fig. 12, its piston being then connected to the scoop by a rod and a bifurcated lever provided with a stop so that during the last few inches of the lowering movement of the scoop, as it touches the water, the piston is caused to rise on the cylinder. The upper end of the cylinder is connected to the delivery pipe, wherein a deflector is provided, and there is interposed between the delivery pipe and the cylinder a valve arranged to open towards the cylinder, but to close in the reverse direction, and in such a manner as to close communication between the delivery pipe and the cylinder when the piston is rising, and so to cause the cylinder to act as a dashpot by compression of air above its piston, and thus to cushion shock as the descending scoop enters the water.

In operating the gear the forward movement of the scoop *b*, after it has been lowered into the position shown in full lines, causes the water to flow up the back of the delivery pipe *a* in the usual manner, but part of the water is caused to enter the cylinder *i* by the action of the lip or deflector *l*, and thereby produce pressure on the piston *i* and a corresponding pull on the pin *l* connecting the system of levers to the rod *s*, the pull so exerted tending to lift the scoop *b*, and either doing so or assisting in doing so when the hand-lever *w* is released or moved

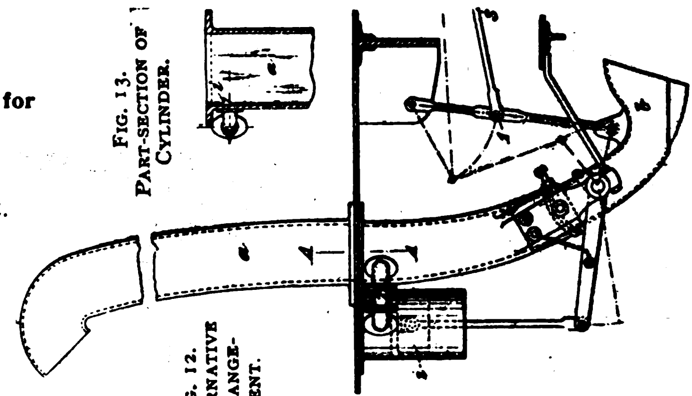


FIG. 13. PART-SECTION OF CYLINDER.

FIG. 12. ALTERNATIVE ARRANGEMENT.

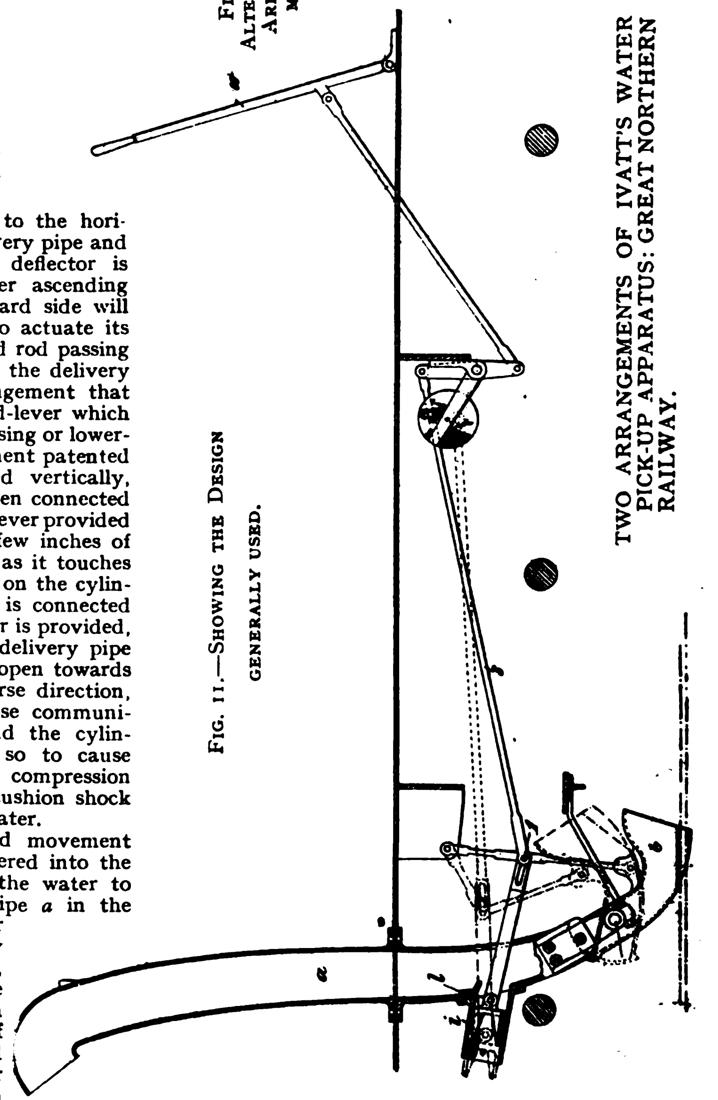


FIG. 11.—SHOWING THE DESIGN GENERALLY USED.

TWO ARRANGEMENTS OF IVATT'S WATER PICK-UP APPARATUS: GREAT NORTHERN RAILWAY.

in a direction to raise the scoop. The operating hand-lever *w* is, of course, represented in the drawings as being located at the front end of the tender within easy reach from the engine footplate.

(*To be continued.*)

The Construction and Repairing of Motor Bicycles.

By "SREGOR."

(*Continued from page 17.*)

THIS article deals with some miscellaneous details of motor bicycle construction, Referring to the sketches (Figs. 58 to 63), these show some methods of grinding in the valves and the proper tools to use to effect same. The most common design and method provided for grinding in a valve is that given in Fig. 58, which shows a simple saw cut, or milled slot, to receive a screwdriver which fits in the chuck of a brace to turn it, but whilst this form serves the purpose, it will readily be seen that it has its defects, the chief of which is that the driver has a tendency to slip out of the slot, especially when it does not run quite true in the chuck, with the result that it damages

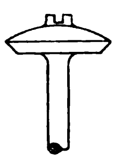


FIG. 58.

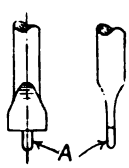


FIG. 59.

the top of valve or surrounding parts—the slot has to be found and the driver inserted again; this is very readily accomplished under favourable circumstances, but not so easy if the job has to be accomplished in the dark or when the valve is located in an awkward position. A tool that will dispense to a large degree these faults is that shown in Fig. 59, which is similar to the common driver shown in Fig. 58, with the addition of the round nose on the end. The valve must be provided with the saw-cut as before, with the addition of a small hole drilled in the centre a bit larger than the nose A on driver. The nose must be tapered as shown, so that it will readily enter the holes, and when once in, it can easily be kept in position. It is important that the slot and holes shall be an easy fit, as it allows the operator to readily enter the tool and prevents any tendency to slip the valve off its seat as it adjusts itself to any irregular running of the driver, which is usually experienced when used in a brace.

Another form of driver is that shown in Fig. 60. The principle of each is the same, as when the tool has entered the slot it cannot slip out sideways; in the latter case, the nose on top of the valve must not be larger in diameter than the hole in the tubes, but should be an easy fit, to allow for the possibility of the slot in valve-head being out of centre. The details of the driver are shown in Fig. 60. Sometimes it is an advantage to use a driver when grinding the valves that will remain attached to the valves and withdraw it off its seat. This is accomplished by the method shown in Fig. 61, which shows a plain piece of rod screwed at one end. The valve-head must be drilled and tapped to take the screw; in this case the valve must be turned only one way, or the screw will withdraw, unless a locknut is provided, as shown.

It is advisable—when convenient—to cut the screwdriver slot in the lug of valves, in set pins, etc., with a cutter, especially those of a slender section of metal, at the root of the slot, as shown in

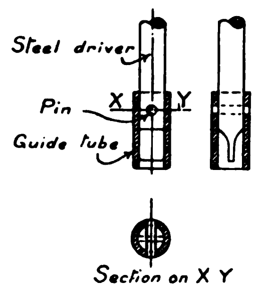


FIG. 60.

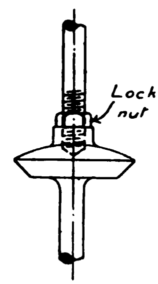


FIG. 61.

Fig. 62. The half-round finish at the bottom is very much stronger than the square finish (as usually made). A detail which very much facilitates the dissembling and assembling of a machine is the fact of providing a screwdriver slot in the heads of small bolts and setpins, even up to, say, ½ in. diameter; and when the head is provided with a square or hexagon-shape for the spanner, the pin can be unscrewed or screwed in in much less time—and reached in almost inaccessible positions—than with the spanner, the spanner being used to give the pin its final turn to tighten. When the screwdriver is rounded at the end, as shown in Fig. 63, it can be more readily entered in the slot, and does not cut the head of pin like the square-ended driver does. It is a good idea to case-harden the heads of those screws which are commonly

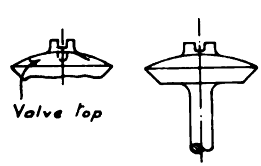


FIG. 62.

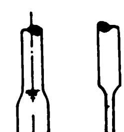


FIG. 63.

being removed for various reasons, to prevent getting disfigured by the continual screwing up of same.

There are necessarily a large number of small parts in the construction of a motor, and it is most advisable to minimise the number as much as possible, and also to design details to make the assembled part as intact as possible, which tends to simplify the machine. In Fig. 64 a design for securing a plain cover is shown. This is held in position by the two screws; but which are not removed when the cover is detached, but only require one half-turn and the cover moved to allow the holes to slip over the screwheads; obviously, such an arrangement is much sooner attached than if the screws had to be removed.

In Fig. 65 is shown a simple and cheap drain tap, which is made out of an ordinary set-screw. This detail can be used effectively as a drain tap for the crank case, etc., and occupies much less space than an ordinary drain cock, and is considerably cheaper. Fig. 66 shows the position when screwed up, and Fig. 67 when used to drain the case. After deciding

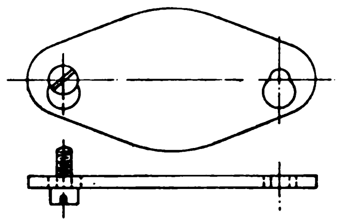


FIG. 64.

upon the size of setpin to be used, it is advisable to drill the holes as large as practicable, to enable a quick passage for the oil. As soon as the screw is unscrewed to the position shown in Fig. 67, the oil will flow down the centre hole and out at the side hole; the length of screw must be governed by the thickness of the case, care being taken to ensure the end not coming in contact with any parts inside the case. It is an advantage to make the thread a fairly fine pitch, from the fact that a larger diameter hole can be used and retain the same thickness of metal between the hole and bottom of the thread than when a coarser pitch is used; also, the locking effect is more decisive when screwed up. In the design of head it is a matter of indifference, whether hexagon or plain, when screwdriver slot is used. The screw can be inserted in the side of the crank case in a position to control the height of the oil, or if used as a drain, secured to the base of the case. The position shown in Figs. 66 and 67 is in the sides of case.

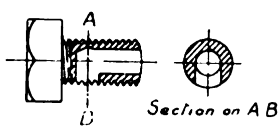


FIG. 65.

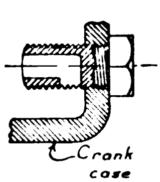


FIG. 66.

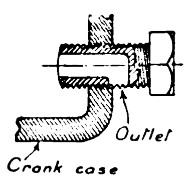


FIG. 67.

It is sometimes necessary to provide a hardened surface to receive the wear of some details, but not advisable or practicable to harden the whole of the piece which carries the said detail, such as the end of a spindle which receives an end thrust. The common ball, as used in bearings, is most adaptable for the purpose, from the fact that it is perfectly round and hard. Fig. 68 shows detail of a simple ball thrust. The spindle is shown with its end next an aluminium case into which the steel ball is fixed. The centre line of the ball is slightly below the surface of the case, which provides a ready and efficient method for fixing the ball in position. This is accomplished by caulking the metal of the case around the side of ball, as shown; the diameter of ball at the point level with the case being less than at the centre ensures the caulking proving an effective lock. An oil hole is shown at the side to provide a means of lubrication. The end of spindle can, of course, be readily hardened, if necessary.

In Fig. 69 is shown a handy method for removing the cotter pin from the valve stem, and one which does not require the use of any specially designed tool. As shown in the sketch, the cam position is at the top of its stroke, and the spring is consequently in its compressed state. Having turned the crank round to obtain this position, all that is required is to insert a distance-piece between the valve guide and the bottom of the spring cap. The piece—as shown in sketch—is a piece of tube with one side filed off to allow it to slip over the valve stem. This takes a bearing three-fourths of the diameter of the cap, and holds it level, which allows the valve stem to freely pass through the holes.

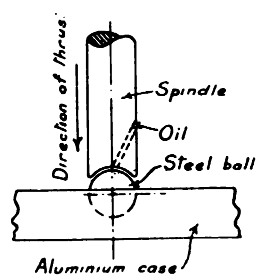


FIG. 68.

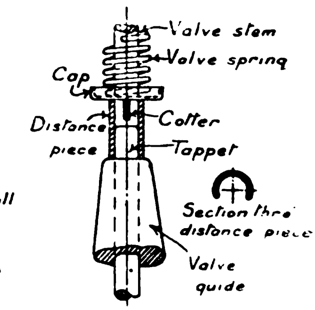


FIG. 69.

When a flat piece is used, it tilts the cap to one side and causes it to grip the valve stem and generally prevent the valve from dropping on to its seat when the crank is turned round to allow it to do so, so that the cotter pin can be withdrawn, which is the object in view.

(*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 intended for publication.*]

Re Model Beam Engine.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I note with interest the illustrations and article of Mr. Watson's beam engine, and I am pleased to see there are yet some readers interested in the beam engine. There is a fascination in all model engines, but I think in the beam engine particularly. Still, I should like to kindly draw his attention to an error respecting the eccentric where he says—"and keyed on shaft at right angles to crank"—when, according to the position of weigh shaft, etc., as seen in the illustration—"without allowing for cap and lead"—the position of the eccentric would be in line with crank centres and directly opposite crank-pin for a forward motion, and the same direction as crank-pin for a backward motion. Regarding the cap, I do not think any necessary—in this size—for lead. The eccentric should be advanced a little in the direction the engine is intended to work, so as to open port to just admit the corner of a bit of newspaper. which would make the engine quite lively when under steam.—Yours truly,

Bilston. ISAAC T. ASTLEY.

Steel for Drilling Glass and China.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Will you kindly inform me what special steel is used for making drills for drilling china, glass, etc. I have tried all ways to harden ordinary drills for this purpose, but failed, although drill-making is part of my daily work. If steel cannot be made hard enough for this purpose, what stone (not diamond sparks, which are too expensive) would be suitable?

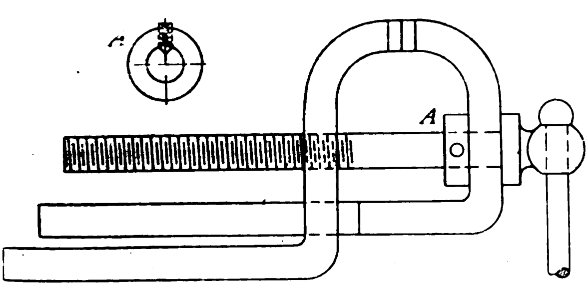
Can either steel or stone drills be bought? If so, please give me address of makers, and oblige. —Yours truly, JAMES DORRINGTON.

[Can any of our readers supply this information? —ED., *M.E. & E.*]

Re Strong Parallel Vice.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I think the vice illustrated and described in the issue for December 13th, 1906, very useful; but I do not see any way by which the front jaw is brought back—unless pulled towards the worker. I would suggest putting a loose collar



SKETCH SHOWING IMPROVEMENT TO PARALLEL VICE.

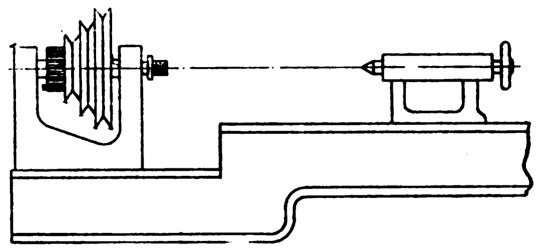
on the screw inside the jaw, as shown at A on the sketch herewith. Obviously, this will enable the front jaw to move backwards and forwards as the screw is turned.—Yours truly, H. WOODWARD.

Tiverton.

Concerning Small Lathes.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I am writing to you on a point which has for some time struck me as being one of the weakest points of small lathes, and that is, the size of the speed-cone. I find that the belt always causes much annoyance by slipping, unless it is very tight, in which case it must tend to wear the bearings considerably out of truth. (I use rawhide, which slips less than anything else I have tried.) It seems to me that the headstock might very well be cast on the bed, so that a 3-in. lathe might easily have a 6-in. pulley, and I have seen a single-geared lathe in which this was done, but even there the pulley was 1½ ins. less than it very well might have been. Of course, in a back-geared



A SUGGESTION TO IMPROVE SMALL LATHES.

lathe there might be a difficulty in the casting, but in that case why not have the headstock fixed to a continuation of the bottom of the gap, instead of having the bed brought up to the level which it was before? I am quite willing to admit being peculiar in objecting to a tight belt, but I think there are reasons against it, and I do not see that my suggestion would entail much extra work, if any. I should like to see the opinion of your readers on this point.—Yours truly,

South Sheilds. M. W. BURROWS.

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.]*

ON Saturday, January 26th, by the courteous permission of G. J. Churchward, Esq., a visit was made by about thirty members and friends to the Great Western Railway engine sheds and repair shops at Old Oak Common, N.W. The party—under the guidance of the foreman, Mr. Webb—spent three hours inspecting the fine engine house (capable of holding 128 engines at one time) arranged in four groups on short lengths of line radiating from all points of four large turntables, the tables being driven at a good speed by four independent electric motors. Amongst the various types of engines of all sizes then in the shed, the new four-cylinder non-compound and the original French de Glehn compound—"La France"—locomotives were inspected with much interest. After spending an hour and a half watching the shunting of engines and stalling them in their proper berths, the party proceeded to the repair shop, where several engines were seen undergoing various repairs and renewals, the machinery comprising two very large wheel-turning lathes, screw-cutting lathes, drilling, slotting, and planing machines, and numerous special tools and appliances. The members were allowed to make a very close inspection of the engines, many mounting the footplate and inspecting the boiler fittings, others examining the smokebox interior, and some enthusiasts descending into the pit to view the motion from underneath. A visit to the stores disclosed a large stock of machine requisites and spare parts of every description. One item that interested the party was the lighting of the locomotive fires, large scoopfuls of live coals from special furnaces being carried by men and placed in the locomotive fireboxes, the men's backs being protected from the heat by asbestos and steel shields. By permission of the driver of one of the large "Atlantic" type engines, several of the members enjoyed a short run on the footplate, taking turns in handling the regulator. At the close a very hearty vote of thanks was accorded Mr. Webb for his kindness in enabling the visitors to see everything of interest and allowing them plenty of time to watch the movements of the engines.

FUTURE MEETINGS.—The next ordinary meeting will be held at the Cripplegate Institute on Wednesday, February 20th, at 7 p.m., the evening being devoted to the running of locomotives and other models under steam. All members having locomotives or other models capable of being run under steam are requested to make a special effort to bring them to this meeting. For particulars of the Society and forms of application apply—HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

Provincial Societies.

Tyneside.—This Society has recently secured premises for a workshop and meeting-room in the centre of the city—at 2, Princess Street, off Northumberland Street. A lathe and other tools are already installed. On Saturday, February 9th, at 7 p.m., the president, Mr. T. E. Dann, will read a paper on "Petrol Motors," illustrated by lantern slides. Prospective members wishing to attend are requested to communicate with the Hon. Secretary, THOS. BOYD, 128, Dilston Road, Newcastle.

Stoke-on-Trent.—Model engineers and others who are interested in the formation of a Society in this district are asked to communicate with Mr. E. COTTON, Abbey Villa, Milton, Stoke-on-Trent.

The Victoria Model Steamboat Club.

THE loan exhibition recently held in the Holy Trinity Church Hall, at Stepney, was considerably enhanced by a large number of models lent by the members of the Alexandra Model Yacht Club and the Victoria Model Steamboat Club. Amongst the exhibits of the V.M.S.C. were model T.B.D.'s, including the *Ena*, which gained a bronze medal in the recent Speed Boat Competition; a model man-o'-war of very realistic appearance, a well-made model police boat, besides other model marine steam craft. Another interesting item was that of a marine engine, made, we understand, in the year 1827, and representing the engine fitted to the *Cock o' the North*, which was the first steamship to leave the Port of Hartlepool. We hope at a future date to give further particulars of some of the interesting steamers belonging to this club.

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:—

[12,030] **Partial Failure of ¼ h.-p. Electric Motor** H. W. (Colwyn Bay) writes: (1) I have a small overtype electric motor of ¼ h.-p. at 100 volts, and cannot get it to go nicely at all. There are two wires projecting from the top of each field coil, and I think it is meant to be connected in shunt, as the wire is of small gauge. When I connect it up in shunt it always runs backward—*i.e.*, clockwise—and sparks very violently at the brushes, which are copper carbon. I was using a series resistance board on the negative wire. What is the best kind of oil for the bearings of a motor like this? It has oil ring and phosphor-bronze bushes. (2) Is it possible to run a 16 c.-p. lamp from an 8-volt accumulator if the amperage is large? I have one giving 15 amp.-hours. Would this light one and for how long? (3) Can the amperage of an accumulator be measured by the size of the plates? If so what is the rule?

(1) It is very difficult to determine whether your field coils should be connected in shunt or series, as shunt coils are frequently made with a short length of thicker wire soldered to each end for mechanical strength. You can experiment by connecting them in series with the armature; if they are intended for shunt coils their resistance will be so high that the motor will either not run at all or only very slowly without much power. To change the direction of rotation of the armature, you must reverse the direction of the current through either field coils or armature, but not both, by crossing over the connecting wires. Are you sure that your coils are connected so as to produce N and S poles? You can try this by means of a compass needle, taking care to keep it a fair distance away so that the needle is not overpowered, and remember that like poles repel and unlike poles attract one another. The sparking may be due to wrong position of the brushes or a broken wire in the armature winding. Ordinary machine oil will do for the bearings. The size and shape of the oiling rings will affect the question. You must try to find the correct thickness of the oil by experiment. (2) Lamps of 16 c.-p. are not usually made lower than about 30 volts. You could, perhaps, have one made specially, in which case it would take about 6 amps., and your cells would run it for about] 2½ hours. (3) Yes, approximately. Large cells give higher efficiency than smallo nes; 15 amp.-hours per sq. ft. of active positive plate surface is a fair rule. The heaviest rate of safe discharge largely depends upon the make and type. If you discharge at a greater rate than the plates will stand, they buckle and loose the paste.

[12,065] **Electric Boiling Apparatus.** B. M. (Southport) writes: I would be very much obliged if you would answer the following questions:—I want to make an immersion coil to boil a kettle of water about one pint or less. Of what material should the coil be made? My current is not very powerful. Would copper tube, ⅛ in. or ¼ in. diameter, coiled round like a wire spring do, or would platinoid wire be better? What should be the length of tube or wire? How do you make connection to the coil when it is immersed inside the kettle; when it is wound around the outside of the kettle?

The best way to apply the heat from a coil of wire is to enclose it under the vessel in an outer casing which covers the bottom and sides of the vessel containing the liquid. You will require something like 500 watts to be of any service, but it is impossible to advise you as to amount of gauge of resistance wire without knowing the volts and amperes at your disposal. If you will refer to reply to Query No. 8,021 in THE MODEL ENGINEER for May 14th, 1903, you will find a sketch giving a suggestion for dealing with a similar problem. It is not an easy matter to make successful electric cooking apparatus. Copper tube or wire is unsuitable unless you have low volts and heavy current.

[10,238] **Lighting Plant for One Room.** R. A. H. (Chesterfield) writes: I should like to light a room, 15 by 13 by 13 ft. high, by electricity, and shall be much obliged if you will kindly let me know the answers to the following questions: (1) What would be the approximate total cost? (2) Could it be done by means of batteries? If so, what kind and how many would be required? (3) What would be the best voltage for the lamp? (4) Where could I obtain the necessary materials?

(1) You would need about 16 c.-p. at least—*i.e.*, a battery or dynamo capable of giving 64 or 70 watts. (2 and 3) The battery would be too large to be convenient, but a dynamo and engine would be more practicable. (4) Any of our electrical advertisers would quote you for the above on application. The voltage could be anything you choose, say, 30 volts, to suit that of the lamps, which are made to run at this E.M.F. We should advise you, however, to go in for a somewhat larger plant than this in case you wished to get more light in the future. The extra first cost would not be very great for double the power.

[17,147] **Fitting Exhaust Mechanism to Small Gas Engine.** G. A. L. (Eastbourne) writes; I should be obliged for the information noted on sketch. The engine is finished so far. I bought the castings second-hand, so do not know maker, and had no drawings with them. I have your book on "Gas Engines," and have tried one or two arrangements unsuccessfully. I want rough sketch of some arrangement to connect gear-wheel with exhaust.

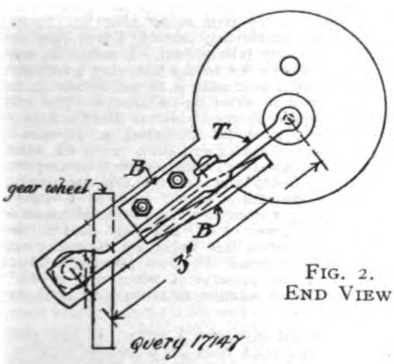


Fig. 2.
End View.

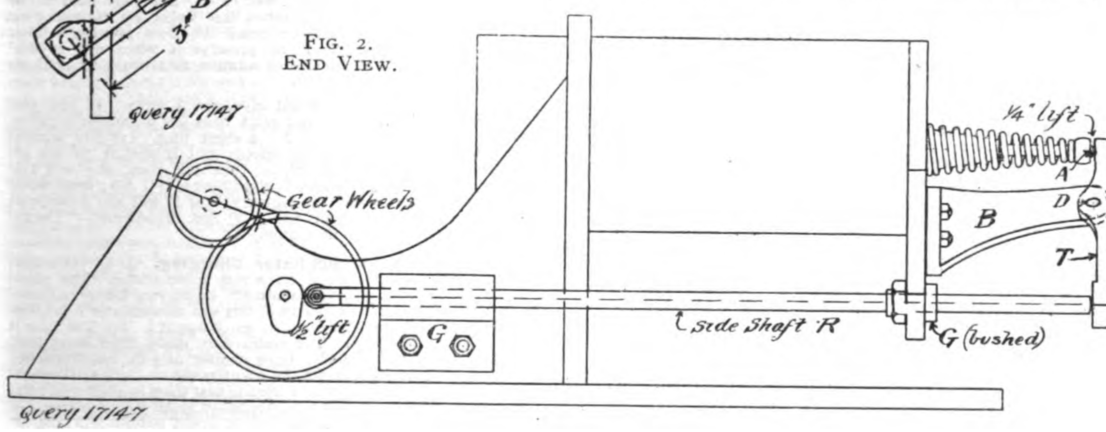


Fig 1.—Showing Arrangement for Working Exhaust from Existing Gear Wheels.

We append your sketch, on which we have inserted an outline of suggested arrangement for operating the exhaust valve. The rod R slides in the two guide brackets G G. It is operated by the cam on large gear wheel. A lever, T, is carried by the bracket B, and the distance from its centre to points of contact, A and D, will be proportional to the required lift of exhaust valve. The bracket carrying T will have to be specially made to suit the circumstances of your case, but no doubt you can arrange to fit this up quite easily.

[10,271] **Controller for Model Electric Railway.** B. M. (Deganwy) writes: I should be greatly obliged if you could give me an idea of how to make a controller for a model electric railway, to be outside between the battery and rails, that I might be able to regulate the speed of the locomotive?

Suitable rheostats for this purpose have been described from time to time in these pages, to which we must refer you for particulars. The exact amount of wire in the coil depends upon many unknown factors, such as size of motor, voltage of supply, distance over which the locomotive runs, etc.

[12,031] **150-watt Dynamo Windings, Etc.** L. D. (London, S.E.) writes; I shall be pleased if you would kindly answer the following questions. I am making a small dynamo to light a few lamps in a house in the country. I have got a ring armature, but the size is not in proportion to the ones in "Small Dynamos and Motors," being 4½ ins. diameter and about 4 ins. wide from edge to edge of stampings, wound with No. 18 D.C.C. (quantity not known). Will you kindly tell me the size of yokes and diameter of cores to suit this armature (Manchester type), also gauge and quantity of wire for same, approximate output, and power required to drive (oil engine)?

We cannot answer your query in full as you do not supply sufficient particulars. Presuming your armature is toothed, you can take the 150-watt size (Manchester pattern, Fig. 13, page 20 of "Small Dynamos and Motors") as being practically the same machine as your armature would suit. Make the core to suit your diameter and increase the width of the yokes to suit the length; this will necessitate a slight increase in the length of the cores to compensate for the increased size of the bore; the cores can be made 1¼ in. diameter instead of 1⅛ ins. For winding, take the 30 volts 5 amps. output as given on page 51, but you will probably be able to get 8 amps. at 30 volts. No. 21 gauge would be preferable to No. 20 for the magnet coils; speed about 2,400 r.p.m., possibly lower. Engine should give at least ¼ b.h.-p.; ⅜ would be better if you want to get maximum output.

[10,275] **Sealing up Accumulators.** "Works" (Patricroft) writes: I am making up some small accumulators for a bicycle lamp, and would like to know how to seal them up. I have heard that the best way is to fill them in with sand and pour the wax composition on to that and then get the sand out through the vent holes; but as I am using corrugated celluloid for separating the plates, it would be almost impossible to get the sand out afterwards. I do not want to go to the trouble of cutting out a vulcanite lid for each cell, with holes and slots, etc., in it for the lugs and vent holes, unless absolutely necessary. What method would you advise?

The most satisfactory way is to cut out pieces of vulcanite to fit on top of plates as you mention, and then fill in with molten pitch with a little beeswax added. Use the pitch in a fairly viscous state until the vulcanite is covered, and all likelihood of it running inside the cell will be avoided. Then melt up till quite fluid and fill up.

[17,226] **Model Steamer Machinery.** S. A. S. (Plumstead) writes: I have a torpedo-boat hull, 40 ins. long by 5¼ ins. beam and 2½ ins. draught, which I wish to drive by steam at a decent speed. Could you please give me some particulars as to the size, type of engine and boiler, also means of firing? The boiler, engine, and lamp should not weigh more than 6 lbs. if possible, though a trifle more could be managed. Also could you give me the size of a suitable propeller?

We would advise you a boiler 4 ins. diameter by 9 ins. long, having a single flue, preferably D-shaped, with cross water tubes (as shown on page 47 of our new edition of "Model Boiler Making"). The engine may be of any type which will come below decks. We would advise a double cylinder single-acting engine, say, ¾ in. by ¾ in., or ½ in. by ¾ in. and 1 in. by ¾ in. compound. Fire the boiler with a small petrol burner (as illustrated in our issue of April 27th, 1905). The propeller may be 2½ ins. diameter and 4 ins. pitch.

[12,050] **Electric Motor Problem.** J. M. (Glasgow) writes: Some time ago I was sent to repair a 10 h.-p. motor (4-pole) and found the following fault, which I have never been able to quite understand. On the first stud of the rheostat the motor started all right, but when the handle went to the third stud the motor reversed. That is the problem. The motor was wired all right, and had been working for some time. I found an earth in the field, the removal of which cured the fault. The system here is three-wire, 250 and 500 volts; the motor was 500 volts, 1,200 revs.

The explanation appears to be that owing to the leak to earth the field strength was only that of the residual magnetism—at all events, was very weak. As the regulating handle was moved over, a strong current passed through the armature and reversed the polarity of the field-magnets, owing to the brushes having a backward lead, the armature then reversing its direction of rotation. By removing the leak the field-magnet was excited to its normal strength, consequently the armature maintained its correct direction of rotation. The armature of an electric motor can be considered to be a magnet having N and S poles which respectively attract and repel the N and S poles of the field-magnet, and that the armature will create N and S poles in the field-magnet if the latter is not excited, and will run in whichever direction it is started if the brushes are set exactly in the neutral position. If lead is given to the brushes, the armature will tend to run in the direction of the lead.

[12,029] **Pasting Accumulator Plates.** J. H. L. (Brondesbury) writes: (1) Can you give me a few hints as to the best method of pasting lead grids? I have tried pasting them as directed in your handbook, but find that on attempting to raise the grid from the glass plate in order to treat other side, the paste sticks to the glass and is pulled out of position. I have also tried pasting one side first and allowing it to dry, but find that the paste swells out and makes the surface uneven. (2) I have some old accumulator plates which I intend to make up, but they are covered in parts with a white incrustation (presumably lead sulphate). Can you tell me the best way to get rid of this? Would it be very injurious to the accumulator? (3) Does it affect the working of an accumulator if a little gold-size is mixed with the lead oxide paste in order to make it adhere to the grids?

(1) We are afraid the only remedy is to try until you do succeed. Why not slide the plate off the slab instead of lifting it? (2) The white incrustation is sulphate of lead and must be completely scraped off if the plates are to be used again. It is fatal to the proper working of an accumulator. We do not recommend you to use old plates if badly sulphated: better in such a case recast them in a mould. (3) Only dilute sulphuric acid should be mixed with the red lead; equal parts to acid and water.

[12,134] **The Nodon Valve.** E. R. R. (Portsmouth) writes: Some months previous to your publication of an Electrolytic Rectifier (Nodon's Electric Valve), I had already had one in operation. The output is about 4 amps. The elements are the same metals as stated in your correspondent's recent article, and the solution is a saturated solution of phosphate of ammonium, about 1 oz. to a quart of water per cell. I am using this rectifier to charge accumulators, and I find that although the cells "milk," yet the charge in them is not retained to such an extent as is the case when the cells are charged from a dynamo direct. The voltage here is 100 at 50 periods per second. Now, the rectifier, in my opinion, is not an economical one: at least, not for such small outputs as mine. I think 75 per cent. efficiency is claimed for it, but in my case 50 per cent. would be much nearer the mark. Now, as to my cells "milking," and yet not being thoroughly charged, I can only think of one cause. The action of the rectifier is—when a positive current passes from the iron to the aluminium the resistance is at a minimum, but when a negative current passes from the iron to the aluminium the resistance is at its maximum. Now, when the resistance is low, current passes freely positively and charges the cells, and when the resistance is high some current must flow, but negatively, and so partially reverses the positive charge, but the acid still remains "milky." Do you think this likely to happen, and would that account for the charge not being retained? Do you think a dynamo would do the work more efficiently? For my part I think it would.

When an alternating current is rectified it becomes a unidirectional pulsating current rising and falling from nothing to the maximum and back again; if such a current is used to charge an accumulator at each instant when the current has fallen to zero, the accumulator tries to discharge, and will do so if there is any circuit through which the resistance is low enough. The practical result of using such a current for charging is that the periods when the current can flow into the accumulator are of greater value than the periods when the accumulator can discharge, so that the net result is that the accumulator becomes partially charged, but never fully charged, as there is always a certain amount of discharging going on. The current from a dynamo having a fair number of sections in its commutator only pulsates in a kind of ripple at about the point of maximum voltage, so that the accumulator cannot discharge but must be always receiving current. When a Nodon valve is used as a rectifier, the accumulator probably discharges through the cells of the valve at the periods of zero current, the action being very similar to that which takes place when a dynamo is used having a shuttle armature and two-section commutator, in which case the accumulator is short circuited twice in every revolution of the armature when the brushes press upon both sections of the commutator. To minimise this discharging tendency the pulsating current should be at very much higher voltage than necessary to charge the accumulator, and a resistance used in series with the battery, so that whilst the pulsating current can overcome the resistance and send a charge into the accumulator, the latter cannot discharge at the zero periods to an appreciable extent, because the resistance is too high. For instance, supposing you are charging a 4-volt accumulator, if the pulsating current was at 100 volts and charging through a resistance of 90 ohms, it would send about 1 amp. through the cells, but they could only discharge a very small percentage back. You could try this plan and see if it served your purpose, but, of course, it is not economical. By far the better system is to use a dynamo either driven by an engine or by an alternating current motor. We believe you are correct in your opinion that the efficiency of the Nodon valve is much lower than the figure claimed for it.

[8,423] **Motor and Cells for Motor Launch.** R. S. C. (Glasgow) writes: I have a model yacht—dimensions: length, 4 ft. 6 ins.; breadth, 5½ ins.; depth (moulded), 5 ins. Her lines are very fine and she is very light. She is driven by one of Thompson's electric launch motors, with 8-cog drum armature, described in June 1st, 1902, issue of THE MODEL ENGINEER. Up till now the power was derived from a small 4-volt accumulator, but it is too small capacity, and the motor can stand 6 volts on fairly short runs such as I require. I want to try bichromate cells, but having tried small ones of my own construction already, I was very unsuccessful, the current being very intermittent. I would be very much obliged if you would answer me on the following questions:—(1) Would an arrangement of four cells, as shown in sketch, be the best, or would three cells in series be sufficient? The cells I want to use are those supplied by the Universal Electric Supply Co.—bichromate with lifting zincs (as described in November 15th issue, page 240, of THE MODEL ENGINEER), price 8d. each. (2) Could you tell me (approximately) what current in amperes this cell would give? (3) Could you tell me (approximately) what current in amperes the motor should take at 6 volts? (4) Working about two hours per week how long should bichromate solution last? (5) Would a layer of oil, like that used in the Edison-Lalande cell, make solution last longer by excluding air, or would the oil soak into carbons? (6) Does pouring solution into bottles and corking it up preserve it when not in use? (7) What is the least amount of solution that could be used per cell?

(1) Your arrangement would give you 4 volts. If you used three cells in series you would get 6 volts but a smaller capacity. (2) Not more than 2 amps. for a short time. (3) Not without knowing more concerning the motor, but if similar to the one described, or rather reviewed, in June 1st, 1902, she will take about 2 amps. (4) About six to eight hours. (5) No; there would be no advantage—rather the contrary. (6) It will not deteriorate with standing if not in use. (7) See handbook—"Electric Batteries" for further information.

[10,255] **About Accumulator Charging.** J. D. (Limerick) writes: I have constructed an 8-volt accumulator. The plates are 3 by 5 ins., two plates in each cell. Could you kindly tell me—(1) What would be the capacity of this size accumulator? (2) How many amperes would be required to charge it? (3) The time it would take to charge? The plates were made from sheet lead, 3-16ths in. thick, and had a large number of ⅛-in. holes punched in them, each of which had to be countersunk on both sides, which was a very troublesome job. I tried to cast them in plaster of Paris moulds, as directed in your handbook—"Small Accumulators"—but each time I poured the lead in it would bubble and splutter about as though the mould were damp. The moulds were thoroughly dried each time before the lead was poured in. I even enlarged the air-hole, thinking that might be the cause, but with the same result as before. (4) Would it cost much to have iron moulds made? (5) Would the patterns be made in wood, wax, or plaster of Paris? I also have a small pocket accumulator, 4 volts 2 amp.-hours capacity, which I charge with five pint size Leclanché batteries. (6) Is the accumulator fully charged when the negative plates begin to give off a great number of small bubbles? I have left it charging for twenty-four hours, but the acid never turns milky. (7) What causes this? For it says in your handbook that it should turn milky. (8) Would it matter if I used a 3-volt lamp with a 4-volt accumulator; would the extra voltage injure the lamp?

(1 and 2) Count 15 amp.-hours per sq. ft. of positive plate area. Charge at the rate of 4 to 5 amps. per sq. ft. of positive plate area. (3) Give cell 1 amp. for nine hours. (4) No, not much. Probably some local smith or engineer would do the job. Metal moulds are more satisfactory to use. (5) Patterns made in wood, but the moulds *could* be made from the plate metal, chipped and filed out to shape. (6) Not always. (7) It will generally if acid is pure and of correct density. (8) This slight difference would not make much difference in the life of lamp. It would burn more brightly and have rather shorter life.

[17,104] **Model Locomotive Firing.** W. S. (Dublin) writes: I wish to fire a boiler with oil or benzoline, if possible. It is the same size as Mr. Greenly's ½-in. scale N.E.Ry. given in his book, with the difference that the firebox is 1 in. shorter, to make room for cranked axle. I have tried the 6-wick lamp, but I find the consumption of spirit excessive. I got a Primus burner, 1½-in. size, and was trying some experiments with it, but I could not get it to burn without smoke. Of course, I only had a makeshift container, made with a carbide tin and cycle valve. Would it be possible to modify Primus burner so as to fulfil the following conditions:—To throw the heat more upwards towards boiler instead of against the sides? To burn without noise or smoke? If this burner would not suit, could you give me a sketch of any arrangement that would? Also correct size of piping to use. By the way, the harder I pumped the container the worse the smoke got, until it eventually went out. There are three points I would emphasise, viz., I do not want noise or smoke; also not to have a light under tender; to work, if possible, without pump.

The only thing we can recommend is a small benzoline or petrol burner on the lines of that described in our issue of April 27, 1905, page 387. A small Primus burner (1½-in., non-silent) is hardly suitable for a ½-in. scale model. The above burner should entirely fulfil your requirements. It makes very little noise, gives a vertical flame, and does not, of course, require any vaporising light. It is impossible, however, to do without a pump, but this need not be connected to the tank. Fit a Lucas cycle valve to the container, and use an ordinary tyre inflator. A Primus burner should burn without smoke.

[10,863] **Small Motor Failure.** A. C. (Glasgow) writes: I have made a small motor on the 10-watt design in your handbook—"Small Dynamos and Motors." The field-magnet I made in wrought iron—bobbin part 1 in. diameter by 1½ ins. long, and wound this with 8 ozs. No. 22 D.C.C., well insulated. Armature I have cut out of a piece of soft iron, 1½ ins. diameter, with six slots, and wound with 1½ ozs. No. 22 D.C.C., with 6-part commutator. This armature runs well between the poles of a permanent magnet, 4 volts. I joined in shunt with field and gave it 6 volts. It would not move, move the brushes as I liked. The current seems to go through the field only, magnetising it so that I can hardly turn armature round. I tried it in series, but not much better. I think I must increase the resistance of the field by putting on a smaller wire. How much and what size? Any other cure you may be able to suggest will be carefully tried. Air-gap is just right. I have tried it as a dynamo, running it between 4–5,000; no effect.

When starting a shunt-wound motor, the field coil circuit should be made before current is allowed to flow into the armature. When both armature and field are switched on simultaneously, the armature tends to become locked and will not start readily; this appears to be the cause of your trouble. Try lifting off one of the brushes so as to break the armature circuit, then switch on the field current, and, lastly, drop the brush on the commutator. As you are using a wrought-iron field-magnet, No. 24 gauge wire would probably be an improvement for the field coil. It is very doubtful if you will be able to get your machine to work as a dynamo. The wrought iron holds very little permanent magnetism, consequently the machine does not start up. You could separately excite the field by means of a battery and then you would obtain current from the armature if driven by a belt. To give the machine a chance as a dynamo, the armature should be re-wound with No. 26 silk-covered wire, and the fields wound with No. 24 gauge wire.

[10,837] **Small Spark Coils.** B. G. (Plymouth) writes: I have frequently seen very small coils giving only about 1-16th in. spark, apparently of French or German make, and costing about 5s., lighting small vacuum tubes, about 4 ins. long. I wish to make a few of these small coils, and should be obliged if you would give me the following particulars. (1) Length of core. (2) Diameter of same. (3) Gauge of primary. (4) Number of layers of same. (5) Gauge of secondary (presumably No. 36, as usual): and also (6) amount of secondary wire to use for each coil. (7) Size and number of the sheets for condenser. I have referred to your handbook on Coils, but the tables of particulars do not refer to coils below ½ in. These coils I wish to make are only for lighting small 4-in. tubes, or even 3-in. (8) Are there any back numbers of your paper dealing with small coils, and, if so, will you state the dates?

The small coils referred to are made in large quantities, the secondary being wound with bare wire with an air space between each turn and thick paper insulation between each layer. We doubt if it is worth your while to attempt to imitate these coils, as they are machine wound. We advise you to make the smallest size given in our handbook—"Induction Coils"—viz., ½-in. spark. You will have a better chance of success. If you preferred it, you could reduce the proportions to some extent, say, core ½ in. diameter by 3 ins. long; bobbin ends, 2½ ins.; gauges of wire the same. Observe the precautions mentioned in Chapter IV. The secondary can be made in two sections only, or even one section. You must remember to make each layer of wire slightly shorter than the previous one, so that the mass of wire tapers towards the centre from each end. Make the first condenser in several portions and add them until you obtain the best effect. Use three layers for primary.

[17,200] **Model Steamer Machinery.** Q. F. S. writes: I have a model cargo boat hull, 44 by 4½ by 6 ins. deep, which I wish to fit with engines. Kindly give me the following information:—(1) Would an engine with single cylinder, 1 in. by 1 in., 1,000 r.p.m., at 45 lbs. per sq. in. boiler pressure, be sufficiently powerful to drive boat at a reasonable pace in calm water? (2) Would a boiler about 4 ins. diameter and 12 ins. long supply steam for above engine, if fired by an oil blower? (3) Would it be necessary to have a feed pump for the boiler for a continuous run of about one hour? (4) What size propeller would be suitable for the boat, approximately? (5) Is a stuffing-box necessary for the propeller shaft?

(1) An engine of the size you suggest will prove too large for the boat. Fit a single cylinder engine, ⅞-in. by ⅞-in. (2) Yes. Use a benzoline or petrol lamp. (3) Yes, we think so. Gear the pump to run 3 or 4 to 1 of the engine shaft. The plunger may be ¼ in. diameter by ⅜-in. stroke. Fit a by-pass to regulate the feed supply. (4) Propeller, 3 ins. diameter. (5) Yes, or else some efficient substitute.

[12,159] **Coils for Motor Bicycle.** D. R. D. (Dublin) writes: I shall feel much obliged if you will be good enough to explain how I should connect a coil and accumulator for motor bicycle. The coil is a B. and M., round, the accumulator is an 18 amp., Minerva pattern (both by Brown Bros.). I have had it connected up as per sketch (not reproduced), the wires being short and almost straight from each point. The accumulator did not stand for any length of time when I had to have it recharged. The same thing happened a second time, so I thought there must be something wrong. I have both enclosed in a tin box clipped to top bar. The accumulator terminals are about ½ in. away from cover, which is also of tin.

Your connections appear to be correct. The makers will give you a diagram if you write to them. There should be a switch in the battery circuit to cut off the current when engine is not running; this switch should be placed between the black terminal and the frame (you might try the effect of changing over the black terminal to P in place of the red one). If the connections are correct, the cause of the accumulator running down may be that you do not get the engine running before switching on the battery current: that you leave the machine standing without switching off the battery current; that the accumulator is absolutely new and does not hold its charge very well. If this is the case, it will improve with each successive charge; this is frequently the case with new cells. If the battery current is not switched off by an independent switch, the contact-breaker may be resting in contact when you are not riding, and thus wasting the current. Even a very slow contact, such as will occur if you are walking the machine, will waste the current to a considerable extent. The contact should be made and broken instantaneously. The connecting wires should be examined for faulty insulation; leakage can also occur by reason of the machine being thoroughly wet.

[17,247] **Charging Cells of Different Capacities.** W. C. (Edinburgh) writes: Would you kindly assist me in the matter of charging small accumulators. I have very often accumulators of different charging capacities to charge, and would like to know if it is possible to charge two or more at the same time. Say I have one taking ½ amp. and another that requires 2 amps., can I do this by charging through the same lamps? Of course, I could do it by burning separate lamps for each size of accumulator, but this comes more expensive than if I could charge the different size accumulators at the same time and through the same circuit of lamps. If it cannot be done by lamps, could you tell me what is the next best thing to do in a case of this kind? It is a 230-volt pressure that I am using.

Arrange a sufficient number of lamps to send a current that will suit the smallest cell to be charged in the group. This cell will, of course, become charged first—*i.e.*, before those of greater capacity—and will then be taken out of circuit and the others left charging till fully charged. Read the recent query replies on this subject, and you will have no difficulty in arranging your cells.

[17,193] **Model Locomotive Firebox.** W. H. A. R. (Sheffield) writes: I should be glad if you would say what you consider the smallest practicable fire-heated locomotive boiler. Please give dimensions of same, especially of firebox.

A firebox 2½ ins. by 4 ins. will be found quite satisfactory if fed with good coal, or, better still, the half burnt embers of good coal See "The Model Locomotive," by H. Greenly, price 6s. net, 6s. 5d. post free.

[17,199] **Model "Lady of the Lake" Locomotive.** T. A. (Manchester) writes: I am about to build a L. & N.W.R. Company's single locomotive No. 1 and named "Saracen." Kindly let me have—(1) Drawing of elevation to ½ or ¾-in. scale. (2) What would be the width of the inside and outside shells in a water-tube boiler of ½-in. scale? (3) Number of spokes in wheels. (4) Would two outside cylinders do for same? (5) Would it be a suitable locomotive for a beginner to model? (6) What pressure should the safety valve be?

(1) You will find a drawing of the "Lady of the Lake" class in our issue of November 17th, 1904. (2) For a ½-in. scale engine (2½-in. gauge), a 2-in. outside shell and 1½-in. inside barrel may be used. (3) See drawing above mentioned. (4) Yes; 7-16ths in. by 1 in. (5) The boiler is rather small, but in spite of this you ought to make a success of it. (6) Press to 50 lbs. per sq. in.

The Editor's Page.

WE have been called to order by the *Birkenhead News* in the following editorial note :—" It is not often that that excellent publication THE MODEL ENGINEER AND ELECTRICIAN is caught napping, but surely an error has been made in this week's issue. In an illustrated article, headed 'The Latest in Engineering,' are described electrically-controlled tramway points. The article commences thus : 'For many years there has been a need of some apparatus on electric tramway lines to do away with the services of the point boy. This problem has now been successfully solved by the electric point shifter. . . .' We would point out to the writer of this lucid article that two electrically-controlled points similar to that described in the article have been in use in Birkenhead for almost two years. One is situate at the corner of Hamilton Street and Conway Street, whilst the other is opposite the end of Bridge Street. The points, which are Dixon's Patent, work very satisfactorily, and save the Corporation a great deal of money, as the automatic arrangement does away with at least four point boys." We stand reproved, and congratulate Birkenhead on being ahead of the times in its tramway details.

* * *

Although a considerable number of readers wrote us recently, urging that we should open our Queries and Replies column to replies from readers, we have, strangely enough, received very few communications for insertion in the extra space we agreed to allot for this purpose. We do not quite know whether to regard this as a compliment on the excellence of our own replies, or whether those who supported the proposal referred to really meant that it was the " other fellows " who were to come to the rescue and not they themselves. Time will doubtless show.

Answers to Correspondents.

A. T.—Write to the Secretary, Miniature Railways of Great Britain, Ltd., Newland Chambers, Northampton.

F. T. (Shepherd's Bush).—The whole tunnel is lighted by these arc lamps. Air is compressed by motor-driven air-pumps. For connecting motor up so as to run from the mains, see recent query and replies. Connect it in series with one 16 c.-p. 100-volt lamp.

H. F. V. (Ealing).—We have no particulars of this make, but probably some of our electrical advertisers would supply you.

A. H. T. (Bromley).—We think you would get a satisfactory course of correspondence instruction through the Institute you mention.

A. F. (Muswell Hill, N.).—See articles in Vol. X on " Metals and Alloys," by C. F. Townsend.

A. LOVE.—We thank you for the correction.

R. H. (Birmingham).—Thanks for your letter; but we cannot see our way to publish the same.

W. R. G. (Larkhall).—Your idea is an old one, we regret.

H. S. (Rock Ferry).—Try Cotton & Johnson, 14, Gerrard Street, Soho, London, for the tungsten steel you require.

O. H. W.—Daniel cells or bichromate cells would do. Four of the former (large size) in series would answer; or, two large bichromates in series.

H. T. (Cricklewood).—Current is taken by an insulated wire direct to the switch, which, when closed, allows current to flow in the armature.

C. J. P. (Dorking).—See our issue of November 10th, 1904, for a drawing of the G.N.R. 8-ft. single locomotives.

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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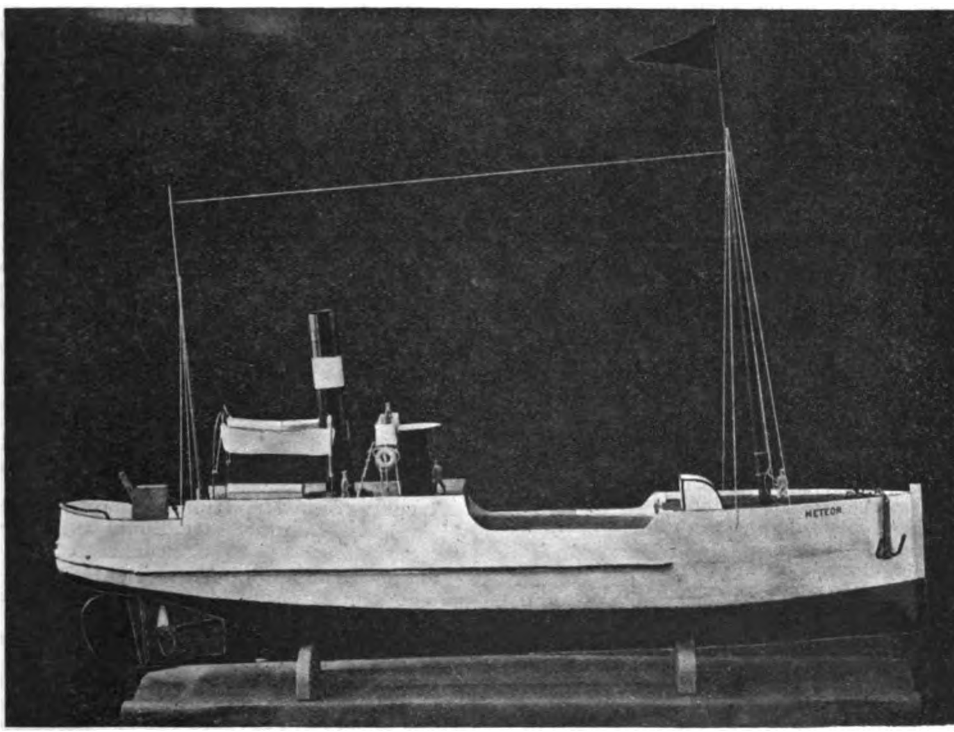
An Electrically-Driven Model Cargo Boat.

By M. G. CARTER.



MR. M. G. CARTER'S MODEL CARGO BOAT.

THE following is a description of my latest model, in which I have endeavoured to try electricity as the motive power for a small boat. This boat was designed to have a large carrying capacity, with a fair speed, and has been a great success. The dimensions of the hull are :— Length, 3 ft. 6 ins. ; width, 8 ins. ; depth at the waist, 6 ins. She is built mainly of Venetian blind lath, cut into planks about ¾ in. broad at the widest part, and each plank runs from stem to stern. There are six ribs, cut out of mahogany, and only one cross-piece being left in—amidships, the false keel and rudder-post being fixed after the stern tube was put in. The deck was made of picture backing, and is made to take out in sections. The bridge, deckhouse, boat davits, and funnel are all fixed to the deck. The bridge rails have a canvas wind shield and an iron wire ladder. The two lifebuoys are made with rubber rings painted white, and the boats are blocked out of cardboard. The funnel is made of tin and screwed to the deck. The forward hatch is of wood, with a cardboard top; the deck and masts were stained and varnished after all the fittings were put on.

The stern tube has no gland, but has an extra long bearing; and the propeller shaft, which is 3-16ths in. diameter, made of silver steel, was ground into the stern tube with fine emery and oil, afterwards being well washed out with petrol and filled with melted grease, and no water whatever comes up the stern tube. The propeller is 2 ins. diameter, made from a brass casting. It is fitted with a very powerful motor, made long and low. The motor has eight segments to the commutator, and works well with 8 volts. To drive it, two 4-volt accumulators are used, each having a capacity of 25 amp.-hours. The total weight of motor and accumulators is 24 lbs., and when going straight the boat travels about 4 miles an hour.

Of course, the bows are very bluff, but it makes her very steady in rough water, and having a quick run towards the stern, thereby balancing the bluffness of her bows. In the stern will be seen the switch. The small sailors were bought at a toy shop, and when the boat is on the water they add a very lifelike appearance to her. They are, of course, glued on. The anchor is made of soft iron, and has a joint like the usual stockless pattern.

The hull received nine coats of paint, the upper part being white, and below the water, bright red. If electricity is used in this way, it is very satisfactory as a motive power, and much cleaner and quieter than steam.

Notes on Making Small Hexagon Bolts and Nuts.

(*Continued from page 127.*)

Mr. Hilton Bradshaw.

The following is the method I once adopted when having to make a very considerable number of odd bolts and nuts, ranging from 1-32nd in. to 3-32nds in. of various lengths. After obtaining hexagonal steel rods of suitable sizes, I made the following tools before attempting to proceed with the work:—

(1) Running-down tools to fit in poppet of lathe, of suitable sizes, as per sketch, with set screw fitted in end of rest for setting length of bolt. (Fig. 1.)

(2) Parting tools, made so as to give the necessary chamfer to the bolt head before finally cutting off the bolt. (Fig. 2.)

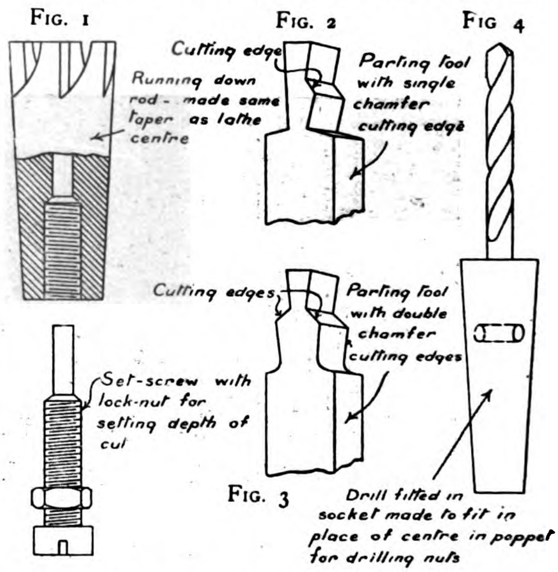
I then proceeded as follows: Held the steel rod passed through the lathe mandrel in a good chuck, ran down with poppet, screwed with screw slab, and parted off. Then proceeded as before.

The nuts I made in a similar manner, using a drill instead of the runned-on tool (Fig. 4), and parting off with a parting tool made to chamfer on each side before finally cutting off. (Fig. 3.)

Mr. A. Astin.

Small bolts and nuts, B.A. screws, terminals, and finials, and other similar work, as used in the manufacture of small mechanical and electrical apparatus, are now exclusively made in the factory on the small wire-fed semi-automatic capstan lathes; these lathes having superseded the old French and Swiss screw-making lathes, which required a certain amount of skilled labour for their operation. The English makes maintain their supremacy over American and German machines in their ability to stand the strains and abuse of the unskilled operative, who, more often than not, is a youth having no previous knowledge mechanically. Their operations, being of an automatic nature, it is not surprising to find on the market an entirely automatic lathe, which requires no further attention—having once set the tools and stops—with the exception of replenishing the raw material, usually rods of steel, brass, or ebonite from 3 to 6 ft. in length.

A description of a capstan lathe, similar in design to a "Bradbury," is a typical example of machines in use generally. Essentially, it is a turning lathe, differing only from the plain lathe in its adaptability



Illustrating Mr. Hilton Bradshaw's Method of Making Small Bolts and Nuts.

for repetition work. These capstans have usually 6-in. centres on 3-in. straight beds, large hollow mandrels fitted with interchangeable "draw-in" chucks, and actuated by a lever and clutch fitted on rear end of headstock. The use of draw-in chucks enables the operator to withdraw a length of rod from the chuck sufficient to form the bolt or nut as the case may be, and to tighten same in position without stopping the lathe. A headpiece having a female cone centre (marked R in Fig. 1) is also fitted to slide over a circular bar, which is screwed to the back of the headstock and keywayed for its full length. A wire rope fastened to the headpiece passes over a small grooved pulley to which a weight is attached, provides the necessary movement when feeding the rod. The cone centre in R, fitting over the end of the rod, pushes the rod through the chuck when the latter is opened by the lever N, and actuates the forked clutch of the draw-in chuck.

In place of the ordinary compound slide-rest of the turning lathe a slide is used having one traverse only. This is worked backwards and forwards on its slides by the hand-lever O. To this slide is attached a capstan or turret toolholder capable of holding six round-shank tools set out equally around its sides, the setscrews clamping the tool into the capstan-head. From the under side of the head a circular projection passes through the sliding portion of the rest, and is held in position by a collar and lock nuts, thus allowing the head to swivel round. To rotate this head automatically, a six-toothed ratchet wheel is keyed to the aforementioned projection, a spring pawl being attached to the fixed portion of the rest. On the backward movement of lever O the pawl engages the ratchet wheel, which, being free to rotate, is each time carried round the proper distance. A piece of flat iron extends from the back end of the sliding portion of the rest, and has its end bent to right angle (P). A screwed rod is fixed to the fast portion of rod, and is allowed to pass through the bent portion of the flat bar; two nuts are screwed on, and act as stops to the traverse of the slide. The tools used in this capstan head deal only with the pivoting, screwing, drilling, and tapping on the rod, all other work being carried out by the parting rest. This rest is fixed in position between the fast headstock and the capstan slide, and has a rack and pinion motion operated by handle M. Two slotted tool posts are generally used with this rest—one post is fixed in front of the work; the other tool post is fixed in the back slots, the tool in this case being inverted. A stop Q, similar to the capstan stop P, is arranged at the back of this slide, which limits the depth of the cut. The lever K is fixed to bed on brackets, and actuates the quadrant E (Fig. 2) on the belt slipper. The countershaft has a coned drive to match headstock, and two loose and one fast pulleys. The fast pulley D is placed between the loose pulleys C C, and is twice their width; a pulley on the line shaft is equal in width to the fast and loose on the countershaft, and is coupled thereto by a straight and crossed belt. This provides a convenient arrangement for reversing the rotation for screwing and tapping.

The work is flooded with lubricant by a small pump worked from the line shaft, and feeds several capstans at once; the surplus is trapped and strained in the tray provided under the bed for catching the turned articles as they are cut from the rod. This tray has a hollow place in it covered with a fine mesh strainer, which is connected to a tube leading to the suction tank of the pump.

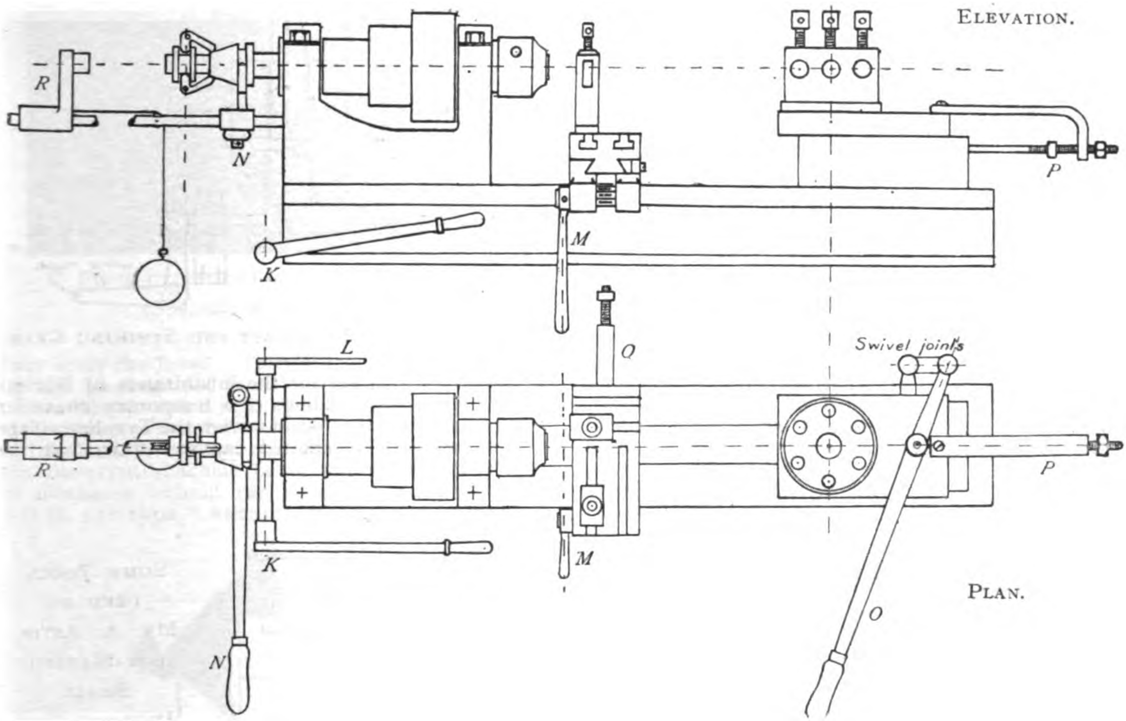


FIG. 1.—DIAGRAM OF CAPSTAN LATHE, SHOWING ARRANGEMENT OF LEVERS, ETC.

The chief tools for making small hexagon nuts and bolts are shown in Figs. 3, 4 and 5. The die-holder consists of two parts—the shank F, and the die-holder proper (G). Two pins are inserted diametrically opposite, so that when pressed together these pins engage. The shank F, being clamped in turret head, prevents the die-holder rotating, and allows for this rotation when the die is up to the shoulder of the bolt; the pin on the end of G engages the slot in F for withdrawing the die when the reverse motion is used. The tap holder is similar in design except for the screwed nose and split collets S P. A square-nose tool, similar to the square centre of the turning lathe, is used for centreing the rod for drilling and for removing the burrs afterwards. Twist drills, which are invariably used, are clamped in a holder to fit turret head. A shouldering tool is turned from round mild steel; flat cutters having slots in them are excellent for this work. Cast tool steel collets are inserted to act as steadies. Rose or cross pivot tools are used for finishing pivots.

Having set the tools and started the lathe, handle N is pulled towards the operator, the rod of mild steel inserted through the draw-in chuck, the female cone centre on head R engaging the end of the rod.

The distance tool in the capstan is butted up to the end of the rod, and by handle N the rod is locked in the chuck. Then lever O is operated, returns with shouldering tool in position, and so on, for the screwing and tapping. Having run a screwing down to the bolthead, the pins at the back of the holders are then disengaged, and the die continuing to rotate with the screw, preventing threaded portion being twisted off until handle K is depressed, thus shifting the belts and reversing the motion. Still keeping this handle depressed, handle O is pressed outwards; the stud and slot at the back end of the holder engaging, holds the die until it runs clear of the thread. On relieving K, the spring on belt slipper pulls the belt to their previous positions. Handle M is depressed to chamfer the head, and is raised to finally part off from the rod. The whole cycle of operations is repeated indefinitely till the required number is finished. These operations are carried on by the experienced worker with such monotonous rapidity that the casual observer would have difficulty to discriminate between the start and finish of a bolt or nut.

(*To be continued.*)

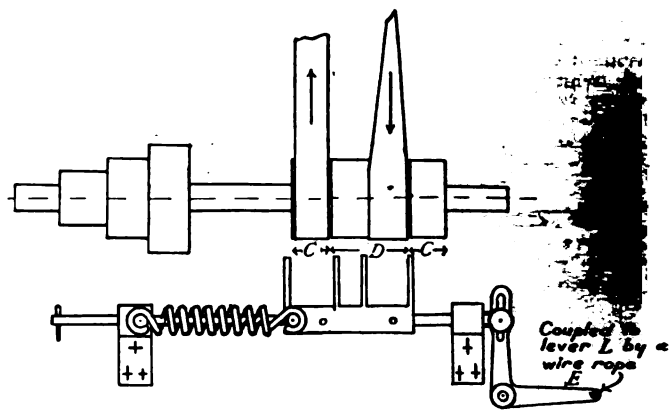
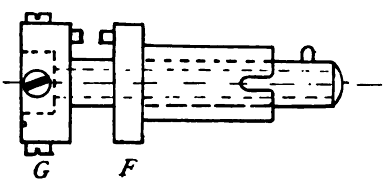


Fig. 2.—Arrangement of Countershaft and Striking Gear.

Fig. 3.—Die Holder.



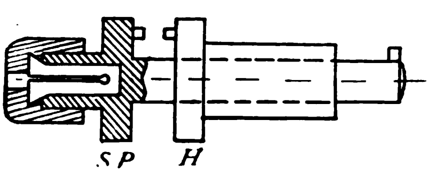
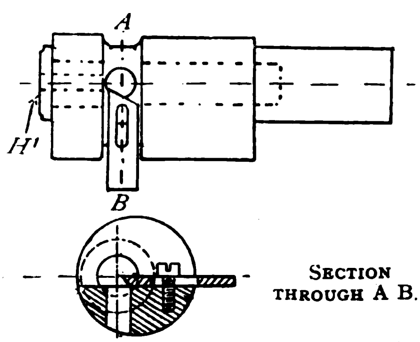


Fig. 4—Tap Holder.



Section through A B.

Fig. 5—Pivot Tool.

Some Tools used by Mr. A. Astin for Making Small Hexagon Nuts and Bolts.

The life of the mercury arc lamp in some cases amounts to 3,000 hours and more. The conducting material of the anode is either mercury alone, graphite and iron, or nickel.

A Model Engineers' Tramp Abroad.

(*Continued from page* 126.)

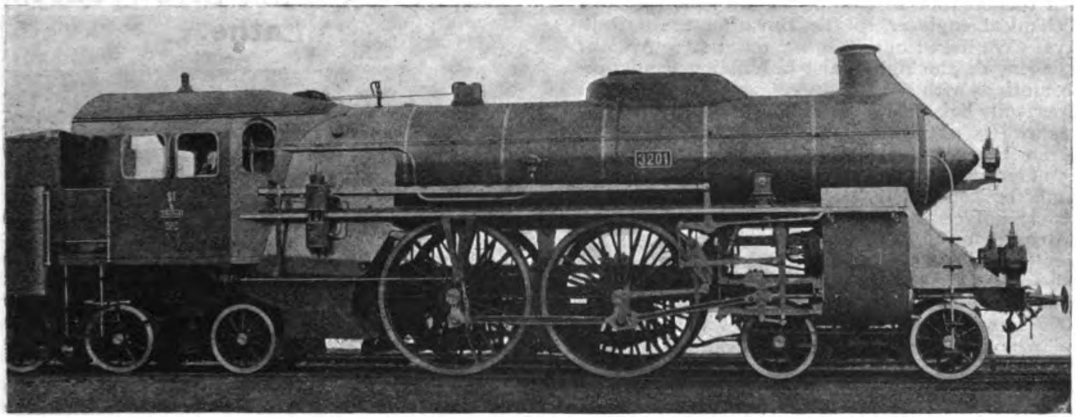
Our evening visit to the National Bavarian Exhibition at Dutzendteich ("Dozen-lakes") did not give us more than an opportunity for a walk through the well laid out grounds—which, by the way, are to become a permanent place of recreation for the inhabitants of Nuremberg when the buildings of a temporary character have been removed—and to view the Tyrolese village (this was not a painted canvas affair, but the "real" thing) and the splendid display of illuminated fountains.

On the following day we were able to find the exhibition buildings open, and, of course, in "doing the exhibits," as our Yankee cousins would say, we gave more particular attention to the railway and machinery sections.

The locomotives, which were all Bavarian—the entire exhibition being quite an exclusive affair—were exceptionally fine, and for the most part represented the work of the world-renowned firm of Messrs. Maffei, of Munich.

Both their largest and smallest were represented. Of the former class we illustrate the new four-cylinder compound locomotive designed by the Chief Engineer Weiss to run trains of moderate weights at speeds of 150 kilometres (94 miles) per hour upon the level. This engine,* as will be seen by the photograph, is a very large one, having twelve wheels and a high-pitched boiler. We have made a comparison between the external dimensions of this locomotive and one of our largest engines, the Bavarian machine being shown standing out in silhouette behind the outline drawing of the G.N.R. 251 type "Atlantic."

Messrs. Maffei's engines did not enter the speed trials on the experimental Marienfeld-Zossen line in 1904, but official records have since been made with one of their "Atlantics" designed for 75 miles an hour. The engine which was tested gave superior results to those tried on the above-mentioned course, and attained a speed of 90 miles per hour with a 138-ton train on a slightly raising gradient, this exceeding quite easily the anticipations of the designer.



FOUR-CYLINDER COMPOUND EXPRESS PASSENGER LOCOMOTIVE: BAVARIAN STATE RAILWAYS.
(Specially designed for high-speed service and built by Messrs. Maffei, of Munich.)

The new high-speed engine has, in common with all the latest Bavarian express locomotives, four cylinders, not arranged in the de Glehn fashion but all in line. The L.-P. cylinders are outside the frames, and the H.-P. inside, all connected to one driving axle, as in the "Webb" engines. One set of valve gear is also used. The reciprocating parts are exceptionally light, and every effort has been made to produce as perfectly balanced an engine as humanly possible. How far this result has been obtained may be judged by the very small amount of balance weight needed in the coupled. In addition, power has been striven for without adding unduly to the weight. For this reason bar

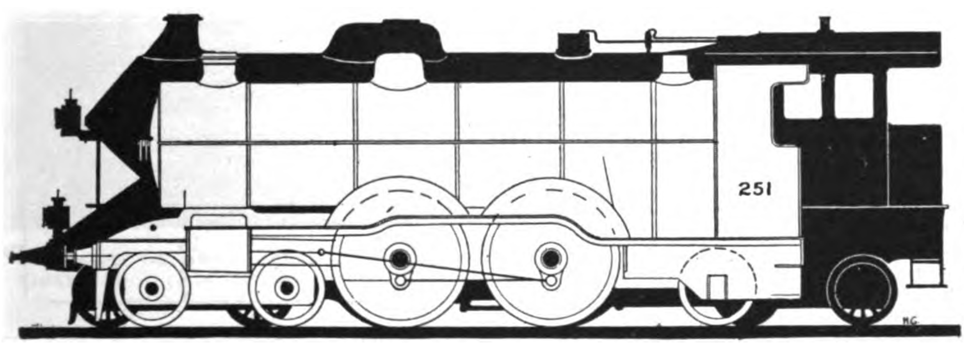


DIAGRAM SHOWING COMPARISON BETWEEN THE LARGE BAVARIAN ENGINE AND THE G.N.R. 251 TYPE "ATLANTIC" LOCOMOTIVE.

Although it is doubtful whether such speeds as 94 miles per hour are required by the traffic department of the Bavarian State Railways, we have no fear but that the designed speed will be obtained at the trials of this remarkable engine.

* See "The Locomotives of 1906," by Chas. S. Lake (1s. net), for full dimensions of this engine.

frames have been adopted, which incidentally permits the driver to readily see all parts without using a smoky torch-lamp, and also to attend to the moving parts without the necessity of getting under the locomotive.

As students of locomotive engineering, we were deeply impressed by this engine. Irrespective of the looks of the machine, and not forgetting the splendid work of our English locomotive engineers, we felt there was a distinct lesson to be learnt from this creation of Herr Eduard Weiss, the chief mechanical engineer to the Bavarian State Railways. We asked ourselves the question: Are our engineers on the right track in building ponderous locomotives with heavy moving parts, more or less imperfectly balanced? We think not, and although prophecy is not exactly our speciality, we are of opinion that, for high-speed work more particularly, the four-cylinder balanced locomotive, whether simple or compound we care not, will some day become universal. The heavy piston, connecting- and coupling-rods of the large-cylindered simple locomotives must go if the economical working of high-speed trains is to be one of the aims of the locomotive engineer of the future.

The locomotive in the Exhibition was fitted with the new "Staby" smokebox prevention device, which is now being rapidly adopted by the German locomotive authorities owing to the smoke trouble occasioned by the use of inferior coal, when an engine is standing at a station and any firing has to be done. It is found that just after firing, with the furnace doors closed, dense black smoke issues from the chimney for a short time. The reason for this is that insufficient air comes through the grate to effect complete combustion of the gases rising from the fuel, and the air does not become mixed with sufficient intimacy. Usually, also, when the regulator is shut off, dense smoke is given off, because, when the blast pipe ceases working, the weak, natural draught is insufficient to draw the necessary air through the grate. In order to prevent smoke formation a quantity of air, proportional to the amount of fuel to be gasified, should be supplied, and it is on this principle that the arrangement to be described is designed.

By means of two steam-jet blowers the air is blown into the firebox, the necessary steam being taken from a special reservoir of definite capacity. The latter is charged with steam to an extent depending on the movement of the fire-door and the regulator lever. The arrangement has the following advantages:—

(1) Controlled action.

(2) Simplicity of construction.

(3) It is completely automatic.

(4) Economical in steam consumption.

(5) No attention required on the part of the engine-man.

(6) Low first cost and maintenance.

(*To be continued.*)

Overhead Apparatus for a Barnes' 5½-in. Screw-cutting Lathe.

By S. E. Anderson (Cape Town).

HEREWITH is given a photograph and drawing of an overhead apparatus for use with my 5½-in. screw-cutting lathe, which I have just completed, and which may be of interest to some of your readers who have not added this useful gear to their workshops. The photograph which was taken inside the workshop with a very difficult light, the window being opposite the camera, shows the lathe and arrangement of the overhead apparatus. The drawing gives the dimensions, and I may here say that the drum would have been better if it had been 6 ins. longer.

The pulleys and drum are made from Australian jarrah, which takes a polish like dark mahogany, and which has the merit here of being very little more expensive than pine, though care should be taken to see that it is well seasoned. The pulleys are built up from three planks glued and screwed together, with the grain crossed, and the drum is turned down from a solid block of 5-in. square timber.

The frame is forged from 1-in. × ½-in. bar iron, with pieces welded on at the bosses to give sufficient metal to make a good bearing for the centres, thus considerably reducing the weight of the apparatus.

In order to further reduce the weight of the apparatus, I bolted an angle bracket of ½-in. bar iron to the frame to take the driving pulleys, thus avoiding the necessity of having a heavy shaft the whole length of the frame.

The centres are made from mild steel and case-hardened. If mild steel is used for the spindles, the ends should be bushed with tool steel.

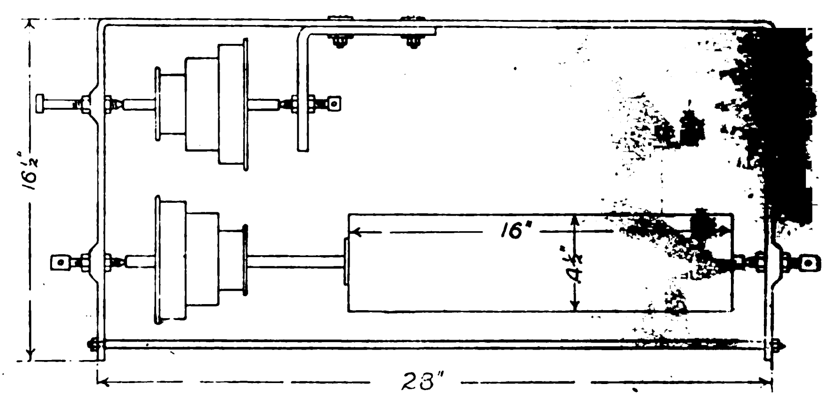


Fig. 2.—Plan of Overhead Gear. (*Scale: 1½ ins. = 1 ft.*)

My tension arrangement is, I consider, a considerable improvement on the usual method of utilising weights, with the consequent danger of these coming down with a run and damaging the lathe. A thimble slips over the front staybar, and a piece of strong cord or round leather belt (I use a "riem," that is, a piece of green hide which is used in this Colony by the farmers for the harness, and is very tough and strong) is spliced on to the thimble and carried by two pulleys to the back of the overhead and down to the window sill at the back of the lathe, the end being fastened

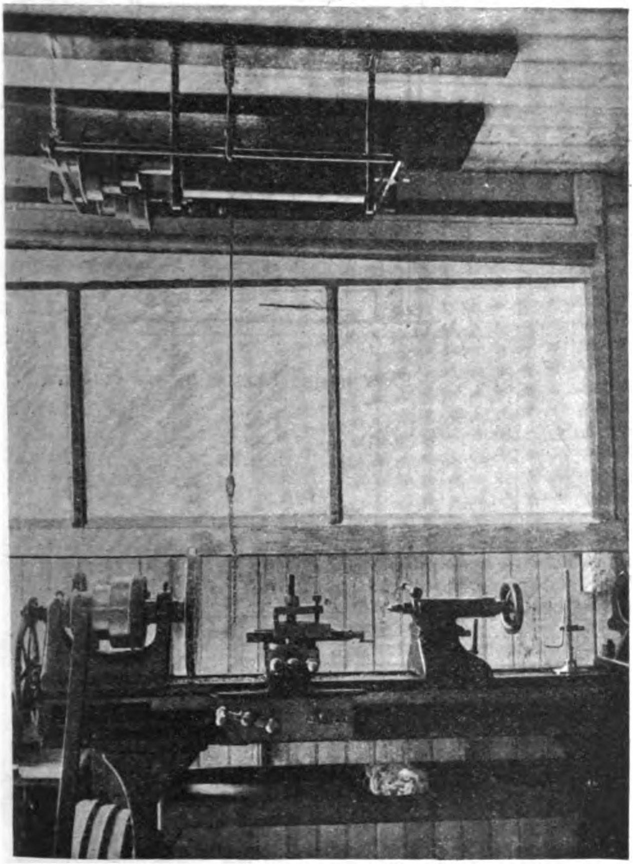


FIG. 1.—SHOWING GENERAL ARRANGEMENT OF OVERHEAD GEAR FOR A 5½-IN. SCREW-CUTTING LATHE.

to a fairly stiff spiral coil spring, which may be purchased from any ironmonger or motor sundries shop. To the lower end of the spring is fastened about a foot of small link steel chain, and the required tension is given by linking up the chain on a small strong hook screwed into the window sill. This is a very neat and handy arrangement, as it enables one to adjust the tension without stopping the lathe, if the belt from the drum is found to slip.

My apparatus, as will be seen from the photograph, swings in two bent iron hangers, which are bolted on to a 1½-in. jarrah plank, the latter being screwed to the roof rafters by four coach screws. This makes a very rigid job, though my ceiling and roof are not very strongly built.

To provide against possible mishap a safety chain is attached to the front staybar to prevent the frame swinging back against the window should the tension cord slip off the hook by accident. Two light iron hangers are also screwed on to the ceiling in such a position as to just clear the ends of the drum, to form a cradle into which the drum would fall should the centres by any chance work loose and allow the drum to fall out, thus precluding the possibility of damaging the lathe through any mishap to the overhead gear.

The centres, of course, have lock nuts and washers on both sides of the bosses of the frame. The drilling spindle, or milling appliance, is driven from the drum by means of a round leather belt, and travels freely as the slide-rest moves to and fro on the lathe bed. The apparatus is of simple design, and runs very smoothly and steadily.

COBALT.—Hitherto the only use for cobalt has been for colouring glass, enamels, and porcelain. A recent discovery has found it useful in the manufacture of storage batteries.

THE "HELION" FILAMENT LAMP.—With a new substance called "helion," Professor H. C. Parker and Mr. W. G. Clark, of Columbia University, expect to obtain a brilliant light with about one-third of the current required for the carbon filament. The new material consists largely of silicon. The substances are deposited from gas upon a thread of carbon. In some tests two filaments were enclosed in a single glass bulb, the one being the ordinary 16 c.-p. standard carbon filament, and the other the helion filament. When absorbing 38 watts the new filament gave a brilliant white light, while the carbon filament emitted only a dull red glow. As the power was increased to 55 watts, the old light changed from red to yellow and increased in brilliance until it reached 16 c.-p. The "helion" light at 38 watts was equal to 40 c.-p., and was a pure radiant white light. The new lamp would cost 10 cents more to make than the old one, but would last twice as long, and certain lamps actually tested had lasted from 485 to 1,270 hours. According to Professor Parker, the lamp that ran 1,270 hours was started at 37 watts and 37 c.-p. At the end of 200 hours it began to show an increase in candle-power, which continued until at 400 hours it showed 40 c.-p., with a consumption of 37 watts. Then the brilliancy declined very slightly, and sank at 500 hours to 37 c.-p. When the last reading was taken, after 1,200 hours, the photometer still recorded 35·5 c.-p., and the consumption had sunk to 28·5 watts. Though it has not been found possible to make the new filaments to show less than 30 c.-p., the inventors hope shortly to produce a lamp of 20 c.-p.

How It Works.

VIII.—Water Pick-up Apparatus for Locomotives.

(Continued from page 137.)

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

THE drawings (Figs. 14 to 18) show the detai's of the water pick-up apparatus designed by Mr. G. E. Robinson, chief mechanical engineer of the Great Central Railway, and employed on all modern locomotives running on that railway.

In this arrangement the use of steam is resorted to for operating the water scoop, which latter is connected by a link to an arm fixed to a transverse rocking shaft mounted on top of the tender.

Another arm on the rocking shaft is connected by a link to one end of a piston-rod extending towards the front of the tender, and the position of which is arranged to work in a fixed cylinder and the scoop passes through a vertically arranged tube extending through and secured to the tank of the tender. The piston-rod is extended beyond the piston, and is connected to a nut mounted so as to slide in a guideway, which prevents its rotation. Extending through and engaging with

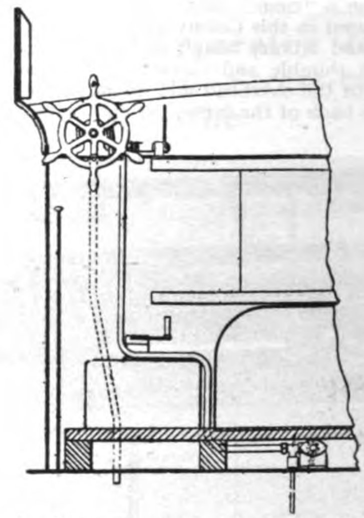


Fig. 16.—Part Front Elevation of Tender.

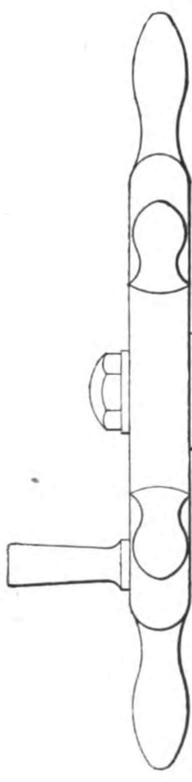
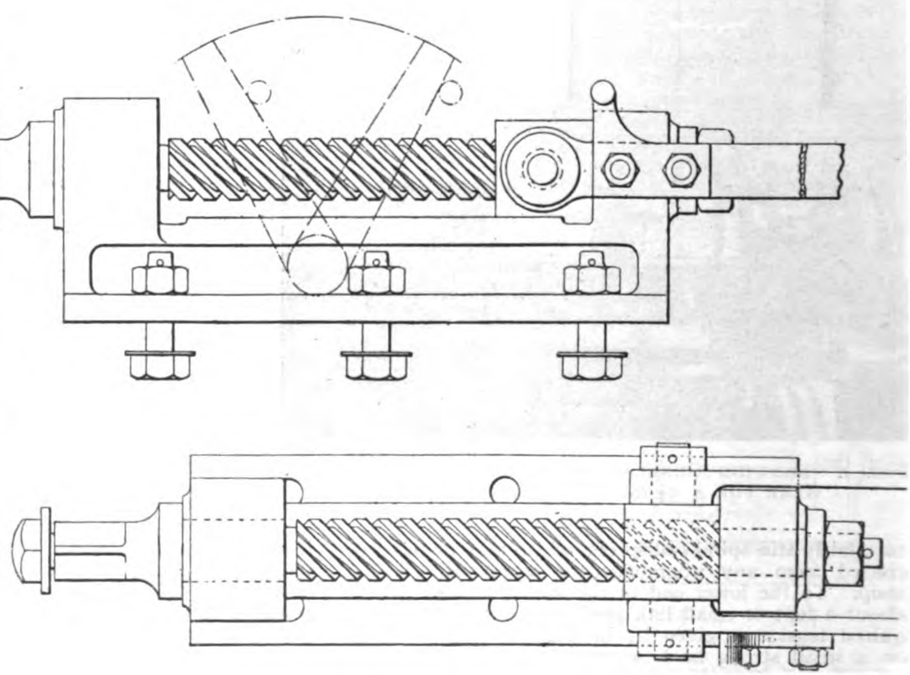


Fig. 17.
Elevation and Plan of Operating Hand-wheel.



Robinson's Water Pick-up Apparatus: Great Central Railway.

supplied with steam from the boiler. The two arms of the rocking shaft are arranged at an angle to one another, after the manner of a bell crank lever, and the connnecting-link between one arm this nut is a screwed rotary spindle, that is prevented from moving endways in its bearings, and is furnished at its front end with a hand-wheel conveniently located for operation from the platform

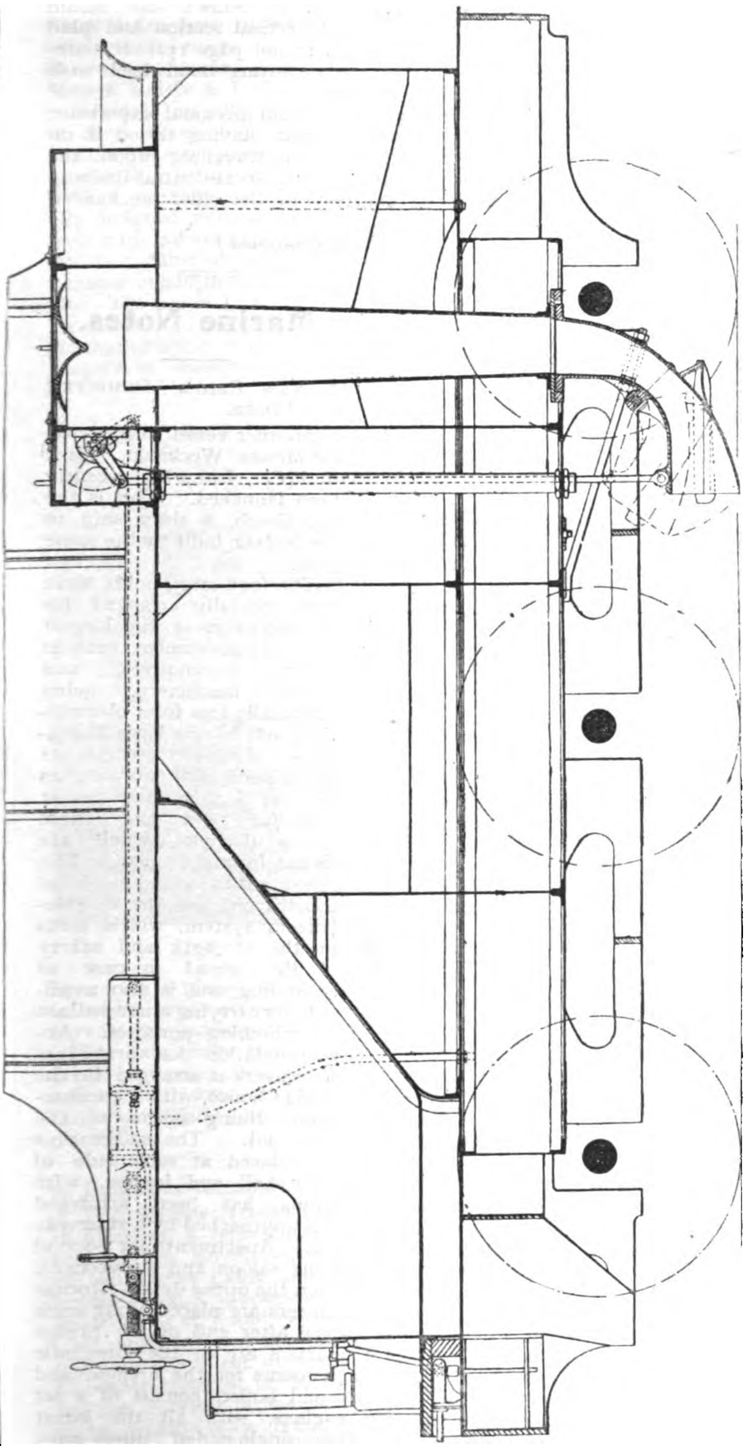


Fig. 14.—Longitudinal Section of Tender, showing Arrangement of Robinson's Water Pick-up Apparatus.

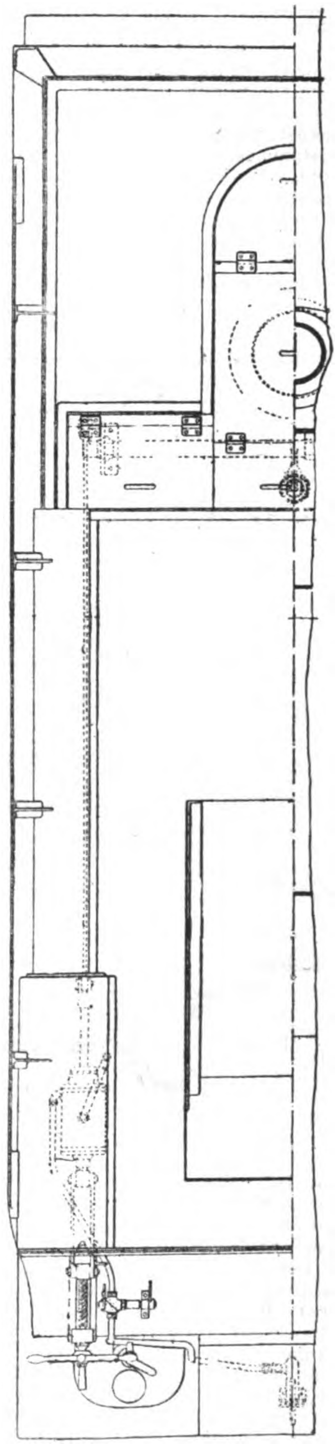


Fig. 15.—Half-plan of Tender.

of the tender. The arrangement is such that rotation of the screwed spindle will cause the nut to travel on its guide in a direction, and by means of the connecting gear, so as to move the scoop up or down in accordance with the direction in which the spindle is rotated. The steam admission port is near the back end of the cylinder, and the exhaust port is about midway in its length, so that the steam escapes before the completion of the piston stroke, provision (as, for example, a hole in the opposite end cover of the cylinder) being made for the free escape of air or steam from the cylinder on that side of the piston not acted upon by steam pressure.

The steam supply is controlled by a plug cock provided with a hand-lever whereby it can be opened to admit steam to the cylinder, and which hand-lever is so arranged that when the cock is open the lever is in the path of a tappet secured to the piston-rod in such a position that after the cylinder is open to exhaust, continued movement of the piston-rod will close the cock. The exhaust steam escapes into the atmosphere through a tube extending through the tank of the tender. The drawings accompanying this description of the gear are so clear as to be self-explanatory without further remark. Figs. 14 and 15 show in sectional elevation and part plan the general arrangement of the apparatus. Fig. 16 is a half-transverse elevation of the front end of the tender showing the relative positions of the handwheel, steam cock, etc. Fig. 18 shows the steam cylinder in longitudinal vertical section and plan respectively, whilst Fig. 17 (on page 152) is a detailed drawing of the operating handwheel with screwed spindle-nut, etc.

The writer can speak from personal experience of the efficacy of this gear, having tested it on numerous occasions when travelling upon the footplate of various classes of Great Central Railway locomotives by courtesy of the chief mechanical engineer.

(To be continued.)

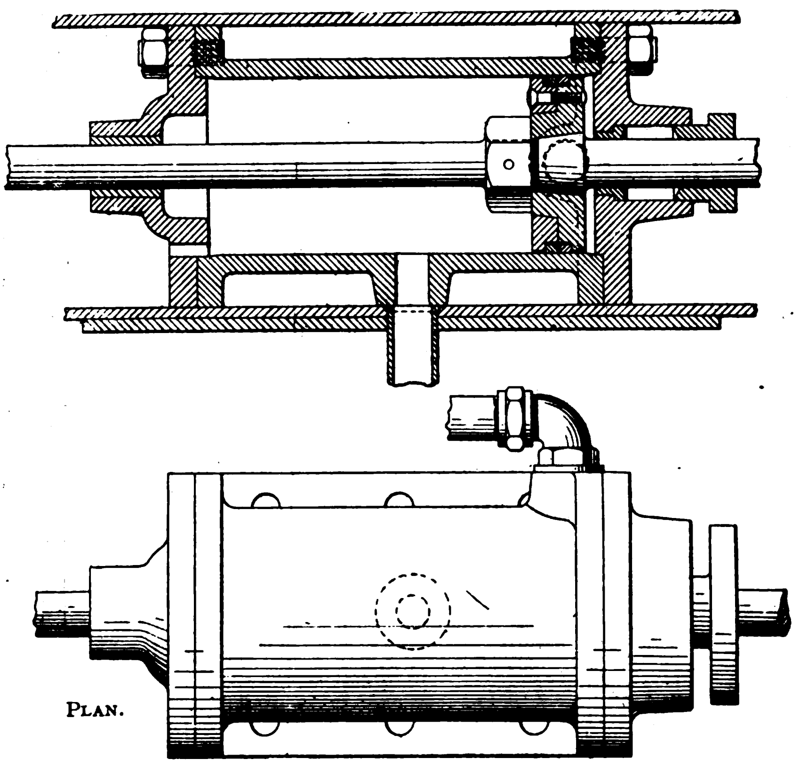


FIG. 18.—SHOWING THE OPERATING CYLINDER: ROBINSON'S WATER PICK-UP APPARATUS, GREAT CENTRAL RAILWAY.

Marine Notes.

A NEW ELDER - DEMPSTER LINER.

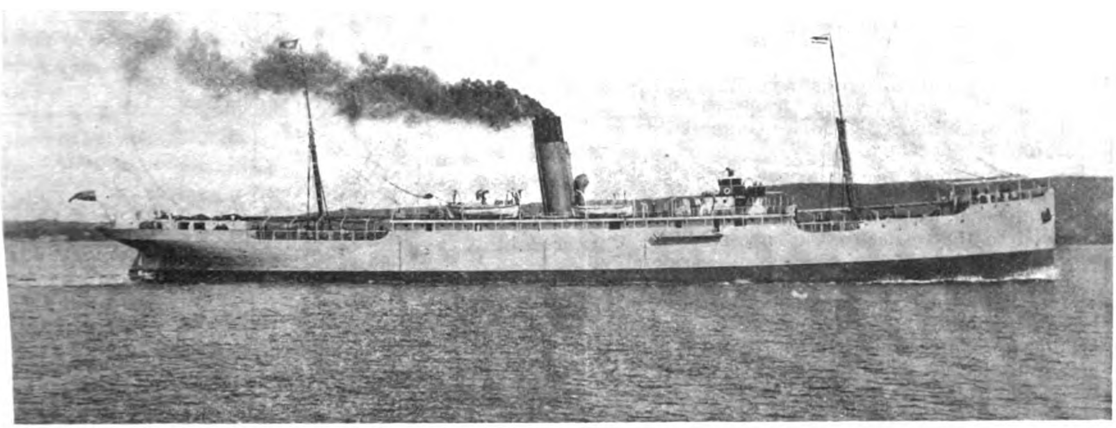
Another vessel constructed by Messrs. Workman, Clark and Co., Ltd., has recently been launched. This is the s.s. *Gando*, a sister ship to the *Salaga*, built by the same firm.

The four cargo holds have been specially arranged for the reception of the largest type of consignment, such as boilers, locomotives, and general machinery, being practically free from obstruction, and having large hatchways. Each of these hatches is equipped with two winches of the largest and most powerful type and three strong derricks, which are swung from the masts. The bottom of the vessel has been constructed on the double-bottom system, which adds to the strength and safety of the vessel in case of grounding, and is also available for carrying water ballast for trimming purposes. Accommodation for first-class passengers is arranged in the bridge house, with a commodious dining saloon at the fore end. The staterooms are placed at each side of the vessel. An entrance hall and lounge, with a smoking-room adjoining, has been arranged on the bridge deck, and is approached by a stairway from the saloon passage. Apartments for second class passengers, including saloon and staterooms, are arranged further aft on the upper deck. Rooms for the officers and engineers are placed along each side of the vessel at the after end of the bridge space. The crew's quarters are in the forecastle space, and include messrooms for the firemen and seamen. The engines and boilers consist of a set of triple-expansion engines, with all the latest improvements, and three single-ended boilers have been constructed in Messrs. Workman, Clark and Co.'s Queen's Road Works.

THE SS. "REVENTAZON."

The writer is indebted to Messrs. Workman, Clark & Co., Ltd., of Belfast, for the accompanying photograph—taken during the trial trip—of the fine screw steamer *Reventazon*, built by them for Messrs. Elders & Fyffes, Ltd. of London.

Mention has already been made of this vessel in these notes, but for the readers' convenience it may be well to repeat a few of the particulars previously given. The *Reventazon* is 389 ft. long, with a tonnage of about 4,000. She is specially designed, and built for the banana and general fruit trade between the West Indies and this country, and is capable of carrying over 65,000 bunches of bananas in addition to large consignments of oranges, etc. The cargo gear has been specially arranged for careful and expeditious handling of fruit cargoes. Accommodation is provided for a number of passengers in staterooms, saloon, and other public apartments placed in a large midship deckhouse, in which every necessary convenience for the comfort of the passengers is provided.



SS. "REVENTAZON." (*Built by Messrs. Workman, Clark & Co., Ltd., Belfast.*)

The machinery and boilers consist of a set of triple-expansion engines, with all necessary auxiliaries, and four steel cylindrical multitubular boilers, working under Howden's system of forced draught.

A FLOATING WORKSHOP.

The *Glasgow Herald* in a recent issue gave particulars of a remarkable vessel now being fitted out for the Royal Navy alongside the shipyard of Sir James Laing and Sons, Sunderland. This vessel—H.M.S. *Cyclops*—has a length of 460 ft.; breadth, 55 ft.; and depth, 40 ft. She is of 11,000 tons burthen, and her purpose is that of accompanying the Fleet at sea and by the aid of her elaborate system of appliances make it possible for the heaviest ordinary repairs to be effected to ships which may become disabled. The huge hatchways lead to decks below, extending almost for the full depth of the vessel, and among the different workshops to be found on board will be a foundry, a boiler shop, carpenter's, blacksmith's, and armourer's shops, a fully equipped fitting shop, and electrical and coppersmith's departments. A crane travels all round the ship, and the other equipment includes a large ice-making plant and a set of condensers so large as to be capable of supplying a fleet with fresh water if at any time that became necessary. All the machinery, cranes, etc., will be worked by electric motors, and wireless telegraph apparatus will be carried. The ship will be a floating workshop of the most completely equipped description.

THE GREAT CENTRAL RAILWAY COMPANY'S NEW TURBINE STEAMERS.

The steamers *Marylebone* and *Immingham* have been designed by Mr. F. J. Trewent for the Continental trade of the Great Central Railway Company; they have accommodation for seventy first class, twenty-four second class, and 300 third class passengers, besides 1,000 tons deadweight cargo, which is an almost unique combination for vessels of their size and speed. They are triple-screw turbine steamers, 282 ft. long, 41 ft. beam, with a moulded depth of 21 ft. 6 ins., capable of steaming 18 knots an hour, and have been built for the Grimsby and Rotterdam service, with the object of reducing the passage from about seventeen or eighteen hours to ten or eleven hours.

Mr. Sam Fay, general manager of the Great Central Railway, has kindly promised to provide a photograph of one of these vessels for the purpose of illustrating the same in THE MODEL ENGINEER.

LAUNCH OF ANOTHER CANTILEVER STEAMER.

There was launched recently from Sir Raylton Dixon & Co.'s, Ltd., Cleveland Dockyards, Middlesbro', the steamer *Sygna*, built with cantilever frames, her leading dimensions being 372·2 ft. × 52 ft. × 28·4 ft, moulded, and she will carry a deadweight cargo of over 7,400 tons on 23·7, with four exceptionally large hatchways 36 ft. long and 30 ft. wide, and perfectly self-trimming and unobstructed holds. The vessel will be equipped with ten powerful steam winches, eight derricks, hand and steam-steering gear, and will have six water-tight bulkheads, four boats, etc., and all the latest and most modern appliances for the rapid handling of cargo. In addition, she will carry an unusually large quantity of water ballast, located under the deck in topside tanks as well as in the double bottom end peaks.

She will be fitted with engines by the North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 26 × 42 × 70 × 48 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 engines will be placed aft in vessel.

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.*]

ELECTRIC BELLS, INDICATORS, AND AERIAL LINES. Translated and revised from the original by S. R. Bottone. London: Guilbert Pitman. Price, 2s.; postage, 2d.

For the amateur mechanic who knows nothing whatever of electrical matters the contents of this book will be of use, but the information which is conveyed to the reader in the space of some 100 pages should have been condensed considerably, and the value of the book would have been the greater. However, those who are interested in the subject, and who have not done any practical bell fitting before, will find much that will instruct them between the covers.

GERMAN SCIENTIFIC AND TECHNOLOGICAL READER. By E. Classen and J. Lustgarten. Book I and Book II. London: Harper & Bros. Price 2s. net each. Postage 2d.

So many valuable contributions to the literature of science and engineering appear in the German language that the student who can enjoy the advantages of such knowledge at first-hand has a long start of his less fortunate brother. As with most other languages, the reading of a scientific book in the German is not nearly so difficult a task as the reading of general matter, for a less wide range of words is needed, and there is in many cases a sufficiently close resemblance between technical terms in the two languages to render recourse to a dictionary unnecessary. These two readers provide graduated exercises in reading technical matter, and the examples given deal with physics, chemistry, dyeing, metallurgy, electrotechnics, and engineering. A useful vocabulary is included in Book I. In Book II the same range of subjects is covered, with the addition of spinning, and weaving, and brewing. Some slight previous knowledge of the grammar is necessary before these two readers can be usefully approached, but once this is acquired, the books under notice provide capital stepping-stones to the easy reading of almost any technical book or article.

A Design for a Model Marine Boiler.*

By DAVID SCOTT.

THE drawings herewith reproduced show a design for a water-tube boiler for a racing model boat about 6 ft. 6 ins. long, 7 ins. beam, and about 5 ins. deep, and to supply a D.A. engine (⅞-in. by ¾-in.) at a working pressure of 180 lbs. per square inch.

The steam drum is a piece of copper tube, 9 ins. long, 2½ ins. diameter, and 16 W.G., with the ends faced true in the lathe.

The water tubes are twenty in number, 7¼ ins. long, 5-16ths in. diameter inside, and 20 W.G., screwed as shown (Fig. 5) for the purpose of getting a more efficient heating surface. They will then

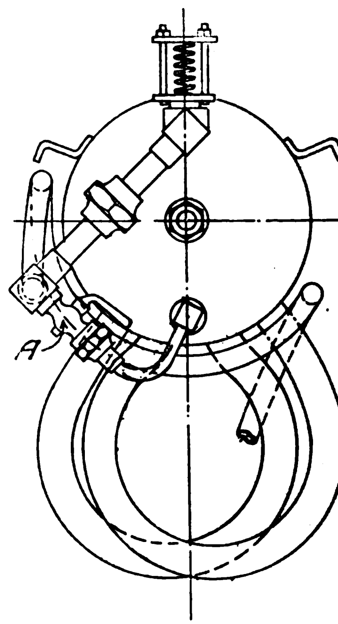


FIG. 1.—FRONT ELEVATION OF BOILER; CASING REMOVED.

be required to be softened, bent to shape, and fixed in position, the holes in steam drum being bored a tight fit to receive them, and then brazed from the inside.

The ends are brass castings, with bosses cast on for fittings, and turned with slight taper, driven into steam drum, and screwed up with a 5-16ths-in. brass stay passed from end to end, the shoulders being hard up to the ends of steam drum.

The ends are now ready for being bored and tapped for ⅛-in. copper wire, which is screwed in tight and riveted over; but before starting to bore, it is advisable to test the brazing with water pressure, for fear it is not done correctly. The ends should be lightly caulked when riveted up.

The steam pipe and superheater is a brass tube

*The prize of two guineas was awarded for this design in the recent Competition, No. 42.

FIG. 2.—LONGITUDINAL SECTIONAL ELEVATION.

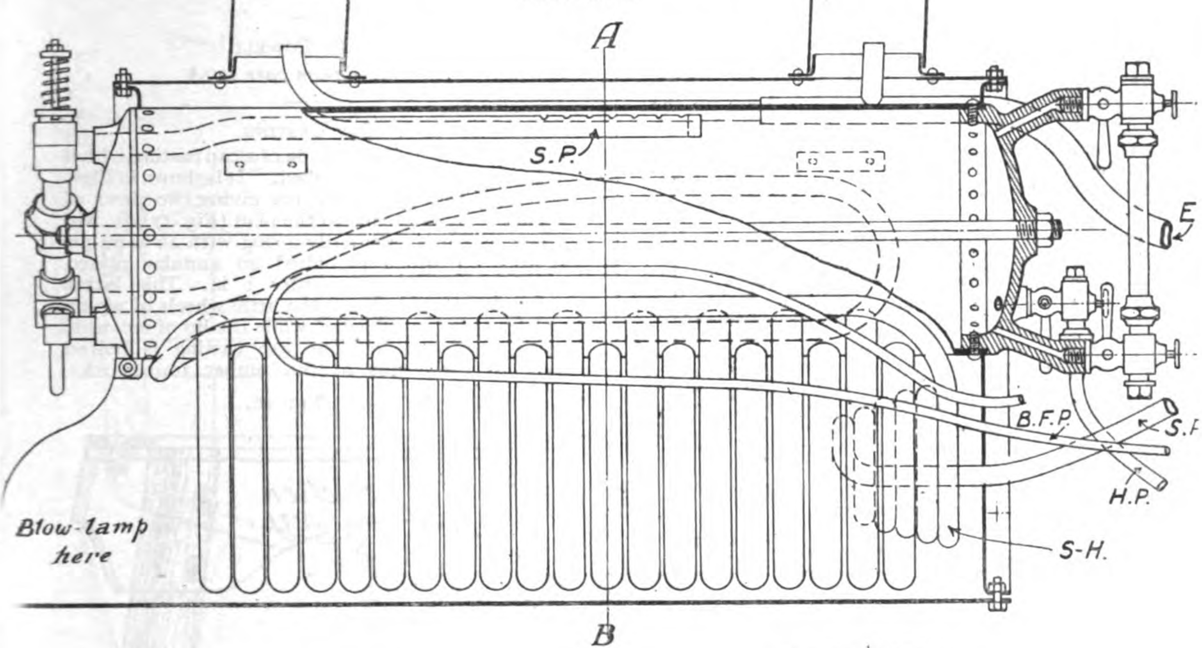


FIG. 3. CROSS-SECTION THROUGH A B.

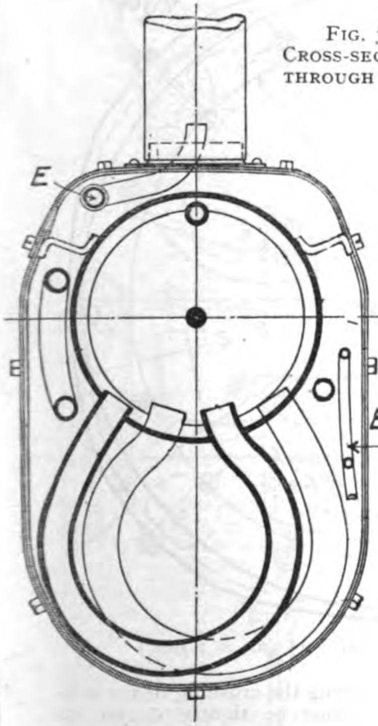
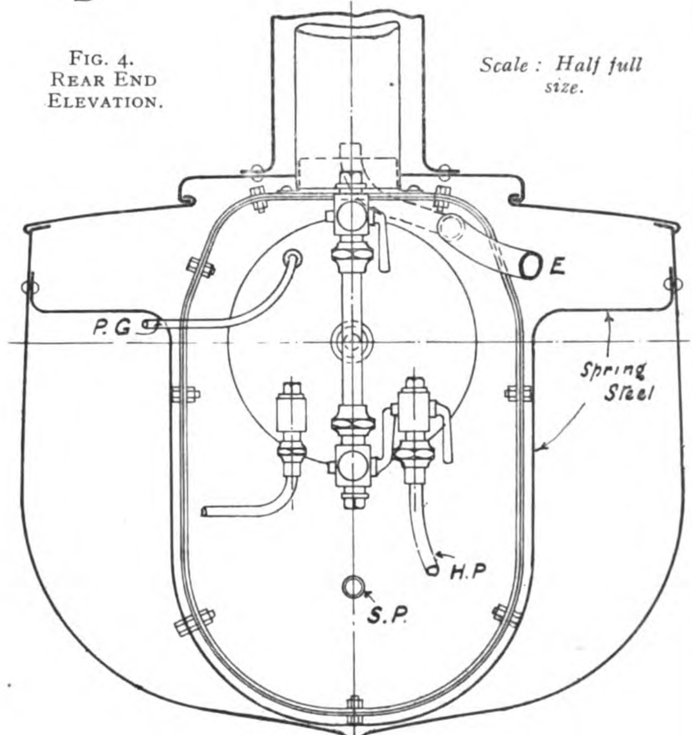


FIG. 4. REAR END ELEVATION.

Scale: Half full size.



DESIGN FOR MODEL WATER-TUBE MARINE BOILER.

By DAVID SCOTT.

¼ in. outside diameter, 22 W.G., and about 4 ft long, passing along the sides of boiler and then coiled into the after end of water tubes, so that the flame from blowlamp will be spread and strike it among the tubes.

As this boiler only holds about 1½ pints in working condition, a feed pump is required to keep up the supply, the boiler feed-pipe (B.F.P.) passing through the casing and along the side of boiler for a turn or two before going to the check valve, the water being almost into steam before going into boiler.

A hand-pump is required for starting purposes,

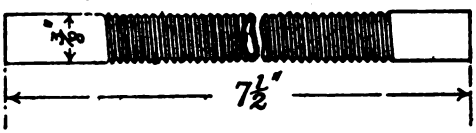


FIG. 5.—WATER TUBE. (*20 off thus.*)

and is connected to a separate check valve by the pipe H.P.; this valve should have a cock, as it is advisable to shut off when done pumping.

The cock A (Fig. 1) is for regulating the amount of superheat by allowing water to pass along with the steam, and being forced by the bands of the tube to come into contact with the almost red-hot metal, is quickly turned into steam.

The firing is done from the fore end by blowlamp, working at 30 lbs. pressure, the flame from which should be fairly thick, so that it fills the space made by the water tubes. The casing is made of very thin sheet brass, lined on the inside with asbestos, and bolted together, lugs being riveted on steam drum to hold it in position. As will be seen, the exhaust passes up both funnels.

The weight of boiler is made up as follows:—

Steam drum	..	1·5 lbs.
Water tubes	..	2·0 ,,
Steam drum ends	..	·8 lb.
Casing	..	·6 ,,
Superheater	..	·5 ,,
Fittings	..	·5 ,,
Total	..	5·9 lbs.
or, practically,	..	6·0 ,,

The heating surface is:—

Water tubes	..	140 sq. ins.
Steam drum		63 ,,
Superheater		33 ,,
Total	..	236 sq. ins.

The method of fixing the boiler in the boat is as shown in Fig. 4: a piece of clock spring (about ½ in. broad) is bent to the shape of the boiler at each end and carried out to meet the sides of hull, and fastened there.

As a guide to the various pipes:—

B.F.B. = boiler feed pipe.
S.P. = steam pipe.
S.H. = superheater.
H.P. = hand-pump pipe.
P.G. = pressure gauge pipe.
E. = exhaust pipe.

A Design for a 20-ft. Windmill.

By F. E. POWELL.

(*Continued from page 110.*)

V.—CAP CASTING.

MENTION has been made of a cap casting, which has now to be described. It is shown in Figs. 16 and 17, each figure giving two views of the part. By reference to the plan (Fig. 17), it will be seen that it is essentially a ring with an annular, flat top, on which is bolted an annular plated iron ring projecting inwardly 1 in. This latter carries the movable head, the little wheels of which (see Fig. 8) run on its edge, while the lip of movable casting underlaps it. The cap casting is bolted firmly to the heads of the timber frameworks,

FIG. 16.

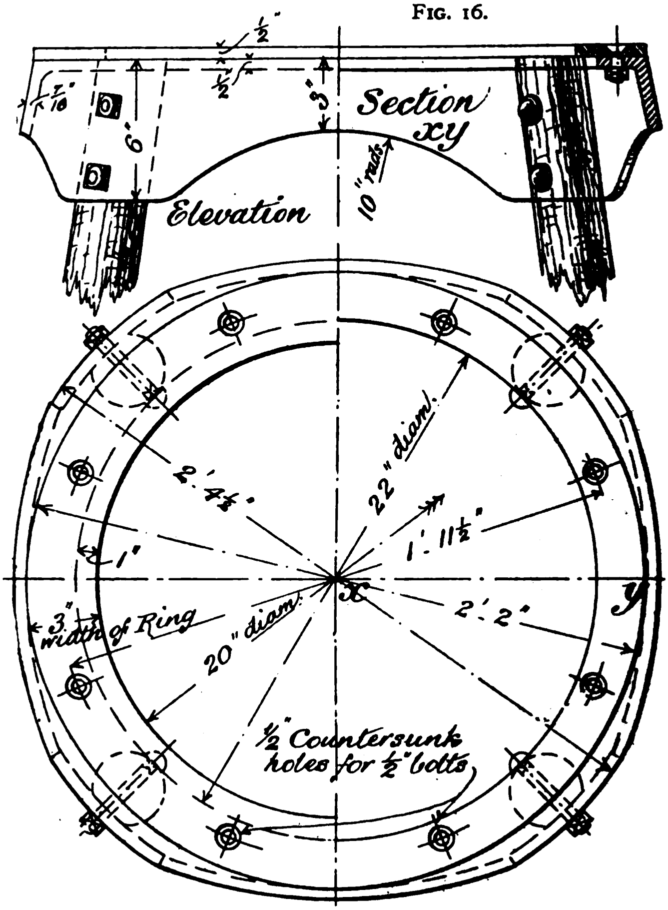
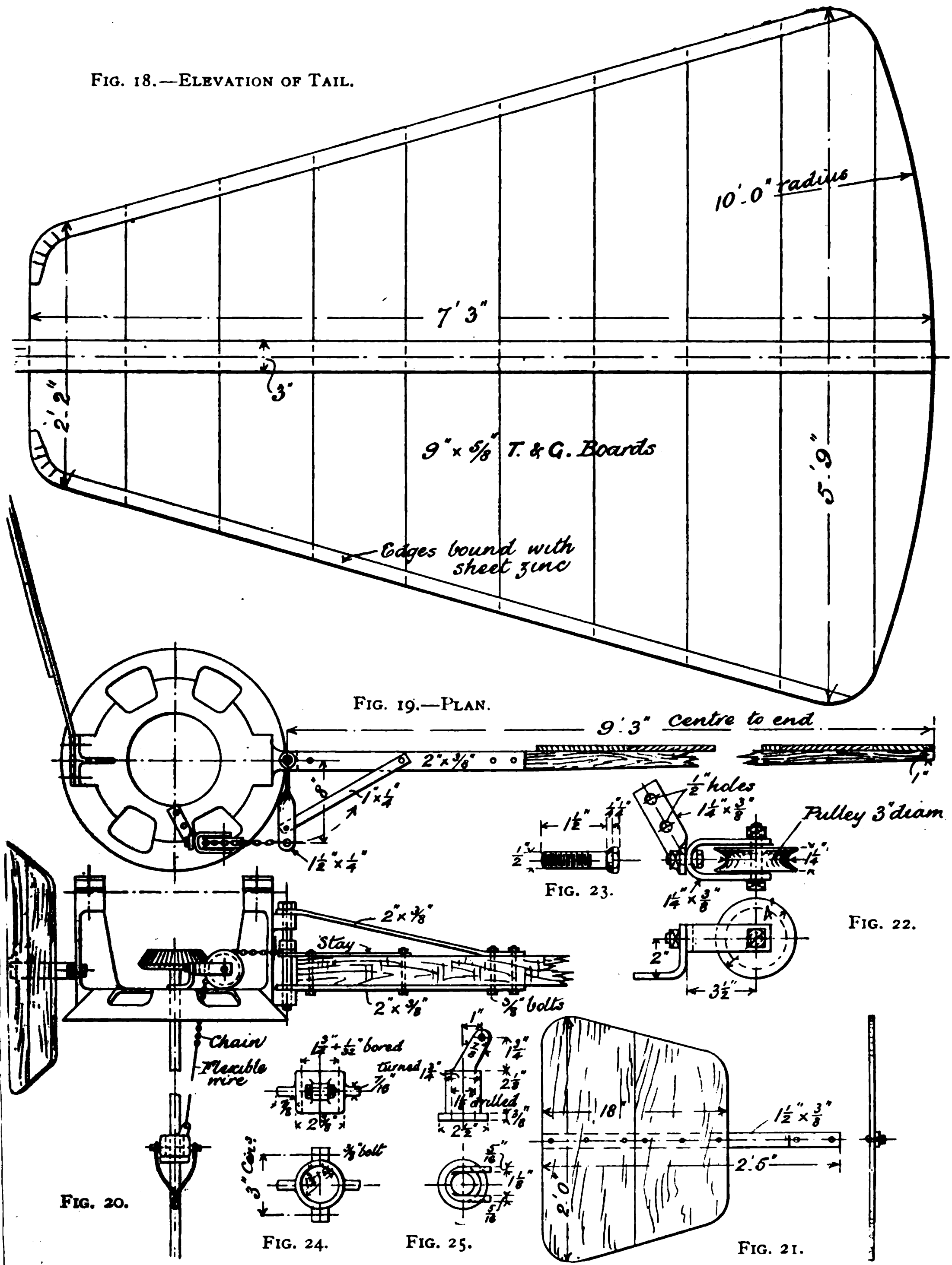


FIG. 17.—CAP CASTING. (*Scale: 1½ ins. = 1 foot.*)

good big washers receiving the crushing of the bolt-heads, as the bolts must be tightly drawn up. Between these timbers the casting may be lightened out as shown in the figures. No machinery should be necessary on this casting, unless it has warped so much that the ring does not bed fairly all round.



DETAILS OF TAIL AND REGULATING GEAR. (*Scale : 1/4 in. = 1 ft.*)

VI.—Regulating Gear.

An important part of the machine now claims attention, this being the controlling mechanism and regulating gear. In a windmill of this size it is not only necessary that it should turn automatically to face the wind, but it must be self-regulating in order that speed and power may remain constant, and high winds have as little damaging effect as possible. The device adopted in the present design, and shown in Figs. 18 to 25, accomplishes its object in the following way.

There is first the large "tail," "wind vane," or "weather flag" (Fig. 18). This is simply a large flat tail made up of boards fixed vertically to a horizontal wooden shaft after the manner of the sails, but without "any angle of weather." Its edges are zinc-bound in the same way, and it should be made as light as possible within reason.

The wooden shaft which carries the tail instead of being fixed to the movable head, which would keep the sails always square on to the wind, is carried by a hinge in lugs provided in the top, movable casting, and shown in Figs. 4 and 5. These will again be recognised in Figs. 19 and 20, and it will there be seen that the wooden shaft is carried by strips of iron or steel, 2 ins. × ⅜ in., which are drilled for ⅜ bolts through the timber and for the ¾-in. diameter hinge pin on which they revolve.

At right angles to the wooden shaft, and also carried by the hinge pin, a short lever (8 ins. long) projects outwardly, and carries the end of a light chain at its outer extremity. It is kept in this right-angled position by a light iron stay riveted or bolted to it and to the shaft. The lever is simply a piece of 1½ ins. × ¼ in. iron, bent to encircle the hinge pin and twisted at the middle of its length, as seen in plan.

The chain mentioned as being secured to the lever passes away over a pulley down through one of the large openings in the movable head, and with the intermediary of the parts shown in Figs. 24 and 25 (to be described later) is weighted in any convenient way. The effect of this is, of course, to pull back the tail in one direction as long as the weights are free to act and the tail to move. The latter is prevented from coming back to more than a central position (namely, that shown in Fig. 19) by means of a stop—a simple piece of iron bolted on to the movable casting and abutting against the lever arm. It is not shown in Fig. 19, but is indicated in Fig. 4 between the two lugs.

Now, so far as the tail is concerned, its action is simply this: it will endeavour always to lie in the plane of whatever wind is blowing, and if the weight at the end of the chain is sufficient, the whole movable head will go with it, with the result that the plane of the *sails* will be brought at right angles to the wind, and the mill will commence to work. This, indeed, is exactly what is intended to happen under light or normal conditions of wind, up to some reasonable velocity, above which another element comes into play in the shape of a small "regulating vane," shown variously in Figs. 1, 19, 20, and 21.

This small vane, it will be noticed, lies almost at right angles to the plane of the tail, and is securely fixed to the other end of the movable head. The position is also indicated in Fig. 4. Its action is, therefore, in opposition to the tail proper, its tendency being to throw the sails "off the wind," and this it is actually enabled to do in high winds, by reason of the fact that while the wind pressure upon it varies according to the square of the velocity, the weight tending to keep the tail up to its work is constant, or may even be made to diminish in effect, if it be desirable. Added to this is the fact that as the sails come off the wind they also begin to exert a turning action owing to the distance of their centre of gravity (or, rather, centre of effort) from the centre on which the whole mill revolves. The amount of these combined turning effects cannot be very easily determined, so that although an attempt has been made to give an approximately correct figure for the weights, it is quite likely the actual requirements may be found very different.

(To be continued.)

A Model Horizontal Steam Engine.

By B. Durrant.

HEREWITH is illustrated a horizontal engine I have just finished; bore, 1 in.; stroke, 2 ins.; travel of valve, ¼ in. The cylinder, pump, eccentrics, and flywheel are made from castings, the remainder from scrap. The guides I made from ⅛-in. sheet brass. The bearings are gun-metal, and split for adjusting. The brass connecting-rod is fitted with a gun-metal bush. The crankshaft is made from mild steel; the webs were cut from a bicycle crank, and sawn in halves; it was then brazed to the spindle, which makes a strong job of it. The crank is balanced. The flywheel was a rather stiff job, being ¾ in. on the face and 5½ ins. in diameter, and my lathe a single-geared 3½-in. only. There are ten oil-cups, made from brass rod. All studs, nuts, and screws to the number of ninety-eight were made by myself, the studs being made from wire nails and the hexagon nuts and screws from round steel bar filed to shape. The cylinder is lagged with asbestos and mahogany, held on with two brass bands. The whole is mounted on a mahogany base, and weighs 10 lbs., being 14 ins. long and 9 ins. high. In conclusion, I may say that with 15 lbs. of steam the engine runs at about 350 r.p.m. The pump, which has a ¾ stroke, is a very easy one to make and works perfectly.

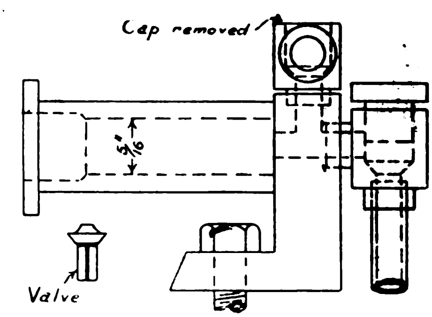


Fig. 2.—Side Elevation of Pump.

The Junior Institution of Engineers.

WITH the permission of the President of the Royal Naval College, Greenwich, Admiral Sir A. D. Fanshawe, K.C.B., and the assistance of Dr. James A. Ewing, F.R.S., Director of Naval Education, upwards of one hundred members of the Junior Institution of Engineers on Saturday afternoon, January 19th, visited the College and precincts.

They were received in the Painted Hall by Professor J. B. Henderson, D.Sc., Mr. Henry F. V. Negus (Secretary to the College), and Hon. Lieut. Thos. Pratt, R.N. (Curator of Museum). After seeing the notable collection of naval pictures, etc., there, they were shown over the chapel and museum. Proceeding to the new engineering laboratories, they were met by Dr. Ewing, vice-president of the institution. All the apparatus, etc., was on view, including that used to demonstrate Dr. Hele-Shaw's "Stream Lines," shown by Mr. John Smith.

The laboratory is equipped on research lines, and not for elementary teaching, since the engineering students have had a five years' course at Keyham College and Devonport Dockyard on the "sandwich" system before going to Greenwich. The course extends to one year for the average student, and to three years for the best students, who are destined later for expert work at the Admiralty or dockyards. The equipment of the laboratory comprises a 2,000 h.-p. triple expansion steam engine (*ex* H.M.S. *Rattlesnake*), a 45 h.-p. Bellis engine and Siemens dynamo, a 45 h.-p. Parsons turbine dynamo, a 30 h.-p. de Laval turbine dynamo, a 15 h.-p. Diesel oil engine, a 9 h.-p. Crossley gas engine, a 12 h.-p. Thornycroft petrol engine and Siemens dynamo, a small Hornsby oil engine, a 10 h.-p. air-refrigerating plant, a three-stage torpedo air-compressor, an 18-in. torpedo, a hydraulic pumping engine, two hydraulic motors, a Babcock & Wilcox water-tube boiler, superheater (separately fired), a water-softening plant, a White-Forster boiler (with oil fuel), a 100-ton and 5-ton Wicksteed testing machine, a complete Zeiss apparatus for the study of the microstructure of metals, a well equipped workshop for making and repairing apparatus, a good equipment of measuring apparatus of all kinds used in experimental work.

At the conclusion of the visit the party were entertained to tea by Dr. Ewing, and on the proposal of Mr. Eade, member of Council, seconded by Dr. H. S. Hele-Shaw, F.R.S., a vote of thanks was tendered for all that had been done for the reception of the Institution that afternoon.

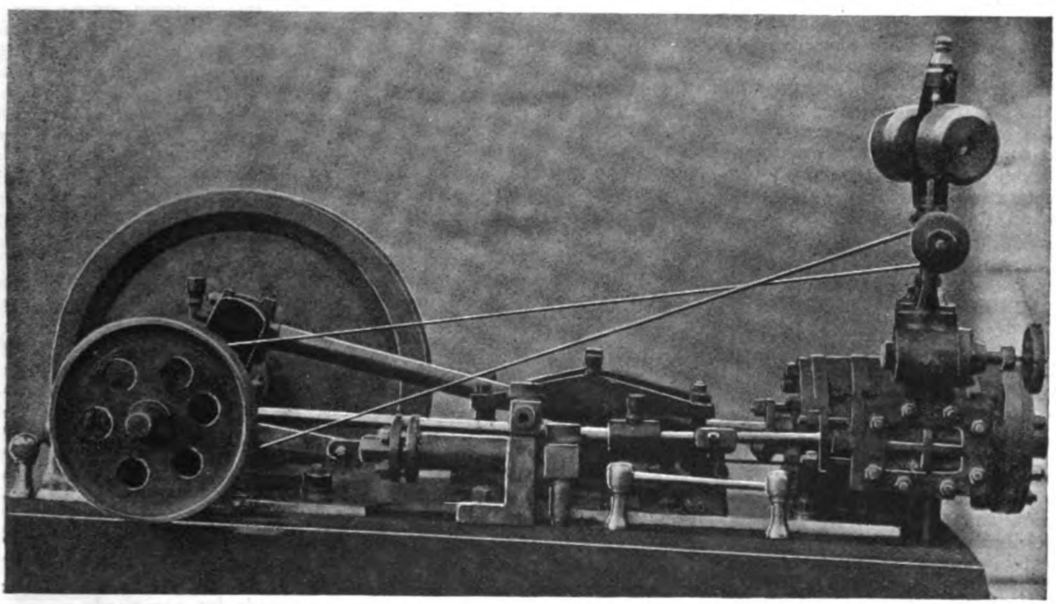


FIG. 1.—MR. B. DURRANT'S MODEL HORIZONTAL STEAM ENGINE.

DEPOSITING COPPER UPON ALUMINIUM.—This has been successfully accomplished by the use of an anode of pure copper and an electrolyte of water, with a few drops of sulphuric acid in it. After the current had been in action some time copper sulphate was formed, and from this the copper was deposited. After thirty minutes the plate was taken out and well washed in water, then in a solution of hydrochloric acid, then in sodium hydroxide, and again in water. This operation was repeated several times, the final result being an even deposition of copper all over the plate.

The Sixth "Gauge" Competition.

To further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th, 1907

The 1906 Model Speed Boat Competition.

CONSIDERING all things, we are doubly gratified by the results of the recent Model Speed Boat Competition, for not only has there been an increase of speed all round, but the number of models entered is more numerous than in any previous competition. Moreover, it is pleasing to know that Great Britain still retains the lead in model speed boat performances, the speed of the fastest boat in the Branger Cup race* being 3·4 miles per hour, against Mr. Weaver's 7·86 in class A and Mr. Tillett's 6·136 in class B.

Reviewing the performances in our 1906 Competition, we have to admit that the majority of the boats were raced during the winter months under the attendant difficult conditions. In a letter received from the Secretary of the Clapham Steam and Sailing Club, containing the particulars of the tests of Mr. A. H. Arkell's petrol-driven boat, *Moramia*, this trouble was specially referred to, and it was averred better performances had been obtained with the boat (unofficially) during the past summer. Mr. David Scott, who won the 1904 Competition, and lately gained the prize for the best design of model marine boiler also wrote regretting his disability to make a speed trial owing to all the ponds in the neighbourhood of Leith being full of weeds. On one occasion the vessel stuck for two hours in the centre.

In settling the conditions of the next competition we shall therefore endeavour to make the closing date rather earlier in the year, particularly as we feel that anxiety for improvement upon improvement would in any case lead the model ship-owner to leave the final test to the last possible moment. Therefore, with the closing date in the winter, although it would, of course, be better for the owner to try his boat in the summer for reasons mentioned above, it would really mean that the final trial would be deferred until the last week or so, and the circumstances of the weather would again interfere.

We come now to the details of the performances. The Wirral Club still leads with the increased speed of Mr. Weaver's *Era*. This boat maintained an average rate of 7·13 miles per hour in 1903. In the present competition, under the same circumstances and over the same course, the *Era's* speed averaged 8·766 miles per hour, or, within a fraction, one mile an hour faster than any previous record, Mr. Scott's record in 1904 being 7·719 miles per hour. As will be remembered, Mr. Weaver's boat approaches the limit of size laid down for a Class A model.* It measures 6 ft. 11¾ ins. on water-line, has a beam of 10¼ ins., and a draught of 3¼ ins., the displacement being 60 lbs. Altogether, this boat, which is a steamer, driven by 1 in. × 1¾ ins. × 1 in. compound non-condensing engine, is a much larger and heavier craft than Mr. Arkell's petrol boat *Moramia*, which is only 5 ft. long × 5¾ ins. beam × 5¾ ins. deep, and displaces only 20 lbs. of water.† The performance of the latter boat is therefore very meritorious, and, we should say, establishes a record for a boat of the exact size and displacement.

The official figures of the speed test of the *Era* are as follows:—Three separate runs were made, each 100 yds. in length, the times being 22, 25, and 23 seconds respectively; total, 70 seconds. The whole time taken for the test, which included two reversals of the boat at the ends of the course, and two extra distances beyond the 100 yards marking line to the end of the lake, was 133 seconds. The 300 yds. in 70 seconds, of course, equals the very creditable speed of 8·76 miles per hour, and anyone who has seen a boat going at this rate will be able to realise how fast it is

The petrol boat belonging to Mr. Arkell made three runs of 140 yds. each, with about 30 seconds between the runs, the respective timings being:—

35 2-5ths	seconds for	140 yards.
37 1-5th	,, ,,	140 ,,
35 2-5ths	,, ,,	140 ,,
108	seconds for	420 yards.

Figuring this out, readers will find that the average speed was 7·95 miles her hour.

Mr. J. M. G. Tillett, of Radyr, near Cardiff, who won the silver medal in class B (boats under 4 ft. 6 ins. long), has been model-making for a number of years past, and beside the winning boat, numbers amongst examples of his finished work the three steam engines and small power gas engine shown in the accompanying photograph. Mr. Tillett was also one of the successful men in the recent "Workshop Problem" Competition.

The model steam yacht *Doris*, which will be seen in the foreground of the illustration herewith, is fitted with compound engines, ¾ in. × 1¼ in. × 1-in. stroke (see Fig. 5), working at 50 lbs. pressure.

* See issue of November 15th, 1906.

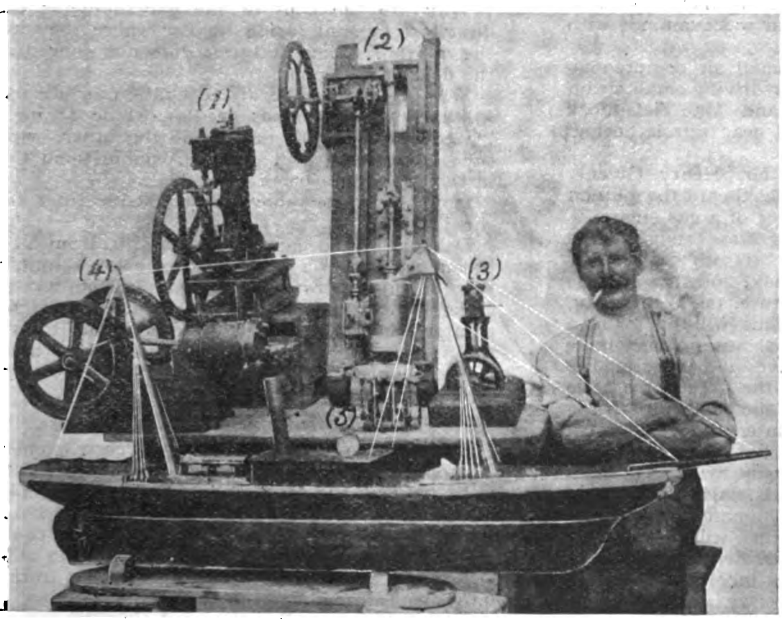
* See issue of November 26th, 1903.

† See also description in issue of April 26th, 1906.

The boiler fitted to the boat is 13 ins. long × 5$\frac{3}{4}$ ins. diameter, having a single flue of 3 ins. diameter, provided with fourteen cross-water tubes $\frac{5}{8}$ in. diameter.

The boiler is fired by a large paraffin blowlamp. The hull was cut out of a solid block of pine 5 ft. × 8 ins. × 9 ins. Of the three propellers used, the owner has found a three-bladed propeller give the best speed. The trial was made over a continuous course of 327 yards. The steam was turned on and the boat held for 15 seconds, and letting her go, the trip was performed in 1 minute 49 seconds. The steam pressure fell to 28 lbs. The return trip —when the pressure had again reached 50 lbs.—was made in 1 minute 46 seconds. Upon the latter performance the officially recorded speed has been based. The boat appears to be a large one for its length, and we suppose has a greater displacement than any other competing boat in its class. Does this point to the advisability of building a beamy boat for a model speed boat competition where a length-limit measurement obtains rather than a long, narrow model of the T.B.D. variety?

(*To be continued.*)



Mr. J. M. G. Tillett and his Models.
(The steam yacht *Doris*, shown in the foreground, was the winner of the Silver Medal in the Model Speed Boat Competition, 1906.)

Tantalum.—In drilling a hole through a sheet of tantulum, states Sir William Crookes, F.R.S., a diamond drill was used, revolving at the rate of 500 r.p.m. This whirling force was continued ceaselessly for three days and nights, when it was found that only a small depression 0·25 mm. deep had been drilled; and it was a moot point which had suffered the more damage—the diamond or the tantalum.

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.*]

An ordinary meeting of the Society was held at the Cripplegate Institute, Golden Lane, on Wednesday, January 30th, 1907, Mr. Herbert Sanderson taking the chair at 7.45, and upwards of eighty members and visitors being present.

The minutes of the previous meeting having been read and signed and seven gentlemen elected members, the Chairman stated that the Parks Committee of the London County Council had refused the Society's request for permission to build a railway track in any Park or open space under their control, and opened a short discussion on a suggestion which had been made that the outdoor track should be abandoned and in its place a testing table fitted with adjustable rollers on which model locomotives of all gauges and wheel disposition might be run continuously, the drawbar pull and brake horse being meanwhile ascertained by suitable apparatus. Several members spoke both for and against the suggestion, and on a show of hands being called for, it appeared that there were a sufficient number present in favour of it to warrant the Committee further considering the matter and obtaining plans and particulars of probable cost.

The Chairman then called upon Mr. W. J. Tennant, M.I.Mech.E., to give his discourse on "Some Mechanisms." The lecturer, who was cordially welcomed, proceeded to give an informal discourse on several pieces of mechanism, more or less intricate, and kept his hearers keenly interested for nearly two hours. With the aid of several large diagrams, he explained the uses and properties of the various types of Watts' Sun and Planet motion, passing on to the subject of gearing and gear wheels generally, and particularly with reference to their use in change speed gears for motor-cars and other machinery, including a lengthy description of Hook's universal joint as used in the modern motor to transmit the drive from the engine to the rear axle, and explaining very clearly the reason for the inequalities in the transmitted motion when the central portion of the shaft was on any considerable angle with the two end portions. Attention was next directed to the various forms of change speed motion operated by friction wheels driving from the edge and centre of two wheels, particular explanation being given of Professor Hele Shaw's ball and roller motion designed for effecting this purpose. A very curious gear for transmitting the motion of one crankshaft to another placed at right angles with it by means of one connecting-rod, excited much interest, as did a variety of working models of various differential gears and straight line motions which the lecturer explained.

At the close, Mr. S. M. G. Ferriera proposed a very hearty vote of thanks to Mr. Tennant for his most interesting and lucid discourse, the vote being carried with much acclamation.

Mr. Ferriera exhibited a model of a mechanism he had recently designed for electrically unlocking, shifting, and relocking railway points, the whole operation being effected by a circular movement in one direction only. The gear was examined with much interest.

Mr. Fraser brought up a small air compressing pump and storage reservoir for driving small steam models by compressed air, and Mr. Tiefenbock showed some internal toothed gear wheels he had been engaged upon.

In answer to a question, Mr. Henry Greenly explained with the aid of the blackboard the method of taking the brake horse-power of a gas engine.

A most interesting meeting was brought to a close at 10.15 p.m.

FUTURE MEETINGS.—The next meeting will be held at the Cripplegate Institute, on Wednesday, February 20th, at 7 p.m. This will be made a special track and model night, and to encourage members to bring up locomotives and other models and work them or otherwise, the Committee have decided to offer cash prizes to the exhibitors (being members) of the three most interesting models on view, the judging to be by ballot of the members present. It is hoped this scheme will result in a large number of models, both finished and unfinished, being brought up and in many being shown at work. The following meeting will be held on Friday, March 15th, when Mr. Ferriera will give the members "Some Wrinkles in Model-making."—Full particulars of the Society and forms of application may be obtained from HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

Provincial Societies.

Leeds.—At a meeting of this Society, held on Tuesday evening, January 22nd, Mr. T. Stansfeld gave a paper on "Pressure Gauges," with illustrations on the blackboard of the various improvements in gauges up to those in general use at the present day. The paper proved a very interesting one to all present, and a vote of thanks was passed to Mr. Stansfeld.—W. H. BROUGHTON, Hon. Secretary, 262, York Road, Leeds.

AN application of electricity which may prove of considerable importance is the removal of the small amount of iron in the slag heaps which surround all iron and steel works, and consists of refuse from the blast furnaces and steel furnaces. It contains very little iron, but apparently the Barrow Steel Company consider it worth while to recover this, and the method adopted is by pulverisation and magnetic separation.

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 intended for publication.]*

Reflecting Galvanometer.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I have read with interest the article, entitled "Some Accurate Electrical Measuring Instruments," by Mr. V. W. Delves-Broughton, and should like to ask the following questions:—

Why are the coils of the galvanometer there described tapered (being smaller where they meet the needle), seeing that this does not concentrate the field at that point?

Why are the needles of the astatic pair not made so that the set of four needles, which forms the "needle proper," lie one inside the other, with a tube of mica between them, to enable them to lie in the strongest part of the field?

How does the above instrument differ from the Thomson?

I should like to mention that a strip from a bass broom will make a good substitute for aluminium wire in this instrument, being much lighter, and gives, instead of buckling; these, also, make good pointers, and can be bent into almost any form by the application of a little heat.—Yours faithfully,

Avonmouth. J. BEVAN WARRY.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In answer to your correspondent. The object of making the core of the coils conical is to prevent the rays of light reflected from the mirror being cut off by the outer edge of the coil if the coils were wound parallel. This, of course, refers to the lower front coil only, and the others are made similar to produce an equal turning movement throughout the system.

The astatic needle proposed in the second question would entail considerably more trouble to make, and would entail the coils being mounted wider apart, so that any gain accruing through a better position in one direction would be lost by the displacement of the field in the other.

The difference between the instrument described and Thomson's (Lord Kelvin's) is that the latter was designed with a view to obtaining the very best results with no consideration as to the difficulties of construction, whereas the former was designed to give sufficiently accurate results for all practical purposes with the least possible amount of work or cost of materials. In my case all the material was to hand, and this to some extent governed the design.

Bass broom fibres might answer all right, but I should be afraid of their altering their form by warping or twisting. I have tried various substances—celluloid, whalebone, split straws, etc., but have found them all liable to distortion from heat, moisture, etc. For the same reason, I should be afraid of using bass fibre for pointers in which a slight distortion would vitiate the accuracy of the readings.

For this purpose a seed stem from grass, well seasoned and protected by painting with shellac,

can be used without fear, and will be found as light as anything; but for hanging an astatic needle, nothing can equal a light piece of aluminium wire.—Yours faithfully, V. W. DELVES-BROUGHTON.
Upper Norwood, S.E.

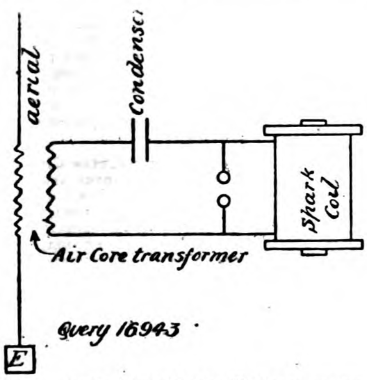
Queries and Replies.

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:—

[16,943] **Marconi's Apparatus.** G. N. C. S. (Torquay) writes: I should be much obliged if you would kindly tell me what kind of transmitter and receiver Mr. Marconi is now using for wireless telegraphy. Is the transmitter like the enclosed drawing? Is the magnetic detector now always used instead of the coherer?



MARCONI'S WIRELESS TELEGRAPHY APPARATUS.

We are not aware of any important change in Mr. Marconi's apparatus. We believe that the magnetic detector is much used, but we have not heard that it is entirely used instead of the coherer. Your drawing of the transmitting circuit is correct. The aerial and transformer secondary must be tuned to the circuit comprising primary, condenser, and gap.

[17,260] **Hardening Drills.** E. B. (South Milford) writes: (1) I have made a flat drill from a piece of tool steel and hardened it according to method described in "Cutting Slender Screws" in your issue for November 1st, 1906, but find it too soft to use. Is there any way to remedy this? (2) Will it be any detriment to electro-magnet if iron core is in two pieces as sketch (not reproduced)? (3) Please inform me of any method to render wrought iron soft enough for armatures?

(1) You have evidently gone wrong somewhere, for if you had quenched the tool at the moment it was the proper straw-colour it would, of course, be quite hard. The only thing to do is to practise till you get satisfactory results. (2) No, provided the surfaces are well together—*i.e.*, a perfect fit. (3) Wrought iron is soft enough for cores of armatures; but only in small machines is it used in one solid piece.

[16,934] **Reversing Switch for Series Motor.** F. G. D. (Catford) writes: I would like some advice on two points on which I am not clear. I am making a model electric tramcar, weight 8 lbs., for which I have one of Thompson's motors, wound for 4 volts. (1) How many pint bichromate batteries would it take to run the car? (2) How could I reverse the motor from the driver's platform by a switch?

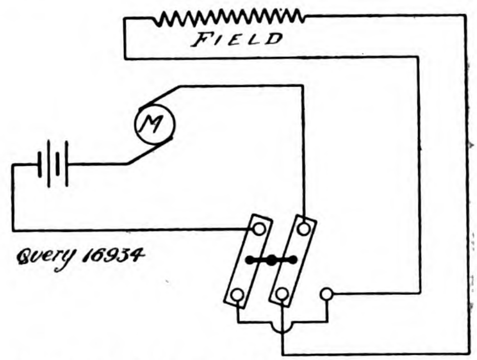


DIAGRAM OF CONNECTIONS FOR REVERSING SWITCH.

(1) You do not say what current motor takes. It depends on this. You can take about 1 amp. from a pint bichromate cell for a few hours. (2) Reversing switch for series motor is shown in sketch. By moving the double-armed switch over to the right the current in the field is reversed.

[17,152] **Windings for Former-wound 200-watt Dynamo.** C. B. (Oldham) writes: I have a 200-watt dynamo (semi-enclosed) with circular yoke about 7 ins. diameter, with two poles, 3 ins. by 3 ins. section, 1 in. long, all one steel casting. Armature (laminated), 3 ins. diameter by 3 ins. long, eighteen slots ½ in. by ¼ in. wide, and 18-part commutator. Please give amount of wire and whether single or double cotton-covered for 100 volts 2 amps. at a speed of 1,800 r.p.m., if possible. Both armature and fields are former wound. Please give measurements suitable for a former for the above armature similar to the one used for the overtype dynamo in THE MODEL ENGINEER, Vol. X, May 26th, page 495, as I specially want to wind on this system. Describe sequence of coils for this system. I have allowed 1-16th in. difference between bore of fields and diameter of armature. Is this about right for this size of armature?

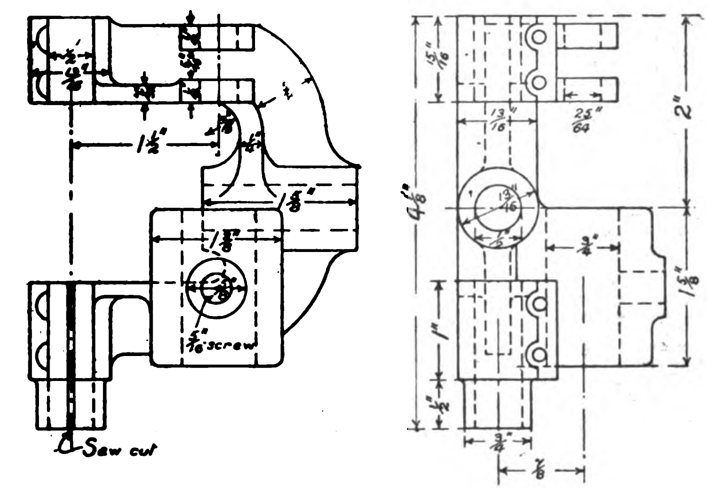
Without a sketch we cannot say how much wire you are likely to get on the magnet poles, but for a shunt winding you should have about 2 lbs. of No. 28 s.c.c. copper wire on each pole. For the armature use No. 26 D.C.C. copper wire and get on as many turns as the space will allow—1 lb. should be ample. We should expect the speed to come out higher than the figure you mention, but this can only be ascertained by trial. It would have been better to work with a smaller clearance than 1-16th in. if possible. As regards the former for armature coils, this must be determined by trial. The article you refer to is a very good guide as to shape. If you can obtain a copy of Eickmeyer's Patent Specification (English Patent No, 2,246 of 1888), you will find a considerable amount of information on former winding for both two and four-pole armatures. He was the pioneer of former winding, and unless the specification is out of print it can be obtained for 8d. and postage from the Patent Office (Sales Branch), Southampton Buildings, Chancery Lane, London. The coils can be arranged to lie side by side or alternate over and under each other; that is, each coil is on top at one side of the armature and lies under at the other side. The connections are precisely as for hand-wound coils in place.

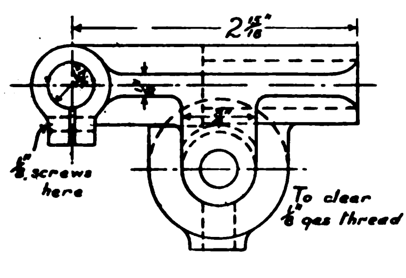
[17,016] **Small Low Voltage Motor Generator.** M. B. (Morecambe) writes: I am making a small motor generator (Lahmeyer type), as per dimensioned sketch enclosed, to convert from 220 volts to 8 or 10 volts 20 to 25 amps. I should be very much obliged if you would kindly let me know if sizes and gauges of wire are correct, and if I can expect the output? Of course, putting good workmanship and close even windings into the machine. Both fields to be excited from 220-volt mains. 3 lbs. of 32 G. s.c.c. on each limb, connected in series and shunt to mains. Motor armature former wound, presspahn and silk insulation, 14 ozs. No. 30 D.S.C. Dynamo armature, 12 ozs. No. 16 G. or three No. 20

in parallel. I may say that I have your handbooks—" A B C of Dynamo Designs,". and MODEL ENGINEERS from 1900.

Yes; but No. 16 for the generator armature is rather small gauge for carrying 25 amps. But the maximum output will not be more than about 140 watts, so No. 16 or 3/20 will do. Use a starting resistance, of course, with motor.

[17,089] **Milling and Gear Cutting Outfit.** B. W. (Stalybridge) writes: I should esteem it a great favour if you could publish a detailed sketch of the cast-iron frame by itself of the milling attachment which was described in the issue for December 20th, 1906.





DETAILS OF GEAR CUTTER FRAME CASTING.

We reproduce herewith, to a scale of half full size, a drawing showing three views of the gear cutter frame casting.

[12,176] **Dynamo Winding.** W. B. (Twickenham) writes: I am making the ¼ h.-p. dynamo or motor from THE MODEL ENGINEER, December, 1899, and shall be pleased for a reply to the following queries:—(1) Could you oblige me with a sketch of winding for armature, as I cannot follow the diagram given in the next chapter of " A B C of Dynamo Design"? (2) Also could you give me size and amount of wire for armature and fields to wind same machine to run as motor from 240-volt continuous supply, as I should like to make a motor as well as a dynamo?

(1) If you will obtain a copy of THE MODEL ENGINEER handbook on "Small Dynamos and Motors," price 6d., and read Chapter III, you will find very simple instructions with diagrams relating to armature winding. On page 35 is a complete diagram of the winding of a 16-coil drum armature, which is precisely what you require. The diagram is for a slotted armature, but the principle is exactly the same for a smooth core; you merely regard the fibre pegs as teeth. The various systems of winding drum armatures have practically the same result, so you would be quite safe in applying the method of the handbook, though it may not appear to exactly agree with the instructions given in the article in which the design appears and in the chapter of " A B C of Dynamo Design" referred to. (2) Wind the armature as full as possible with No. 30 gauge D.C.C. copper wire, and for a shunt machine the fields with No. 34 gauge S.C.C. copper wire, or for a series machine No. 23 gauge S.C.C. copper wire. The armature should take about ¾ lb., and the fields about 1½ lbs. on each bobbin. We advise a series winding for so high a voltage.

[12,111] **Small Plant for X-ray Work.** G. M. (Bournemouth) writes: I am setting up a small electric plant for generating D'Arsonval current, *X*-rays, and violet rays. Any information as to current strength for latter purpose will be acceptable. I propose using a ½ h.-p. Otto gas engine, a small shunt-wound dynamo (estimated to give from 5 to 10 volts), and I hope to get on without a coil if I have strong condensers.

We think you will find it necessary to use an induction coil of 10 to 12-in. spark capacity. Your engine should be just powerful enough to provide sufficient electric energy for your purpose, but the dynamo voltage is too low (unless you have some particular reason for adopting 5 to 10 volts). From 12 to 16 volts is usual with induction coils of 10-in. spark, such as are generally used in electro-therapeutical work. For working a coil direct from the dynamo, the latter is better if compound wound. For charging accumulators it should be shunt wound, but a compound machine can be used if the series coils are disconnected. You will probably find that the most satisfactory system will be to use an accumulator and charge it from your dynamo. A 12-volt 30-amp. capacity accumulator is a useful size; the dynamo would have to give about 16 volts 5 amps. to charge such a battery.

[17,267] **Hand-Feed Arc Lamps.** J. W. (Kennington) writes: I am wanting to make a hand-feed electric searchlight apparatus to use with the different coloured lights for dances, etc. The available current is 25 amps. at 220 volts. I want the lamp for use at one of the public baths in London. Will you kindly tell me what size carbons I require, what resistance and most suitable resistance wire to use? If a 6-in. diameter railway lantern lens could be used, where can I obtain the different colours for placing in front of the light? Do I connect up the same way for alternating current as I would for continuous? I think the supply is continuous. I think you will understand from enclosed rough sketches what I want to make.

The makers of the lamp will supply you with particulars regarding resistance, etc. An ordinary arc lamp resistance coil will answer your purpose well enough no doubt. Terminals are marked positive and negative. These must be connected to corresponding leads if continuous current is used—for alternating it does not matter. Carbons will be supplied according to size of holders in lamp. When ordering state whether for continuous or alternating current, as this would make a difference in type of lamp, size of carbons, etc., also resistances. Coloured glass may be had from any glaziers.

[17,067] **Accumulator Charging; and Running Small Motor from the Mains.** N. S. (Goodmayes) writes: I have a 2½-volt 2-amp. Edison electric motor with 90 amp.-hour accumulator for supplying current for same, and would be much obliged if you could give me information on following:—(1) Could I charge the above accumulator from a 230-volt 2-amp. continuous supply main, and, if so, how many lamps would have to be used for resistance, and of what voltage and candle-power, and how

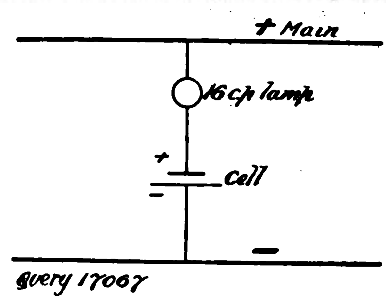


DIAGRAM OF CONNECTIONS FOR RUNNING MOTOR FROM MAINS.

connected? (2) How long should it take to charge, and is an ammeter or voltmeter essential? (3) Could the motor be driven direct from the same main with a suitable resistance, and what would you recommend should be used for the latter? I have tried it in series with a 5 c.-p. 230-volt lamp, but get no result. I have your handbook "Small Accumulators."

(1) If you mean that the capacity of your accumulator is 2 amp. hours, the charging current will have to be very small. Use, in that case, say, one 16 c.-p. 230-volt lamp, which will pass about ·3 amp. Connect as sketch. (2) Duration of charge about five or six hours. Both instruments are useful, but the voltmeter is the more essential, if we may use such a phrase. (3) Yes. Try it with a 16 c.-p. lamp, and if that is not enough, add more lamps in parallel.

[17,045] **Estimating Ampere Turns for Magnet.** "QUERIST" (Carnarvon) writes: I want, for magnetising a piece of iron, 250 ampere turns. How can I get a current of 1 amp. from a circuit at 230 volts pressure or from one at 460 volts? I want a simple and safe method without the expense of a resistance coil. The 230-volt circuit is for ordinary electric lighting. Can I get from it a current of 1 amp. without fusing the safety fuse?

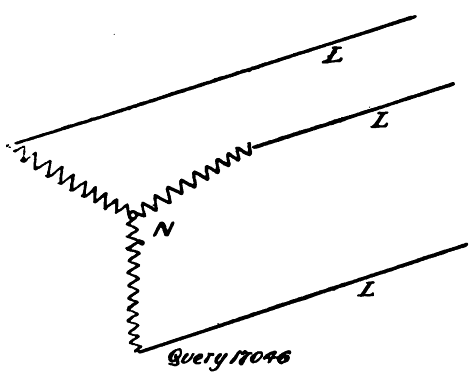
To make an electro-magnet which shall have 250 actual turns of wire on the core, carrying 1 amp., thus getting 250 amp. turns, is quite out of the question, unless you are prepared to use a resistance coil of some kind in conjunction with the 250 turns. To do what is required would mean using 7 lbs. of No. 26 S.W.G. wire—*i.e.*, a total length of 2,212 yds. This would mean that each "turn" of wire would have to be—

$$\frac{2{,}212}{250} = 8{\cdot}8 \text{ yds. approximately,}$$

which is quite impracticable. He could wind his magnet core with this amount (viz., 7 lbs. No. 26), and assuming that the coil has an average diameter of 3 ins., each turn will be 9 ins. long, and he will get 8,848 actual turns on his core. The total resistance of this will be such that 1 amp. will flow when subjected to a pressure of 230 volts. Hence he must either use a high resistance wire (*i.e.*, *not* copper wire) for the coil, or must employ a resistance to reduce the voltage of supply mains to a suitable figure, if only 250 actual turns are to be used.

[17,046] **Earthing Neutral Point of Three-phase System.** D. J. (Blaengwynfi) writes: I would be much obliged if you would inform me what is the benefit of earthing the neutral point of a three-phase system? Will you please give diagram of a suitable switchboard for controlling three shunt-wound dynamos and four circuits? Two circuits are to supply overhead wires above ground.

With a three-phase star connected system the pressure between any of the three live wires and the neutral point is $\frac{1}{\sqrt{3}}$ of the pressure between any two of the live wires; that is, the pressure between L and N is approximately half that of the live pressure. Therefore, if N is earthed the pressure between any live wire and earth is approximately one-half the total pressure; the risk of breakdown to earth is, therefore, much less than if N is not earthed.



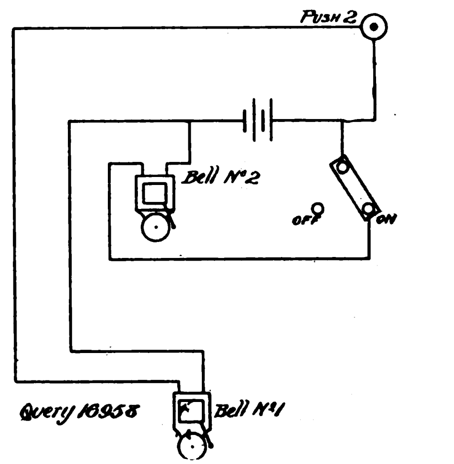
EARTHING NEUTRAL POINT OF THREE-PHASE SYSTEM.

Re switchboard, please apply through our Expert Service Department, giving full particulars of your requirements, and a fee will be quoted accordingly for the information.

[17,143] **Acetylene Gas for Firing Model Boilers.** F. M. W. (Cuckfield) writes: I have a steam locomotive, two outside cylinders 7-16ths in. bore by 1-in. stroke. The boiler is copper tubing, 10 ins. long, 2½ ins. diameter. Can you please tell me if it could be fired by acetylene gas, using a small bicycle lamp for generator, having it fixed in cab or tender? How should I prevent the flame smoking so much?

The possibility of acetylene for firing small locomotive and other boilers has often crossed our mind, and we do not see why success should not be obtained by its use. Of course, the ordinary burner is not applicable. A Bunsen tube must be used to obtain a correct mixture of air and gas. See page 47 of our sixpenny handbook—"Acetylene Gas." Bunsen burners can be obtained from the Thorn & Hoddle Acetylene Company, Victoria Street Westminster. We await experiments by our readers with interest.

[16,958] **Electric Bell Wiring.** E. B. (Prestwich) writes: It is desired to put up a system of electric bells in two rooms, one room immediately above the other. Room 1 to be able to switch on the bell in Room 2 to ring continuously until the bell in Room 1 has been rung by pressing a button in Room 2, when



ELECTRIC BELL WIRING.

Room 1 will switch off. Please say whether the attached diagram (not reproduced) is correct. If incorrect, please say in what particular and give correct method if it be possible to do as required.

We append diagram of required connections.

[17,303] **Small Water Wheel.** P. P. S. (Marlborough) writes (1) Would you please tell me where to get the brass buckets for a small Pelton wheel, and also if it is better to have them halved down the middle? (2) What should the size of the wheel and jet be to give about ¼ h.-p. from 40 lbs. pressure at the tap? (3) Is it a great advantage to make the wheel with ball-bearings if it is to be run continuously, or would long brass bearings be equally satisfactory? Thanking you for your prompt reply to my other questions.

(1) Try Whitney's, of 117, City Road, E.C. (2) A 12-in. wheel with ¼-in. jet running at about 500 r.p.m. would give you ¼ h.-p. at 40 lbs. head, and would use about 4 cub. ft. of water per minute. (3) Ball-bearings, of course, reduce friction somewhat, but it would not be an appreciable advantage in this case.

New Catalogues and Lists.

The Liverpool Castings and Tool Supply Co., 5, Church Lane, Liverpool. The January number of the *Amateur Mechanic*, issued by the above firm, contains numerous full size drawings of steam fittings for model boilers and engines. Prices and particulars of complete model launch engines, or sets of castings and parts for same are given. Various small pumps are illustrated, and other information of interest to model engineers is included.

The Brook Tool Manufacturing Co., Ltd., 179, Belgrave Road, Birmingham. We have received from the above a list of involute gear-cutters in both best cast steel and special high speed steel; the prices of each being side by side are easily compared. This firm is now making the shallow or stub form of tooth (for motor car gears and other quick running machinery) which works more smoothly than the usual form of tooth.

James Carson & Co., Ltd., 51, Summer Row, Birmingham, have issued a supplementary price list of parts and material as used in their model locomotives. Photographs are reproduced showing respectively the link motion and Joy's motion fitted to ½-in. scale engines, and the arrangement of an outside cylinder engine (to the same scale) built by this firm is also shown. The list will be sent to all readers post free for three penny stamps.

The Editor's Page.

THE following interesting letter recently reached us from a reader residing on the other side of the Atlantic :—" At the commencement of Vol. VIII of THE MODEL ENGINEER I began subscribing to same, and have continued my subscription ever since, besides buying each of THE MODEL ENGINEER Handbooks as they are published. Beyond an occasional 'hint' and the knowledge gained from reading same (which I may say is of no small amount, for I have read every page of every number up to the present, including many of the 'ad.' pages), THE MODEL ENGINEER has never been of any *practical* use to me until quite recently, though I received most of my electrical knowledge from same, but being a draughtsman in the mechanical line, this has not been of use to me so far. The case referred to above came up last October, when I applied to a large telephone apparatus manufacturing firm for a position as designer in the tool design department of same. I was then employed by a large engineering firm of this city, who did nothing but very large and heavy work of all kinds, so when I stated that I was then employed by that firm, the chief, to whom I had applied, would not accept me because he feared I was unable to cope with their work owing to it being so minute, for I was used to measurements of feet and tons, whereas their work was inches (and fractions thereof) and ounces, and their drawings were figured to four decimals (the micrometer being used almost entirely). To this objection I replied that I had done some model work and considerable model designing, with the result that before the week was ended I had secured a first-class position, increased salary (with promise of further increase according to my ability), better hours, and a chance of advancement—all of which I consider is due to THE MODEL ENGINEER. I have recently started on some extensive model electrical work in conjunction with my brother (who is in Western Canada), but the great difficulties to be overcome, in the way of time and correspondence, prevent us from submitting any particulars of same to THE MODEL ENGINEER for some time to come." This is only one of many instances where knowledge derived from the pages of our Journal has proved of business value to a reader, and we may say that we frequently find in our correspondence frank admissions on the part of practical mechanics and engineers that THE MODEL ENGINEER has helped them in their everyday work. This is naturally gratifying to us, for though our articles have been largely addressed to amateurs, we have always believed that amateurs should be taught to do their work in a proper mechanical way. Nearly all our contributors have been men who have been professionally trained in their work, and we are sure that the high reputation for technical accuracy which THE MODEL ENGINEER has established, has been entirely due to the fact that its writers have always been experts in their own particular subject.

Answers to Correspondents.

" PEDIMETER."—Thanks for your note ; we cannot however, see our way to publish.

A. S. (Bradford).—We are unable to accept your contribution, for which we thank you.

A. T. C. (Bucks).—We will publish a design at the earliest available opportunity.

H. B. (Wolstanton).—Use 6 ozs. chromic acid in 5½ pints of water ; then add ½ pint of pure concentrated sulphuric acid.

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 o 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 Posta 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, etc., 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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[*The asterisk* (*) *denotes that the subject is illustrated.*]

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THE

Model Engineer

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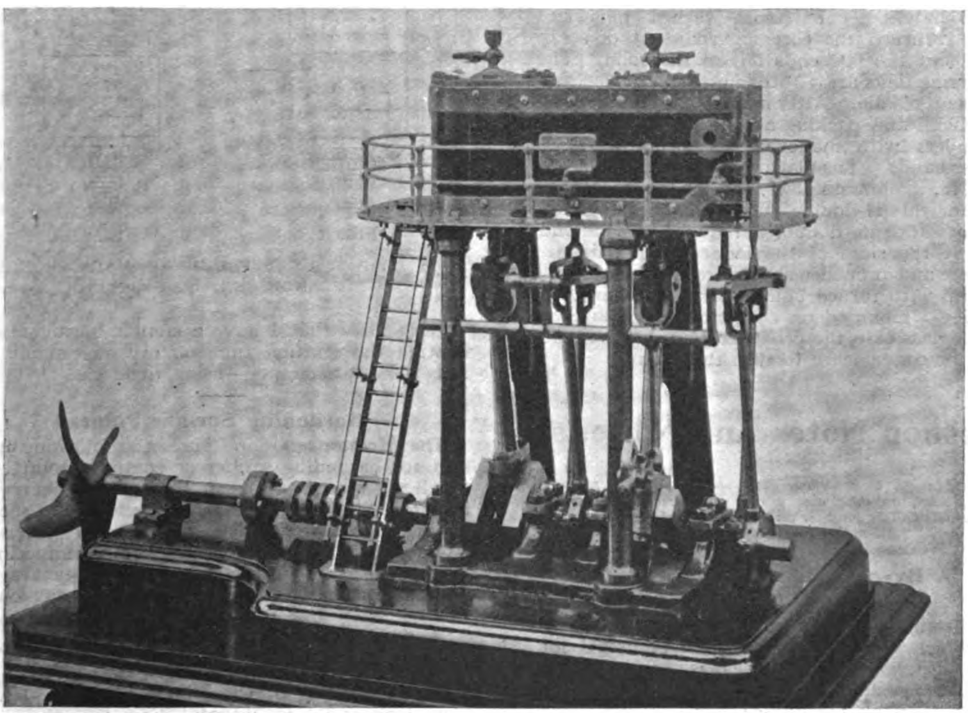
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVI. No. 304 FEBRUARY 21, 1907 PUBLISHED WEEKLY

A Model Compound Marine Engine.

By E. B. WILCOX.



MR. E. B. WILCOX'S MODEL COMPOUND MARINE ENGINE.

THE engine illustrated above was designed and constructed in my spare time, between the age of 16 and 19½, thus occupying 3½ years of patient labour. After designing the various parts, I set about making the patterns. The engine bed was the first item, made chiefly from the wood of an old cigar-box. After having it cast at a local foundry, I next proceeded to file the facings for the pillars, and to fit the brasses in (there are four pairs of brasses for the crankshaft, plainly shown in the photograph), each of them filed to shape from scrap pieces. I next drilled and fitted the caps on, and bored the brasses out to ½ in. in the lathe. The next job I did was the crankshaft, which I had forged at a country smithy. It is forged in one piece, and took three weeks of my spare time to turn, file, and fit it in the brasses.

I next decided to erect the pillars. The front ones were turned out of ¾-in. round Muntz metal, and it will be noticed the ¼-in. reversing shaft runs right through them both. To prevent end play of this shaft, I turned a groove in it, and met the groove with a setscrew in the pillar. I next made the pattern for the back pillars and slides, and also the cylinder patterns; these I got cast at Barnsley. After successfully machining the pillars, and dovetailing the slides, I secured them to the bed with ⅛-in. studs. The cylinders I bored to 1⅛ ins. and 2¼ ins. respectively, the stroke being 2 ins., and the steam ports I drilled and cut out. The steam chests are of the box type, secured to the cylinders with six ⅛-in. studs in each of them. After turning and fitting the pistons, rods, and covers (all from suitable pieces of iron off the scrap heap), I erected the cylinders. The crossheads are of brass, the slippers being dovetailed to correspond with the slides. The connecting-rods are of mild steel, forged and turned taper 5-16ths in. to ⅜ in., the big end fitted with brasses and turned bolts. The eccentric clips and sheaves are of brass, cut out of 5-16ths in. plate. The L.-P. sheaves are necessarily in halves, secured with turned pins and cotters. I turned the eccentric-rods out of scrap steel and cut the jaw ends out of the solid. The slot reversing links are 3-16ths in. thick, drilled and cut out of an old file. After making the slide-valves, setting them, and packing all the glands, I lagged the cylinders with mahogany, securing the lags with brass bands. The platform round the cylinders is 1-32nd in. thick brass plate, and the ladder leading down from this is double staved. The staves are turned to 1-16th in. diameter, reduced at each end to prevent the sides of the ladder from shifting. The thrust and propeller shafts are ½ in. diameter, coupled up with turned bolts 3-32nds in. diameter. The engine I mounted on a walnut stand covered in with a glass case, the propeller being left outside the case for convenience to turn the engine.

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 By-pass Bunsen Burner.

By A. F. CHEETHAM.

The following is a description of an easily made burner, which I have found extremely useful for all small work where a good heat is required *intermittently*. As will be seen from the sketches, it is made from an incandescent gas burner; the only alteration necessary is to remove the tube A (Fig. 1) and substitute a straight piece of tube C, which fits tightly over the nozzle B, as shown in Fig. 2. The by-pass tube is bent straight and brought up outside the tube C, and overlaps it by about 1-16th in.

In my burner the tube C has eight air-holes drilled in two rows, the bottom row being on a level with the nozzle. This row was drilled first, but I found they were not sufficient for my purpose, being only ¼ in. diameter, so I drilled another row of ⅛-in. holes just above. This gives a short but intense blue flame, which is sufficient for all ordinary purposes.

A sliding piece of tube can be placed on the tube C to regulate the amount of air, if necessary, but I have found that for delicate work it is sufficient to turn off the gas a little by means of the by-pass tap.

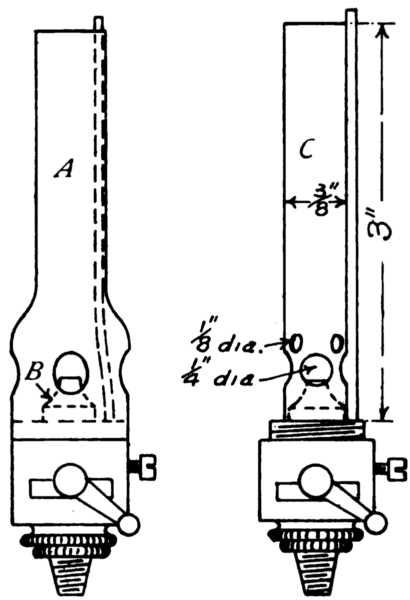


FIG. 1. FIG. 2.

A BY-PASS BUNSEN BURNER, MADE FROM AN INCANDESCENT GAS FITTING.

I may say that I have a similar burner also for heating the ignition tube on my gas engine, and it is very satisfactory—using little gas.

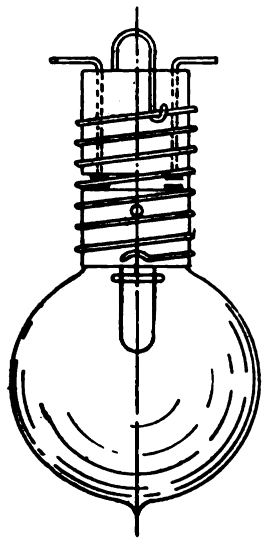
Hardening Scriber Points.

The *Mechanical World* gives the following useful hint for hardening scriber or compass points. An excellent way is to heat them to a cherry-red, then force the points immediately for a few seconds into a piece of soft wood, and instantly after that plunge them into cold water. No tempering is necessary, as it will be found that they are hard enough to scratch glass without being too brittle.

A Holder for Capped Electric Lights.

By A. G.

Wind a spring of wire (preferably brass) about 1 in. long and ⅜ in. internal diameter—the size of cap of small lamps. Turn a piece of hardwood down to ⅜ in. diameter and about 1 in. long, bore two holes for copper wire leads to make connection with lamp; these copper wires should be about 20 gauge, turned over about ¼ in., flattened, passed through holes, and turned over at the top to fasten them in cylinder. The ends may be left long enough to project outside cylinder—for convenience in connecting to supply wires. Force about half the spring over cylinder; the top rung of spring may be bent upwards and passed under coil on opposite side of cylinder to form suspension loop, and the bottom coil may be bent to spring against the second coil. Screw the lamp in until it makes



An Electric Lamp-holder.

contact with studs; a half-turn switches the lamp out. I have some of these in use, and they answer the purpose well, although only costing about one penny.

A Simple Slotting and Planing Machine.

By H. Casselton.

The following is a description of a small machine I have made for doing small planing and slotting, and which I have found to act splendidly. Two iron castings should be obtained, as shown at A and B, A being a bridge to fit over top of lathe bed, and 2½ ins. wide, with two bosses on top 3 ins. apart, as shown. B (Fig. 2) is the travelling tool-holder, which slides up and down the guide rods. This should be 4 ins. wide, 2½ ins. long, ½ in thick, with a lug at each corner (1½ ins. by ½ in.), and a lug in the middle to hold the tool. Continuing from the back should be a projecting arm 3 ins. long, ¾ in. wide on the top, as shown at B. The lugs should be 1½ ins. high. Fig. 1 shows the front and side elevations. A piece of iron should now be obtained 1½ ins. by ½ in., 4 ins. long; this is for the top, into which two ⅜-in. holes are drilled 3 ins. apart. Into the bosses on the top of A drill and tap two holes ⅜-in. Whitworth, exactly the same distance apart as in the top plate. Great care must be taken to get both sets of holes exactly the same distance apart, as the guide rods which fit in them must be quite parallel. Two pieces of smooth round iron should now be obtained 1 ft. long. The ends of these should be centred truly, and on one end of each a ⅜-in. thread ¾ in. long is cut to screw in A. On the other end a plain ⅜-in. pivot is cut, with a ⅜-in. thread on ½ in. long. These pivots fit in the holes in the top plate, and clamp it tight by the nuts. The base A is clamped on the lathe-bed in the usual way—by a nut and bolt. Holes are now drilled through the lugs on the slide B 3 ins. apart, to fit on the 1-in. rods. This slide must now be made to slide freely up and down the rods. In the centre boss a hole is drilled and filed ⅜-in. square to hold the tool. A hole is drilled from the top into the square hole, and tapped 5-16ths-in. Whitworth for a bolt to hold the tool tight. Into the projecting piece continuing from the back a hole is drilled and tapped ⅜ in., and a ⅜-in. pin 2 ins. long, with a thread on ½ in. long, is screwed very tight. Into a faceplate to fit on the lathe a hole is drilled 2½ ins. from the centre, and tapped ⅜ in. A strong shoulder screw is now made to fit in this hole, and having a plain part ½ in. in diameter, ¼ in. long, under the head. A piece of iron 1 in. by ¼, 5½ ins. long, should now have a ⅜-in. hole drilled through ¾ in. from one end and a ½-in. hole drilled through 1 in. from the other end. This is the connecting-rod with the holes, in which work the pin in B and the shoulder screw in the faceplate. A tool should now be held to the square hole in B, projecting about ¼ in. and held tight by the bolt in the top. The machine is now finished, and by screwing the faceplate on the nose of the lathe and clamping the

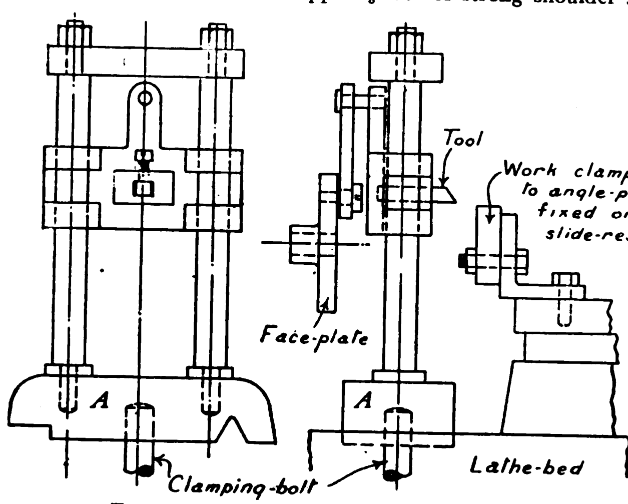


Fig. 1.—Front and Side Elevations.

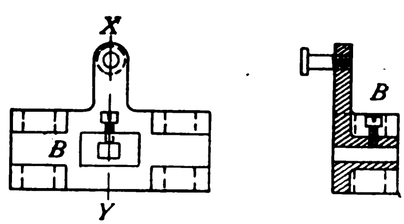


Fig. 2.—Two Views of Travelling Tool-holder.

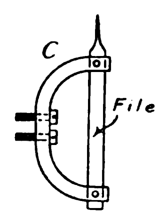


Fig. 3.—Tool-holder for Keyway Cutting

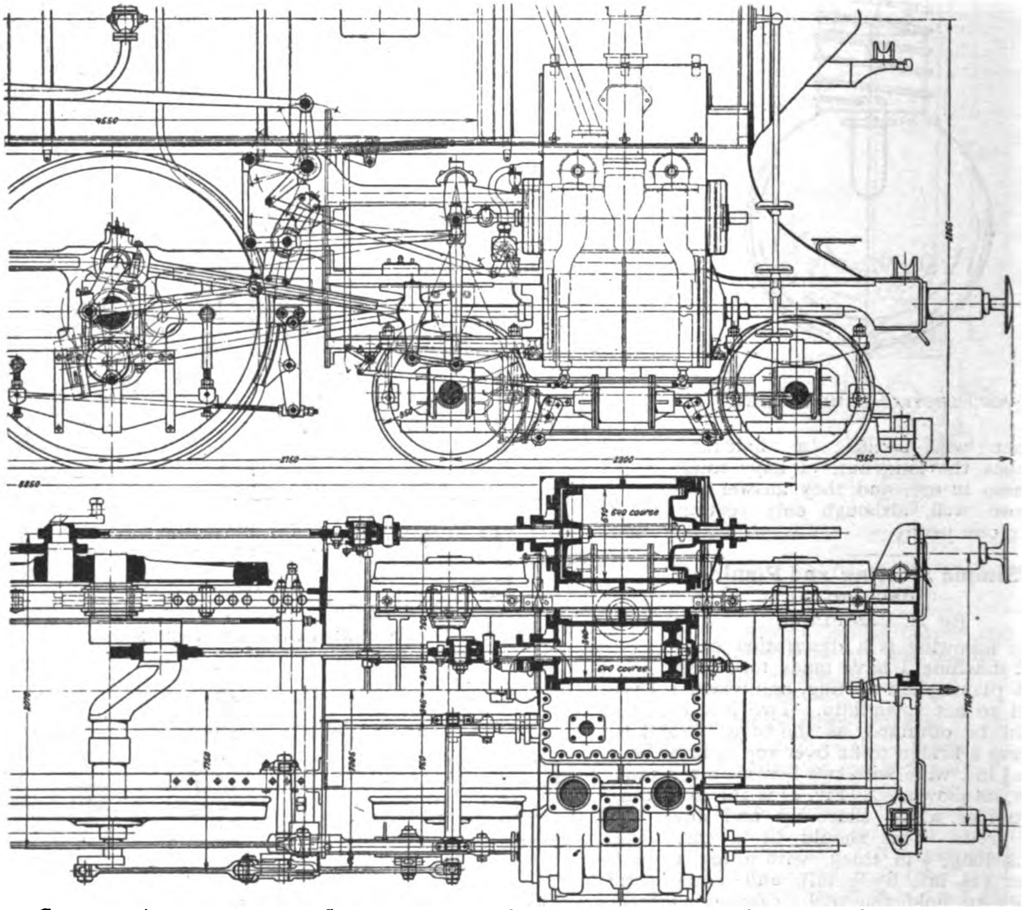
A Slotting and Planing Attachment.

tool down on the bed by means of the nut and bolt underneath and the connecting-rod fixed, when the lathe is revolved towards you the eccentric pin in the faceplate causes the connecting-rod to move the slide up and down the guide rods. The work to be planed or slotted is held under the toolpost, or on an angle-piece screwed on the slide-rest. The feed is taken by travelling slide-rest towards the cutter, and the cut taken across with the lathe revolving. For cutting keyways in wheels a piece of iron should be obtained ½ in. by ¼ in., and should be bent as shown at C. This should be screwed on the slide B. A file the thickness of the keyway required should be obtained, and a slot filed in the ends of the iron rod in which the file fits. The ends of the file are now softened, and, holding it in the slots, a hole is drilled through each end for a pin, as shown. For large wheels the iron will require to be bent more, so that it spans over half the wheel while the file works in the hole. It will be found the tool only takes a few minutes to fit up ready for use, and will save its cost in a very short time.

A Model Engineers' Tramp Abroad.

(*Continued from page* 150.)

ANOTHER interesting feature of the Weiss-Maffei compounding arrangement is the neat and ingenious starting gear. This gear does not require any special attention on the part of the engineman. It is set so that when the reversing lever is in full forward and backward gear, and the cut-off in the cylinders is more than 70 per cent. of the stroke, live steam is admitted from the boiler. The device consists of a valve (or valves, the exact details varying on different classes of engines) which is actuated by a link attached to an arm fixed to the reversing shaft. It will be seen by the diagrams herewith that if this arm is so placed that the starting or live steam valve is in "shut off" position when the reversing lever is in mid-gear, the movement of the lever to either full backward or full forward gear is bound to open the valve to the



General Arrangement of Cylinders of a Maffei Four-cylinder Compound Locomotive of Mr. Weiss' Latest Design.

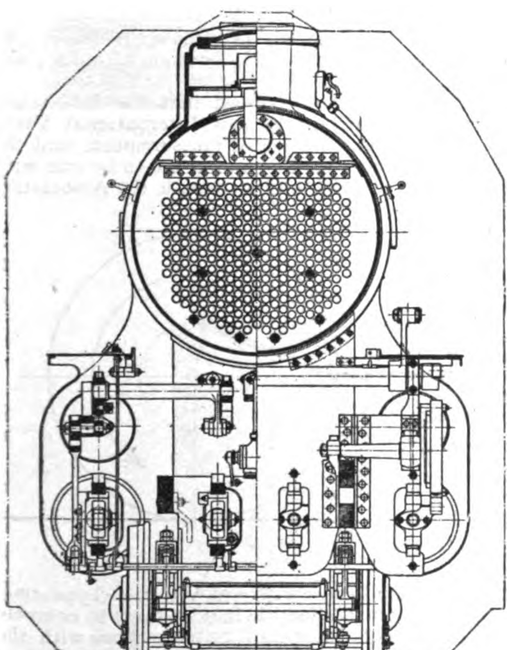
(*The starting valve details are a little different in this design, although the principle is exactly the same.*)

(*Scale:* ¼ *in.* = *1 ft.*)

same extent, and at the same time in each direction, and that to set the arrangement for any specified point of cut-off, it is only necessary to adjust the length of the connecting link. The accompanying diagrammatic sketches show the arrangement clearly. We include a drawing of the cylinder and motion of one of the new "Atlantic" locomotives used on the Bavarian State Railways, which shows how the gear is arranged in practice, and also the method of working four valves with only two sets of valve motion.

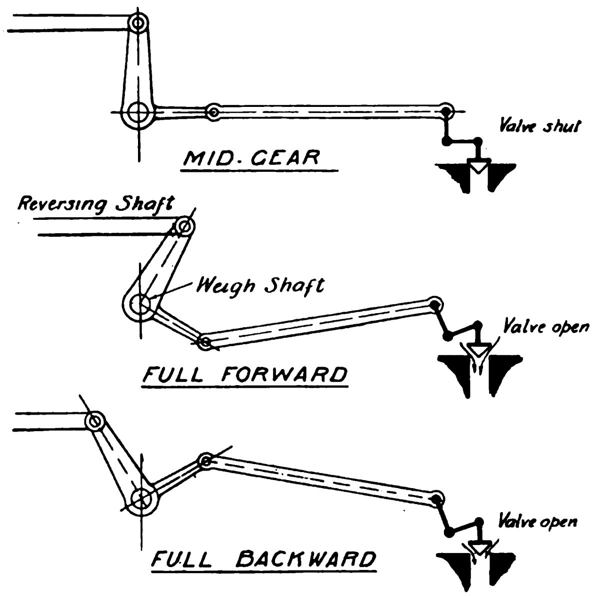
During our visit to Germany in 1903, before the rail-motor coach had become so popular in this country, we were attracted by the appearance of a vehicle of this kind which ran into a small station in Wurtemberg while we were waiting for our train for Munich. This coach, we were told, had at that time been running six years and was worked on the Serpollet system, no mechanism being evident from the outside.

At the Nuremberg Exhibition, Messrs. Maffei exhibited a very fine example of a rail motor. This we illustrate in the accompanying photographs, which respectively show the engine portion and the complete coach. The novel features of the mechanism of this vehicle lie in the type of boiler and the peculiar cylinder and motion arrangements the builders have adopted.



Cross Sectional View.

We understand that two types of boilers have been tried, one of the ordinary locomotive type placed in the coach in a similar manner, but the reverse way round, to the L. & N.-W. Railway coach illustrated in the issue of The Model Engineer for October 12th, 1905; the other boiler being a sort of "Yarrow" water-tube generator, as shown in the photograph, kindly supplied to the writer by Messrs. Maffei & Co., which is reproduced herewith. The boiler, it will be noticed, is provided with a coal hopper, and by means of suitable traps the rate of firing may be regulated. Superheater steam is supplied to the cylinders, the valves of which are of the piston type. The motor has one cylinder on each side of frames. Each of these cylinders has two pistons, connected fore and aft to the leading and trailing driving wheels respectively. The crank-pins are so placed that



Diagrammatic Sketch showing Action of the Starting Valve employed on the Maffei Four-cylinder Compound Locomotive.

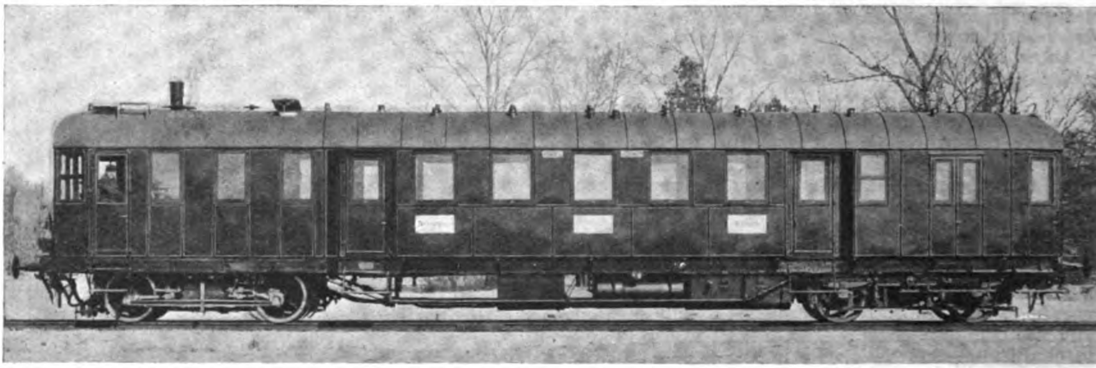
the two pistons, with their connections, move in opposite directions; thus all reciprocating parts are perfectly balanced. At the same time, the work is spread over two crank-pins instead of being applied to one, and the power transmitted to the other wheel by means of coupling-rods. Moreover, "side lash"—so common in ordinary outside cylinder engines—is practically eliminated, and the cranks being set at 90 degs. to those on the opposite side and 180 degs. to those on the same side, four points instead of two, a position of maximum power is obtained by the arrangement.

Only one valve and one set of valve gear is required on each side, and to keep the two pairs of driving wheels in synchronism, coupling rods are employed; these being revolving masses, however, are readily balanced by counterweights in the driving wheels. The engine can develop a maximum power of 350 h.-p., and a speed of 47 miles per hour, or with two trailer cars 40 miles per hour. The cylinders are 8 ins. diameter by (twice) $10\frac{1}{2}$-in. stroke.

The motor coach is arranged to be driven by one man only, and on the return journeys he does not change his position, as is the practice in this country. The coach has a seating capacity for fifty-five, and "standing room" for thirty persons—making eighty-five in all. It is solely third class, and is divided into three portions—smoking and non-smoking, and a place for luggage. The wheelbase of the motor bogie is 9 ft. 1 in., and that of the trailing bogie 8 ft. 2 ins. The total wheelbase is 51 ft. 6 ins., and the length of the coach no less than 78 ft. 7 ins. The height is 14 ft. 9 ins., and weight in working order 50 tons.

Near to the motor coach was exhibited a small shunting or light railway engine built on the same plan, *but without coupling-rods.* The writers were much perturbed at the time as to how the wheels were kept in synchronism—there being only one valve in each side driven from one axle. At first we thought that there was only one piston, but five minutes thought, or the same time at the drawing-board, will soon dispel this idea. We, therefore, suppose that the makers "trust to Providence" and to the action of the valve in admitting and exhausting the steam, to always keep the two uncoupled axles in tune with each other. These engines are used on the light normal gauge railway systems of Bavaria.

(*To be continued.*)



BAVARIAN RAIL MOTOR-COACH, EXHIBITED AT THE NÜRNBERG EXHIBITION.
Built by Messrs. Maffei, of Munich.

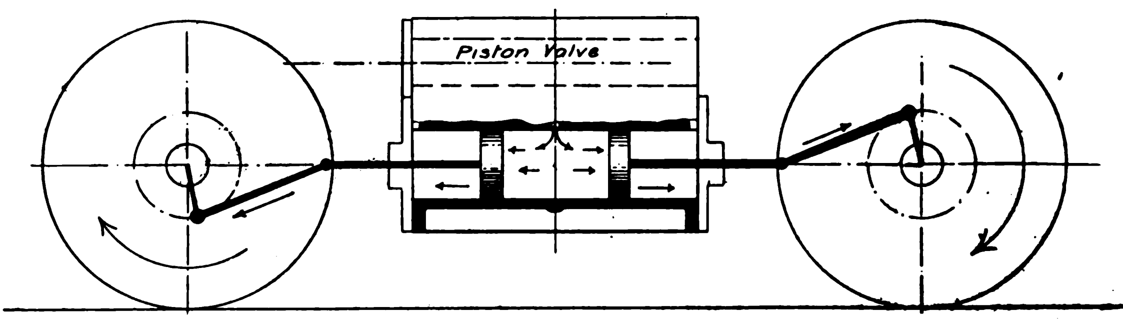


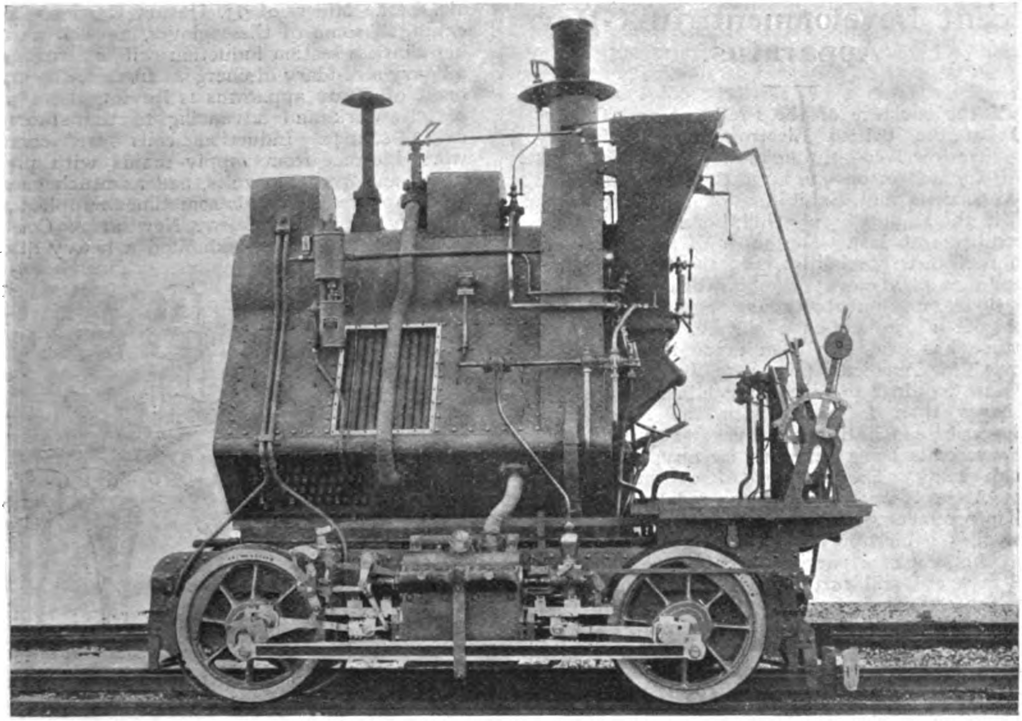
DIAGRAM SHOWING CYLINDER MECHANISM OF MAFFEI'S RAIL MOTOR-COACH.

Northern Model Yachting Association.

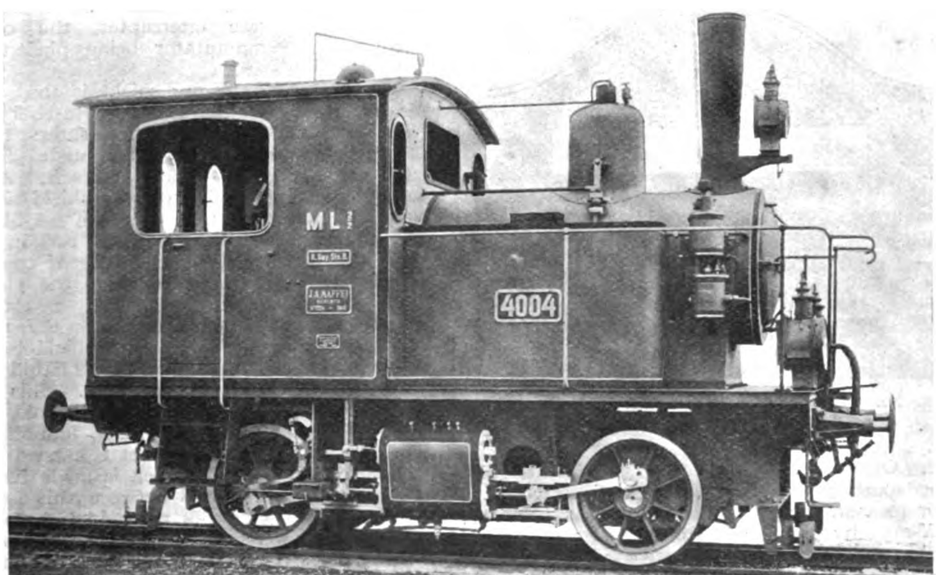
AT the annual general meeting of the above Association held on January 30th, the following gentlemen were elected as officers for the season 1907:—G. H. Willmer, Esq. (president), J. B. Birch, Esq. (vice-president); honorary secretary and treasurer, E. W. Wynne, 31, Clarence Road, Seacombe, Cheshire, to whom all communications regarding the working of this Association may be addressed. The following gentlemen, who represent the various Clubs in this district, were elected to serve on the committee:—Messrs. Wm. McCaig, A. E. Foster, G. Conrod, W. Bradshaw, J. Barry, W. Hicks, W. Halliday, W. H. Norman, H. Allen, and G. P. Nabilet.

It was unanimously agreed that the Association adopt in its entirety the new International Yacht Racing Association Rule of measurement, and the Association races for this season are to be run with the 12 metre model, and so keen is the Association to be quite up to date with regard to model yachting, that a motion to allow the old 42-rater to compete in this season's inter-club matches along with the new 39·4 models, was only carried by one vote.

THE cost of coal for steam locomotives is about 15 per cent. of the total operating expenses for steam railroads, and is the largest of the expenses for materials. According to the annual reports of larger systems, the annual coal consumption is, on the average, about 2,500 tons for each steam locomotive. From the United States census report on "Street and Electric Railways," the cost of fuel for power for electric railways appears to be a little 10·5 per cent. of the total operating expenses.



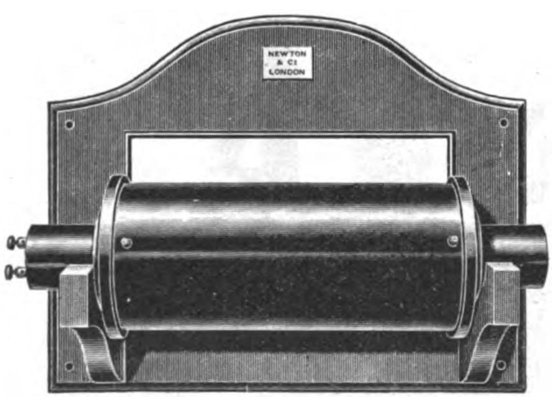
MOTOR ENGINE FOR BAVARIAN MOTOR COACH, SHOWING THE CYLINDER AND MECHANISM AND THE WATER-TUBE GENERATOR.



SHUNTING ENGINE WITH INDEPENDENT DRIVING WHEELS, BUILT BY MESSRS. MAFFEI & CO., MUNICH.

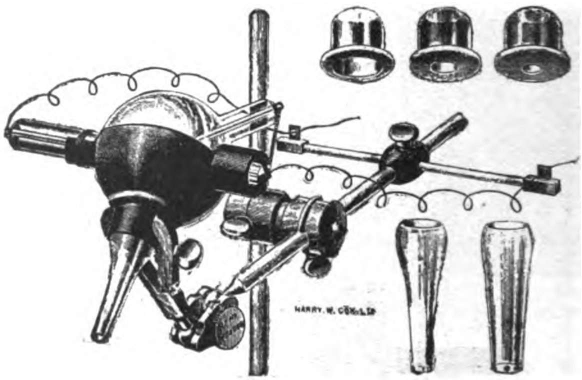
Recent Developments in X-Ray Apparatus.

BY the courtesy of the President and Officers of the British Electrotherapeutic Society we received—through the Hon. Secretary, Dr. Reginald Morton—an invitation to their annual Conversazione and Exhibition of new apparatus held in the Small Queen's Hall, London, on Friday, December 14th last. A number of manufacturers exhibited their specialities, and there was a good attendance of visitors; smoking being permitted, and light refreshments provided, the proceedings were of a free-and-easy nature. Considerable advance has evidently been made in the use of *X*-rays for medical purposes. Induction coils are now required to give a much heavier rate of discharge than formerly, with the result that radiographs can be taken by very short exposure, a few seconds being sufficient for any part of the human body. The amount of current passing through the *X*-ray tube is measured by means of milliamperemeters, and the tube itself is enclosed in a shield which prevents the rays from striking upon the skin of a patient except where required. The rays are still further localised by means of glass tubes which fit into the shield, and are pressed against the skin. Apparently, parasitic, or secondary, rays are formed if the *X*-rays strike against an object before reaching the skin; these interfere with the action of the true *X*-rays. One object of the arrangement of shields and tubes is to ensure that true *X*-rays only reach the skin, Mechanical devices for adjusting the position of the *X*-ray tube in the shield and diaphragms to regulate the size of the cone of rays emitted are



MESSRS. NEWTON & CO.'S WALL BRACKET INDUCTION COIL.

provided. Other refinements are the spintermeter or spark-gap measurer, the radiochromometer for measuring the radiochromometric value of the *X*-rays by gauging the degree of vacuum in the tube, and the soupape, or valve tube, which prevents a flow of current through the tube when the interrupter or contact-breaker is making circuit. Operators are also protecting themselves from *X*-ray burns by means of gloves, aprons, and screens made of special material impregnated with lead. Mr. Leslie Miller, of 93, Hatton Garden, London, exhibited some of these gloves, as well as one of his jointless section induction coils at work, giving a heavy secondary discharge. In fact, the management of *X*-ray apparatus is leaving the condition of guesswork and advancing to the state of an exact science. Induction coils are commonly worked direct from supply mains with pressures up to and over 200 volts, and as much energy as 5,000 apparent watts is sometimes supplied to the primary winding. Messrs. Newton & Co., of 3, Fleet Street, London, exhibited a heavy discharge

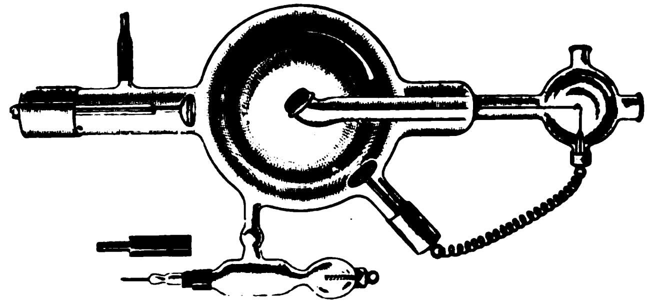


X-RAY TUBE SHIELD AND STOPS, MESSRS. HARRY W. COX, LTD.

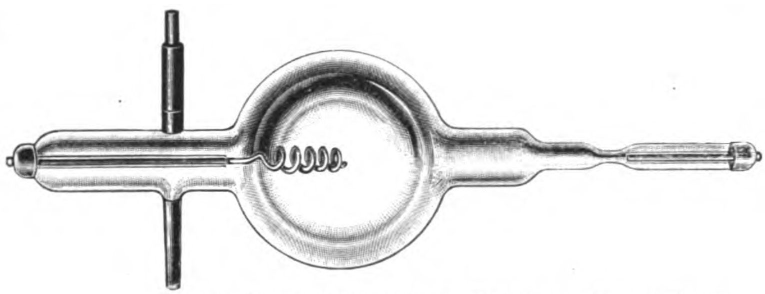
induction coil in action, which is intended to give a 15-in. spark and up to 25 milliamperes of current in the secondary discharge; also one of their wall-bracket pattern coils, as shown in the illustration, suitable for working with a mercury jet or other separate interrupter, the controlling switches and commutator being placed upon a special switchboard.

One pattern of *X*-ray shield is that made by Messrs. Harry W. Cox, Ltd., 1A, Rosebery Avenue, London, E.C. The illustration shows the shield in position over the tube; it is made of a special rubber composition—pliable and soft. Applicator tubes of lead glass fit into the shield as shown; they are shaped so that they can be adjusted to any angle in the shield to make certain that the rays pass directly down the bore of the tube on to the patient without touching the glass. The *X*-ray tube is held in the shield by an elastic band at one end, the other fitting into the ring seen at the right-hand end. As the shield is soft and without metal fittings, there is less liability for the tube to be broken or perforated. This firm has produced an improved form of the old platinum contact-breaker for use with induction coils. The moving platinum contact is carried upon the double rocking-bar U, which is made like a fork. The armature A moves between this fork, being attracted by the core of the induction coil, strikes against the lower limb of U and separates the contacts. Thus A can move for some distance before striking against U; the time of make is therefore prolonged, and the break rapid. *X*-ray tubes with water-cooled anodes are used to enable the tubes to stand the heavy discharges previously referred to. Mr. A. C. Cossor, of 54, Farringdon

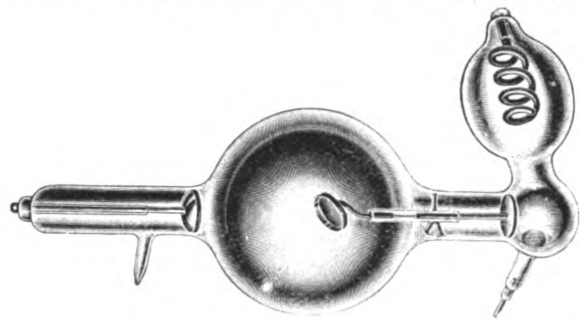
Road, London, E.C., exhibited some of these of his own manufacture—one taking a discharge of 20 milliamperes approx.—as well as ordinary types of tube. The water is contained in a glass tube which terminates at the platinum anode at the inner end; the outer end is made with a spherical bulb, two necks being provided to which rubber tubes may be attached, and a circulation of water maintained. At the lower part of the main bulb is a special arrangement of osmosis tube. It consists of a small platinum and palladium tube closed at the outer end, but open to the interior of the bulb. If the vacuum is too high, it may be lowered by applying a Bunsen flame to this tube. It is well known that platinum—when red hot—is porous to gas. Palladium, however, has about eight times the conductivity of platinum in this respect. Mr. Cossor has adopted a combination of the two metals. The part of the tube which is sealed into the bulb is made of platinum, and the outer part is made of palladium; the two are gold-soldered together. Heat is applied to the palladium portion only, and it is advisable to work the *X*-ray tube whilst the vacuum is being adjusted, as the gas passes through so rapidly that the effect should be observed as a precaution against the vacuum being reduced too far. Platinum is used for the portion of the tube which is sealed in the bulb, because its rate of expansion and contraction is nearer to glass than that of palladium. An ebonite cap protects the osmosis tube from injury when not in use. A higher degree of vacuum is obtained by connecting the cap at the right-hand end of the lower bulb to the terminal of the anode, so that a third anode is thus brought into operation. This consists of a small coil of special wire, which becomes heated and absorbs some of the gas existing within the main bulb, and thus produces a higher degree of vacuum. The rectifying, or valve tube consists of an exhausted bulb having at one end a corkscrew-shaped piece of aluminium and at the other a flat platinum disc or rod. It is connected in series with the *X*-ray tube, the aluminium end being connected to the anode of the *X*-ray tube. The discharge will pass from the platinum disc to the corkscrew wire, but not in a reverse direction; only the current at break can, therefore, pass through the *X*-ray tube; the reverse current produced at make is stopped. The result is a greater



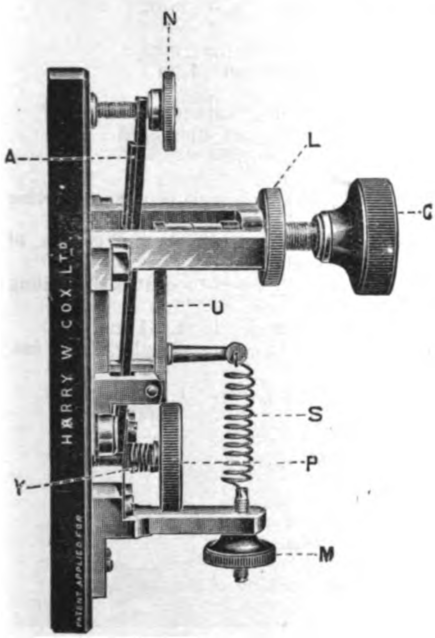
Messrs. Cossor's *X*-ray Tube with Water-cooled Anode.



Messrs. Cossor's Soupape or Rectifying Valve Tube.



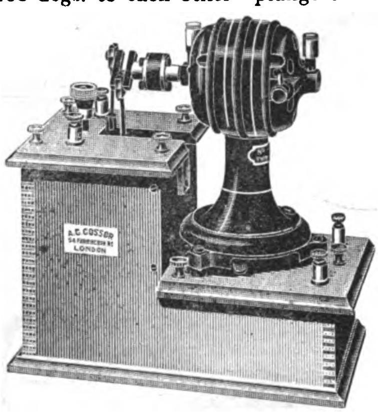
Messrs. Cossor's Combined *X*-ray and Valve Tube.



New Patent Platinum Interrupter, by Messrs. Harry W. Cox, Ltd.

production of *X*-rays from the tube, especially when the induction coil is being used with high-voltage current, such as is obtained from street mains. An *X*-ray tube may also be worked by this means with alternating current from a high-tension transformer, as the valve tube permits the discharge to pass in one direction only. The valve tube can be combined with the *X*-ray tube, as shown in the illustration. We understand that all Mr. Cossor's tubes are made in his factory in London, and that he also caters for experimenters requiring vacuum tubes made to special design, or any description of light glass blowing.

Motor interrupters for coils were a feature of the Exhibition. Mr. Cossor makes a very simple pattern, consisting of a double-crank attached directly to the spindle of a small motor, but insulated from it. Each crank drives a vertical dipper by means of a connecting-rod. These dippers are simple cylindrical rods working in guides, the arrangement resembling the piston-rods, cross-heads, and cranks of a steam engine. They are plunged into mercury contained in a cast-iron pot. As the motor spindle rotates, the cranks—being set at 180 degs. to each other—plunge the dippers



MESSRS. COSSOR'S DOUBLE DIPPER MERCURY INTERRUPTER.

into the mercury alternately and withdraw them. The circuit is thus made and broken twice in each revolution, giving 4,000 interruptions per minute for a speed of 2000 r.p.m. of the motor spindle. One connecting-wire is joined to the pot containing the mercury, and the other to the guide in which the dippers slide. A rack-and-pinion movement depresses or raises the level of the mercury by the submersion of a displacer ring of suitable bulk, and therefore increases or decreases the time of contact. By releasing four thumbscrews the motor and dipper gear can be removed intact, and the mercury-containing pot exposed for cleaning purposes. This interrupter is intended to work with pressures up to about 100 volts across the primary terminals; the motor can be wound direct for pressures up to 250 volts.

(To be continued.)

WE regret that the article on "A Home-made Twist Drill Grinder" in Feb. 7th issue was attributed, by a printer's error, to A. Wilson. This should have read, "By A. Nelson."

Locomotive Notes.

THE NEW L. & N.-W.R. LOCOMOTIVES.

The writer has been favoured by Mr. George Whale, M.Inst.C.E., chief mechanical engineer of the London and North-Western Railway, with a photograph and full particulars of the new 4—6—0 type locomotive, No. 285, which is the first of the latest series of engines built at Crewe Works. The photograph, reproduced herewith, shows that in general design the new locomotives are a repetition of the "Experiment" class, the principal difference between the two designs being a substantial variation in the diameter of the coupled wheels.

Mr. Whale appears to be following the lead of his colleague, Mr. McIntosh, of the Caledonian Railway, in adopting the 4—6—0 type of engine with inside cylinders for working widely divergent classes of traffic. The "Experiments" were built for heavy express passenger work, and the new engines rank officially as fast goods engines. We shall, however, doubtless often find them hauling passenger trains, and they are, of course, well suited to the requirements of mixed traffic working.

The leading dimensions are as follows:—

Cylinders, 19 ins. diameter by 26-in. stroke.

Boiler:—
Barrel: Mean diameter, 5 ft. 0¾ in.
Length, 12 ft. 6 ins.
Distance between tube plates, 12 ft. 10⅝ ins.
Firebox: Length outside, 8 ft. 2 ins.
Width outside, 4 ft. 1 in.
Number of tubes, 291.
Diameter of tubes (outside), 1⅞ ins.
Boiler pressure, 185 lbs. per sq. in.

Wheels:—
Radial truck, 3 ft. 3 ins. diameter.
Coupled wheels, 5 ft. 2½ ins. diameter.

Wheelbase:—
Radial truck, 6 ft. 3 ins.
From centre of radial truck to centre of driving wheel, 10 ft.
From centre of driving wheels to centre of intermediate wheels, 6 ft. 9½ ins.
From centre of intermediate to centre of trailing wheel, 6 ft. 9½ ins.
Total wheelbase of engine, 26 ft. 8½ ins.
Height from rail level to centre of boiler, 8 ft. 7 ins.

Heating surface:—

Tubes	1,840·5 sq. feet.
Firebox	144·3 „ „
Total ..	1,984·8 „ „

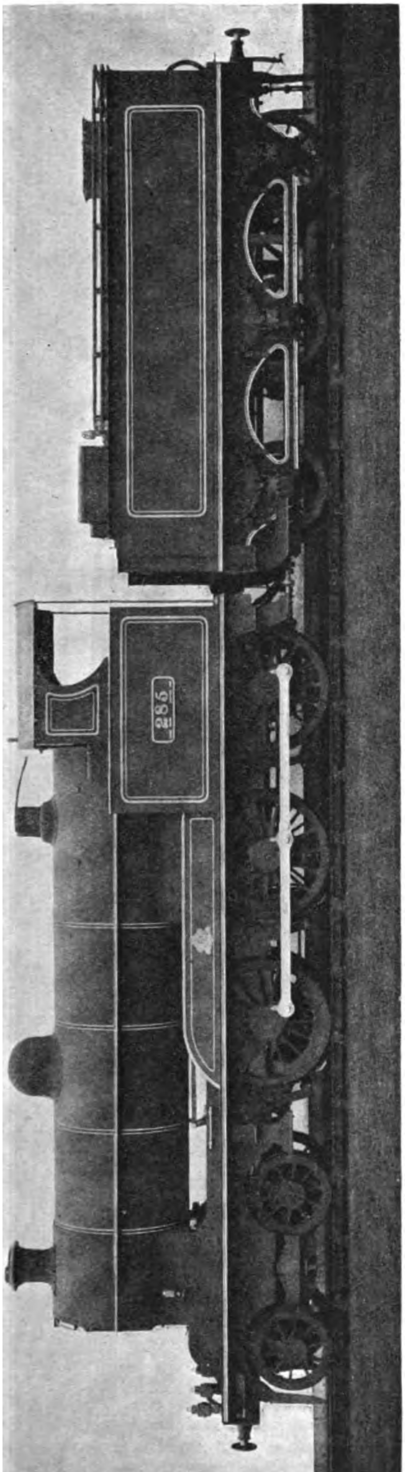
Grate area, 25 sq. ft.

Tender:—
Water capacity, 3,000 gallons.
Coal capacity, 6 tons.
Wheelbase, 13 ft. 6 ins.

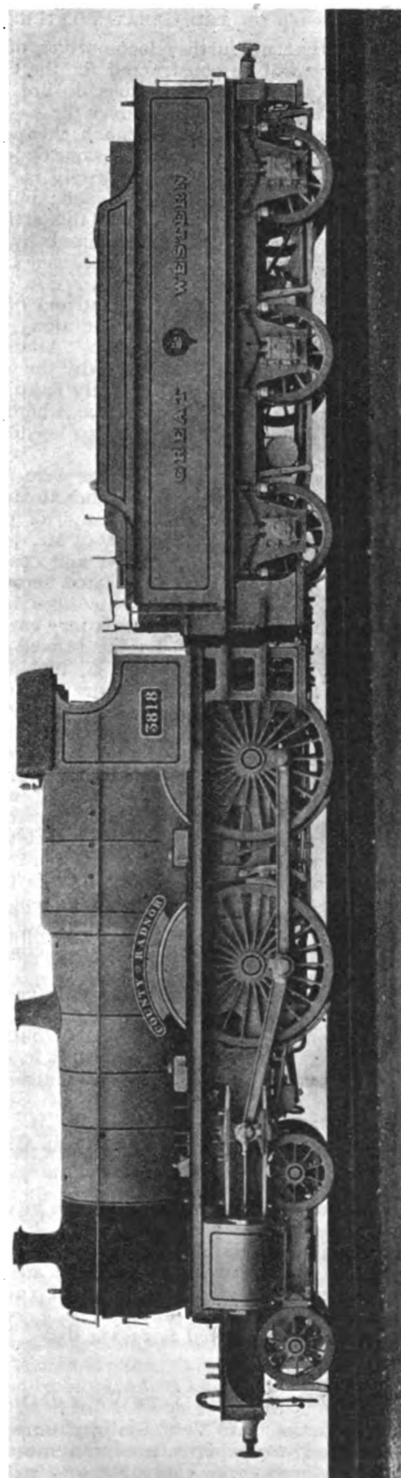
Weight of engine in working order:—	t.	c.
On truck	18	16
On driving wheels	16	0
On intermediate wheels	14	15
On trailing wheels	13	9
Total	63	0

Total weight of engine and tender in working order, 100 tons.

Total length of engine and tender over the buffers, 57 ft. 5 ins.



4—6—0 Type Fast Goods Locomotive: London & North-Western Railway.



New 4—4—0 Type Locomotive, "County" Class: Great Western Railway.

More 4—4—0's on the Great Western.

It is stated that no further locomotives of the "Atlantic" type will be constructed for the Great Western Railway—"as these engines do not offer sufficiently substantial advantages over the 4—4—0 type, which latter are, of course, much cheaper to build and maintain." Practically the same opportunities for utilising adhesion weight apply in both cases, there being two coupled axles in each; but it is difficult to see how anyone can defend this attitude in view of the superior facilities offered by the 4—4—2 wheel arrangement, where increased boiler power and distribution of total weight are in question. However, the L. & N.-W.R. and one or two other important railways seem to get along very well without a single locomotive of the "Atlantic" type, and there is no reason therefore why the Great Western should not do the same. Only it appears a little singular that on the very line where the 4—4—2 type should succeed, it is to be discontinued.

Quite recently some further additions were made to the number of "County" class engines already in service, and one of the new series, viz., No. 3,818, "County of Radnor," is, by courtesy of Mr. James C. Inglis, M.Inst.C.E., general manager and consulting engineer of the G.W. Rly., illustrated herewith. No differences of an essential nature have been introduced in bringing out these supplementary engines, the first series of "Countys" having proved very successful and as economical as a high-speed simple express locomotive can be expected to be. The cylinders have a diameter of 18 ins. and a piston stroke of 30 ins., and steam is distributed to them by Stephenson link motion actuating piston valves working on top of the cylinder through the medium of a rocking shaft, by means of which motion is transferred from the inside gear to the valve spindle outside the frames. The boiler is of the Belpaire type, without dome, and the barrel, in accordance with modern practice on the Great Western Railway, is coned throughout its length.

Other leading dimensions are given below:—

Wheels, bogie diameter, 3 ft. 2 ins.; coupled, 6 ft. 8½ ins.

Wheelbase—Rigid, 8 ft. 6 ins.; total (engine), 24 ft.

Boiler diameter—Smokebox end (outside), 4 ft. 10¾ ins.; firebox end (outside), 5 ft. 6 ins. length of barrel, 11 ft.; height of centre from rail, 8 ft. 6 ins.

Heating surface—Tubes, 1,692·14 sq. ft.; firebox, 128·21 sq. ft.: total, 1,820·35 sq. ft.

Grate area, 20·56 sq. ft.

Working pressure, 200 lbs.

Weight on coupled wheels—with engine in working order—37 tons 12 cwts.

Weight of engine in working order, 58 tons 16 cwts.

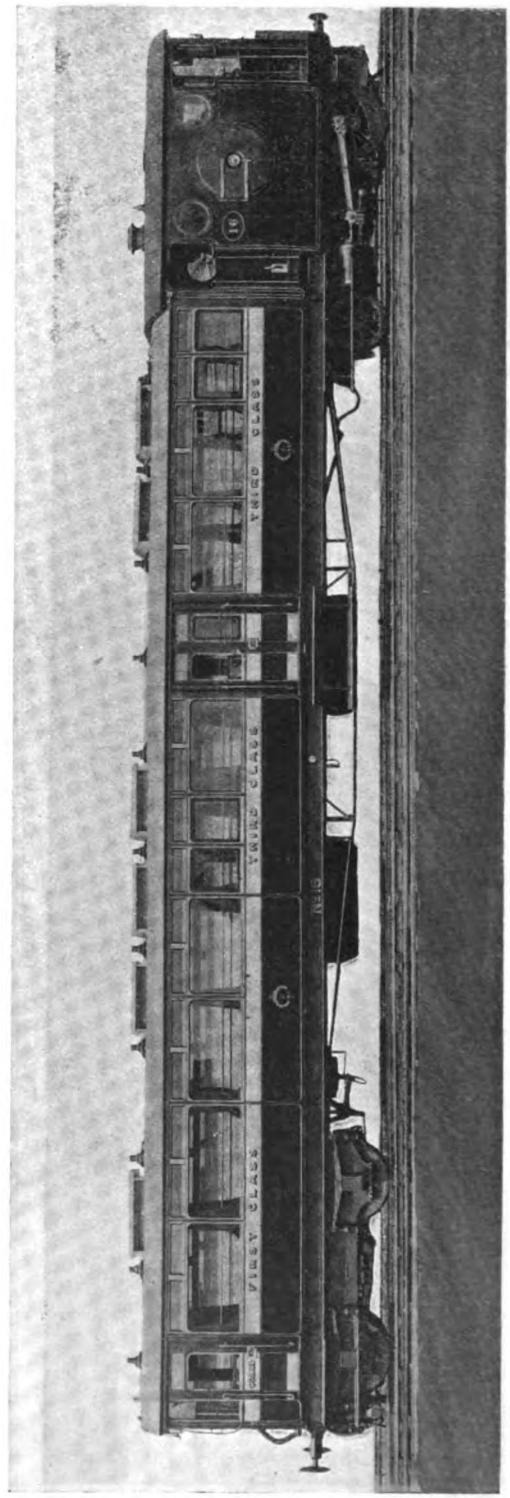
The tender weighs (in working order) 40 tons, so that engine and tender complete (in running condition) weigh 98 tons 16 cwts.

The tractive force exerted is 21,734 lbs.

———

Rail Motor Cars on the Taff Vale Railway.

During 1906 the Taff Vale Railway Company, encouraged by their experience of rail motor-car working, introduced some cars of a new pattern, which had been designed by Mr. T. Harry Riches, M.Inst.C.E., locomotive carriage and wagon super-



Latest Rail Motor-Car: Taff Vale Railway.

intendent. The new cars present many differences and some important advantages over the earlier, or 1903, design. They carry twenty-two more passengers, while affording the same amount of seating space to each, and improvements have been effected in the design of both the carriage and locomotive portions.

The seating accommodation is for sixteen first and fifty-seven third class passengers, smoking and non-smoking, and the general comfort and convenience of the cars is much appreciated by those who have occasion to use them. The riding is wonderfully easy, and the accelerative powers of the engine are remarkable, especially when it is remembered that the latter is of the single-driving type.

The accompanying reproduction gives an accurate idea of the external appearance of one of the 1906 cars. The engine cylinders are located under the cab gangway, and they drive the end pair of wheels. The boiler has two barrels, with the firebox between them, the barrels being arranged transversely across the engine compartment, with a smokebox door on each side. One of these can be seen in the illustration. The valve gear is Stephenson's, and is placed inside the framing out of sight and away from dust and dirt. The engine can be worked from either end of the car, there being a driver's compartment at both ends and duplicating appliances for controlling the engine when running backwards. The car is steam-heated, and lighted on the Pintsch oil gas system. The engine cylinders have a diameter of 10½ ins. and a stroke of 14 ins. The total heating surface of the boiler is 464·84 sq. ft. Grate area, 10 sq. ft.; working pressure, 180 lbs. The driving wheels are 3 ft. 6 ins. in diameter.

Some Accurate Electrical Measuring Instruments.

By V. W. Delves-Broughton.

(*Continued from page 132.*)

A Tangent Galvanometer.

Having constructed the necessary apparatus to detect minute currents and to measure resistances, the next requirement for our electro-physical laboratory is an appliance for measuring currents, and for this purpose nothing can excel a "Tangent Galvanometer," as it can be used both to measure volts and amperes, or, in other words, pressure and quantity.

The principle of a tangent galvanometer lies in the fact that if a magnetic needle is surrounded by a relatively large coil, the deflection of the needle as indicated on a tangent scale is proportionate to the current flowing through the wire. Thus, if 1 amp. causes a deflection of *a* degrees on the tangent scale, 2 amps. will cause a deflection of *2a*.

Theoretically, the needle should not be more than one-twelfth the length of the diameter of the coil; but for all practical purposes it will be found that a needle one-eighth of the diameter will give sufficiently accurate results.

As it is difficult to construct a needle less than ¾ in. in length that will give sufficient directive power, this fixes the diameter of our coil at 6 ins.

The coil must be wound on a frame that will not twist nor warp, as any deformation of the coil when once the instrument has been calibrated will affect the accuracy of the readings. For this reason I have constructed my coil with a brass ring, which was cast in halves and sweated together, as shown

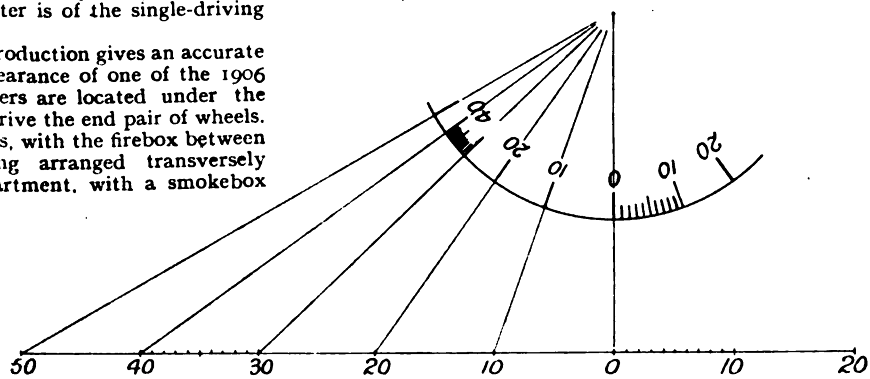


Fig. 1.—Method of Constructing a Tangent Scale.

in the drawings, thus obviating the necessity of coring out the groove round the edge.

If great economy has to be studied, the ring may be cast in a plaster mould in zinc, which is sufficiently strong for the work it has to do, but does not look quite so nice when finished and lacquered.

For the sake of clearness I shall now give in some detail the method of construction I employed in making my galvanometer.

The groove was turned out and the sides faced up by screwing the casting to a wooden faceplate in the lathe. The brackets for the compass-box were then filed up, during which process the sides of the ring were somewhat scratched, and to give a neat finish they were gone over with a scraper, the mottled effect will be clearly seen in the photograph.

The forked plug was filed up and screwed to the ring, and the conical part was turned and bored whilst in position on the ring. The tripod was next faced and bored, and the plug ground in, then it was filed up and the levelling screws fitted.

There are two windings on the coil, one consisting of 200 turns of No. 35 wire wound double, and one of 20 turns of No. 20 wire, also wound double. These coils virtually form four independent coils, as their ends are not connected in the ring, but are led out through the stem of the hollow plug, being joined to flexible bell wire to ensure against breakage and the ends joined to eight terminals in the weighted ebonite block, as will be shown diagrammatically.

The flexible wires are twisted into a cable and pass under the tripod to the terminal block at a distance of about 15 ins. from the instrument.

The advantage of this form of construction over the usual construction with the terminals on the ring is that there is no fear of the connecting wires carrying heavy currents being brought near the coil, and thus upsetting the accuracy of the reading.

After winding the coils, each wire was tested for resistance, and each pair were made quite equal by leaving that showing the least resistance a little longer than the other, and folding the slack wire away under the silk ribbon used to cover the wire in the groove.

Before the wire was wound, paper was cemented to the sides and bottom of the groove with shellac

The compass-box consists of a piece of brass tube 4½ ins. in diameter by ¾ in. deep, with a sheet zinc bottom and a strip of sheet zinc fitted inside to form a rebate for the glass to rest upon. The glass is held in position by a ring of brass wire sprung into place.

The compass-card is raised about 3-16ths in. from the bottom of the box by a piece of thin wood with a hole in the centre, in which the needle revolves. The inside of the box was lined throughout with

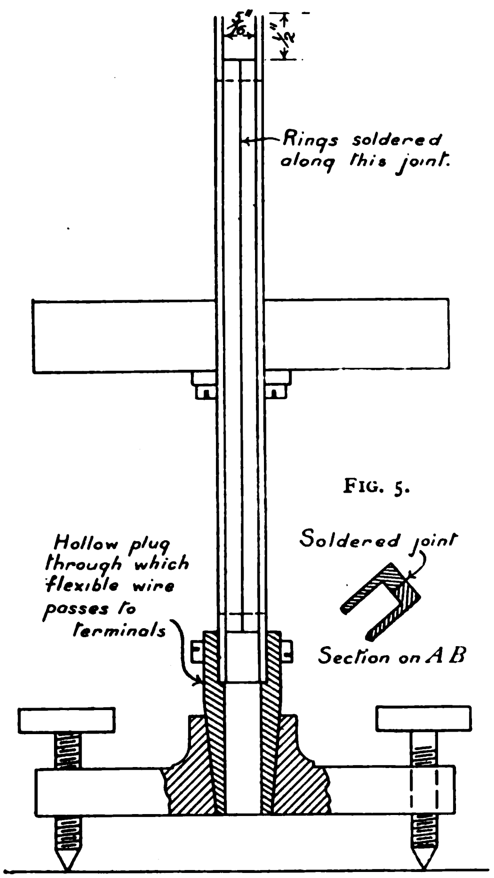


FIG. 5.

FIG. 2.—SIDE ELEVATION.

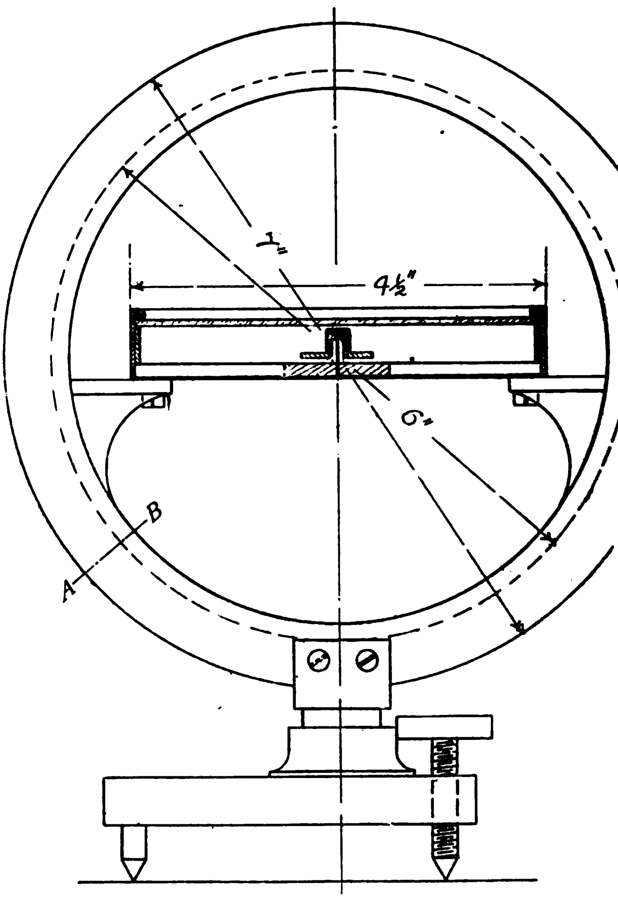


FIG. 3.—FRONT ELEVATION.

DESIGN FOR A TANGENT GALVANOMETER.

varnish, and during the process of winding the wires were well saturated with shellac, and the whole thoroughly dried in an oven, thus firmly fixing the wires and preventing the absorption of moisture.

After the coils were wound, the paper, which had been left slightly projecting, was folded down and a piece of silk ribbon cemented over the top of all to give a neat finish.

The brasswork having been polished and lacquered the coil was put together, and a small screw fitted to prevent the plug lifting out of the socket, but allowing the plug to turn freely in the socket.

white paper, which gives a neat finish and serves to reflect the light upon the scale.

Under the magnetic needle a forked spring is fitted, which can be forced up by means of a small screw with a milled head, thus raising the compass-needle off the needle-point when the instrument is not in use.

This device is not shown in the drawings, but some such arrangement is necessary, as should the instrument receive a jar whilst being carried the needle-point is liable to suffer.

(To be continued.)

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 ENCYCLOPÆDIA OF PRACTICAL ENGINEERING. Edited by Joseph G. Horner. Vol. V. London: Virtue & Co. Price 7s. 6d. net; postage 5d.

The new volume of this useful work, which has just appeared, commences with the subject of "files" and concludes with "indicating." Among the more important articles included within this range we notice:—Flash Boilers, Floors, Flying Machines, Forced Draught, Forging Dies, Forging Presses, Foundations, Furnace Flues, Galloway Boilers, Gas Engines, Gas Holders, Gas Producers, Gears, Girard Turbine, Gold Mining, Grabs, Goliaths, Grinding, Guns, Hammers, Hardening, Headstocks, Heat, Helical Gears, High-speed Engines, High-speed Lathes, High-speed Steel, Hoists, Horizontal Boring Machines, Hot-water Systems, Hydraulic Cranes, Ignition Devices, Incandescent Lamps, and Indexing. These all give thoroughly useful information on the subjects indicated, and, as usual, the illustrations are excellent.

ADVERTISING THAT TELLS. By Geo. C. Mares. London: Guilbert Pitman. Price 1s. 6d. net; postage 2d.

Although advertising does not come within the scope of model engineering as a hobby, it is an important matter to those who are following such work from a business point of view, and the book under notice gives some excellent advice on how to advertise in a small way successfully. It explains also the technical matters of type, blocks, and proof-correcting, and has an instructive chapter on the cultivation of a postal business. It concludes with some typical examples of successful American advertisements.

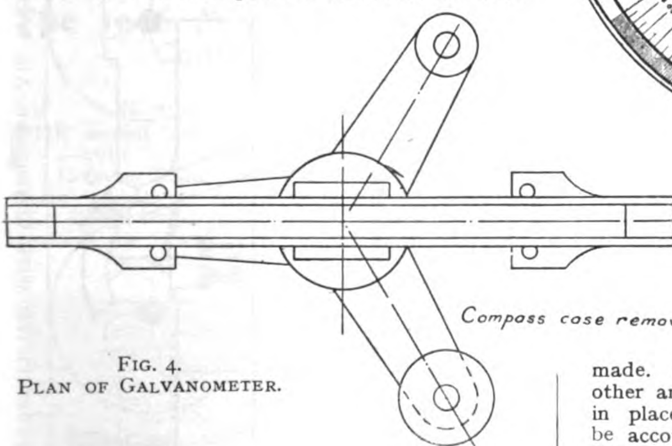


FIG. 4.
PLAN OF GALVANOMETER.

EXPERIMENTING WITH INDUCTION COILS. By H. S. Norrie. London: E. & F. N. Spon, Ltd. Price 1s. 6d.; postage 2d.

This little volume of some seventy-four pages is a most useful addition to the literature relating to the handling of induction coils and many and varied experiments which can be carried out after a knowledge of the possibilities of the subject has been acquired. The book is well illustrated and clearly written.

The Sixth "Gauge" Competition.

TO further encourage model-making in all its branches, we offer to send an improved sliding caliper gauge, with screw adjustment, to every reader who sends us for insertion in our Journal a sufficiently good photograph and description of any model, tool, or piece of apparatus he has made. If preferred, any other tool, book, or other article to the value of 6s. 6d. will be sent in place of the caliper gauge. Entries should be accompanied by a separate letter, giving the title of the article, and stating exactly what tool is desired. If other than a caliper gauge is required, the page and number of the tool in the firm's catalogue from which it can be obtained should be mentioned. The article should be written *on one side of the paper only*, with the name and address of the sender on the back. The photographs and separate sketches enclosed with the contribution should similarly bear the name and address of the sender, otherwise delay may arise in the awarding of the prizes. It is essential in this, as in our other competitions, that the copyright of the photographs must be the property of the senders, and the covering letter should contain a declaration to this effect. The competition will close on February 28th.

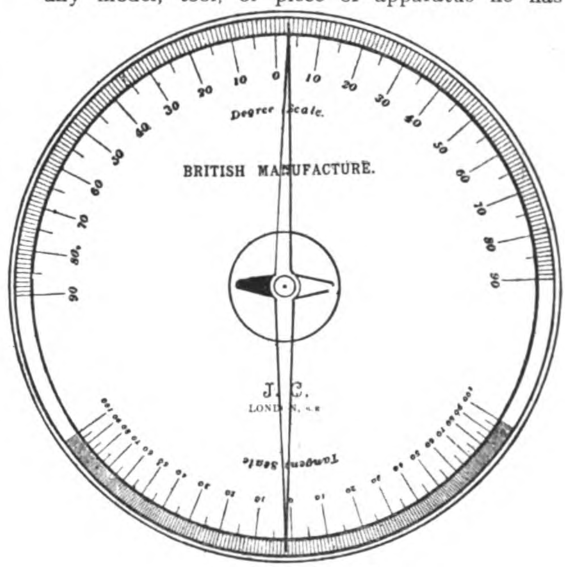


FIG. 6.
SHOWING PLAN OF COMPASS-BOX; WITH SCALE, NEEDLE AND POINTER FOR TANGENT GALVANOMETER.

(Two-thirds actual size.)

How It Works.

VIII.—Water Pick-up Apparatus for Locomotives.

(Continued from page 154.)

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

On the Great Eastern Railway Mr. James Holden, the locomotive superintendent, has introduced an arrangement of water pick-up apparatus worked by compressed air. The customary air reservoir of the Westinghouse brake is divided into two portions, and the compressed air used for operating the water scoop is compressed in the ordinary way by the air pump of the brake apparatus. One of the chambers in the reservoir is reserved for the air pumped into it for working the scoop, and the other for storing air for supplying the brakes. The two chambers are connected by a pipe in which a non-return valve is placed, and the air for the brakes passes through the pipe and valve from the first chamber to the second, and in this way both reservoirs may be utilised for the purposes of the brakes, but only one, viz., the first chamber, which takes air directly from the pump, can be relied upon for operating the scoop; and by this means accidental applications of the brakes are avoided.

The movements of the piston in the compressed air cylinder are controlled by means of a suitable valve, governed from the platform through a handle, and when this handle is moved from its normal position in the one marked "down" the effect is to admit air under pressure to the top of the piston in the cylinder, such air passing from the reservoir through a pipe communicating with the control valve, and afterwards through a second pipe to the upper end of the cylinder. As the result of the pressure which is thus brought to bear upon the top of the piston the latter naturally descends, and in doing this it forces the scoop down into the water trough, when water is forced up the pipe (by reason of the motion of the engine over the trough) into the tank of the tender.

On sufficient water being collected, the handle of the control valve is placed in the position marked "up," and as a consequence of this movement, the cylinder above the piston is opened to exhaust, and pressure being admitted to the under side of the piston, the latter ascends and draws the scoop up with it clear of the trough. After this is done, the handle is placed in its normal position, *i.e.*, midway between "up" and "down," and as a result air is allowed to escape from the cylinder and the scoop is held in its clear position by means of coiled springs.

The compressed air cylinder consists of two portions, of which the lower portion is the piston chamber, whilst the upper one acts as a dashpot. The latter has two small holes at the top and four larger ones lower down. Suitable passages are provided for admitting air to both ends of the cylinder, and a piece of wood is placed between the two pistons for the purpose of reducing the volume of air consumed. The dashpot might, of course, be placed with the control valve, but greater rapidity of action is secured by locating it above the cylinder.

The water scoop is provided with a bracket,

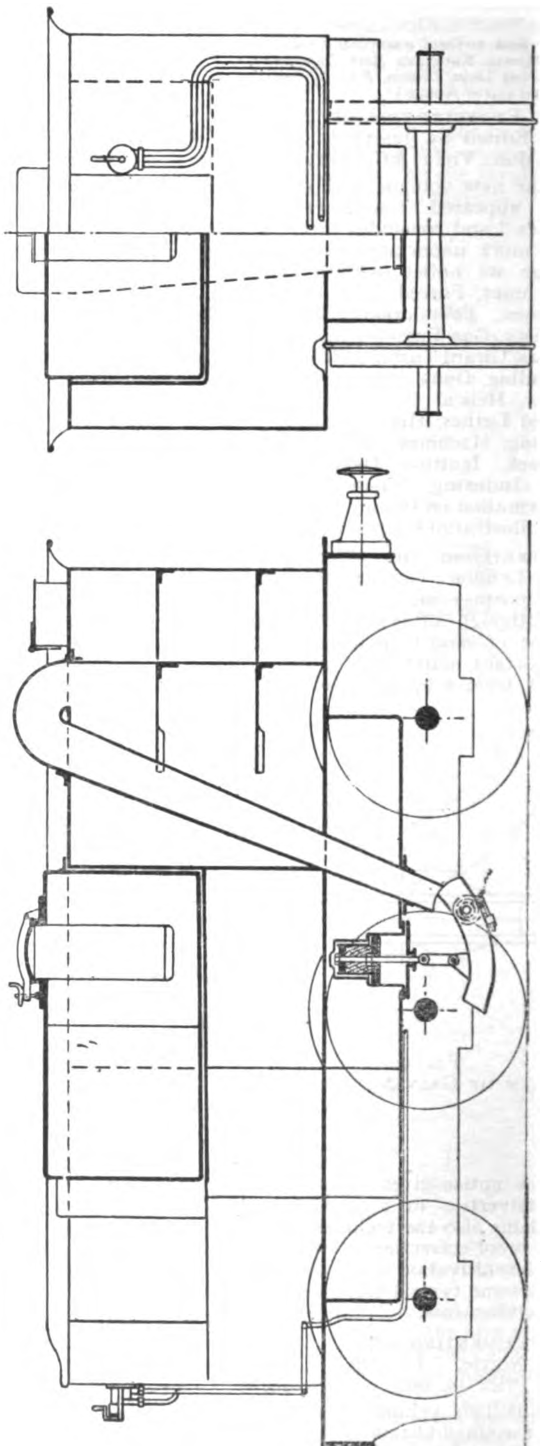


Fig. 19.—Showing Tender fitted with Compressed Air Water Pick-up Apparatus: Great Eastern Railway.

and the piston-rod of the cylinder is connected to this bracket by means of slotted links in which a pin attached to the bracket works, the pin being at the top of the slot when the descent of the scoop first commences, but as the water resistance increases and the scoop is drawn deeper into the trough, the pin moves downwards, and on reaching the bottom of the slot, the movement of the scoop ceases as a matter of course. This arrangement secures greater elasticity, and as a result of its employment a greater amount of water is taken up into the tender.

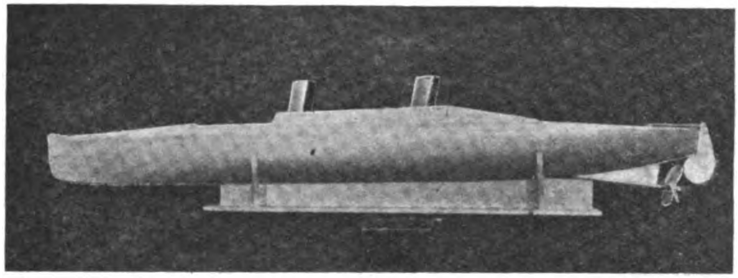
The air above the piston escapes when the "up"-stroke is in progress, first through a passage at the side of the cylinder and then through the lower ports in the dashpot and on these becoming covered by the piston in its ascent, the air exhausts slowly through the holes in the top of the dashpot. By these combined means all the cushioning effect necessary for the prevention of shock is easily secured.

The writer has been informed by Mr. Holden that an average of 1,900 gallons of water is picked up whilst passing over a trough with the aid of this gear, which has given every possible satisfaction in working on the Great Eastern Railway.

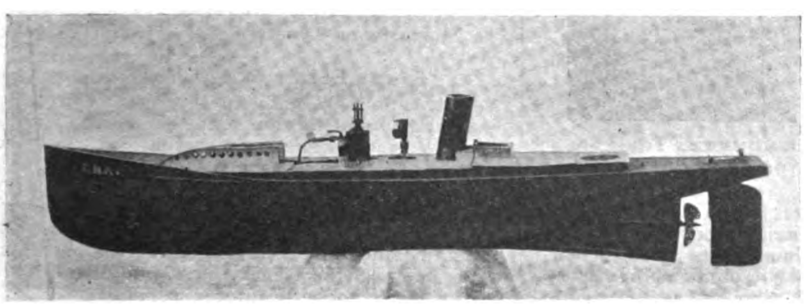
The 1906 Model Speed Boat Competition.

(*Continued from page* 163.)

THE second boat in the "B" class—the *Ena*—built by Mr. T. Bowman Duff, of 88, Lefevre Road, Bow, E., is one of the 'Metre" boats of the Victoria Model Steamer Club. It was tested on the Regent's Canal between Victoria Park Bridge and the Cricketers' Bridge Lock on Christmas Eve, the course being 300 yds. long. The time for the whole distance—in one run and from a dead start—was 1 minute 55 seconds (115 seconds), which gives 5·366 miles—a very creditable feat for a boat only 39½ ins. long. The report states that the above speed does not represent the best performance of the boat—condensation and other heat losses, due to the extreme weather, being a considerable factor in accounting for the difference in the present and previously recorded speeds. The canal was the only available piece of water, the lake the club generally uses being covered with ice. The following are a few particulars of Mr. Duff's boat:—The hull is built of zinc, soldered together in six sections. The deck is made of mahogany, and the sides of the hull are fixed to the deck with rivets ⅛ in. long, and a piece of brass wire is soldered on the edge to give it a finish. The length is 1 metre (3 ft. 3⅜ ins.), beam 7 ins., and depth 5 ins. The outer shell is of 22 gauge sheet copper, double riveted at the seam and soft soldered. The furnace tube is solid-drawn copper tube, with twenty-five copper water-tubes silver-soldered into it. The ends of boiler are flanged and riveted to outer shell and flue tube. The smokebox is made of tinplate. The boiler is provided with a dome and also a superheater fitted in the smokebox. The working pressure is 50 lbs. per sq. in., and the length of the outer shell 7 ins. by 4½ ins. diameter. The flue tube is 2 ins. diameter. The blowlamp is an ordinary benzoline self-acting type of Max Sievert's (Stockholm) make. The engine is the ordinary slide-valve type, with one high-pressure cylinder, having a ⅞-in. stroke and a ⅝-in. bore. Steam is taken from boiler through the flue tube and a coil in smokebox. The steam pipe is ⅛ in. diameter, and the exhaust is led up the tunnel. The propeller is 3 ins. diameter, attached to a shaft ⅛ in. diameter.



MR. W. H. RIMMER'S MODEL T.B. "WOLF."



MR. T. BOWMAN DUFF'S MODEL T.B.D. "ENA."

(*Winner of Bronze Medal in Class B.*)

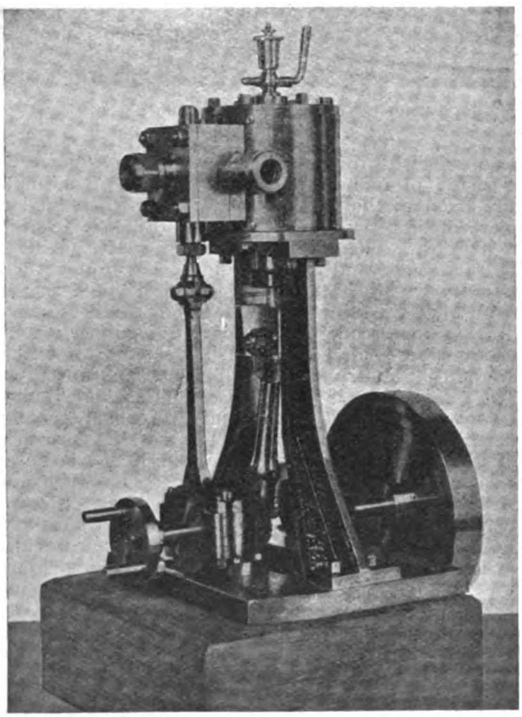
We come now to the speed boats which were awarded certificates of merit. In each case these boats have exceeded a certain speed, determined by the general conditions, viz.:—Five and a-half miles per hour for "A" class boats and four miles per hour for "B" class boats.

Mr. W. H. Rimmer, of the Liverpool Model Yacht Club, is to be highly commended for his laudable attempt to gain a medal. His 6-ft. 10½-in.

model torpedo-boat *Wolf* attained a speed of 7·67 miles per hour in one run over the stipulated course of 300 yds., which performance exceeds that of the medallist of the 1903 competition, and is practically the same as that obtained by Mr. David Scott in 1904.

The dimensions of the hull are 6 ft. 10½ ins. L.W.L., 10½ ins. beam, 6½ ins. depth amidships, 4½ ins. load water-line. The total displacement is 45 lbs., and the hull has a water-tight compartment fore and aft. It is built on torpedo-boat lines—round section throughout. The deck is made of 22 S.W.G. aluminium, and is provided with no fittings save a starting-valve lever and a steam gauge.

The boiler weighs (without water) 15 lbs., and measures 15 ins. long by 6½ ins. diameter. The shell is of 18-gauge copper. Two furnaces are



THE ENGINE OF MR. W. H. RIMMER'S TORPEDO-BOAT, "WOLF."

provided, each 2 ins. diameter at the mouth, diminishing to 1 in. diameter. These furnaces are fitted with ten crosstubes, ½ in. diameter. The boiler works under an induced draught, obtained by means of a jet in the funnel. The boiler has the usual fittings—safety valve, 1-16th in. diameter, loaded to 60 lbs. pressure during the trial; water gauge, with three asbestos-packed screw-down cocks; main steam cock, asbestos packed, ¼ in. bore; exhaust pipe, ⅜ in. diameter. After completion the boiler was tested to 150 lbs. hydraulic, and with 110 lbs. steam. All the tubes and boiler ends were brazed in. Only one longitudinal stay is fitted, and the furnaces can be withdrawn at any time, flanges having been brazed on to the boiler and furnace ends so that the latter can be bolted in place by ¼-in. diameter brass bolts.

The engine is of the ordinary vertical marine type, weighing 4½ lbs. all told. Steam is arranged to be cut off at ¾ stroke, and inside lap is provided so that exhaust cuts off early and a fair amount of compression is obtained. By this method the owner finds that there is not only some economy of steam, but smoother running at high speed is obtained.

The firing arrangements consist of a two-burner petrol lamp, each burner tube having three nozzles. The lamp works at about 5 lbs. pressure.

The propeller is no less than 6 ins. diameter. It has three blades, the width of which at the widest part is 2¼ ins. The pitch is 1 2-3rds times the diameter, viz., 10 ins. The propeller shaft is canted to a slight angle, as will be seen on the photograph herewith, and has a ball thrust-bearing in the stern post.

(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 intended for publication.]*

Re Roget's Vibrating Spiral.

TO THE EDITOR OF *The Model Engineer.*

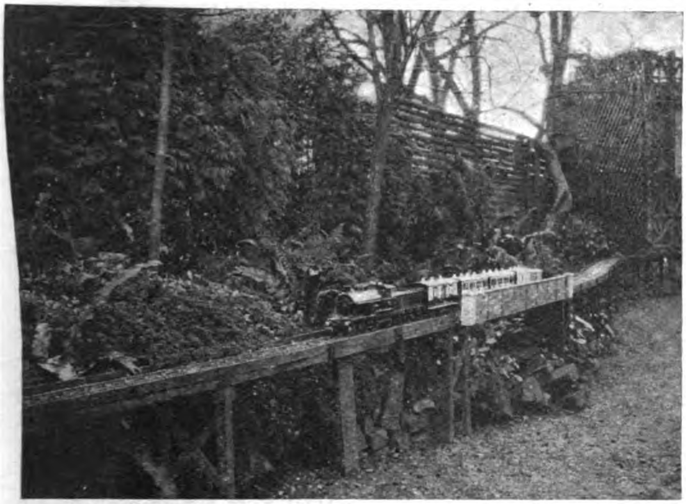
DEAR SIR,—Having made the Roget spiral, as described by Mr. N. Sharpe in THE MODEL ENGINEER of May 24th, 1906, I have been unable to get it to work successfully. The spark at the surface of the mercury seems to make the mercury dirty, and so prevents a free flow of the current. I have tried both Nos. 28 and 36 silk-covered wire coiled 20 to the inch, but neither was successful. Perhaps Mr. Sharpe would explain if he has had any trouble with the mercury getting dirty, and, if so, what means he used to overcome the difficulty. Also, how close spiral ought to be wound to give best effect.—Yours truly,

Newcastle-on-Tyne. J. N. F. SCOTT.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In reply to Mr. Scott's letter *re* the vibrating spiral, I cannot say that I was ever much troubled with the mercury clouding over. I will, however, give a few suggestions which may remove the trouble. I found that the best gauge of wire was Nos. 26 or 28. I tried No. 36 once, but it was useless, owing to the coils falling too far apart by their own weight. The distance between the turns should seldom exceed 1-16th in. Then, Mr. Scott might try the effect of a copper contact needle, 1-16th in. or 16 gauge. This will wear in use, and after a little will thicken the mercury, but will work well enough for some time.

With regard to the mercury, it need hardly be said that it must be clean. I remember I failed at first by using mercury which I had returned from my zinc amalgamating bath. Clean mercury sets this right. If a drop of the metal leaves "tails" when running over a smooth surface, it shows the mercury to be dirty.



Lastly, I always use a battery of from four to five bichromate cells to work the apparatus. Mr. Scott might also try the effect of a layer of spirits of wine above the mercury, as is used in some interrupters. Hoping this may be of use.—Yours truly,

NATHAN SHARPE.

Kincardine-on-Forth.

A Picturesque Model Railway.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I enclose three photographs of my model railway, thinking they may interest some of your readers. The gauge is 2½ ins., and the lines are correct section laid on sleepers, with chair and keys and fishplates throughout. The engine depicted is a "Precursor" of Messrs. Carson and Co.'s manufacture, and I am at present engaged on building another locomotive from castings supplied by same firm. The bridge over the small pond I made entirely of wood. The lattice girder work makes it very rigid.

I originally had automatic stopping devices working in connection with the signals and interlocked with the various points, but owing to the great difficulty of keeping them all in order, I am discarding their use altogether.

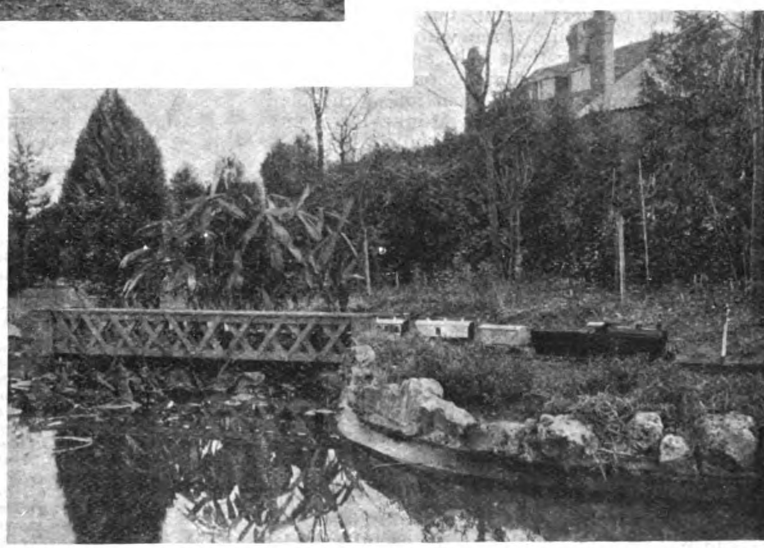
At one end of the line is a turntable; at the other, a circle.

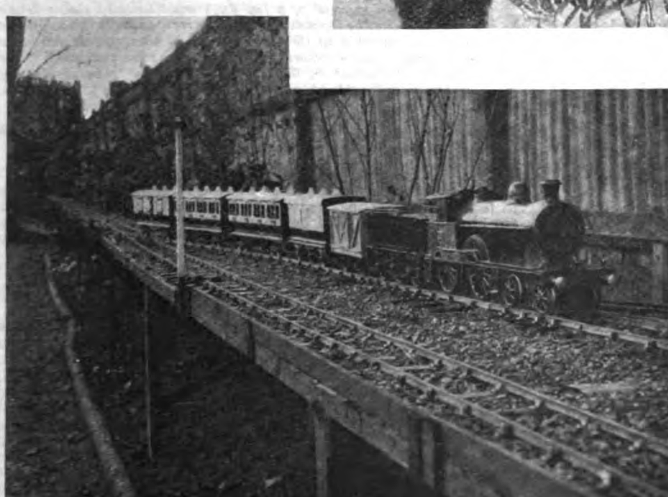
Although the locomotive has cylinders ⅝ in. by ½ in. (which is rather large for ½-in. scale, I believe), I can easily maintain 40 lbs. pressure, with which she travels splendidly.—Yours faithfully,

DUDLEY W. HOLE.

Evesham.

MR. DUDLEY W. HOLE'S PICTURESQUE MODEL RAILWAY.





Concerning Small Lathes.

To the Editor of *The Model Engineer*.

Dear Sir,—Has Mr. Burrows ever tried dressing his belt with anything? Having experienced the same trouble, I made a mixture of resin and linseed oil—about the thickness of treacle—by heating them, and apply a little occasionally to pulleys. This has made belt (a solid round leather one) beautifully supple, and with it moderately tight, it hardly ever slips.

With regard to his suggestion, I do not care about the idea of having the head cast in one with the bed, as having only a small 3-in. centre lathe myself, I often find it convenient to block up headstock slightly, and on one or two occasions I have reversed it entirely—when wanting to turn a rather large disc of wood. This, naturally, would be impossible if it were all cast in one. With regard to second suggestion, as illustrated, if I were going to have a large headstock (as shown), I should prefer a large tailstock as well, and this would just mean that lathe would swing more between centres (which would be very useful, but equivalent to a larger lathe). I quite agree with Mr. Burrows in objecting to a very tight belt, and if he wishes to *entirely* obviate the slipping on heavy work, I think he cannot do better than follow the plan described by the writer in The Model Engineer for August 9th, 1906.—Yours faithfully,

Highgate, N. Douglas Newton.

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 at the Cripplegate Institute, Golden Lane, on Friday, March 15th, when Mr. Snodgrass, (of the Northampton Institute) will give an illustrated lecture on "The Construction of Petrol Engines for Motor Cars, etc." The following meeting will be held on Tuesday, April 9th, when Mr. Ferreira will give the members some useful wrinkles in model-making. Full particulars of the Society and forms of application may be obtained from—Herbert G. Riddle, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

Provincial Societies.

Leeds.—This Society held a meeting on Tuesday evening, February 5th, when Mr. R. B. Woodhead gave a paper on "Gas Engines," illustrating by drawings on the blackboard the workings of the various early types of gas engines and the different kinds of ignition devices. A very interesting evening was spent. A vote of thanks was passed to Mr. Woodhead for his very instructive paper.—W. H. Broughton, Hon. Secretary, 262, York Road, Leeds.

American Society.

New York.—At the December meeting of this Society Mr. de Vignier discussed briefly the choice of type and the relation of stroke to speed, showing why low speeds are inadvisable, principally on account of cylinder condensation, and presented a short argument against the practicability of model Corliss engines. Suitable piston speeds were given as well as the ratio of bore to stroke for various types. The paper also treated calculations of strength of parts and suitable materials. A considerable portion of the paper was devoted to the design of model feed-pumps and to notes on their speeds, the areas of valves and passage, the inertia and proper velocity of water in pump openings and piping, and on the effect of inertia at high speeds. In this connection the equalising effect of air-vessels was indicated, and the author of the paper described suitable sizes of tubing for both suction and discharge piping, the effect of slip-water, and proper means of lubrication. Mr. de Vignier also treated engine lay-out as it should be made on the drawing-board, and closed the lecture by remarks on materials for patterns, pattern and corebox making, allowances for shrinkage of various metals, and amount of stock necessary for machining small castings in various ways. The paper is an extract from a new book by Mr. de Vignier on the "Design and Construction of Small Steam Engines," which is now in the press

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:—

[17,297] **Lacquering; Bell Indicator Failure.** S. F. (Luddenden) writes: Will you be so kind as to inform me (1) how to lacquer brass fittings; say what to get and how to use same? (2) Please state how to nickel brass bells with silver; say, mercury or any other way of silvering with a good coat? (3) Query No. 16,857, January 24th, 1907: Electric Bell Indicator Connections. Your diagram is just as mine is fixed, but the mechanical indicator will not drop, but the bell rings all right on top of indicator. Can you give me any information?

(1) Apply with a soft camel-hair brush, but warm the articles to be lacquered before applying. Lacquer can be bought from any good oil stores, or any of our advertisers would supply you. It is about 1s. per pint. Some makes can be applied to articles cold, but warming them first is preferable. Use it freely, and do not go over the same surface twice with the brush—*i.e.*, do not put it on like paint. Small articles may be dipped in it and hung up, or otherwise, to dry. (2) See articles on the subject commencing in August 16th, 1906, issue, page 158. (3) Perhaps the electromagnets used to attract the indicator pendulum have become more or less permanent magnets through having been made of a hard iron or steel. We cannot say without details of your instrument and its behaviour.

[17,227] **Primary Cells.** S. H. A. (Stroud Green) writes: *Re* "How to wcrk a small accumulator installation" in "Electric Lighting for Amateurs," I should be much obliged if you would answer the following questions:—(1) Is the wire to copper in diagram soldered or simply rested against the Cu strip? (2) When casting zincs, what quantity of mercury would you put in when casting, and would zinc sheeting or tubing be the best for melting so as to cast? (3) You say that the cost for $CuSO_4$ can be reckoned at about 6d. per week, and you also state that the cells should be made up every month with about 1 lb. of $CuSO_4$. Well, on enquiring the price of $CuSO_4$, I am told it is about 6d. per lb.: 12 lbs. would cost 6s. — 1s. 6d. per week, which, if this is so, it would not be worth fitting up the installation. I was intending to fit up a 4-volt accumulator installation instead of an 8-volt in this way, and should require one "Osmi" 3 c.-p. lamp or three 4-volt H.E. lamps for about an hour or so of an evening. Which lamp or lamps would you advise, and would this 4-volt (accumulator battery) installation be reliable, and, above all, cheap? I should be obliged if you would let me know for about how much per week I could do as I intend.

(1) Secure the wire without soldering by threading it through the strip and heating it carefully together to make a good joint. (2) We should cast them without mercury. Either sheet or tubing so long as it is fairly pure. (3) The cost is a matter depending on the amount the cells are used, and can only be given approximately. No primary battery installation is ever cheap—*i.e.*, the output compared to the cost is always low. We regret we cannot give you more definite figures to work upon—an actual trial is required. We believe the "Osmi" lamps give good results.

[17,236] **Small Power Boiler.** G. W. L. (Burton-on Trent) writes: A friend of mine wishes to know if you will tell him what size vertical centre-flue boiler he would require to drive a 3-in. by 5-in. engine at 50 lbs. pressure? He would like one that would require the least attention.

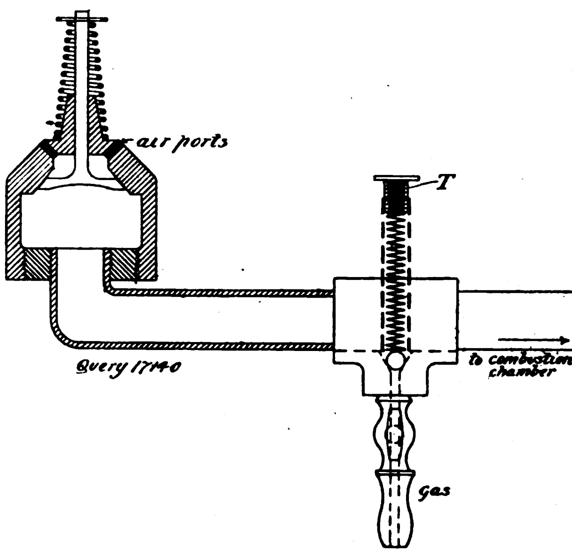
We do not recommend a vertical centre-flue boiler, but a vertical multitubular boiler, as the former will work out larger and more expensive. The following sizes may be adopted, respectively:—Vertical centre-flue: 22 ins. by 48 ins. shell, made of 5-16ths in. plate for 90 lbs. working pressure, or ¼-in. plate for 60 lbs. pressure; height of firebox, 24 ins. Vertical multitubular boiler: 20 ins. by 32 ins. shell, made of ¼-in. plate; number of tubes, 25; outside diameter, 1½ ins.; height of firebox, 11 ins. The larger boiler will, of course, require the least attention, but will consume more fuel in proportion to the evaporation of water.

[17,212] **Small Dynamo Failure.** E. P. (Plumstead) writes: Can you give me a hint why an electric motor which I have just constructed will not work? The field-magnet was cast in soft grey iron from my own pattern. It is of the ironclad type; sketch not reproduced. It is wound with 1 lb. No. 22 s.c.c. copper wire. It is hardly possible to make a mistake in the field-magnet winding, and mine is strongly magnetised in a correct manner. The armature is 1½ ins. diameter and 2 ins. long, 8-tooth drum, wound with about 4½ ozs. No. 22 s.s.c. copper wire. It is wound in the manner recommended by Alfred Avery in his articles on "A B C of Dynamo Design," January, 1900. Every pair of channels wound in the same direction shown (sketch not reproduced) by an arrow, the two ends being twisted together at the top. The finishing end at A was then connected to starting end at B and then to the commutator bar. The finishing end at B was connected to starting end at C and to next commutator bar, and so on right round. This is the only part which presents the least difficulty, but a perfectly correct magnetic field appears when a circuit is closed through any two opposite commutator bars. A record of this field accompanies this letter for criticism. There are no short circuits. The brushes are making good contact and have been placed in every conceivable position. I have tried both series and shunt connections, but the armature does not rôtate at all. It is not a question of power, for I have tried three 4-volt ignition accumulators. The directions in which the current flows in the armature winding, when traced out, appear to be perfectly correct. I might mention that I intend to use it as a dynamo for charging accumulators.

We can hardly say from your diagram whether your connections are correct or not, as it is difficult to follow, but if you wind as per Fig. 40 in Avery's book, or as Fig. 43 in handbook—"Small Dynamos and Motors"—you will be right. It is only a matter of trial and observation to get good running once your connections, etc., are in order. We suppose you have used a small resistance in the main circuit when trying to start up? A small lamp would do of voltage corresponding to that of the machine.

[17,140] **Fitting Gas Valve to Small Gas Engine.** H. G. (Lowestoft) writes: I have a small gas engine, 2½-in. bore, by 3½-in. stroke, I suppose about ¼ h.-p. Would it be practical to use it for driving a dynamo for lighting a workshop, 12 ft. by 6 ft.? If so, what size dynamo would it drive? I find it costs 1d. per hour to run from slot meter (17 ft. 1d.). Would it be cheaper to run with oil and blowlamp (it is adapted for same)? If so, would it be much more trouble? Could a simple governor be fitted without diminishing much power? If so, will you kindly send sketch? The compression is fairly good, but if I had a heavier set of rings fitted, would it give any more appreciable power? Sometimes when engine is running it suddenly stops, and as you will see from the very rough sketch that when the engine stops the gas escapes, and also when engine is running, between firing and suction stroke. Now, would it be possible to fit a simple ball valve to air-hole A, or a flap similar to flap fitted in a pair of common bellows? If so, will you kindly send me sketch. The exhaust is the only valve mechanically operated.

We do not think you will save anything by running with oil. Gas is always preferable when it is to be had at a fair price. It is hardly possible to fit a useful governor to such an engine without going to considerable trouble and expense. No doubt it could be done, but some reconstruction and alteration would be necessary. If you will read the articles on "A Design for Small Otto Cycle Gas Engine," which began with the January, 1906 issue (see coloured plate), you will get some hints on devising a governor which could be applied to the exhaust on your engine. You would then have to fit a small air and gas valve-box similar to the design referred to, so as to prevent leakage of gas when no suction took place. If the gas enters *via* the air inlet in your engine, then a very light valve could be fitted to lift on suction stroke. A small ball valve loaded with an adjustable load (spring) could also be used. The tube T containing the spring to be perforated with a number of small holes. Perhaps these few hints will suggest something which you can work out in detail. Of course, a small gas valve could be used—of the mushroom type—but we think for so small an engine



Air and Gas Inlet Arrangement for a Small Gas Engine.

you will get more delicate adjustment by using a ball loaded with a sensitive spiral spring. If you have any further difficulty you can write us again, and we shall be pleased to assist you. Engine should give about ¼ h.-p., but this can only be found accurately by actual trial—so much depends on details of construction in these small engines.

[17,330] **Accumulators for Small Lamps.** H. C. H (London) writes: Thank you very much for answering my question. Could you please answer the following:—I have an accumulator (4-volt), two plates in each cell, one positive and one negative, 3 by 1½, from Economic Electric, which they say will light a 4-volt 2 c.-p. Osram for five to six hours. I had it charged, when it registered a little over 4 volts. I got an Osram lamp (4-volt 4 c.-p.), and connected to the terminals, when it lit up for two or three seconds, and then died down. Is this because I am taking too much current (4 watts, I understand)? If so, could I make up another cell, one positive and one negative, same size, and connect in parallel? Would this be sufficient, or should I have to make two? I want the light for about half or three-quarters hour every night. How long would this accumulator light the 4-volt 4 c.-p. lamp? I want to charge accumulator on 100-volt mains, but do not want to use lamps if I could help it. Is there any resistance I can use besides platenoid wire—cheap as regards waste of current and price of material (I am told platenoid wire would cost me about 5s. per lb.). If not, would two 16 c.-p. lamps be enough? Would No. 18 gauge wire do for connecting accumulator to mains?

Accumulator is evidently too small. Either use a much larger one, or couple up several in parallel. You can charge through two 16 c.-p. lamps very well. This is the most satisfactory way with small cells. The inefficiency will be the same, no matter what *kind* of resistance wire you use. See recent replies on the subject. Yes; 18 gauge will do.

[17,269] **Small Accumulator Making.** P. F. (Chiswick) writes: Having been a reader of your paper for some time, and not having seen the information I require, I am now writing to ask a few questions *re* Accumulators, etc. I want to make an accumulator giving 2 volts, and I am going to put two plates (one positive and one negative) in it. (1) Will you please tell me about how many amperes this cell will give? and (2) shall I get any more amperes from a cell if I put three plates in it, and if so, ought I to put two positives or two negatives? (3) Is there any other way of pasting a positive plate besides doing it with red lead and sulphuric acid, and if not, will you tell me how strong to make the chloride of lime for forming it? (4) I understand that I can make the negative plate by making a paste of litharge and dilute sulphuric acid, and the plate is then ready for use without any further forming; is this so, please? (5) I want to light two 2-volt electric lamps from a 4-volt circuit (the lights are in a model electric locomotive I am making). Shall I require any fuse, as I shall only want one lamp alight at a time now and then, and if I must have a fuse, will you tell me kind of wire I must use, and what gauge? (6) I have made a paste of litharge and sulphuric acid, and pressed it into the grid, and after letting it dry hard, I found it still remained a yellowish colour, and I think a negative plate should be grey, should it not? and (7) I understand litharge is a brown-yellow colour; what I have is that colour; is this all right, please?

(1) Reckon 15 amp.-hours per sq. ft. of positive plate surface. (2) Outside plates should be negative. There is always one more negative plate in a cell than the number of positive. (3) This is the quickest and best. There is no other method of pasting them, but they can be made from solid lead plates, though the process is a slow one. Use a concentrated solution of chloride of lime. (4) No. After pasting the negative, it (the cell) must be charged and discharged repeatedly before the negative is formed. (5) No. But you will damage the lamp if you use it on a 4-volt circuit. Use 4-volt lamps for a 4-volt supply; otherwise, you must run the two 2-volt lamps together in series. (6) The negative only turns grey after it is formed and has been in use some time. The colour you have is quite right for a new negative plate. (7) Yes. See handbook, "Small Accumulators," 7d. post free.

[17,328] **Cutting Speeds for Metals.** F. P. (Woburn Sands) writes: I have recently purchased a screw-cutting lathe, which I intend to drive from shafting, running 350 r.p.m. Can you kindly inform me the proper speed in feet per minute required for turning (1) cast iron, (2) wrought iron, (3) brass?

For cast iron the cutting speed varies with the diameter of the job and the rate of feed. For 1 in. diameter or less, 26 to 30 ft. per minute, with a traverse of 1-18th in. per revolution, *i.e.*, eighteen revolutions of the work per inch of cut. For 3 ins. to 4 ins. diameter, 20 ft. and 1-12th in. traverse. For 9 ins. to 12 ins. diameter, 16 ft. and 1-16th in. traverse. Wrought iron takes a slightly higher speed for small diameter stuff, but a lighter cut is usually taken. Thus, 1 in. diameter or less, 35 ft. and 1-24th traverse; 3 ins. to 4 ins. diameter, 23 ft. and 1-16th in. traverse; 9 ins. to 12 ins. diameter, 18 ft. and 1-7th in. traverse. Brass for the same respective diameters is run at 100 ft., 70 ft., and 50 ft., with about 1-26th in., 1-16th in., and 1-14th in. traverse. For finishing brass a much higher speed is used, and the cut, of course, reduced to a minimum. For roughing out, the above are about correct.

[17,326] **Running Small Motors from Cells.** S. R. (Norwood) writes: (1) I have a small electric motor (about 2 volts) and two bichromate batteries, consisting each of two carbon plates, 4 ins. by 1½ ins., with a zinc plate between—slightly smaller. Whether both or either of the batteries is connected to the motor I have the same result, namely, that the motor is driven round for a few seconds and then ceases. If the battery is allowed to rest for a few moments, it picks up again, but I cannot get it to work motor continuously. What is the cause of this, and how could it be remedied? I might mention that I use in battery a solution of bichromate of potash, sulphuric acid, and water in usual proportions. (2) Would you kindly exactly define to me the meaning of the terms "volt" and "ampere," as I find them difficult to grasp? (3) Is there any method by which I could bore a hole in a carbon plate; and if there is, I should be very pleased if you would explain same to me?

(1) Motor is evidently taking more current than batteries can supply continuously. Either rewind motor with finer gauge wire on armature and fields, or use more cells in parallel; or, what amounts to the same thing, larger cells. See recent query replies on this subject. (2) See "The First Book of Electricity and Magnetism," by Maycock, 2s. 9d. post free. (3) A well-hardened drill will do it, but don't drive it at a high speed. Repeated sharpening will be needed, as the carbon acts more or less as a grindstone, and soon blunts the best drill.

[12,083] **Hot-air Engines.** B. F. R. (London) writes: I should be much obliged if you could give me any rough idea as to the dimensions of cylinders for a ½ h.-p. hot-air engine, and if the one described in "The Simple Mechanical Working Models" is the best type; and, if so, how many times larger would it take to make ½ h.-p.?

The size of the power cylinder of a ½ b.h.-p. hot-air engine would be about 8 ins. diameter by 6-in. stroke, and displacer cylinder in proportion. We think you will do better to make a gas or oil engine. If you will refer to the reply to Query No. 10,838 in THE MODEL ENGINEER for May 12th, 1904, you will find some further information on the subject.

[17,292] **Solutions for Bichromate Batteries.** J. A. P. (Southampton) writes: I shall be glad if you will kindly inform me on the following. I have completed a shocking coil given in THE MODEL ENGINEER series, and should like to make a Fuller battery. In your article on this battery you did not give the quantity of bichromate potash. (1) For a jar, what quantity of bichromate potash to a quart of water? Should the sulphuric acid be pure or commercial, and what quantity? Also what quantity of sulphuric acid to water is required for a porous pot? (2) I enclose two grades of flexible wire, and should like to know which would be better for the handles of the shocking coil? (3) I have got two rectangular porous pots, 4½ ins. by 1 in. by 5 ins. deep, and wish to make a double cell, and should like to know the size of compartments. What sort of wood would you recommend, and what lining to keep it acid-tight?

(1) Use 12 ozs. chromic acid, 11 pints of water, and add to this 1 pint concentrated sulphuric acid. For the solution in the porous pot use 6 ozs. zinc sulphate to the pint of water. A better result is often obtained by using dilute sulphuric acid (water 10 parts, by volume, to 1 part of acid) for the porous pot. Use pure acid. (2) The more flexible is to be preferred—*i.e.*, the plaited. (3) We do not grasp your meaning with regard to the size of compartments. The boxes could be lined with pitch, but we should advise you to use earthenware vessels, these being much more satisfactory.

[17,278] **Ignition for Small Gas Engine** H. B. (Middlesbro') writes: I shall be greatly obliged if you will answer me the following. I have built a model gas engine, a photograph of which I intend sending you as soon as completed. I tried tube ignition, but could not get perfect combustion owing to the hot tube being too far from the chamber. I am now fitting electric ignition. I have purchased an ignition coil through your advertisement columns, which I think is all right, but I cannot get a plug suitable for engine. I tapped the hole for firing block, ⅛-in. gas, and cannot very well enlarge the hole to suit the standard size of plug. Can you give me the name and address of any firm who would make me one screwed this size? Will you kindly inform me if enclosed sketch of electric connections is correct? I have made an ebonite cam for side shaft (revolving, geared 2 to 1) and let a piece of brass into it to make contact with spring. Should this piece of brass have contact with side shaft or be entirely insulated? How long do you think I should be able to run off three large size dry cells, connected in series? Thanking you for previous assistance.

Perhaps Whitney's, 117, City Road, E.C., would make you a special plug. Yes, your connections are quite right and the brass contact-piece is in contact with the side shaft—*i.e.*, practically speaking, earthed. We cannot give a figure as to the life of dry cells. It depends much upon their make, and the current the coil takes. We can only advise you to give them a good trial. We shall be glad to see a photograph of your work when completed.

[17,274] **Working 3-in. Coil from the Mains.** J. C. F. (Wimbledon) writes: *Re* working 3-in. coil from 210-volt mains. Many thanks for your letter of 16th inst. The coil works splendidly with cells, but I cannot get it to work with the main supply. The mains are continuous current I know, for they have not long been changed from alternating, and I charge my accumulators from it all right. I have never worked a coil from public mains before, so I cannot find what is wrong. The core does not become magnetised when the current from the mains is connected, although the current runs through the primary all right, because the resistance lamps light all right. The coil is in good order for accumulators (charged from the same supply) work it splendidly. I shall be much obliged if you could suggest what is wrong, if possible, to help me.

It is probably only a matter of giving the coil a suitable current. Vary the number of resistance lamps until you find what number give best results and, of course, see that the contact-breaker is working nicely.

[17,203A] **Boiler Queries; Motor for Model Omnibus.** F. S. (Salisbury) writes: I am building a model compound marine engine, ¾ in., and 1-in. by 1½-in. stroke. (1) What would be size of suitable boiler? (2) I should like the vertical type if satisfactory, and powerful enough to drive engine 300 or 400 r.p.m., as I want it to drive a model dynamo. (3) Also, a friend of mine has built a model motor omnibus. What would be a suitable power to drive it? It weighs 3½ lbs. I thought an electric motor would be best. (4) Could you recommend me a motor powerful enough to drive it? (5) Also, could I get flat accumulator to drive it?

We recommend a vertical boiler 6 ins. diameter by 12 ins. high, with fifteen tubes ½ in. or ⅝ in. diameter. Yes, we can recommend electricity. Try Messrs. T. W. Thompson & Co. for both motor and accumulator. Their smallest B motor should drive the model well.

[16,985] **Oversea Wireless Telegraphy.** F. W. T. (Sunderland) writes: Will you kindly give a diagram of connections and a brief description of manipulation of the above as installed on board liners and war vessels. Many liners have four parallel wires suspended horizontally between the masts. If these pairs of wires are for transmitting and receiving respectively, what difference in effect is there when vessels signalling to each other are somewhat abreast of each other (though not visible) when the transmitting and receiving wires will be more or less parallel to each other, and when vessels are in line ahead or astern when aerial wires will be end on? What benefit accrues from the apparently longest obtainable horizontal stretch of aerial wires, their height being always fixed? I have Bottone's and Kerr's books on Wireless Telegraphy, but they do not mention anything as above, nor have I been able to find it in any of the numbers of THE MODEL ENGINEER. If I had a wireless apparatus capable of transmitting and receiving to a distance of two miles only, could I communicate with any liner if passing within that distance of her at sea?

FIG. 1.

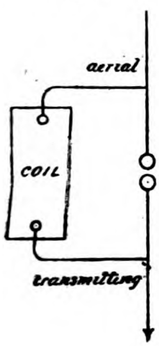
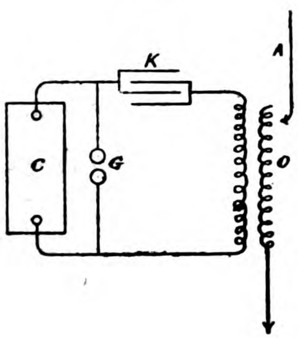


FIG. 2.



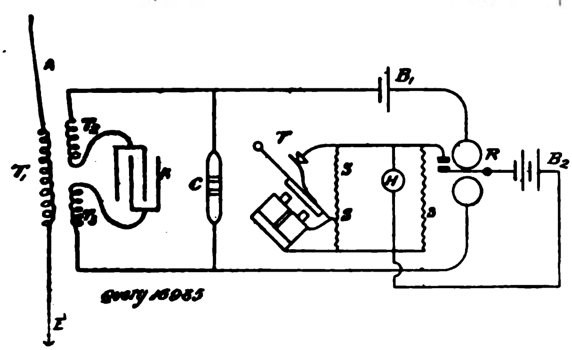


FIG. 3.

DIAGRAMS OF CONNECTIONS FOR WIRELESS TELEGRAPHY APPARATUS ON WAR SHIPS.

Most English liners and war vessels are equipped with Marconi apparatus, though there are other systems which are equally suitable. For a detailed account of various apparatus for wireless telegraphy we refer you to a book which we shall publish very shortly. Connections, as used on warships now, are as shown in Figs. 1, 2 or 3. A, aerial connected to earth through primary T1 of oscillation transformer. T2, T3, two halves of secondary of transformer with capacity K between them to prevent the cell B from short circuiting through them. C, coherer. R, relay through which cell B sends current when C becomes conducting. B2, battery which actuates instrument H and tapper T when contacts of relay come together. H, Morse inker or sounder. S, S, non-inductive shunts. O, oscillation transformer with variable turns for tuning or a self-induction in series with secondary. K, condenser. C, coil. G, gap. The manipulation of the apparatus chiefly consists in making proper adjustments of the strength and rapidity of stroke of the tapper and of the control and motion-freedom of the relay. Careful adjustments must also be made if sharp tuning is desired. Such adjustments cannot be described here at length, but if we understood more clearly, exactly what you want to know, and whether you wish to construct apparatus yourself, we could doubtless supply you with information which would be of use. The magnetic detector is now a good deal used at sea. There is no great difference in the action of the apparatus according to whether the ships are in line or broadside on. The longer the horizontal wires are the greater will be the capacity of the aerial, and, consequently, the greater will be the power of storing energy therein, and the greater will be the energy of radiation. The wires simply serve as capacity-areas, and would work as well if arranged in squares as networks. Yes, you could communicate under these circumstances, but might find it necessary to tune your apparatus if working near the limits of its sensibility. We do not know how the law stands for work on the High Seas, but no apparatus can be set up on land without a licence.

[17,096] **Launch Machinery.** K. N. H. (Leicester) writes I have a twin-cylinder vertical engine, cylinders 3-in. bore by 4-in. stroke. Feed pump off rocker off one of the crossheads. I have designed a plain steel multitubular boiler, 20 ins. internal diameter by 20 ins. between tubeplates, with 100 tubes 1 in. external diameter expanded into ends. This boiler, as you will observe, provides about 6,500 sq. ins. of heating surface. (1) Do you think this boiler would prove fairly efficient? I cannot have it larger as space will not allow. (2) How many No. 6 (4-in.) Primus burners would be needed to work boiler at full power? (3) Reckoning an evaporation of 1·5 cubic ins. of water per 100 sq. ins. of heating surface under forced draught, I should have 22,000 cubic ins. (approximately) of steam at 100 lbs. per sq. in. pressure, and reckoning 50 per cent. cut-off and 25 per cent. condensation losses, this gives a working speed of 250 r.p.m. What would be the pitch of a propeller, 14 ins. diameter, to absorb the power developed in a 16-ft. by 4-ft. launch? Also, with skilful handling, what brake horse-power can I expect?

(1) Even with a slightly smaller nominal heating surface better results will be obtained with flue tubes ⅝ in. or ¾ in. internal diameter. Fit a coil superheater. (2) No. 6 Primus burners, 4 ins. diameter, are not now manufactured and, therefore, you will have to obtain some other burner. There are several on the market in use for motor-car work. (3) The pitch of the propeller should be 24 ins., and the diameter about 15 ins. *As to brake horse-power*, we reckon at 100 lbs. boiler pressure you will be able to get 2½ to 3 b.h.-p. We do not think you will get an evaporation of quite 1·5 cubic ins. of water per 100 sq. ins. of heating surface. Probably 1·25 cubic ins. would be nearer the mark with the type of boiler chosen and oil fuel.

[17,287] **Small Charging and Lighting Plant.** C. H. (Southampton) writes: Being a reader of your valuable little paper, can you give me a little advice on the following. Being a mechanic and having started in business as cycle and motor engineer, I wish to be able to charge small accumulators. Can you advise me on best style of dynamo and where I could get castings for same, and what would be the best power to run same? I want the dynamo to run four incandescent lamps as well as for charging. Would power from public supply mains be best, or small engine, gas or petrol? I think small engine best, for I could then run lathe, etc., when dynamo was not in use.

Avery, Thompson, or Whitney's would supply you with castings and suitable windings for a dynamo. You require one of about 500 watts output for useful work. Say one giving 50 volts and 10 amps., although 200 or 300 watts would be large enough for charging small accumulators. But we advise the larger, then you could arrange to charge at night time when you have the lamps going for lighting workshop, etc. A gas engine of fully 1 b.h.-p. is needed. Be careful when buying the latter. Get a written guarantee that it will give its rated output in brake horse-power, and get one with a governor. A *very cheap* gas engine is the *worst* bargain you could get hold of.

[17,022] **Boiler Failure.** W. C. (Battersea) writes: I have a boiler and engine (vertical) which is used to drive a lathe. When I raise 25 lbs. steam, then start the engine, after a few minutes it falls back to 10 lbs. The boiler is of following dimensions: Height, 37 ins.; outside diameter, 10½ ins. This boiler has a firebox with waterspace round it. Diameter of centre flue, 3 ins., with two horizontal cross tubes each ⅞ in. diameter. The engine is 2½-in. bore by 3½-in. stroke. Is this due to our method of firing (we use coal), or is the boiler insufficient to supply the necessary steam? What can be done to make it steam faster?

The boiler is not sufficiently powerful for the engine. The only way to improve the plant is to carry the steam pipe into the furnace and out again (*via* the centre-flue), using seamless steel tube for the purpose, and to use the exhaust steam to induce a better draught. Nozzle the exhaust down to about ⅜ in. diameter.

[16,969] **Old G.W.R. Locomotives.** E. S. (Birmingham) writes: Will you kindly give me a sketch or principal dimensions of the old Bristol and Exeter broad gauge tanks (No. 42 type); or, if that is not possible, a sketch of the old Great Western "Lord of the Isles" will do?

In reply to your query, we would advise you to look up the back issues of all the locomotive engineering journals, *The Locomotive Magazine* more particularly. For particulars of the old B.E.R. double bogie tanks, see the new book on "Historic Locomotives," by Bennett, price 2s. 6d. net, 2s. 10d. post free from this office. We have still a few copies of locomotive plate 498, "Lord of the Isles" in stock, price 3d. post free.

The Editor's Page.

A CORRESPONDENT—" Orlando " (Rochdale)—writes us that he has a grievance against some of his fellow-readers. He frequently looks through the advertisements in our " Sale and Exchange " column with a view to purchasing something of which he is in want. He finds one, or perhaps several, readers offering articles of the kind required; but their advertisements are worded so vaguely or so incompletely that he is in doubt whether the particular goods described will suit him or not. He says that he cannot be troubled to reply to all the announcements, and, in his experience, if a reply is sent, it often happens that a fuller description of the goods proves them to be not quite what he is looking for. Had the article been more completely described by the seller in his advertisement in the first place, both parties would have been saved the trouble of a letter. We think this is a point well worthy of closer attention from those who use our Sale Columns. An announcement which gives full details of type, size, and condition of a model or other article is more likely to attract a likely purchaser at the first insertion than an incomplete advertisement repeated several times, and, moreover, it lessens the correspondence necessary to effect the sale.

Answers to Correspondents.

R. W. W. (Porthcawl).—See " Gas and Oil Engines," by Runciman, 7d. post free. *Re* temperature of gases: This is a rather complex subject, and you should study the matter in some text-book, such as " Heat and Heat Engines," by Popplewell, price 6s. 4d. post free. You evidently forgot to enclose envelope for reply.

" ACCUMULATOR " (Wigan).—We can only suggest that your plaster has been too coarse. Use a very fine grade, and allow it plenty of time to dry before using the mould. If you are still unsuccessful, you had better get a pair of iron moulds. No doubt some of our advertisers would supply you.

W. G. T. (Wednesbury).—Output about 12 watts; but best plan is to run it and see what it actually generates. Thompson, of Greenwich, would supply you.

J. H. (Bishopston).—6 b.h.-p. would not be too much. Speed is a matter of trial. Propeller of about 8 ins. diameter would do. Pitch will depend on speed of engine. You omitted to send your name and address with your inquiry.

G. R. S. (Retford).—Evidently the one lamp is taking more current than the accumulator can stand, and so it becomes polarised—*i.e.*, run down for the time being. The remedy is: use a larger capacity accumulator or a more efficient or smaller lamp.

W. R. G. (Larkhall).—We thank you for Workshop Note, but regret we cannot see our way to insert same.

J. V. M. (Cape Town).—Thanks for your letter and cutting enclosed. A large number of such bottles have been invented during the last few years.

A. B. R. (Kentish Town).—Thanks for the pamphlet, which we hope to make use of.

B. L. H. (West Norwood).—This is quite correct. Both brass and copper can be annealed in this way. Try it yourself, and you will be convinced.

B. C. (Bacup).—Your reply has been returned through the Post Office. Here it is: It will probably generate as it is, without rewinding, if you run it at a good speed—say 3,600 or more. The brushes of such a motor must be so arranged as to cut-out the various coils of armature when they pass the dead point. If you wish to rewind them, use 22 S.W.G. on armature and No. 24 on fields (shunt).

J. P. (London).—We do not think drawings of the locomotives you mention have been published. However, send us a photograph, and we will see what can be done.

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, etc., 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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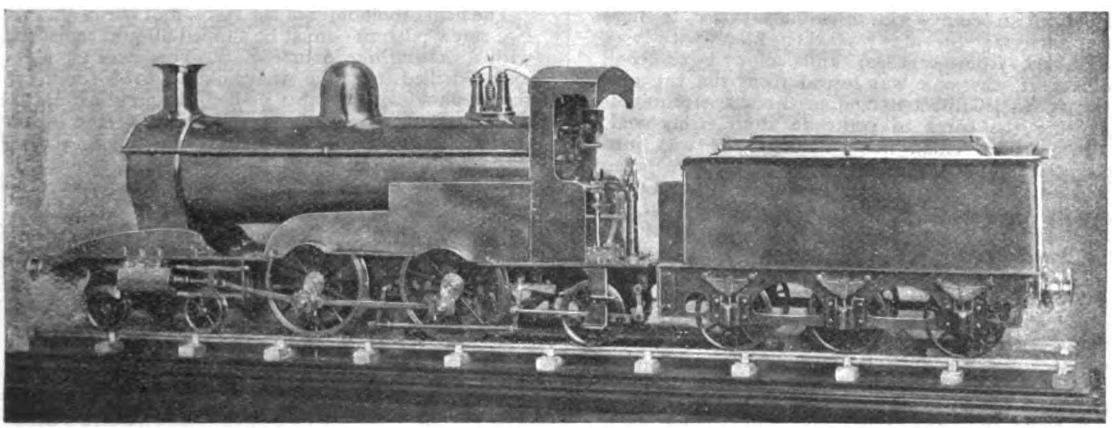
A Model Four-coupled Locomotive.

By J. Mendez (Lance-Sergt. R.M.L.I.).



Mr. J. Mendez's Model Locomotive and Tender.

The accompanying photograph represents a model four-coupled locomotive, which I have made in my spare time. The principal dimensions are as follows:

The boiler shell is of 3-32nds-in. brass tube, 4 ins. in diameter by 15 ins. long; internal firebox, 6 ins. long, 3½ ins. wide, 4 ins. deep. It has four ¾-in. tubes through it. The smokebox is 2¼ ins. wide. All the joints are single-riveted with ⅛-in. copper rivets, spaced ½-in. apart, and are sweated with soft solder. It is fitted with a steam dome, a Ramsbottom pattern safety valve, a water gauge, and two steam whistles. The steam dome is attached to the boiler with six 3-16ths-in. countersunk headed screws, and is covered with a brass casing; it contains the regulator, worked from the cab. The boiler steams very well, using charcoal with a petroleum spray, the working pressure being 35 lbs., but the boiler has been tested to 80 lbs., and would probably stand more. The cylinders are ¾ in. diameter by 1½-in. stroke, the steam ports being drilled with two ⅛-in. holes close together, and the exhaust with two ¼-in. holes close together. The reversing gear is Stephenson's link motion, and is worked from the cab.

The driving wheels are 4½ ins. in diameter and are coupled, the trailing wheels 2½ ins., and the bogie wheels 2 ins. diameter. The gauge is 4 ins., which is rather wide; but I knew no better when I put them together. The frames are cut from ⅛-in. sheet brass, with angle-pieces riveted on as guides for the bearings, which are split and kept together with taper pins; the bearings are attached to the imitation springs. The bedplate is 24 ins. long and 6 ins. wide, also cut from ⅛-in. sheet brass. The bogie is mounted on a pivot, and has a swing of about ¼ in. The tender, which is six-wheeled, is 13 ins. long, and is fitted with water-tank and toolbox. The buffers of both engine and tender are fitted with springs. All the working parts, including the axles, are of steel, the remainder of the engine and tender being of polished brass and makes a fine ornament.

I may say that being in the Service I have had to work under considerable difficulties, having made most of my model either on board ship or in a barrack room, neither of which are ideal places to work in. I am better situated now, having a small workshop fitted up in a private house.

I have also had to make most of my own tools, including a 3-in. back-geared lathe and compound slide-rest.

The castings for my model I also made myself, melting the metal on an ordinary portable blacksmith's forge, built round with fire-bricks to retain the heat, and burning coke.

The moulds I made in the following way. I cut the cores for the cylinders from bath brick, allowing ½ in. to spare at either end, then placed them in an empty tin of sufficient size to hold the pattern; the tin was then filled with wax (obtained from candles) and allowed to cool. When set, the wax was forced from the tin, and with a sharp knife trimmed to the shape required, allowing the cores to protrude from either end. I then drilled small holes through the wax into the core, and in them put small brass wire pins; then obtained some clay and mixed brick-dust with it, working it up with water till it was of the consistency of dough. The clay was then plastered thickly round the wax pattern, a small plug of wood being put through it for the purpose of providing a hole to pour the metal into the mould. The clay mould was then put into the galley oven to dry, and when dry enough, the wooden plug was removed, the wax melted and allowed to run from the mould. When everything was ready, the melted brass was run in and allowed to cool.

A separate wax pattern is required for each casting, but the wax, after being poured out, can be used over again, very little being absorbed by the clay.

When the clay was broken and the castings turned out, they were found to be very clean and free from blowholes, and required but little working up.

FOR the purpose of carrying off 4,000,000 cubic feet of gases per minute from smelting furnaces, the construction of a gigantic chimney is contemplated at the Boston and Montana Smelter, U.S.A. The height of the chimney from the top of the foundations is to be 506 feet, or 46 feet more than the highest chimney at present in existence. It will have an internal diameter at the top of 50 feet, and an external diameter at the bottom of 75 feet, and will weigh about 16,000 tons. The chimney will be the largest in existence.

Notes on Making Small Hexagon Bolts and Nuts.

(*Continued from page* 148.)

Mr. Sidney Russell.

The following method of making model bolts is a modification from a very successful form of apparatus which the writer became acquainted with some years since. The present method is applicable to either plain lathes or those fitted

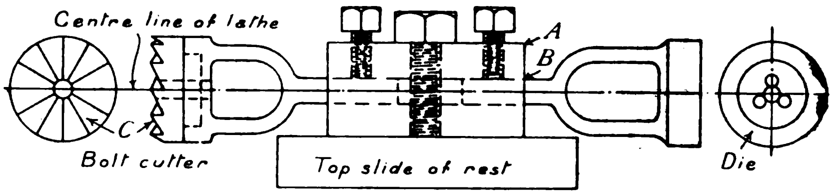


FIG. 1.

with overhead motion, and with or without a slide-rest.

Assuming a slide-rest to be obtainable, the following is the course to be adopted:—

The usual toolholder of the rest—if of the ordinary two-screw pattern—must be slipped off and replaced with a casting like A in Fig. 1. This is of circular form, drilled to take the holding-down bolt of the toolholder, and also drilled through carefully at B horizontally at the exact height of the lathe centres. If the toolholder is of the single-screw form, as usually fitted to the smaller American lathes, the casting must be replaced by a wrought-iron or steel bar, also drilled endwise at the height

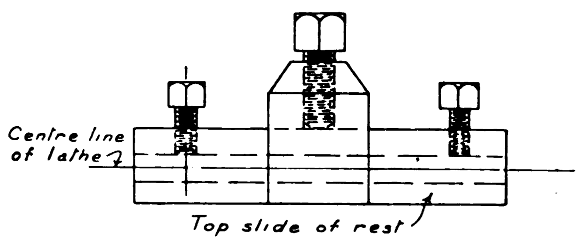


FIG. 2.

of the lathe centres (see Fig. 2). Next, the cutters for shaping the bolt and the dies for screwing must be fitted as follows:—

Almost everyone is aware that with the well-known "Pratt & Whitney" type of dies—that are arranged to cut a full thread at one operation—what is known as a "dieholder" can be obtained, for holding the dies for use in an ordinary hand-brace, and two fitted to the casting A at opposite sides. Next a corresponding series of cutters similar to C, Fig. 1, must be made from steel, the teeth being formed very carefully quite true and square with the axial line; but if the end has been faced true, this will not be difficult. The hole in the centre, of course, is the size of the bolt, and must be perfectly smooth. The method of operation is as follows:—

A piece of wire large enough to form the head of the bolt is cut off sufficiently long to make two or three bolts (if the lathe has a hollow mandrel, of course this is a great advantage, permitting a long piece of wire to be used). The wire being held in a self-centreing chuck, sufficient is allowed to project to make one bolt, and the casting A (or bar) being clamped down on the slide-rest, the same is adjusted to bring the holders exactly in line with the centre-line of the lathe. The cutter is then brought up to the work, which should be slightly pointed to allow the cutter to start fair, and being well lubricated with oil or soap and water, is fed forward until the bolt is the required length (a gauge can be fitted across the holder to determine the length required, but is not absolutely necessary). The holder is then run back and the casting revolved, bringing the die into position. This being adjusted to centre is also run forward by the rest, and being well lubricated, the thread is rapidly formed. Of course, it is best to gently pull the lathe round by hand while this is being done. It now remains but to run the die back, form the head with a file, and with a fine parting tool cut off the finished bolt.

In the event of a slide-rest not being available, the shanks of the cutter and dieholders can be fitted to the back poppit centre. If a large quantity of bolts and nuts are to be manufactured, it would

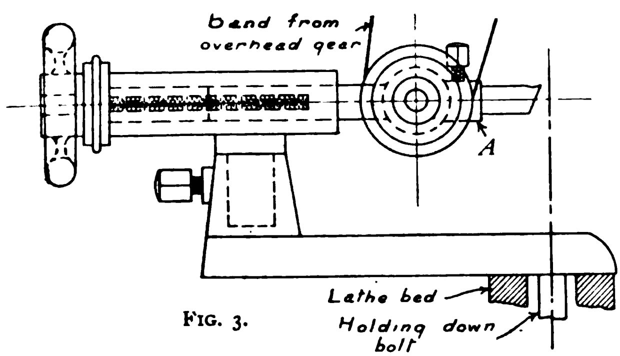


FIG. 3.

be worth while to fit up a special attachment to shape the heads and part off the finished bolts, which can be arranged as shown in section, Fig. 4.

A casting must be made similar to the cylinder of the back poppit of a lathe, but with a stem cast on its under side (see Fig. 3) to fit the hand-rest of the lathe. This must be bored out and a cylinder fitted thereto with a screw and hand-wheel like an ordinary back-centre, but the sliding part, as will be observed by a glance at Fig. 4, has a T-head, which is drilled to carry the spindle for a revolving cutter. This can be fitted in various ways, but one of the best methods would be to bore the T-head out and sweat in two cups, exactly like the bearing of a bicycle bottom bracket, and fit up the spindle with cones and balls. This will give a splendidly easy-running bearing, while the materials for same are easy to procure. A pulley should be fitted to the outer end of the spindle, as shown. On the front of the T-head

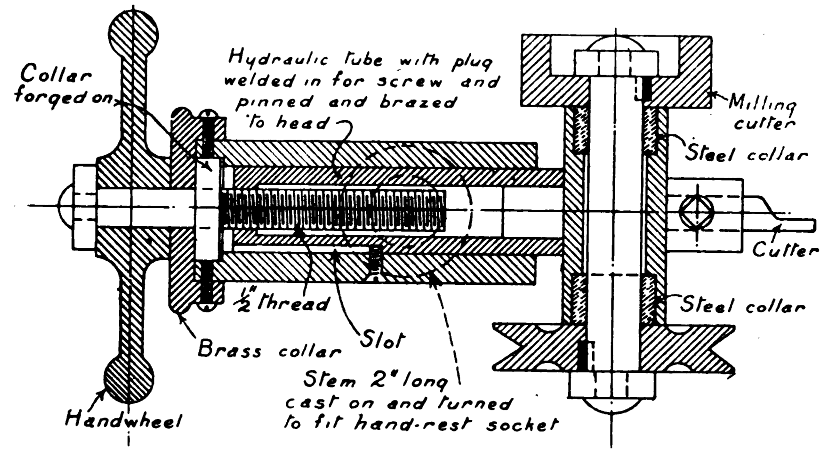


FIG. 4.—SECTIONAL PLAN OF BOLT AND NUT SHAPING ATTACHMENT FOR THE LATHE.

a projection A will be noticed (see Figs. 3 and 4). This should be drilled (and drilled out square, if preferred) to take a small fine-pointed parting tool, held in its place by a setscrew at the top.

Now, in order to accurately shape bolt heads of either square or hexagonal form, a division-plate is necessary, or some handy substitute. The method of operation is easily explained as follows :—

The bolt, having been cut and threaded as described, the belt is removed from the lathe mandrel and the overhead motion is started. The cutter is advanced by the hand-wheel and the bolt-head shaped thereby. The belt is then removed from the overhead and the mandrel belt replaced. The parting tool being then inserted in the front of the cutter carriage, the bolt is quickly parted off, the rest being first shifted a little way to bring the tool to the right position.

The procedure for nuts is, if anything, easier, and is briefly thus :—

A piece of wire large enough to make the proposed nuts being held in the chuck as before, a rather wide-faced cutter is put on the spindle, and sufficient of the wire to make two or three nuts is faced up square or hexagonal. The cutter attachment being then removed, a hole is started with a drill of the correct size fed up by the back-centre, and is then deepened to the required distance by a D-bit, also supported on the hand-rest and fed forward in the same way. The thread is then carefully cut by a tap held in the same manner, the lathe being pulled slowly round by hand, and, lastly, the nuts are parted off with the tool described previously for bolts. Plenty of lubrication must be used, and in the latter operations a small squirt may be used with advantage.

(To be continued.)

A Model Engineers' Tramp Abroad.

(*Continued from page 174.*)

LOCOMOTIVES and motor-coaches did not occupy the whole of our attention during our rounds of the Nürnberg Exhibition. The models exhibited there were of the highest order and embraced a great variety of subjects.

The Germans are very great on pictorial effects combining actual models in the foreground with pictures of the more distant scenery at the back. These picture models are so arranged that looking through the glass-fronted opening one cannot see where the picture begins and ends. The most striking of those we saw represented the Rhine near Aschaffenburg. It comprised models of steamers on the great waterway, with buildings and foliage on the banks in the foreground, and although small—the opening being about 4 or 5 ft. wide by 2 to 3 ft. high—it was exceptionally realistic.

The success that can be obtained by these means leads us to suggest that any model engineer having the necessary artistic skill (and we know several such), who possesses a good model of a ship or locomotive—a model that is essentially a glass-case affair rather than a working model, which may be in constant use—would not do amiss to mount it in the foreground of a picture-model of this kind. Great care would have to be taken with the perspective of the picture and also in proportioning the accessory models in the foreground. After this, the chief thing would be to "light" the picture satisfactorily, which could be done by electric lamps just behind the front of the case or "proscenium," and also to see that the opening cuts off any view of the beginning and the end of the picture. For, say, a model cargo boat a very good arrangement would be to have the water and the model of the ship in the foreground, behind and to the right models of a wharf or quay, with the buildings placed upon it, and the painting of a sky with the masts of sailing ships silhouetted upon it behind that again. To the left, the end of the quay with a lighthouse upon it could be erected, the sea and horizon stretching away into the distance. This is, however, a serious digression from the subject.

Among the finest models of machinery at the exhibition was the complete model of one of the electric light and power stations of Nuremberg. In addition, those of the locomotives and carriages of the Oberammergau electric railway, built by Messrs. Siemens-Schukert, of Berlin, were very interesting and withal splendid examples of professional model-making.

A large number of the railway models, however, were lent from the Bavarian State Railway and Post Office Museum, which is open all the year round at Nuremberg, and which the writers have twice visited. This museum, like our South Kensington collection, is always worthy of a look round when you are in the vicinity. Comparing the two museums, South Kensington is, of course, the larger; but for purely railway exhibits, both as regards completeness and general excellence, we have to admit that our own does not hold a candle to the German institution. We much regret that we have not yet been able to obtain suitable photographs of the interior or of the individual exhibits; but we may say that, if such had been obtainable, our readers would immediately concur that a museum of similar character in this country would prove of the highest educational value both to railway men and to the lay public.

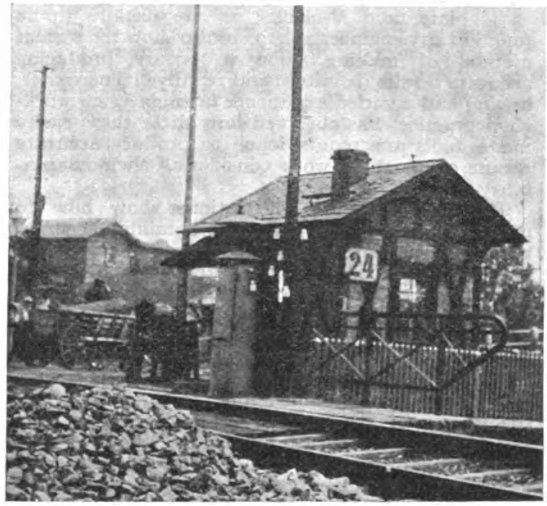
In the matter of locomotives the Nuremberg Museum contains models—all of one scale—of nearly every type (if not every type) of Bavarian locomotive, from the first engine imported from Stephenson's in 1835 to the latest four-cylinder compound. The collection of coaches and other rolling-stock is almost as complete. The Westinghouse brake mechanism in use on the Bavarian railways is represented by full size examples, which are shown in operation, as well as by scale models. Bridges and stations are also represented; one of the most interesting models of the latter kind being that of the State railway workshops where the locomotives are repaired and rebuilt. It is not the practice, as in this country, for the railways to build their own engines. They are designed by the chief mechanical engineer to the particular Administration, amongst whom may be mentioned men of ability and renown like the late Herr von Borries and Herr Ed. Weiss, and the orders for the locomotives are apportioned out to the manufacturing firms of the several kingdoms. The models of the workshops we have just referred to comprise a 1-250th full size general arrangement of the buildings, and what is the most interesting, a detail model of the central machining and fitting shop to a scale of one-tenth full size. This model was made by the apprentices in 1896, and is a really splendid piece of work. It is an exact reproduction, and among other tools contains scale replicas of wheel lathes, milling machines, double-spindle radial drills, slotters, shapers, bench and vices, slings and travelling cranes, all the shafting and belting, and models of the driving engine and boiler.

In addition to being a museum of historical objects and models, providing students of railway engineering and management with something more tangible to look upon than diagrams, drawings, and descriptions of things past and present, the collection is in charge of attendants who explain the details and working of the various apparatus. The writers do not speak the language of the Fatherland, but during our stay in Nuremberg we had the privilege of being accompanied by a young English friend who is residing in the city to learn the German tongue and business methods, and who helped us considerably in our cross-examinations of the worthy attendant. By the aid of a full size scenic model we had explained to us the principle of the apparatus carried on every Bavarian train, by which the guard can telephone to the station nearest to the point where he may elect to fix up the apparatus to tell the authorities the details of any mishap which may have occurred to the train.

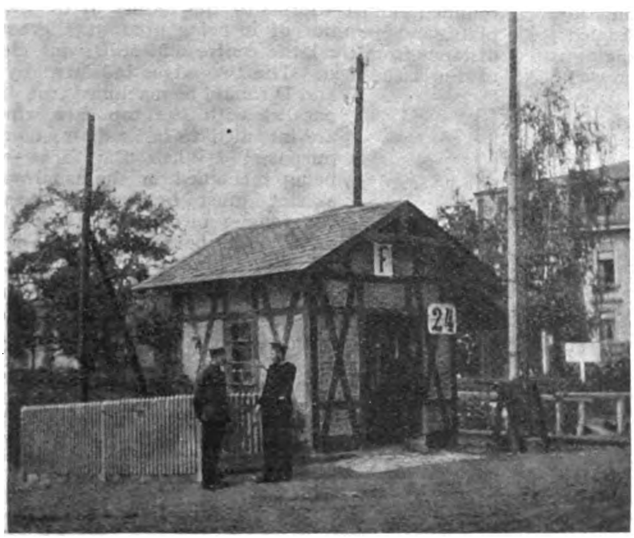
The standard system of signalling adopted by the Bavarian State Railway Administration was also explained to us by means of a model signalling set similar to those that are now employed for instructional purposes on the Great Western Railway.

Those readers who have travelled on the Continent will have noticed that bridges carrying the railway over the roads (or *vice versa*) are not such common objects as they are in this country. The railway traffic is much lighter than here, and the level crossing abounds, its disadvantages not being nearly so keenly felt by the railway officials or the general public. Instead of the gate, with which we are all so familiar, the Germans use a gaily coloured sort of barber's pole, with a chain-like appendage hanging from it to keep dogs and other small fry from passing under the pole on to the line, when it is down and the road both actually and literally "barred." This pole is balanced by a large counterweight on the short end, and there is, of course, the usual crossing-keeper's hut alongside of it, the accompanying photographs showing a very typical example. By the side of the hut stands a bell tower, a structure about 2 ft. 6 ins. diameter by about 7 or 8 ft. in height, surmounted by a large gong. Models of this apparatus—of German manufacture—may very often be seen in our toy shops, during Christmastide especially. In the Railway Museum we had the apparatus fully explained—per our interpreter. Not only, we were given to understand, is the tower used to give an audible signal to the crossing-gate keeper of the approach of a train, but the internal arrangements provide for the despatch of messages from the crossing-gate to the nearest railway stations in either direction. The difficulty of the crossing-keeper not knowing the Morse system of telegraph signalling is got over in an ingenious manner. Inside the tower are hung a number of brass discs, with variously sized and arranged notches in their peripheries. Each disc tells a different tale. If there should happen to be a bad smash to a passenger train, the gate-keeper lifts down the disc which will correctly describe the circumstances of the occurrence, puts it in the machine, winds up the clockwork (everything would appear to be actuated by such mechanism in the Fatherland: the very words "clockwork" and "German" always seem to us to be synonymous). Immediately the alarm signal is given at the adjacent station or depot, the tape machine at the same time spelling out in the usual Morse hieroglyphics a message such as this: "Send breakdown train, men, and doctors immediately."

(To be continued.)



View of Railway Crossing from the Line, showing the Bell Tower.



A German Railway Level Crossing: View from the Roadway.

Large Crane Controllers.—Three of the largest automatic crane controllers ever installed have just been despatched from the works of the Adams Manufacturing Company, Ltd., for one of the largest steel works in Sheffield, where they will be used for handling with lightning rapidity, white-hot steel ingots weighing up to 120 tons. These mammoth crane controllers are for 325 h.-p. Hitherto a 100 h.-p. crane controller has been considered a very large size, and few even of this dimension have been installed, and it is believed that none of them was entirely automatic, while from 50 to 60 h.-p. has been the average. The entire operation of these crane controllers is by means of a small master switch, which can be easily operated by one hand. This switch transmits through solenoid controlled contactors, which handle the main current between the supply circuit and the motors; the normal current handled by these switches would be about 1,200 amps. The amount of current used for operating the contactor switches handling 1,200 amps., does not exceed ½ amp. The largest like apparatus supplied for crane or ship derricks, and controlled on similar lines, were three 80 h.-p. controllers supplied to Japanese shipyards.

Notes on the Faceplate, Angle-plate, and V-Block.

By "SREGOR."

THE object of this article is to illustrate the usefulness of the common faceplate, angle-plate, and V-blocks, as are usually to be found in any engineer's shop, and to show the correct method of making same to ensure producing accurate results definitely and readily. The writer, having had a varied experience in engineering workshop practice, has observed how little these easily made tools are requisitioned to produce accurate results on machine work considering their adaptability.

The accompanying illustrations show how to produce these tools to guarantee obtaining accurate results. The chief features are the methods employed to dispense with the usual practice of setting the piece of work to be machined and the method of gauging and testing the different positions which ensure strict accuracy. There are various degrees of accuracy observed in the machine shop, and what is accurate for one class of work will be considered a rough finish for another class. But the degree of accuracy to be considered in this article is to be at least within the limits of one-thousandth part of an inch of the true measurement, and this can be readily obtained, and in less time than the old method of setting lathe and machine work.

In Figs. 1 and 2 an end and side elevation is shown of a lathe faceplate, angle-plate, and gauges for obtaining the correct distances from the centre of lathe to the fixed angle-plate. The faceplate, as shown, is not of the pattern as usually found in the shop. The design, as shown, is intended to suit the purpose and method adopted for gauging, the departure being in the fact that the screwed bore which fits the lathe mandrel nose is not continued right through; a recess is shown to clear the tool when screwing, after which, and when fitted to the lathe it is intended for, the front hole must be bored a suitable standard size. This can vary with the size of lathe in use. Assuming n the present design a 1-in. hole to be a suitable size, which will allow the usual centre to project through and clear same, this hole must be bored dead-size to receive a 1-in. plug—a good push-fit. After which a slot must be planed or milled across the centre of plate. It is essential that this slot is exactly central, and to ensure this, I suggest the method shown in Fig. 3, which shows the central portion of plate enlarged. Having decided upon the width for the slot, which in this case is assumed to be ¾ in., or ·750 in., and having the central hole already bored 1 in., the distance of A and B will be ·125 in., so that the one side of slot can be machined approximately to this size and tested by pressing the straight test-piece against the face and trying a ·125 plug gauge between (as shown), after which

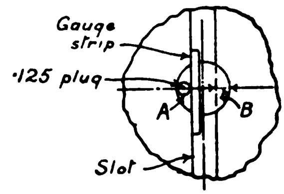
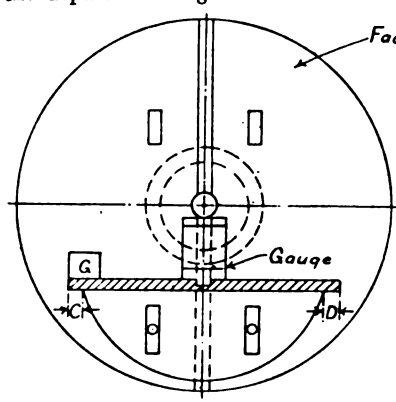


FIG. 3.

the full width of the slot can be machined to size. Should the operator take a little too much off the first side by error, an equal amount can be taken off other side, and the sliding tongue (shown in Fig. 4) made to suit. The usual holes must be provided in plate to receive the holding-down bolts for securing the work under operation.

A handy design of angle-plate to use in conjunction with a faceplate is that shown in Figs. 1 and 2 attached to the faceplate. The one face is rounded, and conforms to the radius of the faceplate, and permits of it being used at a greater distance from the lathe centre and still swing clear of the lathe bed. The two edges indicated by C and D should be machined true and parallel with the top face, which are intended to be used for gauging purposes. When the faces are being machined in the usual way, a slot must be cut to receive the tongue piece about the centre of plate on both faces, the width to be the same as the one in faceplate. This is necessary from the fact that it is intended to make these slots and tongues interchangeable with each other, also the two slots must be strictly in line with each other. This is readily accomplished with ordinary care, as the first slot—when cut—serves as a suitable guide for cutting the second true with it. The usual holes for securing bolts must be provided in convenient positions to allow angle-plate slot to coincide with slot in faceplates.



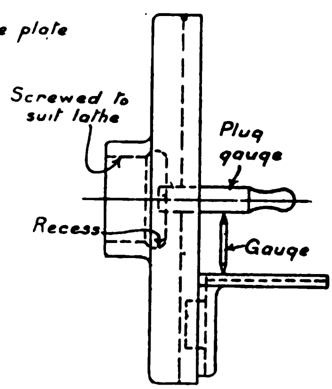


FIG. 1.—END ELEVATION, FIG. 2.—SIDE ELEVATION.
SHOWING A LATHE FACEPLATE, ANGLE-PLATE, AND GAUGE.

The V-blocks to be used in conjunction with the face and angle-plates must be accurately machined, the important point being to ensure that the V is dead central with the slot in the base. The following method—if rigidly adhered to—will guarantee this accuracy readily.

Procure a piece of metal of suitable size in cross-section and long enough to make two complete blocks. The first operation is to machine the base flat and cut the slot for tongue about the centre, the width of slot to be same as in the face and angle-plates and a suitable depth. Now fit the tongue-piece, which should be machined up square and parallel and a push-fit in the slots, as shown in Fig. 4, which is an end view of the block. The machining of the vees must be done with care; and unless the slots in the machine table can be strictly relied upon for being in a true, straight line with the stroke of the tools, it will be advisable to secure a piece of metal on the table and machine the top face and cut a slot to receive the tongue which is fixed in the V-block (or, rather the piece which is to be the block), as shown in Fig. 5. Should the table slot be true enough, the tongue can be pressed against it for machining the vees; but, assuming the former method is to be used, and the required angle of the vees to be 60 degs., then the roughing tools may be set to the 30-deg. mark each side of the zero and the vees machined to nearly finished size, after which a finishing tool must be fixed and the angle set to one of the 30-deg. marks; and as it is practically impossible to set the mark equal distance each side of the true vertical, it is advisable to retain the angle of tool in the one position for machining both sides of the vees to guarantee strict accuracy of the angle, a finishing cut being taken down the one side H, and then the block turned round on the temporary plate and

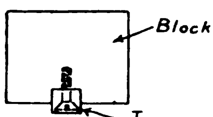


FIG. 4.

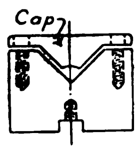


FIG. 6.

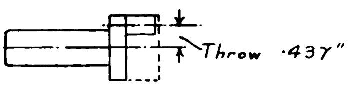


FIG. 9.

a cut taken down the other side J without either altering the position of angle or depth of cut. The sides can also be machined up by the same method, only that the tool will be set, of course, to the zero mark, after which the block can be sawn through and the ends trued up. The size of the blocks will, of course, be governed by the size of machine they are intended to be used on; but in any case sufficient section of metal should be provided to allow the holes to be drilled and tapped to receive set-pins for holding the cap in position, as shown in Fig. 6. As mentioned above, the tongues are fixed in the slots; these could, of course, be formed solid, but the movable type possesses distinct advantage over the solid ones, from the fact that the tool can be used more universally and set at any angle and position; also the tapped holes can be utilised for securing the block to the plate by pulling it tight on the base with bolt or set pins.

Having now constructed our three tools accurately, we will consider the use of same. Assuming we wish to bore and face the two holes in the rotary pump shown in Fig. 7, the usual method adopted by the machinist would be to set out the centres by means of a pair of compasses and describe the two circles E and F around the centres, after which the casting would be fixed on the faceplate and set so that one of the lines runs true, an operation which requires great care and time, and—however carefully done—it only serves as an approximate and rough degree of accuracy, because of the possibilities of the marking of the centres being out and also the setting true of the lines on the faceplate. The result of this method depends to a large degree upon the eyesight of the workman. This, however,

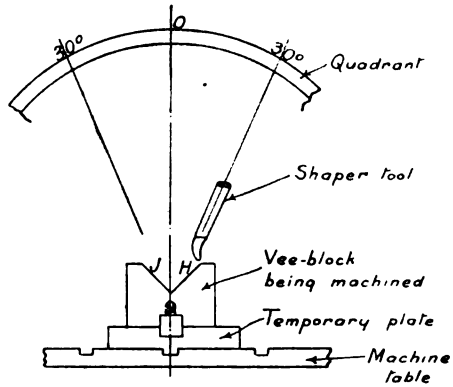


FIG. 5.—METHOD OF MAKING A V-BLOCK.

is entirely dispensed with by using the method shown in Figs. 1 and 10, and absolute accuracy can be guaranteed, or within the one-thousandth part of 1 in., beside a saving of time on the work. Referring to the pump (Fig. 7), the important dimensions requiring a fine degree of accuracy are the distance between the centres and the diameter of the bore. Assuming the base has been faced flat and the two bosses at the back of the

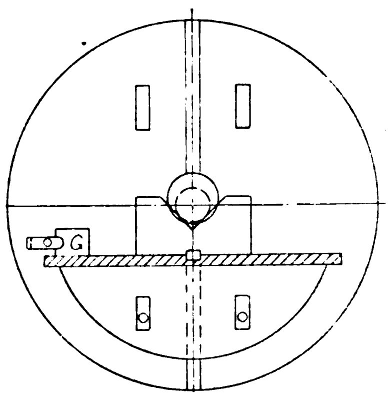


FIG. 8.—SHOWING USE OF V-BLOCK.

casting square with the base, the first operation will be to set the angle-plate the correct distance from the lathe centre, as shown in Fig. 1, the distance being 3·000 ins. The half-diameter is equal to ·500 of an inch, so that the gauge-piece must be 2½ ins., or 2·500 ins., the exact measurement.

A standard plug gauge of this dimension, or flat gauge, or the vernier, can be used, after which the casting will be secured on angle-plate with the one core about central and the two bosses X Y pressed against the faceplate, and the first hole can be bored to size, after which the plate G—which is a square piece of metal of suitable dimensions and accurately machined up flat and square, and to be used in conjunction with the face and angle-plates—is secured to the faceplate and against the end of pump casting, as shown in Fig. 10. The pump casting can now be moved along the angle-plate until the distance gauge, or measuring tool, which accurately measures 1·750 ins., fits between. The casting can now be secured to plate, taking care to press the two bosses X Y tight against the faceplate to ensure the two holes being strictly parallel with each other.

Obviously, other holes can be bored at any required distances from each other and varying distances from the base by adjusting the angle-plate, as above described. The tongue piece, sliding in the slot, prevents the work being moved other than in a true straight line. As mentioned previously, it is necessary to face the base and back of the casting square and true to ensure a correct result when moving from one position to another. In a large number of cases this would be necessary in the design of the article, apart from the facilities it affords in machining; while in many other cases this would be unnecessary labour on the work. To avoid this, I suggest the use of a movable foundation plate, which must be machined up flat and square. A piece of hard cast iron of suitable dimensions will do, suitably tapped holes being provided for securing the work to be operated upon to it, the idea being that when the work is once fixed to the plate, the work and plate is moved bodily to the various necessary positions, as described above, keeping the face and edge of the baseplate tight against the face and angle-plate to ensure the various operations being true with each other. Another distinct advantage of the movable plate is the fact that the work can be readily set to any

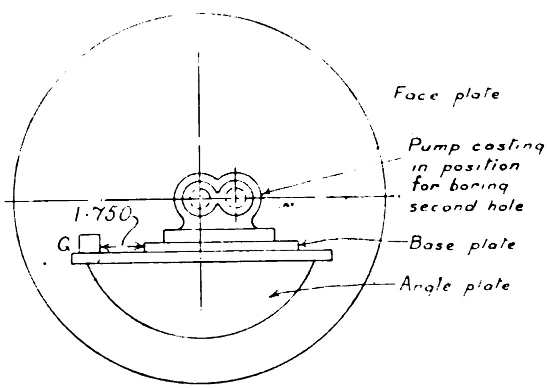


FIG. 10.—SHOWING METHOD OF MACHINING SMALL PUMP CASTING.

angle with the faceplate for boring one hole at an angle with another. Also, the complete work and plate can be moved from one machine to another for different operations without the trouble of re-setting the work up true to the operations already done, which is a great advantage on the smaller class of intricate work.

The same principle applies to the use of the V-blocks in respect of gauging the positions. In Fig. 8 its use is illustrated for producing accurate results, which shows a small spindle crank as used in an eccentric rotary pump, extensively used in motor-

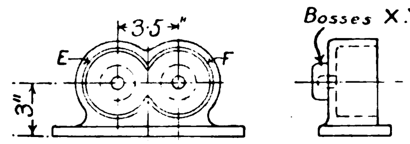


FIG. 7.—ROTARY PUMP CASTING.

car engines, etc. It is necessary that the throw of the pin shall be within the limits of one-thousandth part of an inch, its dimensions being ·437 in., as shown on the finished component (Fig. 9). The first operation will be to turn the main spindle between the lathe centres to finished size, leaving a piece on one end out of which the pin is to be turned the correct throw with the main spindle, the piece indicated by the dotted lines in Fig. 9. Obviously, any attempt at marking off the centres to guarantee the correct throw would be useless. To obtain the correct centres would require the use of an accurate jig, but by using the accurately constructed vee blocks, the pin can be readily turned to exact centres. Having the spindle already turned to size, all that is necessary is to secure this part in the block, as shown in Fig. 8, and adjust the angle-plate up or down the slot until the spindle runs true, after which the gauge-piece G must be secured to faceplate, with its edge resting on the angle-plate, as previously explained, and the angle-plate then lowered to allow a ·437 gauge to fit between the two, which will determine the exact position to give the correct throw. When the block is once secured in this position, any number of components can be turned without any further marking-off or setting.

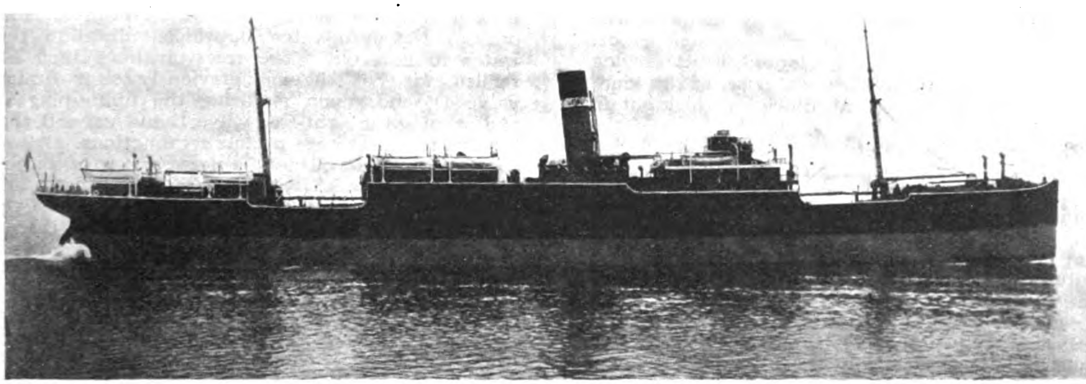
This illustration will serve to show the usefulness of the tool and the many accurate results that can be readily obtained without the expense of constructing costly jigs for the job. The V-block and cap forms an excellent chuck in itself, and holds the work dead-true and rigid. As mentioned at the beginning of the article, the faceplate (as shown) was of special design, but any faceplate can readily be converted to equally guarantee accurate results by re-boring the front of the hole and fitting a piece in, and boring same to take the plug for the gauging purposes.

STORING coal in pits capable of being flooded has been adopted at the new plant of an American electric power company. A plot about 320 ft. by 75 ft. has been excavated to a depth of about 12 ft., and lined and sub-divided by concrete walls into twelve 80 ft. by 25 ft. pits. Their bottom is the clay sub-soil, and the walls are carried about 4 ft. above ground. The pits can be flooded by means of a 12-in. water main. The longitudinal division walls are wide enough to carry the tracks on which the coal is delivered. It is removed from the pits by a steam shovel.

Marine Notes.

THE S.S. "CITY OF LONDON."

The latest addition to the Ellerman Lines, Ltd., the *City of London*, is the sixteenth vessel built and engined by Messrs. Workman, Clark & Co., Ltd., for the City Line fleet (who have kindly sent us a photograph, which we reproduce herewith), and is a handsomely modelled steamer, 507 ft. in length and having a gross tonnage of over 8,800. She has been built under the special survey of the British Corporation of Shipping for their highest class, and will fulfil the requirements for a Board of Trade passenger certificate. In designing the vessel special attention has been given to the arrangement of the passenger accommodation. The first class rooms have been arranged amidships on the upper bridge and promenade decks. The first class dining saloon at the forward end of the bridge deck is a palatial apartment furnished in oak. The lighting of the saloon is by large cottage windows round the front and sides, having bevelled panes, and also by a handsomely designed dome through a large well overhead. The entrance hall on the promenade deck is decorated with an oak dado and upper panels in white and gold, the floor being of artistic rubber tiling, and is lighted by a large skylight. Opening off the forward end is the music saloon, a special feature of which is a handsome alcove dividing the two rooms. The room is well lighted by large cottage windows and also by a large stained glass dome overhead. At the after end of the entrance hall a number of special *cabins de luxe* have been fitted up. The promenade deck affords abundant space for exercise and recreation; the smokeroom is placed at the after end of this deck, having all the necessary comforts for smokers and card parties. The floor is laid with parquetry, and abundant light is given by cottage windows and a large skylight. A fully equipped gymnasium has been arranged and fitted up under special awnings in the forward well. A plunge bath has been fitted up in the after well. The second class passenger accommodation is divided in the poop. The saloon, placed in the centre of the vessel, is most comfortably furnished. A stairway leads up to an entrance hall, with smoking room adjoining, in steel house on the poop deck. The lavatory accommodation throughout is of the most up-to-date character and includes a number of spray and shower baths. The commissariat departments are provided with the most modern appliances for efficiently meeting the demands of a full complement ot passengers. A cold store, with suitable refrigerating plant, has been provided for the preservation of provisions and vegetables during the voyage. The vessel is lighted throughout by electricity, and all the public rooms and staterooms are fitted with electrically driven rotary punkahs, while in the special cabins electric radiators are fitted. An efficient system of steam-heating is supplied to the principal public rooms. The cargo space is divided into five large holds, which, by the adoption of the girder system of construction, are free of obstruction and are capable of receiving the largest type of consignment, such as boilers, locomotives, motor-cars, and machinery. For the speedy loading and discharging of cargoes powerful steam winches are provided at each hatchway, with the necessary derricks swung from the masts and crane posts. The bottom of the vessel is constructed on the double-bottom system, which, besides adding to the safety of the vessel, is used for the reception of water ballast for trimming purposes. The machinery and boilers consist of a set of quadruple expansion engines, with all the latest improvements in auxiliaries and four steel multitubular boilers, working at a pressure of 215 lbs. per sq. in. under Howden's system of forced draught.



S.S. "CITY OF LONDON." (*Built by Messrs. Workman, Clark & Co., Ltd., Belfast.*)

THE FIRST AMERICAN BUILT TURBINE STEAMER.

The first vessel built in the United States for commercial purposes to be fitted with turbine propelling machinery is the *Governor Cobb*, constructed by the Delaware River Iron, Shipbuilding, and Engine Works, of Chester, Pa.

The vessel has recently been placed in service

She has a length of 290 ft. on the water-line, whilst the length over-all is 300 ft. The maximum beam is 55 ft., and she has a load draught of 14 ft., the greatest depth, viz., from deck to keel, is 20 ft. 6 ins.

The turbines are of the Parsons' type, designed for 5,000 h.-p. There are three propeller shafts and five turbines. The centre turbine is worked by high-pressure steam, and one of the turbines on each outside shaft receives low-pressure steam, the remaining turbines being for go-astern purposes. Steam is supplied from six boilers of the "Scotch" type, working at a pressure of 150 lbs. per sq. in.

The *Governor Cobb* is owned by the Eastern Steamship Company, of Boston.

A Design for a Model Sight-feed Cylinder Lubricator.

By R. M. de Vignier, U.S.A.

THE accompanying design illustrates in model form a standard type of automatic lubricator for the cylinders of steam engines. The capacity of the reservoir is, approximately, 1 oz. of oil, and the construction adopted, while varying somewhat from that of larger devices of this kind, embodies the same general principles which obtain in the latter.

The constructional details adopted in this design have been chosen with a view to simplicity and compactness, and those members of the model engineering fraternity who decide to build this small apparatus will, it is hoped, be pleased to note that only one pattern is required.

Referring to the lettered drawing and to the section of the lubricator, the *modus operandi* is as follows:—

Steam being admitted into the pipe F, which leads from the boiler to the steam chest of engine, and valves B, D, and E being shut, will gradually condense in the sight-feed tube H, since it has free access to the latter until the tube is full of water. While this is taking place, unscrew the filling-plug C, and fill the glass reservoir *full* of oil. After replacing the filling-plug, open valve B and admit steam to condensing coil G. At this point it may be as well to observe that valve B has been merely indicated by a dotted circle, as any small valve will answer the purpose provided it be fitted with a union and of sufficient size to connect to the coil. This last may be varied to suit particular requirements, and may be made of 3-16ths-in. or ¼-in. tubing (either brass or copper), and should contain three or four turns; or, it may be replaced by a straight vertical tube of 8 or 10 ins. in length provided an adequate length of vertical steam-pipe is available. Should, however, the steam-pipe be horizontal, the tube may spring vertically from it and curve down to a short coil, as illustrated. But to return to our subject; water having taken the place of steam in the lower portion of the condensing coil, will flow to the bottom of the reservoir through the curved tube J, and if the needle valve E is opened, will displace the oil, causing it to flow down from top of reservoir through the curved tube K, and thence through the sight-feed nozzle, from which it will float upwards in drops through the water in the sight-feed glass H, and, upon reaching the steam-pipe, will be entrained by the steam to the valve-chest and cylinder in an "atomised" state, lubricating thoroughly both valve and piston.

Oil, being lighter than water, will float upon the latter, and it will therefore be at all times possible to ascertain at a glance how much oil remains in the reservoir. The flow of the oil-drops is to be regulated by the feed-valve E, and should approximate five or six drops per minute; very heavy oils should never be used, as, apart from the fact that they are not suited to model steam engines, it must be remembered that both water and oil in the lubricator are *cold*, and that consequently the drops formed would not detach themselves from the nozzle until they had reached a considerable size, possibly sufficient to adhere to the sides of the sight-feed tube and obscure the reading. It is with the intention of avoiding this unpleasant occurrence that the sight-feed tube has been given generous proportions, it being borne in mind that oil-drops do not readily lend themselves to being reduced to scale models.

Upon the reservoir becoming empty of oil, it may be refilled, without interfering with the continuous running of the engine, by first closing valves B and E and next unscrewing the filling-plug C and opening the drain-valve D, which will allow the water to flow out. The reservoir may then be refilled with oil, having previously shut drain-valve D, and, upon replacing the filling-plug C and opening the sight-feed valve E and valve B, the lubricator will at once resume its functions. After the first time it will not be necessary to recharge the sight-feed glass H with water unless it has been necessary to blow it out with steam in order to cleanse it of oil which may foul the glass, if by any chance the oil-drops should have been allowed to flow more rapidly than they could be carried away into the steam-pipe.

To blow out the gauge in the above event it will be necessary to empty the reservoir of oil and water; next close valve B and open valve E, drain-valve B being left open.

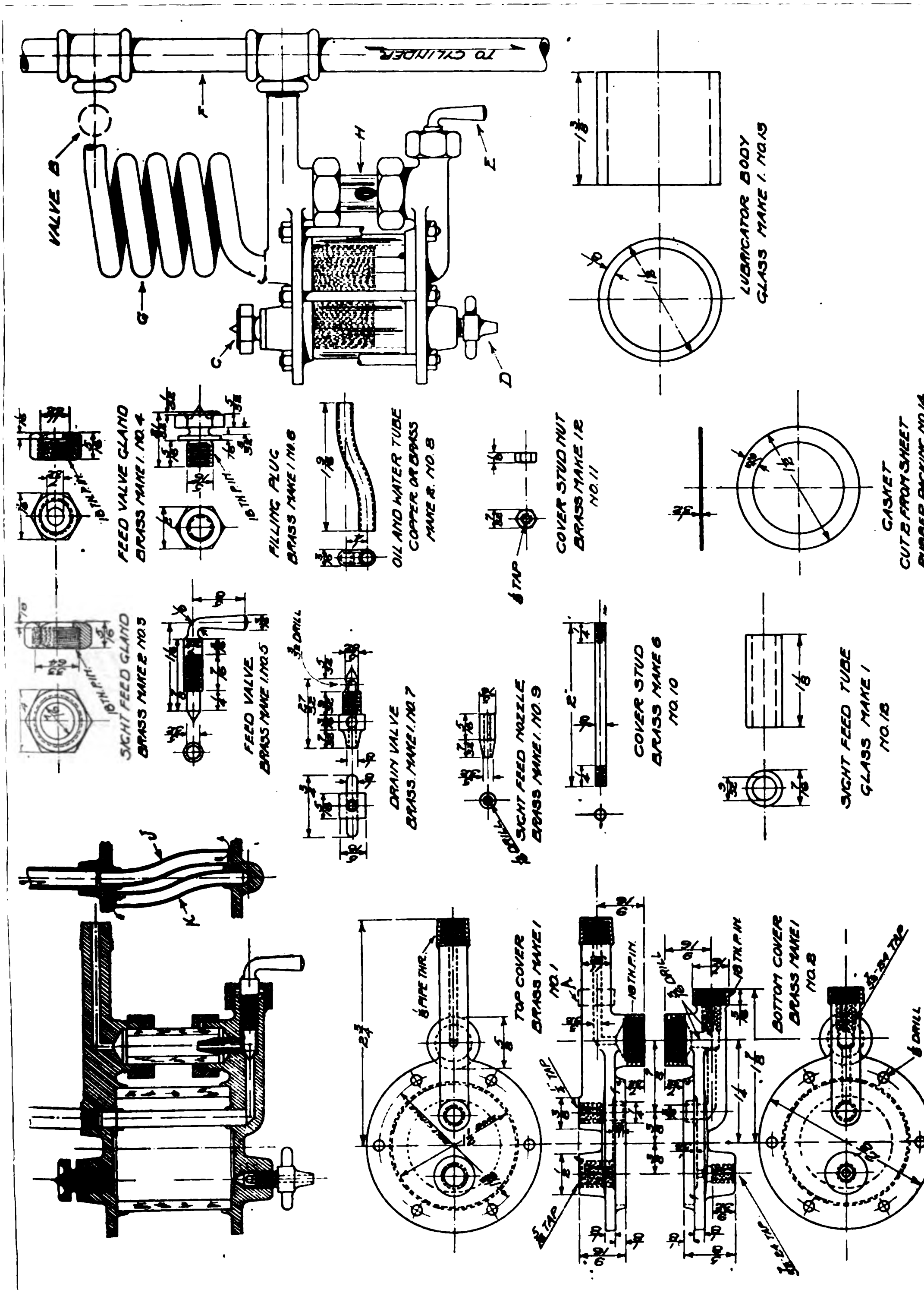
Proceeding to a description of the construction, it will be well to say that the reservoir or lubricator body, No. 13, is a glass from a standard oil-cup, and may be procured from any dealer in steam fittings for a trifling sum. It would be advisable before beginning work on the lubricator to purchase this and measure it accurately, as there is frequently a slight variation in the diameter of these glasses. Also, pick out one of as nearly uniform thickness as possible.

The tensile strength of glass in sheets being taken at 4,000 lbs., a glass cylinder ⅛ in. thick and 1½ ins. outside diameter will resist an internal pressure of 100 lbs. per square inch, and give a factor of safety of 8 approximately.

Therefore, it is safe to say that such a glass cylinder may be safely used for all pressures commonly met with in model steam engineering.

As stated above only one pattern is necessary, it being advisable to make this with a shoulder 7-16ths in. diameter, as indicated by dotted lines at A in the drawing of No. 1. This shoulder should have a length of 3-16ths in., and will serve as the boss on which a thread is to be cut when used for No. 2. It may be filed off the casting used for No. 1.

Also, in the casting which forms No. 2 the sharp edges are to be filed from the boss which in No. 1 is drilled and threaded for the condensing tube.



DESIGN FOR A MODEL SIGHT-FEED CYLINDER LUBRICATOR.

By R. M. de Vignier.

(*Scale · Half full size.*)

The drawings show all remaining details clearly, and do not require further elucidation.

This small lubricator will be found suitable for engines of from 1½-in. to 2½-in. or 3-in. bore, and its use cannot be too strongly recommended, *versus* the usual cylinder oil-cock, as it ensures the oil being carried in a fine spray to all parts of both the valve-chest and cylinder.

A Design for a 20-ft. Windmill.

By F. E. Powell.

VI.—Regulating Gear.

(*Continued from page* 160.)

To assist in making this regulating device perfectly clear, the diagrammatic sketches, Figs. 26, A, B, and C, are given. Each of these represents a plan view of the mill under certain conditions of wind. In the diagrams, S S S are the sails, T the tail, W is the wind-shaft, R the small regulating vane, P is the pulley carrying the weight-chain, H the hinge on which the tail turns, L the short lever at right angles to tail, and C the centre of the mill, on which turns the movable head, with sails, etc., attached. In the diagram, Fig. 26 A, we see the condition of things under normal or light winds coming in the direction of the arrows. Under these conditions, whatever tendency there is for the pressure of wind on vane R to turn the sails away is counteracted by the tail T, which is kept up to its work by the weights acting on the end of lever L.

Now suppose an increase in the force of the wind sufficient to accelerate the speed of the machine. Remembering that the weights falling on the lever L remain constant, it will be seen that at some particular moment the pressure on the regulating valve will suffice to turn the sails away from the wind in spite of the tail. The latter, of course, still remains approximately in the plane of the wind's direction, and the weights have been raised by the pulling out of the chain. This condition of things is indicated in Fig. 26, B.

The force of the wind, as already stated, increases very rapidly with the velocity; thus, a wind of 30 miles an hour has four times the pressure of one at 15 miles an hour. This is taken advantage of in the present mill by the fact that not only does the regulating vane act more strongly at the higher velocities, but the sails also rapidly present less surface as they recede from the wind. Thus—for slight increases of pressure—even a large departure from the normal position will not much reduce the sail area presented, but as soon as the windshaft makes an angle of 45 degs. with the normal centre-line, the available sail area decreases so rapidly that some approach to normal speed may still be expected. It is only when some maximum speed—say, 30 miles an hour—has been reached, and the sails have taken up the position shown in Fig. 26, C, that they quite cease to revolve, for it would be just as foolish to run the mill in a high wind as to drive a steam engine with a steam pressure much greater than that for which it was designed. In either case there might not be actual disaster, but there would be every chance for the machine to "knock itself to pieces."

The constructional details of this regulating device are shown in the series of diagrams, Figs. 18 to 25, which are not only dimensioned, but are to a scale of ¾ in. = 1 ft. A few words only of explanation are needed in connection with them.

Commencing with the wind vane or tail, it has already been pointed out that this has been carried by lugs on the movable head casting. The hinge pin is a 1-in. turned bolt, 10 ins. length under the head, and is prevented from lifting either by a 3-16ths-in. split (or taper) pin beneath the lower lug, or may be held fast by a set-screw in one of the lugs. In any case, it is very important that this

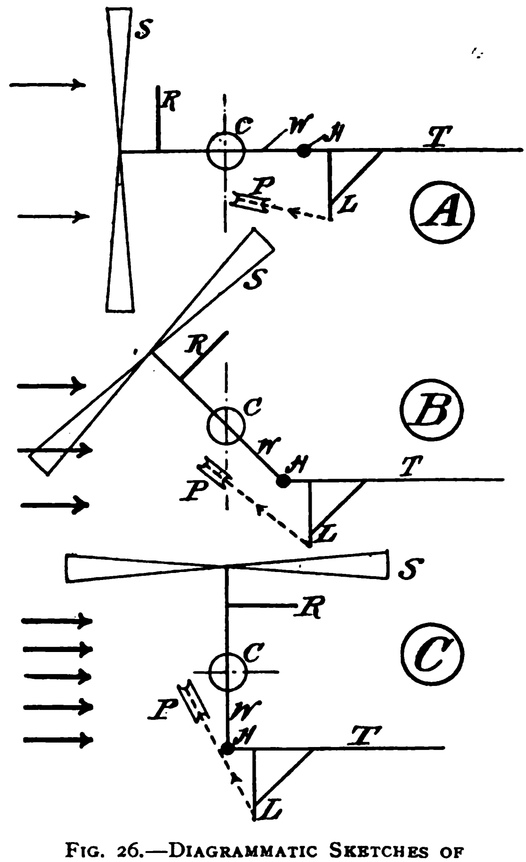


Fig. 26.—Diagrammatic Sketches of Regulating Gear.

hinge pin should be a good fit in holes in lugs, which should be also perfectly upright, and there must be no slack in the holes in the 2-in. × ⅜-in. iron plates carrying the tail.

The last-mentioned plates are clearly shown in Figs. 19 and 20. The top one is bent upwards to the top of upper lug, and both plates are fixed with ⅜-in. bolts as shown. The shape, position, and size of the weight-lever are sufficiently indicated to need no description.

The varying positions of the weight-chain, due to alterations in the position of the tail, necessitate a pulley capable of adjusting itself to keep in a true line with the chain. This pulley and its carrier are shown in Fig. 22, in which the upper diagram is a plan, and the lower a side elevation. The pulley, which must be of brass or gun-metal, runs on a bolt which serves as axle in a U-shaped piece of iron, which again is held by a specially shaped bolt to the fixed carrier, bolted in its turn to the movable-head casting. The "special" bolt mentioned is shown to double the scale in Fig. 23. It will be noted that it is merely an ordinary ½-in. bolt, with the underside of the head turned "countersunk," or rather, spherical. The nut on this bolt is not to be screwed up tight, but must be prevented from coming off by a split pin through it and the bolt.

The chain to be used need only be a short length, a couple of feet being sufficient. It may be ¼-in. galvanised steel chain, as there is no very great strain upon it. The lower end will be secured to a piece of (preferably) flexible steel wire, and this again to the parts shown in Fig. 20, and to a larger scale (1½ ins. to a foot) in Figs. 24 and 25.

The object of this little apparatus is to allow the movable head, with tail, weight-chain, etc., attached, to revolve freely while the weight remains always in one position. Thus, the brass sleeve, shown in Fig. 25, surrounds the vertical shaft, and has the end of the weight-chain attached to its two lugs. By the flanged shoulder at its lower end it carries the iron castings (Fig. 24), which are bolted together and bored out to turn freely upon the inner sleeve. These castings in their turn carry the weight itself by means of the wire shackle indicated in Fig. 20. Further details of the weight-gear will be given in due course. It is important to keep the surfaces between these two sleeves thoroughly well lubricated.

Details of the regulating vane are shown in two views (Fig. 21). The shape of this is not of much importance as long as the area and the general position are adhered to. It is formed of 9-in. × ½-in. boards, bolted with small galvanised bolts to a 1½-in. × ⅜-in. iron bar, which again is secured to movable-head casting by ½-in. bolts, shown in Fig. 4. The bar is "set" to an angle of about 15 degs., this being indicated in the plan view (*Fig.* 19).

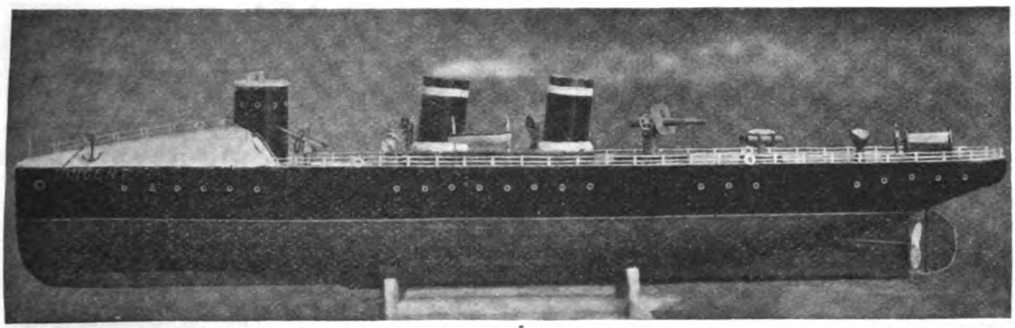
(To be continued.)

The 1906 Model Speed Boat Competition.

(Continued from page 186.)

IN section "B" of the competition Mr. T. J. Davies came third with a well fitted-up model torpedo boat. Deck fittings, of course, add weight and increase the displacement, and increased displacement means less speed for the given length and power of the boat. The owner of the *Vincent* is, therefore, to be congratulated on the measure of success he obtained. Describing his model, he says :—

"My model torpedo-boat destroyer—shown in the accompanying photograph—was designed, built, and engined by myself during 1905. It was built as nearly as possible to represent the prototype, and not expressly for speed. At the same time, 100 yds. have been covered by her in 47 seconds, which works out at 4⅝ miles per hour. The hull is built of red pine in two layers of 3 ins. each, and the joint between planed even and put together with white lead and screwed with a wood screw at each end. The length over all is 54 ins. ; length on water-line, 50 ins. ; beam amidships, 7¼ ins. ; beam amidships (inside), 6½ ins. ; depth (inside), 5½ ins. ; a false keel is fitted, as well as a lead keel weighing 4¾ lbs. The engine is a compound : H.-P. cylinder, ¾ in. ; L.-P. cylinder, 1 3-16ths ins. ; stroke, ¾ in. ; and no castings were used in the making. The cylinders are built up of tubing and scrap material. The boat has twin screws each 3 ins. diam., with three blades. They are of the built-up type, and are driven by two ⅝-in. spur wheels coupled direct to the engine ; between the spur wheels and tail shaft are spiral shafts, each 3 ins. long, to allow for any out of alignment and to ensure easier and steady running. Attention may be called also to the propeller tubes. Stuffing-glands at either end are done away with. In Fig. 1 will be seen the arrangement I have adopted, quite clearly. Just behind the bushes is fixed a lubricating tank, standing 1½ ins. above the stern tubes. From this tank there are two branch tubes 3-32nds in. bore, one running to each propeller tube. The tank is made from a piece of tube by filing a portion at the top away (as shown in Fig. 2)



MR. T. J. DAVIES' MODEL TORPEDO BOAT DESTROYER "VINCENT."

and soldering a brass disc on at each end. On filling the lubricating tank, the propeller tubes are completely filled with oil. The tail shaft is ground into the bushes a nice working fit. I find that there is no leakage of water into the hull by this device, and it is practically frictionless compared to the stuffing-box arrangement ordinarily used.

"The boiler is made of sheet copper (18 S.W.G.), and is of oval cross-sectional shape (see Fig. 3). The barrel is 8½ ins. long, 4½ ins. wide, and 3 ins. deep. It has eleven water-tubes of solid-drawn copper ¼ in. diameter, set at an inclination. They are tower and funnels are made of tinplate. The turtle deck is made from a solid piece of pine, shaped and hollowed out. The other deck fittings consist of two guns forward (to imitate 12-pounders), heavy gun on platform, four ventilating cowls, binnacle, searchlight, two torpedo tubes, eight lifebuoys, and a captain's gig. The stanchions were made of 3-32nds-in. brass wire, cut as shown in Fig. 6 for the railings, which are of wire soldered in. The boat weighs in working order 27½ lbs."

Mr. Hughes' *Albert* was tried under the auspices of the Liverpool Model Yacht Club, together with

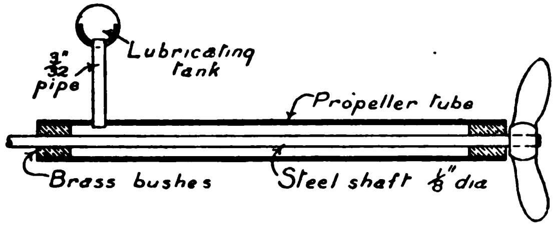


FIG. 1.—LONGITUDINAL SECTION THROUGH PROPELLER TUBE.

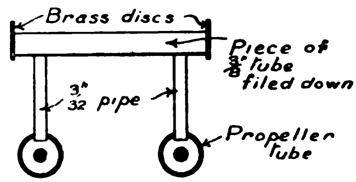


FIG. 2.—METHOD OF LUBRICATING PROPELLER SHAFTS.

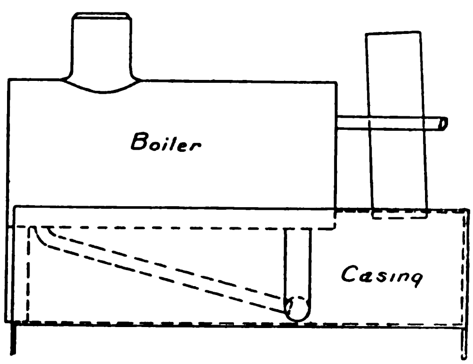


FIG. 5.—SHOWING BOILER IN CASING.

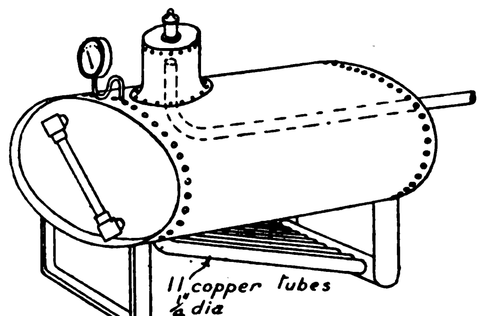
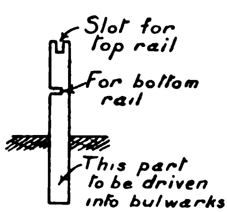


FIG. 3.—VIEW OF BOILER.

FIG. 6. DETAIL OF STANCHIONS.



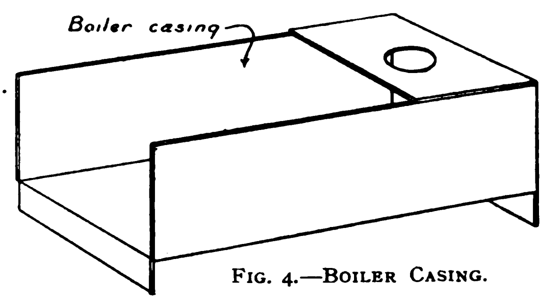


FIG. 4.—BOILER CASING.

SOME MACHINERY DETAILS OF MR. T. J. DAVIES' MODEL T.B.D.

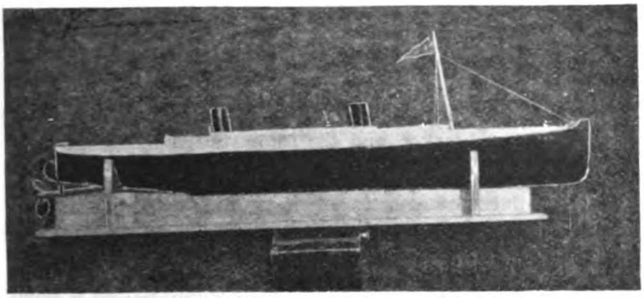
connected to the shell at the front and to the downcomer at the back.

"The lamp used burns benzoline or petrol and was purchased from the Liverpool Castings Company. It will raise steam in three minutes from cold water to a pressure of 25 lbs., and when not in use in the boat, I can do light brazing jobs with it.

"The deck of the boat is strengthened by 14-gauge steel wire, soldered all round underneath. A wire grating is fixed in the deck to ventilate the lamp, the grating being 3½ ins. square. The conning Mr. Rimmer's *Wolf* and Mr. Coxon's *Ades*. It is a 4-ft. 6-in. boat, having a beam of 7½ ins. and a depth of 4 ins. The boat is propelled by a 1-in. by 1-in. launch engine. The boiler is 12 ins. long and 4¾ ins. in diameter. It has a single furnace tube 2½ ins. diameter, fitted with eight cross tubes. A petrol blowlamp is used to supply the necessary heat.

The following particulars of the *Ades* are supplied by Mr. Frank Coxon:—L.W.L., 6 ft. 1½ ins.; beam, 8 ins.; draught, 3½ ins.; displacement, 42 lbs.; engine, 1¼ ins. diameter bore by 1-in.

stroke, cut off at ¾ stroke, single cylinder; boiler, 6 ins. diameter by 13 ins. long, water space, double-flued, 2-in. bore furnaces with ten cross-tubes in each ½ in. diameter; shell, 16-in. gauge copper, double riveted, longitudinal joint; working pressure, 70 lbs.; propeller, 5 ins. diameter, three blades,



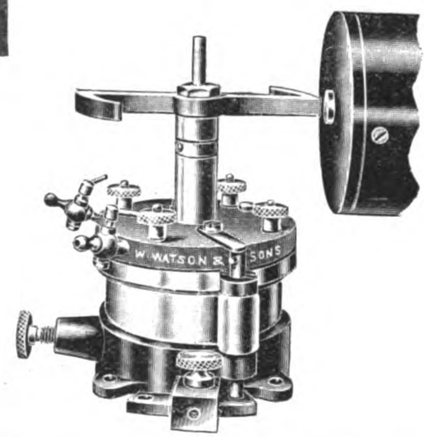
MR. HUGHES' MODEL BOAT "ALBERT."

12½-in. pitch; blowlamp, double burner, coil type, using petrol. The actual speed of boat is 5½ miles per hour, but the official published speed was obtained on a run over a very erratic course, due to bad steering and no time being available for further runs.

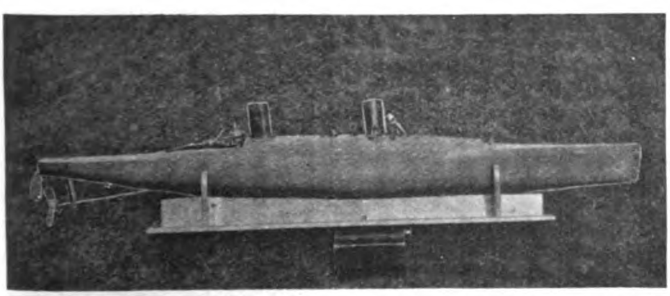
Recent Developments in X-Ray Apparatus.

(Continued from page 178.)

A NEW form of mercury jet interrupter was exhibited at work by Messrs. W. Watson and Sons, of 313, High Holborn, W.C., with one of their intensified induction coils—that is, a coil specially constructed to give a high-tension discharge combined with large capacity. They claim that this interrupter will run for about four months without cleaning; no liquid di-electric is used, and the quantity of mercury is less than 1 lb. The principle is that of a jet of mercury, which strikes against some rotating metal teeth, the circuit being completed when the jet is in contact with a tooth, and broken when the tooth has passed by the jet. The mercury is circulated by means of a pump contained within the apparatus. Rotation is produced by attraction between an iron armature of peculiar shape and the core of the induction coil. The combination of induction coil and break armature forms a contact motor. Each arm of the armature is attracted in turn by the core of the induction coil and rotation thus produced, the movement keeping step with the interruptions of current produced by the interrupter itself. Speed is regulated by a mechanical adjustment, which alters the timing of the contact, no resistance being used. The chamber containing the mercury, pump, and revolving teeth is devoid of air, which is replaced by ordinary house gas, for the purpose of suppressing the spark at break. The makers state that no gas is actually consumed, but it is advisable to maintain connection with the house supply or other service to compensate for any small leakage which may take place. This interrupter attracted much attention, and appeared to be giving remarkably good results. At present it is made for continuous current only, but the makers hope to adapt it for alternating current also.

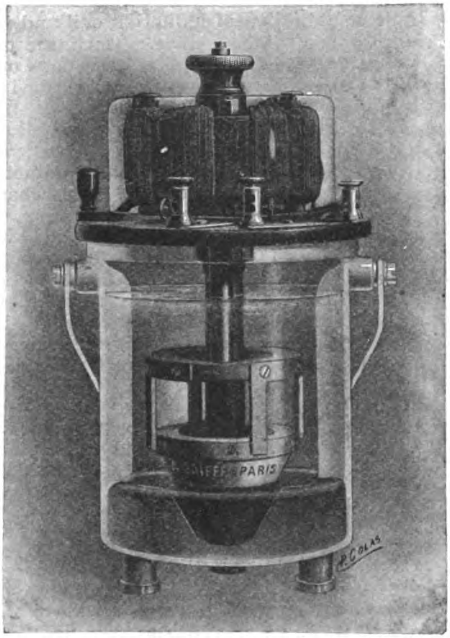


MESSRS. W. WATSON & SON'S NEW MOTO-MAGNETIC INTERRUPTER.



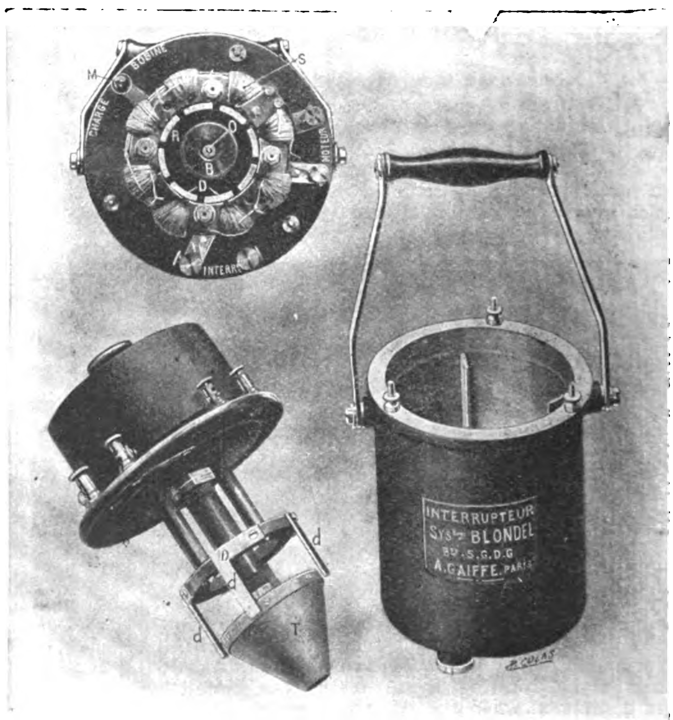
MR. FRANK COXON'S MODEL BOAT "ADES."

Another interesting pattern of mercury jet interrupter was shown in action by Messrs. The Medical Supply Association, of 228, Gray's Inn Road, London, W.C., who are agents for the makers, Messrs. A. Gaiffe, of Paris. It acts as a rectifier as well as an interrupter, so that an induction coil can be worked, or accumulators charged, with current derived from alternating current supply mains. The principle is again that of a jet of mercury striking against copper teeth, but in this apparatus the teeth are stationary and the jet rotates. It is produced by a cone T (see illustration), in which is a straight canal pointing upwards and outwards, dipping into the mercury, and rotated by means of a motor fixed on the cover. As the cone rotates, the mercury—moving with it—rises, and is expelled by centrifugal force



MESSRS. THE MEDICAL SUPPLY ASSOCIATION'S ALTERNATING CURRENT MERCURY JET INTERRUPTER AND RECTIFIER.

through the upper end of the canal. At the moment when it is striking against the teeth *d d*, circuit is made; when it is passing across the space from one tooth to another, the circuit is broken. The width of tooth adopted determines the duration of time of contact for any given speed and the relation of make to break in this respect. Absolute alcohol or methylated spirit is used to cover the teeth and jet where the sparking takes place. The motor is started by hand, and runs up to synchronism in about thirty seconds, it will then rotate in step with the current. This point of synchronism is indicated by the needle of a milliamperemeter becoming steady, or by the sound of the break, which is at first rough, and becomes smooth as the motor reaches synchronous speed. Only one wave of each flow of alternating current is used. The motor has eight poles, but the mercury jet is making contact only four times during each revolution, as there are only four contact teeth; thus, when the motor armature is running in step with the alternating current, the jet is out of contact at each alternate wave. All the waves of current which flow to the primary of the induction coil, or battery of accumulators, if the interrupter is being used for charging purposes, will be in the same direction. Only the higher part of each wave is used, and the proportion is determined by the width of the contact teeth. For accumulator charging, the makers recommend this proportion to be about one-sixth of a period. The motor consists of a laminated iron ring stator, having eight polar teeth and wound with eight coils connected in series. The rotor consists of eight soft iron segments fixed upon a brass supporting ring carried by the spindle, which is lightly pivoted. At starting, the motor winding is placed in series with the contact breaker, and the rotor started by hand. The motor then acts in a similar manner to an ordinary contact motor, and runs with an increasing speed until the rotor is in synchronism with the current; the stator winding is then switched direct on to the supply current, and the contact breaker connected in series with the induction coil winding or batteries. A condenser is connected as a shunt to the break, for the purpose of reducing the spark. Regulation of the current can be effected by means of a resistance in series with the primary of the induction coil; for charging accumulators a transformer can be used to reduce the supply pressure at the terminals of the battery. The stator of the motor is provided with an adjustment so that it can be rotated through a small angle in either



MESSRS. THE MEDICAL SUPPLY ASSOCIATION'S ALTERNATING CURRENT MERCURY JET INTERRUPTER AND RECTIFIER. SHOWING CONSTRUCTION.

direction; by this means its position with relation to the contact teeth is determined, so that the jet makes contact with the desirable portion of the current wave. If accumulators are being charged, the peak of the wave is used, but if the current is working an induction coil, a portion of the rising side of the wave near the peak is used.

(*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 intended for publication.]*

A Useful Battery

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The following is a description of a useful battery I have made, which may be of interest to some of the readers of THE MODEL ENGINEER.

Procure an old porous pot from a Leclanché battery. Break the pitch from off the top, and take out the carbon plate and the mixture surrounding it. Soak both the plate and mixture in boiling hot water to get rid, as far as possible, of the salts in them. A glass jar will then be required, about 3 or 4 ins. wide, and of such a height that the carbon plate when placed in it will allow the terminal at the top to project about 1 in. above the top of the jar. Then take an odd piece of sheet zinc as high as the carbon plate and measuring about 2½ ins. or more across, according to the width of the jar, and solder a stout piece of copper wire to the top of it.

Next procure a strip of old linen or calico about 2 ins. wide, and wind this tightly round the zinc plate, taking care that it covers the whole of the surface, including the edges and corners, which are liable to cut through the calico. Do not put too much on. Then soak the top of the zinc plate for about 1 in. in paraffin wax. Place the zinc and carbon plates in the glass jar, keeping them about 1 in. apart, and fill up the jar to the top with the mixture out of the porous pot. If there is not sufficient, mix some broken-up coke with it. Then pour into the jar a solution of common salt or sal-ammoniac, filling to within about ½ in. of the top.

The absence of a porous pot and the closeness of the elements, together with the large surface of zinc offered to the carbon, all help to diminish the internal resistance considerably.—Yours truly,

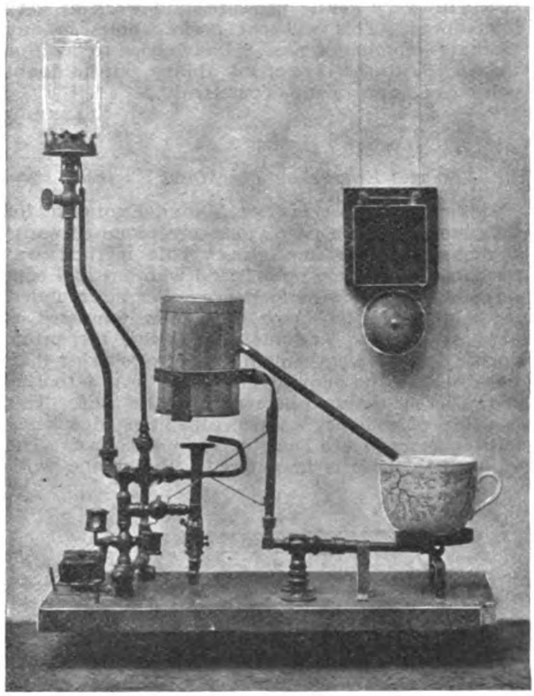
J. G. NICKSON.

An Automatic Kettle.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Enclosed you will find the photograph of an automatic kettle which I have made, and if you care to reproduce it in THE MODEL ENGINEER the following are the particulars.

I set the clock (not seen) at any time required, and place it to form part of the circuit of two wires to the bell, next fill the boiler up to the level of the syphon tube (which runs to the bottom of the boiler) with water, and light the two by-passes. Immediately the clock comes round to the time set it completes the circuit, allowing the electric current from a battery (not shown) to pass through the electro-magnet, which at once attracts the armature (working on two pivot points). A small hook on the armature releases a weighted tap which falls and allows the gas passage to the incandescent light and to the Bunsen burner under the boiler, at the same time ringing the electric bell. I have a switch near the bedside to stop the bell until the water boils, which takes about eight minutes; the water at boiling point expands enough to bring it above the level of the bend in the tube, the result being it "syphs" through to the cup and empties the boiler, both



MR. WM. GRAY'S AUTOMATIC KETTLE.

of which are balanced. The cup, receiving the weight of the water from the now empty boiler, drops about ⅛ in., and again forms contact, sets the bell ringing, and allows another weighted tap to fall and put the Bunsen burner out, leaving the incandescent burning. I have to lift the cup off to stop the bell.—Yours truly,

WM. GRAY.

North Shields.

Re Drilling Glass and China.

To THE EDITOR OF *The Model Engineer.*

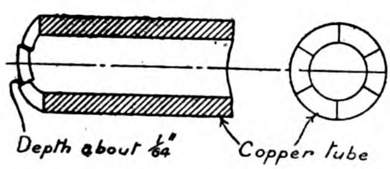
DEAR SIR,—I think I can supply your reader with the required information; the method is used in a large plate-glass works, so I am sure it is quite the thing. For drilling holes to the diameter of ½ in., take a three-cornered file—a broken one preferably, it being best not to have it too long—and grind it down at the broken end. Put it in a woodworker's brace and drill where required. The main point to be observed is to keep the drill and the place to be cut well soaked in turpentine while cutting; this prevents the glass splitting, and also causes the drill to bite. Use a little pressure at first and do *not* work too fast.

For holes ½ in. and upwards, procure a piece of seamless brass tube to the required size and about 2 ins. long. Force one end on to a piece of wood so as to be able to fix in a drilling machine (the one described recently would be just the thing). In the other end of the tube cut four slits ½ in. by 1-16th in. at equal distances apart. Now we are ready to place the china or glass to be cut in position on the machine. Around the place to be cut, make a ridge of putty ½ in. high; into this pour some fine sand and water, lower the drill into this with very gentle pressure, and work at very high speed. This will cut perfect holes in any thickness of china or glass. I have tried to describe this to you to the best of my ability, but no doubt you could improve it.—Yours truly,

J. CLARKE.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I see in THE MODEL ENGINEER for February 7th, 1907, page 139, a correspondent wants a method for drilling glass. This method was recommended to me by a friend who has had considerable mechanical experience. For holes under, say, 3-16ths in., ordinary steel drills, tempered as hard as possible, and moistened with turpentine during drilling, may be used. For holes larger than this (the size he showed me was ¼ in.), a tool as shown in the diagram herewith may be used. This is made of ordinary copper tube, the edge being left blunt, and teeth being cut in it as shown. The number of these is immaterial. Either the work



or the drill is chucked in the lathe—the work, if possible—and this is rotated as quickly as possible; then the work or drill (as the case may be) is forced up by the poppet, emery powder being liberally sprinkled on the tool. My friend has drilled a hole through a photographic plate in 15 minutes by this means. Hoping this may be of use, yours truly,

"LATHELESS."

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Replying to your Editorial note *re* above, diamond drills suitable for the purpose, such as are used by jewellers for drilling jewel settings, may be obtained from the makers, Messrs. Wood & Son, 54, Spencer Street, Clerkenwell, and range in price from about 1s. upwards, according to size.

I have such drills in constant use for drilling dental porcelain, and find them very durable, especially when the knack of properly using them is acquired.

Before discovering this firm, I had to pay 4s. to 6s. for drills I now obtain for 1s. 6d. to 2s. 6d. each. And one of these drills properly used will outlast two hundred steel drills, however well tempered.—Yours truly,

"GRATEFUL."

A Simple and Effective Burner.

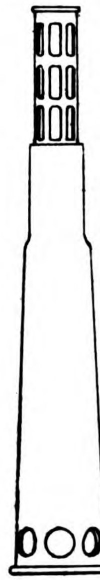
TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I herewith send you a drawing of a simple but effective burner which a friend of mine and myself made out of two cartridges.

The lower one is a service rifle cartridge, round the bottom of which five holes were bored. The cap was then removed, and the two small holes in the bottom of the cartridge acted as a jet. We then procured another cartridge, which fitted tightly into the top of the first, and perforated it all over. This was then hammered tightly into the lower cartridge, and the burner was ready for use. By fitting a blowpipe to one of the air-holes of the lower cartridge an exceedingly hot flame was the result.—Yours truly,

B. LE M. A.

Felsted.



A BURNER MADE FROM CARTRIDGE CASES.

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 intended for publication.*]

Model Full-rigged Ships.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—As I belong to that portion of your readers which are more interested in model yachting than model engineering generally, it has been with much pleasure I have seen so much of your space devoted to yachting correspondence this last three months. The letters advocating model full-rigged ships have been most ably written, showing that many of your contributors have a good knowledge of the subject. I was pleased at the tone of "W. H. T.'s" letter and its appeal for information, and have no doubt that "W. H. T." would have made an ardent sailor had his lot been cast that way.

Who could help but admire the stately grace of a full-rigged ship under weigh; or, who would not regret that miniatures worthy of the originals should become extinct?

Of this "W. H. T." need have no fear. There are hundreds of scale models of these vessels, which, I doubt not, will be in existence 100 years hence. I had the pleasure of seeing one—it was exhibited at the St. Louis Exposition—a model of the five-masted full-rigged ship *Prussien*, and has cost her builders £1,500 in wages alone ! Everything here was to scale and perfect in every detail; quite as much as, if not more so than, most model locomotives. This, however, is not the kind of model for sailing—where simplicity must be the keynote. Model square-rigged ships sail remarkably well, but you must have plenty of room, so that in beating to windward they can make "long boards," and so avoid the necessity of having to be continually "putting them about."

You cannot put a square-rigged model "about" by simply pushing them round on to the other "tack" like a "fore-and-after,"; you would have to bring her alongside to swing the yards.

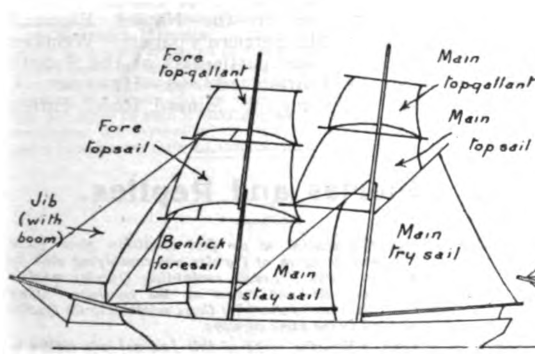
For racing purposes square-rigged vessels are not "in it" with "fore-and-afters," but, sailing for pleasure and picturesque effect, the square-rigged model wins easily.

As these models, when sailing, are generally viewed at some considerable distance, the masts, rigging, and sails, as also the general outfit and deck fittings, can be greatly simplified, and yet contain sufficient reality to be most life-like.

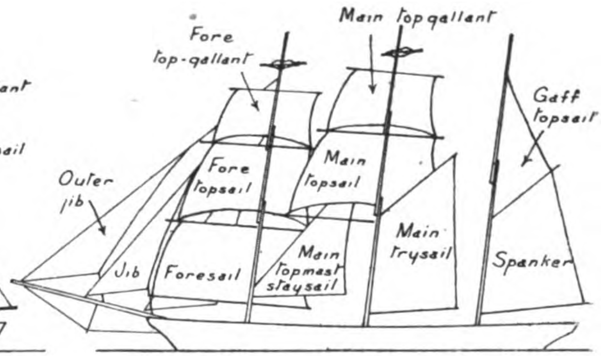
I would not advise anyone to go in for "full-rigged" ships, but topsail schooners—two and three-masted; brigs with a "Bentick" foresail, *i.e.*, a spar along the foot, with a tack in the middle of the spar, obviating the necessity to shift "tacks and sheets," and no square mainsail; what is known as a "Jack-ass" barque, *i.e.*, with a fore-and-aft trysail in place of a square mainsail, and a "Bentick" foresail; or a brigantine: all these make good sailing models, easily worked, and without any of the braces being led down to the deck; but I would not advocate double topsail yards, much less double topgallant, or royals. These are all labour-saving devices in the original, and not at all suitable in a model; nor do they have the same picturesque appearance as the old-fashioned single topsails and topgallant sails. If a more realistic appearance is desired than is possible with only courses, topsails, and topgallant sails, then royal yards might be fitted with or without dummy "furled" sails, and the yards left "squared." In many breezes, courses and whole topsails would be found sufficient, because you will find the "top hamper" in a square-rigged model will be out of all proportion (in weight) to its prototype.

On non-racing days our park ponds would be made attractive by craft such as I have mentioned, giving pleasure to many onlookers, but simplicity of rig is a *sine qua non* if a successful sailing model is aimed at.

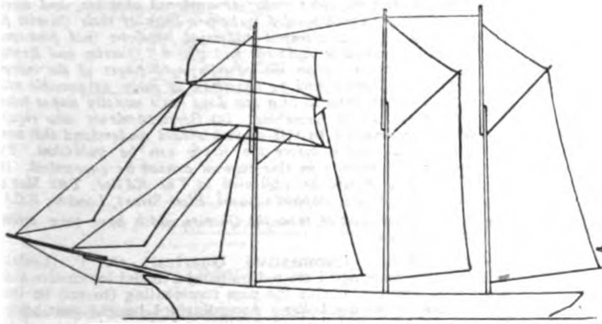
I could rig such a model so that the yards could be swung and the ship off on the other tack in something like twenty seconds—perhaps less.



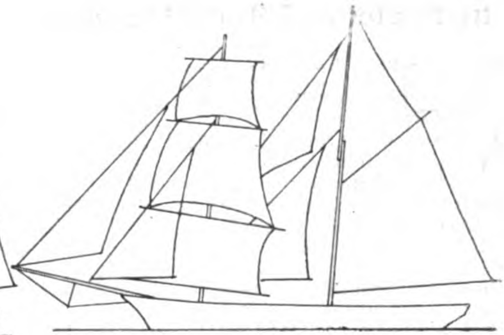
Brig.



Jack-ass Barque.



Three-masted Schooner.



Brigantine.

Types of Full-rigged Sailing Vessels Recommended by "West-Sou'-West" for Modelling.

I enclose a photograph of a seven-masted fore-and-aft schooner.

Much more could be written on this subject and many more reasons adduced why a sailing model (which is made for use and not for a glass case) can never be so completely like the original as many model locomotives are like the types they represent; but I think probably by this time your correspondent, "W. H. T.," will have seen the futility of striving to carry out all detail in this class of vessel.

Again, the beauty of our sailing ships will live for centuries in our Art Galleries; we have to-day, perhaps as fine marine artists as ever lived.

My credentials—to copy one of your valued contributors—for imposing on your space and patience to the extent I have done are:—Twenty-nine years' service at sea, fourteen of which as master, and an ardent model-maker ever since I could handle a pocket-knife.

By-the-by, *all* model sailing yachts are not freaks; many of them are very nearly scale models of the types they represent.

I hope to send you soon some photographs of a 42 lineal rater, designed by Mr. Kitchingman, the design of which appeared in "ours" of April 27th, 1905.—Yours faithfully,

"West Sou'-West."

[The seven-masted schooner referred to was illustrated in our issue for July 15th, 1902.—Ed., *M.E. & E.*]

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.*]

At the invitation of Captain Bunn a party of the members on the evening of Wednesday, February 13th, visited the headquarters of the Electrical Engineers (volunteers), at Regency Street, Westminster. The party was met by Captain Bunn, and under his guidance and that of other officers inspected the very interesting plant installed in the building for generating electric current for supplying the huge searchlights as used for harbour and coast defence. The plant, being used mainly for the purpose of instructing recruits in its use and working, was of a varied character, and included several sectional models—one of a Hornsby oil engine and another of the feed-mechanism of the searchlights being particularly interesting. The running plant comprises a compound undertype steam engine and boiler, driving a Victoria (brush) dynamo. The latter was interesting as being a type rarely seen nowadays. Two 25-h.-p. Hornsby oil engines, driving two modern overtype dynamos, the engines being self-starting by means of compressed air stored in a separate receiver and admitted to the cylinder on the working stroke. Another item of interest was a self-contained field generating station, comprising a two-cylinder oil or petrol vertical engine direct coupled to a Shuckert dynamo, with water-cooling apparatus and all necessary instruments, switches, etc., the whole mounted on a heavy four-wheeled trolley drawn by six horses. The large arc lamps for the searchlights were seen in operation and their action explained, and a small searchlight captured by the Brigade from the Boers in the South African War, fitted with a species of Venetian blind for signalling, was noticed. The formal inspection being over, the party descended to the basement and inspected the armoury, and spent the remainder of the visit in shooting practice on the Morris tube range. The usual acknowledgments to Captain Bunn and the other officers having been made, the members separated at nine o'clock.

Future Meetings.—On Friday, March 15th, at the Cripplegate Institute, at seven o'clock, Mr. Snodgrass will give an illustrated lecture on "The design and construction of Petrol Engines, with special reference to the Napier Engine." Tuesday, April 9th, Mr. Ferriera's paper, "Wrinkles in Model-making." For particulars of the Society and forms of application address—Herbert G. Riddle, Hon. 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.*

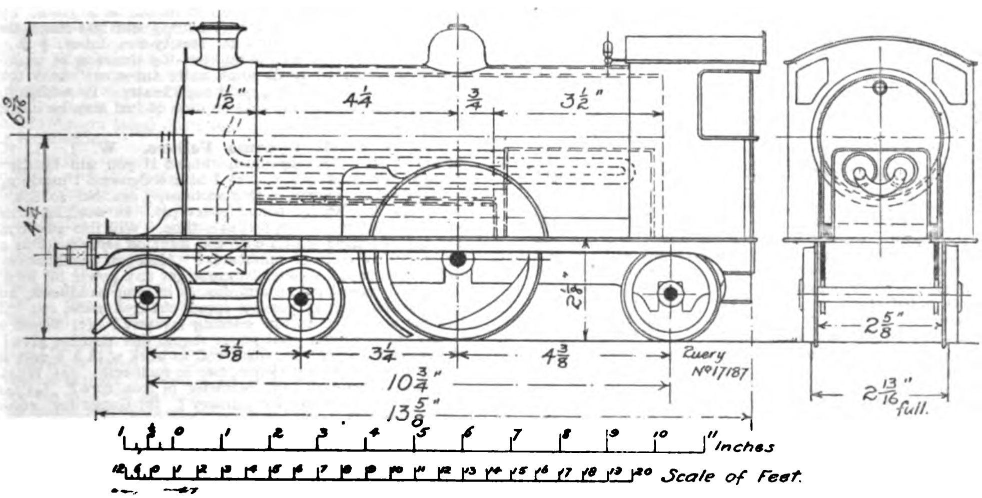
Queries on subjects within the scope of this Journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, 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:—

[17,187] **Model Locomotive Queries.** C. P (Leeds) writes: Some years ago I started building a model locomotive and resolved to commence with the part representing (to me) far the greatest difficulty—the boiler. Accordingly I bought your handbook No. 6 (4th edition), and finally pitched on the locomotive boiler illustrated on page 49, Fig. 19, made by splitting a piece of drawn tube, as being the easiest to construct with satisfactory results. I adopted, however, the following modification (*a*) water space all round inner firebox; (*b*) $\frac{1}{4}$-in. water tubes arranged $\frac{1}{8}$ in. out of horizontal in ditto; (*c*) perforated steam pipe in place of dome. I enclose rough sketch (not reproduced) of same as actually finished. Barrel, drawn copper tube, 18 S.W.G.; flue tubes (two $\frac{3}{4}$-in.), drawn copper tube, 20 S.W.G.; water tubes (three), drawn copper tube, 22 S.W.G.; inner firebox and other plates, sheet copper 16 S.W.G. Stays as indicated in sketch. Total weight (empty), $3\frac{1}{2}$ lbs. Having appliances, all joints are brazed. I have tested it to 50 lbs. hydraulic, which it stands without a murmur. I propose to lag with asbestos and tinplate. I also enclose sketch (not reproduced) of proposed simple spirit burner. I have submitted, being a novice at model engineering, my completed boiler to a local expert. I was dismayed to find I had created not a boiler, but an abortion. On these grounds—(1) No model boiler of this pattern on so small a scale and with so small a firebox could hope to succeed, the only right principle being that of the water-tube (Smithies) type. I have seen this referred to in your paper, but not explained. It appears to me very excellent for a model, though somewhat far from ordinary locomotive practice. (2) My flue tubes were of a gauge far too massive; also the plates of inside firebox. To this I plead guilty of having erred on the side of safety. (3) My perforated steam pipe, which I adopted for reasons connected with exposed position of a dome, is a bad mistake in a model. When any incline is encountered, or even on starting and stopping—fizz!—and after that the deluge. A dome is the only efficient fitting for any model locomotive, but on this

type of boiler is imperative. I feebly urged that such fitting is possibly of little use unless double—an abominable complication, to my mind, in so small a model. (4) When he saw my proposed spirit burner he fairly snorted. It was pre-Adamite. Nothing but a vaporiser was of any use at all. (5) If lucky I might raise 10 lbs. pressure, but he sadly doubted it. I had hoped for 15-20. (6) The boiler would make an excellent adornment for any scrap heap. I admit that brazed joints must be of necessity rather untidy. In appealing to you I am perfectly humble and quite prepared to start afresh, if absolutely necessary, and should much prefer to do so if my boiler is likely to prove a great source of disappointment. If, however, it passes muster as even moderately efficient, I propose to use it to drive a *single* inside slide-valve cylinder, ½-in. bore by 1-in. stroke, and I should be greatly obliged if you would advise me what type of locomotive to imitate (tank engines excluded). What I want is a practical efficient working model, something like reality in outward appearance. Single cylinder is imperative to avoid complication in a first model. I propose to fit Stephenson's link motion, having a horror of slip eccentrics and such like devices as being base subterfuges even in a model. I shall also make lubrication as efficient as I can.

We are much interested in your query and have to admit that owing to the development of the water-tube boiler for model locomotive purposes the design you choose has no great merits. However, the boiler should not prove an *absolute* failure, as your friend predicts, but if you like we shall be pleased to make a test of it if you will agree to send it carriage paid both ways. In the meantime, we answer the several points of your query *seriatim*. (1) This is not a fact, as we know of several small locomotives having tubular boilers which are within ordinary limits perfectly successful. We would refer you to the description of Mr. A. Bowling's engines in our issue of November 1st, 1901. The chief thing against the design you have worked to is the fact that there are only two flue tubes, but suggest a method by which these may be used to advantage. We show in the accompanying design for a ½-in. scale locomotive, which we have prepared to suit the proportions of your boiler, the steam pipe passing down one flue tube and up the other on its way to the cylinders. This is done to prevent the *core* of heated gases passing along the large flues being wasted (see "The Model Locomotive," by H. Greenly, the chapter on Boiler Construction, page 194, Fig. 250), and at the same time it adds to the total efficiency of the generator. You will find full descriptions of the water-tube locomotive boiler in our back issues, but the information is much augmented and arranged in a scientific manner in the above-mentioned book. (2) Both the flue tubes and plates from which you have made the inner firebox are rather heavy; this reduces the efficiency of the boiler considerably. (3) A single dome has no advantage over a perforated pipe, except that there is less likelihood of water being carried to the cylinders when the boiler is too full. You can prevent the inclination of the locomotive when going up or down a hill carrying over water to the cylinders by arranging the perforations in the centre of the collecting pipe. About six 1-40th in. holes are sufficient to supply the cylinders. (4) The advent of the water-tube boiler has rendered the necessity of the spirit vaporising burner a very rare occurrence. In your case it may be required, but we would prefer a small petrol burner in preference to any vaporising spirit arrangement, as both more reliable and cheaper to run. (5) Use small cylinders, a small number of small holes in the collecting pipe, and fit a superheater as already advised, and hope for the best. The superheater must pass through the fire. In addition, attend to the draught (see "The Model Locomotive," page 58 to 62 for full data and drawings). Use an auxiliary blower for steam-raising (see page 244 of above book). Lag the boiler. (6) We do not advise you to scrap the boiler until further experiments have been made. It would pay you to go on building the engine, and then when everything was ready to try the present boiler, and if it fails, to build a new one. You are advised to use a single cylinder, ½-in. or 9-16ths-in. by 1-in. stroke. Do not add link-motion unless you are an expert user of the file and can fit the parts very well. If you do adopt this reversing gear, make everything of steel. With the valves on top, which is the best place in a model, the extra weight of the valve being advantageous if anything, you may like to go in for a single eccentric link gear. The one we recommend is that shown on page 154, Fig. 176, of "The Model Locomotive." We include a design which should make the best model under the circumstances with the boiler you have. The firebox is out of scale in width, therefore we advise you to adopt the No. 4 gauge, 2 13-16ths full, instead of the correct 2½-in. gauge for a ½-in. scale model. All the wheels are stock sizes. The boiler is not long enough for a wide firebox engine of any other type than a front-coupled tank engine (as in THE MODEL ENGINEER Locomotive of 1904—see "The Model Locomotive"), or possibly for the now old-fashioned front-coupled six-wheeled style of engine used for mixed traffic. We have chosen the single-wheeled locomotive as an engine which has the smallest percentage of "internal resistance." The design is something like a modernised Caledonian Railway No. 123.



DESIGN FOR MODEL LOCOMOTIVE WITH SINGLE DRIVING WHEELS..

[17,206] **Gas-bag for Gas Engine.** F. E. writes: What size cooling tank shall I require for a 1 h.-p. gas engine? Also can I use a 12-in. by 7-in. rubber hot water bottle for a gas-bag for the above engine? Is it really necessary to have a gas-bag?

Re cooling tank for gas engine. One tank, 3 ft. 6 ins. or 4 ft. high by 1 ft. or 1 ft. 3 ins. diameter, will suffice. The usual form of rubber water bottles will do for gas-bag if you can make a gas-tight joint at the closed end. A gas-bag is necessary to prevent the lights in the vicinity of the engine jumping as each charge is taken; also to steady the ignition burner flame, as explained in our handbook—"Gas and Oil Engines," by Runciman, 7d. post free.

[17,230] **Wireless Telegraphy.** A. L. M. (Bowdon) writes: I am obliged for enclosed. I have numerous books on the subject but cannot get the particular information I want—*i.e.*, telegraphing through or over a hill as my sketch, and doubt whether the new book you mention will give me the necessary information. Whether it will be effective if the wires are lower than the top of the hill is what I want to know.

Certainly, signals can be sent with aerials which are lower than the intervening ground. It is merely a question of using sufficient power and making the receiving apparatus sensitive enough by careful construction, and, if necessary, tuning. The Lodge-Muirhead wireless apparatus has, among other severe tests to which it has been put, been used for signalling from one side of Snowdon to the other, the distance through from station to station being 19 miles, and the greatest height between being 3,200 ft. The height of each aerial was 42 ft. This remarkable achievement did not require any excessive power, and the apparatus used was reasonably portable.

[17,281] **Cells for Small Lamps, Etc.** C. W. B. (Ireland) writes: Kindly advise me as to the following. (1) Would the ordinary Leclanché batteries be suitable for intermittent electric lighting? If so, for how many minutes would three ordinary Leclanché cells light a 4-volt 2 c.-p. "Osram" lamp, and how long would the battery last with one charge, using it only once a day? (2) Could I by any means charge a 4-volt 5 amp.-hour accumulator from a set of three ordinary bichromate batteries, or from a set of four ordinary Leclanché cells, quart size? And, if so, how long would it take to charge fully from the former and latter respectively?

(1) *Not* very suitable, except for very small currents. Try bichromates for your lamps. (2) Bichromate cells are suitable. Use as large ones as possible. Charging at the rate of 1 amp. it would take about seven hours to charge a 5 amp.-hour accumulator.

[16,960] **Telegraphists.** W. I. (London) writes: I shall be very thankful if you will kindly answer the following questions: (1) Is it possible to learn to read by sound a printed telegraph message coming through an Exchange Telegraph Company's machine, without going through a course of telegraphy? (2) Is the sound, and alphabet, the same as the Morse that is used by the G.P.O.? (3) Could I learn the above by books? If so, where can these be obtained, and at what price are they published? (4) What would you recommend me to do, as I only want to learn a message by sound. I am in a place where printed telegraph messages on an Exchange Telegraph machine are coming through nearly the whole day. If I could learn this, it would be the means of increasing my salary considerably.

(1) You cannot read a printing telegraph by sound as each letter is usually represented by a single current impulse and, therefore, all sound alike. (2) The Morse alphabet consists of signals varying in number and duration with each letter. (3) Where reading by sound is possible, the art can only be acquired by constant practice and cannot possibly be attained through reading books. (4) We do not understand your last question, and if the considerable increase of salary is to be secured by telegraphic eaves-dropping, we advise you to be careful.

[17,074] **Injector Trouble.** H. W. (Moseley Village) writes: I have a centre flue vertical boiler, 24 by 12 ins., fitted with injector, which does not work satisfactory. It will not draw the water from the tank unless I lift the tank so that the water is close to the injector, when it will draw the water for about one minute and then it will cease. It will not force any water in the boiler. I have tried it with steam from 5 to 40 lbs., and it will not work. I should be much obliged if you can suggest any way to make it work satisfactory. It is a "Vic" injector. I do not know the name or address of maker or I would write to them. If you know the address, kindly let me know.

It is not easy to say without actual investigation what is the cause of your trouble. Failure to lift may be due to a leak in the suction pipe, or the overflow passage is constricted in some way, thus preventing the steam from freely discharging and producing a vacuum in the suction pipe. With regard to the inability to lift this is most probably due to the check valve sticking, or, perhaps, not lifting sufficiently. See that all pipes are clear, and the injector itself is quite clean, and make quite sure that you have coupled it up correctly.

[17,220] **Small Accumulator Difficulties.** J. H. (Glasgow) writes: Would you kindly answer the following. After reading your series No. I, The Model Engineer (1) I am under the impression that all cells are only 2 volts, unless made up of extra compartments. Is this so? (2) I have a transformer celluloid accumulator, 8½ by 6 by 3½ ins. over-all, with a partition in the centre. I presume this will be 4 volts? (3) How long should it take to charge the above accumulator? There are seven plates in each side (fourteen plates altogether); the plates are about 4 ins. by 4 ins. The paper on the side of the cell is scratched off, so cannot make that out. What will the voltage be and ampere hours? (4) Will it spoil the accumulator to charge it an hour at a time? I am only home that length of time. (5) Which is the best way to tell when fully charged? Should I take out the two plugs when charging? Should I see that specific gravity of mixture in cell before charging is 1·184? Where can I get an instrument for testing, and how much do they cost? What do you call them? I was under the impression my accumulator was 8 volts 60 amp.-hours, and was trying to charge same from my small dynamo (drum armature, shunt-wound), 8 volts 5 amps., supposed to light six 10-volt lamps. I ran the dynamo up till I had one 10-volt lamp with fair light, then switched in accumulator. Will I have done the accumulator any harm? The cell has turned a dark-brown on the top only. The negative side—(–) is this the negative, I am not sure? I have tried a 6-volt lamp on accumulator and it gives a fair light. How do you find negative and positive on dynamo? I tried the wires in water when running and there were no bubbles from either wire. After reading the series No. 1, "Small Accumulators," I find I should have run the dynamo up slightly over 8 volts and put 4-volt lamps between dynamo and accumulator for resistance. Is this so? What voltage should those small electrical motor trains take to run them on the lines? My accumulator ran them beautifully when charged by the Corporation, but I cannot make my dynamo run them. I have two electrical carriages and about 30 ft. of rails.

(1) Yes, secondary cells. (2) Yes. (3) Reckon 15 amp.-hours per sq. ft. of positive plate surface. Get a voltmeter to test the voltage. (4) No. (5) By the voltage and the specific gravity. The latter varies from 1·06 or 1·07 at 1·9 volts to 1·8 specific gravity at about 2·6 volts (per cell). Use a hydrometer with narrow bulb specially made for use with accumulators and to be had from any of our electrical advertisers. Your best plan is to read our handbook on "Small Accumulators" carefully. The negative (–) wire will give off small bubbles if held fairly close to the positive in slightly acid solution. The charging current should be about 25 per cent. higher voltage than the cells to be charged. When charging are you certain you connect the positive of cell to the positive of dynamo? We cannot understand why motor should run from a 4-volt accumulator supply and not from the 8-volt supply from dynamo. You should obtain an ammeter and voltmeter and take readings of what the accumulator and the dynamo are really giving. See also recent query replies on similar subjects.

[17,253] **Boiler Queries.** B. W. H. (Bournemouth) writes: I have a small engine and 30-watt dynamo. I should be greatly obliged if you would suggest a suitable boiler for same. The engine is 2-in. stroke, 1½-in. bore, flywheel 7 ins. I have a 12-in. by 24-in. single flue boiler, but cannot keep enough steam with a gas-ring.

In reply to your query we think a standard 11½-in. by 24-in. vertical multitubular boiler, with twelve tubes, 1 in. diameter, fired by coal or coke, would do very well. You will, however, have to obtain a draught by employing the exhaust steam as in a locomotive. The other alternative would be a 10-in. by 20-in. vertical boiler without firebox (for firing with gas-ring), the boiler being provided with twenty to twenty-five tubes, ¾ in. outside diameter. The only way to improve the steaming of your present generator would be to fit some water tubes or "field tubes" in the firebox and to have a good superheater. In addition, to get a better evaporation, the consumption of fuel may be increased by providing a good blast.

[17,213] **Small Dynamo Failure.** W. J. S. (Clapton) writes: I shall be very much obliged if you will kindly answer enclosed questions for me. (1) I have a dynamo I made up, 8-cog drum armature, wound in four sections, 5 ozs. No. 20 D.C.C., fields wound 1½ lbs. No. 22 D.C.C. (overtype). In winding armature I wound one layer of each coil at a time. Will this affect machine, and should I have wound each coil right off *separate* (this makes a big bump at ends of armature)? Although machine works as motor with about 3 volts, I cannot get any power off as dynamo, although I have tried all remedies as in your handbook, and have run machine at every possible speed, changed leads, etc. Can you give me a solution to this seeming mystery? (2) When working at, say, 3,000 r.p.m., what power should this machine give? (1) I wish to construct a ½-in. spark coil to work with a 6-volt accumulator (plates 3½ ins. by 1½ ins., two in each cell). (2) What length coil shall I require? (3) Diameter of iron core? (4) Gauge of iron wire? (5) Gauge for primary? (6) Gauge for secondary? (7) Amount of each? (8) Size, and the number of sheets, in condenser? (9) Can I wind this in one section (for secondary), or shall I get much better results with, say, about twelve sections? (10) How long will above accumulator work this coil? (11) Could you state total cost of above materials, as this is a consideration?

(1) No, but will be awkward if repairs are needed in the future. (2) It is a matter for actual trial. It is often the case with small machines. (3) As a motor it will give the equivalent in horse-power to the watts put into it, minus inevitable losses, which will amount to fully 40 per cent. *Re* coil: Full details will be found in handbook—"Induction Coils for Amateurs," 7d. post free; 5s. or 6s. would cover the cost of construction.

[17,299] **200-watt Lighting Set.** H. G. (London) writes: Can you inform me which is the best make of dynamo for a small electric light plant, the dynamo to be shunt-wound and to light six 8 c.-p. lamps? Also some idea of price and what horse-power gas engine it would take to drive same? I should like to make the gas engine from castings myself. Can you tell me a good maker of same? I should not require all lamps to be alight at the same time, and I believe this would necessitate a resistance; if so, can you tell me what kind I should want?

A 200-watt dynamo, 40 volts 5 amps., ½ b.h.-p. would be required to drive it at full load. Price finished, about £4 10s. Henry Butler would supply you with castings of the *M.E.* gas engine given as the supplement to January 4th issue, 1906. No resistance is necessary if you use 40-volt lamps with a 40-volt supply.

[17,265] **Wireless Telegraphy.** A. H. M. (Ramsgate) writes: Will you kindly assist me briefly in the following points on wireless telegraphy. I have the following books on the subject: "Wireless Telegraphy," by Kerr, 1901 (1s.); by Story, 1901 (1s.); by Ernst, 1901 (1s.); by de Tunzelman, 1902 (1s. 6d.); by Sewall, 1904 (10s. 6d.). (1) Please name any other work giving more up-to-date information on subject, details, apparatus, etc. (2) Is "Wireless Telegraphy," by Mazzatti, translated by S. Bottone, any use? (3) Is the commercial form and details of apparatus now used in Marconi stations known to the public? (4) Please name any firms who make speciality of wireless telegraphy apparatus. Your personal advice on this point will be much appreciated. I have a good regular transmitter and Morse inker,

1,000 ohms relay, and all other details on receiver, but, unfortunately, have not been successful with coherer and tapper, the commercial form of which does not seem to be generally known.

(1) Very shortly we shall publish a book on the subject by Mr. R. P. Howgrave-Graham, and we think that this should exactly meet your requirements. (2) We do not know the book named, and we are not aware of any publication except our own and Mr. Bottone's which usefully attempts to give information which will aid the amateur in the construction of apparatus. (3) Much of the apparatus used by the Marconi Company has been described in various books and papers, including Dr. Fleming's Cantor Lectures, and the various technical journals. Much information may also be gleaned from patent specifications. (4) Mr. Miller, of Hatton Garden, E.C., has considerable experience of wireless telegraphy apparatus which we believe he supplies. Complete commercial outfits can be obtained from the Lodge-Muirhead Company or the Marconi Company, but are, of course, very expensive. For details of apparatus, we would ask you to wait for the above-mentioned book, which is full of information, and has received very great care and attention in its preparation.

[17,341] **Pantelephone.** H. N. G. (London) writes: Requiring a very powerful transmitter, I made one up—a pantelephone—according to the instructions given in your handbook, only to find that it will not transmit the voice or even the loud ticking of a clock, but only the vibrations caused by the shaking of the instrument, and although I have tried different adjustments, I can get nothing more out of it. Can you suggest anything that I could do to make it work respectably? Perhaps if I state for what purpose it is used you may be able to tell better. It is for a very deaf gentleman at the church I attend. I have used an electrophone, and although he can hear when the mouthpiece is spoken directly into, when speaking a foot or more away he can hear nothing, thus pointing out that a more delicate transmitter is required or one giving more surface for vibrations to strike, etc., so in reading your Telephone handbook and seeing this instrument described, thought it would do, but find it will not. I certainly made the diaphragm larger than that described, but that should not affect its working.

We cannot give a definite reply to your enquiries as we have not had experience with this instrument in a similar situation, but we have obtained very good results from it in transmitting conversations carried on by people at the far end of a fair-sized room. It might be advisable to try a larger pine board, say, 8 ins. or 9 ins. square. Yellow pine is most suitable. You say nothing about the distance apart of speaker, receiver, and transmitter; and a good deal depends on this. The battery power might be varied to get best results by trial, which is, in fact, the only satisfactory way in such a case as this. The pineboard we used (referred to above) was cut from an 11-in. board, and was practically 11 ins. long.

[17,312] **170-watt Direct-coupled Steam Generator.** H. W. (Liverpool) writes: I have just finished a 2-in. by 2-in. vertical engine (Stuart Turner castings) and I propose running same at 600 r.p.m. at 75 lbs. steam. I wish to couple direct to a dynamo for small lighting and charging plant. Will you kindly assist me by answering the following, viz.: (1) How many watts is the engine powerful enough for? (2) I require about 15 volts, but if I increase steam pressure and the revolutions of the engine, would it damage the dynamo windings? Is it possible to arrange the windings to stand either 600 or 900 r.p.m.? (3) Would a 5-in. by 3-in. gramme ring, with Manchester type magnets (as per Fig. 13 in your book on "Small Dynamos") be suitable? If so, please give me weight and size of wire for coils and ring, making volts 15, and amps. as much as possible.

If you are going to run dynamo direct, we recommend you to adopt balanced cranks, as the only drawback to this method of driving is that the dynamo requires a higher speed than the single cylinder engine can comfortably manage. (1) At 50 lbs. boiler pressure, the engine running at 1,500 revolutions (600 is absolutely useless for a direct-coupled dynamo) will give a brake horse-power of about ¼ h.-p. This means about 150 to 175 watts, allowing for the inefficiency of the dynamo, or, say, 15 volts 10 amps. (2) As before mentioned, you will not get the engine to run readily at the speed the dynamo requires let alone run too fast. We would rather you adopted a belt drive and ran the engine at about 800 r.p.m. You must not expect too great a duty from the engine continuously. It will not stand anything over ¼ h.-p. (for which maximum power it is designed) for any length of time. (3) A multipolar machine is most suitable for a direct-coupled job. Avery, of Tunbridge Wells, would supply you with a suitable set of castings, etc., and wire for winding armature and fields for 15 volts 10 or 12 amps.

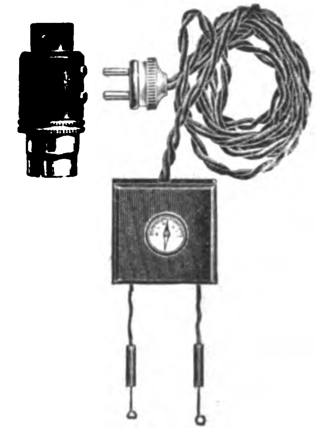
Further Replies from Readers.

[10,275] **Sealing Up Accumulators.** Try filling cell within, say, ¼ in. of top with water, or the usual accumulator strength of sulphuric acid, taking care that top of cell and lugs are quite dry. Then pour on melted paraffin wax or the usual wax compo. If the wax cools too rapidly and does not adhere to sides, hold a red-hot poker near it, or play on wax gently with a small blowpipe flame, and I think you will make a good job of it. It would be as well to attach small strips of wood or ebonite near top of cell to form a "key" for wax. Do not forget the glass tubes for filling and emptying.—DOUGLAS NEWTON.

[12,029] **Pasting Accumulator Plates.** It would seem as though the paste is made too wet. Only sufficient dilute sulphuric acid should be added to make the material bind. If paste still sticks, give glass a thin coating of paraffin wax, by warming glass and rubbing wax on. I think this would cure the trouble, as the wax would repel the moisture in paste.—DOUGLAS NEWTON.

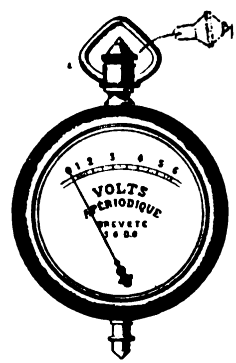
New Catalogues and Lists.

The Universal Electric Supply Co., 60, Brook Street, C.-on-M., Manchester. The supplement of their latest lines, which this firm have just issued, contains items of interest to motor cyclists and others. We illustrate from this list the "Indispenso" Charging Adaptor (and Polarity Indicator) for charging



THE "INDISPENSO" CHARGING SET.

accumulators from any direct current electric light main. Particulars are given of the "Hydranamo" set, comprising a water motor, direct coupled to dynamo for charging motor car or cycle accumulators. A special feature of the new pattern pocket voltmeter, also illustrated herewith, is the top contact, which can be drawn out for use and automatically springs back into its ordinary



A NEW PATTERN POCKET VOLTMETER.

position. This is supplied in a leather purse. The supplement, together with a complete list, will be sent to readers of this Journal post free upon application.

L. Muggleton, 1, Gordon Road, Stratford, E. We have received an illustrated price list, comprising electric novelties, such as flash lamps, scarf pins, shocking coils, batteries, small electro-motors, dynamos, bells, telephones, and accessories; also steam engine and boiler fittings. The list will be sent post free for two penny stamps upon application.

The Editor's Page.

IN regard to the subject of electrically-operated tramway points, "J. H." (Galashiels) draws our attention to the fact that such points are also in use in Leith, the system having been installed about eighteen months ago. He says that he would not have troubled to write, but that he felt it his duty to let us know that "we Scotties are not behind." We are glad to hear from "J. H." in defence of "bonnie Scotland," and we have no doubt that similar information may be forthcoming from other quarters. To set the minds of all our readers at rest, however, we quote the following from a further letter from Mr. R. J. England, the writer of the original article :—

DEAR SIR,—In the issue of THE MODEL ENGINEER for February 7th, is reproduced a comment on my article entitled "Electrically Controlled Tramway Points." With your kind permission, I would like to point out to the editor of the *Birkenhead News* that the Tierney Malone point shifter was first installed here in May, 1903, or just two years before the ones so triumphantly referred to. The apparatus, as originally brought out however, necessitated a specially constructed trolley head on the cars to operate the point, and so the improved form of the Tierney Malone patent was substituted in November, 1905. It was this improved form which I endeavoured to describe, having witnessed its successful operation during the past year. My intention was not to make out that the electric point shifter was an invention of the last few days, but to describe a new form which had shown itself to be an improvement under working conditions.—Yours truly,

Dublin. R. J. ENGLAND.

* * *

Mr. Henry Lea informs us that since making the slender steel rod which was exhibited at the last Conversazione of the Society of Model Engineers, he has succeeded in producing rather a curiosity in delicate turning in the form of a Bessemer steel spindle, 26 ins. long and only ·062 in. (half a thousandth less than 1-16th in.) in diameter. We doubt whether such a slender piece of turning has ever been before made in a 5½-in. lathe.

Answers to Correspondents.

[17,343] RE BELLOWS.—A 2-in. inlet valve (B) in your sketch, and a 1¼-in. valve to air-reservoir should suffice.

H. B. (Wolstanton).—We will do this as soon as time and space permit.

T. H. N. (Tottenham).—You will see in the report of the S.M.E. meeting, in February 14th issue, the decision regarding the open-air track.

J. W. R. (Montreal).—We do not recommend a radius of less than 17 ft. 6 ins. for THE MODEL ENGINEER 3½-in. gauge electric locomotive, but probably 15 ft. radius, with ½-in. super-elevation, would be quite safe.

J. C. M.—Yes. Current supplied through lamps, as you say.

W. A. W. (Stedham).—Yes. Can adopt this arrangement, and use an 8-cog drum armature. See articles on the subject commencing in January, 1905. The whole matter is fully dealt with there. We should advise one motor for car your size. This, with plenty of battery power both for fields and armature, will develop enough power. Use No. 26 on the fields, if shunt-wound.

F. D. (Ticehurst).—Introduce a small quantity of petrol into the oil vaporiser by means of an auxiliary cock for starting. Arrange it so that a gravity feed is obtained. In cold weather it is sometimes necessary to warm the vaporiser up a little first.

W. H. W. (Preston).—See the rules laid down in Chapter VIII of our sixpenny handbook, No. 13, "Model Steamer Machinery," price 7d. post free from this office.

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

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

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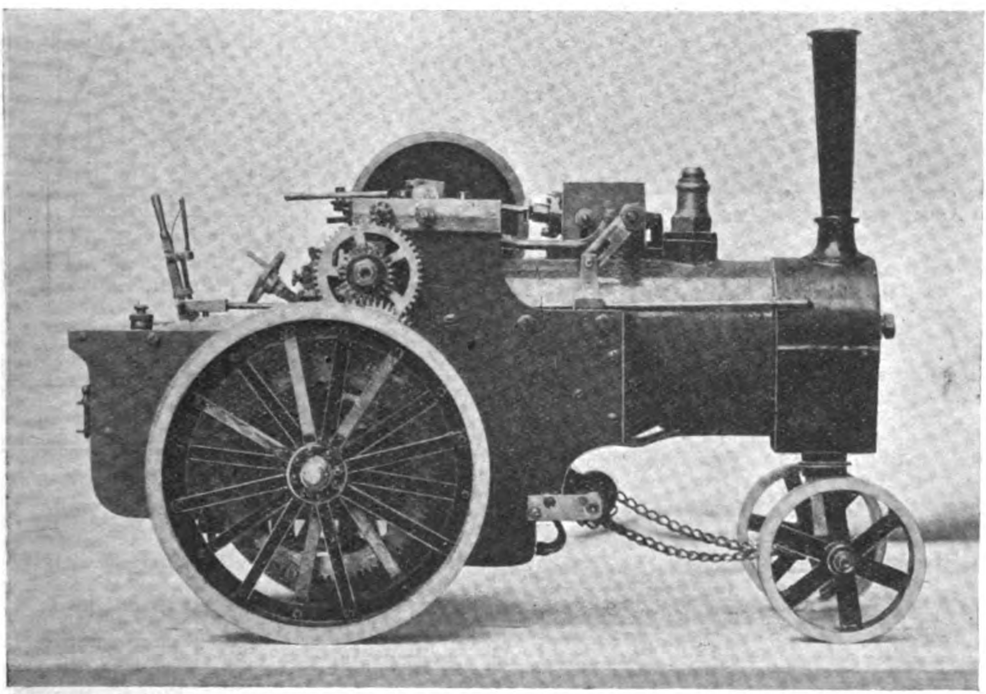
An Amateur's First Steam Model.

By L. L. FOOTE.



MR. L. L. FOOTE'S MODEL TRACTION ENGINE.

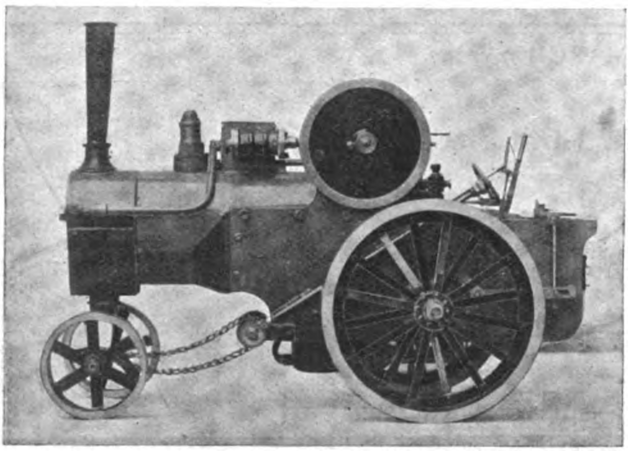
THE accompanying photographs show a small traction engine I have recently finished. I do not pretend it is a scale copy of an existing engine; it was made principally for the amusement of a small son, who had the usual hankering for an engine which would "work."

The boiler was made from a piece of solid-drawn brass tube, 2¼ ins. diameter, with flanged ends, screw-riveted and sweated in, and a 3-16ths-in. stay from end to end. There are three water-tubes below boiler. It is fired with methylated spirit, supplied to burner from a tank in tender, and it steams well.

The cylinder is a D.A. oscillating, ⅜-in. bore, and ⅞-in. stroke, and the engine is geared to road-driving wheels (90 to 1). The gear wheels were taken from old clocks.

It is fitted with a reversing cock in the steam block, actuated by the lever shown in tender. The flywheel is disc type; the rim is a square-section brass ring I had by me. The road wheels are built up, and the rims were made from rings sawn from steel tube. Diameter of large wheels, 5 ins.; diameter of leading wheels, 2½ ins.

A water gauge is fitted on boiler end; but I found it did not register the water level correctly, as I had made the mistake of using a glass only 3-16ths-in. diameter.



Another View of Model Traction Engine.

Length over all, 13 ins.; and weight, when empty, 9 lbs. It travels at a fair rate; it was purposely geared low, so as not to run away from the driver.

I am making a small pump, to be gear-driven from crankshaft, so I hope the engine will be able to stand and pump full when the travelling gear has been thrown out.

This is the first steam model I have made, and I am indebted to The Model Engineer for what I have been able to do in this respect.

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 Strong Vice Bench.

By H. S. Cowper.

I have made a vice table as described in the following, and find it to be very satisfactory. Most amateurs either have an old disused mangle, or know of a scrap-iron dealer's where one may be had very cheaply. After having procured one, take it completely to pieces. All that is required is to cut off the two uprights (Fig. 1) which held the rollers, and to cut out the four small wheels on which it runs. Now put the framework together again, and fasten all bolts securely. At the top of the framework will be found two horizontal grooves, into which the washing boards used to slide and which are generally about 1½ ins. wide. If they *are* 1½ ins., then procure some 1½-in. boards and cut them so as to be a tight fit in these grooves, and put two battens on the bottom to bind them together. These will form the table top. A casing should now be fitted, to cover the frame top where the roller

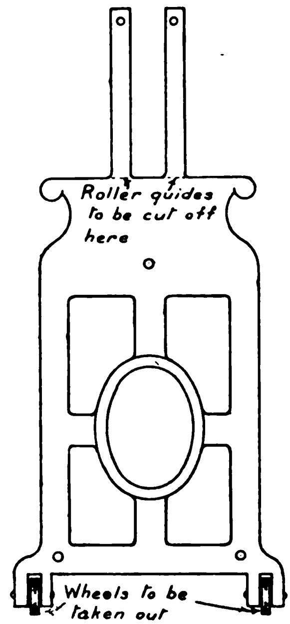


Fig. 1.

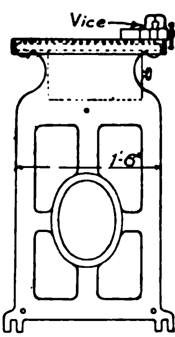


Fig. 2.—Side View.

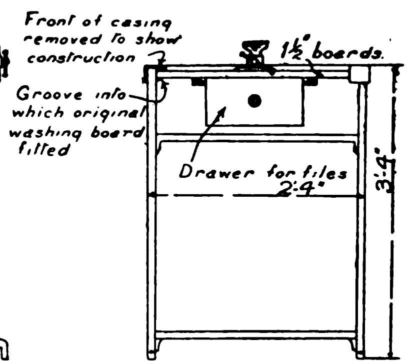


Fig. 3.—Front View.

A Strong Vice Bench constructed from a Disused Mangle Frame.

guides were cut off, and continued across the back of the table, so as to keep anything from falling off. If a drawer is fitted underneath the table, it is now complete, and you have a vice bench which is *very rigid*, and which has cost practically nothing. If the workroom floor is cement, or anything inclined to be slippery, wooden shoes should be fitted on to the feet, to keep the bench from sliding about when heavy work is being done.

A Combined Lead and Leather-faced Hammer.

By John Heyes.

To make this useful appliance procure a 5-in. piece of thin iron piping, 1¼ ins. diameter (E, Fig. 1).

Fig. 2.

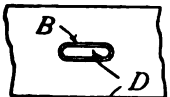


Fig. 3.

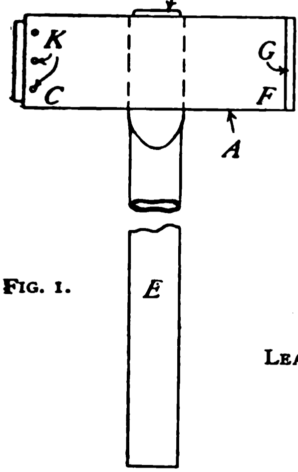


Fig. 1. A Lead and Leather-faced Hammer.

Drill and file out a slot to take the shaft; this slot B (Fig. 2) to be 1½ ins. by ½ in., ends rounded as shown.

Next obtain a piece of 1-in. (outside diameter) iron pipe, 12 ins. long; flatten one end for 1½ ins. to ½ in. thick; the length of shaft should also be slightly flattened to afford a better grip. Fit the flattened end of shaft into slotted pipe, then push end C (Fig. 1) of slotted pipe into some sand for ½ in., and having clipped the end F with some blackened tin to form the lead face G, pour in some melted lead. Drive a steel wedge having very little taper in head end of shaft, as at D.

To form the leather face, roll a length of leather, ¾ in. broad, as shown in Fig. 3, pinned at frequent intervals (H, Fig. 3). Roll sufficiently to fit tightly in end C of head; then drive in, a tight fit, and pin as shown at K (Fig. 1). Trim up with the file.

A Simple Chuck.

By A. T. Smith.

The following is a description of a small chuck, an advantage of which being that it costs next to nothing.

As the photograph shows, the chuck is composed of an ordinary hexagon nut and the end of a bolt and a small set-screw. A nut is chosen a good fit on the lathe nose—in this case it was ⅞-in. standard Whitworth. The end of a ⅞-in. bolt was sawn off and filed, so as to leave only ⅜ in. of it screwed and ¾ in. plain. This bolt-end was screwed home into the nut, until the end of the thread jammed it tight (see sketch). The bolt was then drilled with a ¼-in. hole 1 in. deep. The hole must be central, and to ensure this the nut should be screwed on the lathe nose and the drill held in the back headstock. Not being able to hold a drill in my back

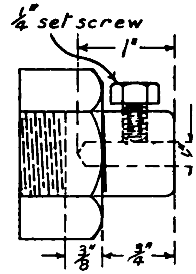


Fig. 2.

headstock, I got a friend to drill it for me. As his lathe was larger, he could not screw the nut on the lathe nose. Instead, he chucked a ⅞-in. bolt truly, and then screwed the nut on that and proceeded as above.

A ¼-in. set-screw screwed in the protruding end of the bolt at right angles to the ¼-in. hole will effectually secure any drill or other material placed in the chuck. The set-screw should be filed down slightly at the end to prevent it from being so burred up as to be unremovable.

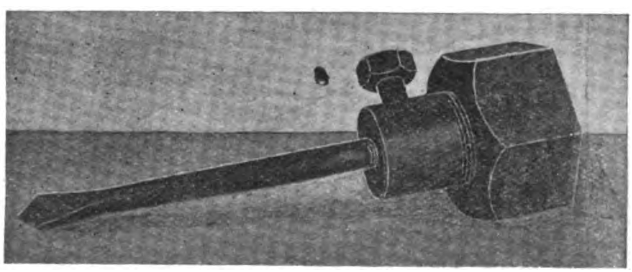


Fig. 1.—A Simple Chuck for the Lathe.

Drills for this chuck can be made at home out of ¼-in. steel. They need only very rough forging, as they can be ground carefully afterwards. They can be made any size up to ⅜ in. easily.

Filling Holes in Cast Iron.

The following alloy for filling holes in cast-iron is given by *English Mechanic*: Melt together 9 parts of lead, 2 parts of antimony, and 1 part of bismuth, and pour this mixture into the hole, first somewhat warming the hole. This alloy possesses the quality of expanding when cooling, hence becomes solid in the holes when cold.

A Model Engineers' Tramp Abroad.

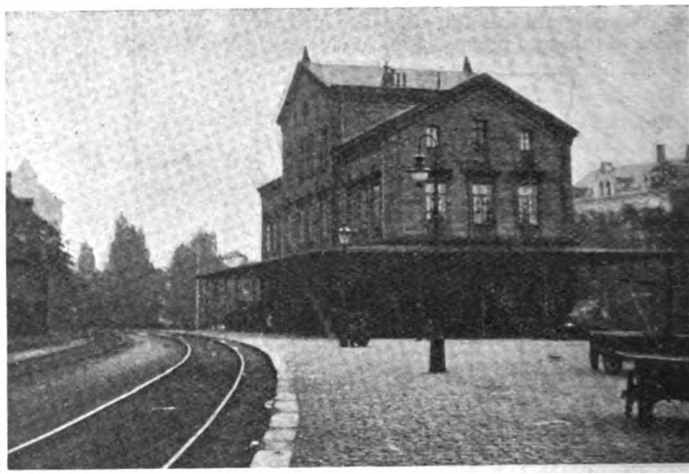
(*Continued from page* 197.)

THE Railway Museum at Nuremberg, which we referred to last week, contains, in addition to the models of locomotives and rolling-stock, examples of broken axles, rails, tyres, etc., with their respective histories, and also the remains of several exploded locomotive boilers which have from time to time failed. To show the bad effects of scale, an actual boiler, which was fitted to a passenger train locomotive, built in 1852, and which ran until 1879, is exhibited, cut in half longitudinally, exposing all the tubes and water spaces of the firebox.

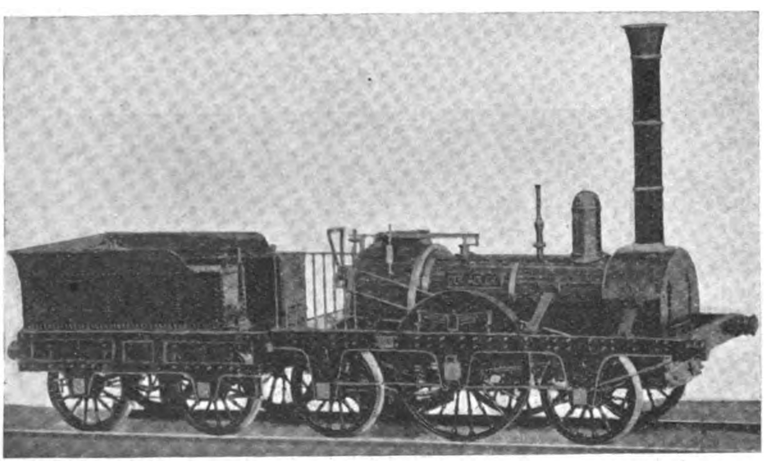
For those desirous of more particularised information, the Museum contains full working drawings of the railway machinery and appliances used by the Bavarian State Administration. If you want to consult the drawings of, say, a certain type of railway truck or passenger carriage, you simply indicate to the obliging attendant which of the many portfolios lying on the table in the Museum you require and he unlocks them. You then proceed to take your notes.

In our last article we just mentioned that the Museum contained a model of the first locomotive used in Bavaria (also the first in Germany). This engine, the records say, was purchased from Messrs. Stephenson & Ericsson* in 1835. As will be seen by the picture herewith, the locomotive is of Stephenson's standard "Patentee" class, as introduced on the Liverpool and Manchester Railway in January, 1834.† The engine was brought over by boat to Cologne—in pieces—and from Cologne to Nuremberg by road. It was re-erected in Spāths workshops at Dutzendteich, and was put into service in December, 1835. The total cost of purchase was 28,880 marks, or £1,444, a fairly heavy sum for such a small engine. The engine had driving wheel, without flanges, as was common in those days, measuring 1·35 metres (4·428 feet) diameter The steam pressure amounted to 3·5 kg. per sq. cm. The valve gear was of the loose eccentric type, with hand gear attachment, the eccentrics being freed during the operation of reversing by a foot lever. To start the engine in the opposite direction, the engine driver used the hand levers to move the valves, until the engine was under weigh, when the driver put the eccentrics into engagement with the backward or forward stud on the crank axle, according to the direction of motion then being pursued.

After a look at the railway carriage used by Prince Bismarck during the Franco-Prussian War, which, we may mention, is one of the "star" exhibits of the Museum, we journeyed across



THE FIRST RAILWAY IN GERMANY: A VIEW OF THE NUREMBERG STATION OF THE NUREMBERG-FUERTH RAILWAY.



A MODEL OF THE FIRST LOCOMOTIVE IN GERMANY: THE "ADLER" ("EAGLE"), NUREMBERG-FUERTH RAILWAY, 1835.

* The writers are not aware of any partnership between Stephenson and his clever contemporary Ericsson. Possibly the latter obtained the order and placed the work in the hands of Messrs. Stephenson & Co. Ericsson was the builder (with Braithwaite) of the "Novelty," tried at Rainhill, L. & M. Rly., in 1829.

† See Stretton's "Development of the Locomotive." (Crosby, Lockwood & Co.)

to the other side of the town to view the railway upon which this first locomotive ran. Contrary to the usual rule, the pioneer railway in Germany, connecting the two towns of Nuremberg and Fuerth, remains, except for improvements in locomotive and carriage—which are not vast—in the same condition as it was seventy years ago. It has not been absorbed, like our Stockton and Darlington and Liverpool and Manchester railways, by the newer and larger systems, but still serves to connect the two towns parallel with the main line of railway and an electric tramway. The principal features of this railway were no doubt taken from the earlier examples in this country, as students of railway history will recognise from the photograph of Nuremberg station, which is reproduced herewith.

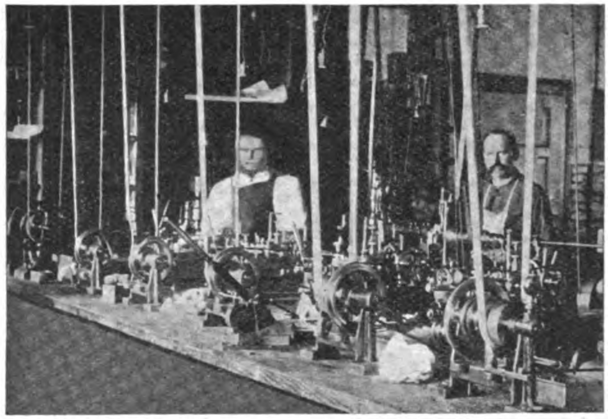
The next item of interest was a visit to one of the large toy factories with which both the towns of Nuremberg and Fuerth abound. A greater

THE PRINCIPAL AND HIS EXPERIMENTAL FOREMAN.

proportion of the work in making toys of the cheaper variety is perhaps done by home labour. The making up of toy pianos, wooden animals, and small metal toys in many cases occupies the time of a whole family, each member having his allotted portion, the raw material in the shape of the fret-cut, shaped, and turned parts, printed embellishments, and other portions, which are better made in quantity by repetition tools, being obtained from the factory, to which the toys are returned by the home-workers when completed.

All the better-class toys—steam engines and phonographs—however, are made entirely in well lighted, well ordered, and cleanly factories. Although Nuremberg turns out millions of toys per annum—we say millions, because of even a single "shilling line" of toy trains a manufacturer told us he put "in work" three or four thousand dozen in one season—there is no smoke and dirt hanging like a pall over the town.

In going through a toy factory one is struck by the care and forethought given to the production of any new kind of toy. The motor omnibus appears on the London streets—very soon afterwards in our toyshops we see splendid models of,



CLOCKWORK PINION MAKING BY AUTOMATIC MACHINERY.

say, a "Vanguard" or a "General" omnibus, correctly coloured, and replete with accurate representations of the advertisements used on these vehicles.

We were privileged during our inspection of the factory at Nuremberg to see how this is done, and were shown every stage in the production of the model—from the drawing office to the packing-room.

The serious item in the bringing out of a new toy is, of course, the press tools, the cost of which often runs into three figures. The first sample is painted and used as a means of getting orders for the model and as a help in the painting and building up of the finished model. All the best models are enamelled by hand, and very expert are the painters and liners employed on this work in plying the pencil and the brush. The models are, of course, dealt with in batches; the parts are pressed out in tinplate,

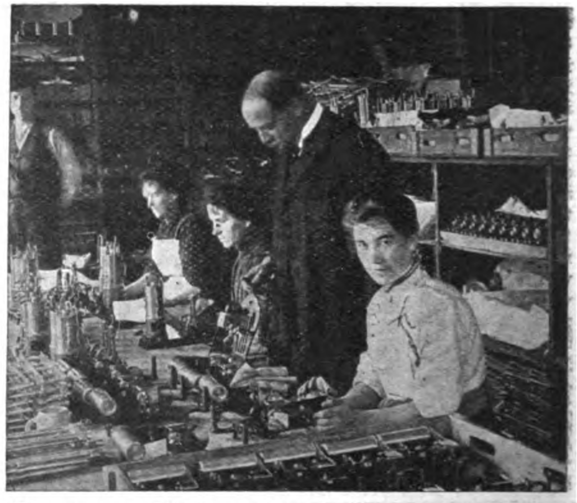
THE DRAUGHTSMAN TESTING A NEW MOTOR FOR CURRENT CONSUMPTION AT THE SPECIAL SWITCHBOARD PROVIDED FOR THIS WORK.

which, by the way, all comes from England (or Wales, rather), and then soldered, or with a sort of hook-and-eye attachment securely jointed together, by girls and boys, the men doing the more difficult portions of the work.

All steam models are tested by steam before painting and by compressed air after painting, and all the enamelled parts are properly stoved.

The accompanying series of photographs show some of the many processes in operation at the factory we visited. A photograph is given of one of the principals of the firm, who was at the time in conference with his experimental foreman, and showing an English visitor some of the new models then passing through the workshops where the first models are made up. We were then shown a batch of shapers in the toolroom. These machines are, as may be imagined, extensively used owing to the large number of flat surfaces to be shaped in making the stamping dies and other press tools. We next saw the stamps in operation. For the most part these are tended by women, as we show in our photograph. Some of the tools are self-feeding, as in the case of those for pressing discs of tin for wheels, a revolving plate being used, so that the operator has only to lay the little discs of tin in the sinkings provided in this revolving plate as they pass by. For clockwork models, the automatic pinion-making machines were among the most interesting we saw in the departments devoted to this kind of mechanism. One girl attends to no less than six machines, a skilled mechanic being in charge of the shop and doing all the necessary work in setting up the tools, which the girl attendant could not do.

Many of the parts of the cheaper models are constructed of cast lead. The moulds for these castings are most beautifully made in gun-metal, and are held in the hand whilst the metal is poured in from a ladle. Groups of women perform this operation. They sit round a cauldron of molten metal, and monotonously turn out miniature wheels, brackets, frames, safety valve weights, and other small but necessary items for mechanical toys and small model steam engines.



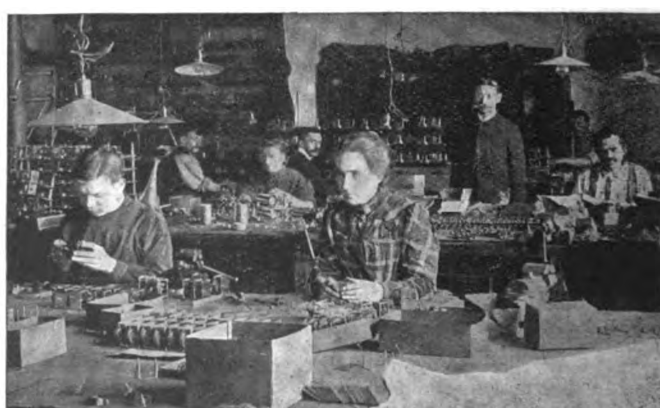
Building up Parts of Model Steam Engines and Phonographs.

Casting Lead Parts for Toy Models.

As mentioned already, the parts are erected by women, boys, and girls, who sit at long benches, each with a tray containing a batch of work before them. Here we see model steam engines being put together piece by piece, the building up of cheap phonographs by the thousand, and clockwork mechanisms in various stages of completeness.

When finished, the steam engines are tested by steam from a little separate boiler, the operator making any adjustments in the valve setting to get each engine to run its best. So skilled is he that this operation is the work of a few minutes only, and then on comes the next model.

Except where the parts are separately painted—as, for instance, in the case of phonograph frames,

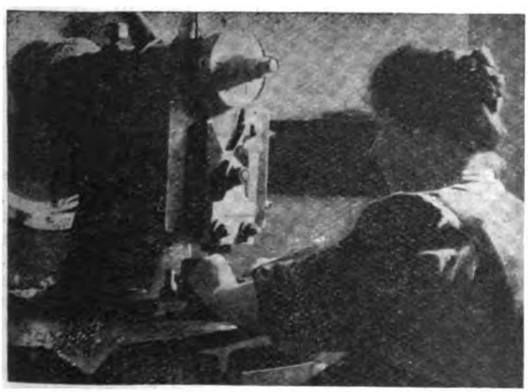


Making up the Clockwork Parts for Various Kinds of Mechanical Toys.

which are hung on a nail and painted by an air-spray brush—after erection the models are painted and stoved, and to ensure that during the latter process no paint or solder has blocked up any of the steam ports or passages, another operator makes a final test by means of compressed air at a high pressure. Whilst he is doing this, he blows on the cylinders of the engine with a jet of flame from a gas blowpipe, and in this way nullifies the severe cooling effect of the expanding air, which would freeze the oil on the cylinder and otherwise lead to false results being obtained.

A Batch of Shapers in a Toy Factory Tool Room.

Although we are not including any pictures of the rooms devoted to the boxing and despatch of goods, we may say that much care is given to this department. By the neat and efficient packing of goods not only a deal of damage is saved, but the customer is doubly pleased—however



A Stamping Press at Work.

much the lady of the house may rail at the shavings and similar litter which may smother the dining-room—when at Christmas time he safely receives

The Painters and Liners at Work.

his model or toy nicely ensconced in proper packing material.

We might have said more about the toy industry of Nuremberg and the district, but the magnitude of the business, its many phases, and the lack of

Testing Model Steam Engines by Steam from a separate Boiler.

available space forbids. Nuremberg, which at one and the same time represents mediæval splendour and modern commercial activity, was the last place in Germany we had planned to visit. We returned northwards with only one other object in view, and that, a visit to The Hague to note the progress our amateur compeers in Holland are making in the art of model-making; and to more particularly deal with the work of the Dutch Society and its vice-president, Mr. J. A. van Hoogenhouck Tulleken.

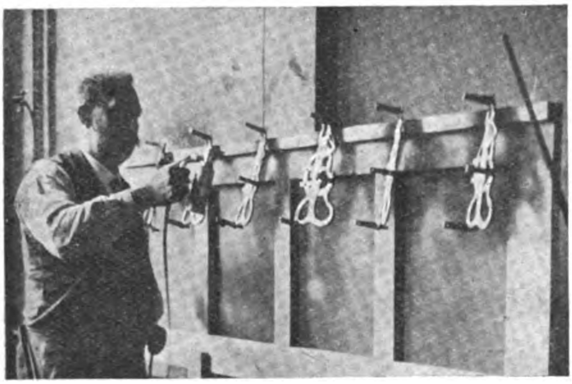
(To be concluded.)

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.*]

Electrical Ignition for Motor Vehicles. By W. Hibbert. London: Whittaker & Co. Price 1s. 6d. net; postage 2d.

This little book will be very helpful to motor men preparing for the City and Guilds Institute examinations who have no knowledge of the principles upon which the successful working of the apparatus under their charge depends. Actual questions that have been set in the past are dealt with. The chapters include information on Batteries, Coils, Commutator, Multi-cylinder Engine Wiring, Magneto Methods of Ignition and Faults. The diagrams and illustrations are very clear and to the point, but many of the reference letters could with advantage have been a little larger.



Painting Cheap Phonograph Frames in batches by means of an Air Spray "Pistol" Brush.

Testing a Model Steam Locomotive by Compressed Air.

The Poulsen System of Generating Electric Waves for Radio-telegraphy.

By R. P. H.-G.

READERS interested in this new system of wireless telegraphy will no doubt welcome the following particulars of Mr. Poulsen's recent lecture in London on this epoch-making invention and its possibilities. Hitherto the only known methods of producing alternating currents of very high frequency have been by means of rotatory or reciprocatory dynamos or by the sudden discharge of condensers through inductive circuits. The first-named method gives an unbroken series of undamped oscillations which differ from ordinary alternating currents only in the excessive frequency of their vibration. By means of specially designed high-speed alternators, with a large number of very small poles, Mr. Tesla has succeeded in producing currents at 25,000 cycles per second, and has shown the greatly increased importance which induction and capacity assume at very high frequencies.

When a conducting body is raised to a high potential so that lines of electric strain are formed in the insulating medium between it and another conducting body, the "electrical displacement" causes a storage of energy; if a conducting path be provided between the two bodies, this energy returns itself in the form of a rush of electricity which eventually equalises the potential of the system.

If the conducting path be such that a current flowing through it produces a magnetic field, an if the discharge takes place suddenly across a spark-gap which interrupts the circuit, the rush is oscillatory, provided that the resistance of the circuit is not too high.

The frequency of the vibratory currents thus produced depends upon the capacity and self-induction in the circuit, and in practice varies from about 100,000 to about 30,000,000,000 of complete oscillations per second.

These figures, however, refer only to the *rate* at which the oscillations take place, and it must be clearly understood that each spark produces a group of vibrations lasting only a few thousandths of a second, and gradually dying away so that the amplitude of the vibration is greatest at the commencement of the discharge and decreases to zero at the end.

The rate at which the oscillations decrease is determined by the rate of dissipation of energy, which, though dependent on more than one set of conditions, may for this purpose be considered as a whole, and is known as the *damping* of the system.

The two most important factors which determine the value of the damping are the resistance of the circuit and the rate at which it is capable of radiating energy in the form of waves.

The production, properties, and detection of electric waves, which, under the right conditions are generated by oscillatory discharges, has for long been the study of numbers of scientists, whose attention has been directed largely to their use for the purposes of wireless telegraphy.

It has long been realised thet if some practical method of producing waves in a continuous stream could be devised, radiotelegraphy would be revolutionised, and the present system of spark-telegraphy would become a thing of the past.

When waves are emitted in short damped groups, as in spark-telegraphy, the radiation of energy is very vigorous while it lasts; but the period of inactivity between each group and the next is very large in proportion to the period of activity; thus the average rate of energy-radiation in a second is very small in comparison with the high value at the commencement of a wave-train.

With the recent rapid development of radiotelegraphy, the importance of maintaining communication between stations without interruption or interception by neighbouring installations has greatly increased; as a consequence the great attention given to the problems of syntony or tuning has led to a high pitch of perfection which was foreshadowed only by Sir Oliver Lodge, the true originator of all syntonic signalling.

To obtain accurate and vigorous selective response in a tuning-fork, it is not merely necessary to sound a note of exactly the right pitch, but the sound must be more or less prolonged so that each vibration arriving from the source of sound shall reinforce the vibrations in the responsive fork, and give a true cumulative effect. If the source of sound is itself a tuning-fork which is set in action by a blow, its vibrations will die away; and as the successive tuned impulses beat upon the responsive fork and increase its amplitude of vibration, they themselves are decreasing in vigour until a moment is reached when the usage of energy in the receiving fork is balanced by the supply from that which is transmitting: this is the moment of maximum amplitude in the series of induced vibrations, and from this moment onwards they must decrease until the combined system is at rest.

The longer the train of waves from the transmitting fork is made the greater will be the maximum amplitude of the induced vibration, until, if the transmitted sound-waves are made continuous by sounding the fork with a bow or by electricity, the amplitude of vibration attained by the receiving fork will rise to a considerable value, at which it will remain as long as the train of waves is maintained.

Steadily maintained sound-waves enable energy to be transmitted from one fork to another at a greater average rate than is possible if blows are applied at intervals, but what is more important, they produce a far greater cumulative effect on an accurately tuned fork and they give a far greater precision and selectivity of tuning than would otherwise be attainable.

Similarly, in spark-telegraphy the tendency has been to arrange the apparatus to give long trains of waves of gradually diminishing amplitude, even when this has involved weakening the instantaneous value of the radiation-energy. At a critical moment, when spark-telegraphy has been brought to a state of great perfection, the world has been startled by the announcement of a method of producing a continuous stream of electric waves just as the bowed tuning-fork gives a continuous stream of sound waves.

The new system introduced by Mr. Valdemar Poulsen is a development of certain discoveries described by Mr. Duddell in 1900. Without any desire to detract from Mr. Poulsen's inventive ingenuity and painstaking experimental work, we may at the same time express a hope that the non-technical press and the public will join with Mr. Poulsen himself in recognising the claims of the brilliant experimenter who, stopping where Mr. Poulsen began, was nevertheless the discoverer of the principle involved and foresaw the possible importance of his work in the future history of radiotelegraphy.

In 1900, Mr. Duddell described some remarkable experiments on the electric arc, the most important in connection with the present matter being as follows:—When a condenser and self-induction coil were connected in parallel with an arc supplied by a direct current, oscillatory currents were set up round the circuit under certain conditions. These currents surged back and forth through the coil and the arc and into and out of the condenser at a frequency which was found to depend on the values of the capacity and the self-induction. The vibrating currents through the arc produced corresponding changes in its temperature and, therefore, in its pressure, and the beats thus transmitted to the air gave rise to a musical note, the pitch of which could be varied by adjusting the condenser and the coil.

By these means Mr. Duddell obtained frequencies up to 30,000 or 40,000 per second, but for radiotelegraphy such vibrations were of as little use as those produced by Mr. Tesla's high frequency alternators. The reason for this is that the natural period of oscillation of the aerial must be exactly equal to that of the alternating currents used; that is, the aerial must be syntonised. At comparatively low frequencies the capacity and self-induction required are so great that a practical and convenient aerial cannot be constructed. Fig. 1 shows the connections used by Mr. Duddell.

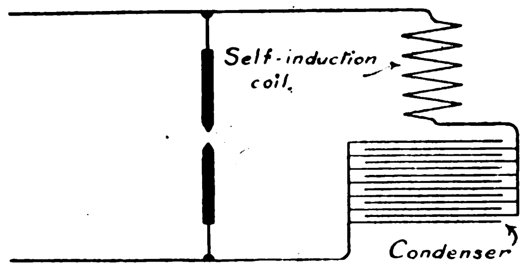


FIG. 1.—CONNECTIONS USED IN MR. DUDDELL'S EXPERIMENTS.

In the course of a series of remarkable experiments made with the object of increasing the frequency of the oscillations so as to bring them within the range of wave lengths suitable for radiotelegraphy, Mr. Poulsen has arrived at an arrangement of apparatus which gives oscillations up to a million per second. The first step made was to cause the arc to burn in some other gas than air. One of the early devices was to surround the arc with alcohol vapour by burning a spirit lamp under it, but coal-gas and hydrogen were found to allow of higher frequencies than alcohol vapour.

(*To be continued.*)

THE motor used by M. Santos Dumont in his recent successful attempt to fly with an aeroplane weighed slightly over 2 lbs. per horse power.

Locomotive Notes.

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

The Locomotive of the Future.

The steam locomotive, without doubt, has still a future before it, and present indications are all in favour of the assumption that it will be in the four-cylinder compound form that that future will find the locomotive when it comes. Everything, in the writer's opinion, points that way. To begin with, it is, of course, certain that both cylinder and boiler capacities will have to be made as large as possible and this leads us at once into the line of thought which ends in its becoming apparent that the piston areas of the largest engines will have to be divided up, and also that the demand upon the steam generating powers of the boiler must at the same time be kept strictly within bounds. The four-cylinder compound is, after all, only an improved two-cylinder engine in effect. The equivalent of two very large high-pressure cylinders is obtained, but the rate of steam consumption is slower, and the boiler is thus saved from having to generate steam with such enormous rapidity as it would have to do if there were really the two large H.-P. cylinders. With four cranks, at 180 degs. apart, on each side of the engine, and at right angles to the opposite pair, good results in balancing may be secured, and all that can possibly be required in the way of maximum tractive power is assured if starting mechanism is fitted so as to make it practicable to greatly increase the power of the engine for temporary purposes.

British Locomotives for Abroad.

Through the courtesy of Messrs. Robert Stephenson & Co., Ltd., the well-known firm of locomotive builders at Darlington, the writer is enabled to place before readers of The Model Engineer illustrated descriptions of two large and powerful locomotives built by the firm named for service in foreign countries. The eight-wheels coupled (0—8—0) type goods engine shown in the first illustration was recently shipped to the order of the Ottoman Railway Company, a standard (4 ft. 8½ ins.) gauge line extending from Smyrna to Aidin. The design incorporates features usually associated with English locomotive practice for this type of engine, and the general appearance is strikingly similar to that of many 0—8—0 type locomotives at work in this country.

The cylinders are placed outside the frames and drive the third pair of wheels. Steam is distributed to them by ordinary flat slide-valves actuated by Stephenson link-motion.

The other locomotive is a 4—6—0 type two-cylinder compound built for passenger service on the Buenos Ayres and Rosario Railway. The cylinders are outside the frames, with the high-pressure on the left-hand side of the engine and the low-pressure on the right-hand side. The middle pair of coupled wheels are the drivers. The engine is fitted with starting mechanism worked from the reversing shaft, admitting boiler steam to the low-pressure cylinder at such times as the valve gear is in full forward or backward position. A Belpaire boiler is fitted and the smokebox is extended. The tender in this case is of the eight-wheeled double bogie type with wheels of the solid disc centre pattern.

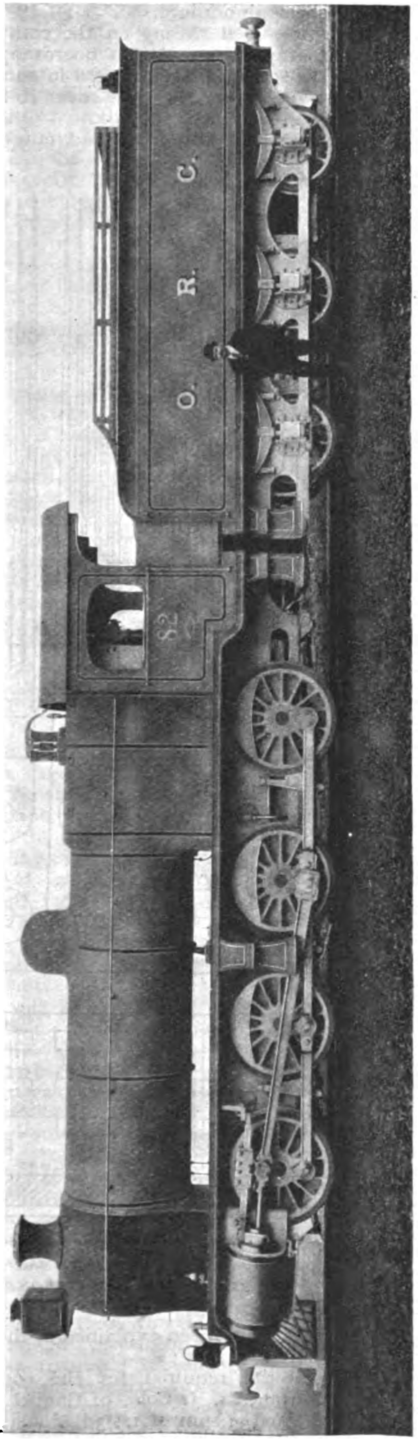
The gauge of the Buenos Ayres and Rosario Railway is 5 ft. 6 ins., and some of the heaviest and most powerful locomotives in the Argentine are employed upon the line. The leading dimensions of the two locomotives illustrated are as follows:—

	Ottoman Railway Locomotive.	Buenos Ayres Locomotive.
Cylinders, diameter	19½"	H.-P., 19" L.-P., 27½"
Piston stroke	26"	26"
Bogie wheels diameter	—	3' 2"
Coupled wheels	4' 6½"	5' 8"
Fixed wheelbase	17' 10"	13' 7"
Total wheelbase	17' 10"	25' 3½"
Heating surface: Tubes	1,634 sq.ft.	1,495 sq.ft.
Firebox	152·4 ,,	139 ,,
Total	1786·4 ,,	1,634 ,,
Grate area	25·35 ,,	25 ,,
Working pressure	180 lbs.	200 lbs.
Weight on coupled wheels	58 tons.	46t. 16c.
Weight on bogie	—	18t. 19c.
Total weight in working order	58 tons.	65t. 15c.
Tender fixed wheelbase	12' 0"	5' 0"
Tender total wheelbase	12' 0"	15' 0"
Tank capacity	3000 galls.	4500 galls.
Fuel capacity	7 tons.	5 tons.
Weight in working order	37t. 5c.	45t. 18c.
Engine and tender, total	95t. 5c.	111t. 13c.

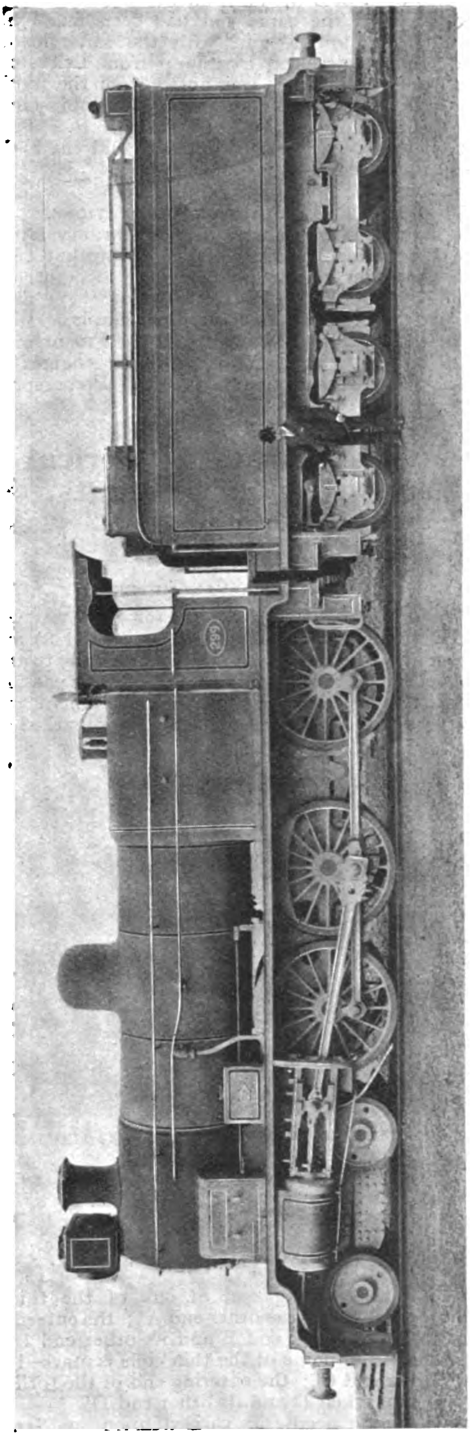
Replies to Correspondents.

A correspondent writes, enclosing a cutting taken from the January (1907) issue of the *Locomotive Magazine*, the subject matter of which is a review of the small volume entitled "Locomotives of 1906," published by the proprietors of The Model Engineer at the end of last year. The correspondent in question calls attention to a remark contained in the review, which is to the effect that the present writer has not so far illustrated G.N.R. engine No. 1,300 (the "Vulcan" compound). The correspondent asks whether it is likely that this engine will be illustrated and described in these Notes. As a matter of fact, the present writer was amongst the first to have published an illustrated description of No. 1,300 engine, G.N.R. The article appeared in the *Railway Engineer* for November, 1905, and was illustrated by an official photograph and outline drawing with accurately stated dimensions. A notice of the same engine appeared in the *Locomotive Magazine* at a slightly earlier period. It was illustrated from a "snapshot" photograph, and the list of dimensions contained at least one inaccuracy. It is not intended to devote space to No. 1,300 in these Notes, as the engine, which was completed at about the middle of 1905, has already been fully dealt with in the engineering press.

Another correspondent sends particulars of the running of a Great Central Railway express train between Leicester and Marylebone when he was present and took notes with a view to testing the performance of the locomotive, viz.: No. 392, of the "Atlantic" type. The load consisted of five eight-wheeled bogie corridor coaches and a dining-car, and the train covered the distance of 104 miles odd in 108 minutes, with slacks at Charwelton, Quainton Road, and Aylesbury, but no actual stop



0—8—0 Type Goods Locomotive: Ottoman Railway.



Two-cylinder 4—6—0 Type Compound Locomotive: Buenos Ayres and Rosario Railway.

This, of course, is excellent running, although the writer has been present, both on the engine and in the train, when the same run has been made in 105 and 106 minutes, and with the same load. Indeed, on one occasion a run up from Leicester in the level 104 minutes was noted from the foot-plate of No. 194, one of the first of Mr. Robinson's 4—6—0 type locomotives on the G.C.R. The driver on that occasion was Johnson, and the load five eight-wheeled corridors.

L. & N.W.R. LOCOMOTIVE ALTERATIONS.

The statement appearing in the February issue of the *Locomotive Magazine* to the effect that two of the 4-cylinder compound passenger locomotives on the L. & N.W. Railway, viz., Nos. 1974 and 1978, had, in addition to having the duplex valve gear fitted, been provided with the "Precursor" type of boiler is incorrect. None of the engines of this class have been fitted with "Precursor" boilers.

Some Accurate Electrical Measuring Instruments.

By V. W. DELVES-BROUGHTON.

A TANGENT GALVANOMETER.

(*Continued from page* 182.)

THE terminals on the block (Figs. 7 and 8) are connected, as shown, diagrammatically to the coils by means of the flexible bell wires passing through the hollow stem of the instrument, as already explained; and the terminals are marked as

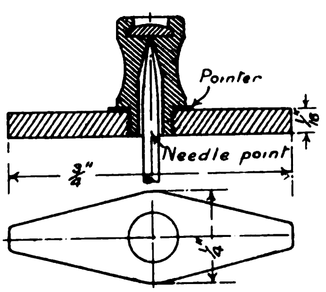


FIG. 10.—SECTION AND PLAN OF NEEDLE.
(*Double full size.*)

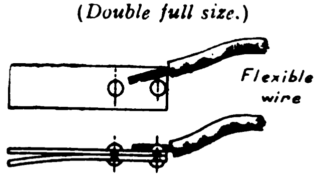


FIG. 12.—SLIDING CLIP FOR RHEOSTAT.

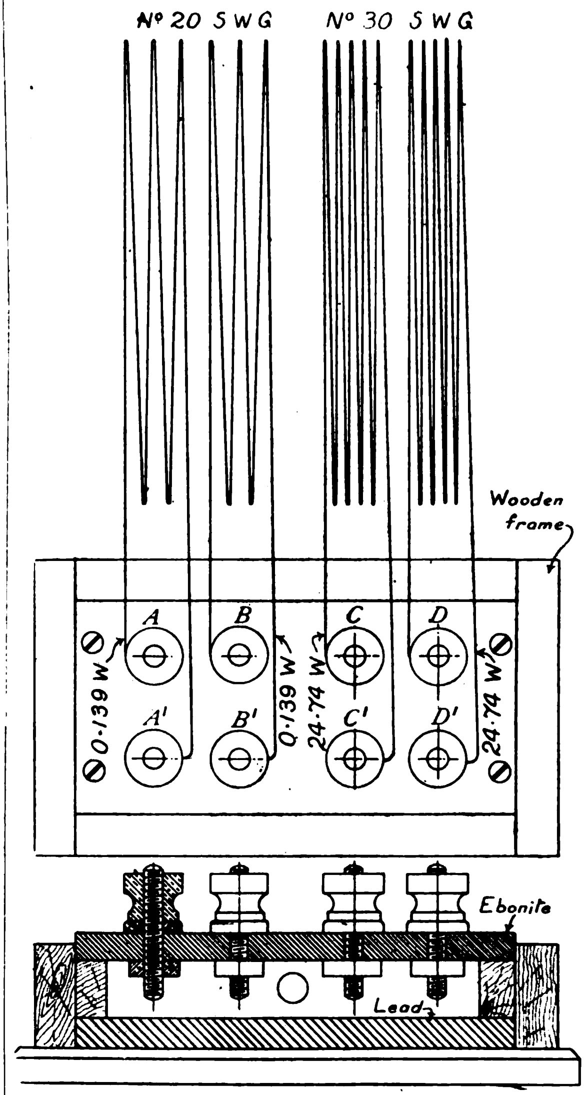
follows:—The entering end of one of the thick coils is marked A and the other end A'; the entering end of the other thick coil B and its other end B'; the entering end of one of the thin coils is marked C and its other end C'; the entering end of the other thin wire is marked D and its other end D'.

The magnetic needle is carried upon an "end jewel," taken from an old watch, mounted in a piece of brass, as shown in the enlarged drawing (Fig. 10).

This brass mount also serves to clamp the pointer to the needle, which consists of a strip of No. 36 S.W.G. sheet aluminium.

The article seen resting on the compass-box in the photograph (Fig. 9) is a microscope used for reading the scale, and is arranged in such a manner that when resting on the glass cover it focusses the scale at the bottom of the box.

The manner of hardening and magnetising the



FIGS. 7 AND 8.—SHOWING TERMINAL BLOCK AND DIAGRAM OF CONNECTIONS.

needle has already been explained in the first article of this series.

The material required for the compass-box I obtained from Mr. J. Cole, of Chapel Road, West Norwood, for the sum of 1s. 3d., consisting of ¾ in. of 4½-in. brass tube; one compass-card, with tangent scale; one glass disc; and a ring of wire to fix the glass in position. The brass castings cost me 3s. 1d., and the wire, ebonite, and other material I had by me, so it will be seen that the galvanometer did not cost very much, although it took some time to make.

A scale of tangents is very easy to draw if there should be any difficulty in obtaining a printed scale. As shown in Fig 1, a base line is drawn, and perpendicular to this a second line is drawn. These lines can be of any convenient length, but should be as long as practicable. The base is then divided into any convenient equal divisions, and each tenth division numbered, the central division being O.

Then a point being taken in the vertical line, a circle is drawn of the required size for the scale. Then, having fixed a needle in the centre of the circle, the divisions on the base are scribed off on the circumference of the circle, using a straight-edge to transfer the divisions from the base line. This description may sound complicated, but is clearly shown on the drawing. If thought desirable, an ordinary scale of degrees can be used, and the tangent found by reference to a table of tangents. In any case, one side should be divided into degrees, as shown in Fig. 6.

Each of the fine wires in my instrument has a resistance of 24·74 ohms. If connected in series, their total resistance = 49·48 ohms. If connected in parallel, their total resistance = 12·37 ohms. And they will carry 0·08 amp. without overheating, so that the instrument, if connected in series, can be used for calibrating voltmeters up to 4 volts without added resistance. If a higher voltage than this is required, a resistance must be added in series with the coils, and should be a multiple of the resistance of the coils. Thus, for my instrument a series of resistances of 49·48 (which gives half the deflection), 148·44 (which gives quarter the deflection), 346·36 (which gives one-eighth the deflection) is used, thus enabling voltmeters up to 30 volts being calibrated. For higher voltages than this, a voltmeter is used, as will be explained in a subsequent article. The thick wires have each a resistance of 0·139 ohm, and when used in parallel, as they usually are, the resistance becomes 0·0695 ohm, and will safely carry 1 amp. in series, or 2 amps. in parallel. For measuring larger currents, shunt resistances are used. Thus. for 4 amps. a resistance of 0·0695 ohm is required, for 16 amps. a resistance of 0·00993 ohm, and so on.

To make these resistances it is advisable to use the coil itself to measure the resistance in process of being made, thus obviating the extra chance of error of a double measurement. Care must be taken, however, that the tangent galvanometer stands far enough away from the reflecting galvanometer, so as to avoid all chance of the current flowing through the coil affecting the reading. Thus using the tangent galvanometer (fine wire) as the known resistance, and requiring to make a resistance of 346·36 ohms, the scale reading on the metre bridge will be 12·5. Again, in constructing a 0·00993 resistance from the thick wire (in parallel), the scale reading will be 87·5.

Care must be taken in making these resistances that thick enough wire is used, especially with high resistance wire, as when passing heavy currents they are liable to heat up considerably, and when heated their resistance alters considerably.

For these low resistances it is a good rule to take as many wires of 20 S.W.G. as amperes to be carried, the length required for German silver being about 18 ins. If this is arranged on an open framework, the heating will be light. No. 18 S.W.G. would be better, of course using a greater length. These low resistances can be made in the form of a gridiron, using thick brass rod to connect the resistance wires in parallel, short bits of cable being permanently soldered to the brass strips to make the connections.

The high resistances should be formed of high-resistance wire (cotton or silk covered) a little thicker than the wire on the galvanometer.

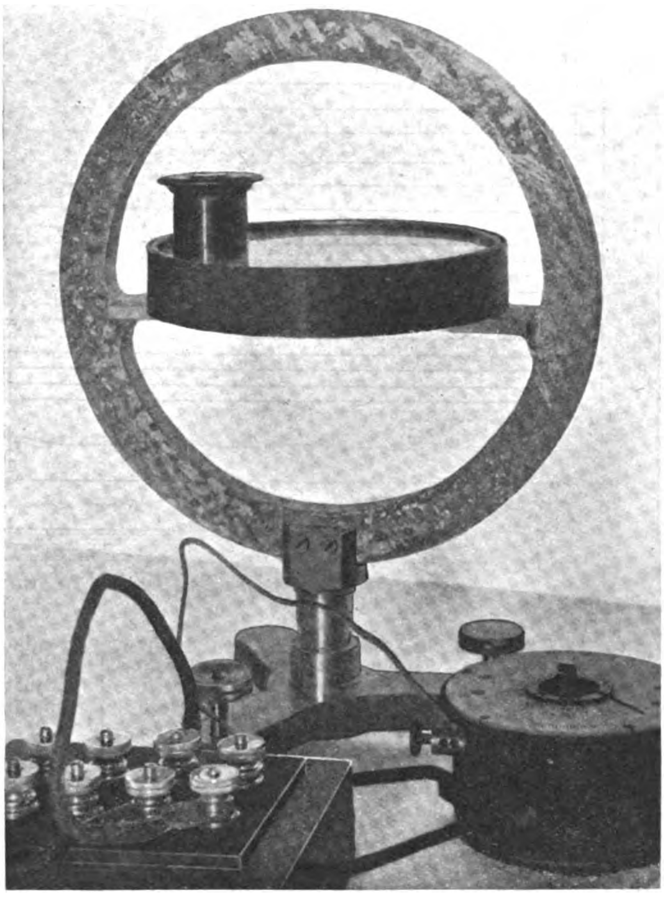


FIG. 9.—A VIEW OF TANGENT GALVANOMETER, SHOWING, ON THE RIGHT, A MILLIAMPERE METER BEING CALIBRATED, AND THE TERMINAL BLOCK ON THE LEFT.

These resistances can be made up on empty cotton reels, as already explained in my last article, and can be placed in a box or wrapped round with some velvet or other material, wiring the resistance on the end and leaving two pieces of flexible bell wire projecting to connect to the terminals.

A few double-ended cable connections, of low resistance, should be made to cross-connect the terminals on the block as required.

Two or three rheostats, or variable resistances, will be required, wound with different thickness of high-resistance wire, and a convenient form is shown in Fig 11. Two battens are securely screwed at the ends of a board, and a row of brass pegs are driven into each batten in such a manner that the wire can be strung tightly in a zigzag fashion between the battens. One end of the wire is soldered to a terminal, which is connected in series between the source of electricity and the instrument being tested, and the correct resistance is obtained by using a spring clip, which will slip on and grip the wire where required.

These rheostats are required both for regulating the voltage and amperes, so that both thick and thin wires will be required for general testing work. For most purposes about 72 ft. of German silver wire will be found sufficient, one-half of which is wound in the two spirals at the end of the zigzag, and three boards will answer most requirements: one should be wound with No. 18 uncovered German silver wire; one with No. 22 German silver wire; and the third with No. 30 German silver wire. The first will have a resistance of about 4 ohms; the second about 12 ohms; and the third about 60 ohms. The battery used should be so arranged that it will give sufficient current at a low voltage to test the largest amperemeter, and when connected in series to give the voltage of the highest reading voltmeter required.

If a very large amount of graduating is to be done, a small dynamo, with a double winding, and the field excited by a storage battery with a rheostat in series, would be a great convenience. If such a dynamo is used, one winding should be made with a very thick wire, for testing amperemeters, and the other with many turns of fine wire for voltmeters, and, of course, there should be two commutators quite independent for collecting the high and low-pressure currents. By altering the field, practically any voltage can be obtained, and by this means a great deal of trouble is saved, as when using a battery fresh connections have to be made as the voltage is increased, and the resistance adjusted till the reading of the galvanometer is correct, whereas with the above dynamo, the field only requires adjustment, which is a comparatively simple operation.

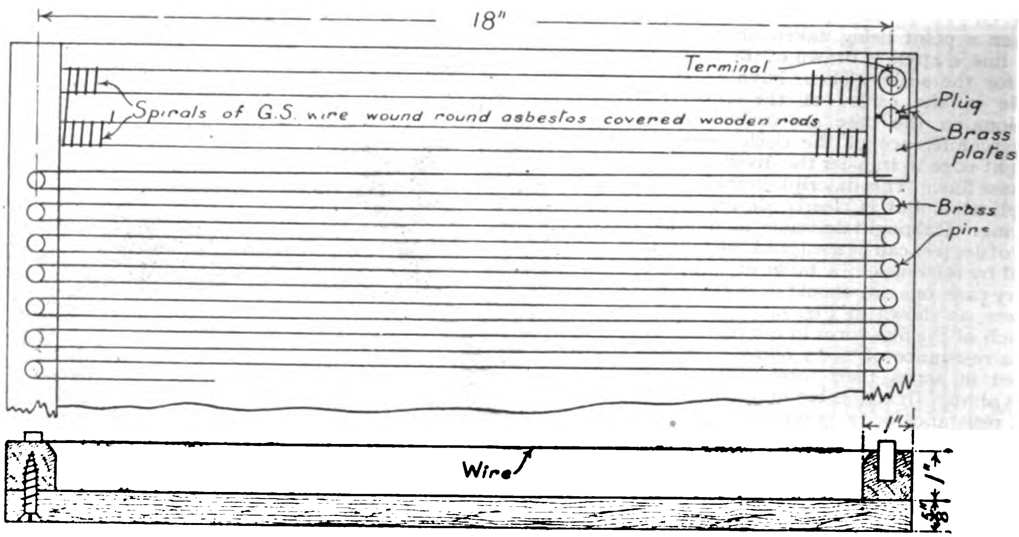


FIG. 11.—DIAGRAM OF RHEOSTAT.

(*To be continued.*)

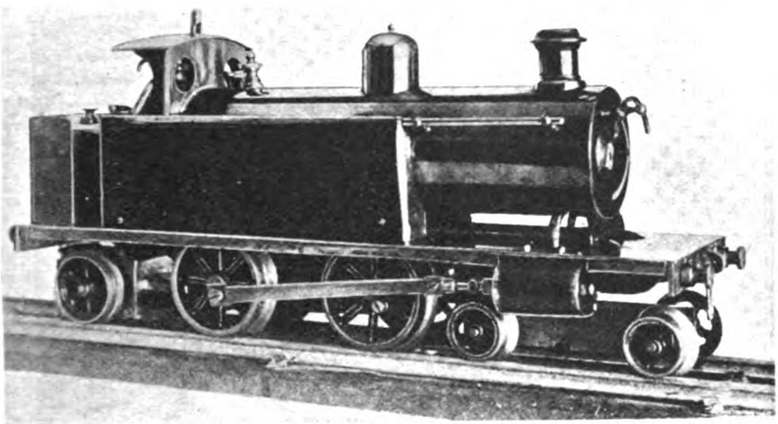
A ⅜-in. Scale "Atlantic" Type Tank Locomotive.

By H. G. DENVIL.

THE locomotive depicted in the accompanying photographs—my first effort in engineering—was built in about four months of last year, and has now been running about eight months. Like your correspondent, Mr. Rompler, I prefer an unpainted engine for "service." This one, which I call "Trojan," is of polished brass, excepting, of course, the valve and piston-rods and axles, also the wheels, which are iron, and were taken off a discarded clockwork locomotive.

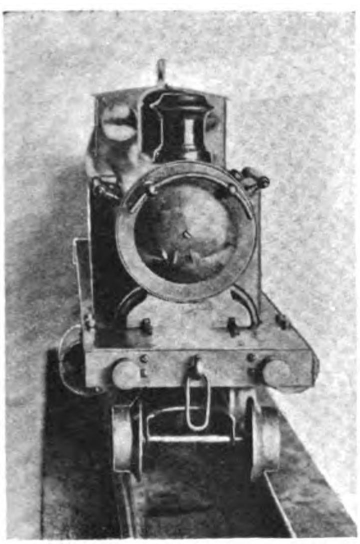
Being an architectural draughtsman by profession, drawing is naturally no *recreation* to me, and I worked without a drawing; but, although the locomotive has been entirely satisfactory, and the engine worked properly from the first moment steam was turned into the cylinders, I should not do so again.

I may perhaps here mention that I have no workshop other than the kitchen table, and the



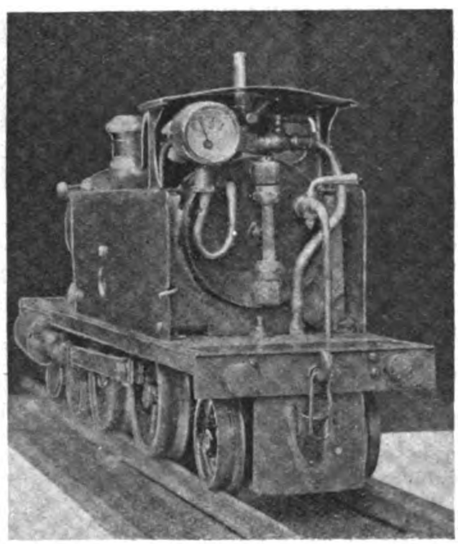
Mr. H. G. Denvil's Model "Atlantic" Type Locomotive.

tools with which the work was executed consist of a few files and *pieces* of files, a soldering bit and blowpipe, a hack saw, archimedian drill, a cheap screwplate, small vice and two clamps, pliers, and hammer, constituting a very poor lot into the bargain.



Front View.

The boiler (which I made first—another error) is of the *simple* order, externally fired, and is of 1-32nd-in. brass tube with cast ends—the one at cab end having brass snap-headed nails driven tightly into drilled holes and soldered outside, as rivets; the other end is about 1 in. inside the tube, and is hard soldered only—the two are tied together with a 3-16ths-in. brass rod. With the help of your little book on boilers I figured out the safe pressure at something between 40 and 45 lbs., and before fixing I several times pressed it up to 50 lbs. under steam on a tolerably hot gas stove—the only leak being a slight one from the top nut of the water gauge. The object of forming a smokebox was to keep the front of the boiler warm when running, my design generally being to present as little boiler surface as possible to the cooling effect of the atmosphere. The boiler fittings comprise, as will be seen, a regulator, whistle, steam pressure and water gauges, high-water blow-off cock, a blower (which is behind the pressure gauge, with the handle outside the spectacle hole of cab), and a wire handle



Cab View.

to pull open the fire-inspection and lighting hole in side of left-hand tank. The fire consists of five ¼-in. wire wick burners.

The frames I drilled out of 1-16th-in brass plate, the buffer beams and front plate of the smokebox were cut and drilled respectively from rather stouter stuff. The footplate (which is in one piece) and the tanks, etc., were sawn out of 1-32nd-in. brass plate, and shaped up as required. The tanks are all detachable, but the rear one only holds water.

The spirit reservoir, as will be noticed, forms a trailing pony bogie, with the wheel axle through its centre; this had to be done so that the engine would traverse the standard curves for this scale, viz., 1-ft. 6-in. radius.

The cylinders are by Messrs. Bassett-Lowke, and the glands have not yet had to be packed. I had some trouble in fitting them, as I made my frames before purchasing, and when I received them found that the valve rods would have to come exactly under the frame, the result being that I had to cut a large piece out of each frame to accommodate same. Slip reversing is fitted, and this I worked out from observations of models exposed for sale in a certain shop window.

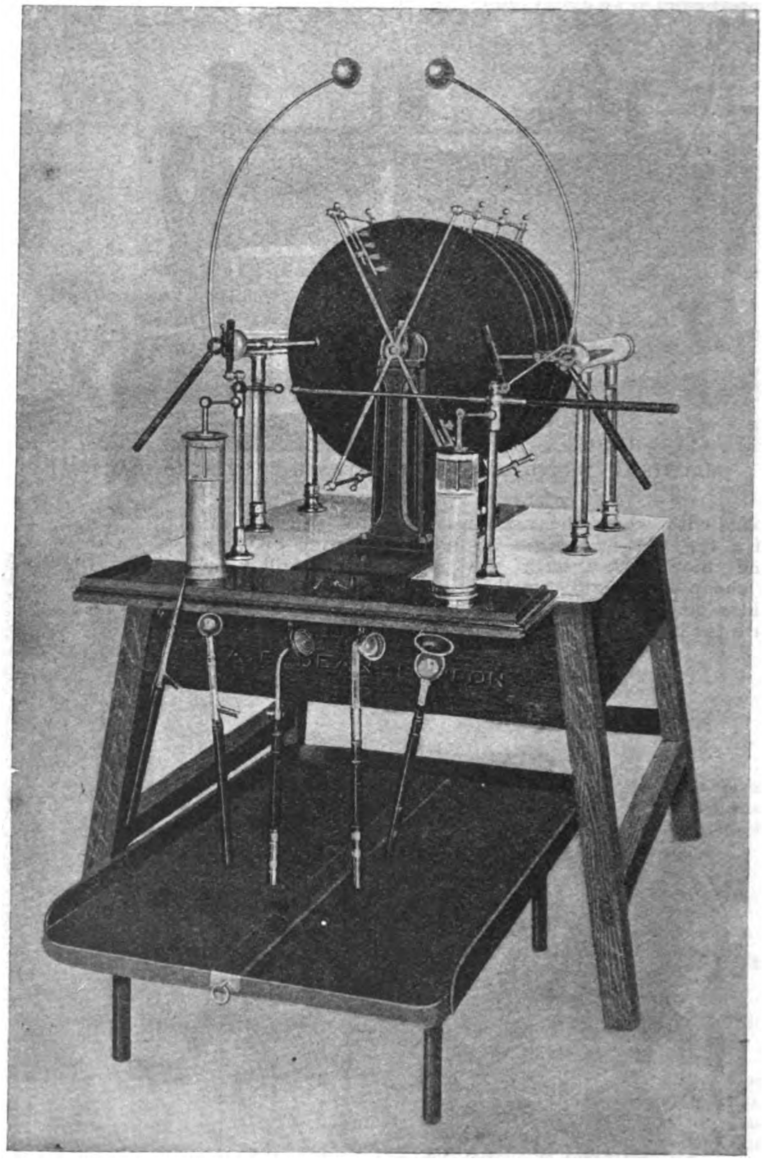
Many oddments entered into the construction. For instance — the smokebox door was "sawn" out of an old door handle; the inner dome is a piece of tube, and the wick-raiser of an ordinary paraffin lamp, with the "stem" of the latter taken down centre and screwed into cross-stay inside boiler; the cover to dome is fashioned from a fishing-rod ferrule; and the connecting-rods were once the brass back of an old saw.

Recently I altered the steampipe so as to get greater superheating of the steam, in which I succeeded, but the valves now get too hot and dry, so this will have to be modified, and when so doing I purpose adding an oiler on the steampipe in the cab.

The engine steams admirably, and runs for about a quarter-of-an-hour without attention; and during the late snowy weather steam was raised outdoors from "all cold" and ran a good hour in a temperature of 34°.

The following are some of the dimensions:—

	Actual Measurement.	Scale Equivalent.
Length over buffer beams	12 ins.	30 ft.
,, of boiler and smokebox	8 ,,	21 ft. 4 ins.
Diameter of boiler and smokebox	2 ,,	5 ft. 4 ins.
Cylinders, bore	½ in.	16 ins.
Cylinders, stroke ..	⅝ in.	1 ft. 8 ins.
Driving wheels, diameter	1¾ ins.	4 ft. 8 ins.



A Machine for Producing Static Electricity.
By Mr. A. Dean.

(See page 233.)

Working pressure maintained .. .. .. 15 lbs. sq. in.
Working weight.. .. About 5 lbs.

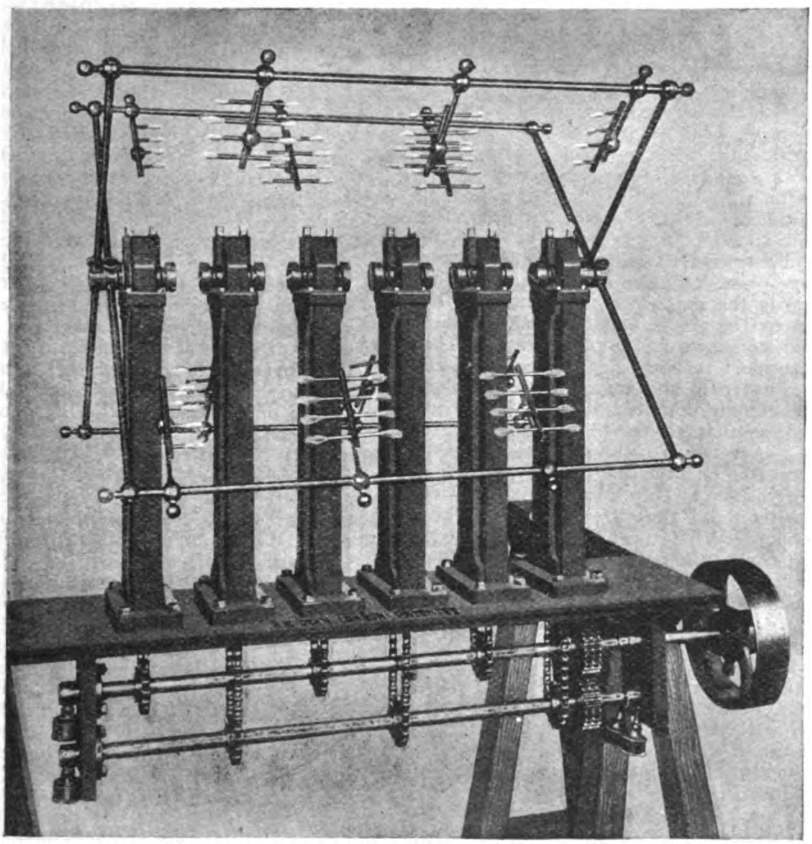
The cylinders are made for ¾-in. stroke, but the wheels were finned for ⅝-in., and could not be altered.

Recent Developments in X-Ray Apparatus.

(*Continued from page* 209.)

MACHINES of the Wimshurst type for producing static electricity are also made by Messrs. The Medical Supply Association: they are used for electrotherapeutic treatment by silent discharge, radiography, and high-frequency current. The plates are of ebonite (about 22 ins. in diameter) without sectors, and arranged so that any pair can be readily removed. They are run at high speed—from 900 to 1,000 r.p.m., or more. No glass case or enclosure is necessary. To clean the plates a cloth may be held against them as they rotate. The makers state that the voltage of a static machine depends upon the material of which the plates are made and the speed at which they are run (other things being equal); the output of current depends upon the number of plates. A 12-plate machine of this make is stated to give 300 milliamperes, a 20-plate machine 500 milliamperes.

The static discharge of electricity seems to have properties distinct from the discharge as given by an induction coil, and which are of peculiar value. On this account a development has been taking place in the construction of such machines, so as to make them fit for regular and heavy work. Instead of the plates being all mounted upon one long spindle, they are arranged in pairs, which are carried by separate bearings, one bearing to each pair, as in the illustration, where the machine is shown with one pair and the end plate removed. The construction is much more substantial and convenient than that of the usual static machine. In addition to the large discharging rods, the machine is fitted with a pair of horizontal dischargers, which act as a spintermeter to measure the spark length which is produced, and as a safety by-pass to the *X*-ray tube; also with two small dischargers, seen at the right and left hand, to act as spark gaps, across which the machine delivers its charge (see MODEL ENGINEER Handbook,



MR. A. DEAN'S STATIC MACHINE: PLATES REMOVED, SHOWING DRIVING GEAR.

"*X*-Rays Simply Explained," page 80). By adjusting the length of the gaps, regulation of the discharge to the patient or tube can be effected. As the discharge from a static machine is not interrupted, as the current from an induction coil, the light produced in the *X*-ray tube is very steady, and therefore is preferred, for radioscopic examinations. According to some opinions, there is also less strain on the tube and not so much risk of *X*-ray burns; but a greater time for exposure is required. Certain electrotherapeutic treatment, such as the electric douche, can only be obtained with a static machine.

A generator which has some novel features was exhibited by the maker, Mr. A. E. Dean, of 82, Hatton Garden. It is called the "Ergos" Static Machine, and is patented. The plates are made of special ebonite, without sectors, 19¾ ins., 21⅝ ins., or 23⅝ ins. diameter approximately. They are supported in pairs by central bearings, as shown in the photograph. Any plate can be removed without disturbing the others. Each driving boss is provided with a slot, and each plate with a flat projection at the side of a metal boss clamped in the centre of the plate. The projection upon the plate slides into the slot in the driving boss, where it is fixed by a screw. It is thus a simple matter to slip out any plate for cleaning or repair. The leading feature is the method of transmitting the driving power to the plates. Chains and sprocket wheels are used, as shown in the photograph. The pillars which support the bearings are hollow, and the chains pass up them and engage with sprocket wheels upon the plate spindles. A positive drive is thus secured, so that all the plates must rotate at equal speed. According to the makers, this very much increases the output of the machine and enables a given voltage to be produced with a lower velocity. They contend that if the plates do not all rotate at equal speed, those having the lower velocity do not contribute their proper share to the output, but also act as a drag upon the more active plates and dissipate energy, especially with multiple plate machines. Horizontal dischargers, to act as a spintermeter, and spark gap dischargers are also fitted. The machine is usually supplied unenclosed, but when a case is desired, the makers fit a fan, driven from the same mechanism, which constantly renews the air without depositing dust.

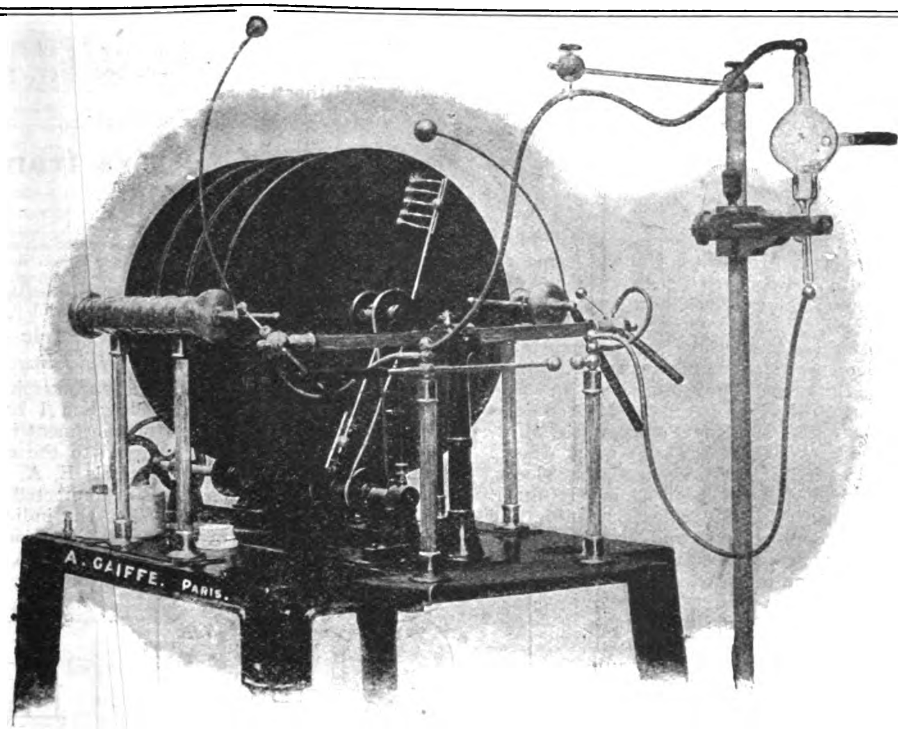
We have to express our thanks to the British Electrotherapeutic Society for their invitation, to Dr. Reginald Morton, and to those exhibitors who have been good enough to lend us the blocks and information made use of in this account.

The Latest in Engineering.

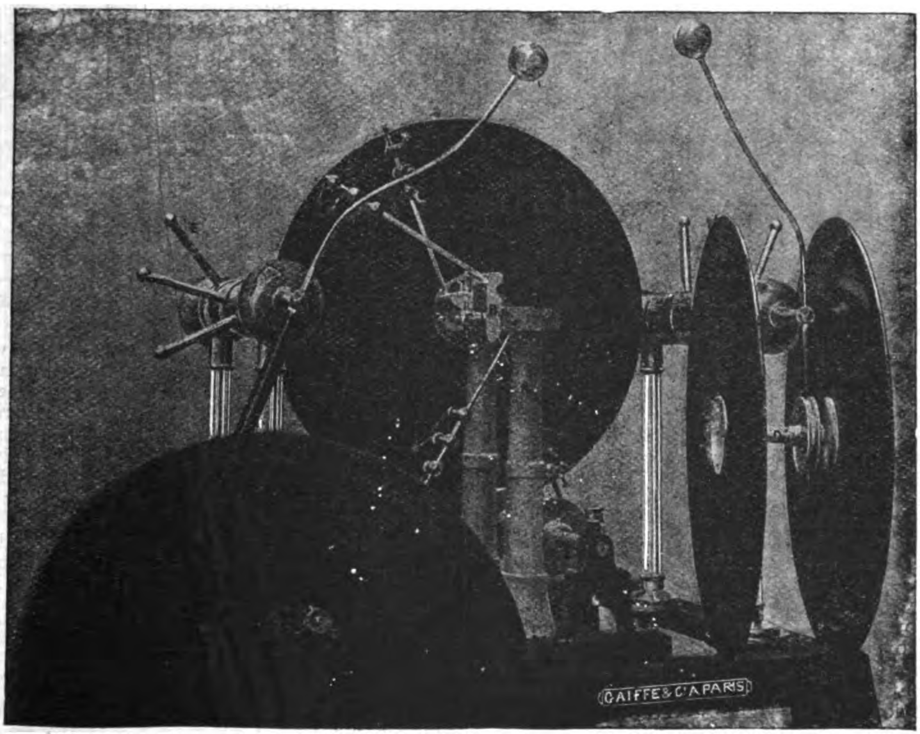
Locking Railway Carriages.—For the first time, it is said electricity is to be applied to the safety locking of railway carriages. The invention, for which provisional protection has been granted, is the work of two engineers, Messrs. A. McPetrie, of Withington, and F. A. Orchard, of Hale, Cheshire. Its great merits is its ease and simplicity of manipulation. It is automatic, and operated from the dynamo used for electric lighting purposes. It consists mainly of a solenoid enclosed in a metal case let into the side of the carriage below the seat. The core of the solenoid is extended to form the locking bolt, which, when in operation, is projected into a receptacle in the door. When the train is in motion, energy is supplied to the solenoid and the bolt is shot into the door and secures it. When the train comes to a standstill the current is automatically cut off and the bolt withdrawn by a spring, thus releasing the door. The portion of the case referred to contains a small switch working in conjunction with a bell or other suitable alarm, which indicates if the door is not securely fastened. It is totally enclosed, is dustproof and water-tight, and has no working parts likely to get out of order. The moving core works on anti-friction bearings and does not need lubricating.—*Engineer*.

Torsion Testing Machines.—One of the latest makes of the above has recently been delivered to the order of the Woolwich Polytechnic. The design is by Messrs. W. & T. Avery, Ltd., for the use of technical schools, polytechnics, etc. The *Engineer* describes the machine as having a capacity of 10,000 in.-lbs., consisting of a baseplate, to which are bolted two cast-iron standards. One standard encloses the two indicating levers, and the other the straining gear. The levers are of wrought iron, and fitted with hardened steel knife edges, the connection between the levers being by wrought iron links having hardened steel bearings. Th main lever has a fulcrum, consisting of hardened steel cones and cups bearing upon rings of hardened steel balls. The second lever has two knife edges, either of which can be made to act as a fulcrum by the movement of a hand lever, according to whether the strain applied is likely to be light or heavy—*i.e.*, in one position of the hand lever the machine is 10,000 in.-lbs. capacity, and in the others 5,000 in.-lbs. capacity. The steelyard is Avery's improved type, in which the poise is propelled along the steelyard by a central screw. The screw is rotated by means of machine-cut gearing controlled by a hand wheel. The connection between the hand-wheel, which is on a fixed portion of the framing, and the gearing upon the steelyard is made at the point of no motion—*i.e.*, at the fulcrum, consequently any pressure of the hand upon the hand-wheel is not communicated to the steelyard. The steelyard is graduated from zero up to 1,000 in.-lbs. single power—2,000 in.-lbs. for double power—by divisions of 10 in.-lbs., and a vernier scale upon the poise subdivides this again into divisions of 1 lb.—single power. A graduated scale at the end of the steelyard in the view of a microscope having a divided line upon its lens enables indications of 1-10th lb. to be taken. The remainder of the capacity of the machine is provided for by the use of four loose proportional weights suspended from the end of the steelyard, each representing 1,000 in.-lbs. single power, or 2,000 in.-lbs. double power. The straining gear consists of a worm-wheel rotated by a hand-wheel. The worm-wheel and worm shafts are turned, and are carried in brasses fitted into the cast-iron standards.

The London Fire Brigade has just had its appliances increased by the addition of two chemical extension ladders. The ladders extend automatically to a height of over 80 ft., and can be worked at any angle and in any direction. The propelling force is carbolic acid gas, contained in cylinders at the base of the ladders.



MESSRS. THE MEDICAL SUPPLY ASSOCIATION'S MACHINE FOR PRODUCING STATIC ELECTRICITY



VIEW SHOWING PLATES REMOVED.

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.

AN ordinary meeting of the Society was held at the Cripplegate Institute, Golden Lane, on Wednesday, February 20th, 1907, Mr. Herbert Sanderson taking the chair, and upwards of seventy members and visitors being present. The minutes of the last meeting having been read, and five gentlemen elected members, the Chairman announced the dates of ensuing meetings, and also stated that permits had been obtained for parties of the members to visit the Royal Arsenal, the Mint, Messrs. Peek, Frean & Co.'s Biscuit Works, Messrs. Robertson's Electric Lamp Works, and other places, but the dates had not yet been definitely fixed. The Secretary then read the rules governing the evening's model competition, and the remainder of the evening was occupied in inspecting the various models on view, which included the following :—Travelling steam crane, shown by the Hon. Secretary, under steam ; Mr. Tiefenbock, steam yacht ; Mr. Lamb, vertical engine ; Mr. Clayton, hydraulic capstan ; Mr. Miller Muir, large force pump, discharger for coil and gyroscope ; Mr. Barrett, 6-coupled L.B. and S.C.R. goods locomotive ; Mr. Hildersley, self-contained electric locomotive ; Mr. Blankenburg, frames, wheels, and complete motion of S.E. & C. Railway express engine ; Mr. Hobbs, torpedo boat destroyer (electrically driven) ; Mr. Seldon, electric motor ; Mr. Pidcock, steam turbine ; Mr. Hart, tank engine and truck. All the finished locomotives ran under steam on the track, including a fine ⅛-in. scale North-Eastern "Atlantic," exhibited by Mr. Burridge, a visitor. The event of the evening was a very exciting tug-of-war between Mr. Hildersley's electric locomotive and Mr. Barrett's 6-coupled steam goods locomotive ; both these were powerful models, and were so evenly matched that neither was able to move the other. Each exhibit having been duly numbered, the company present were requested to fill in their voting papers, and on these being counted it appeared Mr. Blankenburg's unfinished S.E. and C. Railway engine had received the highest number, Mr. Tiefenbock's yacht coming second, and the Hon. Secretary's steam crane third. The announcement of the result was made by the Chairman, and one of the most interesting meetings of the Session adjourned shortly after 10 o'clock.

FUTURE MEETINGS.—Friday, March 15th :—Lecture on "The Construction and Design of Petrol Engines, with special reference to the Napier Engine," by Mr. Snodgrass. The lecture will be illustrated by lantern slides, and all readers of this Journal interested in the petrol engine are invited to be present, and may obtain a ticket free of charge on application to the Hon. Secretary. Tuesday, April 9th :—Mr. Ferriera's paper on "Some Wrinkles in Model-making."—Full particulars of the Society and forms of application may be obtained from HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

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 intended for publication.]*

A Continuously Ringing Electric Alarm.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I beg to enclose a sketch of a continuous ringing electric bell which I have made. A "drop" pattern indicator movement is mounted in a box, with a wire soldered to the end of the moving portion D and terminals E, A, B, and C, as shown. The terminal E is connected on to the frame of the indicator. When the indicator is in the position shown in the sketch, the circuit through the magnet is made at the terminal A (the bell-push being inserted in this circuit). Now, when the push is closed, the core of the magnet is magnetised and the rocker above it is attracted, and the moving portion D falls, breaking the magnet circuit and completing the bell circuit, the bell continuing to ring until the indicator is reset. The advantages of such a system are these :—(1) The indicator is reset on stopping the bell, which does away with the chance of leaving the arrangement unset. (2) The magnet circuit is broken when bell rings, hence we get the whole current through the bell, instead of continuing through the magnet either in series or parallel.—Yours truly,

Peckham, S.E. "HEAVY SLEEPER."

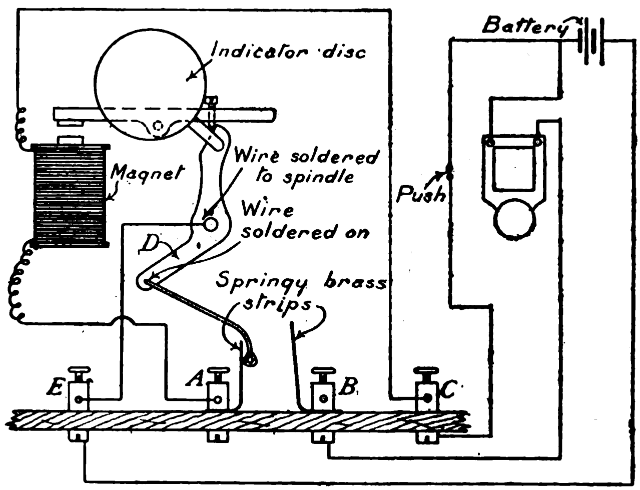


DIAGRAM OF CONNECTIONS FOR CONTINUOUSLY RINGING BELL

Steamer Speed Competition, etc.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In order to avoid the trouble with weeds which I see mentioned in your account of the last steamer speed competition, would it not be practicable to change the date of the competition so that the trials would be held in March or April? The old pond weed would have by then disappeared, and the new crop not yet attained its growth.

This date might also have an advantage in that it comes at the end of the long winter, during which season I imagine the greater part of the model-making is accomplished, rather than in the short summer evenings.

Some of your contributors who may find difficulty in arranging suitable backgrounds to set off models for photographing, might find the following simple dodge useful, though many have, perhaps, thought of it. I have recently employed it successfully both for models and small art objects, such as vases, curios, etc. Place a large sheet of white cartridge (or tinted paper if desired) on the table. Stand the model upon it, fairly near the front edge, and curve the rest of the paper evenly upwards until vertical, forming the background. This does away with any confusing breaks or details behind the model, which stands out clear on an even tone. —Yours truly,

H. Van der Weydem.

Pas-de-Calais.

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.]*

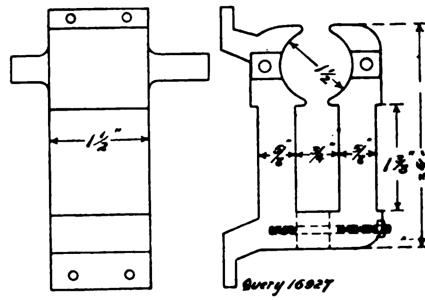
The following are selected from the Queries which have been replied to recently:—

[17,284] **Steam Ports.** A. J. V. (Wellingboro') writes: I am a beginner in model engineering, and I should be much obliged if you will answer me the following:—What should the size of steam and exhaust ports be for slide-valve cylinders ½-in. bore by 1-in. stroke; and what is the best way to cut same? Also, whether the pistons for this size require rings?

Piston rings, as ordinarily made, are not suitable for such small cylinders. For ½-in. by 1-in. cylinders steam ports should measure, on face, ¼ in. by 1-16th in.; exhaust ports, ¼ in. by ⅛ in.; port bar, 1-16th in. Drill down from the face three 5-16ths-in. holes in line for each of the steam ports and two 1-64th-in. holes for the exhaust. Chip to size with a small chisel. Connect exhaust with one ⅛-in. diameter passage, and connect ends of cylinders with three 1-16th-in. holes.

[16,927] **Broken Dynamo Field-magnet Casting.** A. I. (Putney) writes: (1) I have had the castings of a dynamo given me, but the part at the dotted lines is missing through a fall. I should like to know if I could fit a piece of wrought iron in its place to bolt all together? (2) I want to get as much out of it as I can, and should be much obliged if you would let me know what armature to use and wire for same, and also the amount of wire for field-magnets; I shall use it for charging.

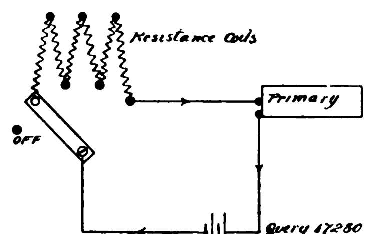
(1) Yes; a piece could be fitted in, making a good joint, and a small stud (wrought iron) put right through a good driving fit, but



be careful not to split the castings. (2) Wind armature with 2½ ozs. No. 22, and field-magnets with 1 lb. No. 22.

[17,280] **Resistance for Working Small Induction Coils** A. K. (Coleshill) writes: I should be pleased if you would answer me the following questions: (1) How to make a resistance for a ½-in. spark coil, when worked with one or two dry cells, so that it can be safely used for a shocking coil? also kind and gauge of wire? (2) Is the resistance betwen the battery and coil, or after the current has passed through the coil? (3) What is the advantage when a core of a coil is made of a bundle of soft iron wires, and when the core is made of a bar of soft iron?

(1) A few yards of No. 28 German silver wire will do. Divide it up into a few lengths and arrange it so that one or more lengths can



Resistance for Shocking Coil.

be put in circuit as desired. See replies to similar questions in back issues. (2) Resistance is placed in the circuit of primary winding. (3) It demagnetises and magnetises more readily. See handbook, "Induction Coils," 7d. post free.

[17,307] **Small Boiler Difficulty.** W. L. F. (Weston-super-Mare) writes: I have a 24-in. by 11½-in. vertical centre-flue steel boiler, with a copper dome bolted down with thirty hexagonal bolts. There is a hole in the dome where the centre-flue comes through, which is a tight fit and caulked. What I want to know is:—How can I uncaulk the boiler to get the dome off, as I want to tighten up the water gauge, which is nutted in inside.

We cannot exactly follow your description of the construction of the boiler, but it appears that it will be rather a performance to get the dome off, just to tighten up the nuts of the water gauge. Do you wish us to infer that the joint of the dome and the uptake (or centre flue, as you call it) is not riveted? If so to undo the joint you have only to apply (very carefully) sufficient force and to recaulk the joint afterwards. What we should feel disposed to do, would be to endeavour to take off the water gauge altogether, and mount it on a circular plate, which may be jointed and screwed to the boiler shell with three or four screws. However, only a personal inspection could lead us to give a decision either way.

[17,364] **Tool Steel; Ethine Compound.** F. C. (Bury St. Edmunds) writes: Will you kindly answer the following queries:—(1) What is the highest percentage of carbon in carbon steel? (2) Is it the voltage (pressure) or amperes (quantity) that is felt in an electrical shock? (3) What is the correct name for the compound of copper and acetylene?

(1) Tool steel contains ·97 per cent. of carbon. (2) The amps., *i.e.*, current; but this is dependent on the voltage or pressure and the resistance of the body (circuit) which has to be overcome. (3) Cuprosovinyl oxide $(C_2HCu_2)_2O$.

[17,313] **Miscellany.** F. H. R. (Hastings) writes: I have been a reader of your most interesting magazine for the last few weeks, but am afraid I have only just discovered that you answer queries by post. I am enclosing four; I hope you will excuse me sending so many at a time. (1) A thermopile, the coupler

composed of No. 16 German silver and copper wire, gives, roughly, ½ amp. 1-12th volt with gas burner (Bottone). Would not German silver and iron give a better voltage? What gauge wire should be used with such proposed couple in order to give ·5 amps.? (2) A good modern dynamo returns 95 to 97½ per cent. of the energy put into it (MODEL ENGINEER handbook). Does that mean that the improvement in dynamos is limited absolutely to an improvement of 4·75 to 2·375 per cent., *i.e.*, that it is an impossibility for a substance to exist which would give, as an electro-magnet, an improvement of, say, 6 per cent. over the cores used in the present dynamos? (3) A thin piece of copper tubing is bent in the middle in a single spiral, like the hinge of a safety-pin, and then the two ends of the tube are immersed in water; heat is applied at the spiral. Air bubbles off (at A only); presently *all* air is expelled, and water circulates very violently up B down A. Could you explain this action? (4) Would it be possible to charge a small 4-volt accumulator off an ordinary electric light main supplying alternating current (200 volts at a frequency of 100) by means of a contact breaker modified so as to pass electricity only in one direction? What lamps should I place in the circuit in order to stop down the current?

(1) Yes; but would it stand the temperature of working? See replies in July 27th, 1905, page 95, and November 16th, 1905, page 478. (2) The efficiency is not likely to be increased much above this figure, as perpetual motion is impossible. You are on the wrong track. Efficiency of a dynamo is the relation between the energy put in and that given out again. (3) The one tube may be hotter than the other, and water of varying temperature has a natural tendency to circulate, being lighter than cold. Hence, once the circuit is completed, the circulation goes on if one part of the system is kept at a different temperature to the other. (4) Depends upon whether this is done efficiently or not. You don't give any particulars of how you propose to rectify the current to either continuous or pulsating unidirectional current. A Nodon valve, as described in a recent issue ("Electrolytic Rectifier") would do. Depends on current required. Probably two or three 16 c.-p. lamps in parallel would do.

[17,334] **Combined Primary and Secondary Shock.** A. W. S. (Gloucester) writes: Can you tell me the correct way to make the connection on an induction coil having primary and secondary windings so as to give three distinct shocks, namely, (1) primary; (2) secondary; (3) combined? I have your handbook on "Coils," but this does not give desired information.

See reply 16,463 in October 18th, 1906, issue, page 381.

[17,344] **Electric Ignition for Petrol Motors.** E. B. F. (Rye) writes: I should be greatly obliged if you could give me your advice on the following points:—With regard to my petrol motor, of which I give a rough sketch. (1) The motor is a 1¾ h.-p., built from castings of the Universal Motor Company, of Derby. I did not build it, but obtained engine only (ready built). It had been running before I had it on a cycle. I have fitted same up as stationary engine, and now cannot get it to start. (1) The carburettor is a Vaurs patent float-feed, made for a 2½ h.-p. engine. I was told this would work satisfactorily with a 1¾ h.-p. engine. Is that so? (2) The coil is a Minerva non-trembler, and I cannot quite understand letters at terminals and connections of same. I have joined up as in sketch. Is it correct? (3) The pulley is connected to a countershaft as shown, the wheel on countershaft being about twice diameter of motor pulley. Two are joined by motor-belt. Should I be able to start motor by means of ordinary pin and ratchet handle on counter-shaft? (4) I have a lever fitted for advancing the spark and lifting exhaust valve. Should the valve be lifted for starting engine in position I have fixed it?

(1) The carburettor should work well enough. Why not use the same carburettor which was used with it at first? We cannot quite follow your sketch, but if you refer to "Petrol Motors Simply Explained," or the article in March 29th, 1906, issue on "Gas Engines," you will get some detailed information on the subject. The positive of accumulator goes to the primary of coil—other end of primary goes to earth—and the negative of accumulator also is connected to earth or, what is the same thing, engine frame. One end of secondary of coil goes to the plug terminal, and other end of secondary to earth. That is the complete circuit, and is the same in every case. If you like, you can bring the return from primary back to the negative of accumulator by means of a wire. *Re* starting motor. No; for we should expect belt to slip. In such a small motor it is not necessary to ease the compression for starting. We think you can pull it over quite easily—though you don't state compression. Of course, retard the spark when starting.

[17,348] **Drawings of G.W.R. "Atlantic" and "ounty Class" Locomotives.** P. N. G. (Shrewsbury) writes: Can you obtain for me, if such has been published in any of the engineering papers, the number containing drawings of either (*a*) G.W.R. Churchward's "Atlantic" passenger engines; or, (*b*) "County Class" of passenger engines, but preferably the former?

Only diagrams have so far been published. You will find a drawing of the "Albion" (No. 171) "Atlantic" locomotive in our book, "The World's Locomotives," by Chas. S. Lake. This and the "County Class" have also been illustrated by diagrams in many of the engineering papers. Look up the back issues at your local library. Since writing the above we find that the *Engineer* of Feb. 22nd, 1907, contains a working drawing of No. 40, the four-cylinder "Atlantic."

[17,317] **The U.S.A. Gallon.** I. D. (Horwich) writes: What is the difference between an Imperial and a U.S.A. gallon of water?

One U.S.A. standard gallon equals 231 cubic ins.; or, 1 U.S.A. gallon equals ·83254 Imperial gallon.

[17,268] **Small Motor Failure.** H. S. G. B. (Lee) writes: I enclose herewith a rough sketch of a small dynamo that I bought second-hand a few weeks ago. It runs well as a motor, with a 4-volt accumulator, but will not light a 4-volt lamp or even ring a bell when driven as a dynamo. I have tried *all* speeds. When driven, large sparks appear at the brushes, but I can get nothing from the terminals. It is connected in shunt, and will not go any better in series. I have had it to pieces, and tested every winding—both fields and armature, and everything is in order, giving N and S. The commutator is twelve sections, with each four sections joined together, making really three sections separated. I have tried all positions for the brushes, and have connected the windings to the brushes in different ways, but the best results are obtained when connected as shown in sketch. It generates current, or the brushes would not spark, but I cannot get current from the *external* circuit. I have read your book on "Dynamos," and also "Avery's A B C," etc., and another book; but cannot find any solution to my difficulty. Should be glad if you would help me, and tell me the output of machine. The fields are wound with a size thicker, and the armature a size thinner, than enclosed sample.

Your machine is intended to be run as a series motor. If, as you say, everything is in proper order, or appears to be, the only thing to do is to examine it carefully till you *do* find something wrong. The trouble is most probably in the commutator. We advise you to fit a new 3-part one. It appears as though the circuit was being partially broken as the commutator rotates, due to imperfect connection between the segments. Do this, and machine will probably run well enough. It is of about 8-watt size, and should run with 6 volts.

[17,321] **Determining Periodicity of Induction Coil Discharge.** W. T. B. (West Kensington Park) writes: I should be much obliged if you could afford me information upon the method of accurately determining the periodicity of the secondary discharge from (1) an ordinary Rhumkoff induction coil; and (2) a Tesla coil. From various scientific works I gather that one method of determining this is by means of a rotating mirror. I have experimented in this direction with a single mirror revolving at a speed of about 1,020 r.p.m., but cannot understand the result I obtain therefrom, which was the reflection of a spark crossing the face of the mirror at the rate of about 90–100 crossings per minute. I am now constructing a revolving mirror consisting of an equal-sided box having four of its sides covered with silvered glass, and capable of being revolved at various speeds. Can you inform how this can be applied to the purpose required?

To measure the frequency of an ordinary spark coil, the discharge of which consists of pulsations in fairly slow succession, is easy, and can be done in various ways. Mount a bright object on a rotating shaft revolving at a measurable and variable speed. Starting with a high speed, gradually reduce it until the object appears stationary when illuminated by a vacuum tube connected to the coil. At this moment the object is illuminated once per revolution, and therefore revolutions per second—frequency. If speeds obtainable are unsuitable, stationary multiple images may be made use of; thus, if the object appears as if stationary in six paces at equal angular distances apart, frequency—revolutions per second multiplied by six. If no suitable method of speed measurement is available, clockwork may be used, the speed of a slower wheel than the one under observation being observed and multiplied by the speed ratio. Again, a disc of paper could be revolved at a known speed for a fraction of a second between the secondary discharge rods, the distance being measured between the holes pierced in it: the calculations for this method are obvious. We have had no experience of the use of revolving mirrors, but would remind you that the speed must be extremely high to show any division between oscillations at frequencies of a few hundred thousand per second. The method is certainly applicable, but we have no details to hand.

[17,346] **Marine Engineer Jobs.** H. F. G. (London) writes: Being an old reader of your paper, THE MODEL ENGINEER AND ELECTRICIAN, I am taking the liberty of asking you the best way for me to get into a marine engineering firm, so as to be able to finish off my training properly. I am in the motor line at present, and have served three years in the motor works. I should be much obliged if you can help me in this matter, as I want to get into something larger, as I consider the petrol engine A B C work.

The only way is to make either personal or written application to the firm with which you wish to get a position. The choice of a firm is an individual matter in which we can do no good in advising, for we do not know how any particular firm is off for hands. Ask to be put on their books, and you will probably be treated in your turn. Personal application is the best course to take. Read the recent replies to similar queries, and perhaps you may get a few more hints on the subject. The North of England is the place to go to, however, for a job in a marine shop—The Tyne, Tees, and Clyde, etc.

[17,360] **Safe Speed of Locomotives on Curves.** A. E. R. (Twickenham) writes: In Major Pringle's (Board of Trade) report on the Salisbury disaster he says he took the centre of gravity as 5 ft. from the rail. Will you kindly explain to me how he got the centre, also the meaning of centrifugal force?

The vertical centre of gravity of a locomotive may be found by carefully calculating the weights and heights above rail level of the various parts of the engine, and resolving the same to one point. We believe one locomotive superintendent—to check his calculations—on one occasion slung a locomotive in the air, and by an adjustment of the point of suspension found by the experiment the exact centre of gravity of the locomotive. We have no further details of this experiment, otherwise we would let you have them. Centrifugal force is the force set up in a revolving body which tends to cause that body to fly from the centre-point of the rotation. The text-book definition we quote is perhaps more precise. "If a body is compelled to move in a curved path, it directs a force outwards from the centre, its amount being found by multiplying the mass of body by the square of the velocity, and dividing the result by the radius of the curved path. A good rule to use is—

$$\frac{W \times R \times S^2}{2936} = \text{C.F. in lbs.}$$

Where W = Weight in lbs. of the body;
R = Radius of circular path in feet;
S^2 = Number of revolutions per minute squared.

If the body weighs 2 lbs., and is running round a path the radius of which is 4 ft. at 200 r.p.m., then the centrifugal force exerted on the material which is keeping it to that curved path will be—

$$\frac{2 \times 4 \times 200 \times 200}{2,936} = 109 \text{ lbs.}$$

or, a force over fifty times greater than the weight of the body itself. In the case of a locomotive engine running round a sharp curve (or any curve for that matter) this centrifugal force acts on the engine at its centre of gravity (or centre of mass) in a horizontal direction, as shown in the accompanying diagram (Fig. 1). The weight, of course, acts in a vertical direction; but when the centrifugal force, due to speed and radius of curve, is sufficient in amount, the centre of gravity moves outwards in the direction of the small arrows, the locomotive turning about the outer rail as on a pivot, and overturning. As the vertical line falls nearer the outer rail the engine becomes more unstable. We have seen a model engine behave in this way. In some cases the movement has only been momentary, owing to the curve being short, and the inner wheel has lifted up (as shown by the arrow in Fig. 2) and dropped down again on the rails without the engine derailing or overturning. The effect of superelevating the outer rail is shown in Fig. 3. The centre of gravity is thrown inwards, and also more weight is thrown on the inner wheels, so reducing the tendency for the engine to overturn in the manner shown in Fig. 2, or, what comes to the same thing, a line drawn from the centre of a gravity to the outer rail approaches more nearly to the horizontal than where no superelevation is present. The exact critical speed, therefore, depends on the speed of the engine, the radius of curved track, the weight of the engine and the height of its centre of gravity, the gauge of the track, and the degree of superelevation.

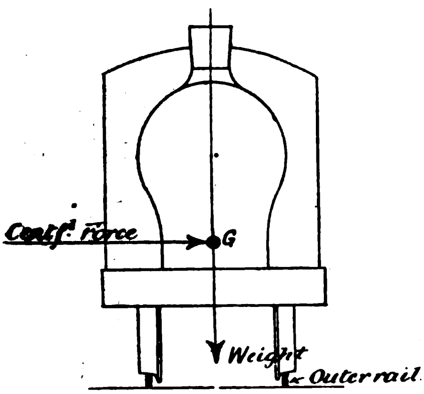


FIG. 1.—SHOWING ACTION OF CENTRIFUGAL FORCE ON A LOCOMOTIVE RUNNING ROUND A CURVE.

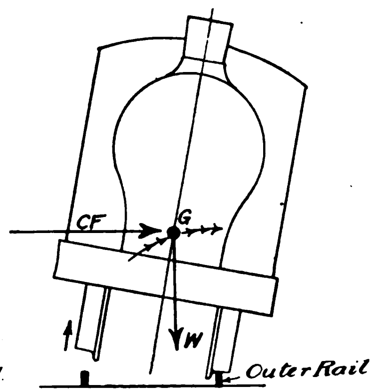


FIG. 2.—DIAGRAM SHOWING CENTRIFUGAL FORCE CAUSING THE INNER WHEELS TO LIFT OFF THE RAILS AND THE LOCOMOTIVE TO OVERTURN.

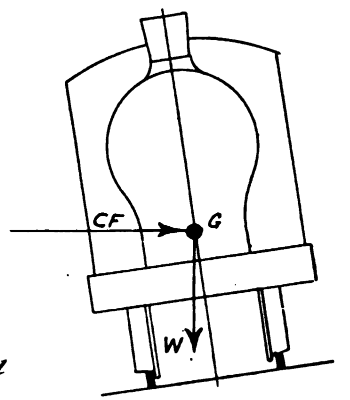


FIG. 3.—DIAGRAM SHOWING HOW THE STABILITY OF THE LOCOMOTIVE IS INCREASED BY SUPERELEVATING THE OUTER RAIL OF A CURVE.

[17,370] **Windings for 150-watt Kapp Dynamo.** "WATT WIRE" writes: In getting parts for 150-watt Kapp type dynamo from your advertiser, I expect they will send wire suitable for 5 amps. 30 volts. What I want is to get more amps. I do not mind if I only get 15 to 20 volts. The wire will most likely come to—for armature, 11 ozs. No. 20; for fields, 4½ ozs. No. 21. Will you kindly tell me what wire I should wind fields and armature with to get 7 to 10 amps. with instead of wire mentioned above. I have your handbook, No. 10, but it does not give anything over 5 amps. on page 49. Also, I have ¼ h.-p. gas engine now putting together from same firm's parts, 2-in. bore, 3-in. stroke; goes well. Will it have enough power to drive 150 watt dynamo? I beg to thank you for your previous advice and assistance.

(1) Armature, 10 ozs. No. 19; and field-magnets, 4½ lbs. No. 20. (2) ¼ h.-p. is barely enough. If you run at high speed and gear suitably, it may just do it.

[17,286] **Model Locomotive Queries.** A. E. G. (Manchester) writes: I am making a model locomotive boiler, 2¾ ins. diameter outside and of ½-in. scale (L. & Y. R. "Atlantic" type), and should be glad if you will answer me the following questions:—(1) If barrel is made of seamless copper tube 1-16th in. thick and end of 3-32nds-in. brass castings, will boiler stand a working pressure of 100 lbs. per sq. in.? (2) What will be the highest water level? (3) What would be the best fuel to use for a firebox measuring inside 3 ins. deep, 1½ ins. wide, and 4 ins. long? (4) Is it possible to make a small injector to suit boiler? (5) If cylinders measure ¾-in. bore, 1-in. stroke, would they be too small? If so, what size would be best?

(1) Yes; if the ends are properly fixed the boiler will stand the required pressure of 100 lbs. (2) The crown should be at least ½ in. below the centre-line of the boiler, and the range of water will be about ½ in. to ¾ in. (3) A small benzoline lamp (see issue of April 27th, 1905, page 387) or a plain methylated spirit lamp. We do not advise you to attempt the same. You are much more likely to obtain success if you adopt a water-tube boiler. See "The Model Locomotive," by H. Greenly, price 6d. net, chapters on "Boiler Design," and "Boiler Construction." (5) Cylinders ¾ in. by 1 in., with valves on top, are the standard. You can obtain both castings and finished cylinders of this size.

[17,331] **Trying to Overload Dynamo.** G. F. H (Plaistow) writes: Would you be so kind as to answer following queries? Having an overtype dynamo which has broken down, I wish to rewind same for 50 volts 10 amps. if possible, or nearest possible output. Underneath are dimensions of same. Length of armature, 3 ins.; diameter of armature, 3 ins.; height of field-magnets from top to base of bobbins, 7 ins.; armature is 8-cogged drum; machine to be wound in shunt; two bobbins, one each on limbs of field-magnet, which is of bipolar type. Machine was wound for 50 volts 5 amps. at 1,700 revolutions I was told when I purchased same. Gauge and quantity of wire to wind above at that output? Speed? Horse-power required to drive same?

You cannot get 500 watts out of a 150 or 200-watt machine We advise you to rewind with same gauge as machine ran with originally. A study of our handbook, "Small Dynamos and Motors," 7d. post free, will assist you.

The Editor's Page.

WE have received a note from the Liverpool Castings and Tool Supply Company, pointing out that the engine of Mr. Rimmer's model steamer illustrated on page 186 of our issue for February 21st was built from patterns owned by them, and that our illustration was reproduced from the same photograph as used by them for their publication, *The Amateur Mechanic.* We are pleased to be able to make this acknowledgment and to compliment the Liverpool Castings and Tool Supply Company on the excellent results achieved by their engine in our Speed Competition.

* * *

"L. A. T." (Newcastle) writes: "I can quite endorse what 'Orlando' says as regards to advertisers giving a description of the goods they have for sale. A few years ago I wanted a dynamo, and seeing one advertised in THE MODEL ENGINEER I wrote for full particulars as to make, size, type, etc. I received the following answer:—'Dear Sir,—In reply to letter the dynamo is 20 c.-p. and is painted red and green and looks well. Yours truly.' No doubt he wondered why I did not write back and say that the dynamo was suitable for my purpose and that he would find P.O. for amount asked and to send it on at once."

* * *

We have just published another little handbook in THE MODEL ENGINEER sixpenny series, entitled "Electrical Apparatus Simply Explained." This is quite an elementary book, and explains in a simple way the working of some of the best known electrical appliances, such as the arc lamp, the accumulator, the battery, the dynamo, the electric motor, the transformer, the induction coil, the voltmeter, the ammeter, etc. It also gives explanations of electrical terms, such as ampere, volt, resistance, electro-plating, circuit, etc. As a first introduction to electrical appliances it will be found very helpful.

Answers to Correspondents.

M. WALKER (Dublin).—A coloured working drawing of a model locomotive appeared in our issue for January 7th, 1904. This can be obtained from our office, post free 3d. There are also several working drawings in our book "The Model Locomotive," by H. Greenly, price 6s. 4d. post free.

A. W. (Rochdale).—Thanks for your letter, which we have read with interest. We shall be pleased to review a copy of your book when ready, and if you will send us your Blackpool address we will insert notice *re* formation of Society.

J. C. (Highbury).—We think you will find Mr. Greenly's book, "The Model Locomotive," give you all the information you need. We would suggest that you also study some of the working models in the Machinery Section of the Victoria and Albert Museum, South Kensington.

J. G. O. (Liverpool).—Full particulars of membership of the Institution of Electrical Engineers may be obtained from the Secretary, 92, Victoria Street, Westminster, S.W.

A. J. J. (Leicester).—Thanks for your appreciative letter which we have read with interest. We still have in mind the competition you refer to, but have not yet been able to settle the details. Letters like yours make us feel "real good."

P. McG. (Co. Clare).—Your inquiry is very vague. Do you mean model boat fittings or *boat* fitting? Any of our advertisers, such as the Clyde Model Dockyard, or Stevens' Model Dockyard, would do the one; and S. B. Sadler, The Quay, Burnham-on-Crouch, would do the other.

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

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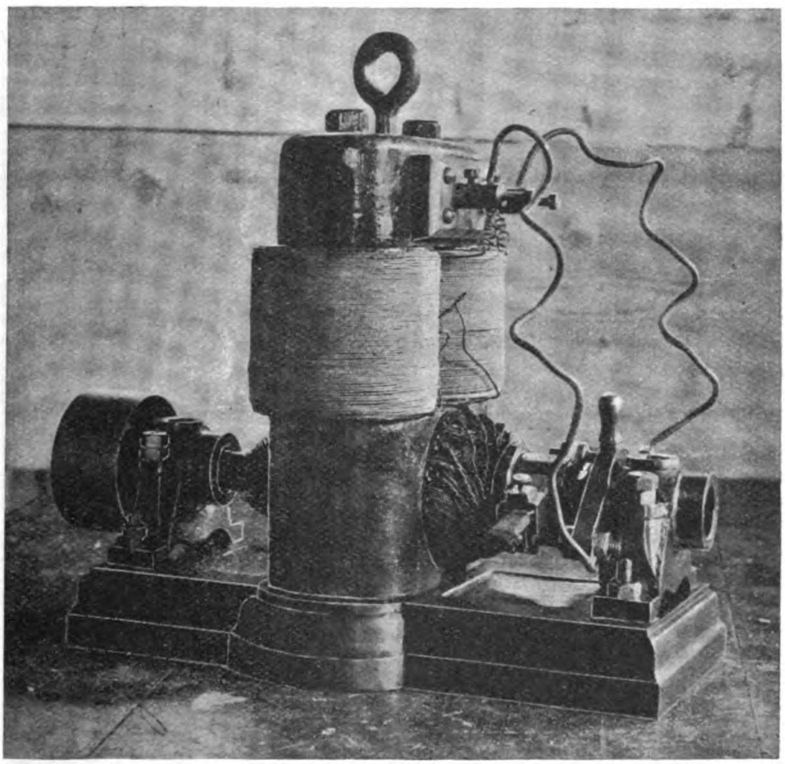
A Small Dynamo for Workshop Lighting.

By G. RANDELL.



MR. G. RANDELL'S SMALL 'UNDERTYPE' DYNAMO.

THE dynamo illustrated herewith was partly copied from particulars given in an early number of THE MODEL ENGINEER. The building of this machine occupied my spare time for about twelve months. The armature, which is 3 ins. diameter, is built up of about 160 laminations, cut out of 28 S.W.G. sheet iron, having a plate of iron ⅛ in. thick at each end. These are held on the spindle by a shoulder one end and a lock-nut the other. There are sixteen slots 5-16ths in. by 5-16ths in. to receive the winding. It is wound with No. 20 S.W.G. D.S.C., put on in two series, thus making sixteen coils in all. The commutator has sixteen sections, and is built up from a casting. They are all cast in one, and cut up after being turned, and insulated from each other by a piece of mica. The brushes are copper gauze. The brush holders and the rocker are gun-metal castings. The bearings are also gun-metal castings, with oil wells cored out, and fitted with an oil ring; the bushes are 1¾ ins. long. The bedplate, being of gun-metal and worked up bright, adds considerably to the appearance of the machine. The field-magnet cores are 1½-in. wrought iron, and the bobbins are built up of tin-plate tube, with brass ends soldered on. These are wound with No. 22 S.W.G. D.C.C. wire. The yoke and pole-pieces are soft grey cast iron; the pole-pieces are bored out 3 1-16th ins. The terminal board is a piece of polished boxwood, with brass terminals. The output of this machine is about 8 amps. 30 volts at 3,000 r.p.m., and weight of machine is about 50 lbs. The dynamo is employed for lighting our workshop, and we have eight lights direct from dynamo. As the gas engine which drives the machine does not run very steadily, we pass the current through the accumulators, and by this means a steady light is obtained.

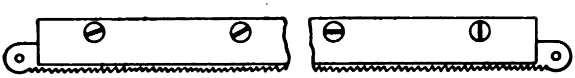
Workshop Notes and Notions.

[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.]*

Renewing Hacksaw Blades.

By JOHN HEYES.

The average amateur, because he cannot afford to buy new blades, uses the worn-out blade unti the teeth will absolutely refuse to grip. Probably many have tried to soften, sharpen, and harden their blades, and the result has been a toothed strip, twisted out of shape. If the following method is adopted, the blades will be straight and devoid of twist.



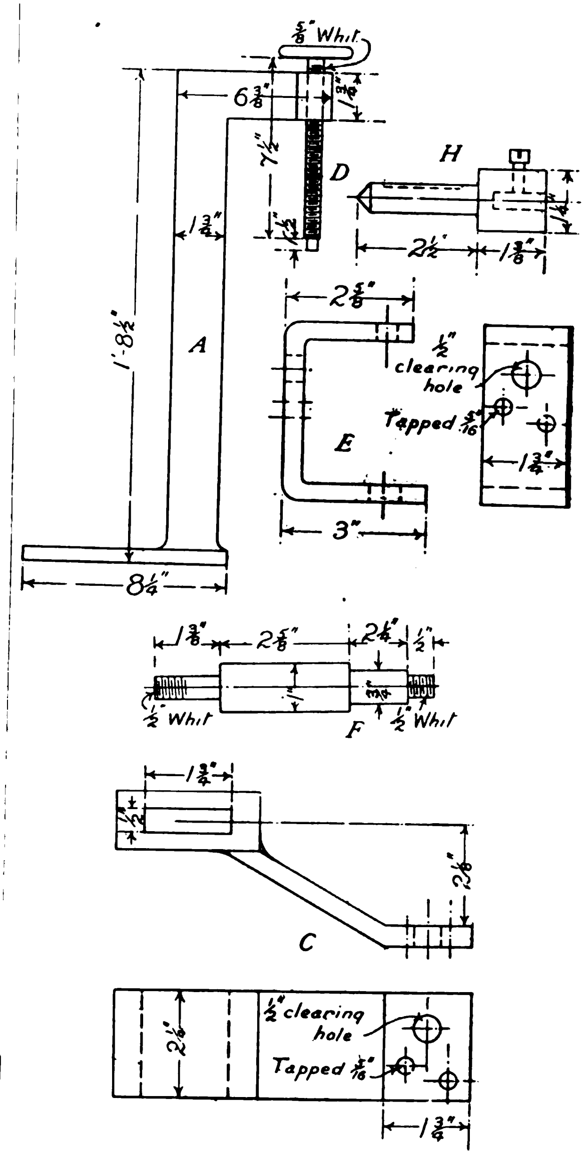
RENEWING HACKSAW BLADES.

Get two strips of iron, 3-16ths in. thick, ¾ in. broad, and almost the length of the blade. Drill and tap four holes to take the screws shown; and in the other strip drill four holes to take the screws. Now, to soften the blade, put it between the strips, grip tightly, and then get the whole to a low, even red heat; allow it to cool gradually, and with a small, fine-cut, three-cornered file go over the teeth. To harden, replace the blade between the strips, get to a low red heat, even along the whole length of the blade; then immerse to a depth of 3-16ths in., tooth edge downward, in a quantity of water. Hold there until all is cold, polish, and let down the ends to a blue.

A Home-made Drilling Machine.

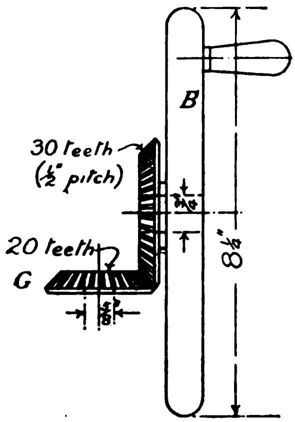
By "READER."

The photograph and sketches are of a handy drilling machine which I have made. The frame A, two brackets C, E, stud F, drill-holder H, and screwed spindle D are all forgings of wrought iron. The wheel on the feed-spindle, the driving wheel B,

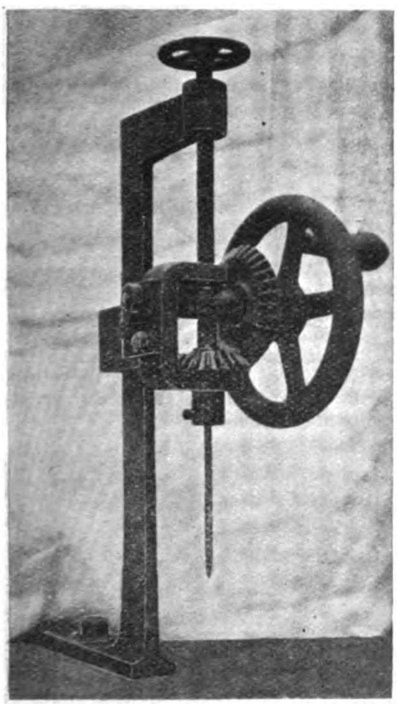


DETAILS OF HOME-MADE DRILLING MACHINE.

and mitre wheels are cast iron. The bracket C has a slot in to slide up and down the frame, one side of the slot being fastened on by 5-16ths-in. set-screws. The bracket E fits on the opposite end of C and is held by two 5-16ths-in. set-screws, and the stud F also helps to fasten it. The driving wheel B and the largest mitre wheel is all one casting and runs on the stud F, being prevented from coming off the latter by a ½-in. Whitworth nut.



Hand-wheel and Bevel Wheels of Drilling Machine.

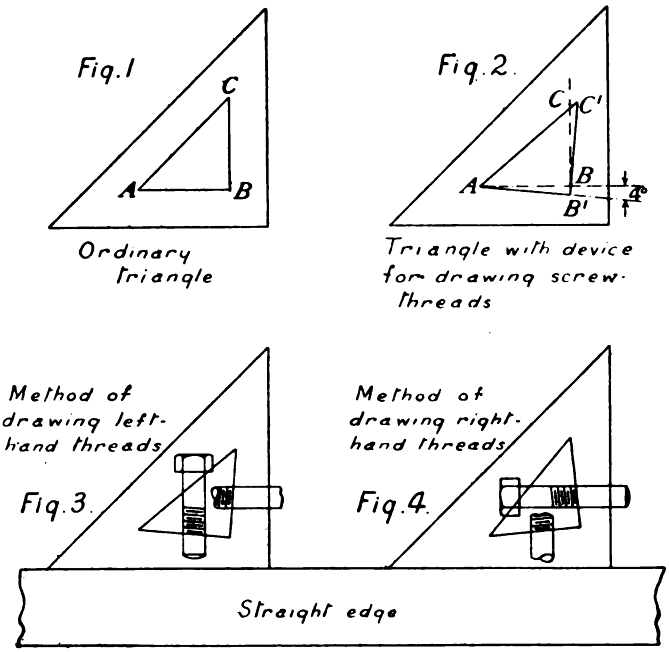


General Arrangement of a Home-made Drilling Machine.

The feed-spindle D, which has a slot round the end, fits into the 7-16ths-in. hole in the top of the bracket E, and the 3-16ths-in. set-screw is just allowed to project into the slot sufficient to allow the spindle to revolve and to hold it in its place. The stud F is countersunk and the end of the drill-holder turned to the same taper.

Handy for Draughtsmen.

A simple device to assist draughtsmen in drawing screw threads easily and more uniform has been described in *Machinery*, and consists of an ordinary 45-deg. celluloid triangle, like that shown in Fig. 1. The lines A B′ and B′ C′ on the triangle are made as shown in Fig. 2, scribing them with any sharp instrument and at an angle of about 4 degs. with the horizontal. With a sharp knife the celluloid is cut away almost down to the lines, and finished off to the lines with a fine file, making smooth, straight edges. Either horizontal or vertical threads may be drawn without changing the position of the



A Triangle for Use in Drawing Screw Threads.

triangle, and right or left-hand threads are drawn by simply turning it over.

Asbestos is mined in open pits, similar to stone quarries, and although it is found in all parts of the world, the mines in Quebec are the most famous, yielding about 85 per cent. of the world's supply of chrysotile. In 1905 the output of the Quebec mines was 50,000 tons.

What is probably the longest 2-ft. gauge railroad in the world has been constructed in German South-West Africa from the Atlantic at Swakopmund—about 21° south latitude—north-east 358 miles to Tsumeb. It is known as the Otavi Railroad, Otavi being an important mining district about 150 miles from the coast. Tsumeb, the new terminus, has mines so important that an aqueduct 14 miles long has been built to bring water to them. The Arthur Koppel firm built the road, which was opened for traffic on November 12th.

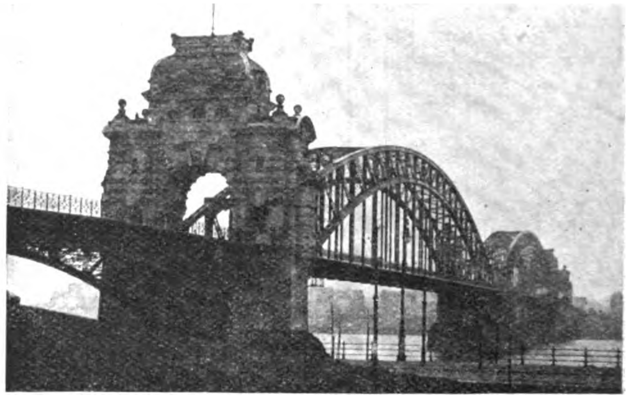
A Model Engineers' Tramp Abroad.

(Concluded from page 223.)

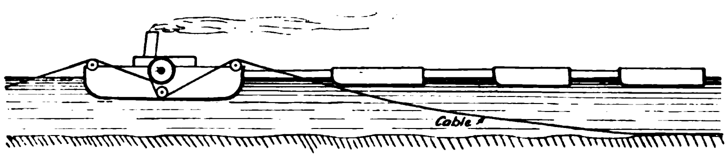
TRAVELLING home from the ancient city of Nuremberg, the most interesting route to choose is that *via* Würzburg, Frankfort, and the Rhine.

Frankfort is a modern city, and, besides its magnificent railway terminus, the tramway system, the river Main and its bridges, it has many features worthy of special notice.

The Rhine and its beauties have been extolled elsewhere, from all time, and therefore we will not dwell on this not unimportant feature of our journey. The bridges, the river craft, and the railway alongside the water, however, interested us as model engineers, just as much as the excellent scenery. The lines are laid on both banks of the waterway winding in and out with the river through cuttings and tunnels of endless variety. Furthermore the railway ticket is available bv either line and by the boat—a most obliging sort of ticket indeed! The tourist can by this means take the Rhine how he likes—n easy stages by rail or steamer; but in all cases where time permits, we recommend the steamer trip as the more pleasant. Sailing up and down the Rhine you get smartly appointed passenger steamers, some of which run express, while others stop at every "port." The skipper of a Rhine steamer is a high and mighty person-



NEW RHINE BRIDGE AT DUSSELDORF, CONSISTING OF TWO ARCHES 197 YARDS WIDE AND 75 FEET ABOVE WATER LEVEL.

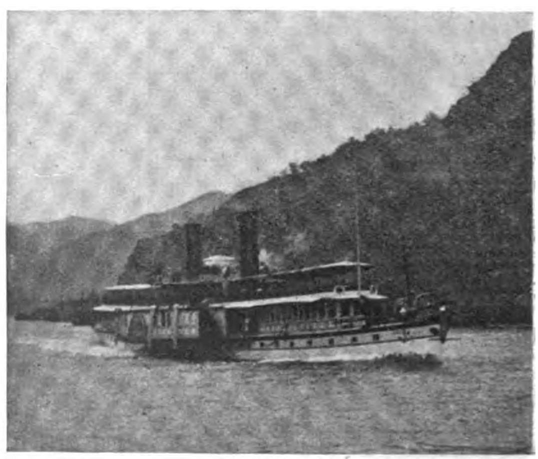


METHOD OF TRANSPORTING GOODS ON THE RHINE.

age—only a little lower than the Kaiser—bedecked in gold lace, and looks as important as he no doubt feels. One good feature of these passenger boats—apart from the excellent cuisine provided—is the method of booking the luggage. On boarding the boat, the purser and his minions take charge of your baggage, giving you a check in exchange in the same way as in a cloakroom. It is labelled with a number, and you are relieved of all further anxiety until the journey is completed.

Although the system has been in operation for many years—it is described in that other fellow's "Tramp Abroad"—our younger readers may not be conversant with the details of the method of propulsion of the cargo tugs on the Rhine. The flow of the stream is sometimes very strong, and it has been found both mechanically and commercially successful to build the boats to haul themselves along by a chain which is laid in the bed of the river, rather than to fit them with paddles or screws in the ordinary way. The system is shown diagrammatically in the accompanying sketch. The rope, or chain, is anchored at each end of the river (so it is a very fair length), and passes in at the bow over a pulley and into the body of the vessel round a drum and out again over another pulley at the stern. Attached to the tug is usually a string of heavily laden barges, as depicted in the diagram.

Another feature of the Rhine is the bridge of boats at Coblenz. This consists of a string of pontoons with a pathway across them, leading from the town to the military fortress of Ehrenbreitstein on the other side. A section of this "bridge" can be folded back and open the waterway for the passage of boats. There is a toll—still commonly levied in Germany—for crossing the bridge; but it amounts to only some small fraction of a penny and, therefore, need not trouble the most parsimonious.



A RHINE PASSENGER STEAMER.

It is not a far cry from Düsseldorf to the frontier of Holland, and we therefore leave the land of the Kaiser for the Hague.

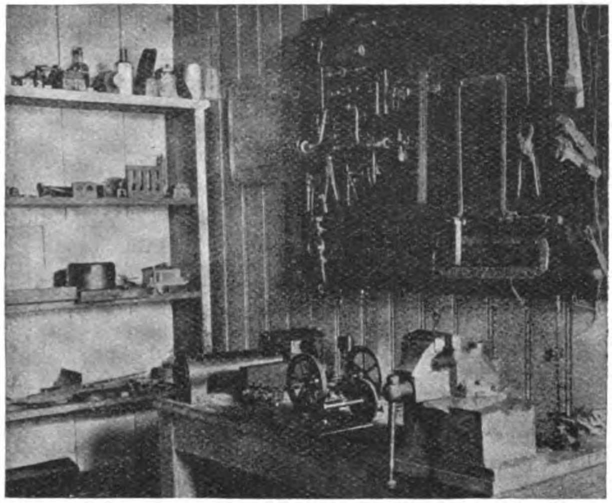
Here we met Mr. J. A. van H. Tulleken, the president of the Dutch Society of Model Engineers, who, by the way, is a First-Lieutenant of H.M. Queen of Holland's Grenadiers, a post which he assured us is no sinecure. They make soldiers work hard—officers not excepted—on the Continent, and therefore he has but a limited amount of time to spare for his favourite hobby. At any rate, the accompanying photographs of Mr. Tulleken's workshop show that the owner has not been idle, and, in addition, it shows that his soldier servant, or "orderly," has not belied his title, in taking care of the contents of the workshop. Mr. Tulleken has made up more than one model steam engine, and is now engaged on

J. A. van H. Tulleken, President of the Dutch Society of Model Engineers.

a model of one of the Dutch locomotives. He has a Drummond 3½ ins. centre lathe, which tool, he mentioned, was very popular with his fellow amateurs in Holland.

At the time of our visit we were apprised of the fact that an exhibition was to be held in the following July, under the auspices of the Hague Society. This Society comprises about twenty-five enthusiastic amateur mechanics, who, although they cannot read The Model Engineer, from time to time have the contents translated for them by their worthy president.

The exhibition opened on July 19th last, Mr. Verbrugge van's Gravendeel kindly lending his private riding school at the "Villa Boschoord" to the Society, with free use of electric light and power. One of the writers managed to spend a week-end in the Hague during the time the exhibition was open, and reported that, considering the small number of members, the "Vereeniging van Amateur-Mechaniciens Archimedes" (The Archimedes Society of Amateur Mechanics) had much to be proud of in their most interesting show. The collection was both excellent in quality and quantity, several

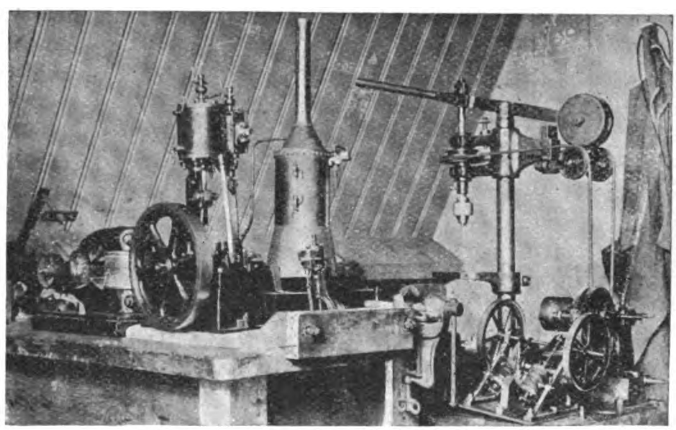


A Corner of Mr. Tulleken's Workshop.

amateurs residing in other Dutch cities contributing to the exhibition. A model-making competition was held in connection therewith, and prizes ranging from £12 10s. to £3 10s. for professionals and £8 to £4 for amateurs were awarded. The "jury," as our friend Mr. Tulleken put it, included Messrs. Janssen Bulthius, Onland van de Kasteele, and Hofman—all engineers and factory owners—and the President and Secretary.

The results of the competition were as follows:—

Class A 1.—A. J. van den Berg (Deventer). Fourth prize for a model horizontal engine and spirit-fired boiler.



Mr. Tulleken's Workshop and some of his Models.

Class A 2.—H. Kramer (Maasstricht). First prize (£8) for a very fine vertical steam engine and horizontal boiler. The cylinders of this model were steam-jacketed and the engine was fitted with governors and feed-pump. The boiler was a coal-fired generator, with feed-water heater, and mahogany lagged.

J. A. VAN H. TULLEKEN (President). Second prize for a model vertical "Stuart" high-speed engine.

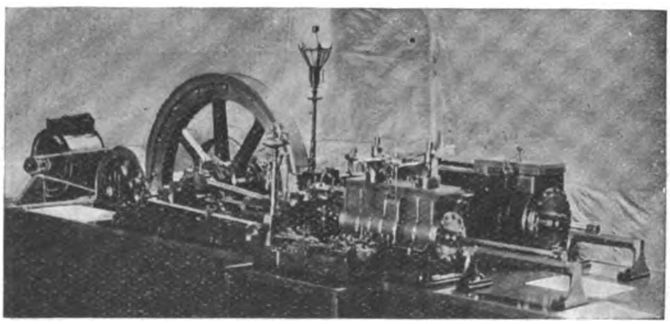
H. TROMP (Secretary of Committee). Third prize for a water turbine, with direct-coupled dynamo.

Class A 3.—H. DALHUISEN (Hengelö). Second prize for a well-finished overtype dynamo giving 50 volts 5 amps.

In the professional class :—

Class B (1).—A. WITTEVEEN, the engineer of the Erste Nederlandsche Katoenspinnery (first Dutch cotton mill), at Hengelö, gained the first prize, value £10, for the splendid model of the horizontal steam engine shown in the accompanying photograph. This model represents the first compound engine introduced into Holland some forty years ago. It drove the machinery of the above-mentioned mill ever since it was first installed until quite recently, when it was replaced by one of more modern construction. The model, which was beautifully made, was shown running by means of an electro-motor connected by a band to a pulley wheel on the shaft. The scale of the model is the popular one on the Continent, viz., 1 to 10.

C. A. VERBERG (second prize). This gentleman is a turner at the Hague Gasmeter Works of Mr. Wilson, and exhibited a valveless model steam engine with a horizontal coal-fired boiler. This very interesting model was an experiment on the part of the maker, having the steam distribution effected by the piston. The piston is hollow and has side channels. At about ¾ of the stroke the piston is partially rotated by means of the crosshead, which slides between two curved guides. On test, the working was rather irregular, but the maker considered he could remedy this defect.

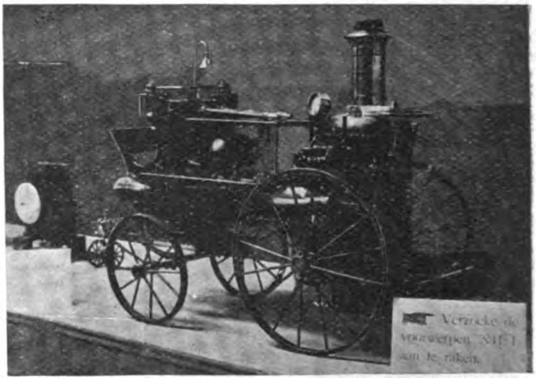


MR. A. WITTEVEEN'S MODEL HORIZONTAL COMPOUND ENGINE.
(Gained First Prize in Class B at the Hague Exhibition.)

P. G. W. LOMMERSE, the engineer at a Coal Tar Manufactory at Rotterdam, gained the third prize with a well-made 3-in. by 4-in. horizontal engine, having balanced cranks and two flywheels.

JAN VAN INGEN, fourth prize for a model 1½-in. by 1¼-in. vertical high-speed engine.

Besides the competition and other private exhibits, the now well-known model supply agency at the Hague, the "Technisch Bureau voor Modellen," of Mr. Zadelhof, provided a very good show of models and fittings, among which were a section of the "Stuart" small power and model engines, and a complete model railway with various accessories, scale model locomotives, wagons, carriages from the firm in the Midlands which the writers need not at the present juncture mention.



A MODEL FIRE ENGINE AT THE DUTCH SOCIETY OF MODEL ENGINEERS' EXHIBITION AT THE HAGUE.

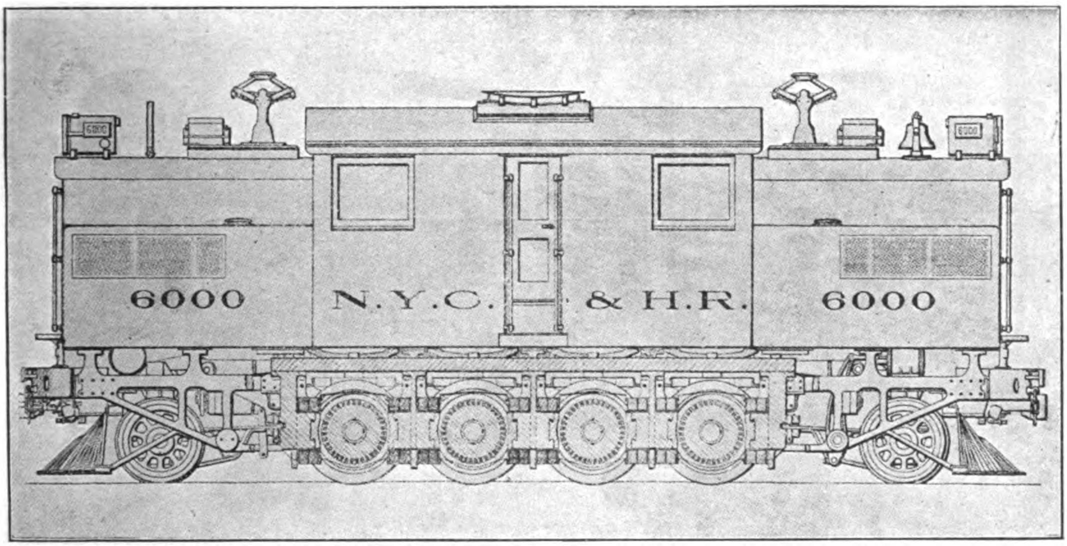
All the models which lent themselves to such treatment were shown working. A shaft, improvised from iron gas tubing, was rigged up on the tables and driven by a ½ h.-p. electro-motor, the models being connected by flexible belts. The hall was open for ten days, a small charge being made for admission to the exhibition, and, we understand from the president, Mr. Tulleken, the affair was altogether a very great success.

Thus concludes our "Tramp Abroad." Within twelve hours of leaving Mr. Tulleken we were at business again, much enlightened by what we had seen during our 2,000 mile journey. We can certainly endorse what one of the speakers said at the time of our paper before the London Society, that everyone should see Germany, those in the engineering profession especially; and, therefore, we take this opportunity of renewing our promise to personally help in conducting any party of model engineers which may be organised by the Society of Model Engineers, or kindred bodies, through the more interesting parts of the Fatherland.

IT is stated that the Italian railway authorities intend to substitute petroleum for coal on all their lines, and that the Government, with a view to the successful working of the proposed change, will reduce the import duty on petroleum.

The Latest in Engineering.

New York Central Electric Locomotives.—Brief reference was made in the last volume to the world's most powerful locomotives, namely, those of the New York Central lines. An American reader has kindly sent us a pamphlet from which we give the following further particulars and reproduce the accompanying illustration of a longitudinal section through the frame, showing the bipolar motors and the field-magnets which form part of the locomotive framework. The armatures are mounted direct on the axles of the driving wheels, and have a free vertical movement between the flat pole-pieces. Formerly, electric motors have been built with each motor an individual unit, and in almost all cases these have been of the multipolar type, which greatly restricts the ease of removing the armature when necessary. The control is of the Sprague-General Electric multiple unit type, permitting two or more locomotives being coupled together and operated from the cab of either one in the same manner as a single locomotive and with the power of the two combined. For the purpose of testing these locomotives under actual service conditions, the New York Central Railroad set aside a stretch of track on one of their main lines west of Schenectady. This was equipped with a third rail for a distance of approximately six miles, a 2,000 k.w. Curtis turbine in the General Electric power-house at Schenectady providing the necessary power. Trains up to eleven cars have been hauled during the trial runs, and with the lighter train a speed of 85 miles per hour has been attained. The record of maintenance for the entire period has been carefully kept, and shows a cost for the electrical locomotive of less than two cents per locomotive mile, as compared with a cost of from 5 to 7 cents per locomotive mile for steam engines in similar service. The following particulars are interesting:—The normal rating is 2,200 h.-p., but while accelerating, 4,000 h.-p. is easily developed. There are four motors of the G.E. 84 A type; the normal capacity of each motor is 550 h.-p. The supply voltage is 660. Normal full load current 3,050 amps. The speed with a 500-ton train, 60 m.p.h. Maximum tractive effort, 40,000 lbs. The diameter of each of the eight driving wheels, 44 ins.: and the four truck wheels are each 36 ins. diameter. The diameter of the driving axles is $8\frac{1}{2}$ ins. Total wheelbase, 27 ft. Total weight of the locomotive is 97 tons. The length over buffer platforms, 37 ft. Extreme width, 10 ft. Height to top of cab, 14 ft. 4 ins.



Longitudinal Section through Frame of New York Central Electric Locomotive.

Electrical Equipment of a Warship.—According to a correspondent of the *Globe*, the electrical equipment of the *Hibernia*, the eighth and last of the *King Edward VII* class, is more comprehensive than that of any other British warship excepting the *Dreadnought*, over eighty electric motors being installed. "The purpose for which the motors are used cover practically everything in the way of power work, with the exception of the main and principal auxiliary machinery. They are even applied to the well-equipped bakery and cooking services, which are capable of keeping the ship's company supplied with newly-baked bread and well-cooked meals." The heavy guns are discharged by motor generators, in place of the electric batteries in the sister ships.

An electric cable railway is being constructed from Bourdeau, on Lake Bourget (Savoy), up the Mont-du-Chat. The line will be about $\frac{1}{2}$ mile long, and rises in that distance a height of just over 1,000 ft.

Kinematic Apparatus for the Study of Mechanism.

THE apparatus here described has been designed by Mr. W. H. Newman, of Totteridge Park, Herts, to facilitate the investigation and to illustrate the properties of such mechanisms as valve gears, straight line motions, etc., and in fact nearly every class of plane mechanism. It is often difficult to understand clearly from a text-book use of the apparatus to be described. By means of it, skeleton models of widely different mechanisms may be built up from the same simple elementary parts and tested in a very short time.

In designing the apparatus it has been endeavoured to make the elementary parts as few in number and as simple as possible. Flat steel rod in different lengths has been employed for all links and sliding rods; on this rod joints can be clamped, or blocks can slide. For joint pins and other purposes, a uniform size of round rod has been used, and provision is made for holding a pencil lead in the end of the pin so that it may trace out its path.

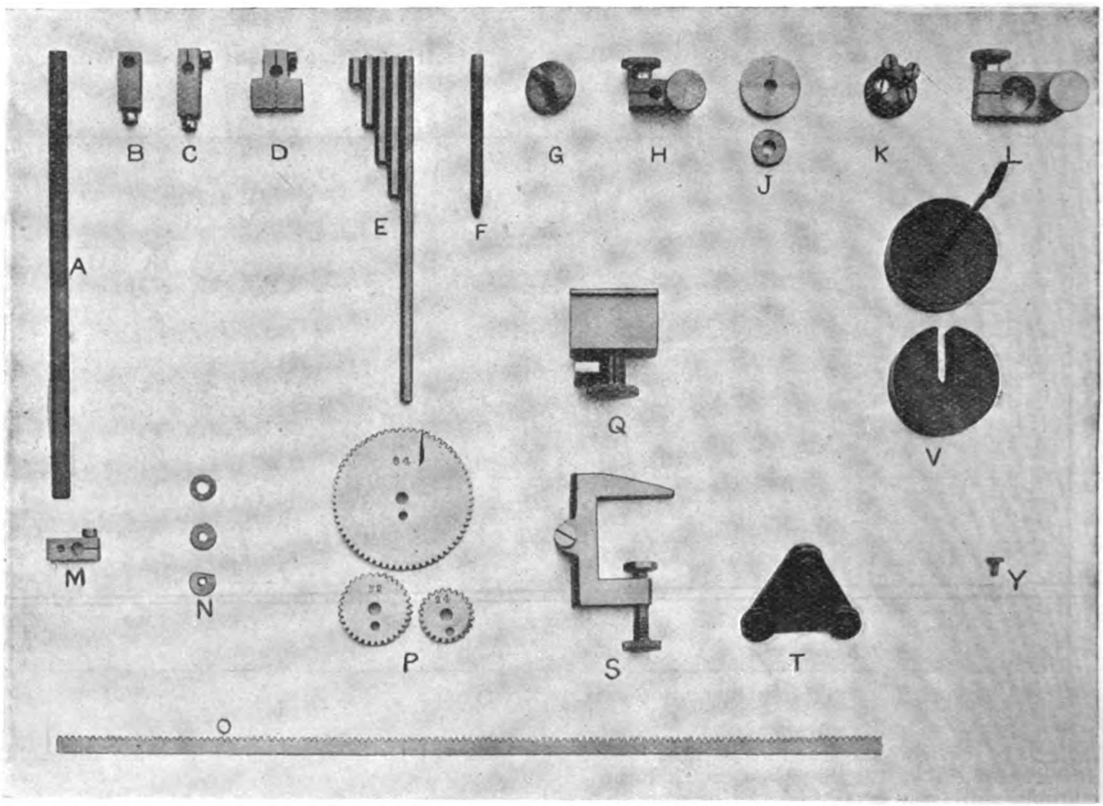


FIG. 1.—SHOWING DETAILS OF MR. W. H. NEWMAN'S KINEMATIC APPARATUS.

description what the properties of a mechanism are, and what will be the effect of altering its proportions, or to comprehend what curve may be traced by a given point on a link. Such difficulties may be lessened by the use of models; but, under ordinary conditions, each mechanism requires a separate model, and unless this be adjustable, the effect of varying the proportions cannot be seen. The properties of a given mechanism may, of course, be worked out very fully on a drawing-board: but this method is slow, and if one requires to test the effect of altering the proportions, the whole process has to be tediously repeated. The drawing-board system is the one generally used in designing new machinery, but the process of arriving at the best proportions may be much simplified by the

The apparatus can be most conveniently used on a special table consisting of two boards divided by a narrow slot in which blocks can slide. This is useful for crank and connecting-rod motions, etc. Bridge tubes can be fixed across the boards in any position, and block-holding pins can be clamped on these so that a fixed pin can be located at any point over the board.

In the following description the details shown on Fig. 1 will be given first, and then a few typical examples of the use of the apparatus will be shown. Each detail is distinguished by a designating letter. In some cases, different sizes of the detail are used; these sizes in inches are given later in the description of parts. Only two sizes of screws are used for the joints, etc.: No. 5 British

Association for the smaller blocks, etc., and No. 2 for the larger.

A is a flat steel rod usually in lengths of ½, 3, 6, 12, 18, 24 and 30 ins. The short lengths are used as packing-pieces to separate two long lengths which are clamped together by clamps K for certain purposes.

A small block (B) of brass forms part of a joint for connecting two links together, clamped on the flat steel rod by the screw, and the hole in it will fit any of the pins E.

This joint (C) is similar to B, except that a clamping screw is provided for the round hole so that any of the pins E can be clamped in the block.

The block D has a long slot in which the flat steel rods will slide easily, and it also has a round hole with a clamping screw similar to C. It is used in any case where a sliding-block is required, or it may be stationary, and used as a guide for a rod, such as a valve rod, etc.

Pins (E) of various lengths, but of the same diameter; usual lengths are ⅜, 1, 1½, 2 and 5 ins. These pins fit the holes in blocks, pulleys (J), and clamps (S). Each pin has a hole at one end, which is tapped to fit the No. 5 B.A. screws. This hole is useful when a joint has to be used in an inverted position, because a screw with a washer can be put in to prevent the joint falling off the pin. The small ferrules (Y) will also screw into the ends of these pins. The 1½ in. have a hole drilled through them from end to end, one end being tapped for a screw, as in the other lengths. A hole through the 1½ in. pin allows a cord to pass through when necesary, and is tapped at one end.

Pins (F) have the end formed as a cutting point and tempered for cutting curves from millboard.

Stationary pins (G) are used whenever a fixed point is required.

The brass blocks (H) are used for supporting the pulleys J in any position and for other purposes.

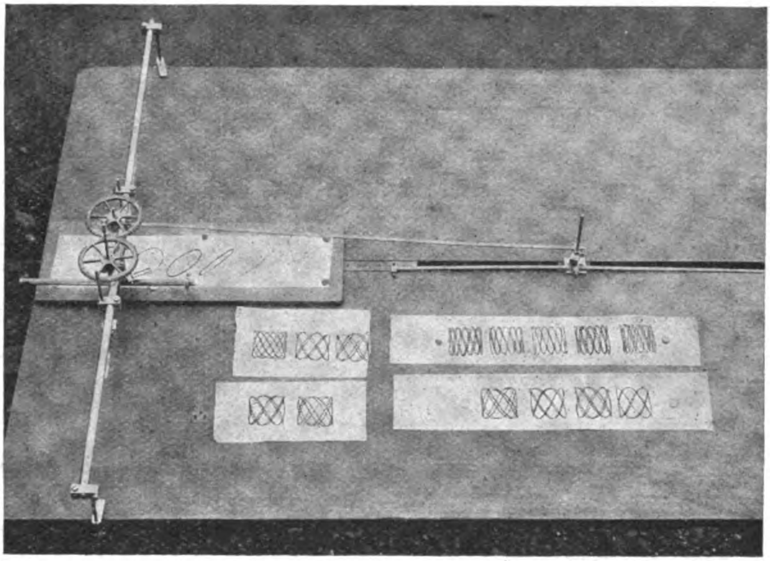


FIG. 6.

There is a groove in the edge of these pulleys for a cord to run over; they are also used as rollers for working against cams. K is a rod clamp for clamping together two lengths of rod (A) in line or at right angles.

The tube clamp L is used for supporting the tubes from the clamp S, or for fixing a pin at any position over the board.

The small blocks (N) can be clamped on pins (E), and have a small hole through which the No. 5 B.A. screws can pass. Used for clamping gears (P) on to pins, etc. A washer (N) should be placed on the screw between the block M and gear wheel P.

The rack O is of the same section as A.

The gears are all of the same pitch. The teeth of these wheels are cut of No. 32 diametral pitch, and therefore the number of teeth in a wheel indicates its pitch line diameter in 32nds of an inch.

Q is a sliding block for table, and slides between the boards of the table, and pins (E) can be clamped in it. It can be clamped in position in the table slot if required by a small cross-bar and screw.

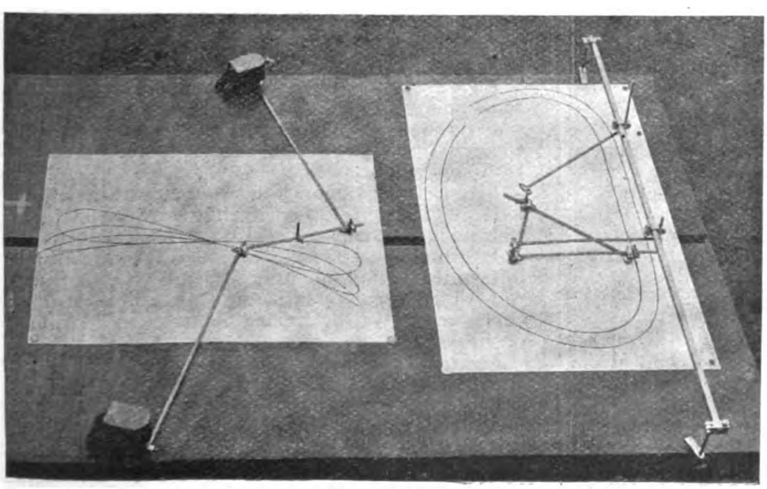


FIG. 2.

T is the link motion swivel, a special attachment used in connection with link-motion valve gears of steam engines. In these gears a curved "link" is used, and as these vary in radius etc., for different engines, a standard link cannot be supplied. In order to overcome this difficulty "links" are cut out of hard millboard to the required radius. On the swivel (T) are three small grooved rollers $\frac{3}{8}$ in., and the "link" is cut of the required width—about $\frac{3}{8}$ in.—to work between the rollers. There is a pin in the base of the swivel of the same diameter as pins (E).

Two strips of wood kept apart by light springs can be pressed into the slot in the table to fill this up when a level surface is required. The weights gear. The link is in this case cut out of hard millboard, and works in a swivelling-block (T). The pins at the ends of the link, to which the eccentric-rods are connected, are fixed by screws passing through the millboard and into the ends of the pins. C blocks are clamped to these pins, and a piece of rod (A) passed through the blocks to stiffen the link. In this case the motion of the pencil at right angles to the valve rod is obtained differently. The valve rod has a rack clamped in line with it; this rack gears with a wheel clamped to a pin having another gear wheel of the same diameter clamped to its lower end. A second rack is geared with this lower wheel, and slides in D blocks parallel to the left-hand bridge tube.

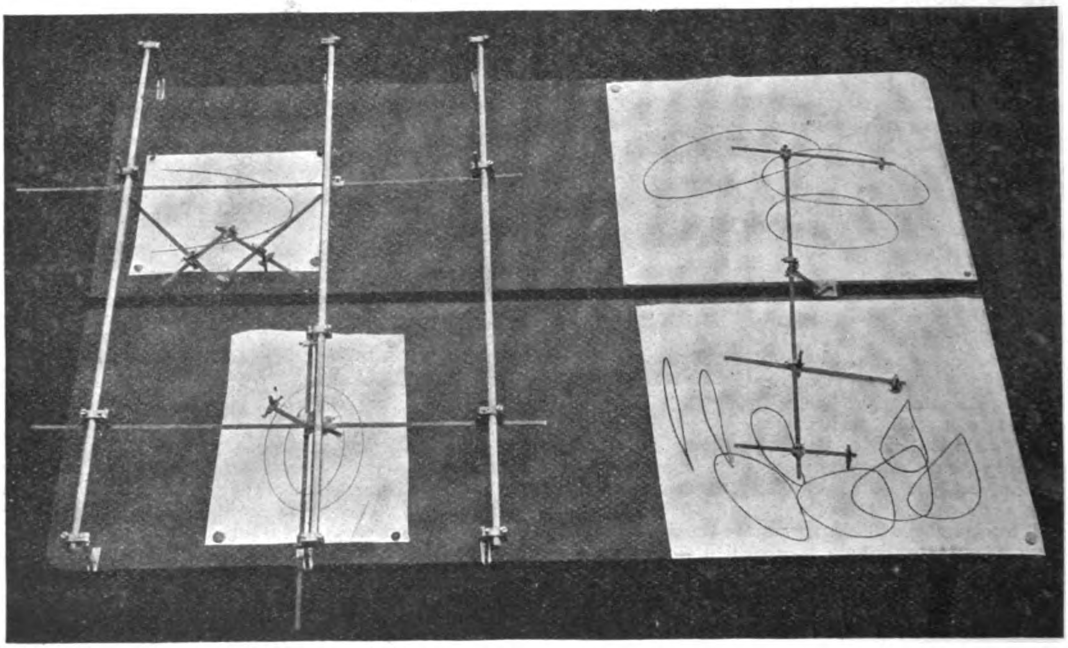


Fig. 5.

shown at V are used in connection with the cord running over the pulleys.

The small plugs or ferrules (Y) screw into the ends of pins (E), and serve two purposes. The hole through the plug is of the same size as the small solid leads which are used for drawing instruments. By the use of a ferrule a lead may be held in a pin (E), which can then be used to trace out its own point path. The ferrule is also used as a guide for a cord, when it is necessary.

Following are some examples of typical uses of the apparatus :—

Fig. 2 shows a Watts' and a Roberts' "parallel motions" arranged on the same board, and the curves traced by the "straight line points." In the Watts' motion the use of the weights fixing the stationary points is shown. In the Roberts' motion the two stationary points are fixed to a bridge tube. The different curves are drawn by altering the position of the tracing point.

Fig. 3 represents a reversing link motion valve

Fig. 4 shows Joy's valve gear. The paths of some points of the mechanism are drawn by a pencil put through the joint pins. The pencil drawing the valve diagram is in this case moved by a cord and weight.

Fig. 5. In this figure the two mechanisms on the left are different forms of ellipsographs. On the right is a mechanism consisting of a crank and a link swinging on a fixed centre. The end of this link and the crank-pin are coupled by a connecting-rod, which is extended in both directions, and the curves are drawn by tracing points fixed at various positions on these extensions.

Fig. 6. This shows the apparatus arranged as a harmonograph. The sliding board is moved by a long connecting-rod driven by a crank on the lower end of the pin to which one of the gear wheels is clamped. To the lower end of the pin in the other gear wheel is clamped another crank, which drives a rod sliding parallel to the bridge tube in the following manner. The crank-

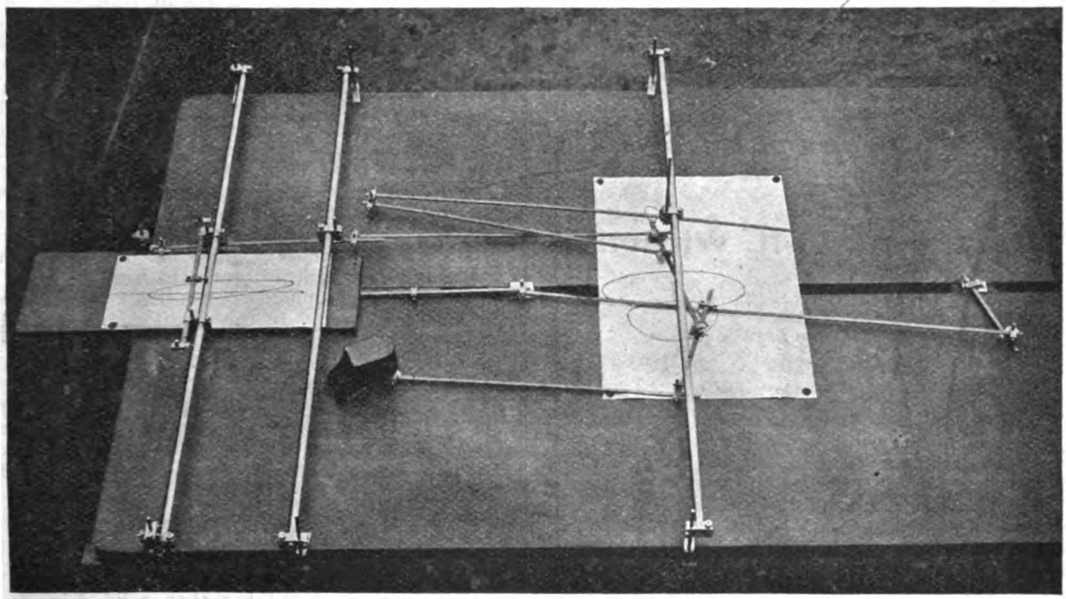


FIG. 4.

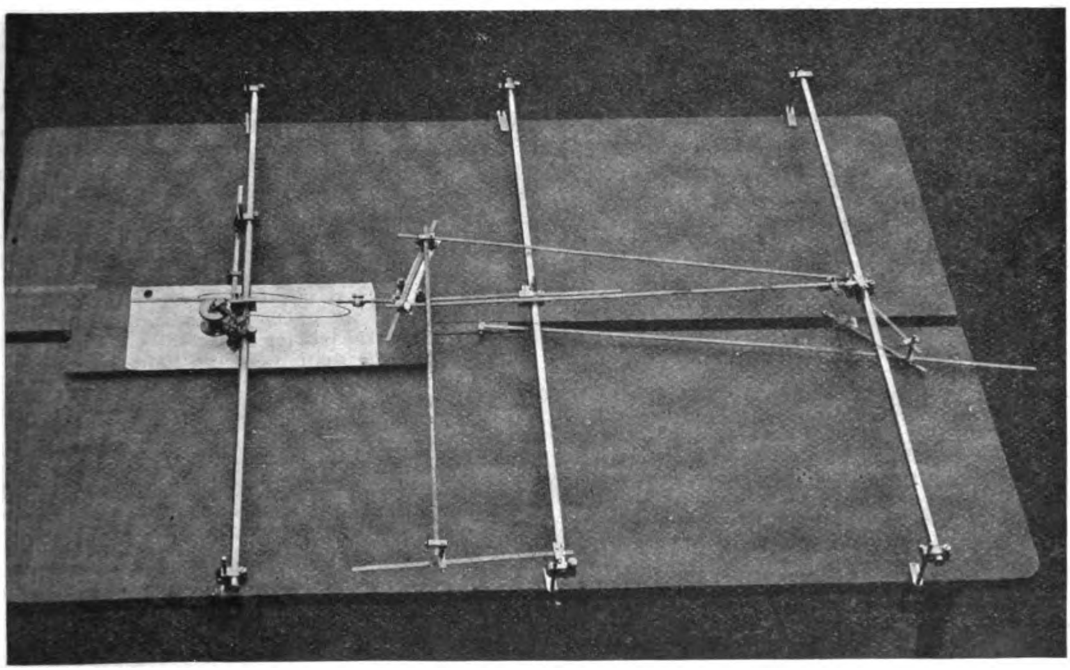


FIG. 3.

SOME EXAMPLES OF THE USE OF MR. NEWMAN'S KINEMATIC APPARATUS.

pin drives a D block, which slides on a rod at right angles to the bridge tube. Another rod is clamped parallel to, and below this rod by a K clamp and packing pieces at each end, so that the rods are separated by a narrow slot. The lower rod is clamped at right angles to the rod which slides parallel to the bridge tube. The arrangement is similar to the crank and slotted cross-head which is used on pumps, etc., and is equivalent to an infinitely long connecting-rod.

A Design for a 20-ft. Windmill.

By F. E. Powell.

(*Concluded from page* 205.)

VII.—The Weight Gear.

THE weight gear itself is shown in Fig. 27, the position at A being the lowest, and at C the highest, limits of the lever arm. This arm is pivoted under the central joist of platform S, Fig. 2, between a couple of simple L-brackets, as shown. It should be placed so as to clear the vertical shaft by a few inches. The outer end of arm carries both the weight *w* (which is adjustable in position) and the end of a chain attached to the heavier weight W. Midway of the length of the arm is a ring, to which is attached the end of the flexible steel rope which operates the revolving head.

The reason for the odd-looking arrangement of weights is to be found in the variable turning effort exerted by the wind at different speeds. In light breezes very little weight is required to hold the tail square with the sails, yet any moderately strong gust would cause the mill to race, and this must be provided against by making it easy for the sails to "run off the wind" in such a case. The arrangement shown in Fig. 27 has this object. In the position shown at A, no portion of the weight W is carried by the lever arm at all, the comparatively light weight *w* and weight of arm itself being all that acts on the flexible wire. The position of this small weight must be adjusted by experiment to give just the pulling effect required.

The large weight W does not come into play until the lever arm has reached the position B. Up to this point, however, the pull on flexible wire has been steadily increasing, as the weight *w* becomes further and further removed from the fulcrum. This increase would not, of course, occur if the flexible wire were free to take up a straight-line position. It is prevented from doing this by the deeply grooved pulley P, and the resulting positions of wire, lever-arm, and weights at the different stages of the ascent would form an interesting and instructive problem in "triangles of forces" for young students to work out.

When the lever-arm reaches position B, as before stated, the heavier weight W is picked up, and as it is lifted higher and higher, produces more and more stress in the flexible rope. This heavy weight might be called the storm-weight. Its function is to pull back the sails after exceptionally heavy blows, and conversely to keep the sails up to the wind as long as the gusts are not really excessive. It is difficult to estimate what each of the weights should be, as so much depends on the friction in various parts of the movable gear—particularly the revolving head—but as near as can be estimated, the following sizes may be adopted: Weight *w*, 4 lbs., 4 ins. diameter, 1½ ins. thick; weight W, 47 lbs., 7 ins. diameter. The smaller weight must be cast with a slotted hole, to slide freely on the arm, and must have a ⅜-in. setscrew one side to fix it tightly in position. The other weight will be spherical, and will have a hook or ring cast in for attachment to the two chains shown.

The weight gear serves also for stopping and starting the mill. By detaching the hook H from ring on lever-arm, all weight is taken off the flexible wire and the lightest breeze is free to turn the sails, so that the plane of elevation is parallel with direction of wind. In this position, of course, the mill ceases to work. A stop is provided to prevent the sails going too far (see Fig. 4), but an additional stop may be made by providing a hook K, Fig. 27, to which H may be hung. The position must be found by trial. Obviously, the whole of the gear should be easily accessible from the ladder, particularly the end of flexible wire for starting and stopping the mill.

VIII.—Shafting and Bearings.

But little has been said—or, perhaps, need be said—on the question of suitable shafting. For the vertical shaft not less than solid ⅞-in. round iron should be used, especially as the bearings are somewhat far apart and the speed comparatively low. The sails should revolve at about 60 r.p.m., and this would make the speed of vertical shaft 120 r.p.m. If this is still too low for the purpose to which the power is to be put, it may be increased by having a large bevel wheel on lower end of vertical shaft, gearing into a much smaller one on a horizontal shaft, which we may call the main-drive. Even this horizontal shaft should not be less than ⅞ in. diameter, and it would be better 1 in. in diameter. The bearing should be 4 ft. apart in the case of a ⅞-in. shaft, and 5 ft. for the 1-in. shaft.

All the bearings may be of the simplest description—those for the vertical shaft being simply cast-iron pedestals, without even bushing if preferred. The top side of bearing may be slightly countersunk to assist in leading oil or other lubricant to the bearing surfaces. The bearings for main driving shaft must be light hangers, and will be the better for having split, adjustable brasses. They will be much cheaper to buy than to make. Any class of pulley could be fitted—even a home-made wooden pulley would prove quite satisfactory, but these details may safely be left to the judgment of the builder, as there is nothing to distinguish them from similar items in ordinary practice.

IX.—Protection of Surfaces.

It is very important that all parts of an exposed structure such as a windmill should be carefully preserved from weather effects. In regard to the timber, either good paint or hot tar will prove efficacious, and the builder is urged not to scamp this work in the slightest. The sails and tail would be very ugly if tarred, and probably a pale-grey mixture of paint would be the most suitable for these parts. Not less than two coats should be applied in any case.

All other timber work, except ladders and handrails, will be best treated by a good coat of hot Stockholm tar. Ordinary coal tar is not quite so good, and its dead blackness is unsightly: the brown colour of wood coated with Stockholm tar is much pleasanter. All parts of timber in contact with the ground will, of course, be specially protected, as already mentioned in the course of these articles.

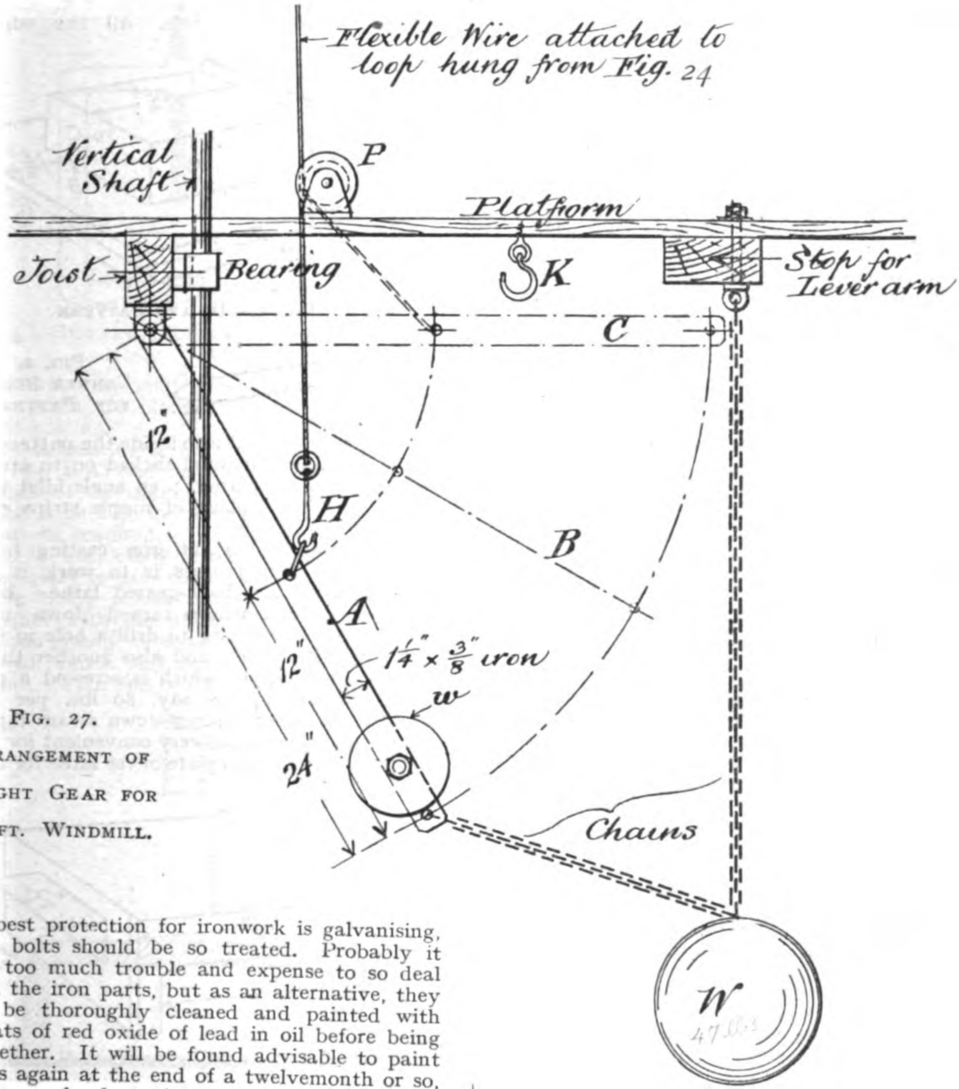


FIG. 27.
ARRANGEMENT OF WEIGHT GEAR FOR 20-FT. WINDMILL.

The best protection for ironwork is galvanising, and all bolts should be so treated. Probably it will be too much trouble and expense to so deal with all the iron parts, but as an alternative, they should be thoroughly cleaned and painted with two coats of red oxide of lead in oil before being put together. It will be found advisable to paint all parts again at the end of a twelvemonth or so, and if properly done the coating may last satisfactorily for several years.

X.—ERECTING.

It now remains to provide a few hints in connection with erecting the mill. This is a job that will require more than one pair of hands, and one or two ladders, a light block and tackle, and some odd lengths of timber and rope lashings will be very useful adjuncts.

Not much can be said—beyond what has already been written—in regard to the erection of the framework. Each of the four poles will be got into position, and shored, and strutted, until the crossbars and diagonals are ready to bolt on. Accuracy of slope may best be attained by means of plumb-bob and rule or a vertical spirit level. The cap casting must be got up after the tops of poles have been sawn off level, but before absolute fixing; and this being bolted in place, will help in steadying the frames and giving final positions of braces, etc. The ladders will then be made and fixed permanently.

The revolving head is the next part to be dealt with, and must be sent up to the top in parts, the lower casting (Fig. 6) first. This will be passed up, and hung in its proper position and secured there by a couple of crossbars nailed to the uprights just beneath it. Wedges may be used to keep it close up against the circular iron ring. This will leave the tackle free to bring up the upper casting, which will be lowered into place after the six small wheels have been properly disposed around the lower ring. The bolts joining the two castings having been put in and tightened, the supporting wedges and crossbars may be removed and the iron ring allowed to take the weight. It is, of course, assumed that all parts would be tried in their relative positions before attempting to erect them.

The next item may be the vertical shaft, to which will be attached its top bevel wheel. It would be easier to get these fixed before the windshaft and larger bevel wheel are put in, which is the next procedure, the bearing cups being then put on and bolted down. The cast-iron spider (Fig. 11) may be put on after the shaft is up, or before, as may be preferred. Probably the latter will save a certain amount of labour.

The sails must now be fitted, and this is the most difficult part of the erection. They will, of course, be prepared on the ground, screwed to the whips, and all bolt holes ready drilled to correspond with those in the spider arms. A still day must be chosen for this job, and a long ladder will be desirable—reaching to top of framework. This will enable two operators to deal with each sail—one on the fixed, and the other on the long, temporary ladder. The sail will be lifted up in correct position between them, bolts inserted, and nuts screwed up. The sail may then be moved one-sixth of a revolution, which will bring the next arm to the bottom, and a rope lashing will be required to keep it there while the second sail is being fixed. The same operation will be repeated until all six sails are up, when the hoop and straining wires shown in the various drawings dealing with the sails may be fixed.

The tail will probably be a somewhat cumbersome object, but presents no special difficulties. Perhaps a strut of 2 ins. x 2 ins. wood tacked to its axis halfway along, and resting with its lower edge on platform S, Fig. 2, will make it easier to insert the hinge bolt.

The fixing of regulating vane, stops, weight gear, etc., presents nothing requiring description, but the owner should carefully go over all the details to see that bolts and fastenings are secure, and nothing left out. All bearings should be supplied with suitable (heavy) oil, and the mill is then ready for its trial spin, and this—the present writer hopes—will be an unqualified success.

A Simple Vulcanising Apparatus.

By Leonard R. Jones.

There are no doubt many readers of The Model Engineer who either ride motor bicycles, motor cars, or ordinary bicycles—at any rate, this is an age of pneumatic tyres, and the following is a description of how to make a simple vulcanising apparatus for repairing both inner tubes and outer covers—an advantage which will be fully appreciated by those who have suffered from detached patches in the hot weather. It may be mentioned, perhaps, that the only thing necessary for vulcanising prepared rubber is to maintain a certain definite heat from fifteen to twenty minutes, according to the thickness of the article to be vulcanised, and the simplest method for this purpose is a small boiler and a pressure gauge.

The first thing necessary is to make a wooden pattern for the boiler, in order to get a casting made from it. Fig. 1 shows a sketch of this, with dimensions attached. It is ⅜ in. thick everywhere. Take care that all the edges and parts taper slightly towards the top. It is most easily fastened together with screws. Fig. 5 shows a sectional drawing of this. All the edges (see

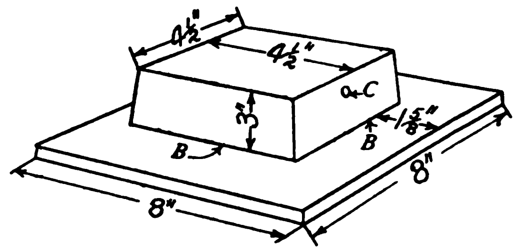


Fig. 1.—Boiler Pattern.

Fig. 2. Corner Fillet for Pattern.

Fig. 1) marked B and also inside the pattern should have angle fillets of wood tacked on to strengthen the casting at the corners; an angle fillet is shown in Fig. 2. They consist of simple strips of wood, triangular in section.

Having obtained a soft-iron casting from this pattern, the next process is to work it up. It must be held in a back-geared lathe; both the top and under surfaces turned down perfectly smooth. It is necessary to drill a hole in the side of the cap (see Fig. 1), and also another the opposite side, into one of which is screwed a pressure gauge, showing up to, say, 80 lbs. per sq. in., and into the other a screw-down steam tap. The writer found these holes very convenient for holding the work on to the faceplate of the lathe for turning.

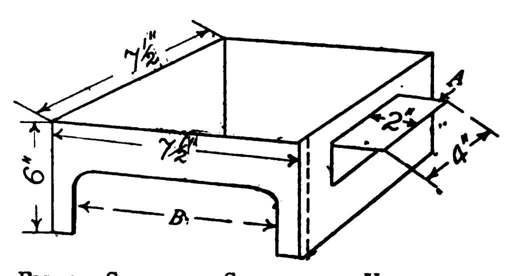


Fig. 3.—Stove and Support for Vulcaniser.

The next process is to obtain a piece of mild sheet steel, ¼ in. thick, and when finished up should be ¼ in. less each way than the bottom of the casting, viz., 7½ ins. square. This should be obtained as flat as possible, and one face turned down in the lathe; only so much, however, should be taken off as to make the surface perfectly even. This plate is then bolted down to the casting by twelve 7-16ths-in. steel nuts and bolts (1¼ ins. long under the head), a piece of steel asbestos being placed between to make the joint steam-tight.

Having finished this, a piece of Russian iron should be obtained in order to make a stove and support for the vulcaniser (Fig. 3). This is bent up as shown in Fig. 3, and the top edge, measuring 7½ ins. each way inside, so as to fit into the flange

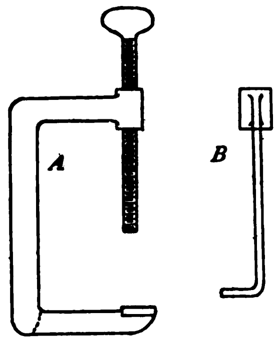


FIG. 4.—SHOWING ALTERATION TO CRAMP.

left by making the mild steel plate ¼ in. smaller each way than the flanged part of the before-mentioned casting.

A piece measuring 4 ins. by 2 ins. should be cut out (Fig. 3, A) and turned up to allow for the spent gases of an ordinary gas cooking ring to escape, also a part B, for the gas-ring to be placed in and out as required. The edge of the Russian iron stove is most easily fastened with iron rivets.

It is necessary to have some arrangement whereby the article being vulcanised shall be brought in close contact with the vulcaniser. For this purpose an iron cramp, as shown in Fig. 4, A, should be obtained, and a part cut off, as shown by the dotted line. This end should then be made red

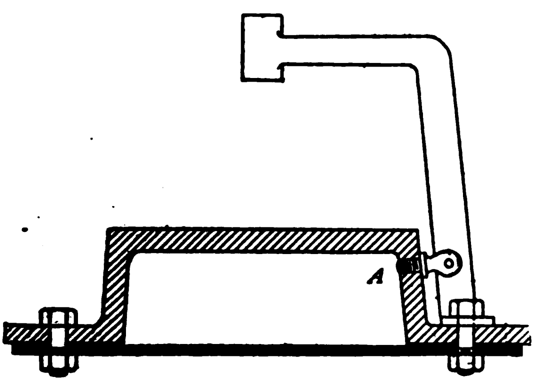


FIG. 5.—SECTION THROUGH BOILER.

hot and bent over to a right angle, as shown in Fig. 4, B. A hole is drilled through this bent-over piece to enable one of the clamping bolts of the vulcaniser to pass through it.

The top angle of the cramp must be altered, if necessary, so that the screw is vertically over the vulcaniser. In order to hold the cramp more securely to the vulcaniser, a small connecting bolt is screwed into the vulcaniser, and itself bolted by a small screw to the clamp (see A, Fig. 5).

Fig. 6 shows the vulcaniser in a finished condition.

As a matter of precaution, it is advisable that some form of safety valve should be fixed; those used for model engines are quite suitable, provided they have a somewhat stronger spring fitted under the valve, and can be screwed into any side of the cap. In order to use it, the following directions are necessary:—

The boiler first being filled three-parts full of water through the screw-down valve, having generated steam by placing the gas stove underneath until the pressure registers 60 lbs. per sq. in.,

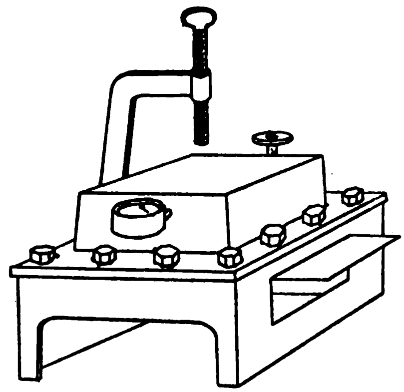


FIG. 6.—SHOWING GENERAL ARRANGEMENT OF SIMPLE VULCANISING APPARATUS.

the temperature is then right for vulcanising, and, assuming an inner tube requires to have a puncture mended, some uncured rubber must be obtained, the puncture in the inner tube carefully cleaned with glass-paper, and some of this uncured rubber placed over the hole.

Prior, however, to this a small piece of stamp-paper should be inserted into the hole so as to prevent vulcanising the opposite side of the tube to the puncture. The tube, being then placed on the vulcaniser (a piece of paper being preferably placed on it first to prevent the tube adhering to it), then slight pressure is applied by means of the screw over the vulcaniser. The inner tube is left in this position for about fifteen minutes at a pressure of 60 lbs. per sq. in.

An outer cover requires rather longer—twenty minutes or so—at a pressure of 65 lbs. per sq. in., and longer according to the thickness of the cover.

AN Indian paper reports an interesting use of undenaturised alcohol for motor car propulsion. It appears that the Shah of Persia bought an expensive motor car which was met by his Majesty at Teheran. The car was unpacked, and its royal owner was anxious to have a trial run at once; but, unfortunately, there was no petrol available. The difficulty is said to have been overcome by the use of old cognac worth about £2 per bottle.

Marine Notes.

A Well-known "B.I." Boat Changes Hands.

After twenty-five years of continual service as a prominent unit of the British India Steam Navigation Company's fleet sailing between London and the East, the s.s. *Goorkha* left the Royal Albert Dock for the last time early in January—not for her wonted destination, but for another sphere of action under the Italian flag. In the course of her long period of service in the British India Fleet she covered close upon 1,400,000 miles, and burned upwards of 250,000 tons of coal. She was built in 1882 by Denny's, of Dumbarton, and was one of the most popular ships with passengers to and from the East. The *Goorkha* will represent a substantial addition to the Italian mercantile marine, and as she is in first-class condition throughout, will doubtless give many years of competent service before her end comes.

Automatic Coaling of Vessels.

The importance, especially where the Navy is concerned, of rapidity in the method of coaling vessels can hardly be over estimated, and it has been the aim of numerous inventors in the past to produce apparatus which shall provide a means of transferring with great expedition large quantities of coal from the depôt to the ship's bunkers.

Recently, trials were carried out in the Mersey, when, as the result of employing two Clarke's automatic barges, H.M.S. *Vengeance* was coaled in an exceedingly short time. Each barge contained 452 tons of coal, and the test was to place between 900 and 1,000 tons on board in a given period.

The automatic barge resembles somewhat a floating grain elevator, and coal is tipped into it in the ordinary manner. The barge is fitted with a false bottom, and between this and the keel bottom there is a space along which runs a continuous chain of buckets. The coal drops into the buckets through a number of sliding doors in the false bottom, and the buckets are conveyed perpendicularly up to a self-acting and self-registering weighing machine. The coal, after being weighed in lots of 5 cwts. each, is automatically tipped into adjustable chutes running down to the deck bunkers, hatches, or the side coaling ports of the ship, as may be desired.

It is said that owing to the simple and ingenious character of the mechanism one man, apart from the engineer and crew, can work the barge during actual coaling operations, and can instantly put the mechanism in motion, slow down, and otherwise regulate it or stop coaling altogether.

In the *Vengeance* test 904 tons of coal were delivered on load from the two barges in 4¾ hours, and it is claimed that this could have been reduced to 3½ hours had a sufficient number of trimmers been available. The officers and crew of the battleship named were loud in their praises of the efficacy of the appliance.

British Shipbuilding in 1906.

The returns relating to shipbuilding in the United Kingdom during 1906 show that Messrs. Swan Hunter and Wigham Richardson, Ltd., of Wallsend-on-Tyne, head the list with twenty-five ships, aggregating 126,921 tonnage; whilst Messrs. Wm. Doxford & Sons, Ltd., of Sunderland, were second with twenty-five ships, totalling 106,158 tons. Messrs. Harland & Woolf, Ltd., of Belfast, were third with eleven ships, equalling 83,238 tons.

The s.s. "Salaga."

This new steamer, built and engined by Messrs. Workman, Clark & Co., Ltd., Belfast, to the order of Messrs. Elder Dempster & Co., recently left the Alexandra Wharf for Liverpool, to be placed on the West African Coast service. The *Salaga* is 395 ft. long, with a gross tonnage of over 3,800. The cargo space is divided into four holds, specially arranged for the reception of consignments of boilers, locomotives, and general machinery. The hatchways to these holds are each equipped with two steam winches of the most powerful type, together with the necessary derricks swung from the masts. Accommodation for a number of first-class passengers is provided in the bridge house, all the staterooms being placed along the sides of the vessel. The dining saloon is situate in the centre of the vessel; a stairway from the saloon corridor leads to the entrance hall on the bridge deck, and opening off it there is a well-appointed smokeroom. Accommodation for second-class passengers is arranged at the after end of the upper deck. The officers' and engineers' rooms are placed along each side of the vessel at the after-end of the bridge space, while the crew's quarters are in the forecastle space. The propelling machinery consists of a set of triple-expansion engines, having all the latest improvements in auxiliaries, and supplied with steam by three multitubular steel boilers working at a pressure of 205 lbs. The boilers are fitted with Howden's system of forced draught.

Model Making for Beginners.

A Simple Pelton Wheel.

By D. Clease.

THE chief feature of this model is its simplicity of construction. It simply consists of a disc with buckets attached, revolving in suitable bearings, and surrounded by a casing to prevent the water from scattering. I made the disc or wheel part, which is 7 ins. diameter by 1 in. thick, of well-seasoned wood. It is built up of two 7-in. diameter by ½-in. thick discs (see Fig. 2), fastened together with the grain of the one disc at right angles to the grain of the other, so as to reduce warping to a minimum. On this wheel I then fastened the cups, which are only eight in number, and which are made out of zinc, being non-rustable. To make these cups I first sketched them from sheet zinc, and then cut them out with a fretsaw. This was rather a tedious job, but when bent to their proper shape, there was no need to solder the joints, and I think this paid for the extra trouble in cutting. The drawing (Fig. 3) explains how the cups were made.

This disc, with the cups attached, was then mounted on its shaft. Having no lathe, I got a friend to turn this shaft for me, also its bearings, which are of brass and of very simple design (Fig. 4), and I think need no explanation. The shaft was turned from ⅝-in. round steel, and is left the full ⅝-in. for a distance of 3 ins. in the centre, the ends being turned down to ¼ in.; 1 in. from each

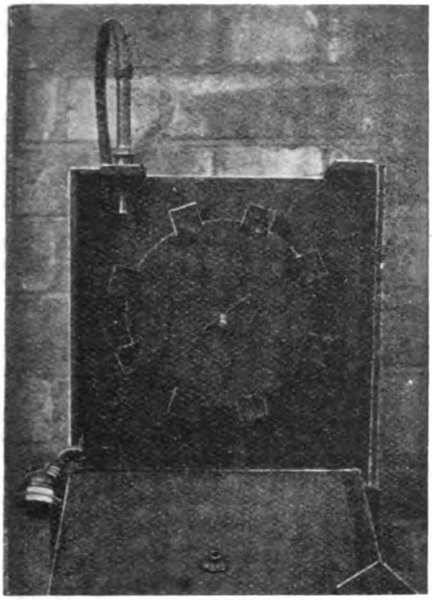


FIG. 1.—MR. D. CLEASE'S SMALL PELTON WHEEL: SIDE REMOVED.

shoulder two holes were drilled to take a nail or suitable piece of wire.

The shaft was then finished and the disc put on, and firmly fastened to it by two nails being passed through the holes and held to the disc by four wire staples. The case consists of two pieces

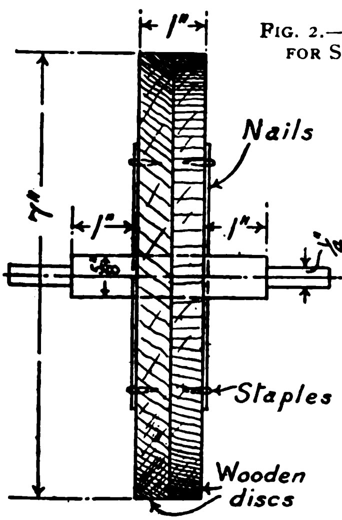


FIG. 2.—WOODEN DISC FOR SIMPLE PELTON WHEEL.

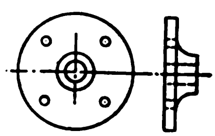


FIG. 4. BEARINGS.

of ½-in. board 12 ins. high by 19 ins. wide. These were securely screwed to a good solid piece for the base, 10 ins. by 2 ins. by ½ in., a hole having first been drilled in the centre of each side for the shaft to pass through.

Over these holes on the outside the bearings were screwed by four small wood screws. These sides are kept the right distance apart by two pieces, 3 ins. by 1¼ ins. by ½ in., through one of which a hole is drilled to take the jet fixed on the top, so as to be exactly over the centre-line of the cups.

The back and front and the top were then covered in by ¼-in. wood, the front cover having a distance

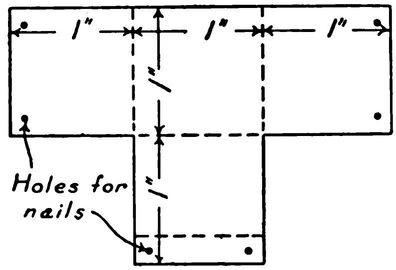


FIG. 3.—SHAPE OF ZINC PLATE FOR CUPS.

of 1 in. sawn away at the bottom to allow the water to pass away.

The top is also arranged to lift off—to allow the inside to be seen. The jet is brass, and fixes tightly in the hole in one of the distance-pieces; it is ¼ in. diameter at the small end, and the angle of taper is 13 degs. It runs very easily, being quite easy to blow round at a good rate, and with a head of 40 ft. it is impossible to stop it by holding the shaft.

The Poulsen System of Generating Electric Waves for Radiotelegraphy.

By R. P. H. G.

(*Continued from page* 225.)

MR. POULSEN has not yet arrived at any very definite conclusion as to the reason for this action of hydrogen, but suggests that it is "intimately connected with its peculiar physical properties. The high atomic velocity of hydrogen results in a great thermal and electrical conductivity, which is probably the chief factor involved in the specific influence exerted by this gas."

The results are further improved by placing the arc in a strong magnetic field, the potential difference of the electrodes being thereby greatly increased in proportion to the length of the arc. An arc only 3 mm. long may be maintained with 440 volts between the electrodes. This enables the self-induction in the oscillation circuit to be considerably increased in relation to the capacity, and therefore raises the potential difference between the coatings of the condenser.

Mr. Poulsen also claims a greater general efficiency for the system when the magnetic field is used, and says that it causes the arc to be more geometrically defined and the oscillations therefore more constant. The windings of the electro magnet used to create the field may be connected in series with the arc.

The effect is still further increased by using an anode of copper and a cathode of carbon, and when large currents are used, the former is further kept cool by being made in the form of a tube closed at the working end and fed with cold water, which enters at the other end and leaves by a pipe inserted in the side of the tube. The end of the anode at which the arc is formed is fitted with a ring of copper, which can be renewed if necessary.

In some cases when both electrodes are of carbon, their ends are very accurately turned to sharp angular edges, and they are slowly rotated so that any change due to the very slight deposition of carbon which takes place is remedied by the presentation of a new part of the edge. The peripheral speed need not be more than ·05 mm. per second. A powerful magnetic field at right angles to the arc forces it upwards so that it bends in a steep arch over the gap. Fig. 2 shows the electrodes of an arc with a water-cooled anode fitted with a renewable ring, as described above.

The arc may be enclosed in a metal chamber, the ends through which the electrodes pass being of marble or other insulating material.

The gas (preferably coal-gas, or hydrogen carburetted by passage through a reservoir of naphtha) is led into the chamber immediately beneath the arc, or even through a channel in the anode. Owing to changes produced in the gas by the oscillations a continuous stream is passed through, but the consumption is small.

The energy which, at a given tension of the feed current, can be transformed into electric oscillation

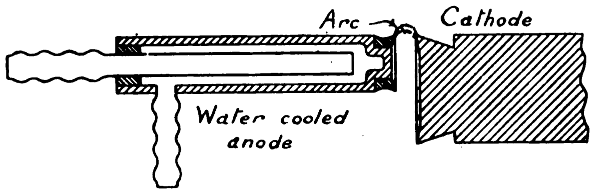


FIG. 2.—ARC WITH WATER-COOLED ELECTRODE.

decreases as the rate of oscillation increases, but for a given number of oscillations it increases directly with the damping in the oscillatory circuit up to a certain point. Beyond that point the decrease is very rapid. Up to a certain point also, the energy increases with the current passing through the arc.

By increasing the number of arcs in series, the power can be considerably augmented, but this has not been found necessary in practice.

With a feed current at a voltage of 440, Mr. Poulsen has obtained an oscillatory power of 1,200 watts, at a frequency of about 160,000 per second; with the same arrangement an increase of the frequency to 240,000 reduced the power to 900 watts.

The above explanations were followed by a remarkable series of experiments, which not only showed the abundance of oscillation energy available from the arc, but demonstrated the extreme accuracy of selective tuning which the method supplies. At a distance of about a yard from the radiating circuit, a vertical resonating coil about 18 ins. high and 6 ins. in diameter, connected to a vacuum tube, was accurately tuned and caused the tube to glow vigorously. On the approach of a conducting body, such as the operator's hand, the capacity was changed sufficiently to throw the coil out of tune and extinguish the glow of the tube.

A larger coil emitted a very powerful brush discharge which appeared to spout from the top, and it was most remarkable to see this die down almost to nothing on the approach of Mr. Poulsen's hand.

Astonishing induction effects were also produced in a single turn of wire which was connected to a bank of four or five ordinary (apparently 100-volt) glow lamps; these glowed at full brightness when the turn of wire was placed a short distance above the exciting coil, and when it was lowered a few more inches they were burned out. A single short-circuited turn of copper held above the coil was rapidly raised to a bright red heat and then fused. The well-known brush discharge effects were produced by means of a Tesla coil with a secondary of 3,000 turns, but when the discharge distance was reduced their place was taken by a 10-in. or 12-in. flaming arc of irregular and variable shape, and somewhat similar to the flame discharge obtained from an ordinary high voltage alternating transformer. A noticeable feature throughout was the quietness of the discharges. The roaring and crackling of the ordinary Tesla discharge, which consists of a rapid series of momentary and violent effects, seemed to be replaced by a slight rushing noise somewhat resembling a stream of burning gas. The flaming arc did not emit a musical note, as do those which are produced by currents at ordinary frequencies; this, of course, is because the periodicity is far above the limits of human audition.

Mr. Poulsen proceeded to describe various arrangements for conveying the energy from the oscillating circuit to an aerial used for wireless telegraphy, and briefly discussed the possible methods of obtaining the changes necessary for signalling by the Morse code. He pointed out that to signal by making slight changes in the frequency of the circuit would involve the use of two wave lengths for each station, and that this would halve the number of stations which could work simultaneously without interference in a given neighbourhood.

Among other devices for this purpose, Mr. Poulsen mentioned short-circuiting a series resistance by means of the signalling key, and altering the length of the arc.

The receiving circuit must be accurately tuned and damped as little as possible so that full advantage may be taken of the resonance principle. The wave detector may be arranged so that it only intermittently forms part of the oscillation circuit. By this means, the damping which would be occasioned by the permanent introduction of the detector is avoided, and the circuit is allowed to get well into oscillation before its accumulated energy is given up to the detector.

The very simple device for attaining this object is known as the ticker, and consists of a small electro-magnetic vibrator, or a toothed wheel in light contact with a spring. Thus, almost any known wave detector can be made to work with this system if a ticker be provided.

The sharpness of tuning with which stations on this system may be worked without mutual interference is in practice about 1 per cent. For instance, two stations transmitting at wave lengths of 600 and 606 metres over the same territory will act without interference on two distant receiving stations which are close together.

Three messages have been simultaneously received on one aerial, the difference in the wave length only amounting to between 3 and 4 per cent. As more energy is obtained with the greater wave lengths, these are used for long distance working, the higher frequencies being reserved with the lower aerials for smaller work.

In June, 1905, signals were received at nine miles after experimenting for a couple of days; this distance was afterwards increased to 27 miles, and communication was established on the same day. Signals were next sent across the whole width of Denmark, a distance of nearly 180 miles, communication being effected, as before, on the day of completing the installation erected for the purpose. The signals were perfectly intelligible even with an energy-consumption of only about 800 watts. The energy radiated was about 100 watts. The potential difference between the aerial and the earth was then no more than a few thousand volts, and the wave-length was from 700 to 100 metres. The signals were afterwards greatly improved by using a stronger magnetic field at the arc, the radiating power being about 400 watts.

On one occasion the apparatus at Esbjerg was fitted up for receiving signals by *spark telegraphy q* the result was a confused and unreadable jumble of signals from various stations, but reversion to the use of the arc instantly restored the communication without the slightest interference from elsewhere. Recently, perfect and unbroken communication has been kept up between Copenhagen and North Shields, a distance of 530 miles, nearly a quarter of which is overland; the mast used was only 100 ft. in height.

The field of speculation and experiment opened up by this discovery is vast, and startling developments may be expected, not only technically, but commercially. Wireless telephony which has hitherto seemed a most remote possibility, now looms large on the horizon, and transatlantic signalling at a comparatively small cost will certainly become possible. Other investigators besides Mr. Poulsen have been experimenting with success on similar lines; it remains to be seen whether their methods of producing undamped radiations can compete with his.

Existing systems of wireless telegraphy must pass away or suffer great changes financially and otherwise, yet the great principle of syntony, without which Mr. Poulsen's system is useless, can be claimed by Sir Oliver Lodge alone. How far the new system will be dependent on his patent rights over apparatus used for tuning will appear in due course, but no impartial person who is intimately acquainted with the history of wireless telegraphy would be sorry to see Sir Oliver Lodge reap the long deferred fruits of the splendid research and experiment for which others have too often taken the credit.

A LIMIT on passenger train speeds has been set by the management of the Chicago, Burlington, and Quincy Railway in a recent order forbidding excessive speeds in making up time or maintaining schedules, it having been decided that the safety and comfort of the passengers are more important than making time. As a guide to engineers, speed indicators have been placed on all passenger locomotives, and instructions issued ordering that time of stops at stations be reduced to a minimum.

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 intended for publication.*]

Concerning Small Lathes.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In a recent issue appeared a letter from Mr. M. W. Burrows, in which he invited criticism of his suggested remedy to alleviate the belt slipping trouble on small lathes. As an amateur lathe-worker of considerable experience, and with all due respect to Mr. Burrows, I have no hesitation in condemning the proposed lathe bed and headstock. Apart from the difficulty in the manufacture, and consequent higher cost of a lathe on the lines suggested, it would be a clumsy thing, the advantages of which I entirely fail to see. If Mr. Burrows wants more power, let him have a larger lathe. If he increases the size of the mandrel pulley, the driving wheel must also be larger in the same proportion, if he wants to maintain the same speed ratio; and if his idea is to obtain more leverage, *i.e.*, a lower speed ratio, is not the back-gear for this purpose? The casting of the headstock in one piece with the bed would, in my humble opinion, be the reverse of improvement. The planing and trueing up of the bed would be rendered less simple, and the means of adjustment would be lost. Slipping, as everyone knows, is a common occurrence in all mechanical contrivances where belts are used for the transmission of power; and although in some cases it may be accompanied by a certain amount of inconvenience, in the case of a small lathe, especially in the hands of an unexperienced amateur, the slipping of the belt is not an unmixed evil. I am bound to confess that to the slipping of the belt at times I am indebted for the safety of my tools and lathe and even for the integrity of my personal anatomy. Let Mr. B. reflect for a moment, what would be the consequence if, say, whilst manipulating the hand-rest, the corner of the tee should accidentally come under one of the jaws of a rapidly revolving self-centreing chuck if the grip of the belt were sufficient to overcome all obstacles, or with a positive drive, say a chain drive for instance. In all machines driven by belts slipping takes place when the resistance exceeds the adhesion between the pulley and the moving belt. In turning metal the resistance varies, of course, according to the thickness and breadth of the shaving being removed multiplied into the circumferential speed of the work. The resistance is also greatly influenced by the shape of the cutting tool and the angle of application. With sharp tools—correctly ground and correctly applied—the adhesion of a round gut driving belt on any well-made lathe in good order is amply sufficient to overcome the tortional resistance of the work and take off quite a respectable shaving from anything up to half the diameter of the speed cone being used, and from larger diameters if a lighter cut is taken. For larger diameters approaching the full size the lathe will take, or for drilling large holes, the back-gear is the thing. There is also no need to have the belt abnormally tight. A great point to be observed is in the shape of the V-groove, both on the driving wheel and the speed cone. My experience is that the angle should be rather acute to get the maximum grip. An angle of 55 degs. gives good results; it should certainly not be more than 65 degs. The thickness of the belt should also correspond with the depth of the groove. Slipping generally takes place when commencing to turn work which is not circular, or is not truly centred, especially if hand-tools are used, as it requires much care to prevent the tool from getting too much hold of the work. The remedy is, of course, to use a slide-rest and put on the feed very carefully. It is also necessary that the tool should be firmly supported as near the cutting point as possible, that the slide-rest should be firmly screwed down to the bed, and that the sliding surfaces should have no shake. It also goes without saying that all these precautions would be of no avail unless the work were in like manner rigidly supported.—Yours truly,

Moscow. G. E. COUPLAND.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I thank Mr. Newton for his letter. Since using raw hide, I have not used any dressing, though I have used it on leather.

Of course, with the headstock cast on the bed, it is impossible to block up the centres, but it is not easy to find a lathe that will answer every purpose, and with a gap I do not think that many jobs would be met that could not be done which the lathe is capable of taking. My own lathe is only 3-in. centres without gap, but as yet I have not wanted to do anything which it would not take except boring out my driving wheel, and that could hardly be taken on the lathe with packed-up heads. I may be wrong, but I certainly prefer a moderately slack belt for all purposes to the seldom-required advantage of a packed-up head, which also introduces complications with the slide-rest.

Another feature of the usual headstock is that the holding-down bolt is too far from the front, and this disadvantage must be much increased when the heads are raised. A larger lathe means more room, as with a bed of the same length the heads take up more room, and so the distance between centres becomes less.

According to the "Metal Turners' Handy-book," Messrs. Tangye make a back-geared lathe with the head cast on the bed. As I have not the volume for 1906 with me, I am unable to refer to the plan described there.—Yours faithfully,

South Shields. M. W. BURROWS.

Nodon Valve.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have been very interested in the different queries, etc., *re* Nodon valve, as I have made one and it also works very eccentric in a 4-volt battery charging from 210 A.C. 50 periods: one half of the battery bubbles away while the other half does not bubble at all, however long I leave it on—as if one 2-volt cell was taking all the current and the other none. I was also surprised at my accumulator running down, until I read your reply in this last week's columns. I also find that by connecting rectifier one way to A.C. mains I get slight shocks both at rectifier and accumulator terminals, but reversing the poles I do not get a shock at all. Which is the proper way to connect?

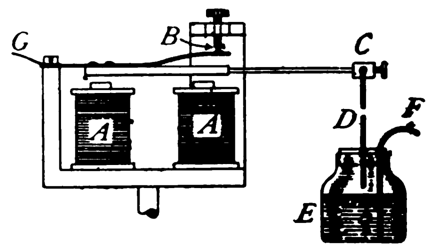
I should think, seeing the interest that is taken in the rectifier, a description of a shocking coil to work with same—passing from 2 amps. upwards—would be very acceptable to many of your readers, including myself.—I remain, yours, etc.,

Llanberis. G. H. J.

A Mercury Break.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I send herewith a description of a modification of the mercury break as described in THE MODEL ENGINEER handbook on "Induction Coils," and which I have found to work well. Instead of employing two mercury caps, there is



only one in use, and, of course, only one dipping-rod. It is arranged as above sketch. A A are the two magnets; B is the contact to actuate the hammer; C is an ordinary small terminal soldered to the end of the hammer in place of the usual knob, and holds the dipping-rod D; E is the 2-oz. bottle containing the mercury; F and G are the two leads to the contact-breaker on the spark coil. With the above break, and calcium tungstate screen, there is very little flickering visible.—Yours truly, GUY STEPHENSON.

The Society of Model Engineers.

London.

ON the invitation of Mr. Oliver Mitchell, a party of the members visited his model track at Ampthill Square on the afternoon of Saturday, February 23rd, and spent a very interesting afternoon watching the running and hauling capabilities of his large Great Northern locomotive exhibited at the recent Conversazione.

FUTURE MEETINGS.—Friday, March 15th: At the Cripplegate Institute, Golden Lane, E.C., at 7 o'clock, lecture by Mr. Snodgrass on "The Design and Construction of Petrol Engines," with special reference to the Napier engine, illustrated by lantern slides. All readers of this Journal interested in the petrol engine are invited to be present, and may obtain a ticket free of charge on application to the Hon. Secretary. Tuesday, April 9th: Mr. Ferriera's paper on "Some Wrinkles in Model-making."

Readers are reminded that the present is a very favourable time for joining the Society, as half a year's subscription paid now covers the period to the end of October next. Full particulars and forms of application may be obtained from HERBERT G. RIDDLE, Hon. 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:

[17,353] **Electro-magnets.** W. F. A. J. (Bedford) writes: I have a small cast-iron magnet (sketch not reproduced) which I want to wind to its greatest power to attract a keeper which will be about 1-32nd in. away from it. Would you be so kind as to help me. I want to know the size of wire to wind it with, and also about the quantity of wire I shall need. I shall work it off one or two Leclanché batteries.

Use No. 30 S.W.G. and get on as much as space will allow. It is largely a matter of trial to get best results. Add an extra cell or two in parallel if they appear to run down quickly.

[17,413] **Hull for 3 h.-p. Launch Motor.** H. R. (Belgrave) writes: Having bought a set of castings 3 h.-p. launch motor, I would like you to give me (if possible) dimensions for a boat suitable for the above motor, and also the approximate cost of building same. What I think of doing, if I can get drawings, is to get a carpenter to make it. Do you think this practical? Hoping you will be able to favour me with above or any other advice you think may give satisfactory results.

Engine would be suitable for a little dinghy, say, 8 or 10 ft. by 4 ft. beam, strongly but lightly built. Some drawings were published in "The Woodworker" for May 16th, 1904 to December 15th, 1904, which would assist you; or, if special drawings are required, we might be able to do something for you through our Expert Service Department. The above issues can be had 3d. each post free. If you paid an ordinary carpenter by time on such a job it will cost you more than having a good craft made at a good boat builders.

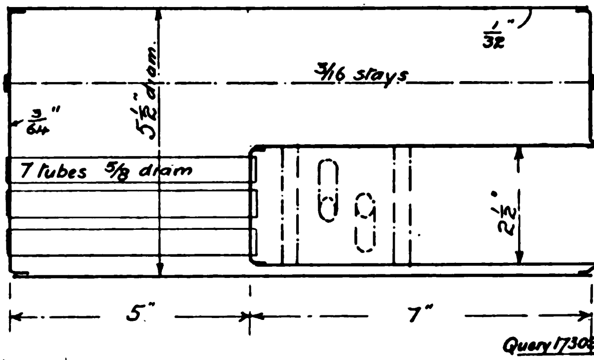
[17,412] **Power for Small Dynamo Driving.** H. J. A. (Tooting) writes: I should be very pleased if you would answer me the following question. I purchased a 100-watt dynamo and they told me it was a 20-volt 5-amp., and it runs well as a motor having a 8-section commutator and laminated armature, but having got some 20-volt 5 c.-p. lamps I fail to get any light from them whatever. Kindly tell me where I am wrong, or should I have lower voltage lamps. I have an ⅛ h.-p. engine to drive it.

To begin with ⅛ b.h.-p. is not enough power; you want ¼ b.h.-p. for 100-watt machine. Get more power and run well up to speed —about 2,500 probably. If possible, get a voltmeter and see what dynamo is giving; also an ammeter could be used in circuit when lamps are on. You have not put lamps in series by mistake, have you?

[17,407] **Oil Engine Trouble.** H. C. S. (Hornsey) writes: Could you give me any answer to the following. I have an oil engine which I have been making during the last eighteen months, 2-in. bore, 3-in. stroke. The valves are made of brass throughout, which are part of the vaporiser, the exhaust working mechanically and the oil and air being above work by suction. The ignition is worked by a brass tube at the back of vaporiser, kept at a bright red heat. When the flywheel is turned round a good compression of air is obtained, also the exhaust opens at the right time as far as I am aware, but I cannot get any one single explosion from same, working with ordinary paraffin and also petrol. The greatest total volume in the cylinder when the piston is at the end of its stroke is 25·3 cubic ins., and when compressed is 9·9 cubic ins. If the vaporised oil is not compressed enough, please let me know the best thing to do.

The matter is one which requires careful trial and inspection. The compression could, with advantage, be greater, but much depends on the design, etc., of engine. It is probably a matter of adjusting the valve settings, and mixture of oil and air to the best proportions. Read our handbook on the subject—"Gas and Oil Engines," by Runciman, 7d. post free. If still in trouble after this, write us again giving fuller details of what you have done.

[17,309] **Model Marine Boiler—Strength of Plates and Seams.** W. S. (Rayleigh) writes: I am making a copper boiler (as per enclosed sketch), to be fired by a paraffin blowlamp, and intend fitting same to a model steamer. I should be glad if you would let me know:—(1) What pressure it would stand? (2) What size cylinder would be suitable for it to keep up that pressure when working? (3) The dimensions of hull it would drive at



MODEL MARINE BOILER.

about 3 or 4 miles per hour? (4) If it would be of any advantage to fit water-tubes across the firebox; if so, number and position of same? (5) If it would be stronger to rivet the boiler together or lap it as per sample enclosed (see sketch below)?

The shell is rather thin. However, you have done the correct thing in deciding to double rivet the longitudinal seam. (1) A boiler 5½ ins. in diameter double riveted should stand a working pressure of 37 lbs. per sq. in., which can be found as follows:—

$$\text{W.P. (factor of safety, 6)} = \frac{25{,}000 \times T \times 2 \times R}{D \times F.}$$

T, D, F, and R, being respectively the plate thickness, diameter of boiler, factor of safety, and riveting allowance (*vide* "Model Boiler Making," price 6d. net, 7d. post free). Worked out, this equation results as follows:—

$$\text{W.P.} = \frac{2 \times 25000 \times 1 \times 2 \times 3}{11 \times 6 \times 32 \times 4}$$

$$= \frac{12500 \times 3}{1{,}000}$$

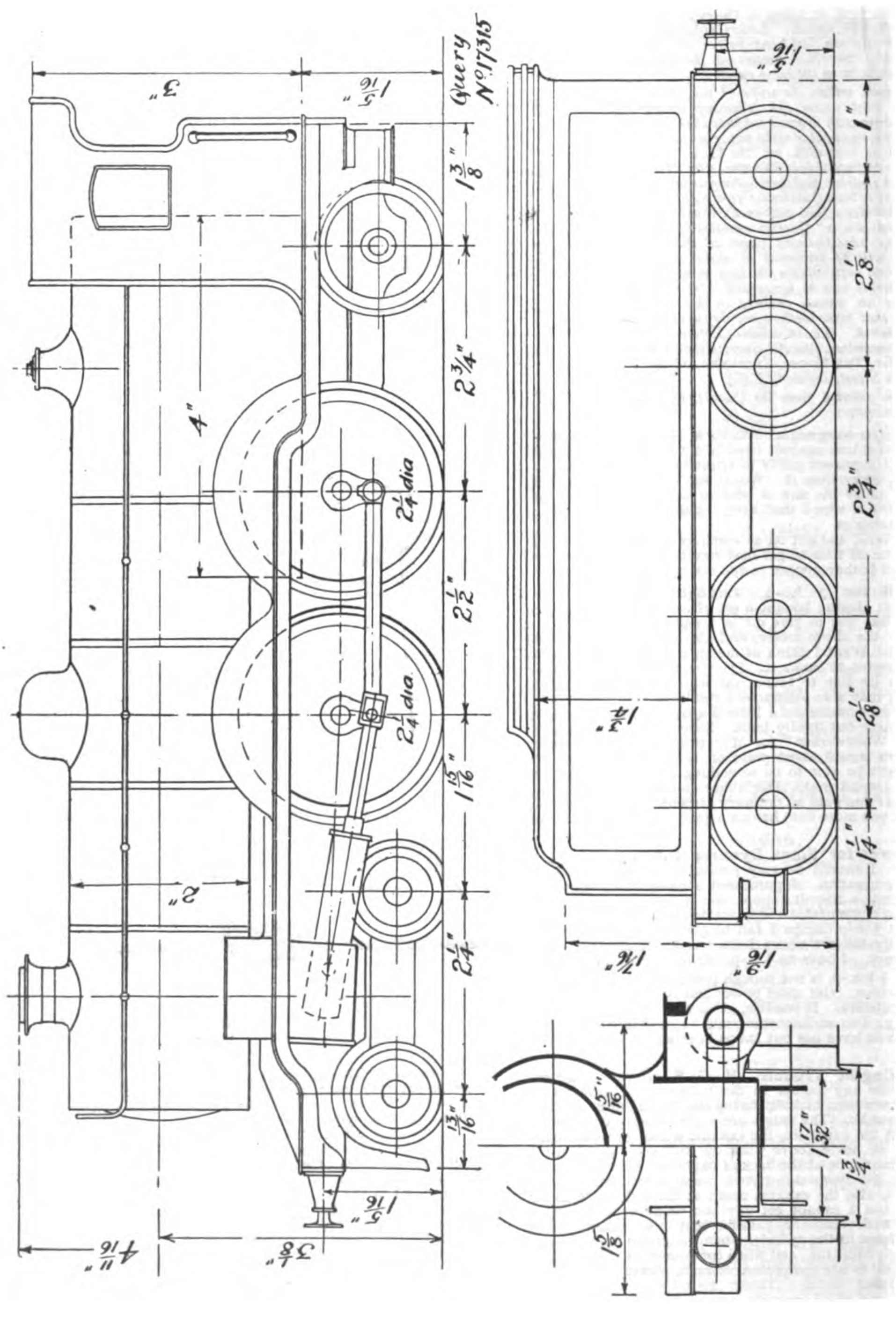
$$= 37 \text{ lbs. per sq. in. approximately.}$$

With single riveting the safe working pressure would have been only 25 lbs. (2) We would advise a ¾-in. by ¾-in. engine. (3) A hull about 5 ft. long by 6½ ins. beam and a draught of about 2½ ins. or 2¾ ins., the exact dimensions depending upon the type of craft adopted. (4) About four water-tubes will do well, but they should be in the back half of the furnace tube nearest to the flue tubes,

PROPOSED LONGITUDINAL SEAM FOR MODEL BOILER.

as we have indicated on your sketch. The water-tubes may be 5-16ths in. outside diameter. (5) If you will turn up our issue of March 15th, 1902, you will find an account of the explosion of a model steamer on the Serpentine, London, which contains drawings and photographs and other useful details of the occurrence. The boiler of this boat was built with a longitudinal seam as you propose. We therefore have no hesitation in advising you to abandon the idea of using this type of joint. As we have shown in answer to your first query, double riveting with a lap or butt strip joint is the only course open to you with the materials you have chosen. If the plate had been thicker, a single riveted joint would have sufficed. The ends are a little thin, so we would advise two stays (3-16ths in. diameter). One may be hollow for the blower, as we very often advise for model locomotives.

[17,340] **Boiler Strength.** H. B. (Glasgow) writes: I started to make a tubular boiler, 11 ins. by 22 ins., and I used ⅛-in. steel for the shell. Since doing that I am afraid it will be too thin to stand the pressure. Could you tell me what it will stand? The crown is 3-16ths in. thick. What power is there in a steam engine, 1-in. bore, 2-in. stroke?



DESIGN FOR A MODEL 1¾ GAUGE "ATLANTIC" LOCOMOTIVE USING OSCILLATING CYLINDERS.

(*Scale: Half full size.*)

With double riveting the boiler should stand a working pressure of 90 lbs. quite safely, but 5-32nds plate would have been advisable so as to reduce the weakening effects of corrosion. With a single riveted lapped seam we do not advise more than 65 lbs. pressure; this, however, should be ample for the engine in question. You can get comfortably about 1-16th i.h.-p. out of a well made and designed 1 by 2 in. horizontal engine.

[17,271] **150-Watt Manchester Dynamo.** W. G. M. (Glasgow) writes: I am making a small Manchester type dynamo, 150 watts, design taken from your MODEL ENGINEER Handbook No. 10, Fig. 12 (to scale). I have turned the magnet limbs (iron) for going through the field coils, which are not wound yet, to 1¼ ins. diameter, and they should be 1½ ins. diameter. Would you kindly tell me what effect this will have, also what alterations (if any) will require to be made in the design.

The machine will not be quite so efficient. Better wind fields with 6 lbs. No. 20 instead of 21 gauge.

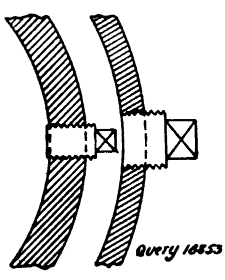
[17,315] **Model 1¾-in. Gauge Locomotive.** C. A. H. (Bolton) writes: I have a model locomotive with oscillating cylinders, reverse gear, etc., 1¾-in. gauge, running on an oval, the round ends of which will be about 2 ft. radius (4 ft. diameter). Could you oblige me with a design of a locomotive which would run on these rails and be a little more like a modern engine? Please say amount of lateral play to allow in axles, etc. I should like to put a Smithies type boiler to new one.

We have carefully considered your requirements and must say that you would do much better with new standard radii curves. The old standard does not give us any scope in designing a suitable locomotive. However, we think that with a bogie having a large amount of side play and a rear pony truck, the annexed design should meet your requirements entirely. You can obtain well-designed castings for all the wheels. We tried at first a four-coupled bogie locomotive, but the shortness of the oscillating cylinders which you propose to use gave a disproportionate design, and also as the rear bogie wheels would have, in an eight-wheeled engine, to move laterally to a much greater degree than in the case of an "Atlantic" locomotive, you should find the latter design preferable to one of the other type. The oscillating cylinders are partly housed in a larger casing, which should be sufficiently large to allow of the unobstructed vibration of the cylinder, and which should be easily removable. The inner boiler can be 1¼ ins. diameter, and should have two or three ¼-in. water tubes. A downcomer is not really necessary, more especially as it would add to the weight of the engine. We would prefer the kind of boiler shown on page 189, Fig. 243, of "The Model Locomotive," to the usual double tube type; the former carries more water, and the paint lasts longer, or if you can obtain it, use a piece of "D" section tube for the double boiler as indicated in Fig. 242, page 186 of the above-mentioned book. You had best find the amount of lateral play by experiment. The frames may be of No. 20 S.W. gauge brass, or of tinplate. Keep the weight down as much as you can, and make all running gear very free.

[16,853] **Repairing Faulty Motor Cylinder Casting.** W. T. (Tunbridge Wells) writes: I have a motor cylinder 4-in. bore, and the walls should be ⅜-in. thick, but there is a bad place half-way down in the casting (spongy). Will it be safe to use it if I bore it out, or will it do any harm if I leave it in? I thought the dirt would collect and wear the piston.

One can only tell by personal inspection. If it is only slightly porous and does not allow the cooling water to come through, then it is all right. If very bad, you should drill the bad place out

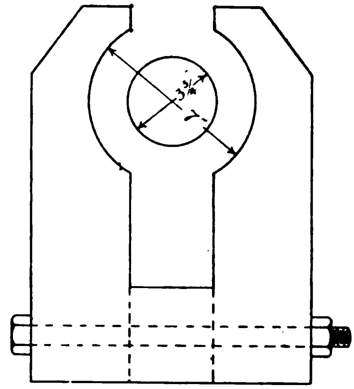
REPAIRING FAULTY MOTOR CYLINDER CASTIN



and fit a screw plug in very tightly, then take a finishing cut off inside cylinder. The section explains how to do the job. You can then rust up both plugs by letting a solution of sal-ammoniac stand in water-jacket for a day or two. The outside plug can be cut off level, or left, as you choose.

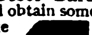
[15,213] **Winding for Ring Armature I.K.W. Overtype Dynamo.** A. W. B. (Otley) writes: I have enclosed a sketch of my dynamo. I shall be pleased if you will give me a winding for it for 110 volts, compound wound. Tunnel is 7 ins. diameter? 3 ins. wide. Spider for gramme ring armature, 3½ ins. diameter 3 ins. wide. Spools for field coils, 4½ ins. long, hole 3 ins. by 4 ins. Commutator, 32 segments. Pole-pieces, cast steel, high grade. Kindly give size required for armature stampings, also complete winding for 110 volts compound wound dynamo; also speed required.

Armature core to be 6¾ ins. outside diameter, plain ring, and wound with No. 18 gauge D.C.C. copper in three layers; about 5 lbs. will be required. We advise you to make inside diameter of ring at least 4½ ins. You will find the wire very crowded inside if made to suit 3½ ins. diameter spider. Wind field-magnet with about 12 lbs. No. 22 gauge S.C.C. copper wire on each



OVERTYPE DYNAMO FIELD-MAGNET.

bobbin for shunt winding, both coils connected in series with each other. Output about 10 amps. at 110 volts; speed about 1,200 r.p.m. It will be better to test the machine for output and speed before deciding upon the compound coils, which can be determined by the method explained in THE MODEL ENGINEER for August 31st, 1905, page 201.

[17,332] **Polished Steel Bars.** J. R. (Bath) writes: Can you tell me where I could obtain some polished steel rod of triangular section or of section like  ? I want to use it as slides for a small 3-in. slide-rest I am thinking of making.

If this section is rolled you will be able to obtain it from G. Adams, 144, High Holborn, W.C. If you have any difficulty get a bright rectangular section and file the bevel to fit the slide.

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 the asterisk have been based on actual Editorial inspection of the goods noticed.*

Instruction for Amateur Mechanics.

There are doubtless many of our readers who would be glad to have occasional instruction in some of the various workshop operations they require to perform from time to time—such as turning, boring, screw-cutting, shaping, brazing, soldering, marking-out, etc. Mr. W. H. Dearden, of 119, Dorset Road, Clapham Road, S.W., informs us that now he has started in business on his own account he is prepared to give day or evening lessons in all branches of mechanical work at reasonable fees; and he is also willing to arrange for amateurs to have the use of tools in his workshop if desired, and to build their models under his personal supervision and instruction. Mr. Dearden's own mechanical skill and experience are such that no amateur could wish to have a more competent instructor.

Notice of Removal.

The Economic Electric Co., Twickenham, London, S.W., have removed their businss to new premises at 26, London Road, having a commodious shop where goods may be inspected, and fitted with a complete plant for accumulator charging and repairing.

The Editor's Page.

SOME few months ago Mr. W. H. Arkell, one of the builders of the model petrol boat, *Moraima*, issued through these columns a challenge on behalf of his brother and himself to race their boat against any other model speed boats. Several people responded to the challenge, but all being then intent upon preparing for our Speed Competition, no very definite steps were taken to bring the race about. We believe that some of those who accepted the original challenge have not yet got their boats completed; at any rate, they did not put in an entry for our Competition, but we think such a race would be a highly interesting and instructive event, and we should be glad to hear definitely from those who would be willing to take part. Mr. Arkell mentioned the matter to us again a few days ago and said that he would very much like to see what the *Moraima* could do against other speed boats. We invite correspondence on the subject, particularly in regard to times and places which would be generally acceptable to intending competitors. If a sufficient number of entries are received we should be pleased either to put up a prize, or to contribute towards one, and to assist in the completion of arrangements.

* * *

In this issue is concluded the series of articles following the design for a 20-foot windmill, which it will be remembered was the subject of our coloured supplement of January 3rd last. Whilst many have undoubtedly studied the details of construction with interest, the building of such a large structure would be practicable only to a comparatively small number of our readers. To the model-maker, however, we throw out the suggestion that a model windmill, constructed, say, two or three times the size of the general arrangement drawing, would be an attractive and fairly easy piece of work. Of course, certain modifications to meet the requirements of a working model would have to be made, but the principal sizes might be adhered to. A model such as this might be employed to drive other small mechanical models.

Answers to Correspondents.

E. D. (Quinton).—About 3,000 r.p.m. You can soon feel if it warms up too much. Use 10-volt lamp if machine gives 10 volts, and candle-power, say, 5. Two or three such lamps could be run in parallel. Power of water motor can only be found accurately by trial. About 1-7th b.h.-p. would be required to drive dynamo at full load. Try it on dynamo and see.

F. R. (Hyde).—You have omitted to enclose your query. We can only find a statement of fact.

R. W. (Mitcheldean).—Any of our electrical advertisers could supply you. State the output in amperes as well as volts, otherwise no one will know what you want.

O. M. (Brimington).—Very vague. It is quite possible for meter to swing 50 amps. when working at 110 volts if 50 amps. are flowing. We do not understand what the trouble is.

P. F. (Southport).—Thanks for your note.

W. B. (Orrell, Bootle).—Query is very vague. See "Petrol Motors and Motor-cars," by White, 4s. 9d. post free.

J. G. (Clayton).—If you enlarge the bore of cylinder ⅜-in. you will get the extra ½ h.-p. required. Alter the other details to suit. We hope to publish the drawings you require shortly.

W. J. H. W. (Homerton).—Please see recent replies to similar queries.

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

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THE
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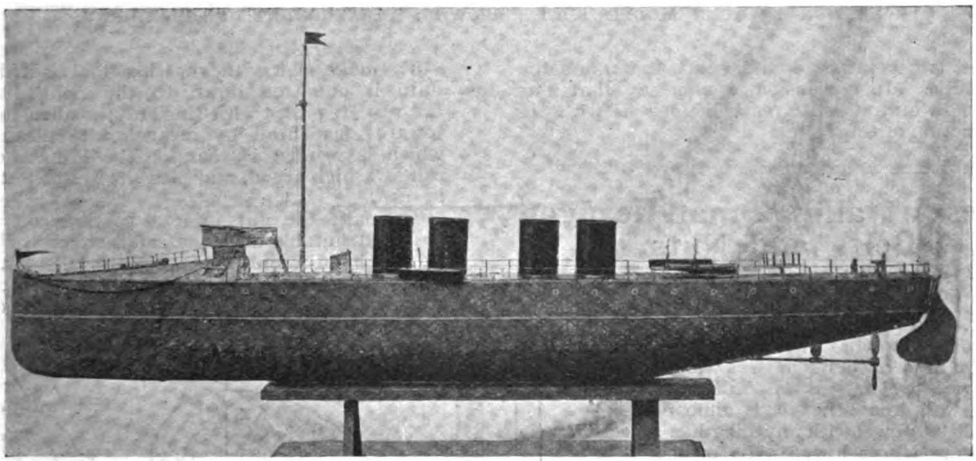
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.
EDITED BY PERCIVAL MARSHALL, A.I.Mech.E.
Vol. XVI. No. 308. MARCH 21, 1907. PUBLISHED WEEKLY

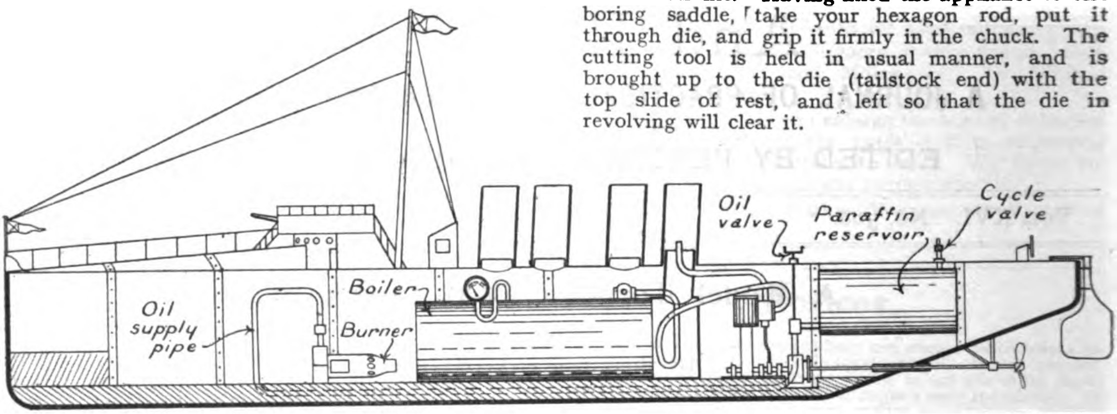
A Model Torpedo Boat Destroyer.

By H. G. and F. L. Wearn.



A Model Torpedo Boat Destroyer.

It is hoped that the following description of a model torpedo boat destroyer, made by two brothers, may prove of interest to readers of The Model Engineer. The length of hull is 4 ft. 8½ ins.; beam, 6 ins.; depth, 6¼ ins.; it is built of No. 24 galvanised steel plate riveted together and soldered, making a very strong boat combined with fair lightness. The engine is ⅞ in. bore by ⅞ in. stroke, and is built up of seamless brass tubing and sheet metal for lightness and also for ease in construction, as we do not possess a lathe. It has a slide crosshead, and cylinder is double-acting piston valve, and is our own design. The boiler is solid drawn copper 12 ins. long, 4½ ins. diameter by 1-16th in. thickness; the end plates ⅛ in. thick and are single riveted to boiler shell; it has a furnace tube 1½ ins. diameter fitted with ten ½-in. copper water tubes. The heating surface is about 100 sq. ins., including smokebox; the boiler has been tested to 100 lbs. per sq. in. by steam. Many readers may think that a 1½-in. furnace is rather small, but we find it answers very well in our case, fired by a paraffin burner, making steam from cold water in three minutes and keeping a pressure of 45 lbs. per sq. in. We have for some time been experimenting with home-made paraffin blowlamps, but with no real success, being a trouble to get the proper mixture of air and gas. The one we have in the boat at present is an "Etna" burner with the hexagon nut cut off, and the end of pipe screwed for a ⅜-in. elbow, which is connected to a ¼-in. oil supply pipe, running from a tank under pressure at the stern. The boat is fitted with a single shaft, the propeller being 3½ ins. diameter; the present speed is about five miles per hour, but we hope to improve on this shortly by fitting twin screws, although we cannot expect wonders, this being our first attempt at boat building. The stand, seen supporting the boat in the photograph, can be fixed to the saddle post of a bicycle for convenience in carrying boat to the water, as readers will admit there is not much pleasure in carrying a boat on one's shoulder a distance of a couple of miles or more to the water. The deck fittings of boat consist of forward and after



SECTION THROUGH MODEL T.B.D., SHOWING ARRANGEMENT OF MACHINERY.

bridges, two boats on davits, chart house, and torpedo tube. In conclusion, I may say that THE MODEL ENGINEER has greatly helped us with the construction of this boat.

Notes on Making Small Hexagon Bolts and Nuts.

(*Continued from page* 195.)

Mr. A. Cope.

Anyone who has tried to make small hexagon nuts or bolts in sizes varying from 1-16th in. to ¼ in. in the ordinary way of turning will know that it is almost an impossibility to meet with anything like success. Special appliances have to be, or should be, made to suit the various builds of lathes. In Fig. 1 is shown an appliance which I made for my 3-in. screw-cutting lathe with boring saddle having T slots. A represents the body, which is a casting. It should be bolted to boring saddle, and the hole bored out to take the die B. It should also be sunk at one side (nearest the fast head) to allow for the shoulder on the die to fit in. A cap or plate C is necessary to keep the die in position, and is shown in dotted lines on A. It is secured by means of two screws. To make the dies, get a length of mild steel rod, and cut up into lengths suitable for the dies. As you will require a die for each size of hexagon rod you are going to work upon, drill holes in them the same diameter as across the flats of hexagons. Now take about 3 ins. of each size of hexagon steel and make some punches, which I did as follows:—File the six corners down to the flat, making the end taper as shown (Fig. 2), also file notches; then case-harden. Each die is made red hot, and then the punch driven in; leave punch in, and allow the die to cool. The punch then serves to hold the die in the chuck whilst you turn it down to a running fit in A. After this is done, you may drive punch out, and ease the inside with small file. Having fixed the appliance to the boring saddle, take your hexagon rod, put it through die, and grip it firmly in the chuck. The cutting tool is held in usual manner, and is brought up to the die (tailstock end) with the top slide of rest, and left so that the die in revolving will clear it.

To make bolts, the cutting tool is fed across until it cuts rod down to the right diameter; the rest, together with this stay, is then fed along towards fast head by means of the lead screw, which is worked by hand. The lathe should be run at a high speed, and plenty of lubricant should be used.

To make the nuts, put a parting tool in tool post and suitable drill in a small chuck (to be held in the hand), and fed up with tailstock. Drill for a distance equal to length of two nuts, chamfer outer edge, and part off, keeping cutter as close to

FIG. 2.

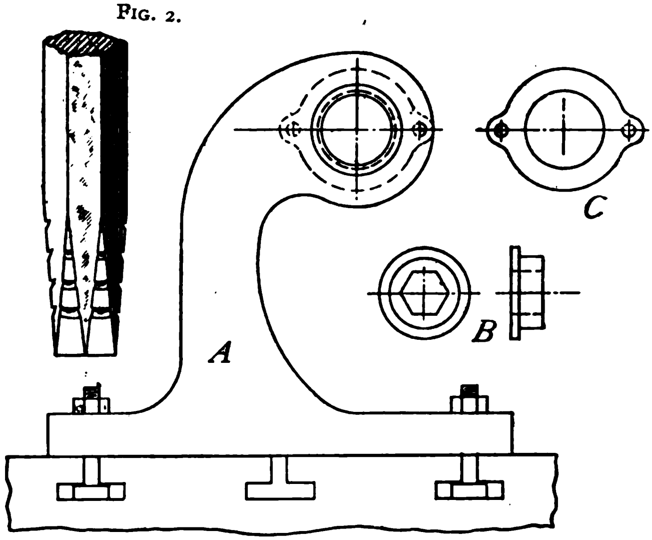


FIG. 1.—AN APPLIANCE FOR MAKING SMALL BOLTS AND NUTS.

the die as possible. I think it is advisable not to drill more than the depth of two nuts at once. Then part one off, and it leaves a centre for the drill to start next time. For these small sizes, the amateur will do well to thread and tap them in the ordinary way with taps and dies. It is also not advisable to try to tap the nuts in the lathe before they are parted off.

Workshop Notes and Notions.

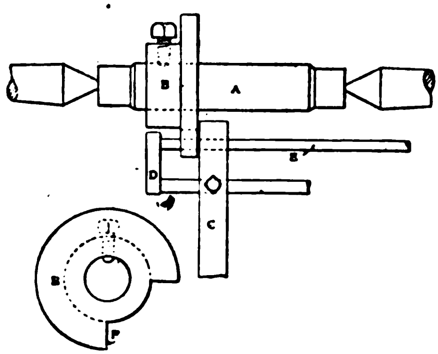
[Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked " WORKSHOP *" on the envelope.]*

Shearing Wire in the Lathe.

Instead of having a shaper rigged for shearing, this work may be done on the lathe, says a a contributor to *American Machinist.*

Swing the mandrel A (see sketch), which has a circular shear B, made of tempered tool steel, on it, between the centres. Fasten a tool-steel piece C (drilled for the wire E to be sheared, and for the stop D, which determines the length of the pieces to be cut) in the tool-post.

Operate as follows: Start the lathe, enter wire E in the hole in C, and press toward stop D; when



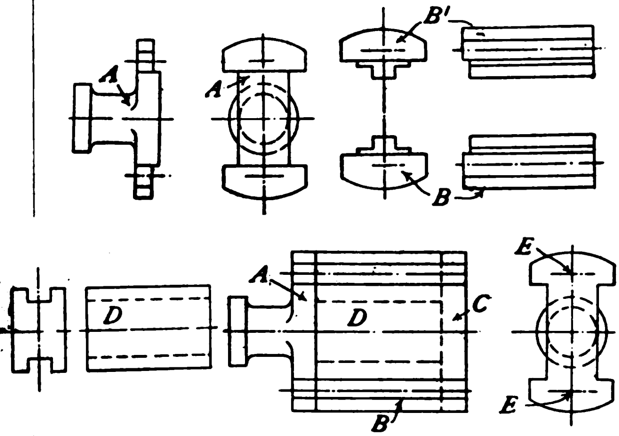
SHOWING METHOD OF SHEARING WIRE IN THE LATHE.

opening B is opposite the hole in C, press the wire up against D, and cutting edge F will shear it off. The piece C can have a series of holes in it to suit different sized wires. The circular shear B will last for a long time, as there is plenty of stock for grinding.

Making a Crosshead for Bored Guides.

By H. GRINSTED.

The following describes how I made a crosshead for bored guides: I first turned a piece of wrought iron down to a sliding fit in the guides and turned one end down to a suitable boss to receive the piston-rod, and then drilled the boss in the lathe. I then filed it to the H section shown, and drilled holes A A to take the clamping bolts before cutting it to ensure perfect alignment of the parts when finished. I then cut it with a hacksaw, along the dotted lines, into five pieces A, B, B1, C, E. I filed the pieces B B1, leaving a tongue about 1-16th in. deep and 3-32nds in. wide, running the whole length on each piece. The tongue was then filed away for about 1-32nd in. from the end of each which was to be in contact with piece A, leaving a D-shaped projection. I next faced the piece A, filed recesses to take the projections on the pieces B B1; fitting the portions



DETAILS OF CROSSHEAD FOR BORED GUIDE.

B B1 into A in this manner prevents them from turning about the clamping bolts when the whole is fitted together. I then cut two similar pieces of brass D, and filed grooves in them, so that they fitted between the pieces B B1, the ends being carefully filed flat and perpendicular to the grooves, and the thickness being a fit into the fork of the connecting-rod end. The outside end of the brasses was filed flush with the ends of B B1 when placed together on the piece A. The piece C was next faced, the whole lot bolted together in positions they held in the solid piece, and the brasses then drilled to receive the crosshead pin.

Loosening Sulphated Terminals.

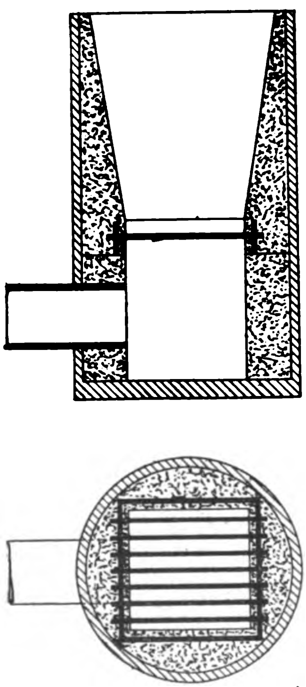
It is sometimes very difficult to loosen the terminal nuts on storage batteries. This is especially true when no great amount of care has been exercised to see that the terminals were perfectly free from the acid or electrolyte used in the battery before the terminal nut was screwed on. In cases where these nuts "stick" it should be remembered that if much force is used the terminal is likely to be torn off. The best method of procedure is probably to use a pair of pliers which have been made fairly hot and to hold the terminal nut with them until the terminal parts are heated through. The nut will then turn quite easily. It is well to cover the screw heads of the terminal with vaseline, after cleaning them thoroughly with acid, before the nut is applied. If this be done, there should be little trouble from sulphating.

A Small Furnace.

By "ARTIFEX."

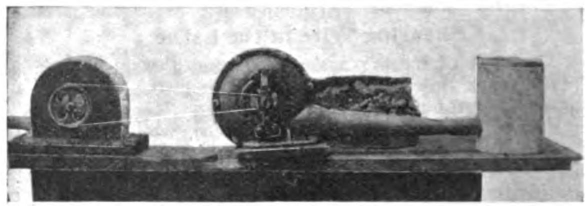
The accompanying illustration shows a miniature foundry. It consists of a forge, furnace, water-motor, and blower. The whole is mounted on an old table which makes it very convenient to use. The sides and base pieces of the motor are of wood; and the casing is of tin. The shaft is a piece of 5-16ths-in. square iron turned down to ¼ in. round in the bearings. The wheel consists of two pieces of wood, with crossed grains, driven on the square and turned down to 3 ins. diameter, being then soaked in paint. The buckets were made from sheet zinc and the bearings are the end of a type-writer roller. They are about 1 in. long. The pulley is cast iron and came off another machine. Before the base was fixed down to the table it was packed with several layers of well-greased brown paper. The water is brought to the motor by compo gas pipe, supported as seen in the illustration, and escapes by the square wooden pipe under the motor. The nozzle was formed by carefully hammering one end of the pipe. The motor runs beautifully, making, as well as I can judge, close on 1,000 revolutions per minute and has plenty of power for the work. The fan was professionally made and has four vanes which fit pretty close to the case. The shaft runs on adjustable centres.

The furnace was made as follows: A large pot was taken and a hole to admit a 1-in. pipe chipped near the bottom. The pipe was placed in position and a square block of wood, nearly as large as the



SECTION AND PLAN OF SMALL FURNACE.

pot, was placed centrally in the pot. A mixture of two parts fireclay and one part sawdust was rammed while wet between the square piece of wood and the walls of the pot for about 3 ins. in height. When this had dried the piece of wood was pulled out and a piece of thin steel strip bent to a slightly larger square than the square hole left by the wood. Slots were cut in two opposite sides of the steel square and little bars slipped into them. The square and bars were then placed on the square hole and the pot lined to the top with fireclay mixture. The square is thus protected from oxidization. The accompanying drawings will, it is hoped, show the method of construction clearly. The forge is a shallow triangular box with one side extended in height. It is filled with fireclay and the front of extended side through which the blast is lead, lined with fireclay. It can just be seen behind the blower. Either the forge or furnace can be used by slipping their supply pipes to a fit on the tapering blast pipe.



ARRANGEMENT OF WATER MOTOR, BLOWER, AND FURNACE.

This little set is very useful for small brazing, forging, and particularly for steel hardening and tempering. The temperature of the furnace can be regulated by adjusting the water tap supplying the motor. The fan delivers a good volume of air at a steady pressure and being power-driven gives a steady heat and allows the operator to concentrate his attention on the work in hand.

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.]*

POCKET BOOK OF AERONAUTICS. By H. W. L. Moedebeck, O. Chanute, and others. Translated by W. Mansergh Varley, B.A., D.Sc. London: Whittaker & Co. Price 10s. 6d. net; postage 3d. extra.

So many people are now taking a serious technical interest in aeronautics that the publication of this work seems very appropriate. Its various chapters deal with Gases; The Physics of the Atmosphere; Meteorological Observations in Balloon Ascents; Technique of Ballooning; Kites and Parachutes; On Ballooning; On Balloon Photography; Photographic Surveying from Balloons; Military Ballooning; Animal Flight; Artificial Flight; Air-Ships; Flying Machines; Motors; Air Screws, and Aeronautical Societies. The information given not only comprises an historical survey of the work of various experimentalists, but includes a great deal of information on practical operating with the various devices described, and formulæ, rules, and tables for calculating proportions and results. There are nearly 500 pages of matter and over 130 illustrations. We cordially commend the enterprise of the publishers in placing such a practical and encyclopædic reference book at the disposal of aeronautic workers.

TECHNICAL ELECTRICITY. By H. T. Davidge, B.Sc., M.I.E.E., and R. W. Hutchinson, B.Sc., A.M.I.E.E. London: W. B. Clive. Price 4s. 6d. net.; postage 4d.

The majority of text-books for electrical students which have hitherto been published have belonged to one of two distinct types—they have dealt with the appliances of the class-room, explaining the theory of the magnet, the compass, the galvanometer, the primary battery, the Leyden jar, and the condenser, or they have dealt with practical uses of appliances of the engineer—the dynamo, the incandescent lamp, the arc lamp, the motor, the bell, the telephone, and the accumulator. The present volume is an attempt to bridge the gap between these two types of book and forms a very welcome addition to technical literature. In it the student is given an excellent introduction to electrical engineering in a scientific way. He is first well drilled in dynamical definitions and units and is then successively introduced to electrostatics, magnetism, and current electricity. In each case the fundamental principles of the subject are first expounded and the student is then made acquainted with the applications of these principles to engineering practice. Published mainly with the object of assisting students preparing for examinations it may be pointed out that the book covers completely the ground of the Preliminary and a portion of the Ordinary Grade of the City and Guilds of London Institute Examination in Electric Lighting and Power, and also Stage II of the Board of Education Examination in Magnetism and Electricity. But apart from its uses as an aid to such studies we can strongly recommend it to all young electrical engineers who want more than a visual acquaintance with the appliances which come within their care. Numerous examples and test questions are given, while the illustrations are profuse and well prepared. Moreover, the book is extremely moderate in price.

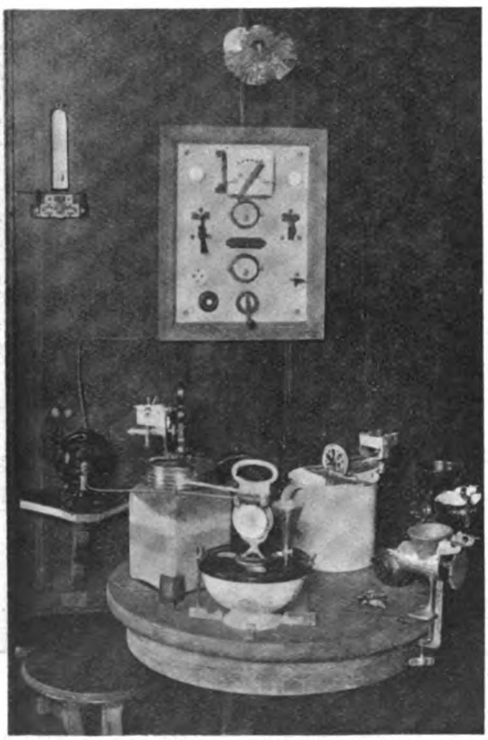
The Latest in Engineering.

An Electric House.—In the town of Troyes, in France, there is an enchanted house, the Villa Feria-Electra, where the good fairy electricity works wonders for her ingenious employer, Monsieur Georgia Knap. The visitor who rings the bell at the entrance finds the garden gate open noiselessly, and, on entering, a mysterious voice instructs him to allow the gate to close by itself. This it forthwith does; the voice in question emanating from a phonograph in a box on the inside wall. In the bedroom, the proprietor has only to press a button at the head of the bed to experience the grateful and comforting advantages of an electrical hot-bottle for warming the bed; while in the morning a touch on another button causes the window shutters to open and the blinds to be raised. The dinner table is connected directly with the kitchen by a service of electric lifts, thus bringing the various courses to the table without the intervention of a servant. The cooking opera-

THE ELECTRICALLY-OPERATED GARDEN GATE LEADING TO VILLA FERIA-ELECTRA.

tions are conducted by the aid of the electric current, and electric power is employed in driving various domestic machinery, and also in the household laundry. Electric burglar and fire alarms are also fixed throughout the building. We are enabled to present to our readeis some photographs of the details of this unique establishment, and have no doubt they will prove of interest. Possibly some similar ingenious applications of electricity may have been made by our readers, in which case we should be glad to have particulars.

A 900 h.-p. Water Turbine.—Particulars and illustrations were recently given in the *Engineer* of this large water turbine which has been supplied by Messrs. W. Gunther & Sons, Oldham, to augment



Showing Various Electrically-operated Kitchen Appliances.

an existing hydro electric plant of the Indian Government. The new turbine is designed to be capable of working up to 900 brake horse-power. The fall is 630 ft. Owing to the fact that a certain speed, viz., 400 revolutions per minute, was required for electrical considerations, the turbine is of a somewhat different type from those first installed, and is of an improved Pelton or tangential type, having a single round nozzle, the area of which is diminished when less than the full power is required by means of a spear-shaped rod which moves in or out of the nozzle, according to the power required at the time being. The shape of the spear end — which is Delta metal with phosphor-bronze end—and of the nozzle—a steel alloy—have been very carefully designed; the wheel centre is of cast steel and the buckets are of steel alloy. The wheel is 54 ins. diameter at the centre of impact of the jet, or about 60 ins. over all; the shaft is 6¼ ins. diameter in the bearings, which are of the self-oiling type with phosphor-bronze steps. The turbine is intended to be coupled direct to a three-phase alternator. The spear rod for varying the area of the jet is moved in or out of the nozzle orifice by means of a hydraulic cylinder. This is one of the most powerful turbines made up to the present time by any British firm of hydraulic engineers.

The first boilers of the Babcock and Wilcox type to be made in Sweden have recently been

The Electric Lift from the Kitchen to Dining Room.

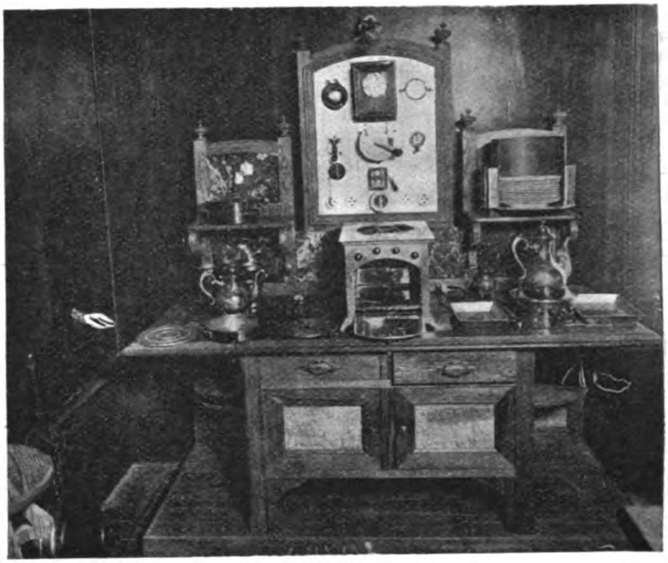
ordered for the new electric central station at Gothenburg.

Copper ore has been found about 50 miles from Mombasa, near the Uganda Railway. Prospectors are leaving for the district,, and definite news of the extent of the belt are expected shortly.

Submarine telephony has been successfully accomplished through a seven mile cable under Lake Constance, in Switzerland, recently laid. The cable is fitted with self-induction coils on the Pupin system for counteracting the effects of capacity. Conversations have been successfully held through this cable and overland lines to Berlin, a total distance of over 400 miles,

Tests of Soldered Joints.

THE strength of soldered joints has been found in thesis tests recently made at the Iowa State College to be a very uncertain quantity, varying widely with the composition of the solder, with the method of making the joint, and with the kind of metals joined. It was found that the process known as "sweating" results in a joint of the least strength of any of the methods of soldering; all joints made with pressure were invariably found to be more or less granular or spongy, while those made without pressure are usually smooth and firm. In comparing different compositions of solder it was found that a solder of 60 per cent. of tin to 40 per cent. of lead was the most suitable for general work in which considerable mechanical strength is required, although the actual strength of the joint was found to depend upon the kinds of metals joined. In a series of joints made on brass and on copper with solders containing from 35 to 70 per cent. of tin, practically all of them broke at loads under 13,000 lbs. per sq. in. The maximum strengths on copper were obtained with 60 per cent. solders, the strength declining rapidly with higher percentages; this peculiarity on copper was believed to be due to the difficulty of maintaining the proper temperature in soldering, as with a slight excess of heat the extreme fluidity of the high percentage compositions of solder causes it to run out of the joint. With brass, on the other hand, the strength increases as the proportion of tin in the solder is increased. In further tests to determine the life of soldered joints under light loads, it was found that joints on brass have longer life under a given load than those on copper. An interesting feature of the observation made in the tests is that the time taken to break a soldered joint is an important factor in the results secured. All joints will after a short time fail under a stress much less than that required to produce failure at once; it was found in many instances that a decrease of five seconds in the total time of testing would increase the strength of the joint from 4,000 to 5,000 lbs. per sq. in., the total time of testing being usually twenty to twenty-five seconds. The maximum strength obtained was 25,900 lbs. per sq. in. in the case of a joint on copper with a 60 per cent. solder, the total time of testing having been shortened to twenty seconds. — *The Mechanical World.*



THE ELECTRIC SIDEBOARD.

THE DINING TABLE, SHOWING THE WELL FOR ELECTRIC LIFT.

FOR some years the elevated railroad in Berlin has employed automatic ticket-vending machines, and as the price of a certain ticket is not even with any Breman coin, the machine is arranged so that when the proper coin is inserted it delivers the ticket and a pfennig change.

Design for Model Horizontal Compound Tandem Engine.

By W. Tucker.

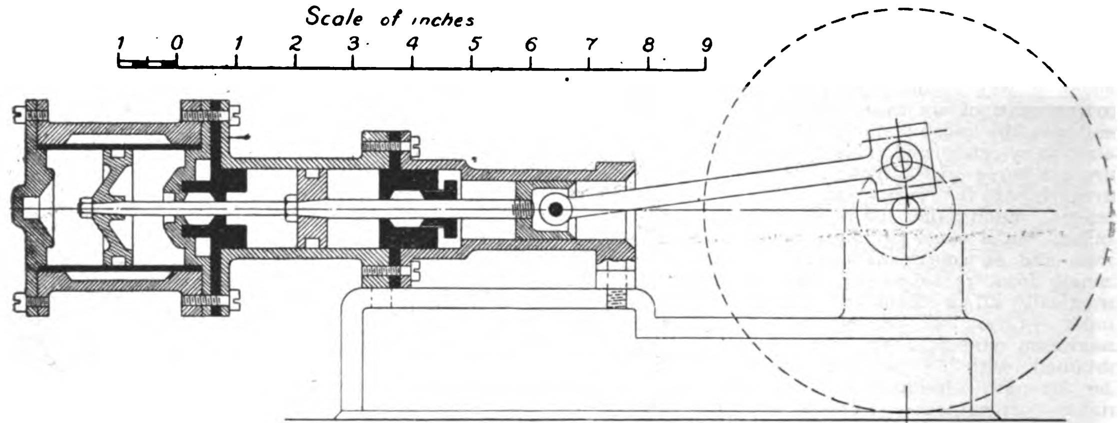
THE design herewith given represents a horizontal engine of the compound tandem type, having a H.-P. cylinder of 1-in. bore and L.-P. of 1½ ins., with a stroke of 1¼ ins., and, with a boiler pressure of 75 lbs., should develop 3-16ths h.-p.

The flanges of the H.-P. cylinder are 1 31-32nds ins. diameter and ⅜ in. thick on the crosshead side, and on the L.-P. side 2¾ ins. by ⅛ in. thick; on the L.-P. cylinder, 2¾ ins. diameter by ¼ in. thick on the H.-P. side and on the other side 2¾ ins. diameter by ⅛ in. thick. The length over flanges of the H.-P. and L.-P. cylinders is 2⅛ ins., and the distance from centre to centre is 2½ ins.

The covers are of cast iron, and all the flanges are ⅛ in. thick, and are secured to cylinder by ⅛-in. bolts. The spacing is shown in the sections of the cylinders; the H.-P. cover contains the stuffing-box; the drawings give all the necessary dimensions. The gland is of the screw-down type, and is adjusted by means of a pin engaging holes in the circumference of the gland, the pin being worked through a hole ⅜ in. diameter in the guide. The stuffing-box between the cylinders is composed of the two covers, the construction of which is shown in the section of the engine. The pistons are of gun-metal, and are ¼ in. thick and ⅜ in. over the faces, the packing grooves being 3-16ths in. wide by ½ in. deep.

The piston-rod is ¼ in. diameter through the H.-P. stuffing-box; at the H.-P. piston it tapers down to 7-32nds in., and is threaded to receive a brass nut. It is afterwards reduced to 3-16ths in. until it reaches the H.-P. piston, where it is tapered

Fig. 1.—Sectional Elevation.



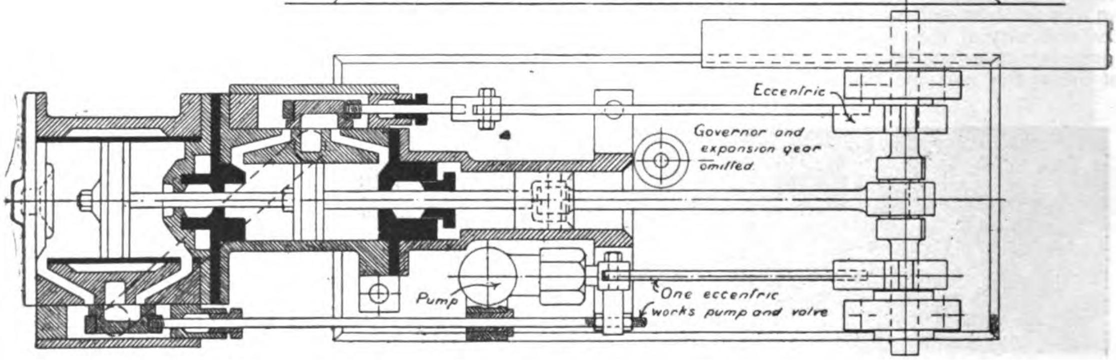


Fig. 2.—Sectional Plan.

Design for Model Horizontal Compound Tandem Steam Engine.

Under these conditions the engine requires a boiler with the same amount of heating surface as a simple engine of 1-in. bore and 2-in. stroke, working with a boiler pressure of 40 lbs., but at the same time developing 3-32nds more h.-p.

The H.-P. cylinder should be of a close-grained iron casting, and bored out to the given dimensions. The thickness of the walls is ⅛ in. The L.-P. cylinder should be cast in a light metal such as aluminium, or one of its alloys, so as not to be too heavy for overhanging. The L.-P. cylinder is steam-jacketed. The steam space is 1⅜ ins. long by ⅛ in. wide; the liner is 1-16th in. thick, and may either be of gun-metal or a piece of brass tube sweated in at both ends. Both cylinders should be heavily lagged to 1/8 in. and again threaded to receive a 1/8-in. brass nut. The valve rods are 1/8 in. diameter; both the piston and valve rods are best made of brass, as this does not corrode like steel, this being important in a model.

From the centre of the H.-P. valve rod to engine centre is 1 1/8 ins., and from the L.-P. valve rod 1 9-16ths.

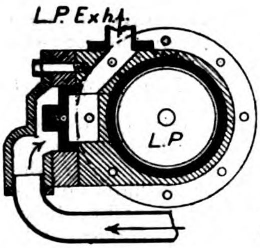


Fig. 3.

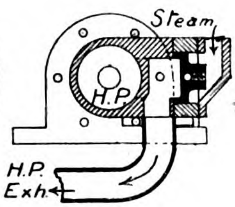


Fig. 4.

The dimensions of the ports and slide-valves are as follows:—

H.-P. details:
- Ports (steam), 5/8 in. by 1/8 in.; ports (exhaust), 5/8 in. by 1/4 in.
- Valve travel, 1/4 in.; lead, 1-32nd in.; lap, 1-16th in.
- Cut-off, about half-stroke.
- Width of valve, 13-16ths in.

L.-P. details:
- Ports (steam), 3/4 in. by 1/8 in.; ports (exhaust), 3/4 in. by 1/4 in.
- Travel, 1/2 in.; lead, 1-32nd in.; lap, 1-32nd in.
- Cut-off, about 7/8 in. stroke.
- Width of valve, 1 in.

The valves are of gun-metal, and are fastened to the rods by grub screws 1/8 in. diameter; the L.-P. valve rod projects and works in a boss. The valve chests are cast separately from the cylinders, as it is difficult to plane up a recessed valve face. They are fastened by eight bolts, which pass right

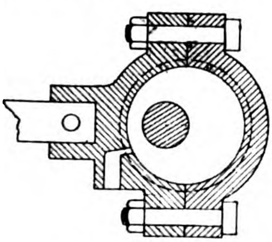


Fig. 5.
Section through Eccentric Straps.

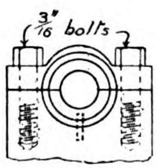


Fig. 6.
Crankshaft Bearing.

through the covers and casing. The cover of the H.-P. cylinder has a projection (Fig. 4) to take a 5-16ths-in. steam pipe, and the L.-P. a similar projection to take a 5-16ths-in. H.-P. exhaust pipe. The covers are 1/8 in. thick on the flanges. The connection or receiver between the H.-P. and L.-P. cylinders is a copper pipe 1/2 in. diameter; at the H.-P. end is a flange which is secured to the cylinder by three screws, and at the L.-P. end is screwed into the cover. This pipe should have careful consideration as to the lagging, or there will be a great loss of pressure.

The guide is of the circular type, and is 3/4 in. diameter. With the ordinary circular guide it would be necessary to fork the connecting-rod, and that would mean a forging to make a nice job, and it is just as simple to have the bore complete. The guide is 1/8 in. thick; at the H.-P. end the bore is increased to 1 in., and is a tight fit on the H.-P. cylinder cover; six 1/8-in. studs passing through the guide (which is 1/8 in. thick) secure

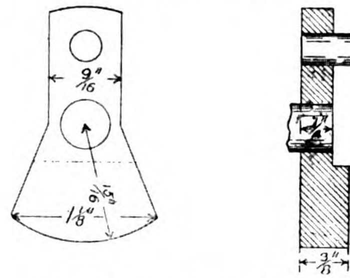


Fig. 7.—Details of Crank Webs.

the cover to the cylinder flange. The crankshaft end of the guide has a lug cast on for receiving the holding-down bolts, which are 1/4 in. diameter. The H.-P. cylinder has similar lugs for the same purpose, and the drawings (Figs. 1, 2 and 4) show these details clearly.

The crosshead is 3/4 in. long, and is of gun-metal. The piston-rod is screwed into it by 1/4 in. diameter thread, and locked by a 1-16th in. diameter pin. The crosshead pin is 3-16ths in. diameter, and is also locked by a 1-16th-in. diameter pin. The connecting-rod is turned from a piece of mild

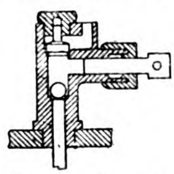


Fig. 8.—Section through Pump.

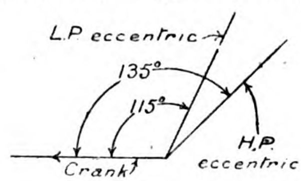


Fig. 9.

steel—in the middle is 1/4 in. diameter, at the crosshead end is 3/8 in. wide, at the crank end is 5/8 in. wide. The crank end is provided with split brasses 1/8 in. thick and 7-16ths in. long; they are best made of gun-metal. The crank-pin bolts, 1/8 in. diameter, are locked with a thin piece of sheet brass, similar to the method described by "Sregor" in The Model Engineer of November 19th, 1903.

The bedplate is 1/4 in. thick, and serves as a tank for the feed-water. The base is a piece of 1/8-in. brass plate bevelled. The inside of the bedplate should be well painted, so that it does not corrode and weaken the bedplate. The pump (Fig. 8) has a bore of 1/4 in. and 1/4-in. stroke. The valve chambers are in one vertical line. The suction valve is a gun-metal ball 3-16ths in. diameter, the suction pipes being 1/8 in. diameter. The delivery valve has a clack; the seating is 1/4 in. diameter. This pump is screwed into the bedplate with a 1/2-in. thread. On the side of the pump is cast a projection to receive a gun-metal bush, which acts as a guide for the L.-P. valve spindle. The crosshead pin on the pump plungers is turned from a piece of ½-in. square steel. The L.-P. valve rod is fastened in one end of this pin. This makes the one eccentric do for this pump and L.-P. valve. The arrangement is shown on the plan view.

The eccentric sheaves are of cast iron, and are secured to the crankshaft either by keys or set-screws; they are 1 1-16th ins. diameter. The straps are best cast in gun-metal. They are held together with ⅛ in. diameter bolts and locked with

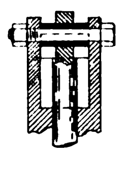


FIG. 10.

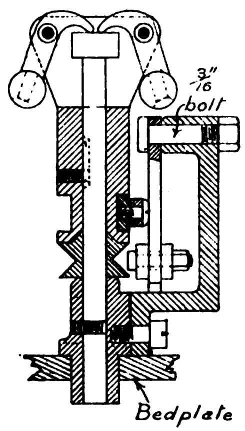


FIG. 11.

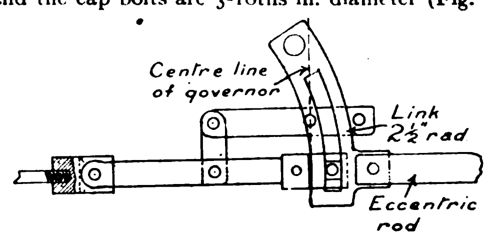


FIG. 12.

DETAILS OF GOVERNOR AND EXPANSION GEAR.

sheet brass, the rods being fastened to the straps by ⅛-in. screw. The rods are cut out of sheet steel, and are ⅛ in. thick by 5-16ths in. deep. The H.-P. valve gear is fitted with an expansion gear controlled by the governor. The valve rod is connected to a curved slot link cut out of ⅛-in. sheet steel, 2½-in. radius (Fig. 12). In the slot is a die 5-32nds in. wide and ¼ in. long. The die is fixed on a forked rod 2½ ins. long, ⅛ in. wide, and 5-16ths in. deep. The rod is forked in a simple way—two more pieces of steel being cut out and riveted one each side of the rod with a 3-32nds-in. rivet. In the centre of this rod is a small link; this is moved up and down by the governor rod. The other end of the rod is fixed on the valve spindle with a knuckle joint made of a piece of ⅜-in. square brass; the pin is ⅛ in. diameter. The slot link can be cut by the following means. The rough shape is first cut about 1 in. longer than the finished size and two holes are drilled, one at the top and the other at the bottom. The 2½-in. radius should then be scribed in the centre. On the mark just made two more holes, ⅛ in. diameter 1⅛ ins. apart, are made; these are the ends of the slot. The piece is then put on a lathe faceplate, and the 2½-in. radius is made to correspond with a 2½-in. radius on the faceplate. A parting tool 5-32nds in. wide is put in the slide-rest, and is started at the bottom ⅛ in. hole. The lathe faceplate is then slowly moved by hand towards the operator, the action being similar to that of the planing machine.

The governor is of the bell crank type (without springs); the base of cast iron is screwed into the bedplate with ½ in. thread. One side of the pillar is faced for the bolting on of a bracket on which the slot link swings. This is shown on the section of the governor (Fig. 11). The pulley is ½ in. diameter, and is keyed to the central steel spindle, which is ¼ in. diameter. The lift portion is ⅜ in. diameter. The "fork" for the governor lever is ⅜ in. deep and ⅛ in. thick, and is in halves, these being joined by rivets. The bell crank can be cut out of ⅛ in. steel, and pieces of brass tube brazed in for the pivot bearings. This is shown on the top section of governor (Fig. 10).

The balls are of gun-metal ⅜ in. diameter, and are riveted to the crank.

The crankshaft is ⅜ in. diameter, and is built-up. The crank pin is ¼ in. diameter. The balance weights and webs are cast in one piece; these are shown in the detail drawings (Fig. 7) two-thirds full size.

The flywheel is of the disc type, 5 ins. diameter and ⅝ in. wide on the face. The crankshaft bearings are fitted with gun-metal liners, which are ⅛ in. thick and ⅝ in. long; the caps are ⅜ in. wide, and the cap bolts are 3-16ths in. diameter (Fig. 6).

In this engine not one forging is required to be used, and even the merest amateur should not find anything very difficult to accomplish.

A Well-made Model Steam Yacht.

By JAS. A. WILKINSON.

MY model steam yacht *Wagtail*, here described, was commenced about two years ago and was afloat last Easter, and it has given much satisfaction. The hull is carved from a log of Canary wood, and measures 3 ft. 6 ins. load water-line, 7 ins. beam, and 5 ins. deep, overhang at counter 3 ins. It has long easy lines and full-bodied amidships, and it carries the machinery very well, only ½ lb. of lead on the keel being necessary. The thickness of hull is ¼ in. bare, and weighs about 1½ lbs.

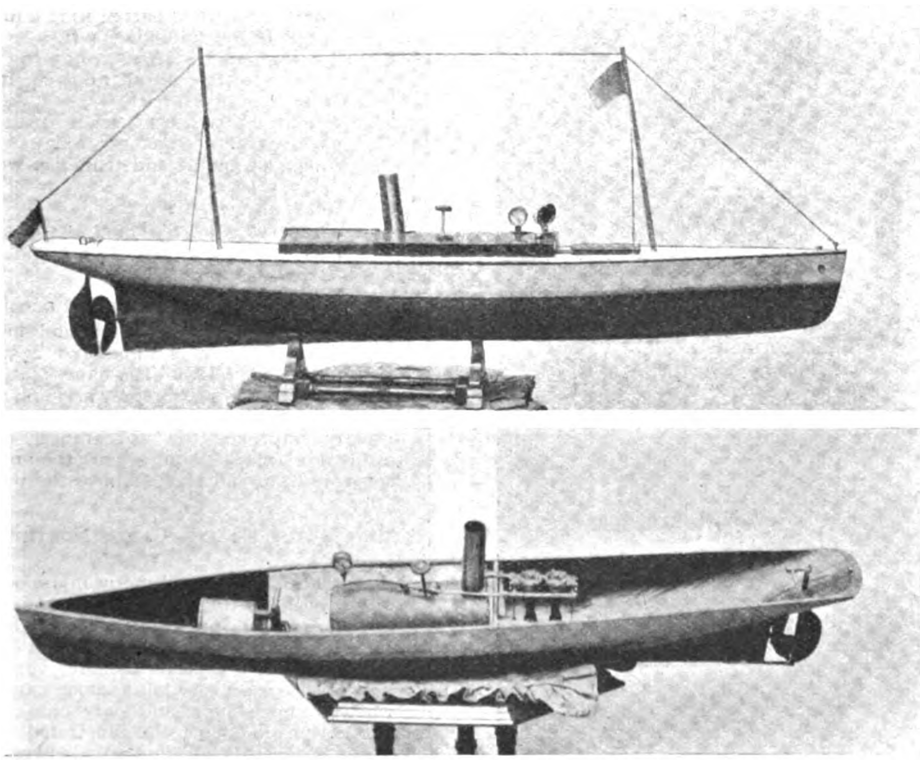
The boiler is made from sheet copper, the ends being flanged over a cast-iron disc. Brass escutcheon pins were used as rivets, being first made soft, and were cut to length after being passed through the holes. After riveting up, a cup-ended punch was used. The rivet holes were spaced ¼ in. The furnace tube is made from 2-in. brass tube, and contains four ½-in. cross-tubes. A combustion chamber is provided at the after end, the steam pipe being passed through this space, being altered since the photographs were taken, and it has proved more successful--drier steam resulting.

The boiler has stood a test of 80 lbs. of steam, and the safety valve blows off at 35 lbs. I have made provision for fixing a feed-pump, which I shall fit presently. The engine has two high-pressure cylinders, ¾-in. bore, ¾-in. stroke, and works very smoothly, and easily drives the three-bladed propeller, which measures 3¾ ins. diameter.

The shaft is made of ⅛-in. silver steel, and runs in a ⅜-in. brass tube, bushed at each end and filled with oil. This makes a water-tight job, with very little friction. The rudder may be set to any angle, and clamped in position, the tube socket being sawn down for about an inch, and a collar and pinching screw being slipped over.

The deck, of 3-16ths-in. holly, is lined to imitate planking. It is in two pieces, and fits in rebate worked in rubbing strake. The skylight over engine and the boiler casing are also removable from the deck.

The firing arrangement consists of a Swedish lamp with vertical burner, and consumes benzoline or petrol, and gives a very hot flame. A bracket screwed in boat keeps it in the proper position. Asbestos board is arranged round burner and boiler to prevent scorching the boat. A beam is placed across, which prevents the sides drawing in. The boat is finished off with several coats of paint, rubbed down with pumice and water, and two coats of best copal varnish. The colours are French grey topsides and holly green underbody, with ⅛-in. gold line; interior, black Japan. The deck fittings are made of mahogany and plain varnished. The cowls are enamelled white outside and vermilion inside.



Mr. J. A. Wilkinson's Model Steam Yacht.

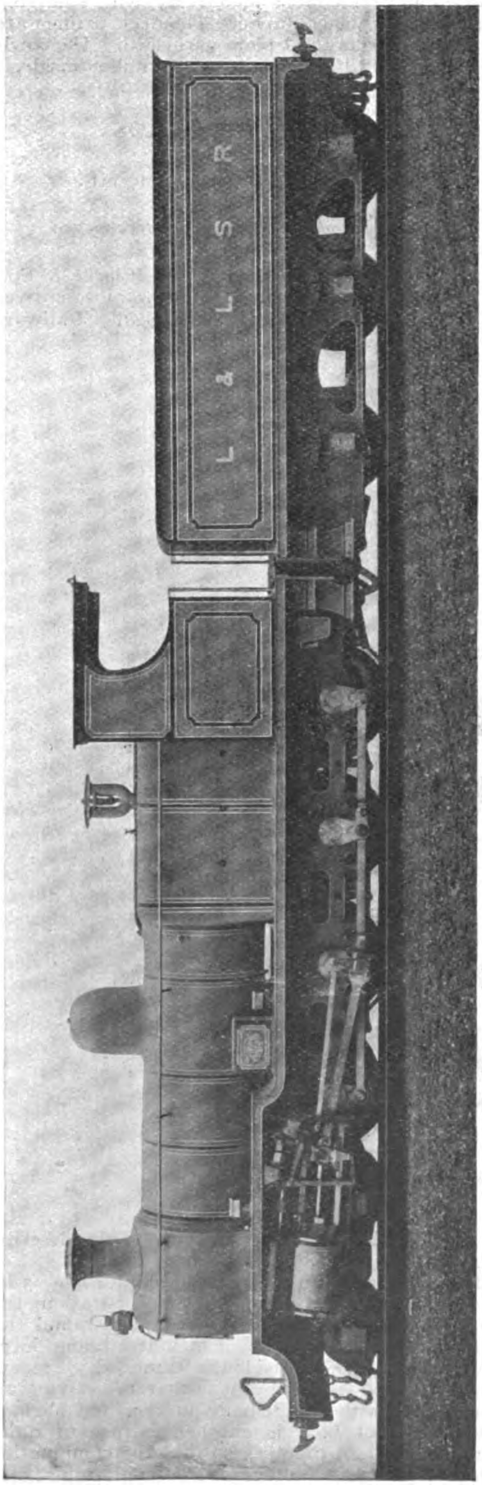
Locomotive Notes.

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

New Narrow Gauge Locomotives for Ireland.

By courtesy of Messrs. Hudswell, Clarke & Co., Ltd., of Leeds, who have built some new locomotives for the Londonderry and Lough Swilly Railway, we are enabled to illustrate and briefly describe one of the engines.

The design is rather remarkable for the 3-ft. gauge, for, as will be seen in the illustration, the 4—8—0 wheel arrangement is employed, and the cylinders—which, as is usual in narrow gauge locomotives, are placed outside the frames—have steam distributed to them by Walschaerts' valve-gear. The boiler, with its Belpaire firebox and slightly extended smokebox, is another feature of quite the most modern practice, so that the combination is one which may be regarded as conforming with the latest ideas.



4—8—0 Type Narrow Gauge Locomotive: Londonderry and Lough Swilly Railway.

The outside frames and cranks are more or less compulsorily adopted, because, unless this was done, the proportions of the boiler and firebox would be much restricted, owing to the limited space between the frames, the gauge being such a narrow one. The presence of eight coupled wheels gives all that is required in the way of traction, and the weight of the engine is distributed with less concentration of load on each axle.

The engines are now working on the Londonderry-Burtonport branch of the railway, which branch is seventy-five miles in length, and has one gradient averaging 1 in 50 for four miles.

The dimensions are given below:—

Cylinders, 15½ ins. by 22 ins.
Wheels: Bogie, 2 ft. 2 ins. diameter; coupled, 3 ft. 9 ins.
Wheelbase (engine), 13 ft. 6 ins.: total, 21 ft. 7½ ins.
Boiler: Length of barrel, 10 ft. 6 ins.; diameter of barrel (outside), 4 ft.
Heating surface: Tubes, 903 sq. ft.; firebox, 102 sq. ft.: total, 1,005 sq. ft.
Grate area, 15 sq. ft.
Weight on coupled wheels, 28 tons (equally divided, 7 tons per axle).
Weight of engine and tender in working order, 58½ tons.
Steam pressure, 170 lbs.
Water capacity of tender, 1,500 galls.
Fuel capacity of tender, 4 tons.

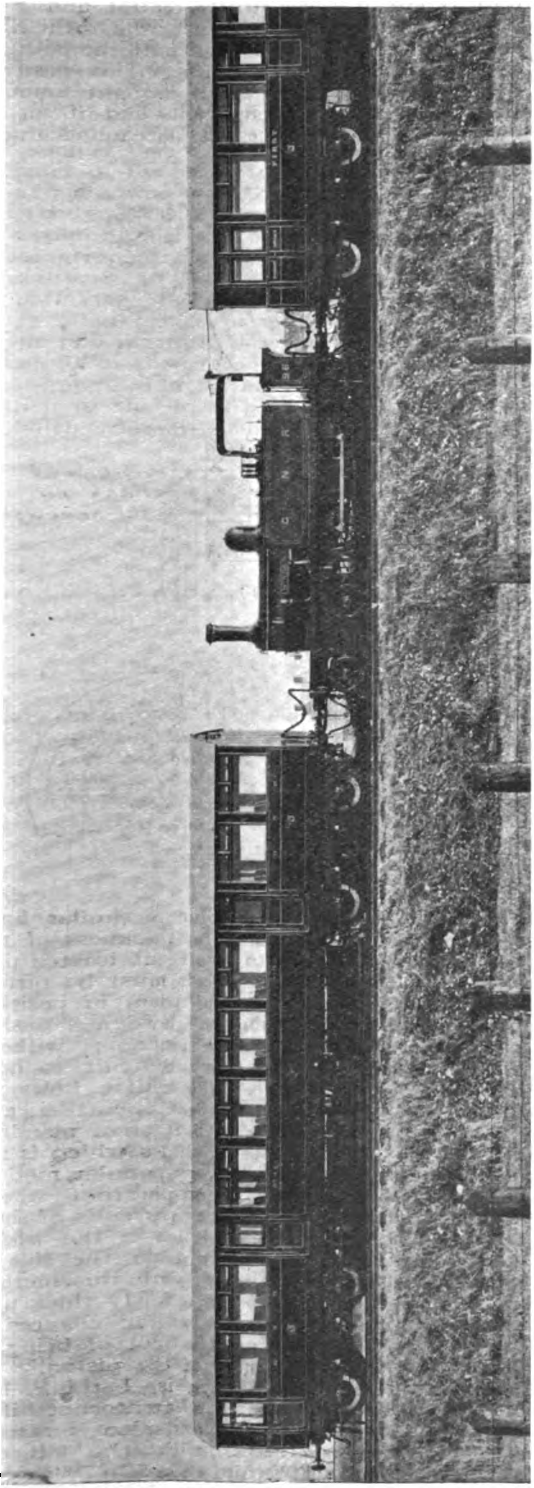
New Great Central Locomotive.

The latest 3-cylinder compound locomotive for the above railway is numbered 295 and named "King Edward VII." The name-plate is under the beading of the first coupled wheel splasher, and has raised brass lettering on a black ground. This greatly improves the appearance, and it looks altogether nicer than when the name-plate is separate from and placed above the wheel splasher.

Rail-Motor Trains, Great Northern Railway (Ireland).

The latest type of rail-motor in use on the railways of Great Britain is that which commenced working in January of the present year on the Great Northern Railway of Ireland. A small 4—4—0 type tank locomotive of the inside cylinder variety is placed between two specially built saloon cars, and, except when traffic is light and only one car is needed, this curious looking train, illustrated on page 277, works backwards and forwards between Dublin and Howth with a car always in front. Each saloon is provided with a driver's compartment at the far end, and the driver couples up the controlling gear to the regulator handle on the locomotive according to which direction the train is going to travel in.

When only one of the cars is in use, the train is worked from the footplate when running engine in front. Telegraphic communication between the engine-cab and the end driver's compartment is established by Chadburn's mechanical telegraph indicator, and by this means the fireman is apprised of the direction in which the driver desires the train to move, and the reversing lever is set accordingly. The engine, which was originally employed for working ordinary light branch line trains, has cylinders, 15 ins. diameter by 18 ins. stroke; bogie



New Rail Motor Train: Great Northern Railway (Ireland).

wheels, 2 ft. 7 ins. diameter; and coupled wheels, 4 ft. 7 ins. diameter. The wheelbase is 17 ft. 7½ ins.; total heating surface, 594 sq. ft.; and grate area, 11¼ sq. ft.

The time allowed for running the 8¼ miles between Dublin and Howth is 22 mins. There are four intermediate stops.

Steam *v.* Electric Locomotive.

The writer, when travelling upon the Great Central Railway on a recent occasion, was afforded an opportunity of witnessing an impromptu competition between a steam locomotive and an electric one. It was really quite an exciting affair, and was, judging from all appearances, greatly enjoyed by the passengers in both trains. There is a train which leaves Marylebone at 6.25 p.m. for Leicester, the first stop being made at Northwood, some fourteen or fifteen miles out.

This was, and nearly always is, drawn by a 4—4—0 type express engine, and on reaching Kilburn the 6.20 p.m. train, *ex*-Baker Street for Verney Junction, consisting of ordinary compartment stock and an electric locomotive, was overtaken. The electric train was slowly left behind, but directly afterwards the driver of the Great Central train had to reduce speed owing to an adverse signal, and this allowed the electric train to come up again, and it passed its "rival" at considerable speed. At Neasden, however, the steam train had just got level with the electric one and the two ran neck and neck the whole way to Wembley, sparks flying from the wheels of the electric locomotive and from the chimney of its competitor as they rushed along side by side. Eventually, the superior speed qualities of the steam locomotive, with its 6 ft. 9 ins. driving wheels, began to tell, and the electric train was finally left behind. In any case, it would have to wait outside Harrow until the other one was clear. Of course, nothing in the character of racing took place.

Bordeaux Exhibition.—A site near the quay has been allotted for purposes of the buildings for the Bordeaux Exhibition to be held in April—October next. The exhibition will be chiefly maritime in character, and will celebrate the centenary of steamship navigation which has developed from the first voyage, in 1807, of the *Claremont* on the River Hudson. M. Bertin, Director of Naval Construction to the French Admiralty, is Chief Commissioner of the Exhibition.

Technical Education in South Africa.—Writing from Pretoria to the *Times*, a correspondent states that the first Polytechnic institution in South Africa has recently been started. Judging from the results, it is destined to become very popular. Beginning with 122 students in the first month, it has risen by fifty a month to a total of over 250, of whom more than 80 per cent. attend regularly. About half of the students are Dutch, who show the greatest eagerness to make up the deficiency in their education caused by the war. There are 22 classes, dealing with the theory and practice of such trades as engineering, carpentry, building, electricity, and plumbing, besides various preparatory subjects.

The Construction and Repairing of Motor Bicycles.

By "SREGOR."

(*Continued from page* 138.)

THE building up of the flywheels, which also forms the crank, shaft, and crank-pin, is one of the most difficult to accomplish—to guarantee that the two shafts A A, shown in Fig. 70, will be strictly in line with each other and also parallel with the crank-pin B, which is most essential. The importance of this point of accuracy is illustrated in sketch, which shows the set assembled, with the crank-pin out of parallel with the shafts A A. The full lines show the pin at the top-stroke position, with the connecting-rod attached and the resulting angle of same, owing to the angle of the pin. The dotted lines at the bottom of the sketch show the corresponding angle of pin and rod when the pin is at the bottom of stroke. It will readily be seen that the actual amount of inaccuracy is exactly double to what it appears to be when looking at the pin in any one position, for the fact that the piston would be forced each side of the true, straight line equal to the amount shown at C and D, hence the utmost necessity to secure the pin absolutely parallel with the crankshafts.

In Fig. 71 is shown a simple easy-to-construct jig that will guarantee strict accuracy and produce the wheels in quantities. The details of jig consist of the ring of cast iron E, which is faced and bored to the exact size of the diameter of the flywheels, and before removing the ring from the faceplate it has been bored upon, the cross-piece F must be secured permanently to it, as shown at G, by some means, such as shaping a slot in face

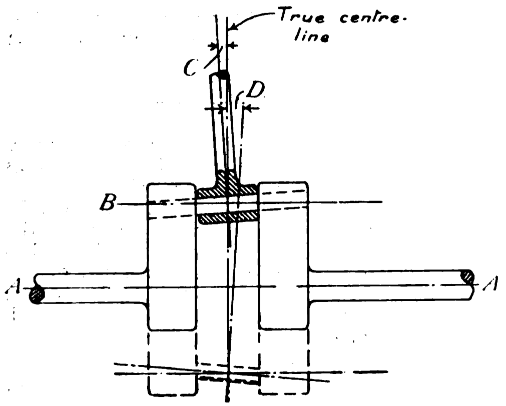


FIG. 70.

of ring and fitting the cross-piece in, and fixing same with setpins, or holding the cross-pieces in position flat on the ring by dowel pins and set-screws. The method of securing it is immaterial provided the method adopted is thoroughly rigid. When fixed, the centre hole H can be bored a convenient size to receive the hardened bush, shown in Fig. 72, which is to form the guide for the drill when drilling the centre holes in flywheels; by boring this hole before moving ring from faceplate ensures it being strictly central and true with the bore of the ring, after which the ring can be moved across the faceplate until the position of the crank-pin holes runs true. This position is not necessarily to be exact—a slight amount over, or under, is not important—and if set to within the thickness of a line, will suffice for accuracy.

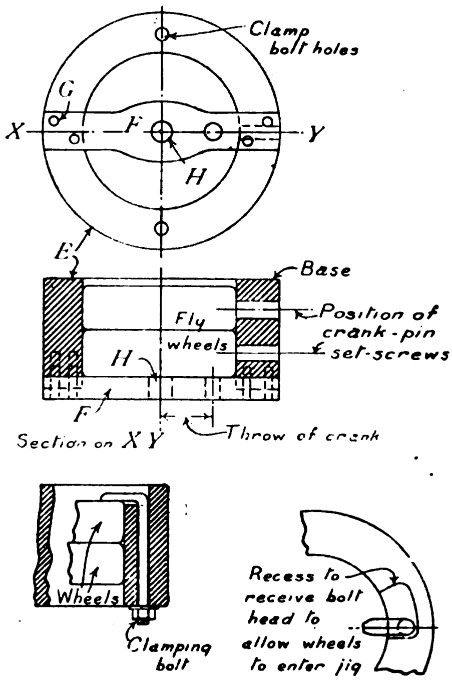


FIG. 71.

A hole is now bored to receive a similar bush to that shown in Fig. 72. The thickness of the ring should be sufficient to receive at least a pair of flywheels at once. The wheels must be turned to an easy fit in the ring, and when in position can be drilled to size, using the hardened bushes as guides for the drills and reamers; without using some such jig, it is very difficult to hold the two wheels dead-true. The centre holes, of course, may be bored as the first operation, and the wheels turned up true with it on a mandrel, but it is the drilling of the pin holes which is the most important operation. A very popular method of securing the shaft and piston-pin to flywheels is as shown in Fig. 73, which has the ends of shaft tapered to fit in the tapered holes in the wheels and held in position by the nut on the side of wheel. The chief disadvantages with this method are that it is impossible to use a fairly thick nut, as the space is limited, and also the chances of the nuts working loose from the fact of being in direct thrust with the impulse of the piston.

The design shown in Fig. 74 is, I think, less costly to make, and ensures a greater stability to the piece when assembled, and also is readily assembled true—one wheel with the other—when dissembled for repairs, etc. In place of securing the shafts by the taper, I suggest that the holes are bored parallel, as shown, and the ends of shafts turned from ·003 to ·005 of an inch larger than the bore of the hole, and the hole in flywheel made hot enough to expand sufficiently to receive the shafts, and when cooled down in the shaft it will grip it very tight. The amount left in the hole smaller than the shaft varies with the normal diameter of the hole. To increase the grip when shrinking a wheel, etc., on a given size of shaft, make the end which fits in the hole larger in diameter than the normal size of shaft—to increase the actual gripping surface, as shown in Fig. 75, if necessary. The two shafts having been fixed by shrinking, the connecting-rod pin, which is also a plain parallel piece, is secured in position by the two pins A B, shown in Fig. 74, which are a push-fit in the pin and outer part of the wheel, and screwed into the inner part of wheel. The position of the drilled holes are obtained by the jig, which ensures them being true with other holes

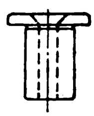


FIG. 72.

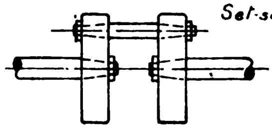


FIG. 73.

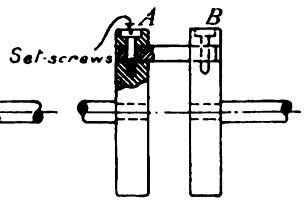


FIG. 74.

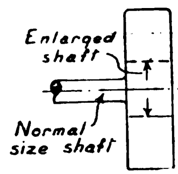


FIG. 75.

already mentioned. The object of the two pins is to locate the two halves of flywheels true with each other, which is the important point in this design of built-up crank. When drilling position in flywheels for the crank-pin, some definite means

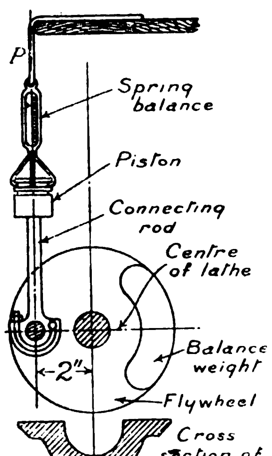


FIG. 76.

must be used to locate same in correct position in relation to the thickened portion of the wheels which form the balance weights. The importance of correct balancing of the moving parts in the combustion high-speed engines is well recognised. These weights should be such as to counterbalance the amount of parts on the opposite sides when held in their working position, *i.e.*, the piston, connecting-rod, and crank-pin (collective weight).

In Fig. 76 is shown a method for testing the ac-

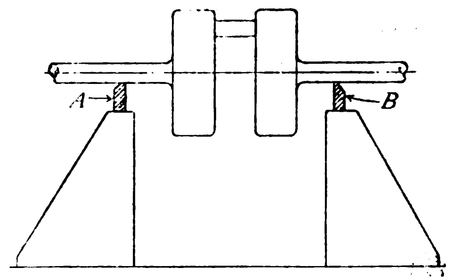


FIG. 77.

curacy of the balance of these parts when assembled. The main shafts are shown held between the centres of a lathe, and, assuming the stroke is 4 ins., then the piston must be suspended 2 ins. from the lathe centres, which position is readily obtained by a plumb line. Now suspend the small spring balance by a piece of string from this point, and connect the other end by a thin piece of string (thin and short to minimise weight) to top of the piston, as shown. Now, assume that the string P is pulled and the spring balance records 1 lb. 4 ozs. when the piston-pin centre is level with the lathe centres and main shafts, it proves that the balancing weight of the flywheel should be increased by 1 lb. 4 ozs., as shown by the spring balance, which extra weight should be equally distributed about the centre-line and a point at equal distance from main shaft's centre to that of the crank-pin, in this case being 2 ins. When the balancing is correct the spring balance would only show the slight amount of pull necessary to hold the piston vertical and the piston pin in the horizontal position. The collective weight of the parts to be balanced can be obtained, and a weight of suitable form that will clear lathe-bed, suspended to crank-pin, will, of course, serve as another method of obtaining the desired result.

Another method of obtaining the balance without the use of a lathe is shown in Fig. 77, which consists of two straight pieces A B mounted perfectly level by some convenient method, and wide enough to receive the assembled crank, as shown. The straight pieces should be of narrow surface at the point of contact with the shafts, which ensures the rolling action of the shafts being more sensitive, the method of testing being similar to method shown in Fig. 76.

(To be continued.)

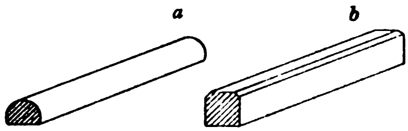
A Series-Parallel Switch.

By D. W. Hardy.

HAVING lately designed a battery switchboard, I was at first puzzled how to make a neat series-parallel switch, till at last I hit upon the following idea.

Cut a length of ¼-in. ebonite rod 2¼ ins. long, plane down to section, as in Fig. 1, *a* or *b*. Recess the

FIG. 1.



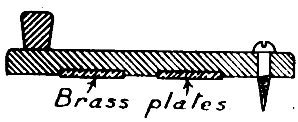


FIG. 2.

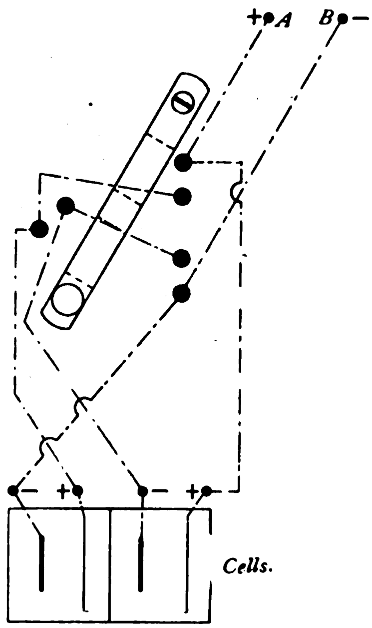


FIG. 3. DIAGRAM OF CONNECTIONS.

A SERIES-PARALLEL SWITCH.

flat side in two places—½ in. long and ¼ in. between both—deep enough to allow two 1-16th-in. brass plates to protrude slightly. Fix plates with countersunk screws so that the heads lie perfectly flush with the plate. Drill a hole at one end of the ebonite rod for pivot-screw, and fix a small knob at the other end for convenience of moving (Fig. 2); finish the rod, or switch arm off neatly. An alternative method to the above is to cut the arm ¼ in. square from sheet ebonite; or, for low voltages, from wood.

Then fix six brass studs on switchboard in the position shown in Fig. 3. The connections are shown by the dotted lines in Fig. 3. A B lead to the lamps, or to whatever the current is needed for.

Notes on Modelling Square-rigged Sailing Ships.

By Geo. E. Hopcroft.

GREAT interest has been taken by the readers of The Model Engineer in square-rigged models. The case for this type of boat was so well set forth by a gentleman interested in the old style of ship, that we were all more or less convinced, in spite of ourselves. I must admit that the "sailing machine" has taken most of my attention of late years. At the same time I must admit also that before I took to racing I constructed many square-rigged models. But this sport can hardly be termed model yachting, and in most up-to-date books upon building, the subject is not touched upon. And this course is the right one, for a model ship is not a model yacht. There is, however, a certain charm about a *model ship*, and as the subject has been brought forward, I think (having made all branches of model yachting my study) a few words will not be amiss.

If a model ship is to be *sailed*, it is quite clear that *all* the rigging of the full-sized vessel, cannot be retained. If my reader will go to any London dock, and take a look at a full-rigged sailing ship, he will see that this is impossible if the model is to be worked at all. A large model can hardly be taken through the streets with sail set, and the masts will most likely have to be unshipped also.

It was pointed out by a correspondent that if all the usual rigging of the "real thing" is retained, most of the day would be used in fitting out. Therefore, if the model is to be sailed, the rigging must be of a simple nature. As far as possible several ropes (in the standing rigging) should be united near the deck, so that only one hook need be used.

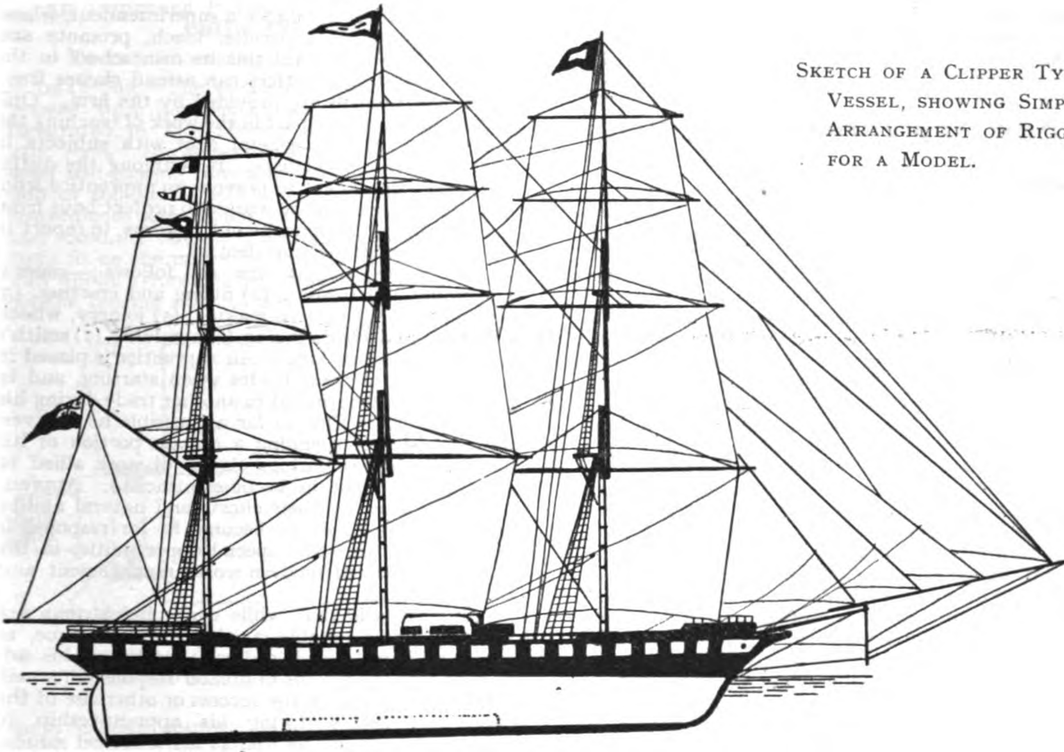
The best length for a full-rigged model is about 4 ft. With smaller boats it is best to use the brig or schooner rig. A 3 ft. model of a 10-gun brig would look very well. I would strongly advise my readers to cut their boat from a single log if possible, as this type of vessel does not need the great beam or draught necessary in yachts. The sketch given has been drawn after a careful study of the clippers of the fifties and sixties. In later years I think it will be admitted that the sailing ship has not advanced, but rather gone back. The chief reason of this is that very great speed is no longer required as clippers have given up trying to compete with steam. The chief things sought after to-day are—first, great cargo space; and, secondly, a sail plan that can be worked by a very limited crew. I would therefore, advise a modified rig, viz., one in which most of the standing rigging is retained, but with the running gear simplified.

Many years ago when quite a lad, I rigged a small 22-in. model as a brig and she sailed very well. The spars should not be too heavy and the sail-cloth in this type should be nainsook, or, better still, silk. As a rule the standing rigging is painted black, and should be composed of thick water-cord.* Very thin water-cord should be used for running gear. A lead keel would look very bad for a vessel of this type, but a good amount of inside lead must be used.

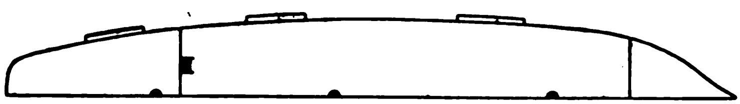
This should be placed as low as possible or the ship may not right herself again if heeled over by a sudden puff. A 4-ft. boat will require at least 8 lb. of lead, and if the model is a "clipper" 10 lb. or more may be needed. If the topsides are black I would advise the "Club" bicycle enamel. This will stand water well and dries in a few minutes with a surface like French polish. Copper bronze looks well for the under water body. This should be dusted on to the boat with a camel hair brush, the surface having been first coated with gold size. This gold size should be allowed to nearly set before the bronze is applied. The running rigging should not be made to lead to the deck, but the ropes should be endless from yardarm to yardarm.

In regard to deck fittings little can be said as this must be left to the taste of the builder. If the boat is to be sailed much, the smaller fittings might be dispensed with. A few boats must be carried if the vessel is to be a "model" at all. The ladders leading to the poop should be used and a wheel and ship's bell look well. The sailing of these boats is quite different to "model yacht" handling, and it is useless to go to standard book. The great drawback to square-rigged models is that they are often taken aback. A friend of mine (Capt. Carter, of Woolston) invented a splendid way by which the boat trims her own yards. This was in a top-sail schooner; the square yards were worked by ropes running to the main-boom. This system worked well and did great credit to its inventor. But with an altogether square-rigged vessel this would not work and the only thing to do is, brace the yards after every tack. Unless the model is rather deeper aft than forward she will often show a tendency to run up into the wind, that is, if the bowsprit is no longer in proportion than would be used upon a real ship. In regard to this tendency it must be remembered that the real ship has a man at the helm, and that he is always ready, by a turn or two of the wheel, to prevent this.

If the builder wishes to retain the greater part of the rigging used upon a real vessel, he must make it of very thin cord indeed or the weight will be more than the vessel can stand. For the rigging of a model must always be stouter in proportion than that of a large yacht. Of course, a weighted rudder can be used as with a fore and aft vessel. One thing is certain, viz., all the sails must be made to furl, for he will find that a model "ship" (built from scale) will be very stiff. In rough weather, with a small



SKETCH OF A CLIPPER TYPE VESSEL, SHOWING SIMPLE ARRANGEMENT OF RIGGING FOR A MODEL.



HALF DECK PLAN.

*Thick only in proportion to the running rigging, which should be very thin.

sail spread, a model frigate would look very natural.

The drawing herewith is not to scale, but the proportions may be taken as correct. The idea is to show the type of vessel and the manner of making the rigging simple. I suppose that most of my readers will have some type of vessel in mind before they commence to build. The types are so many that the sketch given can only be as a general guide, for there are a great number of square-rigged vessels that would look well as models, and these have already been referred to in these pages.

A New Apprenticeship System.

THE following are particulars of a new system of apprenticeship which has been adopted in the engineering works of Messrs. Clayton and Shuttleworth, Ltd., Lincoln.

It is believed that the system will not only interest many engineers, but also a large number of parents who would gladly put their sons into engineering works if they could feel assured that the boys would receive proper attention and be given the opportunity of thoroughly learning a trade. In arranging this system, the firm has had in mind the virtues of the old system of apprenticeship under which master and man lived in close contact, and youths were educated mentally as well as manually in their trade. To graft the advantages of the bygone system on the so-called factory system of modern times is not an easy task, but it is believed that, unless manufacturers make that attempt, it will become more and more difficult to secure the skilful intelligent workman now called for on every side.

With respect to the details of the new system, two chief aims have been kept in view: (1) to supplement the shop work with courses of instruction directly bearing on the work in the shops, (2) to give to all deserving apprentices a varied shop experience.

Large engineering works have the opportunity, hardly possessed by technical or manual training schools, of giving practical class instruction on matters which, although of great importance in the daily routine of manufacturing which is carried on for profit, are too often neglected. By combining mental training with the shop work it is hoped to make more intelligent workmen, willing to use the brain as well as the hand.

Apprentices will be moved from one class of work to another at the discretion of the firm. Diligence, skill, and proficiency will be held to constitute a claim for transference to another class of work. Keeping a boy for months on routine work simply because he has become skilful at it will, so far as possible, be avoided.

Wages will be paid at rates comparing favourably with those paid for youths' work where little or nothing is learned.

The old term of seven years (from 14 to 21 years of age) is abandoned altogether. It is obviously too long a time to serve for any trade under modern conditions. Apprentices will be taken on at any age between 15 and 22. It is hoped that this will induce many boys who have the opportunity of attending school or college beyond the usual period to become apprentices. Courses of instruction will be arranged to suit boys whose parents cannot afford to keep their sons at school beyond 15 years of age, but it is hoped that there will be a considerable number of apprentices entering the works at 16 to 18 years of age who have received a thoroughly good school education and will be able to derive advantage from more advanced courses. In order to encourage the entry of boys of 16 to 18, the same wages will be given to them at starting as if they had begun to work at 15. No premium is asked, and no premium apprentices are taken.

All apprentices are under a superintendent, whose sole duties are to supervise, teach, promote and advise. The firm maintains its own school in the works, and all apprentices can attend classes free; books and utensils are provided by the firm. Officials of the firm take part in the work of teaching the apprentices, and in general deal with subjects in which they are specialists. It is among the duties of the superintendent to prevent an apprentice from "drifting" through the works, to protect boys from favouritism or the opposite in the works, to report to the firm cases of merit or demerit.

The trades taught are as follows:—general machining and turning, (2) fitting and erecting, (3) tool-making, (4) pattern-making, (5) joinery, wheelwrighting and woodworking, (6) moulding, (7) smith's work, (8) boiler-making. An apprentice is placed in one or other of these trades when starting, and in general is not transferred to another trade during his apprenticeship. But so far as possible he is given opportunities of spending a certain portion of his apprenticeship at various classes of work allied to the trade to which he becomes attached. Apprentices who show by their efforts and natural ability that they are likely to become fit for responsible positions will be given special opportunities in the higher branches of modern works management and administration.

It may be said that, while every industrious apprentice should be able, at the end of his time, to support himself as an ordinary workman, his advancement to positions of greater responsibility will inevitably depend on the success or otherwise of the efforts he makes during his apprenticeship to improve his general as well as his technical education.

The rates of pay range from 5s. per week for a lad of 15 up to 18s. per week at the end of the period of training. The amount varies with the trade learnt, boiler-makers receiving the highest and general machinists the lowest pay. These rates of pay are, however, augmented by a scale of increases or awards based entirely upon merit. With regard to the statement that no premium is asked, we should explain that after a lad has passed his three months' probation and been accepted as an apprentice, he must either find five pounds—it may be paid by weekly instalments—or obtain a sound surety for that amount. This sum is returned to him on the completion of his indenture, but it is forfeited if he be dismissed before the completion of his term.

It is reported that experiments in wireless telegraphy have been carried out on the French island of Porquerolles. There is an important station on the island which has succeeded in communicating to a distance of over 1,200 miles. Telegrams were received from Poldhu, in Cornwall, very clear results being obtained.

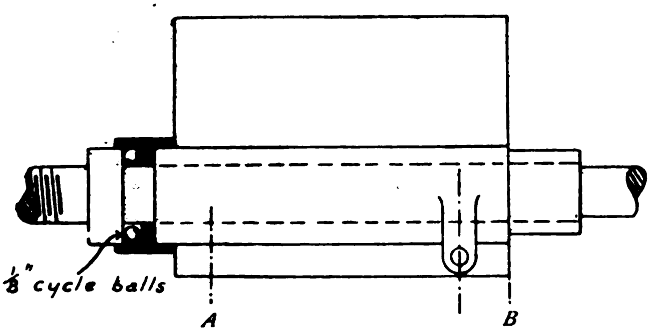
Practical Letters from our Readers.

[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 intended for publication.]*

An Improved Form of Ball-bearing for Cutter Spindle.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The enclosed sketch shows an improved form of bearing for the cutter spindle illustrated in THE MODEL ENGINEER of October 4th, 1906. The improvement consists of the cast steel ball-bearing shown in section on the mandrel end of spindle. The ball race is shown black for convenience and should be turned from cast steel and carefully hardened and ground true. It is a tight fit on the projecting boss of the main casting, and about 1-100th larger than the mandrel collar on the bearing side. I have also had the body or



IMPROVED BALL BEARING FOR CUTTER SPINDLE.

main casting shown, done in the hardest gunmetal I could get, and have dispensed with the front end adjusting screw, the slit for adjustment being carried up to line A only. As it ends at line B it could only be cut with a small circular cutter, which method was adopted. It should be noted that the ball-bearing is intended to reduce friction arising from end thrust when drilling, etc., and not side play. To those who find it difficult to fit adjusting screws, it might be worth while to mention that, provided a really *good* fit is made of the spindle, it will wear for months or even years with no appreciable play, this being due to the fact that its length is many times its diameter.—Yours faithfully,

Clapham, S.W. E. W. FRASER.

A Satisfactory Calcium Tungstate Screen for Visual X-Ray Work.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I enclose herewith a method I have employed for the manufacture of a calcium tungstate screen for visual *X*-ray work. I have no difficulty in seeing the fore-arm bones on the above screen with a 6-in. Apps coil.

The materials required are a piece of cardboard measuring about 10 ins. by 12 ins. (a photographic mount is as good as anything), a penny bottle of gum (Cochrane's), and lastly, ½ oz. of calcium tungstate, at 2s. the ounce. First of all, mount the cardboard in some sort of a frame as good a way as any is to take four pieces of wood, measuring two pieces 13 ins. long and two pieces 9 ins. long. Make a saw slit along the centre of each, so that the cardboard can slide into the grooves. Secure the frame at the corners with nails and the frame is complete.

Next take a small saucer and pour out the calcium tungstate, add enough of the gum to form a thin paste. Apply thinly and evenly to one side of the cardboard with a fairly stiff brush. When dry (it may be dried in front of a fire), apply another coat, taking care to cover every part. When dry, the screen is complete. To protect the surface, a sheet of celluloid may be fitted.—Yours truly,

GUY STEPHENSON.

Re Reflecting Galvanometer.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In that very interesting series of articles, "Some Accurate Electrical Measuring Instruments," I think Mr. Delves-Broughton has made a slight oversight in the construction of the galvanometer, which I intend remedying in one I am making, *i.e.*, the opening in front being left open to any draught striking on the mirror. The way I intend to remedy this is to have the coils 2 ins. apart, centre to centre, and have the mirror central between the magnets and cut an oval hole in the front face, covering this with a ¾-in. watch glass, ground oval. I am winding mine with No. 42 wire. In article of Feb. 7, 1907, page 131—connections of mitre bridge—it states, "The terminal A to brass plate carrying P; and the terminal C to the brass plate carrying T." And in the diagram A is connected to T and C to P. Which is correct, please? Wishing best of luck to THE MODEL ENGINEER, yours truly, "LYBIA."

The diagram is correct.—[ED., *M.E. and E.*]

Cutting Glass Bottles.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—A correspondent in your issue dated Jan. 3rd last kindly gave a method of cutting glass bottles by filling with oil and inserting a red-hot iron into the oil. I have tried this without success, on a test tube, phial, and glass jam jar. I tried gas engine oil, petroleum, water, and water with layer of oil on top. Can he explain where I am wrong, and have other readers been successful?—Yours truly, A. GREEN.

The First Locomotive in Germany.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—May I be permitted to supplement your note on page 220 to the interesting account of the above contained in "A Model Engineers' Tramp Abroad"?

I have searched contemporary records as far as possible, and can only come to the same conclusion as intimated by yourself, viz., that the statement is due to a misunderstanding

According to Church's "Life of John Ericsson," Vol. I, page 92, the firm of Braithwaite & Ericsson failed in 1837, and Captain Ericsson sailed for the United States in 1839. The author seems to indicate also that the above firm were in difficulties previous to 1837, an unfortunate circumstance caused by the bitter opposition the firm experienced when introducing their steam fire engine in London in 1829 and following years, also by the heavy expenses of the Rainhill trials and the ill-success of several of the Captain's inventions. It is noteworthy that the boiler of the "Novelty" was practically identical with that of the fire engine referred to and built about a year previously.

What I desire to convey is that it was absolutely impossible any partnership could exist in these circumstances, while it also is extremely improbable that the "Adler" was ordered *through* Ericsson, who was a vigorous opponent of the Stephensons during the whole of his residence in England, as he did not consider he was fairly treated at Rainhill (see page 6 and 9, etc. of above work).

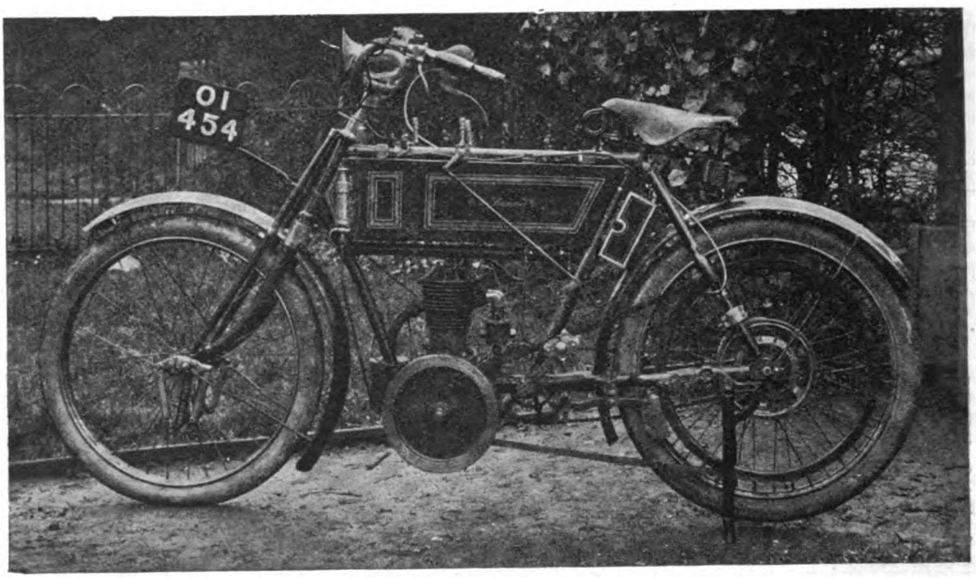
I should like to suggest that the misstatement may be due to the fact that Braithwaite and Ericsson supplied a steam *fire* engine for Berlin to the order of the King of Prussia in 1832, and possibly the error may have arisen in this manner. Illustrations of all these engines can be seen at the Patent Museum,—Yours faithfully,

Cranbrook. SIDNEY RUSSELL.

A "Model Engineer" Bicycle Motor.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Enclosed is a photograph of my motor bicycle, the engine of which I made in my spare time from drawings by Mr. Hawley in THE MODEL ENGINEER, thinking it might interest you and your readers; the only difference being that I favoured an outside flywheel rather than **an inside.** The cylinder is 75 bore by 76 stroke; crank is a mild steel forging with balanced webs, all in one piece; crank pin ⅞ in. diameter; connecting rod is marine type, bronze being used for all bearings; timing wheels are mild steel; and the valves are nickel steel, 1½ ins. on the head. I might mention that the wheelbase is about 54 ins. I ride all times of the year and learned to ride entirely on a motor cycle. My occupation is that of a locomotive driver, but I enjoy a ride on my motor bicycle better even than running a locomotive at sixty miles an hour.—Yours truly, "MOTORIST."



A 2½ H.-P. MOTOR BICYCLE.

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.—Tuesday, April 9th. At the Cripplegate Institute, Golden Lane, E.C., at 7 o'clock, a paper on "Some Wrinkles in Model making," by Mr. Ferriera.

Readers are reminded that the present is a very favourable time for joining the Society, as half a year's subscription paid now covers the period to the end of October next. Full particulars and forms of application may be obtained from HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

ACETYLENE LIGHT TO BE TAXED.—The acetylene light is to be taxed in Russia, along with electric and gas light. The Minister of Finance proposes to levy the tax in the form of excise at the rate of 4 copecks (1d.) per 100 cubic ft. (Russian), to come into effect as from January 14th, 1908.

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:—

[17,381] **Rule for Obtaining the Length of a Railway Curve.** G. M. (Sunderland) writes: Will you kindly show the process of obtaining the length of a curve?

To find the length of a curve (as from points A to B in the accompanying sketch), the following formula may be used:—

$$\text{Length of curve} = \frac{([8 \times CH] - C)}{3}$$

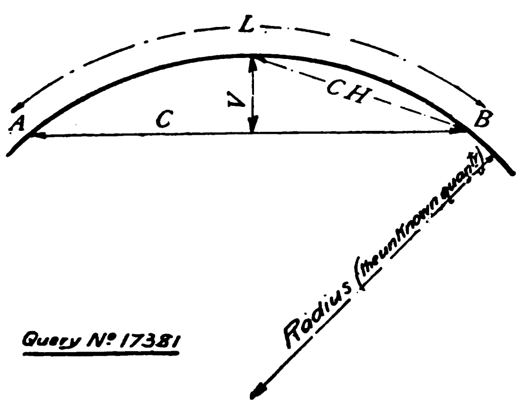
As on the original drawing of that reproduced herewith,

$$C = 11{\cdot}4 \text{ cms.}$$
$$CH = 5{\cdot}975 \text{ cms.}$$

therefore—

$$L = [(8 \times 5{\cdot}975) - 11{\cdot}4] \div 3.$$
$$L = 36{\cdot}2 \div 3.$$
$$L = 12{\cdot}1 \text{ cms. approximately.}$$

By use of a table, such as are published in many pocket books (see "Hurst's Handbook for Surveyors," E. & F. N. Spon), the work is much simplified, and there is no necessity to measure the chord of half the arc (CH). To find the radius of the curve, all that is required to know is the chord (C) and the versed sine (V). Then—



DIAGRAM, SHOWING HOW TO FIND THE LENGTH AND RADIUS OF A GIVEN ARC.

$$R = \frac{(\tfrac{1}{2}C)^2 + V^2}{2 \times V}$$

Now as $C = 11{\cdot}4$ centimetres
and $V = 2{\cdot}0$ centimetres.

Therefore $$R = \frac{(5{\cdot}7 \times 5{\cdot}7) + 2{\cdot}0 \times 2{\cdot}0}{2 \times 2{\cdot}0}$$

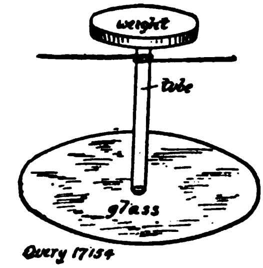
$$R = \frac{32{\cdot}49 + 4}{4}$$

$$R = \frac{36{\cdot}49}{4} = 9{\cdot}12 \text{ cms.}$$

which you can graphically prove to be correct. Great care is required in measuring, as a very slight error in the versed sine will make a considerable difference in the result.

[17,154] **Spark Coil Trouble.** L. H. (Lenzie) writes: I would be very pleased if you would answer me a few questions about a ½-in. spark coil I bought recently. What is the best battery to use with the above coil? Would Leclanché do? I have two big Leclanché cells, each with seven carbons, 1 in. diameter, 7 ins. long, and a cylinder of zinc, and four large glass cells of the ordinary type. When I connect these cells in series I get about ¼-in. spark, and in parallel I get about ⅛-in. spark. Is it the battery of the coil that is at fault? When I touch one of the secondary terminals, and one of the primary terminals while the coil is working, I get a severe shock, and when I "earth" one secondary terminal and bring a wire from the other near one of the primary terminals, large sparks fly across the gap, even larger than at the secondary terminals. Should this be or does it show that the secondary is short-circuited with the primary? If the battery power is at fault, what kind of battery should I use, and whether in series or in parallel? I will be very grateful for any advice you may give me, and would also be pleased if you could tell me how to bore holes in glass about ⅛ in. diameter to ¼ in. diameter.

Bunsen, bichromate, or, best of all, accumulators. You could try your Leclanché cells through and see what results you get. The battery is most likely at fault. Read the recent articles by



METHOD OF DRILLING HOLES IN GLASS.

J. Pike on this subject—they began in May 17th issue, 1906, and have been running ever since. The secondary will always spark across to the primary if you give it half a chance. Nothing is wrong because it does this. To bore holes in glass, some patience is necessary. Use a copper tube and emery powder (fine) and oil. Rig up some arrangement to keep the tube vertical whilst it is being spun backwards and forwards by means of a piece of string wound round its stem. See also recent correspondence on this subject.

[17,235] **12-in. Spark Coil.** A. E. K. (London) writes: Thank you very much for your answers to my questions *re* 12-in. spark coil, and I should be very much obliged if you would kindly answer some more, as follows:—(1) What voltage would produce a 12-in. spark from a coil wound with 18 lbs. of No. 36 wire for secondary, and two layers of No. 14 wire for primary? How many 4-volt accumulators would make this current up and of what amperage should each accumulator be? (2) How many sheets of tinfoil should the condenser be composed of, and of what size should they be? (3) Would it injure the coil in any way if the discharging points were placed beyond sparking distance whilst the coil is working? (4) Would it be sufficient to leave the soldered connections of each section of secondary wire uncovered, but embedded in paraffin wax? If not, what method of insulating them should be employed?

(1) It is possible to use a fairly low voltage, and we should try an 8-volt battery of good capacity—say, 40 or 50 amp.-hours, and capable of discharging at a good rate if required. (2) Condenser—80 sheets of 15 ins. by 9 ins.—*i.e.*, about 30 sq. ft. of effective surface. Make up in two separate portions so that they can be put up in parallel altogether or not, as required. (3) No. (4) Cover with silk (fine) ribbon first and shellac varnish.

[17,391] **Gas Valve for Small Gas Engines.** W. L. T. (Darlaston) writes: (1) Would a gas and air valve as per sketch (not reproduced) be suitable for a gas engine, 1-in. bore, 2-in. stroke? (2) Would it work with petrol, if gas tap were connected with surface carburettor (Fig. 10, page 42, "Petrol Motors Simply Explained")?

Your arrangement would work, but is not a desirable design. We should be inclined to fit an arrangement as shown on page 189, February 21st issue. You do not say whether it is to be suction or mechanically operated. An ordinary suction inlet valve arrangement would work with petrol quite well.

[17,270] **Lead Burning.** W. E. (Ponders End) writes: I am about to make an accumulator. I have a number of grids, but they have no lugs. I thought of putting the lugs on with solder and using resin as a flux. What I should be pleased for you to tell me is, will the tin in the solder interfere with the working of

the accumulator in any shape or form? Of course, the proposed joint will be submerged in the acid when the accumulator is at work? I have one of your sixpenny books—"Small Accumulators"—and understand the lugs should be on when cast or cut out of the lead, but as I have already said, I have a number by me without their lugs, which I should like to use up.

The lugs should be burnt on not soldered. See query replies in back numbers. "Burning" is practically soldering, but lead itself is used instead of solder. Heat is applied by means of a soldering-iron to both pieces of lead to be joined at the same time. The iron is withdrawn just as the surface of the metal melts, when it runs together and forms a solid joint. Only practice will show you how it is done.

[17,440] **Magneto Machines.** J. H. B. (Gloucester) writes: I have a number of magneto machines for ignition purposes, and the magnets require remagnetising, also one or two armatures want rewinding. Would you be so kind as to tell me how to charge, as I have a good chance, viz., three dynamos going all the time; also the way to rewind armatures.

Rewind armature with same gauge as is already on, or was on. To remagnetise, pass as heavy a current round the limbs of magnets as you can. From a table of wire gauges, carrying capacity, etc., make a coil of suitable resistance, so that the maximum current will flow. The direction of flow must be correct, of course. The armatures are, we suppose, simply H type?

[17,425] **On Purchasing Gas and Petrol Engines.** T. A. (Tilehurst) writes: I am thinking of purchasing a petrol motor, 1½ h.-p. (will develop 2¼ b.h.-p.)—price with carburettor, plug and contact, £8 10s.—and I should like to know if you have had any experience as to their quality, etc. Do large firms accept your *M.E.* deposit system? The motor is water-cooled. As I pass my MODEL ENGINEERS on, could you give me the date of issue containing "Hints to Intending Purchasers," by a solicitor?

Yes, you can use our Deposit System in this case if you like. We have not had personal experience with these motors; but quite apart from that, we strongly advise you, *whoever* you deal with, to get a guarantee in *writing* stating clearly that the engine will give its rated brake horse-power and, if necessary, pay a little higher price and get a guaranteed engine. The articles you mention appeared in July 5th and 12th, 1906, issues.

[17,244] **Primary Battery Difficulty.** A. T. W. (Clifton) writes: Could you kindly answer questions below? (1) How much potassium hydrate to one pint of water would be required for a Bennet's "tin-pot" battery? (2) What would you advise to keep the iron borings in the above battery from falling through the iron gauze cylinders? (3) How long would a battery of four cells of above keep a 4-volt lamp alight at a time?

(1) A few ounces. (2) Make the filings too big to fall through the gauze, or use a gauze sufficiently fine to prevent the filings falling through it. (3) Matter for trial. More than four cells would be needed in series probably for a 4-volt lamp.

[17,439] **Rheostat for 500-watt Lighting Dynamo.** J. M. (Ibstock) writes: I enclose a Queries and Replies Coupon, and should be pleased if you will answer me the following: I have a small dynamo (shunt wound), and I desire to know the size and length of German silver wire to make a small rheostat to regulate the field circuit. The dynamo is 200 c.-p., 50 volts, but sometimes has only one lamp on of 8 c.-p.

This depends entirely on what watts you reckon per candle-power. Assuming a 500-watt machine—*i.e.*, 50 volts 10 amps.—the G.S. wire required would be about 1-10th lb.—*i.e.*, say 1½ or 1¾ ozs. of No. 26 S.W.G. Divide this up into a convenient number of lengths on a resistance frame as required. Some sketches of similar arrangements will be found in back numbers.

[17,410] **Engine for Workshop.** H. C. B. (Hatfield) writes: I have Drummond's 3½ screw-cutting lathe with overhead and milling attachment. I want an engine and boiler to drive same, and have a little power to spare for tool grinder. Would Stuart's No. 3 compound 1¼ and 2½ by 1½-in. stroke do this, or should I want their No. 6 2½ and 4 by 3-in. stroke, or would their No. 5 2 by 2-in. be sufficient? I thought of using flash boiler as in THE MODEL ENGINEER, No. 204, if compound engine required. Is this satisfactory for this purpose? If neither of these are suitable, please give me an idea of what is required.

We would prefer the 2×2 engine, as with a flash boiler there is said to be but little advantage gained by compounding. You do not want such a big engine as the 2½-in. and 4-in. by 3-in. (3 h.-p.) compound. The boiler need only be from one-half to one-third the size of that described in the issue of THE MODEL ENGINEER, March 23rd, 1905, to which you refer.

[17,202] **Power of Small Motors.** H. O. (Putney) writes: (1) I have a motor wound for 8 volts, but will take 10 volts. At 8 volts it takes 2½ amps. If I use 10 volts, does it take less amperes than at 8, and, if so, how much less? It seems to me that if this is so, the accumulators would last longer as the discharge rate would be less. The weight would be the same in each case, I suppose. (2) The motor has to propel a 6-ft. boat, being geared down 5½ to 1. Do you think a starting resistance necessary? If so, can I have a switch, starting resistance, and reverser all combined? The motor is series wound. I have one or two of your excellent sixpenny handbooks, including "Small Electric Motors" but I do not feel sure about this point. If I have all three combined, can you give me a diagram of wiring? (3) I do not know how fast motor will run, but I believe it is necessary for the propellers to revolve at as high a speed as possible. There are two of 2 ins. diameter. How many revolutions do you think they ought to make?

(1) No; it will take more current if you apply a higher voltage because the resistance of armature and fields will remain constant. You are mixing up your ideas somewhat. Given two motors, one wound for 8 volts 2 amps., and the other 16 volts 1 amp., and suppose we run the first motor with an 8 volt cell, and the second with a 16-volt cell. In both cases the power developed is the same. But if we use the 8-volt cell for the 16-volt motor, we will not get 16 watts out of it because the resistance of its armature and field circuits are designed to take 1 amp. AT 16 volts pressure and 8 volts will not be sufficient to overcome this resistance and force 1 amp. through the winding. (2) No starting resistance is really necessary with such a small motor as this, though a yard or two of No. 28 G.S. wire would prevent cells getting run down too quickly if motor was inclined to stick at starting. A reversing switch was illustrated a short time ago in these columns for reversing series motors. (3) Speed is purely a matter of trial and depends on many unknown factors. We trust these details will assist you.

[17,350] **On Charging Cells from Small Dynamo and Mains.** B. T. (Norwich) writes: I have constructed a 4-volt pocket accumulator, described in Chapter II of your Handbook No. 1. I left the positive plates in a solution of chloride of lime for an hour to form. When I tried to charge it with my dynamo (tripolar arm, shunt wound), which gives 5 volts 2 amps., keeping a voltmeter in the circuit, it would not charge the accumulator at all. I tested the poles and connected them up properly. Then I charged it with six Leclanché cells, which charged it all right, and the accumulator lit a 4-volt lamp brightly; but after about three hours, with the terminals disconnected, the accumulator emptied itself. I took the plates out and examined them, but could find nothing that could short-circuit them. The case is ebonite and the plates are fastened together by ebonite separating pins. I again charged the accumulator, but with the same result. Can you suggest the cause and the remedy for this? We have electric light laid on—220 volts. What resistance should I use to charge this accumulator from the mains? I have two Nernst lamps, 32 c.-p. Could I use the iron wire resistance for charging the accumulator in any way? Why would not the dynamo charge it?

(1) If you had the voltmeter in series with dynamo and accumulator, of course the latter would not get any current to speak of. Voltmeter should be connected across the mains in shunt. Perhaps the outside of accumulator is wet or damp and leakage takes place from pole to pole (*i.e.*, positive to negative). (2) Use a few 16 c.-p. lamps in parallel or a wire resistance of about 200 ohms; 1 lb. of No. 26 iron wire would do, but would not last so long as German silver or platinoid.

[17,301] **550-watt Ring Armature Dynamo Winding.** A. M. G. (St. Albans) writes: Will you inform me what size wire and how many turns of same I shall require to wind the armature of a Croker Wheeler No. 2 motor which I want to use as a charging dynamo? I have a quantity of wire like the sample enclosed (No. 20 bare) and should like to utilise it if any way possible for armature and field-magnets. I should like to get an output of about 75 to 85 volts and 15 or 16 amps. It was used as a 2 h.-p. motor at 100 volts but was burnt out. The armature is slotted, ring type, laminated, and 7¾ ins. diameter by 3¾ ins. wide; twenty-four slots, ¾ in. wide at top and ½ in. at bottom and 1 in. deep, the two outside laminations being ⅛-in. fibre rings and are included in the 3¾ ins. width. What number of turns will the bobbins require for field-magnets, these being 3¼ ins. diameter? The bolts clamping the spider and armature together, and which pass through the metal of armature, are of iron. Surely these should be brass instead of iron? What speed should I drive to get the above output?

The output you mention is, we should say, much beyond what your machine will give when wound for generating. On armature wind 2½ lbs. No. 20 S.W.G. (*i.e.*, same as you have got: it is barely 20, but will do), and for fields use 15 lbs. No. 22. If you find you cannot get on quite 15 lbs., use as much as you can. If preferred, you can use 2½ No. 19 for the armature and No. 20 for fields. This may enable you to make use of the wire you have on hand, but will only give about 50 or 60 volts, unless you increase speed considerably. Speed should be about 2,400 r.p.m. No, not brass bolts. We presume you are thinking of eddy currents when you suggest brass.

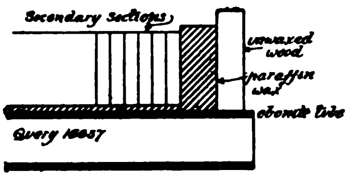
[17,366] **500-watt Lighting Plant.** W. A. I. (Rathgar, co. Dublin) writes: I would be much obliged if you would be good enough to favour me with a reply to the following questions:—(1) What is the lowest b.h.-p. oil engine that would light six to eight 16 c.-p. lamps? (2) What would be the voltage and amperage of dynamo? (3) Would a 1 h.-p. oil engine do the work?

(1) At least a full ¾ b.h.-p. (2) Anything you like. A 500-watt machine is needed. Could be 50 volts 10 amps. (3) 1 b.h.-p. would be one too much, and we advise this rather than a smaller.

[17,332A] **Model Locomotive Boiler.** J. R. (Bath) writes: Could a boiler not more than 4 ins. outside diameter and 12 ins. long, to drive two ¾-in. bore by 1¼-in. stroke cylinders, be designed on the water-tube principle as for the road locomotive illustrated in answer to Query 17,042, January 10th, 1907?

Yes, such a boiler will work very well. We presume you mean that the outer tube will be 4 ins. diameter. If so, make the inner one 3 ins. diameter and fit about seven tubes, 9-32nds in. outside diameter. For further details, see "The Model Locomotive," by Greenly, and also our back issues.

[16,637] **4-in. Spark Coil.** B. H. (Oldham) writes: I have started building a 4-in. spark coil from particulars in your handbook, and should be glad if you would answer the following questions. (1) What is the best way of keeping the tinfoil condenser lugs free from paraffin wax, when the condenser is being squeezed hot; or, if they get waxed, what is the best way of making good contact again? (2) Would two thinner wires than a No. 14 D.C.C. do as well for the primary, so long as the correct number of turns were got on and they carried the full current properly? (3) About how many turns of No. 14 D.C.C. ought I to be able to get on to a core, 8 ins. long and ¾ in. diameter, when wound in three layers? (4) Do the leads for the condenser connections need to be very substantial, say, equivalent in section to a No. 14? (5) Would unwaxed mahogany ends do for this coil if at each end of the secondary winding there was a disc of paraffin wax, ¼ in. thick and ½ in. to 1 in. larger in diameter than the secondary, fitting the ebonite tube well? The reason for not waxing the wood ends being that I want to black enamel them (cycle enamel) to make them look like ebonite. (6) Would this enamel do if the secondary terminals were mounted on ebonite rods sunk into the paraffin discs? (7) About how many of the enclosed filter papers will be required between each section of the secondary? (8) Will the winding of the sections be good enough if the same as the enclosed section in quality? (The wire was waxed before winding and would hold together when taken off the section winder without the threads.) (9) Is 1-10th in. clearance all round the tube too much for the secondary sections to have? The space to be afterwards filled with paraffin wax when all the sections are assembled



INDUCTION COIL CONSTRUCTION.

and connected. (10) Would two thicknesses of the enclosed paper do for the separation of each sheet of tinfoil in the condenser?

(1) It is difficult to clean them if once waxed. Heat them gently and wipe with soft rag, taking care not to break them off. Keeping on smooth flat surface when doing this. If ordinary care is used there is no reason why they should get covered with wax. (2) Better use the one wire, though two in parallel *could* be used. (3) About ten turns per inch for No. 14 D.C.C. You can calculate from this. (4) Yes. (5) Yes. (6) We should mount the terminals in something more solid than wax. They would easily get displaced or loosened. (7) Three or four layers. (8) Yes. (9) No. (10) Yes. One would do if quite clear of weak spots and pinholes.

[17,305] **Oscillating Cylinders.** A. H. (Ishapore) writes: Having a small engine with double-action oscillating cylinder (1¼-in. bore, 1-in. stroke), can you tell me how to reverse motion or make reversible?

You will find several methods of "steam block" reversing described in our sixpenny handbook No. 28—"Model Steam Engines." We cannot give you any help as you do not send us any details of the steam distributing block with which your engine is fitted.

[17,324] **Model Railway Platforms.** T. B. (Liverpool) writes: Please let me know in next issue what height should platform be for model railway, 2-in. gauge.

The standard height for platform above rail level in the 2-in. gauge (7-16ths in. scale) is 1 5-16ths in. This is the scale reduction of 3 ft.

[17,180] **Morse Tape Instruments.** W. H. M. (Cullercoats) writes: Can prepared tape for Bain chemical telegraph be purchased, and will you kindly inform me of a sensitive solution? I have tried potassium iodide, starch paste, and water, but it is not sensitive enough. Please also can you tell me the minimum current that will record its passage on tape?

(1) Try saturated solution of ammonium nitrate, 1 volume; water, 2 volumes. (2) Try any of the Morse tape makers, such as Colley's Patents, Ltd., 3–12, Marine Street, S.E.; Waterloo & Sons, Ltd., 26–27, Great Winchester Street.

[17,411] **Dynamo and Boiler for Small Engine.** W. C (Rogart) writes: I have a horizontal engine, 1-in. by 2-in., high-speed type. Would you kindly tell size and type of boiler suitable for driving this engine, so that it will drive a dynamo, and state what dynamo would be suitable? What book would be most suitable for an amateur for using and understanding how to work dynamos?

This will depend largely upon the speed and pressure you intend to work engine at. For all-round work, a vertical multitubular, 11 ins. diameter by 24 ins., with twelve 1-in. tubes expanded in will meet your requirements; 3-16ths or 11-64ths plate. See articles on "Model Steam Engine Design" in back numbers. A dynamo of 100 watts would be a suitable size. See "Dynamo Attendants and their Dynamos," by Broadbent, 1s. 8d. post free.

Further Replies from Readers.

[17,260] **Hardening Drills.** I have had the same difficulty as "E. B." (South Milford), and would advise him to try the following method. Fill a shallow tin—a tin box-lid will do—with tallow, and holding drill in pliers near gas jet, make point red hot, not white hot, with blowpipe, or by holding drill in gas flame; drop it into tallow, and if over 1-16th in. diameter, move it once or twice on to the unmelted tallow. The point will be hard and the shank tough, no tempering being required. I have used drills (practically needle points) hardened in this manner to drill the row of holes for jets in a piece of ⅛th barrel for gas stove. I use them in lathe driven by power and run them about 1,500 r.p.m. and rarely break one. Perhaps he will report how they answer with him.—A. G.

[17,341] **Pantelephone.** H. N. G. (London) touches a matter of considerable personal interest. His experience so far is my own precisely. The little instrument shown and described in THE MODEL ENGINEER handbook no doubt transmits sound, but the advantage to a very deaf person is absolutely *nil*. The only use I—also, unfortunately, a very deaf person—can find for this little apparatus is to place it upon the pianoforte, when it certainly transmits a fair range of musical notes. But for this purpose the simplest form of microphone, made up of three pieces of carbon (as Fig. 4 in THE MODEL ENGINEER Handbook, "Telephones and Microphones"), answers better, as it transmits the notes without any supplementary vibrations. With this and one dry cell, and using a good quality telephone watch receiver with head band, I can sit at the piano and hear every note: a very great treat to one fond of music and able to amuse himself! I imagine these elementary transmitters are made on too heavy a scale for the most part. Thin pine wood is a good conductor, but a good *base* for a carbon transmitter like Fig. 4 or Fig. 6 is a sheet of mica. For Fig. 5 (Pantelephone) I have found it sufficient to make the hinges of tinfoil, which may be strengthened with a strand or two of No. 36 copper wire. The contact, also may be very thin and fine—a stout pin will serve. Electrical instruments are advertised purporting to answer the requirements of deaf persons in the manner desired by "H. N. G." The prices are alarming—not to say prohibitive; whether they are effective depends, no doubt, on the degree of deafness. I have no reason to believe them otherwise than sufficient to persons "who can hear *well and distinctly* any male or female voice on the telephone." I am making notes and trials of various microphones, etc., for my own personal benefit, and when I have anything to say of likely interest I shall certainly let the readers of THE MODEL ENGINEER AND ELECTRICIAN know of it.—J. PIKE.

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 the asterisk have been based on actual Editorial inspection of the goods noticed.*

Wood for Model Engineers.*

Mr. John Potter, Brabant Yard, Station Road, Wood Green, London, N., informs us that he is prepared to supply woods of all kinds to suit the requirements of model engineers. He is making a special feature of panels and baseboards for mounting models on, and these may be had in any of the well-known woods cut to size and finished with either square, round, bevelled, or moulded edges. A neatly prepared sample of a mahogany baseboard, with bevelled edges, has been sent for our inspection. Mr. Potter is also prepared to supply blocks of wood cut to any required size for building model boats.

The Editor's Page.

WE are pleased to be able to announce that the results of the Sixth "Gauge" Competition which closed on February 28th last, have been very satisfactory. From the point of view of numbers the competition has been the most successful of any of the preceding ones, the number of entries amounting to over 160. Some of these we have been compelled to return owing to the unsuitability of the subject, whilst a few have been rejected as they were hardly up to the standard required. Generally speaking, we feel that the contributions sent in for this competition show an improvement in the quality of the work turned out by our readers. Those competitors who have not succeeded in winning a prize will we hope not be discouraged, but that they will try again when the opportunity arises. Persistent effort is almost sure to be rewarded, as in the case of one successful competitor, who wrote in his covering letter—"This is the fourth time I have entered your Gauge Competition. I have not obtained a prize, but I hope to be successful this time." Quite a large number of contributions would have been useless for reproduction on account of bad photographs sent, and, before accepting, we have had to ask for better prints. In nearly every case these were forthcoming, showing they might have been sent in the first instance. For the future guidance of readers who contemplate submitting accounts of their work, we would impress upon them the necessity of sending photographs in which the model or apparatus to be described stands out clearly, and we once again refer them to the very practical article, "How to Photograph a Model," which appeared in the issues for May 14th and 21st, 1903, Volume VIII, copies of which can still be obtained.

Answers to Correspondents.

T. P. (Pickering).—This is not within the scope of our journal.

A. R. (Beswick).—Try two balls for discharge points.

K. M. (Stornaway).—We regret we have not particulars of such apparatus.

A. J. H. (Earlstown).—We thank you for your Workshop Note; but as the same idea has appeared before in our columns, we cannot see our way to insert.

T. F. D. (Tokenbridge).—Use two of the machines described in "Small Dynamos and Motors," 7d. post free. Take, say, the 60-watt size, Fig. 12, and run it as the motor driving a 40-watt size wound with 5½ ozs. No. 19 on armature and 2½ lbs. No. 20 on fields. Both machines mounted on one shaft. See query replies on similar matter.

"HURFORD."—No, not unless the maximum temperature to which instruments are subjected is considerably above this figure.

J. O. L. M. (Norwood).—To obtain fuller information kindly send a typed copy of your query. As far as we can make out you want to build a model rail motor coach with oscillating cylinders and require information on the construction and working of the latter. We would refer you to our handbook—"Model Steam Engines," price 6d. net, 7d. post free from this office. The type of motor coach of which you send a sketch is not a correct representation of the L.N.W.R. vehicles. The latter have the boiler completely covered in. See THE MODEL ENGINEER, October 12th, 1905; also page 174, February 21st, 1907.

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, etc., 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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[*The asterisk* (*) *denotes that this subject is illustrated.*]

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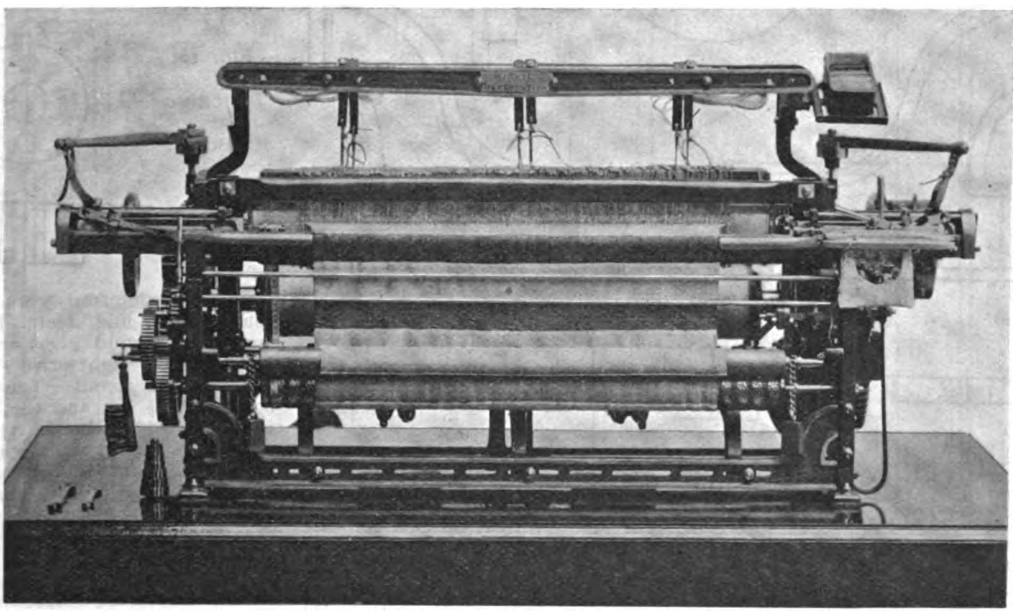
A Scale Working Model Loom.

By WM. BELL.



MR. WM. BELL'S WORKING MODEL LOOM.

THE model 10-4 loom illustrated in the accompanying photographs represents three years' work of my spare time. Having to make all the patterns myself, I first of all prepared full-sized drawings, and from the sixty-eight separate patterns no fewer than 110 castings were made. The loom is fitted with two sets of plain treadles, and has worked over twenty yards of cloth altogether. After I got the loom fitted together and saw that it was in working order, I took it to pieces for the painting, and before doing so I thought that a photo of the parts would be interesting to some of your readers, in order to show to advantage the amount of work entailed in the model.

Now as to the actual making of the loom. I may say that I had many little special tools and appliances to make, as everything was made in my own workshop and no work given out. As the model is perfectly to scale, all wheels are keyed on in the usual manner, and, to cut the keyways in the wheels, I converted my lathe into a slotting machine for the time being. Although I took four times as long to rig up my lathe as I took to do the job, I was well repaid by having a splendid job of the keyways. The small pinions for the taking up motion, which is of the positive type, was a very tedious job and entailed much hard work. For this I had to rig up an overhead shaft and also make small pinion cutters and spindle; I had to drive same with a ¼-in. round band. The slotting wheels which can be seen on the left of the photograph include 268 teeth in all, there being 11 pinions altogether. I may add here that the dividing of the teeth was done by large pinions on the same mandrel as the blanks, and gave a very accurate job. The adjusting parts of the

FIG. 4.—TOP RAIL.

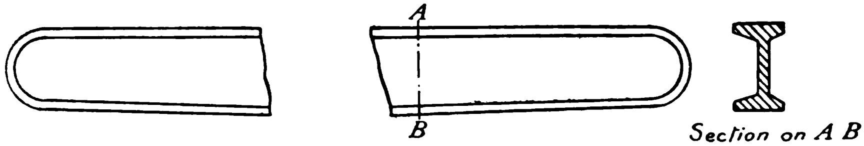


FIG. 5.—BACK RAIL.

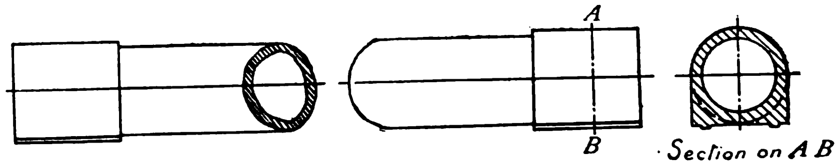


FIG. 10.—SHEDDING WYPERS.

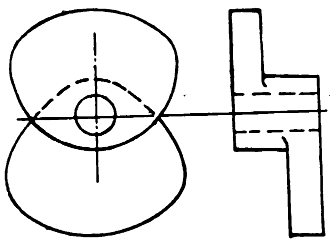
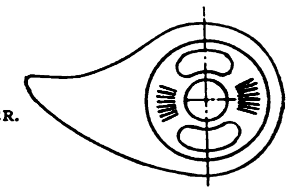


FIG. 11. PICKING WYPER.



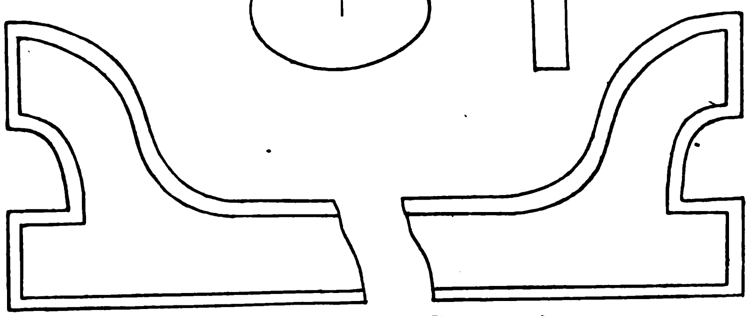
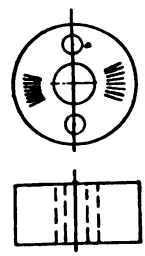


FIG. 3.—FRONT RAIL.

FIG. 12. PICKING BOSS.



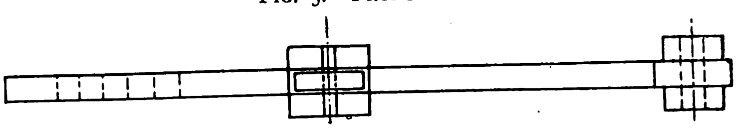


FIG. 6.—PLAN OF TREADLE.

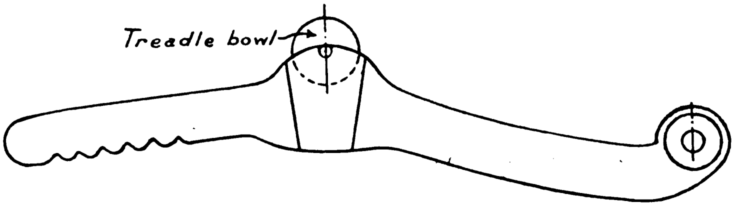


FIG. 7.—SIDE VIEW OF TREADLE.

DETAILS OF WORKING MODEL LOOM. (*Scale: Half full Size.*)

picking mechanism were cut round with fine teeth by a special cutter and gives an adjustment of eighty-two positions to the round. The reed space is 18½ ins. and the cloth is 14 ins. wide; the description of web is fifty porters one in split, the beam is on square arbour and is in two halves, and is filled with 35's line cream yarn, 400 ends, 75 yards long. The loom is fitted with a few extras including self-acting measuring tape, brake, lever set handle, auxiliary handle for setting off at opposite end of loom, also stop for taking-up motion when weft gives out. The pair of shuttles are made of aluminium, and run very well at any speed from 100 to 250 picks per minute and weaving cloth at the same time.

I may say that when the loom was completed last October it was exhibited in the Arts and Crafts Exhibiton held in Dunfermline and gained first prize of £2 in the working model section, and, as the models were all working, I had my loom

(*Scale, Half Full Size.*)

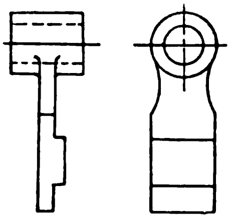
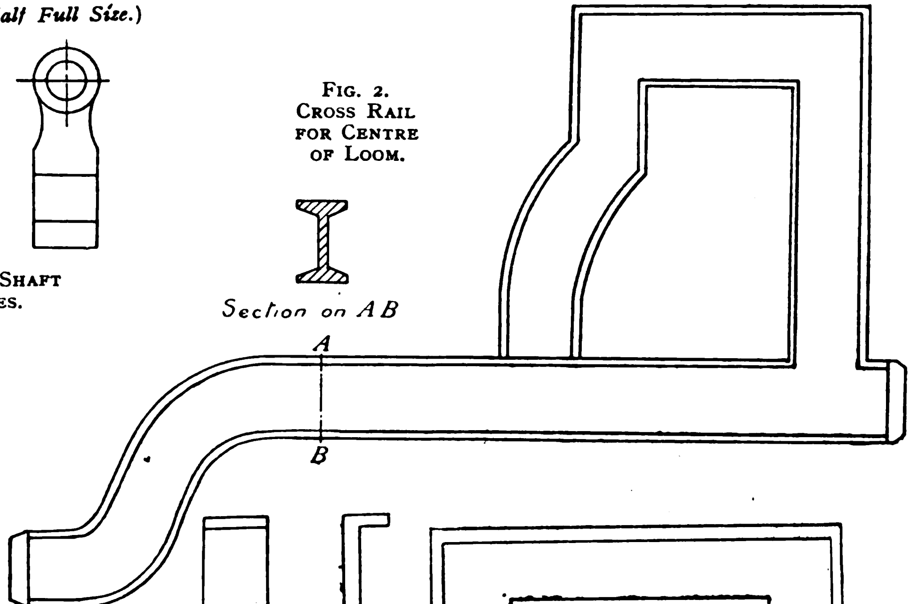


Fig. 8.—Shaft Bushes.

Fig. 2. Cross Rail for Centre of Loom.



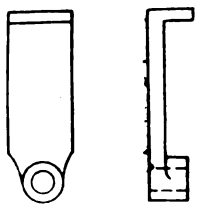


Fig. 9.—Rocking Shaft Bracket.

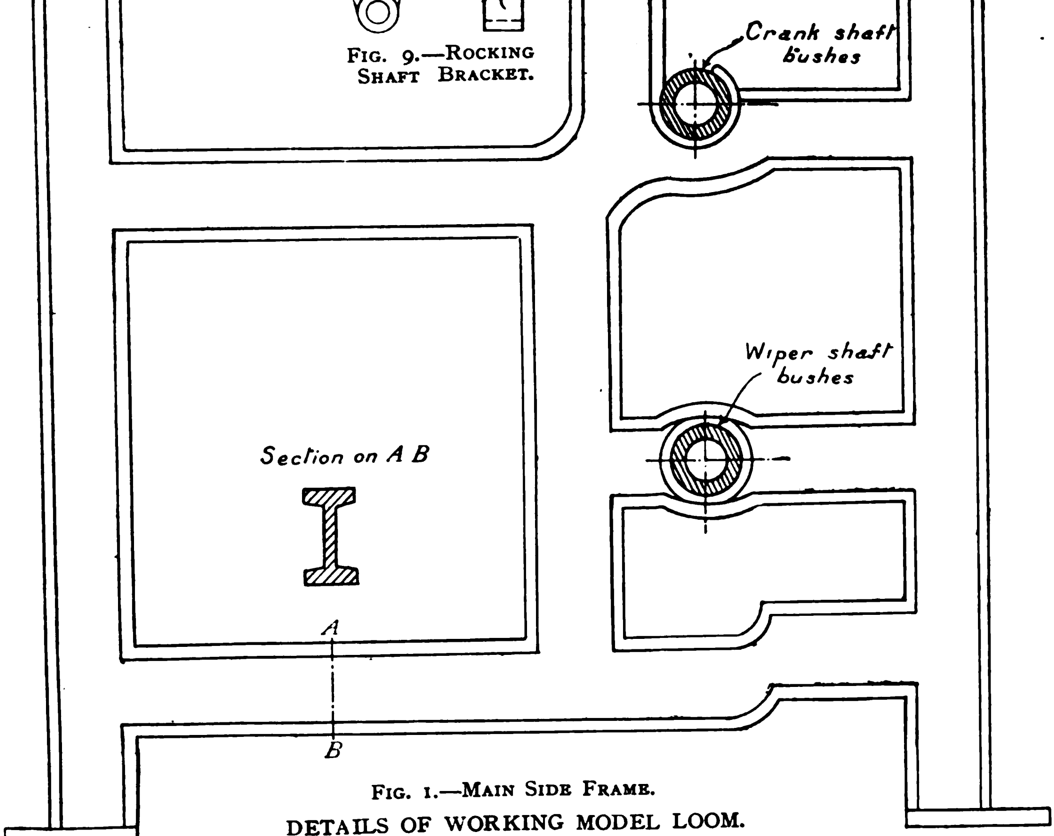
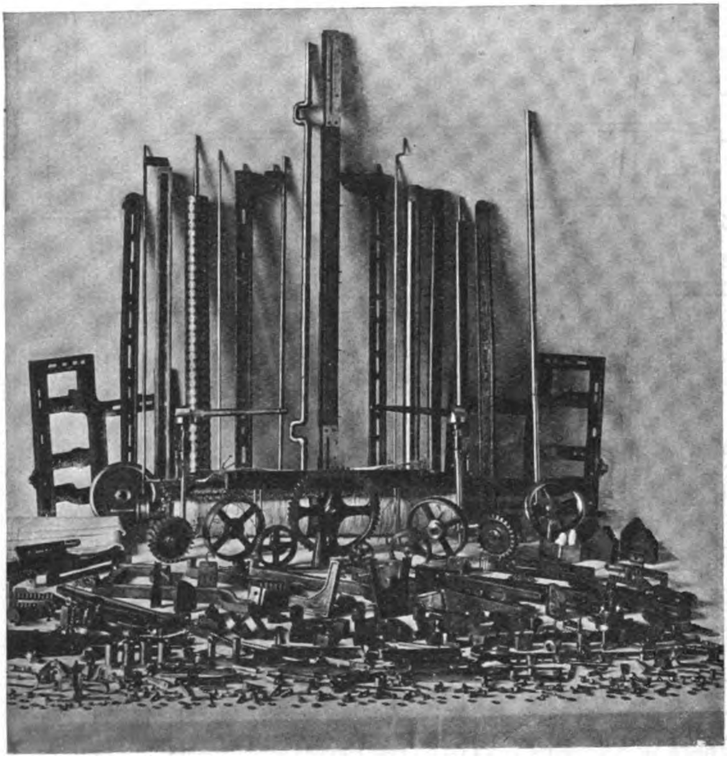


Fig. 1.—Main Side Frame.

DETAILS OF WORKING MODEL LOOM.

weaving cloth for about one hour each night for two weeks which, needless to say, proved very interesting. The model is put together with bolts and nuts numbering nearly two gross, and every part is adjustable and interchangeable. The winding of the cops for the weft was a big job, and I had to convert my lathe this time into a winding frame with cone and traverse motion. I may add that I have all the patterns of the model,



An Interesting Collection of Parts Employed in the Construction of the Model Loom.

and, if any of your readers are interested, I shall be pleased to answer any questions regarding the construction and dimensions of the above model.

In conclusion, and for the benefit of those readers who are not acquainted with the subject, I may say that all the looms as a rule go under the name of the amount of inches of cloth that the loom will weave. A ·o-4, which means ten-fourths of a yard, would equal 90 ins., one-fourth being equal to 9 ins. There are various widths of looms from 3-4 up to 12-4, the 3-4 = 27 ins., 4-4 = 36 ins., and so on to 12-4 = 108 ins.

Moving Railway Tracks.—It is reported that a machine for lifting and moving railway tracks, designed by the general manager of the Panama Railway, has demonstrated, after a careful test, that during a day of ten hours it is capable of lifting and moving 5 ft. to one side a mile of very heavy railroad track, only five men being required to accomplish this amount of work.

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.]

Mixture for Hardening Spiral Springs.

The following oil bath mixture gives excellent results for hardening spiral springs:—Two galls. best whale oil, 2 lbs. Russian tallow, and ½ lb. rosin. Boil the tallow and the rosin together until dissolved; add the whale oil and stir up well, and then it is ready for use.

A Makeshift Vice.

By H. B.

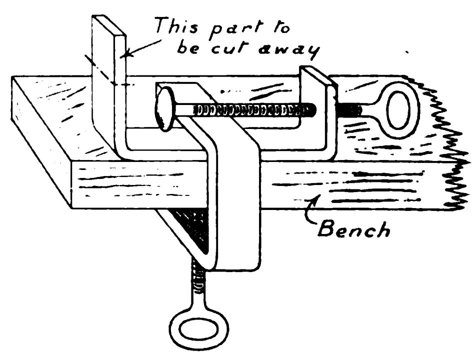
A very handy vice can be made as shown below in the accompanying diagram, by means of two ordinary clamps placed in the position indicated. An arrangement such as this has been found very useful for holding small articles quite firmly.

Altering an Old Wood-turning Lathe.

By John S. Brown.

The following particulars of some alterations carried out on a wood-turning lathe, 3½-in. centres, with a wooden bed, may be interesting. Neither of the headstocks had tenon pieces, and the bed was so light that no metal turning could be done.

The bed was made of two pieces of angle-iron, 30 ins. by 2¼ ins. by 2¼ ins., filed and scraped



A Makeshift Vice.

until their outer surfaces were smooth. These were fixed together by four ¼-in. bolts—two at each end. The holes for the bolts were bored slack, and the bed then put together on a piece of plate-glass.

The fast headstock was then taken in hand.

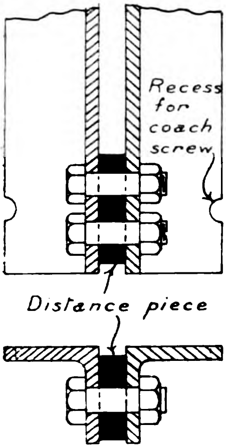


Fig. 1.—Section of Lathe Bed.

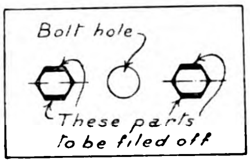


Fig. 2.—Base of Fast Headstock.

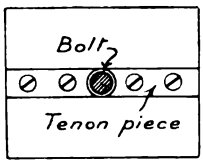


Fig. 3.—Base of Loose Headstock.

Two holes were bored in its base in the centre of the position the tenon-piece should occupy; these were tapped and fitted with ½-in. bolt ends, so that only the head of the bolt projected. The opposite sides of these bolt heads were filed away until they fitted tightly into the bed. This headstock was then fixed in place and fitted with a centre; the loose headstock, also fitted with a centre, was brought up against the centre of the fixed headstock and adjusted until it was in correct position. A scriber was then drawn along from under the bed, giving the position of the tenon-piece on the base of the loose headstock. This piece was chipped out to a depth of ⅛ in., and fitted with a piece of steel suitably cut to allow the clamping screw to pass through.

The supports for the bed were made of teak, 8 ins. by 8 ins. by 2½ ins., cut away to allow the bed to fit in. Semi-circular slots were filed in the outer edges of the bed about 2 ins. from the ends, and through these four coach-screws were fixed into the wood. To hold the lathe in place on the bench, holes were bored through the blocks of wood, and continued through the bench. Into these long bolts are fitted and screwed up from under the bed.

When in use the bed springs slightly when the slide-rest is at the centre of the bed, so that if I were doing this job again I would either use a shorter length of bed or a heavier section of angle-iron.

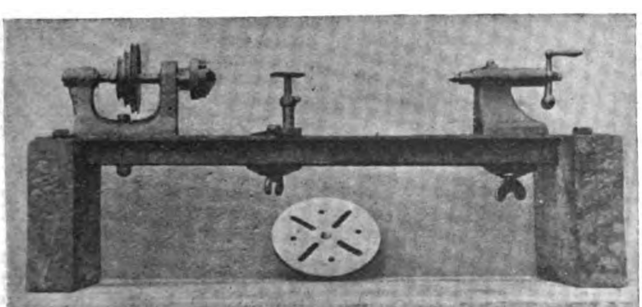


Fig. 4.—Showing Mr. J. S. Brown's Improved Lathe.

Device for Obtaining Smooth Surface on Wood.

By E. Hymans.

The accompanying is the design of a tool intended to make the work on wood with sandpaper shorter

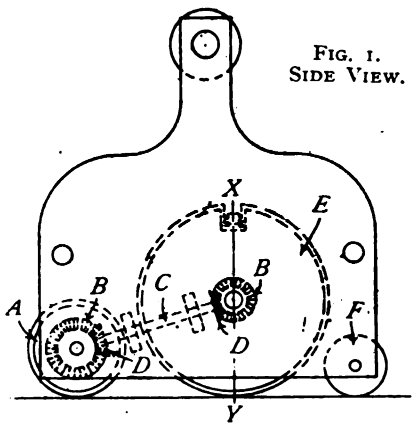


Fig. 1. Side View.

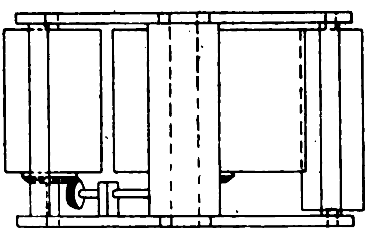


Fig. 2.—Plan.

A Device for Woodwork.

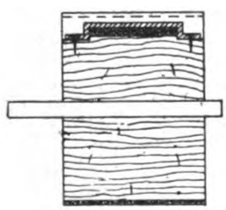


Fig. 3.—Showing Method of Tightening Paper on E.

and less troublesome. I regret I have not been able to test its value practically, but perhaps some readers may profit from it.

Figs. 1 and 2 represent a tool for large flat surfaces. When it is moved over the wood, the cylinder A, clad with india-rubber, turns. The motion is transmitted by the bevel-wheels B and the shaft and wheels C and D to the cylinder E, that is clad with sandpaper and has the double radius of A. F serves to support the tool from behind. The flintpaper on E is moved over the wood with the double velocity of the surface of A, and in the opposite direction. Fig. 3 shows how the paper is tightned on E. The side frames are of sheet metal.

A Small Gas Engine.

By Percy Briggs.

THE accompanying photograph shows a small horizontal gas engine which I have made in my spare time. It was made to drive a dynamo for charging motor accumulators, and this duty it performs splendidly.

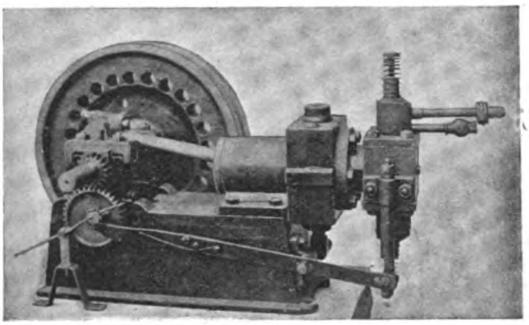


Fig. 1.—Mr. Percy Briggs' Small Gas Engine.

The cylinder is 2-in. bore × 2½-in. stroke. The inlet valve is double-seated to admit of air and gas. The piston has three grooves turned in it, and the middle one is packed with asbestos yarn, and the outside ones have ordinary piston rings; these keep the compression very good. The ignition is by low-tension electric current, and the induction coil consists of a core of soft iron wires covered with about 800 turns of No. 18 B.W.G. wire. This, with a 4-volt accumulator, gives a good fat spark. (See Fig. 2.)

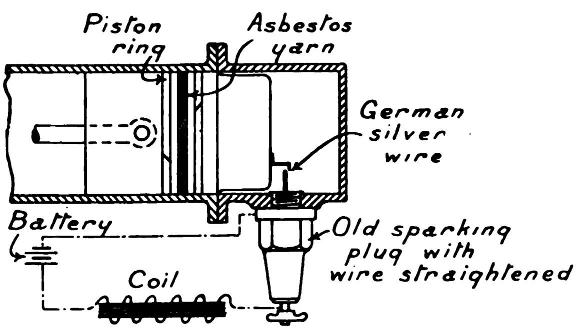


Fig. 2.—Arrangement of Electric Ignition.

I first saw the arrangement in No. 29, Vol. III, of The Model Engineer. As gas was not convenient, I made a wick carburettor from instructions given in The Model Engineer, and I find it very satisfactory and gives a good supply of gas. (See Fig. 3.) When using petrol the engine makes about 350 r.p.m., and it takes you all your time to stop it by putting your hand on the flywheel. At first I intended to have it air-cooled, and by drilling holes in the flywheel I thought they would act as a fan, and thus cool the cylinder. This was not satisfactory, and the engine got very hot, and as I had not made any provision for a

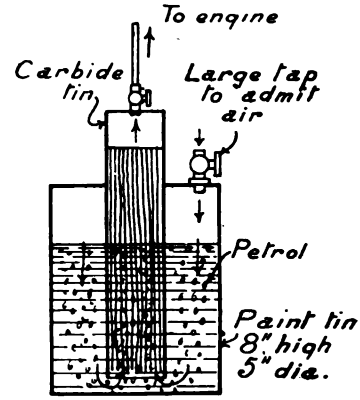


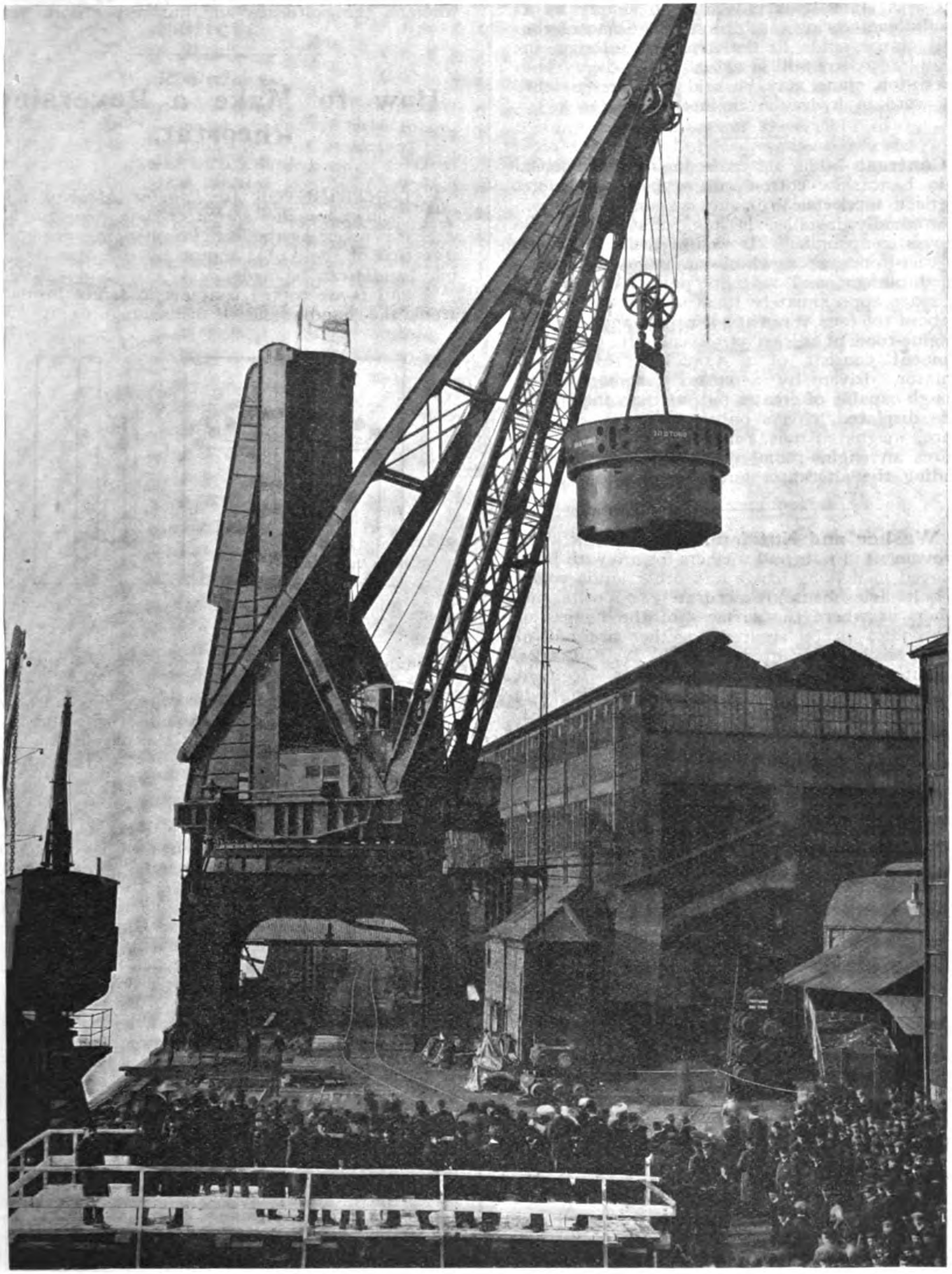
Fig. 3.—Wick Carburettor.

water-jacket, I had to bolt a small square one in halves; this keeps it quite cool. (See photograph.) The wire and tripod on the front of the gear wheel was for a make-and-break contact-maker, but it was not successful.

The Latest in Engineering.

Wearing of Electric Traction Rails.—Since the adoption of electric traction on the underground railway system in London, it has been found that there has been excessive wear of the rails. To counteract this, various experiments are being tried, the most important being the adoption of a harder steel for the rails and the more liberal use of check rails at curves. By the application of these and other means it is fully expected that after a short experience it will be found that the cost of maintenance of the permanent way of the electrified lines will not be materially greater than it was under the old conditions.

A New 150-ton Crane.—We are indebted to Sir W. G. Armstrong, Whitworth & Co., Ltd., for the accompanying illustration of their new 150-ton hydraulic crane, manipulating a 12-in. gunhouse for the battleship *Lord Nelson*. This exhibition was given to an assembly of visitors at Elswick on February 21st, 1907. The gunhouse is built in one of the riverside shops, and when completed is lifted out. In the photograph it is shown just clear of the roof of the shop building. It is curious to notice how small and insignificant the gunhouse looks in the grasp of the crane, yet it is a huge mass weighing 102 tons. The placing in position of these heavy gunhouses, which used to take two days, will now be accomplished in twenty minutes. This crane has been erected to replace the 120-ton shear legs, which were used for the first time in July, 1876, when the steamship *Europa* took out to Spezia the first Italian 100-ton gun. Elswick

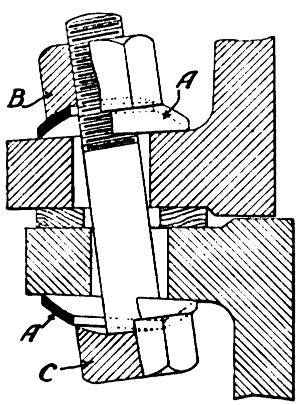


THE NEW 150-TON HYDRAULIC CRANE.
(Built by Sir W. G. Armstrong, Whitworth & Co., Ltd.)

is now known chiefly for its guns and warships, but it was started sixty years ago simply as a hydraulic engineering establishment. Some of the earliest cranes made to the Armstrong design, in 1849 and 1850, are still in actual use to-day. The new 150-ton crane may be said to represent the latest word in hydraulic engineering.

A Contrast.—The old main engine by which a certain Lancashire cotton mill was driven before conversion to electrical driving was of 1,000 h.-p., and originally installed in 1834, but at a later date was compounded. It was of the beam type, with cast-iron spur flywheel meshing with wood-toothed pinions, and with its pumps occupied a floor space approximately 1,040 sq. ft. Its weight was about 100 tons, it ran at $23\frac{1}{2}$ r.p.m., and required an engine-room of at least 38,500 cubic ft. The new equipment consists of a 1,000-kw. three-phase alternator, driven by a steam turbine, which, although capable of greater output than the engine it has displaced, covers only 960 sq. ft. of floor surface, weighs 20 tons, runs at 1,500 r.p.m., and requires an engine-room of only 24,000 cubic ft. including the alternator and the switchboard.

A Washer and Nut for Special Work.—An improvement in nuts and washers for use with bolts employed in making flange and other joints where the bolt holes are not accurately opposite one another, or where the surfaces of the flanges or other bodies to be secured together are out of parallel, has been invented by Mr. T. W. K. Clarke, of Surbiton. The washer A is formed as a segment of a hollow sphere and the under or bearing side of the nut B and also the under side of bolthead C



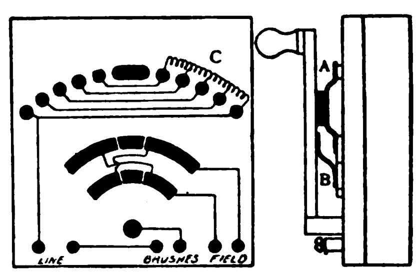
Showing Application of Washer and Nut for Special Work.

concave, the concavity corresponding in each case with the convexity of the washer. Where the bolt holes are not accurately opposite one another, or where the surfaces of the flanges are out of parallel, the bolt and nut respectively supported on washers of the kind described are free to adjust themselves to such a position that, although the axis of the bolt is not at right angles to either of the flanges, it is at right angles to the surfaces of the washers whereon the boltheads and nut respectively seat.

How to Make a Reversing Rheostat.

A CONTRIBUTOR to *Popular Mechanics* has shown by the accompanying diagram how a reversing rheostat for changing either the direction or speed of a motor by the operation of one handle can be made.

A and B are copper contacts, A being insulated from the handle and B connected to it. The



A Reversing Rheostat.

resistance coils C give the necessary resistance for decreasing the speed.

When the handle is in the centre the motor will not move, but when moved to either side the motor will revolve, the direction of the revolution being changed by swinging the lever over to the opposite side.

Shaft Repair at Sea.—When on a voyage from Glasgow to Newport News, several weeks ago, the Donaldson liner *Hestia* broke her thrust shaft. Mr. Angus A. Urquhart, chief engineer, has furnished to the monthly report of the Marine Engineers' Association some interesting particulars as to how repairs were effected, and the machinery made good for the return to Glasgow. The thrust shaft, he says, was 21 ft. long, collars $22\frac{1}{2}$ ins. diameter, and body of shaft $13\frac{1}{4}$ ins. diameter, and thickness of collars $3\frac{3}{4}$ ins. The shaft was completely broken, and was repaired by drilling three $1\frac{5}{8}$-in. holes in collars and recessing, one collar to receive the heads of the bolts so as to clear the thrust web. After fitting the $1\frac{5}{8}$-in. bolts in the collars, three keys were also fitted on the edge of the collar, two of them 14 ins. by 5 ins. by $1\frac{3}{8}$ ins., one—made from the shank of a $3\frac{1}{4}$-in. spanner—being 14 ins. long and $\frac{5}{8}$ in. thick. Securing the shaft—which took forty-eight hours—and drilling the holes and cutting key-seat was accomplished under very trying circumstances. A furious gale was raging, and the ship drifted 256 miles in five days. When anchors were dropped outside Loop Head, Ireland, the repairs were completed, and the vessel steamed to Greenock, *en route* for Glasgow, a distance of 367 miles, which was accomplished in 47 hours 21 mins.

A Design for a Model Marine Boiler.*

By E. Fitzgerald.

In designing a marine boiler for a fast model steamer several special conditions have to be considered. The first and most important is light weight combined with a large heating surface and a good circulation. A low centre of gravity is also an advantage and a reliable and efficient system of firing is necessary. With satisfactory feed pumps it is not necessary to carry a large quantity of water in boiler; by attention to this point alone a great saving in weight may be effected.

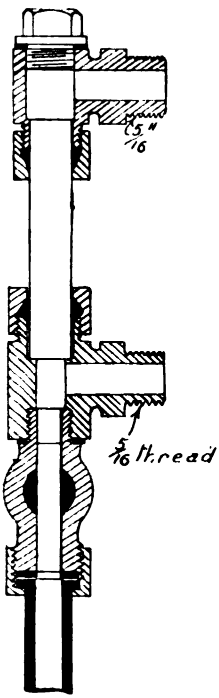


Fig. 5.—Water Gauge.

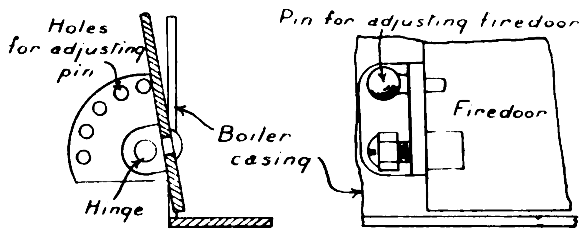


Fig. 9.—Showing Firedoor Hinge.

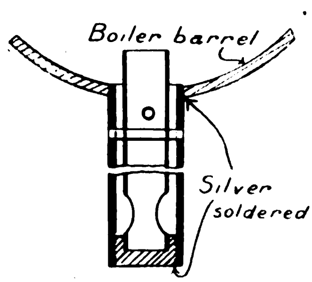


Fig. 6.
Section of Field Tubes.

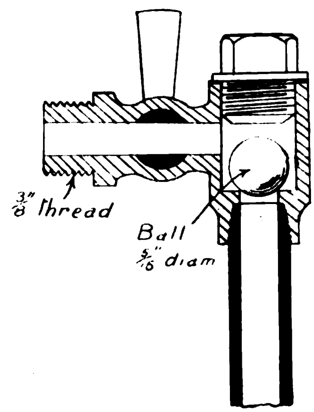


Fig. 7.—Check Valve.

Design for Model Marine Boiler.

The boiler shown in the drawings is designed to meet the above requirements and the size shown is suitable for a 6-ft. by 7½-in. beam boat, but the length of boiler can be altered to suit a larger or a smaller boat, the weight working out at about 1·16 lb. per in., the total weight of boiler being about 16 lbs., this including the oil tank to hold one pint. The heating surface of above boiler is slightly over 400 sq. ins.

The boiler consists of a steam drum 2 ins. diameter by 12 ins. long; into this is screwed 132 field tubes, the top row being 2½ ins. long, the next row being 3 ins. and the two rows along bottom of drum being 1¼ ins. long. These and the drum are of solid drawn copper. The tubes are screwed into drum with a fine thread about 36 per inch, slightly taper on screwed portion, and are silver soldered. The lower ends of tubes are stopped with a gun-metal cap screwed and silver soldered in; these caps are recessed to take the circulating tube. These tubes are shown in section in Fig. 6.

The ends of the steam drum are phosphor-bronze castings with bosses on the inside to take the fittings. If the builder possesses a screw-cutting lathe the ends can be screwed in and silver soldered, as shown in the drawings.

If this cannot be done the ends can be driven into steam drum and secured with screwed pins and then silver soldered. With screwed-in ends one 3-16ths in. stay will be sufficient.

The dome is a phosphor-bronze casting with bosses for fittings. It should be riveted and silver soldered to drum before the ends are fixed into drum. Three or four baffle plates are fitted in dome and a strengthening ring fixed inside steam drum.

We must now consider the fittings and the best way of arranging them. These comprise water gauge, check valve, blower steam gauge to 200 lbs. per sq. in., engine stop valve, and double safety valves set to blow off at 100 lbs. per sq. in. The water gauge (Fig. 5) is fitted on forward end of boiler, it is fitted with a plug cock at bottom for clearing the glass. The glass should be 3-16ths in. bore, and the maker will find the "Beacon" gauge give great satisfaction. On referring to Fig. 5 the various details of gauge will be seen.

The check valve (Fig. 7) is screwed into after end of boiler at water level. The valve is a phosphor-

* A prize of one guinea was awarded for this design in the recent Competition No 42.

bronze ball 5-16ths in. diameter, with a seating 3-16ths in. diameter; the edge of seating should be left sharp and the ball seated by a sharp blow. A plug cock is fitted between valve and boiler, and a valve (not shown) must be fitted between pump and check valve to adjust the quantity of water. The ball valve should have a lift of not more than 1-16th in.; this is important in high speed pumps.

The steam gauge is ¾ or 1 in. diameter graduated to 200 lbs., and is connected to dome by a copper syphon.

A screw down stop valve is provided. This is screwed into T piece on to top of dome and the steam pipe may pass through the boiler casing, this, together with the baffle plates on dome should thoroughly dry the steam to engine.

The steam pipe should be of solid drawn copper ⅜ths in. diameter.

The blower is provided with a wheel valve on dome the tube being screwed into T piece on dome screws at top as shown in Fig. 8, the valves being set to blow at 100 lbs. The transverse hole on body of valve must be fitted with a plug. All castings for fittings should be of phosphor-bronze or gun-metal. It is not advisable to use brass in high pressure fittings.

The boiler casing is of sheet iron about 22 S.W.G. lined with 3-32nds in. asbestos, the asbestos being secured at the edges by thin strips of iron 1-16 by ¼ in., these being fixed by screws from the outside.

The casing is in two parts; this makes it easy to remove it from the boiler.

Baffle plates should be fitted as shown in the cross section Fig. 3 to direct the flames over the tubes.

The fire-door should be large enough to allow the withdrawal of the burners; it is adjusted to give the lamp sufficient air by placing the pin in quadrant plate in the desired position (see Fig. 9).

The firing arrangements must now be considered.

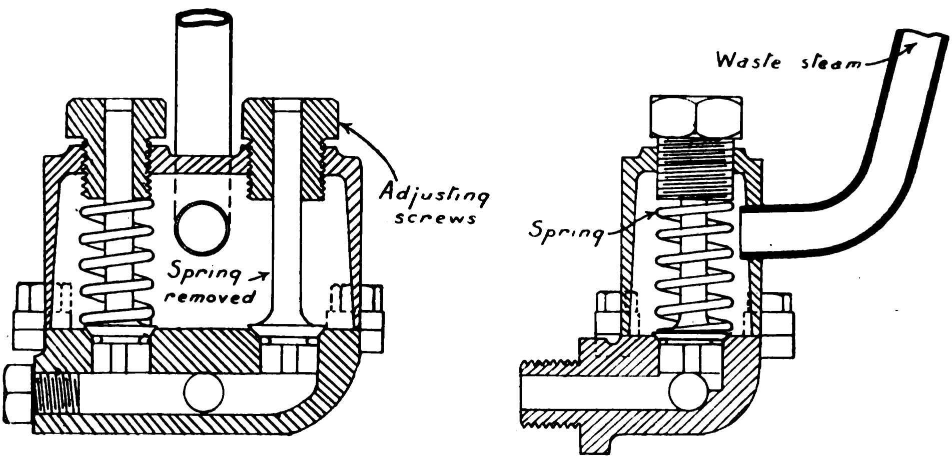


Fig. 8.—Two Sectional Elevations of Safety Valves.

opposite engine stop valve. The blower tube is ⅛th in. diameter solid drawn copper and is coiled into a ring 1 in. diameter under chimney; four small holes are drilled in ring to form steam jets, these holes should be as small as possible, a drill made from a needle point being quite large enough. The ring should be set at an angle to point straight up chimney.

The safety valves (Fig. 8) are spring loaded, two valves being shown in drawing; but these can be replaced by one valve of a larger diameter.

The body of valve is screwed into steam dome and is drilled and seatings for valves turned. The valves have three wings and should fit easily in valve body. The angle of seating should be 90 degs.

The cover is fitted to body by a screw in centre as shown in Figs. 2 and 4, or may be screwed with four bolts as shown in Fig. 8.

The joint between cover and body should be close enough to prevent the escaping steam blowing out over the fittings on dome. The steam is led away by the pipe in front of funnel.

The springs are of steel and are adjusted by As this is one of the most important parts of a racing boat a thoroughly reliable system must be employed. For all-round work the Primus burner seems to give very good results when properly used, and they have been adapted to the design given. Two burners 2½ ins. diameter being used in the boiler 12 ins. long, for a longer boiler three burners should be used.

The oil tank may be any desired shape to suit the boiler, but a cylindrical tank is recommended; this being easy to construct. It should be fitted with a cycle valve, then a cycle pump can be used instead of an air pump, thus cutting down a little of the weight.

The tank should be some distance from the front of boat to enable the burners to be withdrawn from boiler without much trouble, the tank being secured to under side of deck with two wing nuts. The tank should be of brass tube with the ends riveted and soldered in. A wheel valve is fitted between tank and burners, the oil pipe branching off to each burner.

Before raising steam the boiler should be tested to 200 lbs. with a hydraulic test pump.

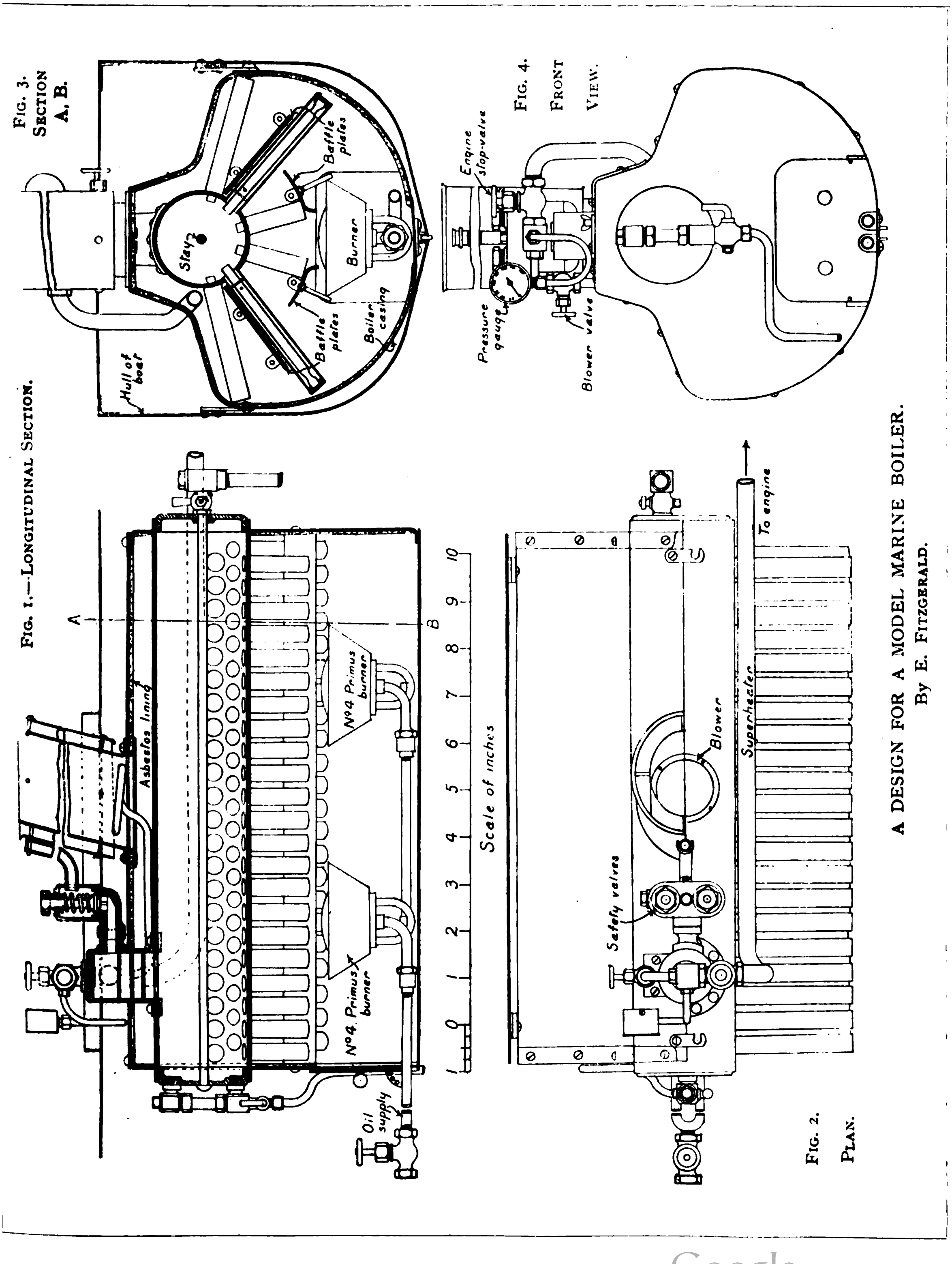


Fig. 3. Section A, B.

Fig. 4. Front View.

Fig. 1.—Longitudinal Section.

Fig. 2. Plan.

A DESIGN FOR A MODEL MARINE BOILER.

By E. Fitzgerald.

How to Bind "The Model Engineer."

By "ORLANDO."

THE following article will be rather a change from the building of model engines, ships, dynamos, etc., and yet I think it will appeal to a great number of THE MODEL ENGINEER readers. How many out of the thousands of volumes published of this interesting and instructive paper, have been bound, I wonder; and of the latter, how many are the work of the readers themselves? Very few, I should imagine, and yet it is fairly simple "when you know how," beside having the advantage of being cheaper and allowing one to have books bound which he would otherwise have to be satisfied with in single numbers; and thereby offering greater facilities in handling and storing. The methods of binding vary somewhat, but I only intend to describe the one which I have followed in binding THE MODEL ENGINEER and if the article is thoroughly understood, no one need be afraid of starting, as it was *my* first attempt and I have finished the whole of the volumes up to the present date (except Volume I, which I have not yet been able to get), and they have all turned out very satisfactorily. The sewing is done on strings (not tapes) and makes a strong job, which will stand ordinary wear and usage. To begin with, the following articles will be required.

SEWING FRAME (Fig. 1).—This is made of wood to the dimensions given, the base being a piece of pine, and the remainder being made from a lath as used for the bottom of window blinds. These are fixed together with glue, and screws or nails, and should be made firm. The nicks are cut as shown, to fix position of strings, and three screws fixed at back edge (Fig. 2) to hold the strings.

KNIFE (Fig. 3).—This is a knife used by shoemakers, and costs 5d.; the 4d. one being too short.

PRESS (Fig. 4).—This comprises two pieces of timber to the dimensions given; two ⅜ in. bolts, 6 in. long, with washers and wing nuts; and two pieces of sheet iron or steel, about ⅛ in. thick, fixed to timber as shown.

STRING.—The most suitable is two-cord soft white cotton string.

THREAD.—The flax thread used by shoemakers will do very well, but two-cord thread as used for letterpress binding is better, if obtainable. This costs about 3d. per knot, the former being 3d. per ball.

GLUE AND GLUE BRUSH.—The glue must be used fairly thin.

PASTE AND BRUSH.—Starch or flour mixed with a little cold water to a thin paste, and then boiling water added until it thickens.

MULL, OR BOOK MUSLIN.—This can be obtained from most drapers, price 3d. per yard. A yard will do a good many books.

NEEDLES.—Small darning needles are the best to use.

STRAWBOARDS.—These are to form the backs, and should be 9¾ ins. long by 7¼ ins. wide by about 1-16th in. thick. If bought, these will cost about 6d. per dozen ready cut; but any odd pieces of cardboard will do, if of suitable thickness.

BOOKBINDER'S CLOTH.—This can be had in various colours from most book-binders, price about 9d. per yard, and is about a yard wide. One yard will do for several books.

PAPER.—Glazed brown, or other colour paper for the beginning and end of book (called "end papers") same size and folded same as the weekly cover of THE MODEL ENGINEER.

HAMMER.—This will be found in most homes.

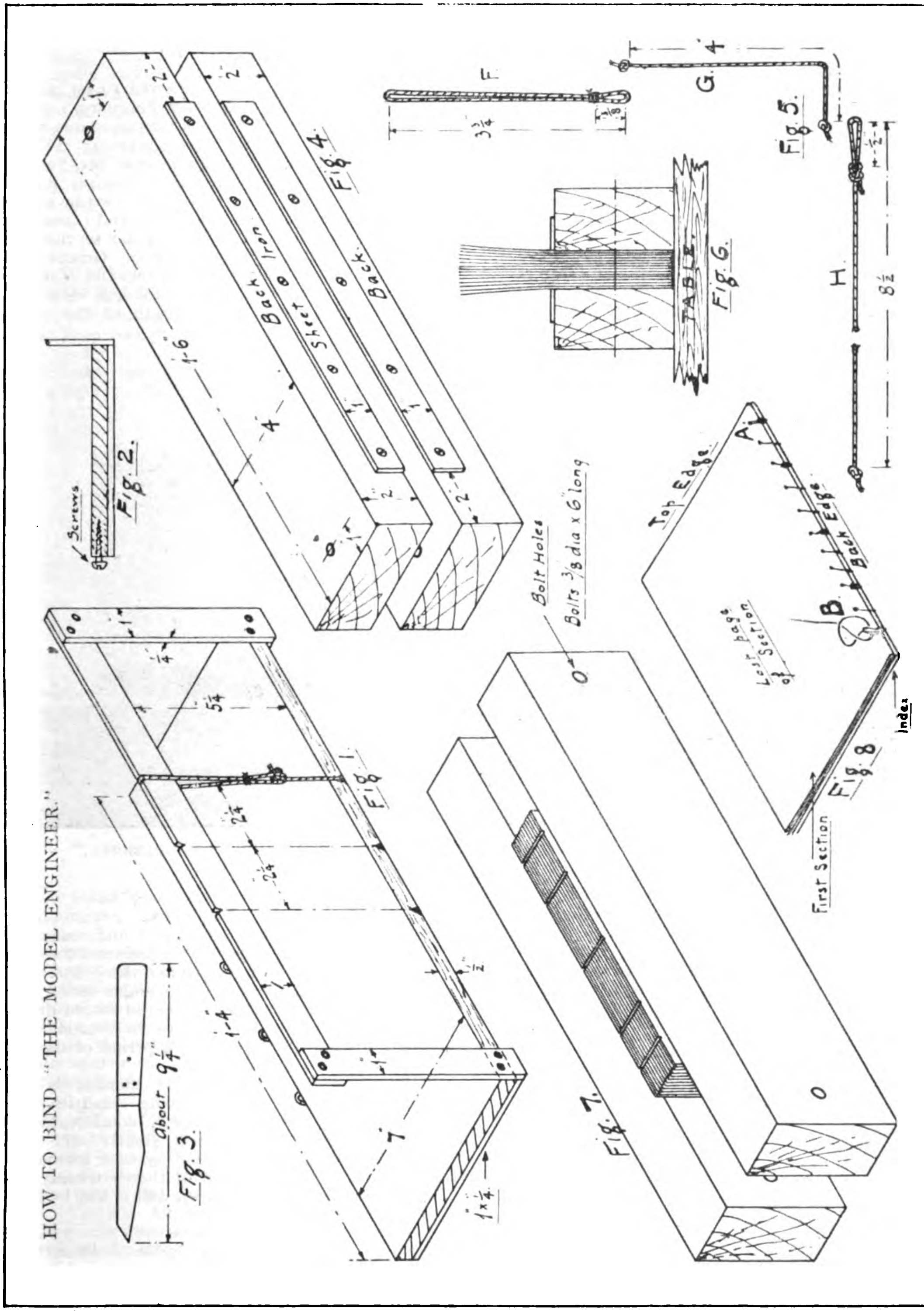
SAW.—Tenon or similar fine saw.

Everything being now ready, proceed as follows: Cut three pieces of the string and make each one into a loop (F, Fig. 5) around the horizontal rail of the sewing frame, and bind with thread as shown. Cut six more and make three of them as at G and the other three as at H (Fig. 5). Then take one of G and pass one end through the small loop of F, and pull it tight; the knot will prevent it coming out. Then put the other end through the loop of H, draw that tight, put it in one of the nicks (Fig. 1), and take the other end underneath the base, and wind it round the screws at back of frame, after which pass the end under the tight portion to prevent it coming undone. The same process must be repeated with the remaining strings, and when this is done they should be all tight, but not tight enough to break the wooden rail.

The staples which hold the leaves of the weekly numbers together, must now be removed by lifting their points, which will be found in the centre of each book, and then pulling them out at the back. Then remove the advertisement pages, taking care not to destroy the Index and also saving a few of the covers, and put all the numbers in their proper positions on top of each other with the Index at the beginning; tear one of the covers into two and place one at the end and one at the beginning of the pile, to keep the end books clean. Take one of the books, which we will now call *sections*, lay it face down on the sewing frame with the folded edge touching the strings and, with a pencil, mark position of strings on the edge; the centre string being about centre of the section; then put another mark about ¾ in. from the top edge of book, and another about 1 in. from the bottom edge. The sections now require pressing to get the folds as thin as possible.

Place the press on a table, take hold of the sections, knock them with the top edges downward, to get all the tops level, and place in the press in the position shown in Fig. 6. Then knock or push them until the folds or back edges which are resting on the table are all level; press them well by screwing up the wing nuts as tight as possible. Unscrew the press with one hand while the other firmly holds the sections to prevent them being disturbed, then carefully push them forward until the folded edges project outside the press about ¼ in., see that the edges are still level, and, with the saw, cut five nicks or grooves in the positions previously marked across the edges as shown in Fig. 7. These cuts should be just deep enough to penetrate the centre page of each section, or about 1-16th of an inch.

OVERSEWING.—Take the last section of the volume and begin at one end (A, Fig. 8), putting the needle and thread through this hole thrice, and, tying the loose end before proceeding, sew as shown. When the last hole is reached, put the thread through this thrice, and fasten it by putting the thread under the double stitch, and



HOW TO BIND "THE MODEL ENGINEER."

then through the loop thus formed (B, Fig. 8), finally pulling tight. Then make another knot exactly the same way, and cut the remaining thread about ¼ in. from the knot. Now take the first section and the Index; put the Index at the beginning of the section, and sew the same as the last section. This oversewing is not required for the other sections. This completed, take one of the old covers and tear it in two down the centre where it is folded, place one of these at the beginning of the volume and the other at the end (Fig. 9), and fix them in that position with three or four dabs of glue or seccotine, as shown.

The first seven volumes, having only about twelve or fourteen sections each, put two volumes to a book; that is, Vol. I by itself, Vol. II and III together, IV and V together, and VI and VII together. This causes the Index of Vols. III, V, and VII to come in the centre of each book, and, so that these can be easily found when using the books, put one of the end papers between the Index and the last page of the preceding volume, and fix it to the Index by glueing along the folded edge about ¼ in. wide. This applies only to the first seven volumes. The sections are now ready for sewing to the strings.

(*To be continued.*)

Effect of Moisture on Wood.—This is referred to in the report of the Forest Service of the United States Department of Agriculture. It was found that proper drying greatly increases the strength and stiffness of all kinds of wood, *e.g.*, red spruce dried at 100° C. is 400 per cent. stronger than when green. Upon absorbing moisture again, woods become weaker than when green. Air-dried wood, protected from the weather, and containing 12 per cent. moisture, is from 1·7 to 2·4 times as strong as when green.

Marine Notes.

New Turbine Steamers for the Great Central Railway.

The above vessels were referred to on page 155 of The Model Engineer for February 14th, and it was then stated that at a later period one of them would be illustrated in these columns. This promise we are now, by the kindness of Mr. Sam Fay, General Manager of the Great Central Railway, enabled to fulfil. The new ships, two in number, are respectively named *Marylebone* and *Immingham*, and they are engaged in the popular service of the Great Central Railway between Grimsby and Rotterdam. Our illustration shows the *Marylebone* at sea, and presents a very life-like view of the vessel under weigh. The length of the steamer over-all is 282 ft., and she has a beam of 41 ft. with moulded depth 21 ft. 6 ins. Accommodation is provided for a number of first and second class passengers. The propelling machinery consists of three Parsons' turbines driving three shafts, and steam is supplied by four large single-ended boilers working under Howden's system of forced draught. The mean speed maintained by the vessels on their trial trips was 18·3 knots for a period of six hours, the draught being 16 ft.

The Great Central Railway Company's New Turbine Steamer "Marylebone."

The two ships are proving themselves to be possessed of excellent sea-going qualities. They are in every sense up-to-date, comfortable, and speedy. Their presence will greatly add to the popularity of the service, and by their introduction fresh evidence is provided of the determination of the owning Company to keep well in the front rank in everything they undertake.

Lengthening a Steamer.

The steamer *Thames* belonging to the Carron Company, and plying between London and Grangemouth on the river Forth, has been in the hands of Messrs. D. & W. Henderson, of Partick (Clyde) since October last undergoing the process of lengthening. She is now practically ready for service again and is vastly improved. Originally she measured 230 ft. in length by 31 ft. beam by 16 ft. 6 ins. moulded depth, but as reconstructed her length is increased by 49 ft. 6 ins., viz., to 279 ft. 6 ins. At the same time, new and large boilers have been installed, the main engines thoroughly overhauled, and a propeller of improved design fitted.

A New Steamer for the British India Steam Navigation Company.

Messrs. Workman, Clark & Co., Ltd., Belfast, recently launched from their North Yard a handsomely designed vessel built to the order of the British India Steam Navigation Company, Ltd., and is named the *Chyebassa*. She is 445 ft. long with a gross tonnage of about 6,000. Accommodation for passengers is provided in the bridge space where exceptionally large and well-lighted state-room are arranged at the side of the vessel. The dining saloon is situated in the centre of the vessel with stairways at the after end leading to the promenade deck above. The officers, engineers, and petty officers' rooms are placed along the sides at the after end of the bridge space. The cargo space of the vessel is divided into four spacious holes, each of which has a large hatchway centrally placed, and equipped with a couple of powerful steam winches with the necessary derricks swung from the masts and derrick posts, and capable of rapidly loading and discharging cargo. The propelling machinery is of the triple expansion type with all the latest improvements in auxiliaries, and supplied with steam from four steel cylindrical multitubular boilers fitted with Howden's system of forced draught.

Another Turret Steamer Launched.

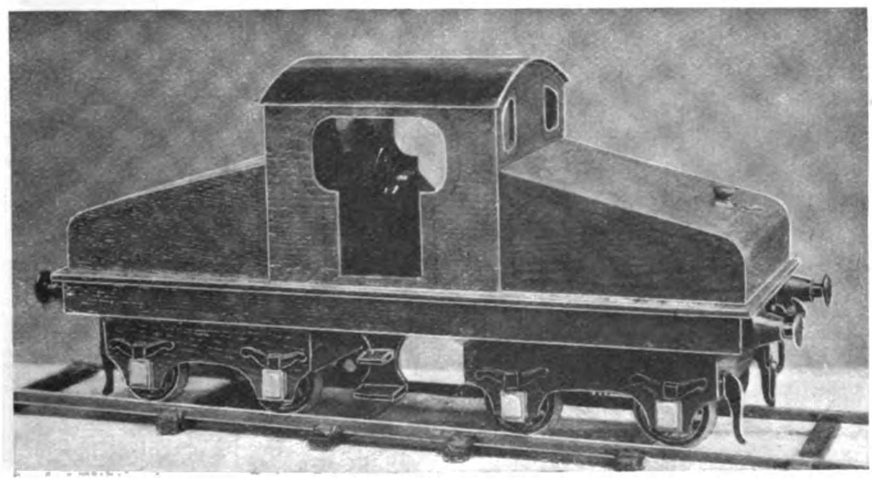
On the afternoon of Thursday, February 28th, Messrs. William Doxford & Sons, Ltd., Sunderland, launched for Messrs. A. Crawford, Barr and Co., Glasgow, the turret steamer *Galavale*, designed for general trading. The principal dimensions are —Length, 366 ft.; breadth, 50 ft.; moulded depth, 26½ ft. The deadweight of cargo and bunkers carried is 6,600 tons, on a draught of 21 ft. 9 ins.

A Beginner's Model Electric Locomotive driven by Clockwork.

By G. W. Mayhew.

NOT possessing the required tools and material for making a model of metal, I decided to make one of wood.

Herewith is shown a photograph of the model electric locomotive driven by clockwork which I have recently completed, and which took up six months of my spare time. My first idea in making this engine was to drive by electric power, but afterwards I decided to drive by the works of a clock, which I fortunately had by me. The model is almost entirely constructed of ash, with exception of axles, which I had to get turned, of mild steel. The motor is fixed between the frames just above the fixed bogie. Having a large cog-wheel, I soldered the same to the centre spindle of the clock, and keyed a smaller cog to the driving axle, thus producing a moderate speed. The ends of the bogies are half lapped, nailed, and glued; the principal parts of the engine are tenoned, which makes it fairly strong. The axle-boxes are constructed of apple wood, which are fixed inside in the horn plates and fitted with dummy springs. Readers who contemplate making a similar model may experience some difficulty



A Model Clockwork-driven Electric Locomotive.

in winding the clockwork. This I overcame by a small ratchet arrangement, using a mainspring ratchet and cogwheel taken from a discarded clock, and filing a square in the centre of the ratchet, and soldered a brass handle to the cogwheel, making a capital device for winding the mechanism from the inside. The motor is controlled by levers, and can be manipulated either side of the cab. There are 378 parts in the whole model, without power. The principal dimensions are as follows:—Height, 7⅝ ins.; bogie base, 3¼ ins.; total wheelbase, 11¾ ins.; length from buffer to buffer, 1 ft. 5¼ ins.; width under cab, 5¼ ins.; diameter of wheels over tyres, 1½ ins.

The buffer beams are painted red and lined, couplings and cab roof black. The body is enamelled green, with red lines, lifeguards red. I may also add that the coupling hooks and links are also made of hard wood. The engine is finished with a coat of varnish, which gives the model a good appearance and certainly pays for all the time spent upon it.

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 intended for publication.]*

A Novel Method of Fitting a Steam Engine to a Rowing Boat.

To the Editor of *The Model Engineer*.

Dear Sir,—Having seen from time to time the doings of amateurs described in The Model Engineer, I thought the enclosed photographs might interest you. The engine—a two-cylinder

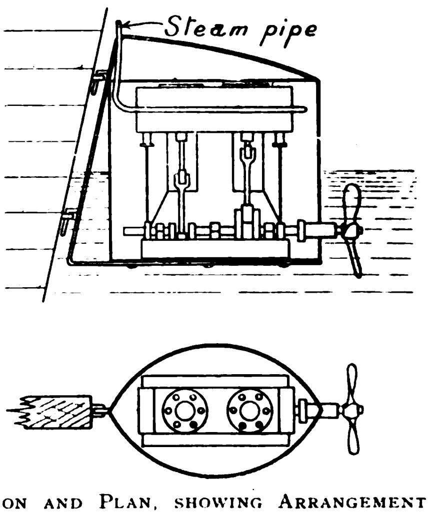
Showing Rowing Boat, Fitted with a Boiler and Engine.

1½-in. x 2-in.)—I made myself from castings, cutting and threading all nuts and studs. The boiler I had made for me, and it has a detachable firebox and gas stove. I use gas indoors and coal outdoors.

Last summer I thought I would like to drive a rowing boat with it, but not liking to cut the boat

Stern View of Boat, showing Engine Casing

about by fitting propeller shafts, etc., I thought of the plan shown in photographs, *viz.*, I built a small box, just large enough to take the engine, out of a large cheese-box. It had bent sides, and was pointed front and rear. This I covered with zinc and made watertight. I fitted a stuffing-box in rear to take a short shaft with propeller



Section and Plan, showing Arrangement of Engine in Box.

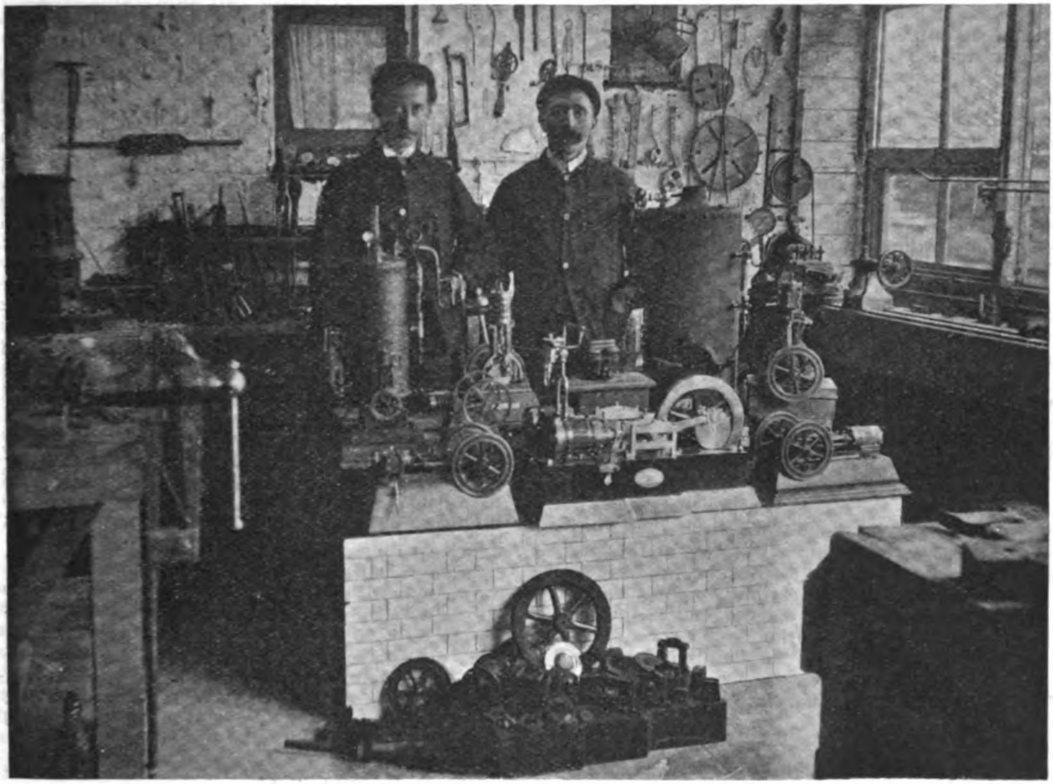
attached. I then fitted the whole in a ½-in. iron frame, which had two hooks, as shown in sketch. I removed the rudder from boat and attached the box by the two hooks to the two eyes in rear of boat. I placed the boiler in the boat, and connected it with engine by a long steam pipe with a suitable movable joint, to enable me to move the box from side to side, and so steer the boat. The engine drove the boat at a good pace considering the size, and was a source of much pleasure and amusement.—Yours faithfully, J. Taylor.

The Workshop of Two Amateurs.

To the Editor of *The Model Engineer.*

Dear Sir,—We have much pleasure in forwarding you photograph of our workshop and models we have made in our spare time. Also particulars of our latest, which we have just completed. It is the centre one of group and of our own design, patterns being made by ourselves. The dimensions are as follows:—Double cylinder, 2½-in. bore, 3-in. stroke; travel of valves, 7-16ths in.; link reversing (lever can be seen on side of bed); parallel guide-bars; 10-in. flywheel, 1¾-in. face; weight, 12 lbs. All bearings, glands, etc., are of gun-metal. Size of bed, 22 ins. by 14½ ins. by 4 ins., which is of cast iron, properly webbed; cylinders lagged with teak and brass bands. We also have made and fitted sight-feed lubricator (taken from particulars in The Model Engineer). Weight of engine complete, 135 lbs. There are also a set of castings of same engine on floor. All turning and boring done by ourselves on a 5½-in. back-geared lathe. Other small engines, castings of which we had from an advertiser in The Model Engineer. We do not want to say a lot concerning boilers and other small engines, as we do not wish to occupy too much of your valuable paper. Trusting these particulars will prove interesting, yours truly,

W. H. Sharpen.
Wanstead, Essex. E. Collins.



The Workshop and Models of Messrs. W. H. Sharpen and F. Collins.

Re Competition No. 42.

To the Editor of *The Model Engineer.*

Dear Sir,—Being much interested in the subject of boilers for model speed boats, I looked forward with keen anticipation to your publication, in these columns, of the design which should meet the conditions of the recent competition.

Upon receipt of your issue of February 14th, containing a description and drawings of Mr. David Scott's design, which was awarded the prize, I was, therefore, somewhat disappointed at finding that he has not furnished the data upon which are, doubtless, founded the various assumptions from which he must have deduced the quantities used in the design.

These assumptions, which the reader must take for granted, are, roughly, as follows:—

1. What i.h.-p. or b.h.-p. is assumed to propel the boat?
2. What number of revolutions per minute is assumed at full load?
3. What rate of evaporation is assumed per unit area of heating surface?
4. What justification is there for the use of 180 lbs. boiler pressure in a model?

Referring to the rule given in No. 13 of The Model Engineer Handbooks, for the size of cylinders, it would seem that, if C.C. $= \frac{L\,B\,D}{a}$, in which *a* for a boat of 6 ft. 6 ins. to 7 ft. L.W.L.

may be taken as 1,300, and where L = 78 ins., B = 7 ins., and D = 2½ ins., we have

$$C.C. = \frac{78 \times 7 \times 2 \cdot 5}{1300} = 1 \cdot 05 \text{ cubic ins.}$$

This corresponds to a cylinder of 1¼-in. bore by 1-in. stroke, which would, according to the Handbook, propel the boat at a *reasonably* good speed.

The terms of the competition, however, are that the boiler is to suit a *racing* boat, for which, no doubt, the above cylinder dimensions would have to be exceeded.

This being the case, it seems at first sight as though an engine having a cylinder of ⅞-in. bore and ⅞-in. stroke, as specified by Mr. Scott, would be somewhat below the requirements of the case. This is borne out by the dimensions of the engines of the *Era*, which attained a speed of 8,766 miles per hour, with a compound engine of 1 in. and 1¾ in. by 1 in.

However, as pressure and speed are governing factors in the matter of power, and as neither the Handbook referred to nor the published particulars of the *Era's* machinery furnish statistics on these points, we must take for granted that, with a certain speed, the engine for which Mr. Scott's boiler is designed will do the work. What this speed should be it would be interesting to know.

If we assume for the engine a speed of 1,000 r.p.m., the indicated horse-power will work out as—

$$I.H.\text{-}P. = \frac{170 \times \cdot 0625 \times \cdot 6013 \times 1000 \times 2}{33000} = \cdot 3872$$

which would not appear excessive by any means. In the above, the boiler pressure being 180 lbs., the M.E.P. (absolute) has been assumed as 170 lbs., roughly allowing for losses, back-pressure, etc.

It seems to have been pretty conclusively demonstrated that an evaporation of 1¼ cub. ins. of water per minute per 100 sq. ins. of heating surface is an excellent performance for a model boiler; therefore, in order to supply the engine with steam at 180 lbs. pressure and for a speed of 1,000 r.p.m., we have—

Cubic capacity of ⅞ × ⅞ cylinder = 0·45 cubic inch; 0·45 × 2 = 0·90 cubic inch = volume per revolution. At 1,000 r.p.m., 0·90 × 1000 = 900 cubic ins. of steam used per minute.

Now, since 1 cubic in. of water equals 143 cubic ins. of steam at 180 lbs. pressure, $\frac{900}{143} = 6 \cdot 30$ cubic ins. of water per minute required by the engine.

Again, if 100 sq. ins. of heating surface will evaporate 1¼ cubic ins. of water per minute, $\frac{6 \cdot 30}{1 \cdot 25} = 4 \cdot 85$ and 4·85 × 100 = 485 sq. ins. = heating surface required.

If the heating surface of 236 sq. ins. given in Mr. Scott's design, be accepted as correct, then the evaporation of his boiler will be 2·95 cubic ins. of water per minute, which corresponds to an output of 422 cubic ins. of steam per minute at 180 lbs. gauge pressure.

This will be equivalent to $\frac{422}{0 \cdot 90} = 469$, or call it 470 r.p.m. With this speed, the power will be—

$$I.H.\text{-}P. = \frac{170 \times \cdot 0625 \times \cdot 6013 \times 470 \times 2}{33{,}000} = \cdot 1819$$

As a matter of fact, however, Mr. Scott has figured his heating surface in a somewhat unusual manner, it being customary to count, as effective, only that surface which is covered by water on one side and exposed to the fire on the other. This method, which I believe is usually accepted as correct, does not allow including superheater surface, nor such portions of the steam drum as are above the water level.

Making this correction then, and assuming that the water level is at two-thirds of the diameter of the drum, and refiguring the effective heating surface of the entire boiler, we have—

Water tubes (inside surface)	..	137 sq. ins.
Steam drum (wetted surface)	..	39·4 „
Total	..	176·4 „

This gives an evaporation of 2·205 cubic ins. of water per minute, which corresponds to an output of 315 cubic ins. of steam per minute at 180 lbs. gauge pressure.

This is equivalent to $\frac{315}{0 \cdot 90} = 350$ r.p.m.

With this speed the power developed will be—

$$I.H.\text{-}P. = \frac{170 \times \cdot 0625 \times \cdot 6013 \times 350 \times 2}{33000} = \cdot 1355$$

which seems very low for so large a boat.

When working at such high-pressures, it is well to remember that the tenacity of brass and copper begins to fall at temperatures of 350°—400° F. Steam of 180 lbs. pressure has a temperature of 379° F., and, according to Unwin, $F = A - B(T = 60)^2$, where F = tenacity of metal in tons per sq. in., and—

	For Copper.		For Cast Brass.
A =	14·8	..	12·5
B =	·000014	..	·000024
F =	13½	..	10

From which—

$$F = 14 \cdot 8 - \cdot 000014(379 - 60)^2 = 13 \cdot 373 \text{ tons.}$$

In the example of the steam drum for Mr. Scott's boiler—

$$t = \frac{P \times D \times f}{TS \times 2}$$

where t = thickness of metal in inches.
P = working pressure in lbs. per sq. in.
D = diameter in inches.
f = factor of safety.
T S = tensile strength, in lbs., obtained for the temperature by Unwin's formula.

And we have—

$$t = \frac{180 \times 2 \cdot 5 \times 6}{26746 \times 2} = \cdot 0504 \text{ ins.}$$

If the wire gauge referred to in the design be the B.W.G., No. 16 will equal a thickness of ·065 in., which is more than sufficient, as No. 18, with a thickness of ·049 in., would be ample, and permit a slight saving in weight of about 5¼ ozs.

In regard to the threading of the water tubes, the gain in surface here is more fictitious than actual, since the accepted heating surface of a water tube is that which is in contact with the water. Moreover, scoriating of the surface would have the disadvantage of materially increasing any liability to cracking when the tubes are bent, to say nothing of weakening the tube, which should, to give its highest efficiency, be as thin as is consistent with safety.

While the general scheme and arrangement of Mr. Scott's boiler is ingenious, I would point out that, unless data are forthcoming to justify the various points which have appeared most salient to me and which I have endeavoured to indicate, the boiler, as designed, has missed the purpose of the competition, in that it is incapable of meeting its conditions.

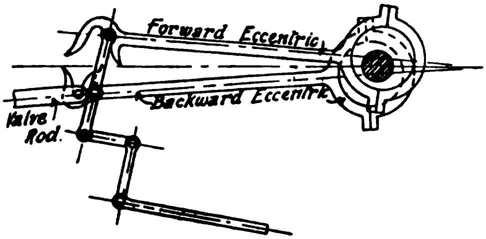
The above remarks are made in no carping or unfriendly spirit, and, while they have attained much greater length than I anticipated, I trust that, for the sake of the widespread interest manifested in model steamers, the Editor will overlook my seeming prolixity and find space for the foregoing criticism.—Yours respectfully,

New York. R. M. de Vignier.

A Reversing Gear for Model Locomotives.

To the Editor of *The Model Engineer*.

Dear Sir,—I send you a short description and sketch of a reversing gear which, I think, would



Reversing Gear for Model Locomotives.

be suitable for model locomotives and be more easily fitted up than the ordinary link motion. This form (see sketch) is the now obsolete gab motion. Two eccentrics are fixed on the driving axle—one being set for forward and the other for backward motion in the usual way—and the eccentric rods are made with hooks, or gabs, either of which is capable of being made to engage with a pinion stud, on the valve spindle. By moving the reversing shaft, one or other of these gabs is brought into action, and the backward and forward eccentric is placed in gear as desired. With this form there is no alteration of the point of cut-off, the engine being in full gear whether running backwards or forwards; but as model locomotives are generally run in full gear, this does not matter much.—Yours truly, J. Alexander.

Re Cutting Glass Bottles.

To the Editor of *The Model Engineer*.

Dear Sir,—I notice in your issue of December 6th a correspondent gives a method of cutting the necks off bottles for batteries. I have used a much easier and quicker method for a long time.

Get a piece of round iron about ¼ in. or 5-16ths in. and bend one end into a ring to slip over the neck of the bottle to where it is to be cut. Heat the ring red hot and slip it on the bottle; hold it there a few seconds, and then quickly plunge the bottle into a bucket of cold water, it will come off neat and clean where the iron was round it. If it does not immediately fall off, a light tap against the side of the bucket will do the trick. Two or three bottles can be done at each heating of the iron.—Yours truly, J. E. Boyd.

Timaru, New Zealand.

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 intended for publication.]*

A Suggestion.

To the Editor of *The Model Engineer*.

Dear Sir,—Though I cannot claim to be a constant reader, I am at least a frequent and highly appreciative one. I take particular interest in the model yachting news, and in that department I would like to offer you a suggestion. It would be very welcome to many of your readers if you would publish an outline sketch (just a profile and a midship section) of some of the new full-size yachts built under the

$$\frac{L + B + \frac{1}{2} G + 3d + \frac{1}{3}\sqrt{S} - F}{2} \text{ Rule.}$$

We are all familiar with the $\frac{L \times SA}{6000}$ types, and the tubby boats of the Length-over-all Rule. The "planks on edge" developed by the Thames Rule are also well known, but model yachtsmen in general are not yet very well acquainted with the forms developed in large yachts under the new rule.

I am convinced that if a reliable pattern vessel (say a 52-rater, that would make a handy size of boat built at ½ in. to 1 ft., or a 36-rater or a 30-rater which could be copied 1 in. to a ft.) were illustrated in your valuable paper, many model yachtsmen who are sticking to the old rule for want of a guide would at once adopt the new rule.

I do not consider that any arbitrary rule, such as the new rule is, can ever develop the ideal yacht. Still, it is the best at present, and is the official rule.

Wishing you a good circulation, yours truly,

Aberdeen. "Wood Waster."

Stanley Model Steamer Club.

To the Editor of *The Model Engineer*.

Dear Sir,—I should be glad if you could grant me a few lines in "Ours" to let the model steamer owner readers in this district know that the difference between us and the sailing boat owners having been agreeably settled, we have formed the above club so that we can work together and abide by our agreements with the sailing boat owners as well as for friendly sport and fellowship.—Yours faithfully, Geo. F. Paris, Hon. Sec.

Stanley Model Steamer Club,
123a, Westminster Road,
Kirkdale, Liverpool.

A Mica Substitute.—This has just been patented for commutator insulation. In order to render the insulation softer than the softest obtainable mica, the inventor employs hard mica calcined under pressure. The mica is pressed between two plates of suitable material, which are placed in a calcining furnace. It is stated in the *Electrical World* that the internal structure of the mica is so altered that it becomes equally as soft as the segments of a commutator.

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.

AN ordinary meeting of the Society was held at 7 o'clock on Friday, March 15th, at the Cripplegate Institute, Golden Lane, E.C., Mr. Herbert Sanderson taking the chair at 8 o'clock, and upwards of seventy members and visitors being present.

The minutes of the last meeting having been read and signed, and eight gentlemen elected members of the Society, the dates of visits and future meetings having been announced as below, the Chairman requested Mr. D. G. Snodgrass to give his lecture on "The Design and Construction of the Petrol Engine." The lecturer, with the aid of several slides and blackboard diagrams, explained very clearly the action of the internal combustion engine both on the four-cycle and two-cycle types, and traced the gradual increase in the number of cylinders applied to the driving of the modern motor-car, taking as the last example the six-cylinder engine of the Napier car. Carburettors next claimed attention, and being a somewhat intricate and very important feature of the type of engine under consideration, the various makes, both past and present, were described at length and their action explained by reference to slides and to actual pieces of mechanism on the table. The various methods of cooling were next considered, and the lecturer passed on to perhaps the most important item, viz., the method of exploding the compressed gases in the cylinder. With the help of several types of coil, accumulators, and magnetos, the lecturer was able to show his audience very clearly the method of firing the charge in any one of the cylinders of an engine at the proper moment, and in this connection the action of the Napier firing synchroniser for a six-cylinder car was shown and explained. The lecturer concluded by throwing on the screen pictures of the first motor-car built by Messrs. Napier and of one of their latest types, pointing out that if the improvements in the engine had in the period been greater the improvements in the numberless details of the body of the car had probably been greater still.

On the motion of the Chairman, a very hearty vote of thanks was tendered Mr. Snodgrass for his most interesting and instructive lecture and for the trouble he had taken in obtaining special slides and parts of actual machines for the benefit of the members.

The meeting terminated at 10.15 p.m.

FUTURE MEETINGS (all at the Cripplegate Institute at 7 o'clock).—Tuesday, April 9th: Mr. Ferriera's paper on "Model Making." Wednesday, May 1st: Short papers on practical subjects by members. Tuesday, May 28th: Lecture by Rev. W. J. Scott, B.A., on "Six-coupled Express Engines on the Great Western Railway."—For particulars of the Society and forms of application, write HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

NODON VALVE.—In a letter under this heading on page 260, "shocking" coil should read *choking* coil.

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 cornor of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.*

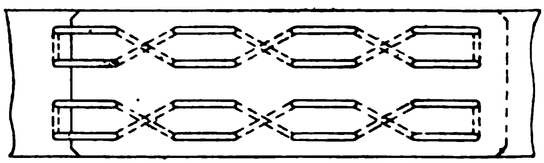
Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied 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:—

[17,394] **Lacing Belts; Accumulators.** J. S. (Norwich) writes: (1) Could a small ammeter reading to 6 amps., and used for battery work, be used in a dynamo circuit (220 volts) without fear of breaking down the insulation, provided that the proper number of amperes for which it is built is not exceeded? (2) When a voltmeter is applied to the terminals of one accumulator, when a number is being charged in series, does it measure the voltage of the cell as it at present stands, or does it measure the charging voltage? (3) An accumulator is charged in series with a lamp (220 volts) from the supply mains (220 volts); what would be the voltage across the two terminals of the accumulator? It is a 4-volt cell. (4) In reading through Mr. W. A. Tookey's book on "Gas Engines," third edition, on page 23 it gives the various consumption of gas on different loads, and I note that on half load that it uses more gas than when on full load. Will you kindly explain why that happens? (5) Can you advise me of a book published solely on belt driving, and one that shows the various jointing of belts; perhaps you will give me a few sketches of how you generally splice belts?

(1) Yes. (2) What you would call the charging voltage. When disconnected, the pressure recorded is lower. (3) Depends upon the candle-power of the lamp, *i.e.*, the current flowing from one terminal of the cells to the other. Because the drop in voltages is proportional to the resistance and the current flowing. See query

FIG. 1.—LAP JOINT FOR DRIVING BELT.



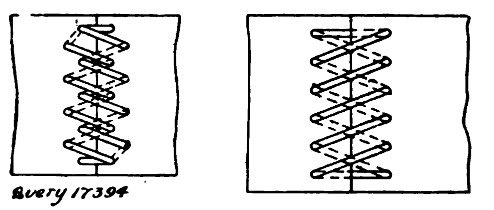


FIG. 2.—FORMS OF BUTT JOINTS.

LACING BELTS.

and reply in issue of March 5th, 1903, on "Reduction of Voltage." (4) This cannot be fully explained in a query reply: but, briefly, it is because the efficiency of such heat engines increases with the temperatures between which they work, and that at half load more heat is wasted in proportion to the work done than is the case at full load. If you look at the table carefully, you will see that it is only the consumption per horse-power which is greater, and not that the actual total consumption for 12 h.-p. is greater than the total consumption for 20 h.-p. (5) We do not know of any book dealing exclusively with the subject. It is not big enough to be so treated. A common form of lap joint is shown in Fig. 1. Butt joints are made in several ways, some of which are given on the opposite page.

[17,359] **Switchboard for Charging and Lighting.** S. C. (Hampstead) writes: Could you connect up this switchboard? It is for charging accumulators and other work. Terminals 1 are connected to dynamo, terminals 3 to accumulator, and terminals 2 are for other work. The connections for ordinary charging would be as my sketch (not reproduced), there being three switches in circuit. Then I want to be able to test either dynamo or accumulator separately at voltmeter by switching it in. Also to be able to use either dynamo or accumulator for other work.

Your switchboard does not appear very suitable for a charging board. The diagram below will give you all the connections for charging cells from dynamo, discharging cells through an outer circuit, and running dynamo to supply outer circuit direct. The voltmeter can be connected up to the points marked by letters *a*, *c*, *e*, and *b*, *d*, *d*, as shown. Connections are not drawn in for the sake of clearness.

[17,388] **Model Compound Engine.** W. H. P. (Hereford) writes: I have a high-speed steam engine, triple expansion cylinders, 2-in., 3-in. and 5-in. bore, stroke 4 ins.; H.-P. and I.-P. tandem to H.-P. and I.-P. slip eccentric to L.-P. (1) What would be the best size of ports for above? At present they are—H.-P.: steam, ⅞ in. by ⅛ in.; exhaust, ⅞ in. by ⅜ in. I.-P.: steam, 1¼ ins. by ⅛ in.; exhaust, 1¼ ins. by ⅜ in. L.-P.: steam, 2 ins. by ⅜ in.; exhaust, 2 ins. by 9-16ths in. Am told they are far too small. (2) What lap would you recommend for the respective valves? I find engine runs best when valve travel is reduced by reversing gear to 7-16ths in. At 75 lbs. pressure engine will run 750 r.p.m. light load, 450 r.p.m. normal load. With very light load it will run with 3-16ths in. travel down to 25 lbs. pressure at about 150 r.p.m. (3) What is most economical pressure to work at, say, when speed is 450 r.p.m.? (4) What horse-power ought engine to give with ports as above at 100 lbs. pressure and 450 r.p.m.? (5) If I have new cylinders as proposed, do you advise different ratio for cylinders, as at present they are 2 : 3 : 5? I ask this because in large engines ratio is 1 : 3, whereas in most models advertised it is only 1 : 2 or less. (6) Is 750 r.p.m. fast for this type of engine? Some say "yes," others say "no, I ought to get 2,000"! The latter might be possible with trunk pistons and S.A. cylinders, but it seems very fast for D.A. slide-valve gear.

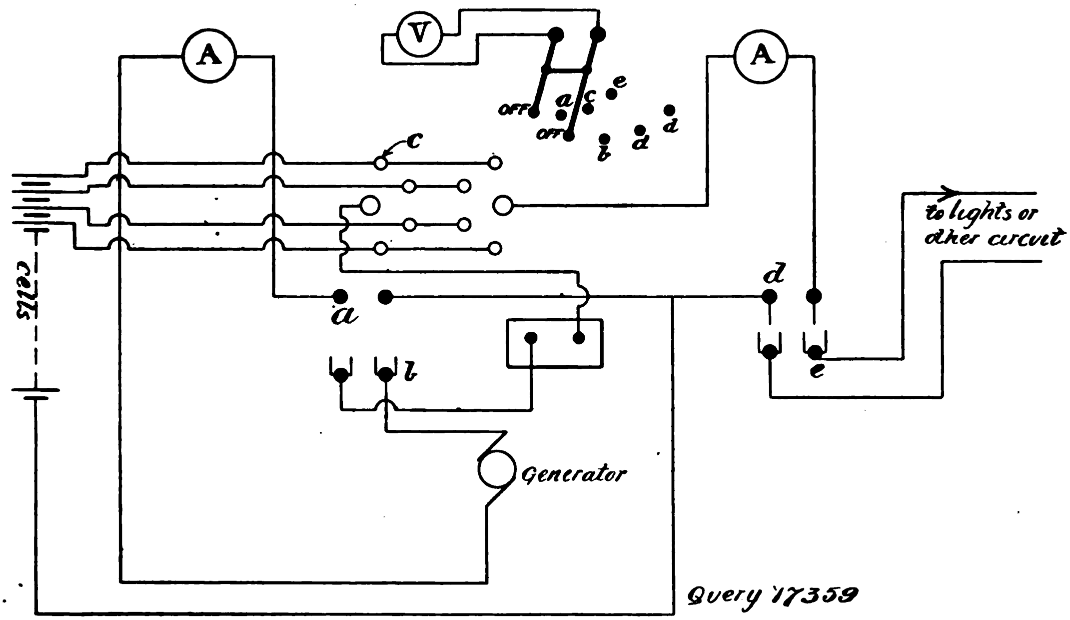


DIAGRAM OF CONNECTIONS OF SWITCHBOARD FOR CHARGING AND LIGHTING.

[17,371] **Boiler and Engine Queries.** F. J. B. (Birmingham) writes: (1) Would you advise a flash or semi-flash boiler to drive steam engine, 1½-in. bore by 3½-in. stroke (castings in brass)? (2) Could I build same to design by Mr. R. Bolsover, in THE MODEL ENGINEER, March 23rd and 30th, 1905, or would it be better to Mr. Nicholls' design in THE MODEL ENGINEER, July 20th, 1905? In either case, how much tube should I require and of what bore, thickness, and material? (3) What would be the most economical method of firing same, as engine would be required to run four hours or so at a time charging accumulators? (4) Would it be possible to use an injector with above type of boiler, or would a small pump be preferable? (5) What would be the best material for outer case, taking into consideration the cost? (6) Would a boiler as above cost less to build than, say, a multitubular vertical one for same power?

(1) We do not advise a flash boiler for an engine made from brass or gun-metal castings—that is, if the degree of superheat is at all high. (2) You require about 350 to 450 sq. ins. of heating surface for a pressure at 40 lbs. per sq. in., and a speed of 300 r.p.m. The Bolsover boiler is too large and heavy a type for your use. (3) Oil firing with a battery of Swedish burners. About four will be required to get full power. (4) You have not quite got hold of the principle upon which the semi-flash boiler works. Read the articles to which you refer again. An injector is not practicable. (5) Iron sheeting. (6) No; possibly more.

(1) For a quick running engine the following proportions should be adopted:—

H.-P. cylinder 2-in. × 4-in. stroke—
1-in. × ¼-in. steam ports.
1-in. × ⅜-in. exhaust ports.
¼-in. width of port bar.

I.-P. cylinders 3-in. × 4-in. stroke—
1½-in. × ¼-in. steam ports.
1½-in. × ⅜-in. exhaust ports.
¼-in. width of port bar.

L.-P. cylinders 5-in. × 4-in stroke—
2½-in. × ¼-in. steam ports.
2½-in. × ⅜-in. exhaust ports.
¼-in. width of port bar.

The low-pressure ports should have a centre bar, on the face at least. The ports could be 85 per cent. of the lengths given without very seriously affecting the speed and efficiency of the engine. (2) Your second query is one which requires a considerable amount of explanation. The point of cut-off of each valve will, of course, determine the amount of work done by each cylinder, as well as the cylinder diameter. We recommend you to study the question thoroughly. As a guide, see our book—"Compound Engines," by W. J. Tennant, A.M.I.Mech.E., price 2s. 6d. net, 2s. 9d. post free from this office. The information you send as to the performances of the engine does not help us in giving any opinion as to its present efficiency. At 25 lbs. pressure, pre-supposing that the engine is non-condensing, the L.P.C. would be doing little active work, as, not considering the difference in the ratio expansion due to the linking up of the valve gear, or even to the normal setting of the valves when in full gear, the pressure in the L.P.C. would be below that of the atmosphere.

25 lbs. gauge pressure = 25+15 = 40 lbs. absolute pressure. Now, as

$$P \times V = C$$

(Pressure × volume = constant quantity) neglecting the temperature drop, and as the H.-P. cylinder has a comparative volume of 4 to 25 of the L.P.C. Therefore,

40 lbs. (H.-P. steam) × 4 (H.-P. volume) = 160
and as the L.P.C. pressure × 25 = 160

$$\text{the pressure in the L.P.C.} = \frac{160}{25} = 6{\cdot}4 \text{ lbs. absolute,}$$

or, 15 − 6 = say 7 lbs. below the pressure of the atmosphere!! (3) We would, therefore, advise that the steam pressure in the low-pressure cylinder should be kept two or three pounds above atmospheric pressure when the engine is linked up to cut-off at, say, half stroke. To accomplish this, the pressure should not be less than 150 lbs. per sq. in. (4) We must know the points of cut-off in each cylinder to be able to correctly estimate the H.-P. Why not rig up a brake and test for the brake horse-power of the engine. This would be a more satisfactory proceeding. At the same time, put a pressure gauge on the L.-P. steam chest. (5) The cylinder ratios are 4 : 9 : 25, or, 1 : 2¼ : 6¼. Therefore, in considering the efficiency of the engine, everything depends on whether the engine is condensing or non-condensing. If it is non-condensing, then irrespective of the ports the L.P.C. is of no use at all (or else is a positive drag on the engine) with steam of less than 110 lbs. pressure at the stop valve. (6) Seven hundred and fifty revolutions per minute is fast for an engine of this size and type, more especially as the steam ports of the H.P.C. are somewhat on the small side of the correct proportions for a high-speed engine. The more serious fault, however, is the presence (and consequent use) of the link-motion and the wide ratio of the cylinders for the pressure employed. For 120 lbs. pressure (non-condensing), we would have advised about 1 to 4 ins.—that is, say, 2 ins. × 2¾ ins. × 4 ins. The speed of the steam through the H.-P. ports appears to be about 9,000 ft. per minute, which is a little too high in such a small engine, and therefore wire-drawing is most likely taking place, which still further detrimentally affects the L.-P. cylinder, rendering it more useless than ever. Of course, should there be any leakage past valves and pistons, this is another story altogether. Presuming it is mostly in the H.-P. cylinder and valve, this cylinder will then be doing much less work, and the I.-P. and L.-P. cylinders more, according to the nature and extent of the leakage. Indicator diagrams will alone reveal what is really happening in the cylinder, although pressure gauge on the I.-P. and L.-P. receivers will help you in some degree. We would try the engine with the L.-P. piston or valve removed, and again with only the H.-P. piston or valve taken out. Without altering the engine, the simplest remedy is, if the boiler will submit to it, to increase the pressure to 175 lbs., which will get over the cylinder ratio trouble, and to reduce the revolutions to 400 per minute, which will to some extent nullify the bad effects of the small steam ports of the H.-P. cylinder.

[17,422] **Accumulator for Small Lamps.** S. B. (Yorks) writes: I should be very pleased if you would answer the following questions. (1) I want to connect one "Osram" electric lamp up for a night-light, 10 volts ·9 amp., small bayonet capped, 9 c.-p. I want to know if it would be cheaper to have an accumulator to work it and what sort to get, the price, and what volts and amperes would it require for a 9 c.-p. lamp, or to have a dry battery? How many cells to have to work it, and the price of them? Or would it be cheaper to have an accumulator, and what will the price be for charging it when required?

An accumulator would be the most satisfactory and, in the end, the cheapest, though first cost would be greater than for dry cells. Get a 10-volt 20 amp.-hour accumulator. Prices may be had from any of our advertisers. Charging would cost 6d. or 9d. at a generating station, or electricians who take jobs of that kind.

[17,011] **G.E.R. Goods Locomotive, No. 1189.** A.-B. S. (London) writes: Would you kindly give me a side elevation drawing of the Great Eastern Railway Company's six-coupled goods engine, No. 1189?

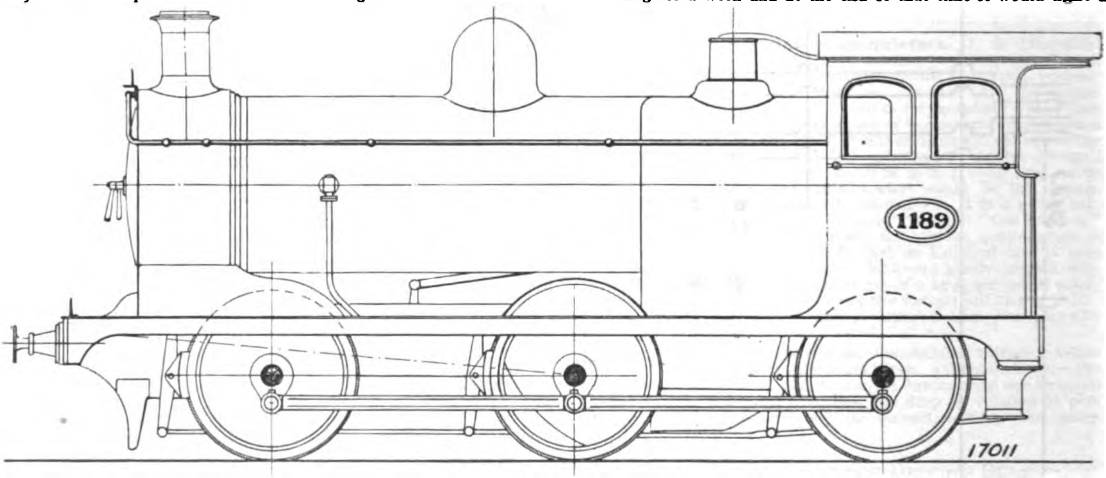
We append herewith an outline sketch of the locomotive to a scale of 3-16ths in. to the foot. You will find a photograph of the locomotive in C. S. Lake's "World's Locomotives," price 10s. 6d. net, or 11s. post free from this office.

[17,415] **Charging from 500-volt Mains.** G. M. (Bishpam) writes: As a regular reader of The Model Engineer, I trust you will answer me the following questions. I have a 4-volt 20 amp.-hour accumulator and for charging same I have access to a 500–550 volts supply. I have had it connected through two circuits of lights, each one five 100-volt lamps, 16 c.-p. for sixteen hours, but it did not gas at all. Is the current too small, and how can I increase it? Will so long a charge at a low rate do any harm to battery? I find at the end of the charge there is a continual bubbling sound inside the battery. I hardly think it shorted. I have had it standing for a week and at the end of that time it would light a 4-volt 4 c.-p. "Osram" lamp. Supposing the acid was leaking from one compartment to the other, would that cause the bubbles? The battery is stated (on case) to be charged at one-sixth capacity in six hours. Would one of a smaller capacity be better for the small current I can obtain? I take it I shall get about 1 amp. Am I right? I have the cell connected up as per sketch below (not reproduced).

The current will be very small. To get a larger flow, add another set or two of lamps in parallel, or use larger candle-power lamps. The bubbling will do no harm. It is usual. It is only a question of charging long enough. Slow charging is good for cells. Your connections are quite right.

[17,434] **"Model Engineer" Steam Locomotive.** H. M. (West Bromwich) writes: I believe there is an error in the dimensioning of the frames near the smokebox part of The Model Engineer steam locomotive, coloured plate of which was given with the issue of January 7th, 1904, and details given in subsequent issues. Would you kindly tell me where the error is, and what is the correct dimension, as I am desirous of building one and do not want to scrap the frames when I have made them?

The correction is specially referred to in article No. XI in the issue of May 26th, 1904. The frames from the underside of the footplates—that is, the top of the buffer plank, should measure ⅞ in. instead of 13-16ths in., marked on the drawing on page 50 of January 21st, 1904. The dimension of the deepest part of the frame is therefore ⅞+1 1-32nd+9-16ths = 2 15-32nds ins. The error is not a serious one, and, if the frames were made, would not require such a drastic remedy as you suggest. It simply alters the height of the boiler saddle 1-16th in. However, we are glad you have raised the point again.



Six-coupled Goods Engine (No. 1189), Great Eastern Railway.

(Scale: 3-16ths in. to the foot.)

[17,460] **Small Petrol Motor for Model Launch.** H. C. (Shettleston) writes: The Madison Works Castings Company supply castings of a small petrol engine, 7 ins. high, 3 ins. wide, and weighs about 4 lbs. I want an engine for a boat 39 ins. long, and I think petrol would be far less bother than steam, but I am afraid the engine mentioned would be too high and top-heavy. Would it do to fit in an inclined position and connected to shaft by pinion wheels? If so, what relation in size should they be in order to give correct speed to shaft? What length of time would engine run without being water-cooled, and would it be possible to fit on a water-cooling jacket? I presume the castings would not include carburettor castings? Would it be possible to obtain castings of a paraffin oil engine to drive a boat of this size?

It is largely a matter of experiment with such a small motor as this, and the workmanship will have to be very good or satisfactory results will not be obtained. Motor must be water-cooled, otherwise it will not run for any length of time. We should not advise putting it on its side to run. Keep it as near vertical as possible. The beam of your boat will enter into the question of stability; you do not mention this at all. We advise you to read up the recent correspondence, etc., on Mr. Arkell's petrol boat in back numbers. You will get a good many useful hints to work upon therefrom. We do not advise paraffin for such a small engine. Get motor running first, and see what speed is most suitable. We do not advise gearing to propeller shaft. Use a fine pitch and run direct from engine.

[17,424] **The "Indispenso" Charging Set.** R. G. (Eastbourne) writes: *Re* the "Indispenso" charging set. (1) Would this be used on continuous or alternating current or either? (2) If I wanted to charge two 2-volt accumulators, should I join them in series? (3) Also, if it was on 200-volt current should I use a 200-volt lamp?

(1) For continuous current. (2) Yes. (3) Yes.

[17,423] **Small Electric Lighting Plant.** F. C. (Gateshead-on-Tyne) writes: Will you help me in the following? I wish to get a dynamo to light about twelve 16 c-.p. lamps. What make is the best? What speed should a 500-watt dynamo run at to light twelve 16 c.p. lamps? What is the cost of same? I have a 1¼ to 1½ h.-p. petrol engine from a motor bike. Would this be suitable to drive a dynamo with a large outside flywheel added to engine. What size dynamo would the engine drive to get good results?

Any of the firms advertising in this journal would supply you. We would advise a drum armature machine of 700 or 750 watts, either Manchester or undertype: twelve 16 c.-p. lamps will most likely need at least 700 watts. A 1½ h.-p. engine will be none too much power to drive it at full load.

[17,305A] **Oil Burners.** A. H. (India) writes: I am at present making a hot-air engine (3-in. cylinder) and expect to drive a shaft and run a couple of bed fans. The only doubt I have is about the fuel—spirits, alcohol, etc., are too dear here. Can I with a 5-gallon generator and suitable pressure gauge rely on engine running without attention for at least eight hours, using kerosene? Can you advise any other method that will be either cleaner or simpler? What pressure should I require?

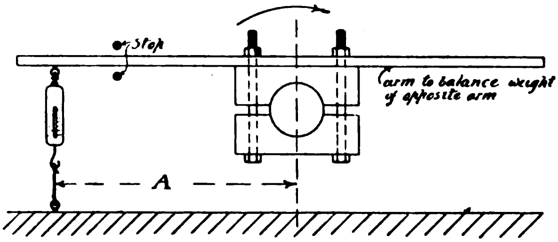
We would point out that while the kerosene (paraffin) blowlamp is perhaps the only suitable arrangement in your case to enable it to work continuously for eight hours with practically the same flame-power, you will have to provide a large container. The oil consumption does not warrant this, as probably half-pint per hour would be the maximum amount required; this would mean a capacity of not less than 4 pints for the night. But say you had a tank of 2 gallons capacity and half filled it with oil and pumped up to, say, 20 lbs. pressure, in the morning—we are presuming that you are wanting to run the engine at night—½ gallon of oil would have been consumed. This would increase the air space to 1½ gallons, and the pressure would be correspondingly lower than when you pumped it up. According to Boyle's law, the pressure will vary inversely with the volume; therefore, with the pressure of 20 lbs. and a volume of 1 gallon, with the new volume of 1½ gallons, the pressure will be as follows:—

$$P \times V = \text{a constant number.}$$
$$20 \times 1 = 20.$$
$$P \times 1\tfrac{1}{2} = 20.$$
$$\therefore P = \frac{20}{1\tfrac{1}{2}}$$
$$= P = 13 \text{ lbs.}$$

This result is not scientifically correct, but is near enough for all practical purposes. To be accurate, the pressure should be calculated from zero, *i.e.*, 14·7 lbs. below atmospheric pressure. With a 5-gallon tank you will, of course, have a much lower drop in pressure *if you only put, say,* ½ or 1 *gallon of oil in it*; but we would advise a much larger tank, say, 8 or 10 gallons only partly filled (with ½ to 1 gallon of oil) at one charge. A better arrangement still would be to have a gravity feed. By this means a smaller tank may be used and air pressure will not be necessary. As oil is lighter than water, reckon that every 2½ ft. the tank is elevated above the burner will give 1 lb. pressure. As 10 lbs. pressure is the minimum we would advise this will mean that the tank will have to be placed 10×2½ = 25 ft. above the burner. If you use a 5-gallon tank, enough oil will be stored for ten runs.

[16,923] **Toy Engine Trouble; Prony Brake for finding Brake Horse-Power.** D. C. writes: (1) I have a small gas engine which I have built up from castings, as advertised in your issue of August 30th. It is the No. 1 set, 1¼-in. bore, 2½-in. stroke, ⅛ h.-p. It is flame ignition and the ignition tube is halfway along the stroke. The valves are quite all right, and the cylinder cover is perfectly gas-tight, and yet, although the explosions are quite regular, the engine only goes about 20 revolutions and then stops. She runs very easily and yet will not quite go. The greater part of the force of the explosion seems to go through the ignition tube, and yet if I have a smaller hole—the present one is about 1-16th in.—or a larger one, I cannot get a single explosion. At first I thought the flywheels were too light, but I have changed my opinion. They weigh 2 lbs. each. What is the cause of this and how can I remedy it? (2) Will you please give me instructions for making and using the simplest form of Prony brake, as besides the gas engine I have a small water wheel which I want to test. The indicated horse-power is 1-9th, but I wish to know the actual. Is there any way besides the Prony brake which would be simpler?

(1) It is extremely difficult to say exactly what remedy should be adopted. Of course this class of engine can never be expected to do much useful work, though it should run at a good speed. Have you fitted a gas-bag to the gas supply? A great deal depends upon the regulation of gas and air, and also upon the flame just outside the ignition tube. We do not quite grasp what your arrangement is with the ignition. Is it a tube proper, or only a



Query 16923

PRONY BRAKE FOR FINDING BRAKE HORSE-POWER.

hole or port? Careful adjustment will go a long way towards solving your difficulty. See query replies in back numbers to similar matters. (2) A simple Prony brake could be made as per sketch. The distance A must be the distance from centre of shaft to centre of pull, measured at right angles to the direction of pull, in feet. Then if R = speed per minute, W = weight or reading of spring balance, the brake horse-power will be—

$$\frac{2 \times 3{\cdot}14\, A \times W \times R}{33000.}$$

Further Replies from Readers.

[12,029] **Re Pasting Accumulator Plates.** In THE MODEL ENGINEER of February 7th, 1907, I noticed (Query 12,029) "J. H. L." (Brondesbury) writes asking for a few hints in regard to filling in plates. I have myself experienced the self-same difficulty with my own. Having tried all ways, even as you have stated, *i.e.*, sliding off glass instead of lifting, but find the paste falls out just the same. Might I in turn make the following suggestions which I have found to act splendidly, having only just finished twenty-seven plates 6 ins. by 4 ins. in a very little time, and much less trouble. First start by procuring two pieces of hardwood—mahogany will do—screw two battens at back to prevent dampness of plates warping it. The pieces of wood to be 1 in. larger all round than the plates to be pasted. Then lay a piece of cartridge paper or any such, with a glazed surface, on one of the pieces of wood, laying plate on top of paper and start filling in plate with the paste (not too wet) pressing it down lightly until you fill in the holes, then finish this side off smooth to an even surface. Now put another piece of paper on top, smoothing it down with the hands, then put the other piece of wood on top. This side being finished, now hold both pieces of wood firmly and turn the whole of them upside down. When done, take off the piece of wood and paper very carefully, then fill this side in, pressing the paste down hard, smooth off, and put a fresh piece of paper on top smooth it down with the hand, put the piece of wood on, and then place the whole concern under a heavy weight for about 15 minutes, after which take plate out by its lug and stand it in a warm place to dry, leaving the paper on each side of plate, for when dry the paper will itself fall off, leaving a smooth and even surface. I myself have drawn the paper off when they have been under the weight half-an-hour. Thick plate-glass will answer same purpose where wood is not at hand. I shall be pleased to write anyone that wants any further information on the subject.—W. G. BILLINGTON.

The Editor's Page.

WHEN we fixed the specially cheap rate for the advertisements in our "Private" Sale and Exchange Column some few years ago, it was with the view that the use of this column should be limited to those who wished to buy, sell, or exchange goods as a matter of private convenience and not for the purpose of making a profit. We have endeavoured to give effect to this intention, as far as possible, but we have had at various times numerous advertisements sent for insertion in this column which have not appeared to fulfil this condition. On making enquiries we have, in some cases, found that the advertisements in question were undoubtedly of a trade nature, and we have had to stipulate for their insertion in the proper column at the trade rates. Other cases have arisen, however, where the advertiser was not a regular trader, but had certain secondhand goods for sale on which a profit could be presumably realised or some business advantage gained; while such advertisers could not legitimately claim that their transaction would be of a purely private character, they have—perhaps with some reason—objected to be classified as traders, and to be charged trade rates. To meet the requirement of the situation we have decided to accept such advertisements at the special rate of ½d. per word, and to insert them under the "Miscellaneous" heading. We desire that our "Sale and Exchange" column should be conducted with absolute fairness to all who use it, and we scrutinise very closely all the advertisements sent in. We reserve the right to classify the advertisements according to our discretion, and we should be glad to be informed by our readers of any cases where undue advantage is being taken of our "Private" column privileges. Such cases are rare, but in spite of all our precautions they do happen sometimes.

* * *

With reference to the article on the model of the engines of the "Simla" which appeared in our issue of February 7th, Mr. George F. G. des Vignes has kindly offered to allow any of our readers to inspect this interesting model at his works if they will give him a few hours notice of their intended visit. Mr. des Vignes also mentions that he constucted a lathe some years ago precisely on the lines suggested by Mr. M. W. Burrows on page 139, and would be pleased to show this also.

Answers to Correspondents.

T. P. (Atherstone).—Ordinary moulder's sand, or plaster-of-paris, or clay would do.

J. L.—Thanks for your letter. Kindly send us your address.

A. H.—Design for model coal trucks were given in the issues for January 1898, and October 15th, 1901.

H. H. L. (Kilmory).—The amperage of any cell depends on the internal and external resistance of circuit and the voltage of cell. The whole matter is purely one of trial. We presume your idea is to connect the two zincs up in parallel and so decrease polarisation? No need to keep the pin O2 away from the pot. *Re* Tin pot battery, see articles in April 9th and 16th, 1903. Four accumulators can be charged by this means, but only at a very low rate.

J. H. G. (Ryde, I. of W.).—If you will peruse our advertisement pages you will find the names of firms who will supply you with the goods you require.

T. A. (Brighton).—An interesting article on Harmonographs appeared in our issues for January 14th, 21st, and 28th, 1904.

F. G. (Croydon).—Particulars of membership of the Society of Model Engineers can be had on application to the Secretary. See address on another page of this issue.

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

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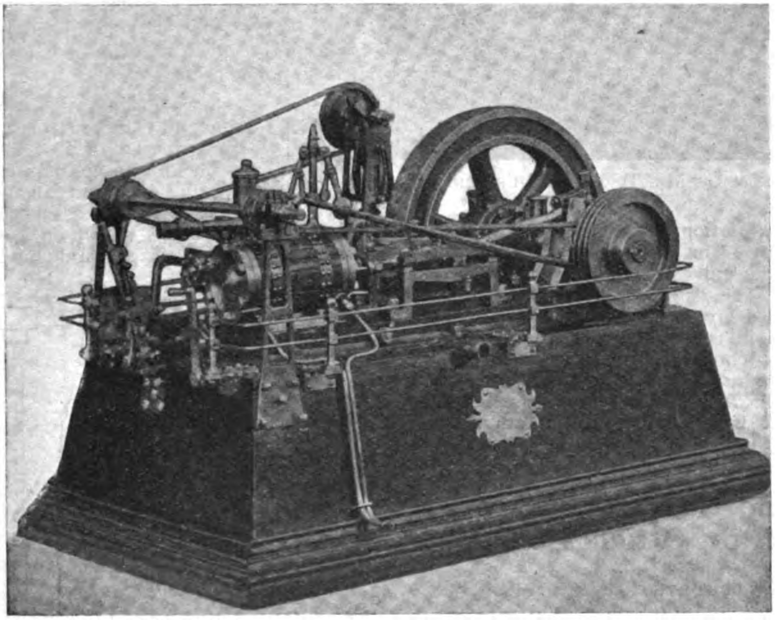
THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

Vol. XVI. No. 310. APRIL 4, 1907. PUBLISHED WEEKLY.

A Model Horizontal Reversing Steam Engine.

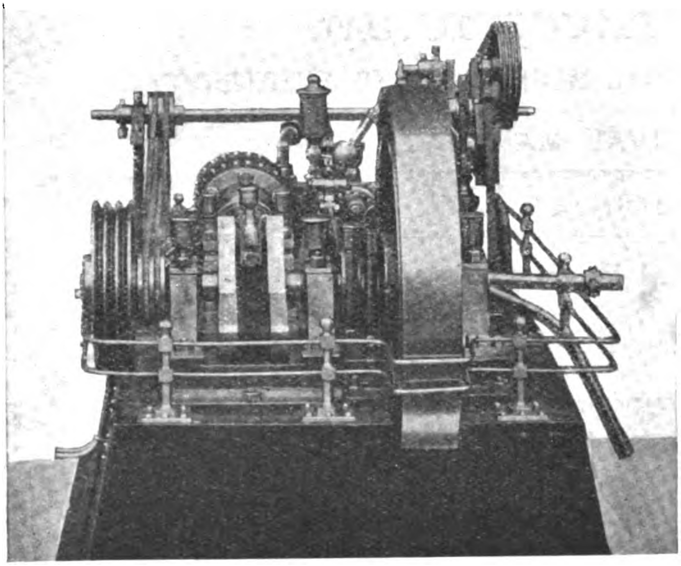
By Thos. P. Smith.



Mr. Thos. P. Smith's Model Reversing Engine.

THE photographs herewith reproduced show a model horizontal slide-valve reversing engine which was constructed in my spare time during the last four years of my apprenticeship. The leading particulars of the engine are as follows :—The cylinder is 1½ ins. diameter by 3-in. stroke. Piston, ⅝ in. thick, fitted with two cast-iron rings 3-16ths in. wide. The piston-rod is ½ in. diameter and 7½ ins. long, being turned taper at the crosshead end. An ordinary D slide-valve is fitted. Slide-bars of cast steel, and the connecting-rod is 9 ins. long, fitted with two sets of brasses, jib and cotter at one end and split with two bolts at the other end. The crankshaft is ⅞ in. diameter, 12 ins. long, turned down ⅜ in. at the bearings. The webs are balanced. Eccentric straps, which are brass, are bored hollow for sheaves to fit, and fitted with two bolts in each. The eccentric-rods are mild steel and are bolted on to straps with 3-16ths in. studs. The flywheel is 12 ins. diameter by 1½ ins.

square rim; it is in cast iron and is turned on the rim and bosses. The three pedestals are finished bright all over and fitted with split brasses.



END VIEW OF MR. T. P. SMITH'S ENGINE.

Stephenson's link-motion is applied. For the pump (⅝ diameter by 1½-in. throw), bicycle bearing balls are used for the valves. The governor fitted is a Watt's style. The two bedplates are planed on top and enamelled green. The engine as above described is bolted on to a block of wood, and polished like black ebony. With 10 lbs. steam pressure the model runs very well. I am indebted to THE MODEL ENGINEER for numerous useful ideas which have assisted me in the production of this engine.

An Overhead Gear for 3½-in. Drummond or Other Lathe.

By T. GOLDSWORTHY CRUMP.

THE photograph and drawings illustrate a simple and very efficient overhead drive which has been fitted to a 3½-in. Drummond lathe. This arrangement is entirely self-contained and no intermediate shaft or balance weight is required. The movable bracket C automatically keeps the line taut, and the heavier the cut the tighter becomes its grip.

The course of the line starting from the back of the flywheel is first to the rear pulley E, then to adjustable pulley D, thence to small pulley on carriage C, then to revolving tool in slide-rest, from there upwards over large pulley in C to the front pulley E and thence to flywheel. The foot drive must always be forward as in ordinary lathe work: reversing the direction causes the carriage C to go to the right and slacken the drive. To change the direction of revolution of tool the belt would be crossed between carriage C and pulley attached to tool.

On reference to the drawings, A shows the brackets which are clipped between the top of lathe standards and the underside of tray. These were cast in brass, bored and tapped as shown, the projecting pieces fitting tightly against the edges of the tray and standards. If necessary these could be built up,

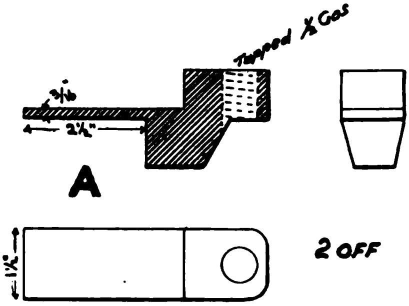


FIG. 1.—DETAILS OF BRACKET FOR CARRYING FRAME.

using a piece of steel for the thin portion; but the brass casting has proved quite satisfactory.

The frame consists entirely of ½-in. internal diameter galvanised iron water pipe with necessary elbows and T's, and of the dimensions shown in B, which is self-explanatory. The frame and brackets must be

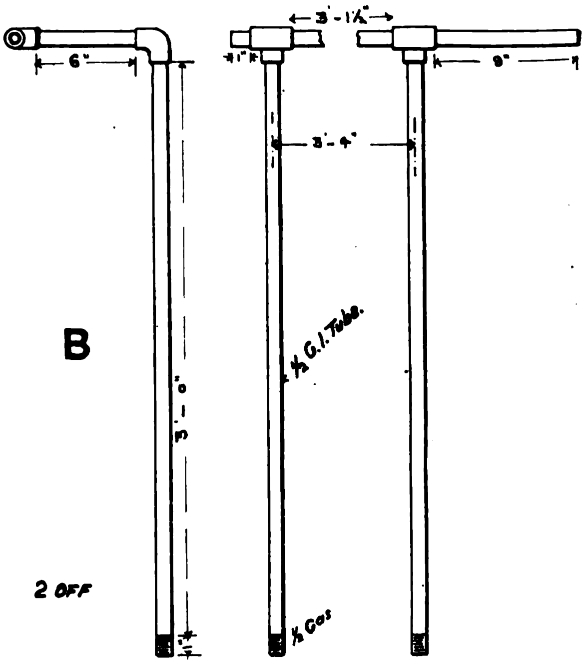


FIG. 2.—DETAIL OF FRAME.

screwed together and brought in alignment before attaching to the lathe.

The movable carriage C is made of two pieces of flat iron, $\frac{3}{4}$ by $\frac{1}{4}$ in., separated by a short length of 1-in. tube so slotted that the frame, when bolted together, forms the angle shown and gives clearance for the top tube. This could be forged in one piece and the arms cranked if so desired. The top or supporting cast-iron pulleys have the peripheries turned to fit the outside radius of tube, and are attached to frame with short studs or axles (riveted) on which they revolve freely. The lower pulleys are of the dimensions shown and are similarly fixed, the grooving being however semi-circular to allow the belt to run with as little friction as possible. The large pulley can be made of wood, with bushed centre.

The pulleys E require but little explanation. They are cast iron and turned with a semi-circular groove, and are attached to the frame by wires so that they can be adjusted to run in correct line with the grooving on the flywheel.

The pulley D is similar, and revolves on a $\frac{1}{4}$-in. bolt which is tapped through a $\frac{3}{4}$-in. ferrule, which

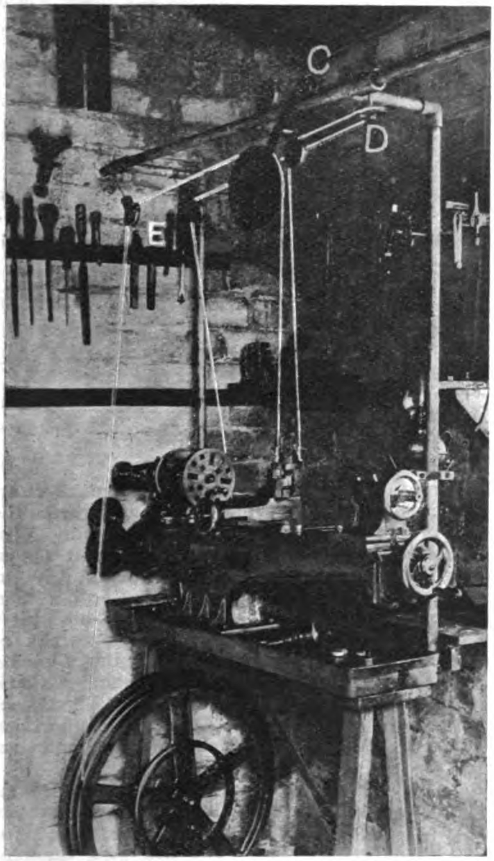


FIG. 5.—SHOWING ARRANGEMENT OF OVERHEAD GEAR ATTACHED TO A $3\frac{1}{2}$-IN. DRUMMOND LATHE.

slides easily on projecting portion of frame and can be instantly fixed at any point for adjusting tension of belt.

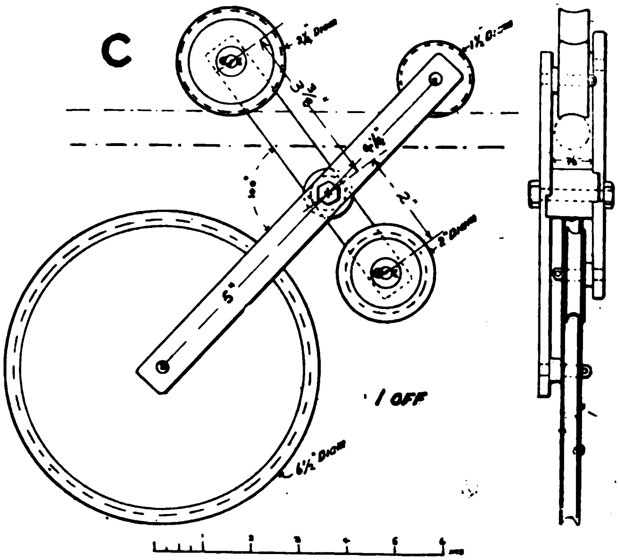


FIG. 3.—MOVABLE BRACKET.

The belt is twisted tape, the various lengths being tapered and sewn together, and it would be impossible to find a sweeter running line.

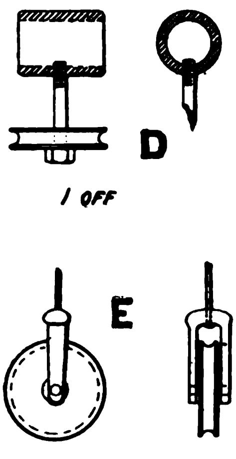


FIG. 4.—DETAILS OF PULLEYS.

Finally, the cost of this overhead will compare most favourably with many that are not so efficient, the one described being produced with an expenditure as under:—

Tubing, cut and screwed elbows, T's, etc. ..	5	9
Castings, pulleys, iron, etc.	3	9
Tape	0	3
	9	9

Some American Steamer Notes.

By "ATLAS."

(*Continued from page* 91.)

II.—On the Great Lakes.

THE Great Lakes of North America are lakes by courtesy; in actual fact, they are inland seas. Stretching for hundreds of miles, and having a depth of hundreds of feet, they are navigated by vessels fit to go to any part of the world and to face any conditions of wind and weather. There are ports on the lakes with warehouses, docks, and piers which would do credit to any of the great maritime countries of the Eastern Hemisphere, and many of the seaports reckoned great at home would be glad to harbour the tonnage which year in and year out enters Duluth, Superior, Cleveland, Buffalo, or Detroit.

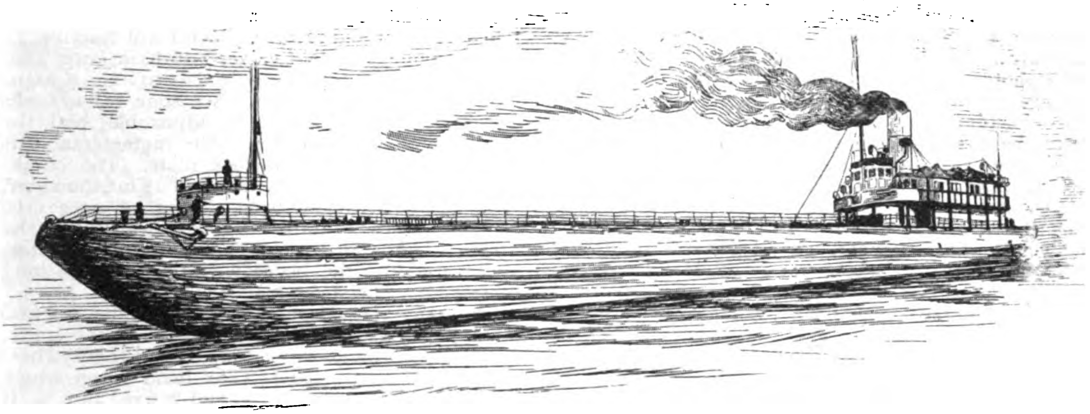
The steamers of the lakes are divided into two broad classes—purely passenger, and purely freight, or cargo, as is the more familiar British term. Of the former the crack boats are the *North West* and the *North Land*, owned by the Northern Steamship Company, of Buffalo. To all intents and purposes these are twin vessels, and are Atlantic liners of the best class, in miniature, albeit that they have a registered tonnage of 5,000 and a horse-power of 8,000. Their over-all length is 368 ft., their beam 44 ft., and their depth 26 ft., and they have ample accommodation for over 500 passengers. The crew totals up to 185. They carry out a regular summer service, mainly for the benefit of tourists, between Duluth, Buffalo, and Chicago, calling at several intermediate cities, and a charming trip it is.

From Duluth to Buffalo is a three-and-a-half days' run, leaving Duluth late on Tuesday night and arriving at Buffalo early on the following Saturday morning. The points of interest on the voyage are many, but it is beyond my present scope to devote much space to the scenic beauties of the route. Suffice it to say that the passages through the Portage River, the Sault Ste. Marie locks—where Lake Superior meets Lake Huron—and the St. Clair Lake in particular provide ample opportunities for the admirers of the picturesque, as also does Mackinac Island, the meeting-place for the Chicago and the through services.

The locks of the "two Soos," as the towns on the American and Canadian sides at Sault Ste. Marie are familiarly termed, are wonderful pieces of engineering skill, and one of these—the Poe lock—takes proud rank as the largest in the world. Some 800 ft. in length and 100 ft. in width, it will pass a vessel drawing 22 ft. of water. It cost £600,000 to build. There is a power-house which generates 60,000 h.-p., this being derived from the water flowing through a specially cut power-canal 200 ft. wide and 2½ miles long. This enormous power is transmitted electrically to the various mills, iron works, and factories which have sprung up in this commercially convenient spot. It is stated on apparently good authority that through the three locks at this point there passes during the navigable season, lasting some eight months only, more than twice the number of vessels and the amount of freight that passes through the Suez Canal during the whole year, and that more tonnage is cleared annually than in any seaport of the whole wide world. These figures are instructive, as showing the enormous carrying trade for which the steamers of the Great Lakes are employed. Most of the steel rails made in the United States pass through the "Soo" locks in their younger days in the form of iron ore. Floating palaces—other than the two palatial vessels I have named—also cater for the enormous tourist traffic, and worthy of special note in this connection are the *Tionesta* of the Anchor Line and the *Huronic* and *Majestic* of the Northern Navigation Company. The *Manitoba*, the lake flagship of the Canadian Pacific Line, is another handsome vessel built quite on ocean lines.

A Typical Freight Steamer Employed on the North American Lakes.

As will be gathered from the foregoing observations, the amount of freight transhipped across the Great Lakes is immense, but the vessels engaged in this particular trade are very different from the ocean tramps which we see in the ports of our own shores. They are more like huge steam barges, and from the accompanying sketches a fair idea of their appearance may be gained. With the engines and boiler placed right aft, the greater length of the vessel is left free for a hold of exceptional length and capacity, and as the deck for nearly the whole extent is clear of masts, winches, boats, or gear of any kind, the effect is very striking. The size that some of these boats run to may be imagined when I mention that the *Augustus Wolvin*, built a few years ago, carries a deadweight of some 14,000 tons. This is one of the "big fish," but vessels carrying 5,000 tons and upwards are quite common. Many of these boats are built on the "whaleback" principle, as shown by a further —and then by way of the St. Lawrence River shooting the Lachine rapids *en route*, till Montreal is reached. Montreal itself is a great port. The terminus for the Allan, the Canadian Pacific, and other great ocean steamship lines, it also docks steamers from almost all countries of the world, and is the gateway of industrial Canada. Local craft of every description may be seen plying to and fro, from a pair-oared skiff to the passenger paddle steamers driven



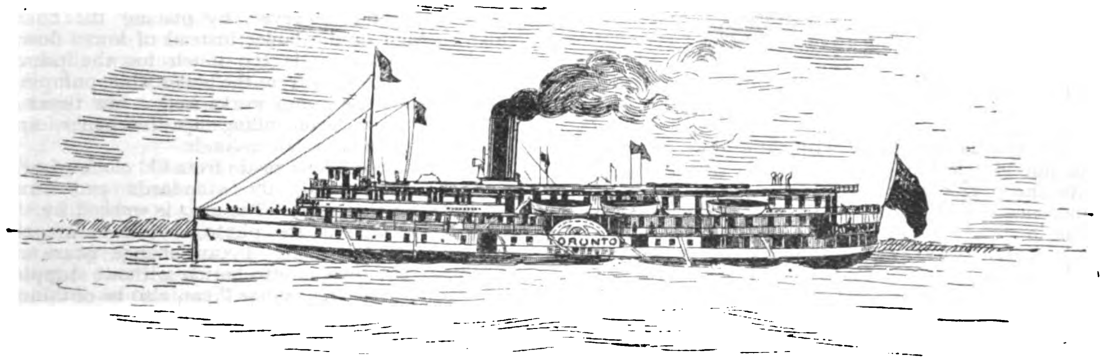
A "Whale-back" Cargo Boat on the Great Lakes.

sketch, and these are just as remarkable looking when loaded so as to bring their upper surface all awash in the water as they are when light with the nose pointing in the air, as here depicted.

The Falls of Niagara put an obstacle in the way of navigation through from Buffalo to Lake Ontario, although this has been surmounted by a canal and a series of locks, in the same way that—on a much smaller scale—the weirs of the

by beam engines, with the oscillating beam projecting as the crowning glory of the upper deck.

Some of these passenger steamers are exceedingly handsome and well equipped craft. The *Montreal*, one of the latest to ply between Montreal and Quebec, is 340 ft. long, with a beam of 43 ft. and an over-all width of 75 ft. 6 ins. She has triple-expansion engines of 3,000 h.-p., with a stroke of 6 ft. 6 ins. There are six Scotch boilers, 11 ft.



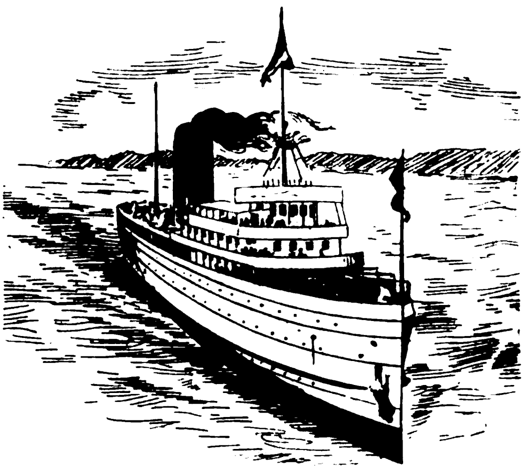
One of the Fast Saloon Paddle Steamers for Service between Toronto and Montreal.

Thames are avoided. The amount of through traffic is, however, comparatively limited.

From Toronto to Montreal another excellent passenger service is in operation by means of fast saloon paddle steamers, one of which I illustrate. The trip is delightful from a scenic point of view, the passenger getting first a run across the broad expanse of Lake Ontario, then through the Thousand Islands—a veritable fairyland for summer holidays

diameter by 12 ft. in length, working at a pressure of 185 lbs. per sq. in. The electric light plant supplies current to 1,200 16 c.-p. lamps. The entire steamer, including staterooms, is steam-heated, and pumps supply running water to every stateroom, of which there are some 260. The dining-room will seat 150 passengers.

From Quebec other steamers of a similar class serve the lower reaches of the river, where there are a number of towns which are very popular with both Americans and Canadians as summer resorts. The mysterious Saguenay River, which runs into the St. Lawrence some miles below Quebec, also furnishes a great attraction to steamer tourists, but although affording a very delightful trip, the wonders of this river seem to be greatly over-rated in the guide books. Still, the inky blackness of its waters, and the knowledge that in places it is so deep that the bottom cannot be reached, provide the traveller with a mild sensation of the mysterious which is perhaps agreeable. Like its big sister, the St. Lawrence, the navigation of the Saguenay is not without some danger, and the writer has a photograph which shows one of the regular passenger steamers piled up on a mid-stream rock. Fortunately, the rock which pierced the bottom held the ship fast and prevented it slipping off, to go down in some 200 ft. or more of water. The St. Lawrence holds many a fine ship within its treacherous grasp, not the least of its victims being the 10,000 ton *Bavarian* of the Allan Line. And yet the St. Lawrence below Quebec is as fair



THE "NORTH-WEST" PASSENGER STEAMER.

to the eye as one could wish, and the setting of the sun in crimson glory across its broad waters, with the purple hills behind, gives it the guise of innocence which, alas! it is only too prone to belie.

(*To be continued.*)

COKE FUEL FOR LOCOMOTIVES.—Burning coke in locomotives on the Baltimore and Ohio Railroad has been practised successfully for some time in the Pittsburg district. Instructions issued by the Motive Power Department give special attention to the starting of the coke fire, ordering wood and semi-bituminous soft coal to be first applied to the grates in order to assist in igniting the coke and prevent it from clinkering over the grate surface. After this coal is thoroughly ignited, the coke may then be introduced until the firebox is filled, the steam blower being used until the coke is well burned through and forms a solid body of fire.

Model Making for Beginners.

A Simple Model Steam Crane.

By ARCHIBALD C. BROWN.

THE accompanying photograph illustrates a working model steam crane. It is the same model which was illustrated in THE MODEL ENGINEER on June 30th, 1904, but with several improvements added, as will be seen by comparing the two photos. The most important of these include the new engine hand pump, and two-speed gear and reverse, which I will describe.

The engine is a slide valve, 7-16ths in. bore, $\frac{5}{8}$-in. stroke, and was originally fixed to an upright boiler which I had by me. The slide valve works on a ball bearing (which is adjustable) and the engine runs very smoothly. The engine standards are strips of American clock plate. The crank-shaft is 4 ins. long and the flywheel $2\frac{3}{4}$ ins. diameter.

The exhaust steam from the engine goes into a tank which contains the feed water for the boiler. This tank is 3 ins. long, $1\frac{1}{2}$ ins. diameter, and is fixed to the bedplate. A tube 3 ins. long carries away the steam from the tank.

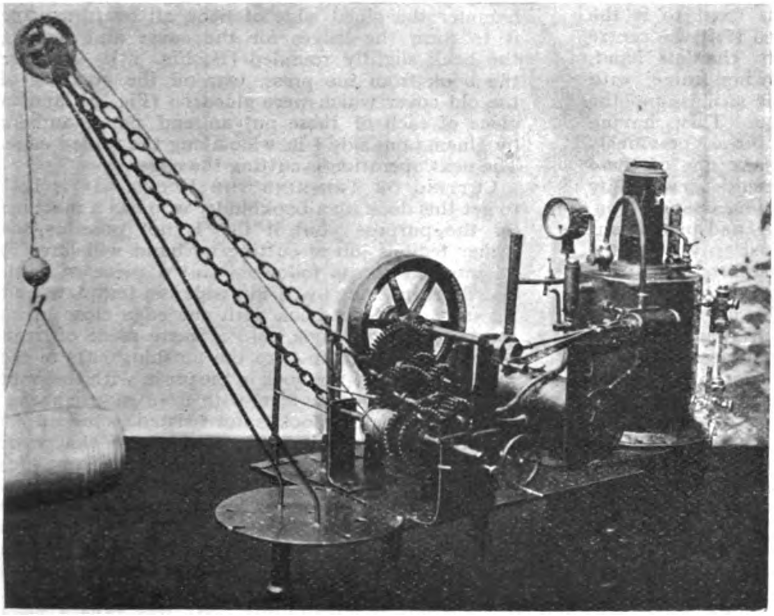
The pump was constructed from the original oscillating cylinder which used to work the crane. It is fixed to the bedplate just under the flywheel and is worked by hand. The hand wheel which works it is seen in the photo and is fixed to a shaft 3 ins. long. On the end of this shaft the crank is fitted which works the pump. By turning the hand wheel this cylinder oscillates, drawing the water from the tank into the cylinder (*via* suction tube) and then forcing it up the delivery tube, through the check valve into the boiler.

The pump is not visible in the photo, but the suction and delivery tubes can be seen.

The check valve is seen fixed into the boiler just under the starting cock. It is made from two pieces of stout brass tube. A screw is fitted into the top of the vertical tube and a cock at the bottom of it. An $\frac{1}{4}$-in. cycle ball forms the check. I made a mistake, however, by placing the check valve so high in the boiler instead of lower down. The steam pressure is too much for the pump, so I have to let steam from the boiler while pumping. On doing this the pump works well, a few turns of the hand wheel soon filling up the boiler, and steam up again in a few seconds.

The two-speed gear I made from old clock wheels, clock plates framing the standards and stout iron wire for the axles. The gear is worked by the three levers seen in the photo, and there are the gear wheels altogether. I can change gear and also bring the reverse into action without stopping the engine. A "free engine" can also be obtained. The winding drum is a winding arbor from an American clock with its ratchet complete. A click is fitted which engages the ratchet and so prevents the load from slipping while changing gear. This click is thrown out of action by the reversing gear. The reversing lever will also act as a brake if necessary. The flywheel makes fifteen revolutions to one revolution of the drum in high gear and reverse, and twenty-five to one in low gear.

I utilised all the bedplate (which is an 8-day grandfather clock plate) for the gearing, etc., so had to fit an extension (a French clock plate) to fit the gib on. I have also added a firebox (fitted with firedoor) to the boiler made from a brass clock case $3\frac{1}{2}$ ins. diameter. The boiler is of brass (not copper, as described in my previous article) and its fittings now include a steam gauge up to 45 lbs., gun-metal 3-cock water gauge, starting cock, safety valve, whistle, blower outlet tap, and the check valve. There is also a wheel valve (seen under the steam gauge) which is made from a terminal and the balance wheel from an old time-piece. It is connected by a tube to the exhaust tube and lets steam from the boiler as required.



A SIMPLE MODEL STEAM CRANE.

No lathe was used in the construction of the model. In conclusion, I may say that the model works well and much pleasure can be obtained by manipulating its various levers.

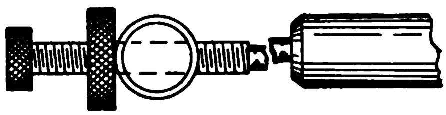
STRENGTH OF GRINDSTONES, WET AND DRY.—Tests seem to indicate that the strength of a grindstone is considerably reduced when it is wet. The wetting not only decreases the tensile strength of the material, but it adds weight, and thus augments the centrifugal pull at a given peripheral speed. The reduction of strength appears to be as much as 40 or 50 per cent. A dry section of stone broke under a stress of 146 lbs. per sq. in. Another section of the same stone, soaked over night in water, broke at 80 lbs. A better stone, under the same conditions, broke under stresses of 186 lbs. per sq. in. when dry and 116 lbs. when wet. Much difference of opinion prevails as to the safe maximum speed at which to operate the stones. Some grinders use a peripheral speed as high as 4,500 ft. per minute, while others limit it to 2,500 ft. Little difference is observed in the liability to breakage, this leading to the conclusion that a frequent cause of breakage must be hidden in flaws or cracks.—*Iron Age.*

The Care of Platinum Points.

A CONTRIBUTOR to the *Telegraph Age* has given the following hints on the care of platinum points:—The importance of perfect alignment of contact points of instruments in telegraph service cannot be over-estimated if a high-working efficiency is desired. It is not only extremely advantageous to have points strike squarely in order to make good connection and utilise all the cross-section of the same, but it will be the means of mitigating, if not entirely avoiding, sparking due to irregular wear, which occurs when points are poorly aligned.

The accompanying figure illustrates what will logically occur with constant pounding on only a portion of the surface of the points. Only the portion that is in contact will wear away and from indentations, which will result in excessive sparking unless the points are frequently filed down to a level, which, by the way, is a very undesirable thing to do when the price of platinum has reached an almost prohibitive stage within the last few months.

A frequent cause for points being out of line is often due to poor or worn-out trunnion bearings of the armature or binding screws. If the screws in such cases are tightened so as to hold the points in alignment, the armature will bind; so the lesser of two evils is often adopted by permitting the points to come out of line by loosening up the binding screws sufficient for free movement. Such instruments are mere makeshifts and had better be consigned at once for repairs.



THE EFFECT OF NON-ALIGNMENT OF PLATINUM POINTS.

In view of the high price of platinum, it might be suggested, instead of frequent filing, to occasionally burnish the points with a smooth piece of steel. The writer found this an excellent medium to clean points with very little wear, only using a very fine Swiss file at long intervals.

WIRELESS TELEGRAPHY. — Marconi's Wireless Telegraph Company (Limited) announce that the wireless telegraph traffic for Marconi-fitted ships for 1906 was 1,261,000 words sent and received, as against 783,950 words in 1905.

How to Bind "The Model Engineer."

By "ORLANDO."

(*Concluded from page* 302.)

SEWING.—Place the sewing frame on the table with the end marked B (Fig. 10) nearest to you, take the first section (which has fixed to it the Index and part of old cover), open it at the centre page, and, keeping it open with the left hand, lay it face downward on the sewing frame, with the folds or back edge close to the strings, and the top edge furthest away from you. Then, having cut a number of lengths of the thread previously mentioned, about a yard long, take one of these and thread the needle. Commence sewing by putting the needle in the saw-cut nearest to you, draw it through with the left hand, and push it out at the next hole at the side nearest to you, of the string; take it round the other side of the string and put it in the same hole, draw it through with the left hand, push it out at the nearest side of the centre string (Fig. 10), take it round and put it in the same hole, then out at the nearest side of third string, round the string as before, in, through the same hole, and out at the end hole. (Fig. 12 explains this.) Draw the thread tight, but leave a portion projecting as at C (Figs. 10, 11, and 12).

Caution.—In drawing the stitches tight, always be careful *to pull in the direction in which you are sewing*, either to, or from you; otherwise the thread will cut through the folds.

Place the second section face downward on the one just sewn, open at the centre page and take the needle in at the end hole (A, Fig. 11), and repeat the stitching except that it is reversed, the thread coming out at the further side of the string and in at the nearer side. When it comes out at the end hole nearest to you, draw it tight, take the end C (Fig. 11) with the fingers of the left hand, and hold it straight up and fairly tight, keeping the sections down at that place with the other part of the hand. Then, still keeping C upright, take the needle and put it *between* the first and second sections at the further side of C and bring it out at the end, take the needle up through the loop which is now formed, and draw it tight upright (D, Fig. 11). This makes a sort of knot, and is called a *kettle stitch*.

Place the third section face downward on the second one, open at the centre page, take thread in at the hole nearest to you, and stitch as before, and make the kettle stitch at the other end by putting the needle between the two previous sections, bring out at the end, pass through loop and draw tight, upward (E, Fig. 13).

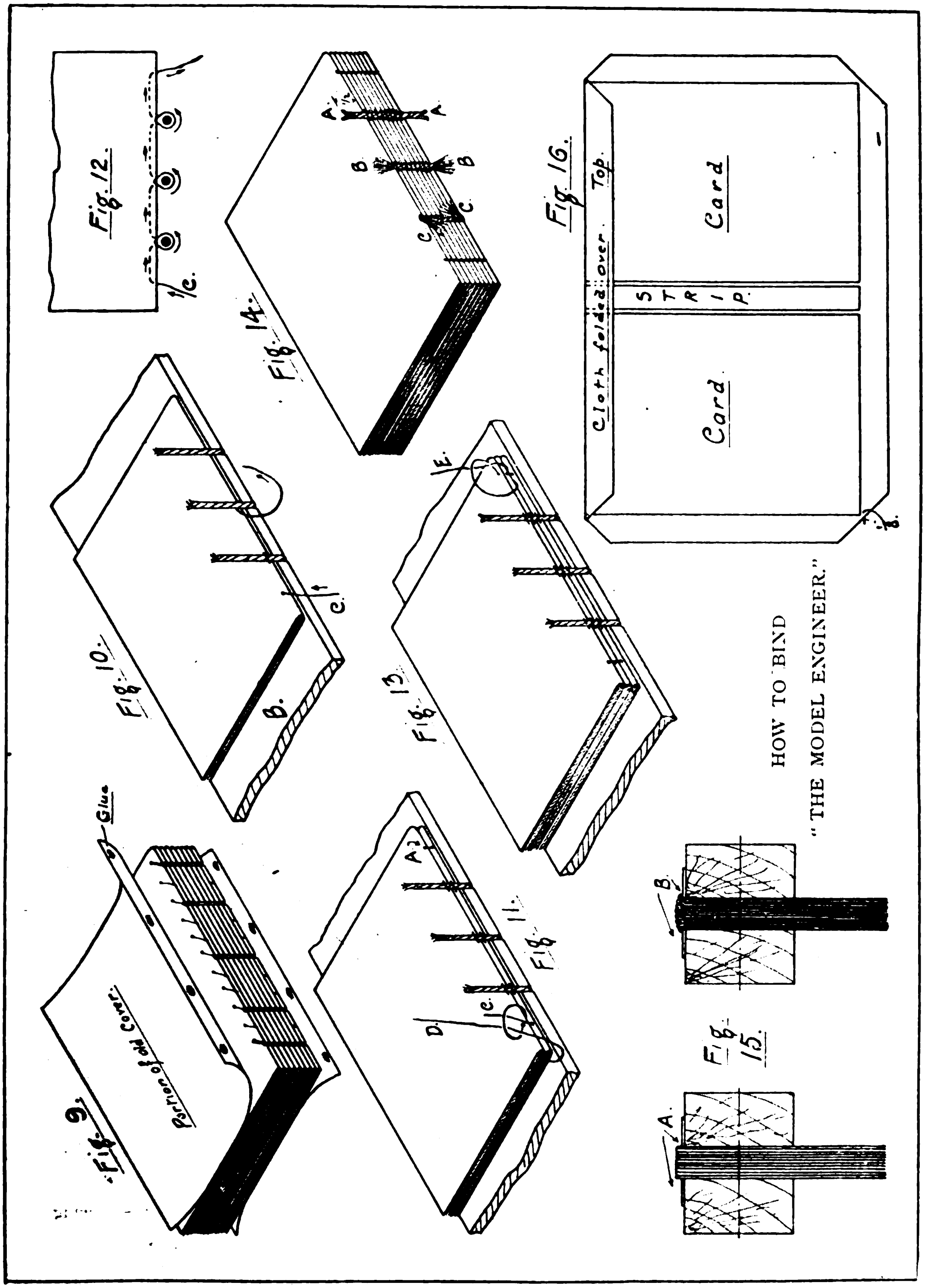
Repeat this process with the remaining sections, and when all are stitched and the last kettle stitch is being made, make it secure by taking the thread between the two previous sections twice. When one length of thread gets used up or broken in stitching, tie a fresh length to the remaining end with as small a knot as possible, and arrange it so that the knot comes inside the section.

Now cut the strings to which the sections are sewn, leaving the ends projecting from the book about ½ in. (A, Fig. 14). Then, with a pin or needle, fray these six ends out like a tassel (B, Fig. 14), well glue the back edges of the book and, while still wet, turn the frayed strings over, put a little glue on them, and press them as flat as possible on to the glued edges of the book in the manner shown at C, Fig. 14. Then put aside to set. When set, or nearly so, put the book into the press, leaving the glued edge projecting about ⅛ in. through the side which has the plates on (A, Fig. 15), screw the press up tight, and well hammer the glued edge of book all over, causing it to form the ledges for the cover and leaving the back slightly rounded (B, Fig. 15). Remove the book from the press, tear off the portions of the old cover which were glued on (Fig. 9), and in place of each of these put an end paper and fix by glueing one side ¼ in. wide along the folded edge. The next operation is cutting the edges.

CUTTING OR TRIMMING THE EDGES.—It is best to get this done by a bookbinder who has a machine for the purpose; but if this is not possible the rather tedious job of cutting by hand will have to be resorted to, as follows:—Cut a piece of cardboard, 9½ ins. long by 6⅞ ins. wide as a template, put this on top of the book with one edge close up to the ledge on the book, and a waste piece of card board underneath to take the finishing cuts of the knife. Then put the book in the press, with the front edge of the template level with front of press and seeing that back of book is not twisted, screw up the press. Take the knife and, after having sharpened the point very well, commence cutting the front edge of the book, keeping the back edge nearest to you. Cut with the point of the knife, which will require sharpening often, and keep the blade pressed quite flat against the face or edge of the press. When this is done, turn the book and template round and cut the top edge; then turn again and cut the bottom edge. Having done this take a piece of the muslin, 9 ins. long by 3 ins. wide, unscrew the press, remove the book, glue the back edge again and also an inch along the end paper each side nearest to the back, place the muslin on the centre of the back edge, the remaining margins of the muslin being turned over one of each of the sides where glued, and well bedded to the book. This forms a hinge for the cover.

COVERS.—If the books are required to look fancy the covers may be purchased ready made from the publishers at about 1s. each; but the home-made ones look very neat and are cheaper. The following is the method of making them.

Cut a piece of the bookbinder's cloth 18 ins. long by 12 ins. wide, lay it lengthways on the table, face downward; glue sparingly the right hand half to within ½ in. of three edges top, bottom, and right hand, take two of the cards (9⅞ ins. by 7¼ ins.), lay one of them on the glued portion of the cloth, leaving a margin of an inch at the three edges just mentioned, and press well with the hands so that there are no creases left in the cloth. Now place the book on this and see that the edge of the card lies behind the ledge provided for it at the back edge of the book; put the other card on top of the book, see that it is behind the ledge, glue the remaining half of cloth, leaving half an inch at each edge, then bring it over on to the top card and smoothe it out as before. Remove the book and you now find that you have a space of about 1⅛ ins. between the two cards. As this portion of the cloth has not to be glued to the book and requires



HOW TO BIND "THE MODEL ENGINEER."

stiffening, cut a piece of stout paper or very thin cardboard 9⅞ in. long and not more than ⅞ in. wide and glue it in the centre of the space (Fig. 16). Then cut the corners of the cloth off to within ⅛ in. of the cards, glue the margins of the cloth and turn them over on to the cards, starting with the top (Fig. 16), then bottom and sides respectively. The cover is now ready for the book.

FINISHING.—Lay the cover open on the table, put the book on the right hand card, central, see that the ledge is right as before, paste well (not glue) the exposed side of the end paper which is at the top of the book, bring the loose half of the cover over, put the edge of the card against the ledge, and press the cover down on to the pasted end paper. Now turn the book and cover bodily over, open the half cover which *was* underneath, paste well the top side of the exposed end paper, put the edge of the card against the ledge and press cover down as you did the other one.

Put the book aside to dry and set, with a few other books on top to keep it flat, and leave for a few hours.

If any lettering is required it can now be done. I have not put any on mine, although I prepared a stencil from stout paper, varnished with shellac, with the intention of using it with enamel or paint, and this seems to me the simplest method from an amateur's point of view.

It will be noticed in the finished book that the front and back pages are not rounded as is usual. If this is wanted, it must be done by tapping the back into the required shape after the edges have been trimmed or cut; but it is not advisable, as books thus treated do not open *wide* without disturbing the folds, and they never close the same after. This is not so with the square edges, which open wide easily.

THE three turbines of the *Carmania* contain in the aggregate 1,250,000 blades, and those of the *Lusitania* will have approximately 3,000,000 blades together. This means probably over 1,000,000 blades for each of the low-pressure turbines.

IGNITION EXPERIMENTS.—According to the *Engineer*, experiments recently carried out by Mr. S. F. Edge with magneto and accumulator and coil ignition systems for petrol engines seem to show that the power given off by the engine does not vary much whatever the voltage of the current may be. For the tests a 40 h.-p. six-cylinder engine was used. With an accumulator and coil and pressure of 4·2 volts, the horse-power given off was 40·9, with pressures ranging from 6 volts to 10 volts 42 h.-p. was yielded. The only thing that seemed to alter was the degree the spark could be advanced; in other words, the same power could be obtained with less advance, the horse-power remaining practically constant.

A Design for Model Racing Yacht.

By "NAÏAD."

THE drawings here given are of a 39·4-in. model yacht (New International Rule) which I designed and built last autumn for inter-club racing. To make the boat (which is in three layers *bread-and-butter* fashion), I bought a piece of mild mahogany, 2¾ ins. by 11½ ins. by 8 ft. for 19s. The two top layers were cut from this with a band-saw. The wood for the third layer was fretted out from the inside of the top layer at a machine fretworker's. It will be noticed that the joints are not parallel to the water line, but to the deck line, thus economising timber and avoiding a fourth layer and an extra joint.

The design was first drawn without the usual *water* and *buttock* lines, three diagonals being used to *fair* the sections. The *joint* lines were added after the wood was bought, as it is not easy to buy wood the exact thickness required. A table of offsets for these is given, the sections being 4 ins. apart.

TABLE OF OFFSETS.

Section No.	0	1	2	3	4	5	6	7	8	9	10	11
Deck Plank	1·8	3·1	4·2	4·8	5·3	5·5	5·6	5·4	5·2	4·7	3·9	3·1
Second Plank... ...	0·4	1·9	3·1	4·2	4·8	5·1	5·1	4·0	4·3	2·8	0·1	—
Third Plank	—	—	0·5	1·5	2·0	2·1	1·9	1·5	0·9	0·4	—	—

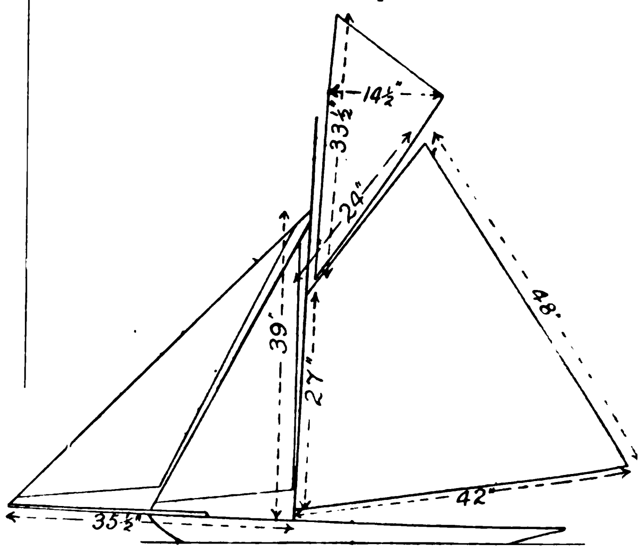


FIG. 1.—SAIL PLAN FOR MODEL RACING YACHT, DESIGNED UNDER THE NEW INTERNATIONAL RULE.

To fasten the sections together, I used 1-in. screws, enlarging the screw holes to ¼ in. diameter in the upper plank nearly through the wood in order that

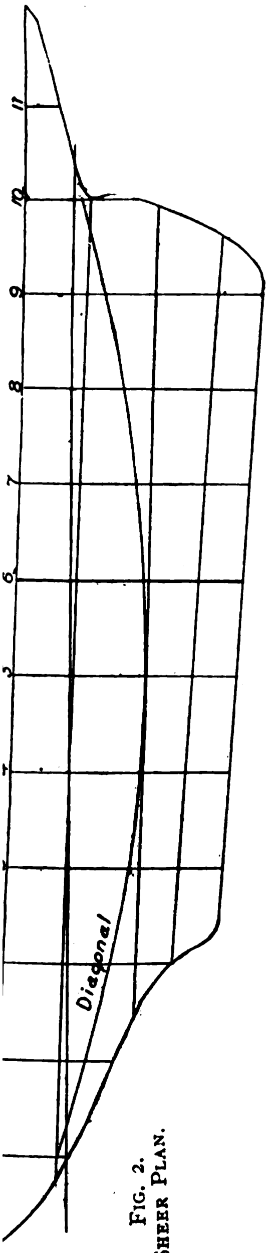


Fig. 2. Sheer Plan.

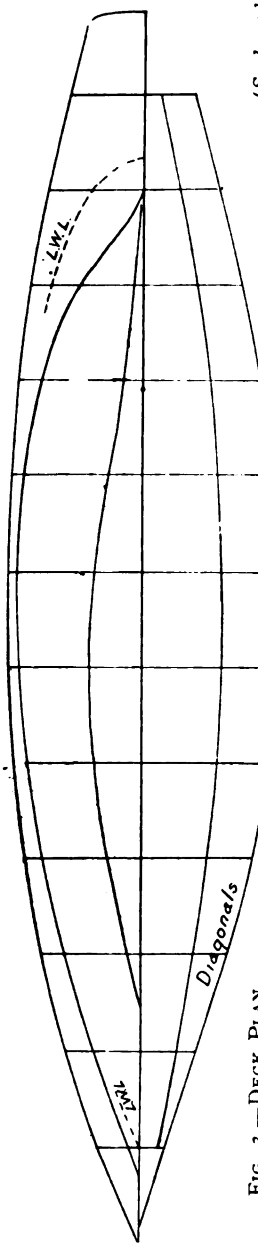


Fig. 3.—Deck Plan.

Design for Model Racing Yacht (New International Rule).

(Scale: 1½ ins. = 1 ft.)

the screw points might reach the plank below. This method of fastening facilitates the hollowing-out process, as the gouge can pass over the screw heads. Then, when the sections are taken apart and glued, some of the screws can be put back to hold the wood while the glue sets. The keel is 1¼ ins. wide at the upper edge and 2 ins. deep. About 18 lbs. of lead were cast with the centre of gravity about the middle. This brought the boat

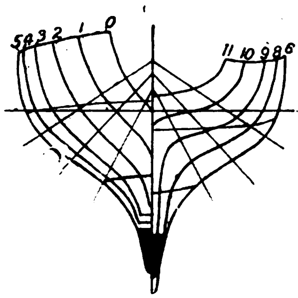


Fig. 4.
Body Plan.

to its designed trim, but on trial I found that the boat sailed better when trimmed down by the stern, so I recast the lead with its centre of gravity ¾ in. aft of its centre of length.

The sail area is rather large, but sail is *cheap* under this new rule.

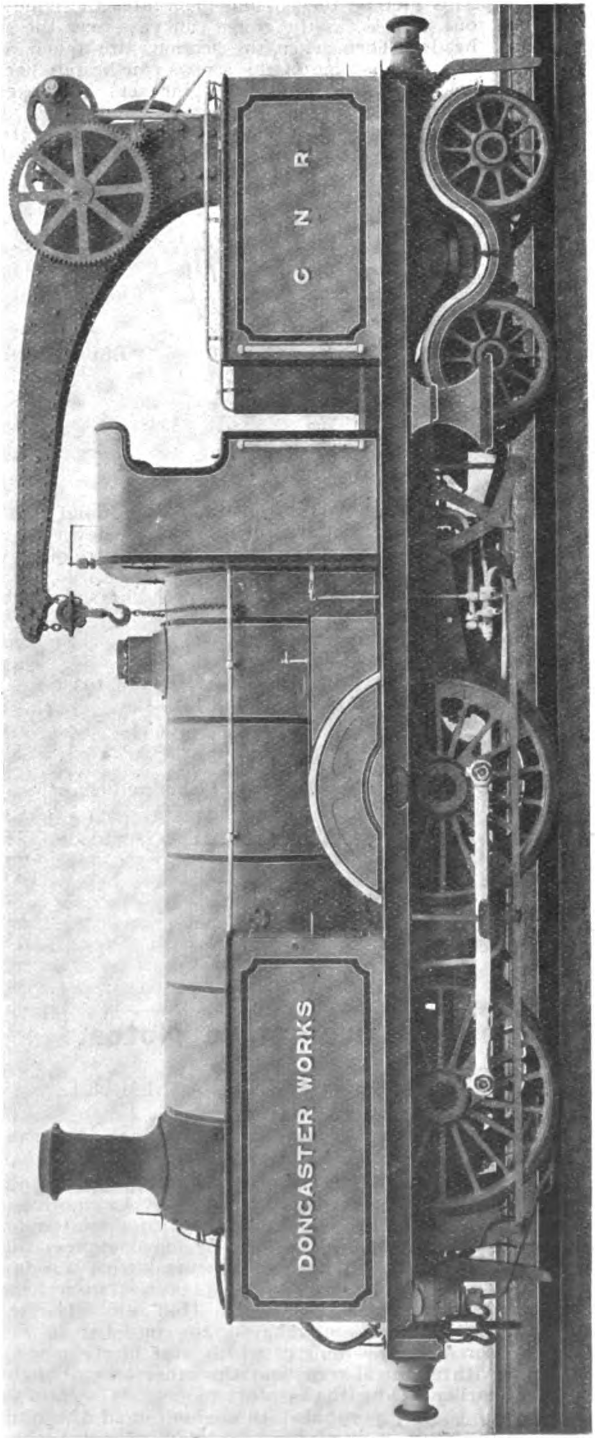
The designed rating is :—	ins.
Load water line	41·2
Difference between skin girth and twice freeboard at bow end of L.W.L. ..	1·0
1-5th same difference aft	1·0
Beam	11·2
½ chain girth at No. 6	9·0
3 times difference between skin and chain girths	3·9
⅓ √sail area (2,025)	15·0
	81·4
Mean freeboard	2·7
	2)78·7
Rating	39·35

Locomotive Notes.

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

Locomotive Work on the Great Northern Railway.

The writer has recently had several opportunities for noting the work performed by locomotives on the Great Northern Railway whilst the latter have been hauling some of the principal express trains of that line. The first of several trips was made by the 5.45 p.m. dining-car express from King's Cross for Leeds, Bradford, Hull, etc. The train on the occasion referred to consisted of eight corridor cars—four of which were of the new type with elliptical roof, and the other four of slightly earlier build with clerestory roofing. The train was, of course, vestibuled throughout, and the dining cars, two in number, each ran upon twelve wheels. Two engines were employed, viz., No. 1,004 as train engine and No. 1,003 as pilot, both being of the late



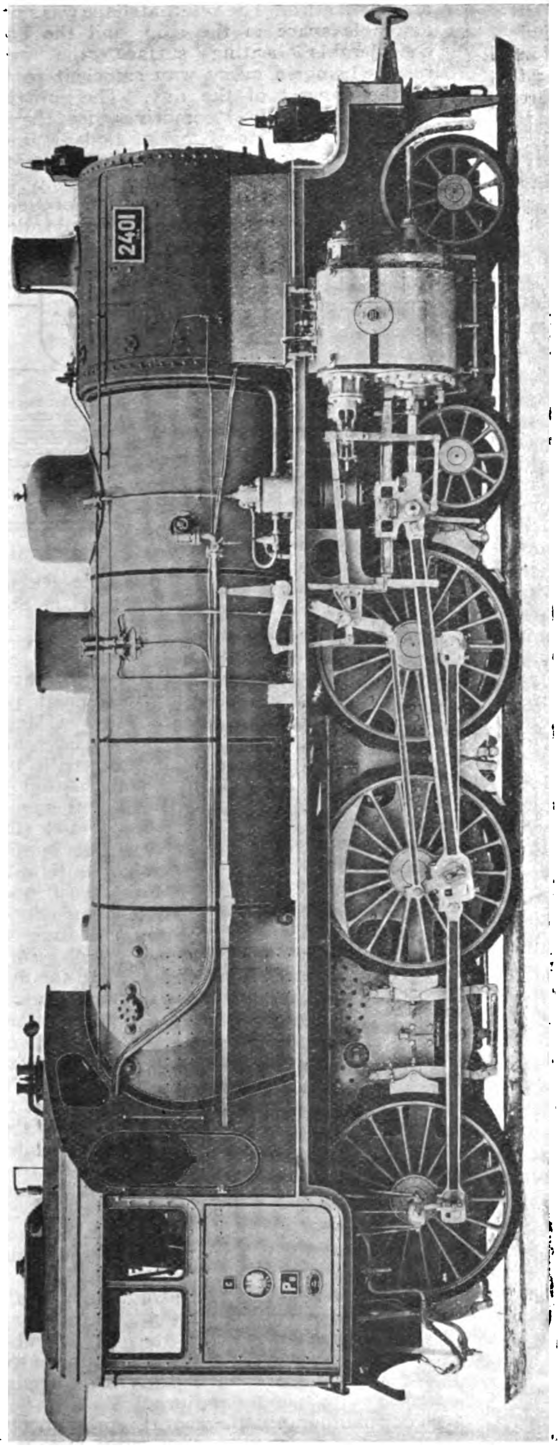
Suburban Passenger Engine converted to Locomotive Crane: G.N.R.

Mr. Patrick Stirling's 8-ft. single-driving type, and among the last of that class to be built at Doncaster Works. Each engine bore date 1894. The 5.45 p.m. express is booked to stop at Peterborough, Doncaster, Wakefield, and Holbeck, and to perform the journey of 185½ miles between London and Leeds in 3 hours 50 mins., including the four stops mentioned. Leaving King's Cross punctually to time, the two 8-footers occupied 19 mins. in covering the 13 odd miles to Potter's Bar, practically all of which is on the up grade. Hitchin, 32½ miles, was passed at 6.24 p.m., or 39 mins. from the start, and Peterborough platform was reached after a dead slow approach for some distance at 7.10 p.m., 2 mins. before booked time. Here the two 8-ft. singles were detached, their places being taken by No. 1,371, an Ivatt 4—4—0 class engine, piloted by No. 234, a 7-ft. 6-in. inside-cylinder (Stirling) single. The train left Peterborough, as booked, at 7.16 p.m., and arrived at Doncaster at 8.48 p.m., or 1 hour 32 mins. for 80 miles, equal to 52·2 miles per hour.

At Doncaster, the two engines from Peterborough were replaced by No. 1,330, another of the 4—4—0 type, and with a reduced load—the front two coaches for Hull having been taken off, this engine made fine running, arriving at Wakefield (Westgate) at 9.15 p.m., and finally stopping at Leeds at 9.34 p.m., or one minute before booked time. Some of the running on all sections was extremely fast, and the hill climbing was uniformly good. A day or so later the writer was enabled to test the capabilities of No. 271, the four-cylinder simple locomotive built at Doncaster in 1902, and since equipped with Walschaerts valve gear to the outside cylinders. This engine was attached at Doncaster to the 8.36 a.m. Wakefield and Leeds express, this train being the 5.5 a.m. *ex* King's Cross. The train was some 10 mins. late leaving Doncaster, but so excellently did No. 271 perform that no less than 4 mins. of this had been recovered by the time Wakefield was reached. The customary stop having been made at Holbeck—the Willesden Junction of Leeds—the train came to a standstill in the Central Station at the last-named place at 9.21 p.m., or 4 mins. late only; no less than 6 mins. having been made up in a run of just under 30 miles, with two intermediate stops. The train was, however, a light one, not more than 130 tons at the outside.

The concluding run was by the 2 p.m. special luncheon-car express *ex* Leeds for King's Cross. This is an especially fast train, being allowed only 3 hours 30 mins. to cover the 185½ miles, with stops at Holbeck and Wakefield. As these stops together consume 5 mins., the nett running time is reduced to 205 mins.

The train on the occasion referred to consisted of four cars of the latest pattern, two being 12-wheeled diners. The engine was No. 1,415, among the latest of the two-



NEW SUPERHEATED EXPRESS LOCOMOTIVE: PRUSSIAN STATE RAILWAYS.

cylinder Atlantic type engines, built at Doncaster Works during 1906.

Starting fully half a minute late, and having lost a further two minutes by the time of leaving Wakefield for the non-stop run of 175¼ miles to London, such excellent going ensued that on passing through Doncaster, at reduced speed on the down through centre road, the train was here on equal terms with its schedule. Grantham was cleared at great speed at 3.35 p.m., and on passing through Peterborough 85 mins. remained in which to cover the intervening 76⅓ miles to King's Cross. The engine made light work of this, going along very easily to Hitchin, where the time at disposal and distance to be run were respectively 37 mins. and 32½ miles.

Eventually the train came to rest in King's Cross Station at 5.29 p.m., exactly 1 min. before it was due to arrive there.

Locomotive Crane, G.N. Railway.

The photograph on opposite page, for which the writer is indebted to Mr. H. A. Ivatt, locomotive superintendent, shows a locomotive crane employed about the Doncaster Works of the Great Northern Railway. Originally the engine was employed on suburban passenger traffic in the Metropolitan district. It was designed by the late Mr. Patrick Stirling, and built at Doncaster upwards of thirty years ago. The crane, which has a lifting capacity of 5 tons, is placed at the rear of the space formerly occupied by a well tank, and to compensate for the absence of this latter two short side tanks have been added at the leading end, where their weight balances the augmented load at the other end.

New Express Locomotives for the Prussian State Railways.

By courtesy of the Berliner Maschinenbau Actien Gesellschaft, one of several new locomotives just built by them for the Prussian State Railways is illustrated herewith.

As will be seen, the 4—6—0 wheel arrangement is employed, in conjunction with outside cylinders. The middle pair of coupled wheels are the drivers, and Walschaerts gear is used for actuating the slide valves, which are of the Schmidt patent piston type, working above the cylinders.

The boiler is of large proportions, and is fitted with a Schmidt superheater of the smoke-tube pattern; indeed, the fact that highly super-heated steam is used in the engine is taken, more or less, as the basis of the whole design. The engine is equipped with all the latest devices associated with Continental locomotive practice, and is built as nearly as possible to the full height and width of the loading gauge. Preliminary tests are at present being carried out with several of these engines, and it is expected that these will prove the great advantage of using superheated steam in large size single-expansion cylinders. The cylinders are 24 ins. diameter by 25¼ ins. stroke; coupled wheels, 5 ft. 10½ ins. diam.; bogie wheels, 3 ft. 3½ ins.; wheelbase, 28 ft. 10 ins.; total heating surface, 2,174 sq. ft.; grate area, 27·9 sq. ft.; working pressure, 170 lbs.; weight in working order, 69 tons.

Notable Models at South Kensington Museum.

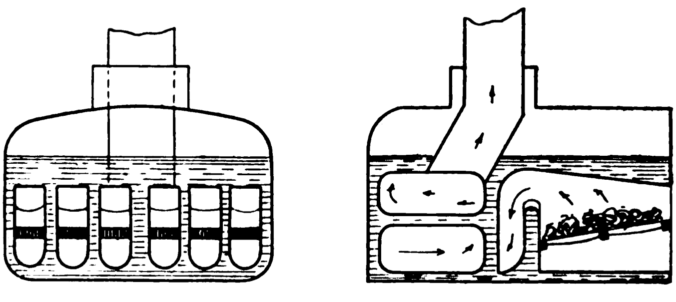
II.—Models of Well-known Types of Steam Boilers.

(Continued from page 443, Vol. XVI.)

In dealing first with the later water-tube types of marine boilers we may be accused of placing the cart before the horse. However, everything comes to him that waits, and this week we include some notes on the earlier steam generators used for marine purposes, and some photographs and particulars of the models of the standard type of marine boiler which is now used in the large majority of British steamers outside the Royal Navy.

Readers who wish to make a study of the history of the marine boiler will not find at South Kensington quite such a continuity of exhibits as he would perhaps desire. However, he should not fail to carefully examine the several interesting cases of models in the marine section of the Museum, both from a historical and constructional point of view.

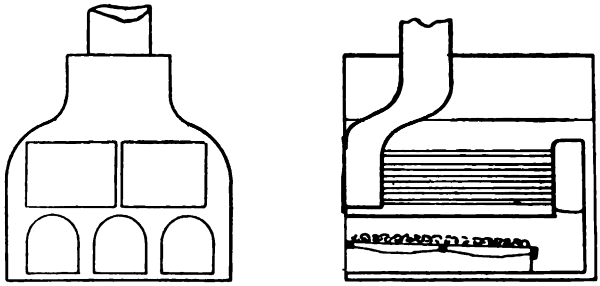
As those who are acquainted with the subject well know, the earliest marine boilers were simply "pot" boilers as used in contemporary stationary practice. Later, however, the desire for a greater amount of heating surface led to the introduction of internal furnaces and flues, and the marine "box" boiler was developed, this type of generator having flat-sided flues and furnaces. They were of various designs, the sketch repro-



Cross Section. Longitudinal Section.

Fig. 17.—Diagram of Early Low-pressure Marine Boiler with Flat-sided Furnaces and Flues.

duced herewith showing a typical example. The type remained in use until about 1845, the working pressures gradually advancing until 35 lbs. was in some cases reached. The flat sides of the furnaces and flues were, of course, well stayed and the type of generator gave very satisfactory results in actual practice. The external shape was suited to the available space in the ship, and the boilers had considerable heating surface, the evaporative results being in every way sufficient to the needs of the engines of the day. The substitution of tubes, as used in locomotives, for the flat flues in the "box" type of marine boiler was, however, much advocated by Thomas Cochrane, the tenth Earl of Dundonald, who, by the way, also had much to do with the introduction of steam power into our warships. Lord Dundonald designed a



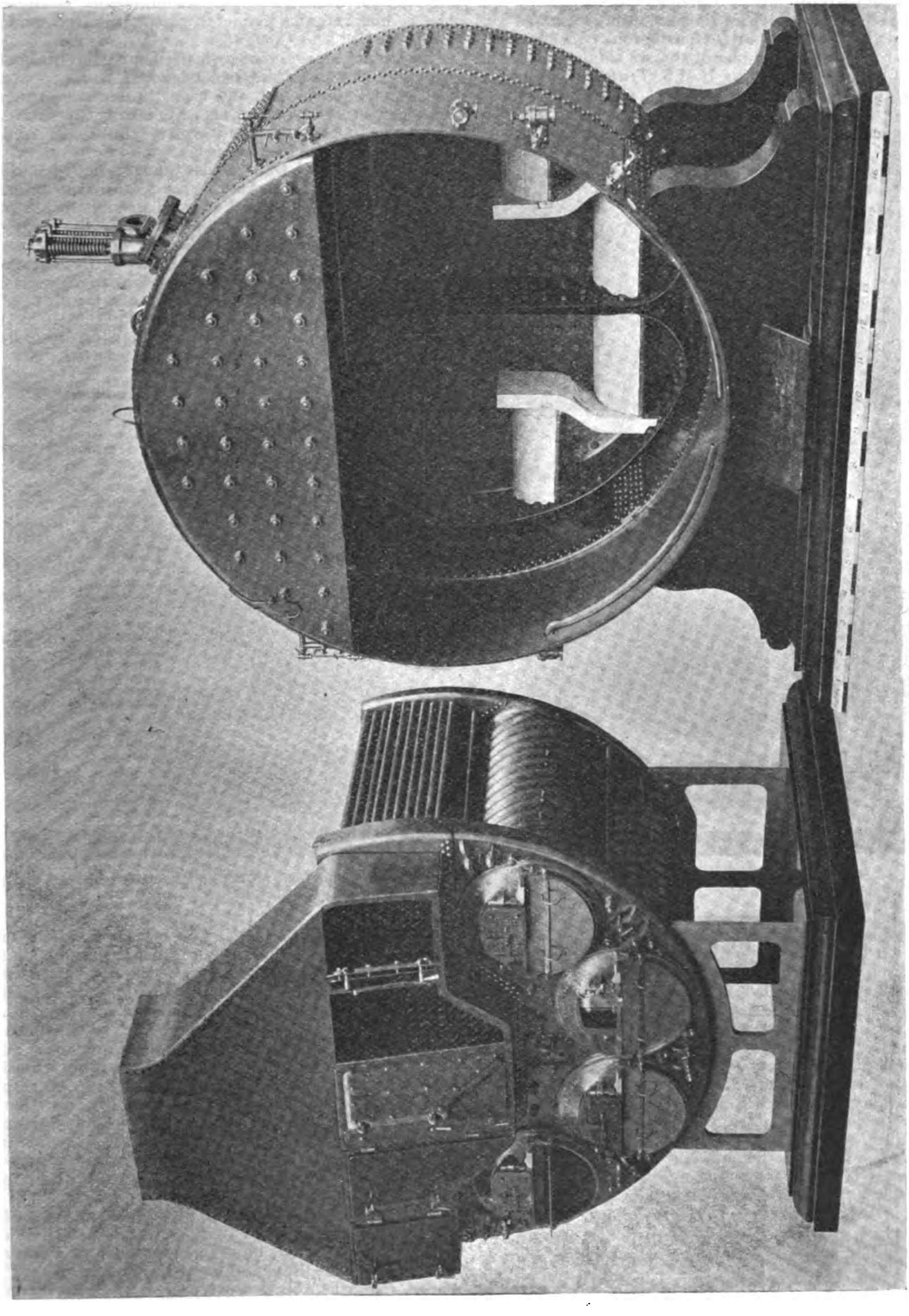
Cross Section. Longitudinal Section.

Fig. 18.—Diagram of the Dundonald Return Tube Marine Boiler. (From the Model in South Kensington Museum.)

war vessel, the *Janus*, fitted with four tubular boilers, which in general arrangement resembled that of the model presented to the Museum by the succeeding Earl in 1861. We have no photographs of this generator, but herewith include a diagrammatical sketch of its construction (Fig. 18).

As will be seen, the boiler is of the rectangular type with numerous flat surfaces and three flat-sided round-topped furnaces. The opposite flat surfaces were stayed together internally, but these, the visitor to the Museum will notice, are not represented in the model. A common combustion chamber was fitted communicating with the three furnaces and through which the heated gases were conducted to the flue-tubes, just as in the modern cylindrical boiler. Passing the uptake through the steam space, as was done in this generator, is not now practised owing to the rapid deterioration of the plates situate above the water level. Except in this particular and in its rectangular external shape, the Dundonald boiler foreshadowed the present Scotch boiler. The cylindrical shell of the latter was rendered necessary by the higher pressures which slowly came into vogue. There was, however, much prejudice against high pressures being used at sea; but the introduction of the compound and later the triple expansion engine settled the matter, and now we have huge cylindrical multitubular boilers with pressures getting on towards 200 lbs. per square inch.

The photographs herewith represent only one model. It, however, passed through a metamorphosis in the Museum workshops in 1902, and this accounts for the difference in construction apparent



NOTABLE MODELS AT SOUTH KENSINGTON MUSEUM.

FIG. 19.—SECTIONAL MODELS OF CYLINDRICAL OR "SCOTCH" MARINE BOILER, AS ORIGINALLY MADE.

in the views we reproduce. The model was originally made by the Admiralty at Portsmouth Dockyard and added to the South Kensington collection in 1889. It is a copy of one of the six single-ended "Scotch" boilers fitted to H.M.S. *Trafalgar*, built in the above Naval depot in 1887.

The actual boiler is 16 ft. 6 ins. diameter, 10 ft. 3 ins. long, with four furnaces 3 ft. 8 ins. diameter by 7 ft. 4 ins. long. It weighs, with its water, fittings, and proportion of uptake and funnel, 84 tons, and supplies steam for 1,403 i.h.-p. on natural draught, or for 2,100 h.-p. with forced draught when used in a three-stage expansion engine.

The shell is formed of two rings of plate 1·156 ins. thick, united longitudinally by internal and external cover straps and treble riveting, with rivets 1⅛ in. diameter. The ring seams are laps, double riveted with ⅞-in. diameter rivets. The end plates are in three pieces, flanged to take the furnace flue and to join to the shell.

The four furnace tubes are of corrugated steel plate, 47 ins. thick, 3 ft. 8 ins. diameter, as before-mentioned. They are riveted to the front end plate, and to the bottom plates and tube plates of the combustion chambers. The fire grates are 7 ft. long, and have cast-iron firebars 1 in. wide, leaving ½-in. air spaces. The grate area is 109 sq. ft., and the heating surface 3,050 sq. ft. There are two combustion chambers constructed of ½-in. plates, and separated by a water space 5 ins. wide. The flat sides of the combustion chambers are stayed with 1¼-in. diameter screwed stays, 7 ins. pitch, with nuts at each end; the roofs are each stayed with ten girder stays, carrying 1¼-in. diameter screw stays.

Deflecting arches and separating walls are built in the chambers, as represented in the model. The 245 return tubes for each combustion chamber are 2½ ins. external diameter, 6 ft. 8 ins. long, and 3½-in. pitch.

Six manholes are shown in the front plate, about the furnace tubes, and one over the steam space. The model shows also the usual boiler mountings and their internal connections, including the surface valve, the bottom blow-out valve, the main feed, and the auxiliary feed valves.

It will be noted that instead of all four furnaces being of Fox's corrugated type, as in the actual boiler, one of these in the model has been replaced by a plain tube, made in short lengths and strengthened by the Adamson flanged joint; another shows the "Farnley" flue, in which helical corrugations are formed to give the necessary resistance against collapse.

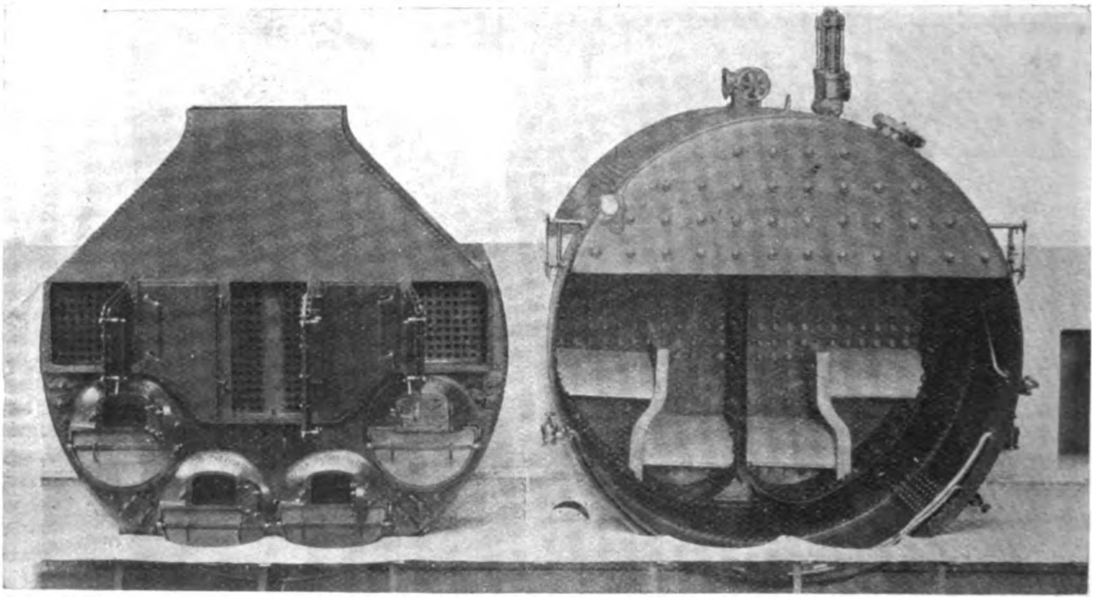


FIG. 20.—SECTIONAL MODELS OF THE CYLINDRICAL OR "SCOTCH" MARINE BOILER, AS NOW ARRANGED IN THE SOUTH KENSINGTON MUSEUM.

As first made the model boiler was finished in bright brass, but with the additional fittings and the special settings and flues, it is now painted in the standard slatey-blue colour adopted for all such models by the Museum authorities. There is actually only one model of a complete generator, but all the inside and the lower part of the front plate, with doors and uptake, are mounted separately to the shell, which occupies a position in the ship which would be taken by another boiler. In our photograph (Fig. 20) we have been obliged to omit the flues and other accessories above the centre-line of the shell; but as now exhibited the model shows exactly how the boilers are set in the ship.

In the same showcase are exhibited models of some of the many kinds of flues which have been patented. The chief, however, are those of Fenby (the "Farnley"), Fox, and Purves. The "Purves" ribbed flue was rolled with projecting rings at a pitch of 9 ins., but the material at the projecting rings or ribs was made thicker than that of the plain cylindrical portions between.

Models, or rather examples, of the "Serve" flue tubes are also shown, and indicate the methods by which these tubes are manufactured.

The "Serve" tube was patented in 1885, and has internal ribs running longitudinally through the whole length of the tube, except for the ends, where the ribs are cut away to allow of the tubes being expanded in. These patent tubes are largely used for locomotives as well as in marine boilers, and over 15 per cent. additional efficiency is claimed. The tubes are made by being rolled in a flat strip, with the ribs projecting. These ribbed strips are then bent circular and the joint lap-welded, in rolls or by a power-hammer, a suitable mandrel being inserted inside the tube during the welding operation. Other marine boiler models include several of a type the writer would term diagrammatical models, all internal parts being shown by drawing on the planes of the section. This method is adopted where the forced

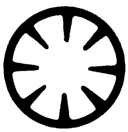


Fig. 21.—A Section of the "Serve" Flue Tube.

Fig. 22.—The "Serve" Flue Tube during Manufacture, before it is Rolled up and Welded.

draught and stokehold arrangements are the features it is desired to more particularly exemplify.

(*To be continued.*)

A Simple and Inexpensive Arc Light.

By G. C. Blake.

The apparatus which I am about to describe is very simple, and if the instructions given here are fully carried out, any amateur should be able to fit up for himself a very efficient arc light for taking photographs at night, or working a magic lantern.

Fig. 1 shows the liquid resistance when fitted up. I will describe this part of the apparatus first. A is a large stoneware jar (capable of holding about 1 qrt.) into which dip two strips of copper B B, ¾ in. wide and 1-16th in. thick. These are bent into the shape of B (Fig. 3), and are kept apart at the bottom when in the jar by means of a piece of glass C (Fig. 3). The jar is then filled about half full of water, and fastened on to a wooden

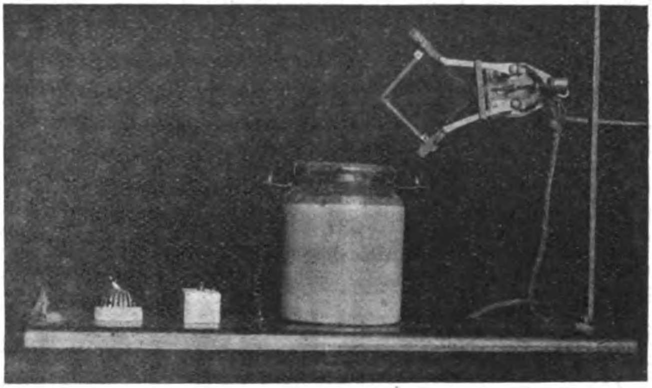


Fig. 1a.—Showing Arrangement of Simple Arc Light.

stand, on which are also fixed a fuse F, a switch S, and six terminals W W', L L', and T T'.

Fig 2 shows the connections, which should be made with insulated copper electric light wire (about 1-16th gauge, not smaller). When these connections have been made and a piece of fuse wire put in the fuse F, terminals T and T' must be connected to the electric light main—T to the negative pole and T' to the positive.

Terminals L and L' must now be connected to two pieces of electric light carbon, which must be fastened in some sort of metal holders, so that the distance between the two carbons can be varied at will.

Fig. 5 shows a simple hand-feed arc lamp suitable for this purpose. L and L' are two strips of sheet brass, about ⅛ in. thick by ½ in. and 7 ins. long

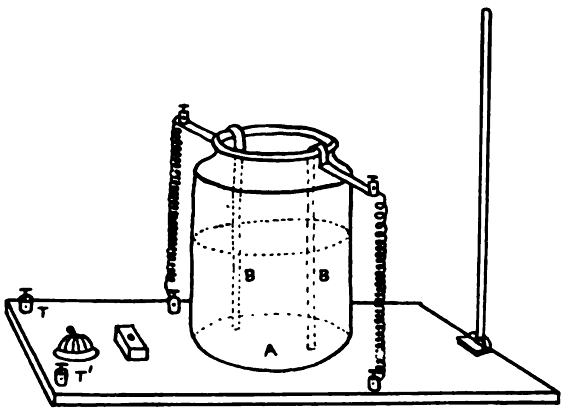


Fig. 1.—Liquid Resistance.

which are pivoted at M and M on to short pieces of sheet brass with terminals T and T' attached. N is a wedge-shaped piece of wood, which can be moved up and down between the copper strips by means of a screw P (see Fig. 6). The two brass strips L and L′ are held in position by means of two short steel springs S and S′, which are insulated from one another by means of a small block of wood W. Y and Y′ are two clamps which hold the carbon pencils, and are pivoted on to the brass strips. Y (Fig. 6) shows the construction of one of the clamps, which are also made of sheet brass fastened together with small bolts and nuts.

The two carbons must now be brought together so as to touch, and then quickly separated, when a very small arc will form between them. In order to increase the size of this arc, add sulphate of copper to the water in the jar A a little at a time, and keep trying the arc until it gives a sufficiently bright light. For safety's sake it is well to insert an amperemeter somewhere in the circuit,

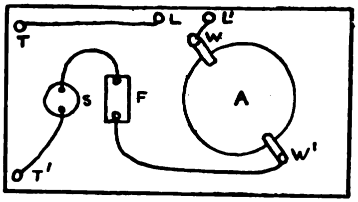


FIG. 2.
DIAGRAM OF CONNECTIONS.

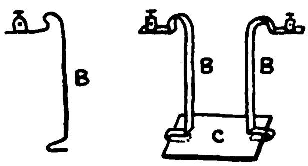


FIG. 3.—COPPER STRIPS.

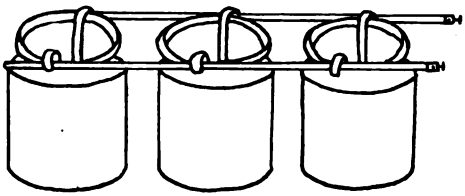


FIG. 4.—BATTERY.

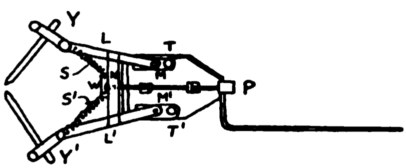


FIG. 5.—ARC LAMP.

FIG. 6.—DETAIL OF CLAMP.

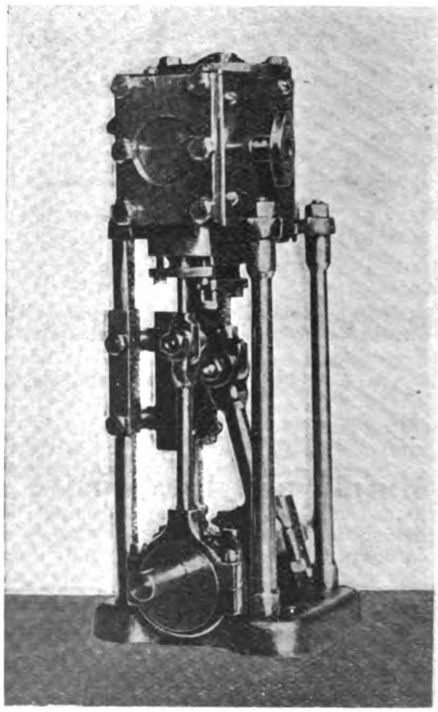
so as to see how much current the light is taking. In proportion as we add sulphate of copper to the solution, its resistance will decrease, and therefore allow more current to pass through the arc. For photographic purposes this single-jar apparatus is all that is needed, but if it is run for long periods of an hour or more, as in a magic lantern, the copper solution will become heated, and will not work satisfactorily. In order to overcome this difficulty a number of jars must be connected up in parallel (as in Fig. 4). If three jars are used, the copper solution in each one must be one-third the strength which it was found necessary to use when only one jar was employed. It will then be found that the three jars will work three times as long.

A Model Launch Engine.

By JAMES CHALMERS.

THE model launch engine here described and illustrated was designed and made entirely by myself. Having prepared drawings of every detail before commencing the actual work, and afterwards taking great care in the construction of the engine, especially the bearings, connecting-rod brass, all working joints, etc., the engine runs up to 3,000 r.p.m. without the slightest knocking.

The only castings used for this model are the cylinder and covers and the bedplate. The former, along with the eccentric and straps, crankshaft and connecting-rod brasses, and the glands,



MR. JAMES CHALMERS' MODEL LAUNCH ENGINE.

are all of gun-metal. The bedplate is of cast iron; all the other parts are of steel.

The cylinder is of $\frac{5}{8}$-in. bore by $\frac{3}{4}$-in. stroke, and the ports—which were drilled and chipped in the ordinary way—are steam, 3-32nds in. by 5-16ths in.; exhaust, 5-32nds in. by 5-16ths in. These may seem somewhat large, but they are a necessity for high-speed work. The cylinder was lagged with sheet steel, and the space between the walls of the cylinder and the lagging was filled with felt. There are between sixty and seventy bolts, nuts, and screws used in the engine. The standards were all turned from ¼-in. steel wire, and the guides are bolted on to pieces held between the standards.

In conclusion, I may say that all the turning was done on a 2½-in. centre lathe (home made) and without a slide-rest.

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 intended for publication.*]

Concerning Small Lathes.

To the Editor of *The Model Engineer*.

Dear Sir,—I must take exception to one or two remarks made by Mr. Coupland. With regard to "the higher cost," the lathe I have seen illustrated as made by Messrs. Tangye is comparatively cheap, and though I have never seen any of their work, I do not think a firm of their reputation is likely to design a lathe which would turn out inaccurate. I fail to see why such a lathe should be clumsy, and, if the lathe is accurate, what need is there for adjustment? I do not consider that I am especially careful in my work, but I can assure Mr. C. that Mr. B. has never caught the top of the tee under the jaw of a quickly revolving chuck; he values his lathe too much to play tricks of that kind.

If greater power is wanted, a very natural thing to suggest is a larger lathe; but my remarks were intended for those who, like myself, have no room to spare. My workshop has an area of only some 56 sq. ft., and a larger lathe would prevent my ever getting into the place. Mr. C and I evidently differ as to what a tight belt is: to take a "respectable shaving" off a 2-in. mild steel bar with a 4-in. pulley without back-gear requires a much tighter belt than I care to use. I may, perhaps, add that for many years I had no slide-rest, and as a result I do know when a tool is cutting properly, and when it is simply tearing off the metal.

The angle of V in my pulley is not so sharp as that which is recommended, and I can quite see that that is one of the things which I had better alter. Owing to this, no doubt I cannot cut a screw of coarse pitch. I have cut eight threads per inch, but I was troubled with belt slip, though the slides work quite easily; even when turning a 6-in. faceplate I cannot get properly under the scale towards the edge, in spite of the back-gear. The occasions when I most object to slipping are in screwing, and so on, not when beginning a job.

I should, perhaps, have stated in my first letter that my remarks were intended for those who wanted power, but had no room for a larger lathe. My experience of amateurs is that they require a lathe to do all sorts of jobs, and therefore require considerable power at times.—Yours faithfully,

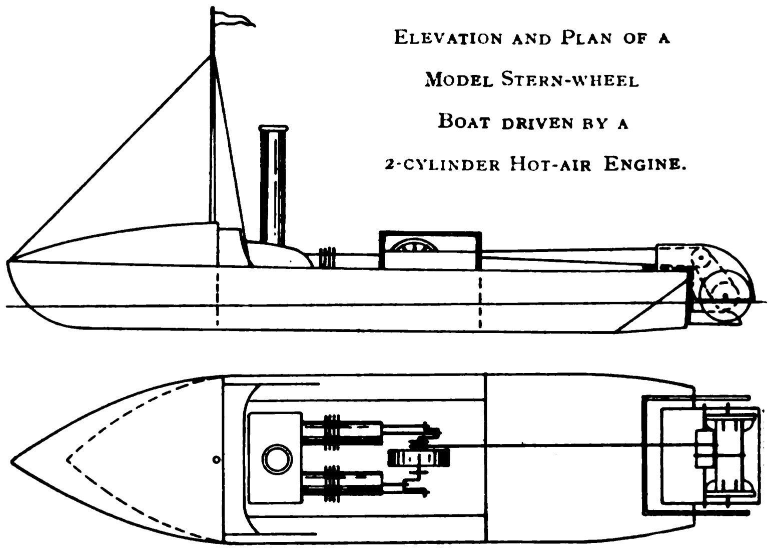
South Shields. M. W. Burrows.

A Model Stern-wheel Boat.

To the Editor of *The Model Engineer*.

Dear Sir,—I am sending you a drawing and short account of a small power model boat. She is a flat-bottomed stern-wheeler, driven by a two-cylinder hot-air engine, costing 6s.; built of 3-16ths-in. wood and mahogany veneer planking. The water-tight compartments will easily keep her afloat should the engine space be swamped. There

Elevation and Plan of a Model Stern-wheel Boat driven by a 2-cylinder Hot-air Engine.



are sixteen floats on wheel, having about ¾-in. surface each, and geared to engine by spring-wire cord.

Boat measures 2 ft. by 6 ins. by 2½ ins. She runs well as long as the lamp is burning. Total weight under 4 lbs. Cost, all told, under 9s. She would be improved by reducing the beam 1 in. and adding ½-in. keel.

Shall be pleased to give your readers any further particulars.—Yours faithfully,

Southend-on-Sea. Sidney Redfearn.

"A Model Engineers' Tramp Abroad"—"The First Locomotive in Germany."

To the Editor of *The Model Engineer*.

Dear Sir,—We are much gratified to find that one reader at least has found the account of our trip sufficiently interesting to induce him to read the last few articles. With regard to the point Mr Russell raises, we may say that we added the footnotes because we doubted any connection between the two famous engineers. But the description of the model engine in the Museum says plainly enough: "Diese Lokomotive würde in Jahre 1835 von Stephenson und Ericisson in England gebaut, zu schiff bis Köln und von da auf der Strasse nach Nürnberg befordert." As Mr. Russell confirms our doubts, we are writing to the authorities on the subject, and thanking him for his kind letter.—We are, dear Sir, yours faithfully,

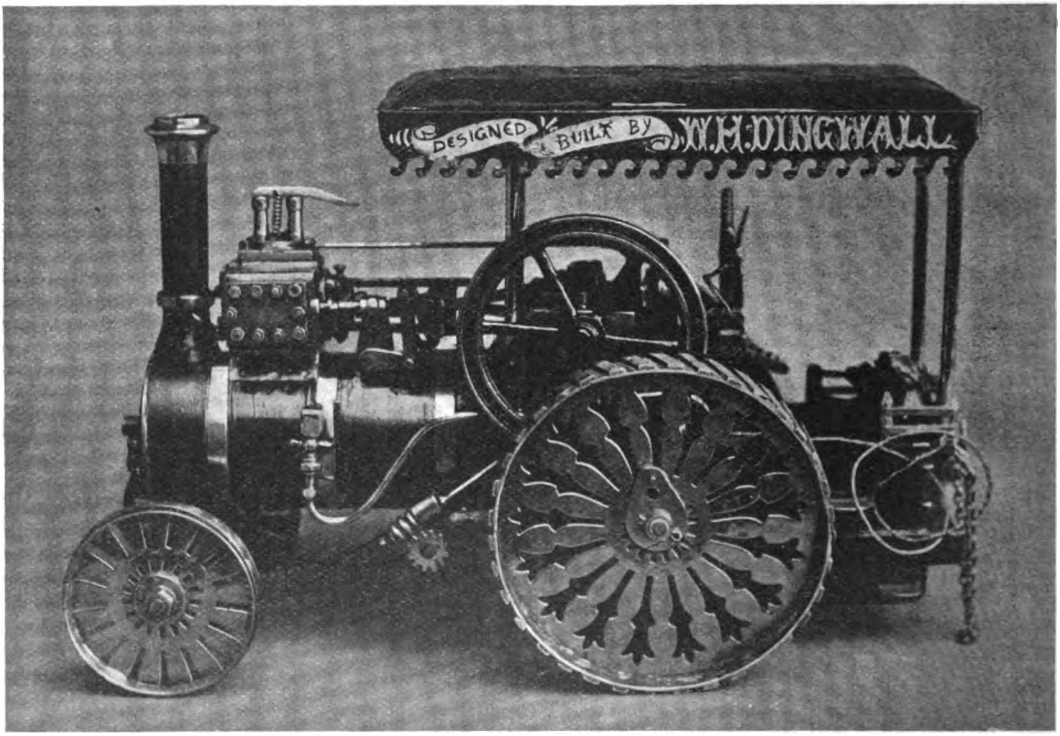
"The Tramps."

A Traction Engine Driver's Model.

To the Editor of *The Model Engineer*.

Dear Sir,—I am sending you a photograph illustrating a model traction engine, which is my first attempt at model making, having occupied my spare time for about six years. The cylinder is 1-in. stroke by ⅞-in. bore; total length of model is 15 ins., width over all 6 ins. The boiler, including the smokebox (which is 1 in.) is 5½ ins. long, and is built of 1-16th-in. copper (riveted), and has three ¼-in. tubes. The firebox measures 2½ ins. by 2 ins. inside, having a 3-16ths in. water space all round; it is stayed top and sides with ⅛-in. stays (screwed). The firing is by means of a methylated spirit lamp. Some idea of the dimensions of the model may be obtained from the sizes of the wheels, which are 6½ ins. diameter in rear, and front wheels 3 ins. diameter. The flywheel is 4 ins. diameter. I hope eventually to fit a dynamo on to the front of engine.—Yours truly,

Dumfries. W. H. Dingwall.



Mr. W. H. Dingwall's Model Traction Engine.

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 (all at the Cripplegate Institute at 7 o'clock).—Tuesday, April 9th: Mr. Ferriera's paper on "Model Making." Wednesday, May 1st: Short papers on practical subjects by members. Tuesday, May 28th: Lecture by Rev. W. J. Scott, B.A., on "Six-coupled Express Engines on the Great Western Railway." For particulars of the Society and forms of application, write Herbert G. Riddle, Hon. Sec., 37, Minard Road, Hither Green, S.E.

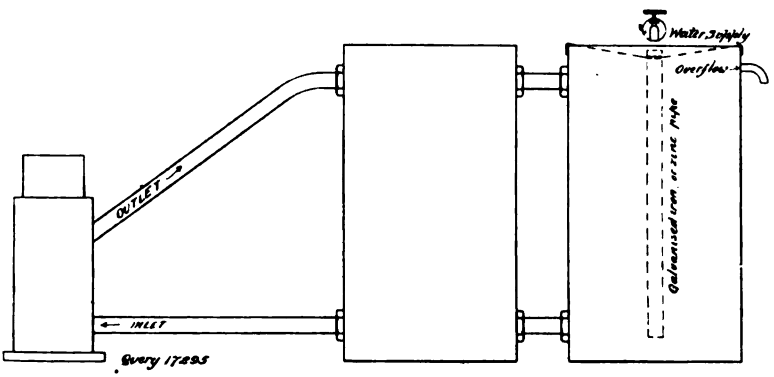
Queries and Replies.

[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:—

[17,295] **Cooling Water Tanks for Gas Engine.** T. C. (Camberwell) writes: I enclose herewith sketch of cooling arrangement which I use to cool my 8 h.-p. vertical gas engine. After running for about five hours, both tanks become very hot, which necessitates my having to draw off the hot water and fill up with cold again. Can you tell me where the defect lies in my arrangement, and which way would give the best results?



WATER COOLING ARRANGEMENTS FOR GAS ENGINE.

The tanks should be connected top and bottom to get best cooling effect. Of course, if both tanks get hot right to the bottom, the only thing to do is to run off some of the hot water and put in some cold. The best method of doing this is as in sketch, where a zinc or galvanised pipe into which the cold water supply is led from a tap, or any convenient source, is shown. The pipe is suspended by a wire or cord as shown. This ensures the cold water going straight to the bottom of tank where it is needed, and the hot water is displaced and overflows from the overflow pipe to waste.

[17,325] **200-watt Dynamo Windings.** R. S. C. (Ramsgate) writes: Will you please reply to the five queries I enclose. I also enclose a half size drawing of field-magnets. (1) How much wire and what gauge must I use on armature and field-magnets for dynamo 25 volts 8 amps. (sketch not reproduced)? (2) How much wire and what gauge must I use on armature and field-magnets (same size as above) for output of 30 volts 7 amps.? (3) How many 8 c.-p. lamps will the 200-watt machine light at full output of 25 volts 8 amps.? Size of armature, 3 ins. diameter by 4 ins. long (see drawing enclosed, 8-cog drum). (4) Will an engine with cylinder 1½-in. bore by 1½-in. stroke drive the 200-watt dynamo at 25 volts 8 amps.? (5) If this engine will not drive dynamo at 25 volts 8 amps., will you please let me know how much lighting power in volts and amperes it will get out of it working at 50 lbs. steam pressure?

(1) Armature, 21 ozs. No. 17. Field-magnets, No. 20—as much as you have room for. About 7 lbs. would be correct amount, but your poles are not long enough for this. (2) A slight variation of speed will alter your voltage the desired amount. (3) Reckon 3½ watts per candle-power. (4) With high enough speed and boiler pressure it could be made to. (5) See articles in back numbers on "Small Steam Engine Design."

[16,522] **Windings for Small Motor.** S. L. (Chiswick) writes: (1) I would be much obliged if you would tell me if it is possible to get any current from machine shown in drawing (not reproduced)? If so, could I get 5 volts with tripolar armature, and will you give me the gauge of wire and quantity for same? (2) Would it be better if I opened the field-magnets a little more so that I could use a 1½-in. armature? I wish to use stampings. (3) Should commutator sections be set as in diagram Fig 18, in "Small Dynamos and Motors"? (4) What current would it want to use it as a motor? (5) If not 5 volts, what current could I get, and what speed should it be driven at? This is my first attempt to make one. (6) Please state number of amperes.

(1) It depends upon whether the machine will excite itself; this is a doubtful point. But it would work as a motor even if it failed to be self-exciting as a dynamo, or would probably be successful as a dynamo if the magnet coils were separately excited by means of a battery. Wind armature (tripolar) with No. 26 gauge single silk-covered copper wire. Get on as much as you can; about 2 ozs. will be required. Wind field-magnet to a depth of ½ in. or so with about 4 ozs. of No. 24 gauge s.c.c. copper wire on each limb; connect in shunt to brushes as Fig. 1 A, page 12, of "Small Dynamos and Motors." (2) Yes; get in a 1½-in. diameter armature if possible, and fit new pole-pieces which embrace more of the armature than the present ones do. Most certainly use stampings. (3) Not necessarily; it depends upon the position of the brushes. In the diagram the brushes would be set top and bottom, but with a slight forward lead. You can always find the best position by trying the brushes in various positions. If they are fitted upon a rocker it will enable you to do this easily. Correct position is absolutely necessary. (4) About 2 amps. with 4 or 5 volts at light load, but you could load it up to about 3 amps. (5) Voltage will depend upon speed. You may obtain anything between 3 and 6 volts. Run at 4,000 r.p.m. and try with a 6-volt 1 c.-p. lamp. (6) You might be able to light two or three 1 c.-p. lamps. Get 6-volt lamps, each taking about ½ amp.

[10,318] **Demagnetising a Watch.** J. M. (Dublin) writes: I now take the liberty to ask you for advice on a matter that is out of the usual line of your journal, but I hope you will be able to give me the necessary advice. I am a watchmaker, and I sometimes get in a watch to repair that has got magnetised, and I find it very inconvenient to send them away. I would like to make a coil with which I can treat the whole watch, and if it could be wrought through an ordinary incandescent lamp-holder, and what size of wire and what kind of insulation would you recommend? I have a number of yards left over after making an induction coil as described in your handbook. I was thinking it would not be suitable.

The simplest way to demagnetise a watch is to suspend it by a cord and spin it round and round in front of a magnet and at the same time gradually take watch away out of magnetic field. Any fairly powerful magnet will do. Wind a few yards of wire round an iron core and pass a current from three or four bichromate cells. This is all you require. Repeat the process several times.

[17,447] **500-watt Motor for 110-volt Circuit.** W. P. (Vancouver, B.C.) writes: Can you oblige me with the windings for armature and commutator for a 500-watt dynamo (Manchester type) illustrated in your small book, "Dynamos and Motors," Fig. 15, for 110 volts? Have sent for your "A B C of Dynamo Design," but may not be able to fathom the mystery even then. The windings are given for only 100 volts, and as the mains here are 110, I do not know whether the machine would be sufficiently strong enough to stand the 10 per cent. increase in pressure. I have a full set of your handbooks, and have several American ones, but for simplicity I find your books far ahead of them.

We have great pleasure in replying to your inquiry to hand to-day. The machine can be used on a 110-volt circuit without any alteration in the windings as regards gauge, but get as much as you can on the armature, *i.e.*, a full 1 lb. 14 ozs. of No. 20. We do not think you will find it warm up too much: but, if so, a yard or two of German silver, or iron (as a temporary resistance), wire No. 20 S.W.G. will check the current. Of course, a good resistance for starting will be wanted: 1 lb. of No. 20 G.S. wire will give you 30 ohms, which will be about right. We trust these details will put you right, and that your machine turns out a success.

[17,314] **Fixing Small Pistons to Piston-Rods.** J. W. (Sheffield) writes: I find when making small pistons and rods, especially pistons about ⅝ in. diameter and rods about ⅛ in. diameter, that the piston, after turning, drilling, and tapping, will not screw on the rod properly, *i.e.* being slightly sideways, as sketch (Fig. 1). These rods are dead size to begin with; and, of course, do not

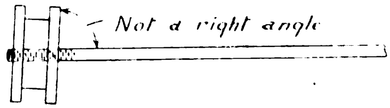


FIG. 1.

SHOWING METHOD OF FIXING SMALL PISTONS TO PISTON RODS.

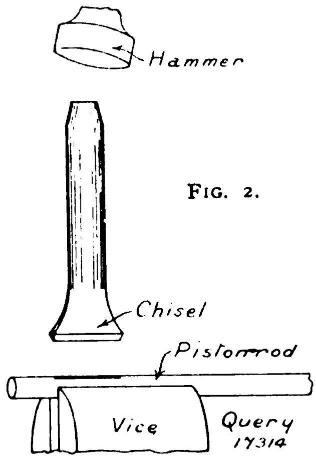


FIG. 2.

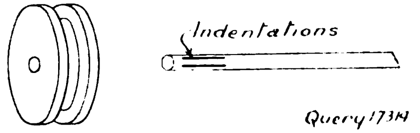


FIG. 3.

admit of a shoulder being turned on them. If that could be done, the whole matter would be easy. As it is, all I can do is to tap them, and trust to luck that they thread in the piston true.

In reply to your query, there is always a risk of failure where a drilled and tapped piston of small size is put on to a plain screwed rod without a shoulder. The following alternative methods may, however, ensure success. (1) Leave the piston "full" in size before fixing the rod. Afterwards hold by the rod in the self-centreing chuck; or, if you have no such chuck, in a piece of metal running in the lathe, drilled a tight fit for the piston-rod, and skim up to proper size. (2) Do not fix by screwing, but make rod a driving fit and adopt the clockmakers' method for making spindles grip a wheel—viz., with a small chisel make three or five longitudinal indentations in the spindle before driving it in into the hole. The indentations should be equidistant. Afterwards the piston may be sweated on. (3) Rough turn, drill, and tap piston. Turn up piston to size on a piece of rod screwed with the same dies as the piston-rod. When the piston is placed on the piston-rod, it should be fairly accurate. Of course, absolute truth cannot be ensured by this method. (4) Another idea would be to screw on a thin nut, with the inside faced after fixing and recessed into the piston. This would take the place of a shoulder. Another nut could be used on the outer end. In any case, however, the final skimming up of the piston would be necessary to ensure accuracy; but with the above arrangement the piston would always go on truly after having been removed.

[17,441] **Model Steamer Machinery; Propeller Proportions.** D. B. M. (Wimbledon) writes: I am making a steam launch, the hull of which is 24 ins. long, 4½ ins. beam, and 3 ins. greatest depth. The boiler is built to a design on page 15 in No. 13 MODEL ENGINEER Series. It is built of brass 1-32nd in. and weighs 1 lb. 4 ozs. Hull, boiler, and all fittings weigh 3 lbs. (1) I would like to know what diameter of propeller to use? (2) I have fitted a balance wheel 1½ ins. diameter. Will this do? (3) Also, what sized cylinder should I use, and whether it should be an oscillating or a slide-valve cylinder? (4) Shall I fit a superheater to the boiler?

(1) You might refer to the excellent article in our issues of March 19th and April 2nd, 1903, on "Screw Propellers." The author of this article gives the following rule:—

Diameter of single propeller =

$$\sqrt{\text{Area of immersed midship secton} \times \tfrac{1}{2}}$$

Reckoning the immersed midship section to be 4½ × 1⅞ in your case, the diameter will be as follows:—

$$D = \sqrt{4\tfrac{1}{2} \times 1\tfrac{7}{8} \times \tfrac{1}{2}}.$$
$$D = \sqrt{8{\cdot}4 \times \tfrac{1}{2}}.$$
$$D = \sqrt{4{\cdot}2}.$$

D = 2·09 ins., or say 2 ins.

(2) We cannot give any opinion on this from the information sent. Most probably it is quite heavy enough. (3) As the height is very small, we would advise either a double-cylinder trunk-piston single-acting engine ⅜ in. by ⅜ in., or a single-cylinder slide crank engine of the same size. (4) By all means.

[17,453] **Steam Engine and Dynamo.** A. V. R. (Sunderland) writes: Would you kindly answer the following questions by post as soon as possible? I have a double-cylinder horizontal engine, and I want this engine to work a small dynamo by means of a belt from the flywheel. The speed required to obtain the output of the dynamo is 2,000 r.p.m., which is 10 c.-p., 37 watts, 15 volts, 2½ amps., and is fitted with drum armature. The cylinders are ⅝-in. bore, 1-in. stroke, both working at high-pressure. The diameter of engine flywheel is 6 ins., and the small pulley wheel on dynamo is ¾ in. diameter. The boiler is vertical centre flue, built of copper, 5 ins. by 12 ins. by 1-16th in., and the working pressure is 30 lbs. Please tell me if the engine will give the required speed to work the dynamo and give the required output?

In reply to your query, the boiler is hopelessly small, and would not continuously supply the engine at a pressure which would enable it to drive a 37-watt machine. The engine is, also, much too small for the work. See the recent articles on "Model Steam Engine Design." At 50 lbs. boiler pressure and 500 revolutions, the engine would give 1-20th i.h.-p., and as the dynamo will not give more than 50 per cent. efficiency, and you may reckon on the same loss in the engine, the output to be expected will be: i.h.-p. of engine, $\frac{1}{20}$; b.h.-p. of engine, $\frac{1}{40}$; theoretical output of dynamo, $\frac{1}{40} \times 750$ = say, 18 watts; actual output of dynamo half this amount = 9 watts.

[17,443] **Painting Locomotive.** C. D. B. (London) writes: I have nearly completed a locomotive I am building (No. 251 G.N.R.). It is 3 ft. 7 ins. long, built of Messrs. Stuart Turner's castings. Could you give me some information as to anyone who would paint it in G.N.R. colours, and how much it would cost; and whether I should have to pull any of it to pieces, or if they could paint it as well if all together? Also, the gun-metal cylinders I do not like the colour of; I would rather they looked like steel or cast iron. Is there any paint I could do them with to make them look like steel, or could I plate them? Also, could you tell me what I could put on polished steel work to keep it bright; someone told me to use some stuff called "Sylico"—I do not know where to get it?

Mr. J. Upton, 27, Roundwood Road, Roundwood Park, Willesden, N.W., would paint your model. We should advise you to plate the cylinder covers either with nickel or silver; nickel for preference, as in London silver very quickly goes black. Vaseline is one of the best things to put on steel parts. We have not used the preparation you name, and at the moment cannot tell you where to get it. You might try Messrs. Christophers, Clerkenwell Road, E.C.

[17,433] **Steam Engine and Boiler Proportions.** F. C. M. (St. Annes-on-Sea) writes: (1) Will you kindly inform me what size and kind of a petrol or benzoline burner will be needed to keep 50 lbs. pressure in a vertical tubular boiler, which supplies an engine whose cylinder is 2-in. bore by 4-in. stroke? The dimensions of boiler, which is copper, are as follows:—Height, 8 ins.; circumference, 22 ins. There are four ⅝-in. tubes and four ⅜-in. tubes. (2) What horse-power will the said engine develop if 50 lbs. pressure is maintained?

(1) The engine is rather too large for satisfactorily working with a boiler fired by ordinary "Primus" oil burners. Furthermore, the boiler is quite out of it. It has only about 300 sq. ins. of heating surface (total, and not perhaps effective); whereas, as you will see by the table in our issue of May 3rd, 1906, the boiler should have, for an engine speed of, say, 300 revolutions and a pressure of 50 lbs., about 1,500 to 1,800 sq. ins. of heating surface. You will have, therefore, to abandon the idea of using the two together, unless you only want the engine to run round and do no work. (2) If, when the engine is *loaded to run at* 300 *revolutions*, 50 lbs. pressure is maintained in the steam chest (not in the boiler only, the two statements pressure *in the steam chest* and pressure *in the boiler* being quite different things), then the engine will develop about ·66 i.h.-p.

[17,430] **Thickness of Multitubular Boiler Plates.** J. S. C. (Lancaster) writes: Will you please say what thickness of steel plate is required for a 7-in. by 12-in. vertical multitubular boiler without firebox, the joints being brazed and riveted? It is to be used at 50 lbs. pressure (maximum).

Brazing joints of steel boilers is not good practice. You will find that good riveting, followed by caulking, will give properly steam-tight joints. We advise 3-32nds-in. steel plate as the minimum gauge of material, but this does not allow for corrosion to any appreciable extent. You would do much better to use ⅛-in. plate, and increase the diameter to 8 or 8½ ins. diameter, double riveting the longitudinal seams of the boiler. In any case, use ⅛-in. plate for the tube plates, and expand the tubes into place.

[17,393] **80-watt Dynamo and Gas Engine for same; On Buying Gas Engines.** J. L. B. (Buxton) writes: As a regular and deeply interested reader of your valuable paper, from which I have gained much news and information, I would be pleased if you could advise me on the size and quantity of wire to use for dynamo castings which I have bought from another reader. (1) Shall I have to part the magnets at A? (2) Would it be better to have tunnel bored to 3 ins. and use 3-in. stampings? (3) Size and amount of wire for each magnet and for armature, 3 ins. diameter, 2 ins. long? I want as many amperes as possible at 12 volts. (4) How many watts ought I to get? (5) Would a gas or petrol engine (2 ins. by 3 ins.) drive it? I cannot find any scale in your book as to this.

(1) Yes. See handbook—"Small Dynamos and Motors," 7d. post free. (2) Tunnel 3 1-16th ins., and 3 ins. diameter armature stampings; that is, 1-32nd air-gap. (3) Armature, ½ lb. No. 20 S.W.G. and 1½ lbs. of No. 22 on each magnet core. (4) Output about 90 watts. (5) For 90 watts you need fully ¼ h.-p., whatever engine you buy. Get a written guarantee that it will give its rated output in brake horse-power. It is not worth buying anything if it is not guaranteed in writing, and there is no worse bargain than a poor gas or petrol engine. We believe the make you refer to is reliable; but the above remarks apply to *any* make.

[17,304] **Small Motor for Tramcar.** R. O. (Guildford) writes: Would you kindly answer the following questions:—(1) Would the small electric motor (10 watts) described in your handbook—"Small Dynamos and Motors," develop enough power to draw an electric car, say, 10 ins. long by about 6 ins. wide, and height in proportion, at 6 volts, with tripolar armature? (2) I intend making two cars running on same lines with double passways. I suppose they would require six bichromate cells to give current, but how would the cells be connected together? Would they go in series giving 12 volts, or in half series and half parallel giving 6 volts at double the quantity? (3) It says in your handbook that if the field-magnet is of wrought iron or stampings that less wire will be required. Could the amount of wire remain the same, and the size of the armature increased, say, to 1½ ins. diam. with 2 ozs. of wire? If so, would the motor be more powerful? (4) What should be the ratio between the pulley on motor to the pulley on axle of car to get maximum of power? (5) I suppose no alterations in wiring have to be made if motor is series wound?

(1) Yes. (2) Connect up cells so as to give a voltage corresponding to that for which motor is wound. If motor is wound for 6 volts, then couple up cells in sets of threes in series, and as many in parallel as you can. (3) Slightly. (4) We should try a gear of, say, 1 to 5: but it depends a lot upon the unknown details, and a trial would be your best guide. (5) We do not understand this. You can run motor as a series machine if you choose—in fact, we advise it.

[10,297] **Speed of Dynamo for Charging Cells** H. A. (Manchester) writes: Is it possible to charge accumulators from a dynamo running at irregular speeds above given speed and then to run an Avery tramcar motor from accumulators? If so, what sort of accumulators and what size dynamo to keep 1-10th h.-p. motor going and still keep a small stock of electricity in accumulators?

Your query is not very clearly stated. Provided voltage generated by dynamo is always *above* that of the accumulators, a slight variation in speed will not matter. The ordinary type of accumulator will do—to be had in vulcanite or glass cases. An ¼ h.-p. dynamo would generate current for a 1-10th h.-p. motor. Same dynamo would also charge accumulators provided it has *not* an H armature.

[17,368] **A Non-Polarising Battery.** W. W. (Liverpool) writes: Have tried to make the above battery up by following your instructions, but could only get from it a current for ten to fifteen minutes, when it seems to run down. After about fifteen minutes it has recouped itself again, but current gets weaker after every run down. As you mention in your Handbook No. 5, this battery is constant, and will give a current when once made up for three days, I would thank you if you will give me the size of elements, etc., which, I think, is my failure, they not having been mentioned by you. I have two glass cells which, if I possibly can, I wish to use in making this battery up. The size of these cells is 8 ins. deep, 8 ins. long, 6 ins. wide; but they are not the size of cell which I have failed to make up. I would, therefore, ask you to give me advice on the queries below. Will these large cells be a success, or will they be too large? Size of porous pot to use with the above cell? Size of carbon, or carbons? Would two carbon plates assist in the strength of the current at two sides of pot, or would crushed carbon be better enclosed in perforated case round the pot? Would a rectangular porous pot be better than a round one using sheet zinc so as to present a larger face to carbons? Can you let me have book dealing with this battery; if so, please state price. Any other information to enable me to make this battery a success?

The larger the plates are, the greater the current that can be taken from them. You have evidently been taking a heavier current than your battery can stand; hence, it runs down quickly. Make plates as large as the containing vessel will carry. This will reduce the internal resistance of cell, and enable a larger current to be taken from it; but, of course, there is a limit to the discharge rate of any cell, and this you will find best by trial. If you want the cell for very heavy current work for short periods, we advise the simple two-plate cell described in the previous chapter. Cooper's "Primary Batteries" (10s. 10d. post free) deals with various types. Two carbons in a single fluid cell can be used to advantage. The *proportions* of sizes of plates given in Handbook are best adhered to.

[17,092] **Mercury Break used with Wireless Telegraphy Apparatus.** G. V. B. (Brockley) writes: I have made a wireless transmitter, the connections of which are as those in Fig. 2, Query 16,758, No. 291 of this Journal. The difficulty lies in the mercury break. I have noticed that (1) the alcohol becomes black after a few seconds working, but the mercury was cleaned even before using it; (2) Sometimes I get a fat green spark, and sometimes a dense violet one, in the pots; (3) After adjustment of dippers no different result is found, even though one leg is longer than the other, so that one never leaves the mercury. When the magnet, which is an ordinary bell magnet, is at rest the dipper is about 1-16th in. from the mercury. Perhaps the enclosed sketch will explain matters. I use a dry cell to work the magnet, and two of Siemens' No. 3 batteries for the coil. Having these particulars will you tell me where I go wrong? When working the mercury break I get a 1-32nd in. spark only.

(1) The blackening of the alcohol is merely what always occurs with a mercury break. It is due to the breaking up of the mercury into minute particles, and does not matter until the mercury gets so thickly muddy at the bottom that the dipper does not make contact with certainty. If alcohol be used the container may be completely emptied and the contents ignited in some suitable vessel; all the alcohol will then burn away and the particles will coalesce and join the main mass of metal, the slight scum of oxide or other impurities being easily removed by squeezing through a cloth. (2) The colour of the spark does not much matter, and probably depends on which contact point is most heated by the arc. The green colour is characteristic of the copper arc and the violet of mercury. (3) Your trouble is probably due to want of sufficient voltage, and this commonly gives trouble with mercury breaks. For satisfactory practical working a voltage of 8 or more is desirable, as lower voltages are not always sufficient to establish thoroughly good contact. There is no substantial gain in using a mercury break with a coil of the size mentioned, especially as the greater voltage required makes the arrangement more wasteful than a low voltage with an ordinary platinum break.

[10,294] **Small Dynamo Failure.** H. B. (Cartmel Fell) writes: I have an enclosed dynamo, shunt wound, which should give an output of 55 volts 8 amps., made by a well-known firm. I was told by another electrical firm that a dynamo shunt wound is self-regulating to a certain extent, and would do without a resistance so long as my water wheel had governors on to cut the water supply off, as lamps are being switched out. (1) I tried my dynamo with four lamps, as I had not sufficient water to light eight; the voltmeter registered about 44 and the amperemeter nothing. I could smell varnish burning, together with a faint smoke, when run about five minutes, when I instantly stopped it. The armature was quite hot and very likely burnt the insulation, for it does the same thing when the resistance is connected in shunt now. I very likely ought to have had a resistance in first when I tried it, but what can one believe? I might say that where armature wires join the commutator there are several segments in contact, owing to the solder spreading over the insulation strips; this very likely is not right. Would you kindly tell me whether this should be like this or not, and what is your opinion about the armature? (2) The ends of magnet coils are all connected to brushes. Is this a better way than connecting, finishing and starting together? I will send you a rough sketch of dynamo connections, resistance, amp. and voltmeter. (3) Would you kindly tell me what is the cause of amperemeter not working? I believe by accident I sent the current wrong way round for a second or two, but it would not work before this. (4) I have a resistance for dynamo, and when I connected it up I made the contact arm positive; is this right or does it not matter? They sent me it with no connection, where marked on sketch. I suppose this resistance is no use for single lamps, seeing, when I place contact arm on one at a time, there is no more resistance in.

(1) Evidently some of the coils of armature are short-circuited, instead of being perfectly insulated from each other. This will account for the heating which you observed. (2) Your sketch shows coils of field-magnet connected in parallel shunt. This is quite correct in many cases. We cannot say what resistance you may need. As the load on machine increases the resistance in the field-circuit should be cut out, and *vice versa*. (3) Examine and see if internal connections are all perfect. (4) A perusal of some recent query replies will make this matter clear to you. If you use lamps of a corresponding voltage to that which the dynamo gives, you need no resistance in circuit with them.

The Editor's Page.

WE have received a further letter on the subject of electrically controlled tramway points from a reader in Toronto, who writes: "There are about a dozen such switches on the tramway system in this city, and they have been in use for about six years. As soon as the car starts, the switch moves. If it goes the wrong way, the motorman shuts off the power and turns it on again. That moves the switch the right way. All the double bogie cars here are fitted with air brakes, the air storage tanks being under the cars between the bogies. One charge lasts about three or four hours when the stoppages are frequent. The smaller cars have hand brakes. I might add that before coming to Canada I was a fireman on the Midland Railway. Although I am a motorman now, the steam articles in THE MODEL ENGINEER are my favourites. I have only missed the first five copies of the Journal since it was issued."

* * *

The Technical Year Book for 1907, which our publishers have just issued, is a volume which should prove very useful to those of our readers who are engaged in engineering work professionally. It contains a collection of all the most important tables, data, formulæ, and recipes which have been published in the technical Press of the world during the past year. It covers automobiles, steam plant, power transmission, electrical work, hydraulics, lighting, marine work, mining, traction, and other branches of engineering in a very thorough fashion, and the information given is representative of the very latest research and practice. For those engaged in the designing or manufacturing of machinery, or the management of power plant, it should prove very helpful, particularly as the source of the information is in all cases given so that the original article or paper can be readily referred to when further particulars are desired. The price of the book is 5s., or post free 5s. 3d.

Answers to Correspondents.

A. C. (South Woodford)—Sorry we are unable to use your "Workshop Note." The well known type of stud-box with a tapped hole right through and a setscrew inserted at the top end is a more convenient appliance than the one you describe. See description on page 51 of THE MODEL ENGINEER for July 20th, 1905.

J. K. (Leeds).—We have a series of articles in hand on "Planing and Shaping for Amateurs," which will commence shortly. These will give you the instructions you require.

F. P. (Bath)—You should refer to the articles on "How to Overhaul a Gas Engine" which are being published in our other journal, *The Engineer-in-Charge.* The construction of an indicator and the method of taking indicator diagrams are fully explained therein.

K. M. (Stornoway).—We regret we have no details of this instrument.

T. C. (Aston).—No. See Handbook, "Model Boiler Making," 7d., post free.

J. T. L. (Chelmsford).—Thanks for your letter. We have got the matter in hand and will endeavour to do something with it in an early issue.

M. B. (Stoke-on Trent).—If you refer to the "Query" columns of March 5th, 1903, issue, you will find the matter fully explained in the reply, "Reduction of Voltage."

G. L. L. (Cardiff).—Yes. *Re* electric ignition, you will find what you want in March 29th, 1906, issue, in the article on THE MODEL ENGINEER Otto Cycle Gas Engine.

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, etc., 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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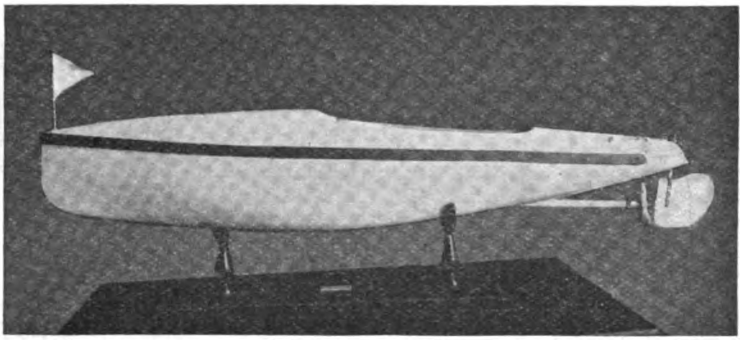
A Model Racing Motor Boat Electrically Propelled.

By J. COULSON LOAM.



MR. J. COULSON LOAM'S MODEL RACING MOTOR BOAT.

A SHORT description of an electrically propelled model motor boat recently completed by a friend and myself might be of interest to some of THE MODEL ENGINEER readers.

The boat is 3 ft. 9 ins. long, 10 ins. beam, and draws (excluding propeller) 1½ ins. of water amidships. The shell is in two sections, the hull yellow pine and the deck American whitewood, and jointed in the manner shown in Fig. 1, the joint being covered by a shear strake.

The "digging out" took a considerable time, but eventually the thickness of shell was reduced to about 3-16ths in. The weight on completion was 5 lbs. For the propeller tube 5-16ths-in. copper tubing was used, and ⅛-in. rolled steel for the shaft. The propeller has two blades, and is 3 ins. in diameter.

The stuffing-box was made from the top of an old water tap, which screws over the tube as shown in Fig. 2, and is fixed on the propeller end. The rudder is 4 ins. by 4 ins. (greatest measurements), and is made of sheet copper. It is supported at the top by a collar, and is manipulated by lines and toggles.

The motor was originally an overtype, but, as can be seen in Fig. 1, is inverted and slung from the sides of the boat. An 8-volt 40-amp. accumulator is used for storing current—sufficient for a good afternoon's sport. This is placed about midway between the stern of the boat and the engine. The reversing gear was made according to instructions in "Small Dynamos and Motors," and works admirably.

Under fair conditions the craft will attain a speed of nearly 5 miles per hour. The copperwork is polished, the hull enamelled with "Satinette White Enamel," and the shear strake French polished.

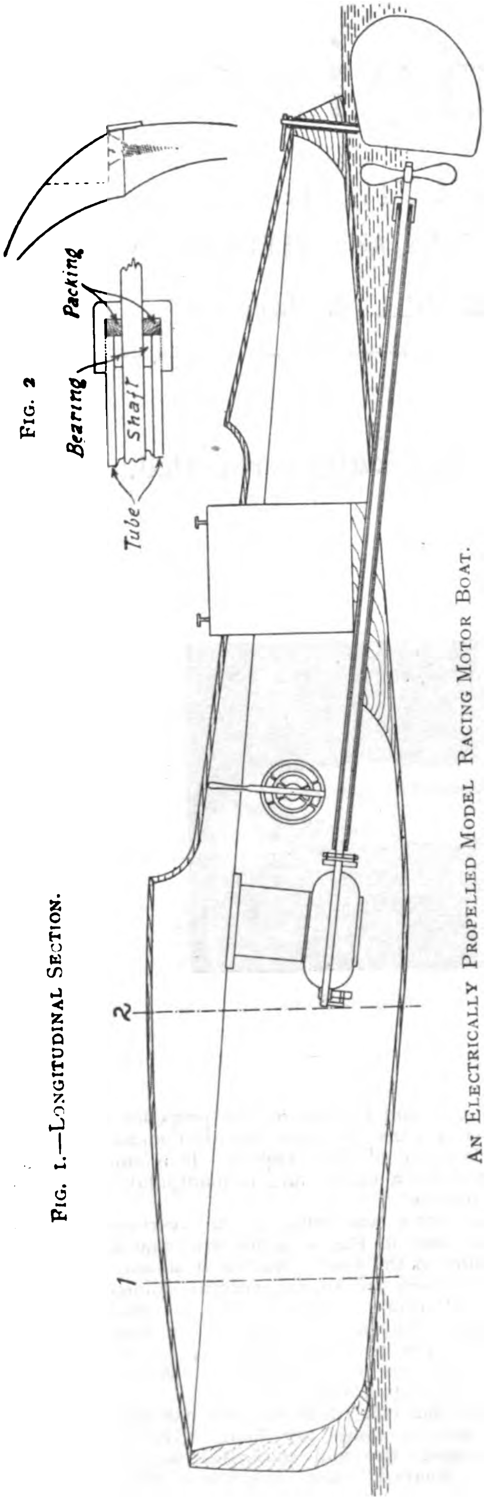


Fig. 2

Fig. 1.—Longitudinal Section.

An Electrically Propelled Model Racing Motor Boat.

By J. Coulson Loam.

[see front page.

For description]

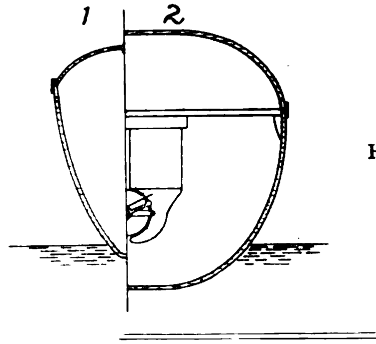


Fig. 3.

Half Cross Sections.

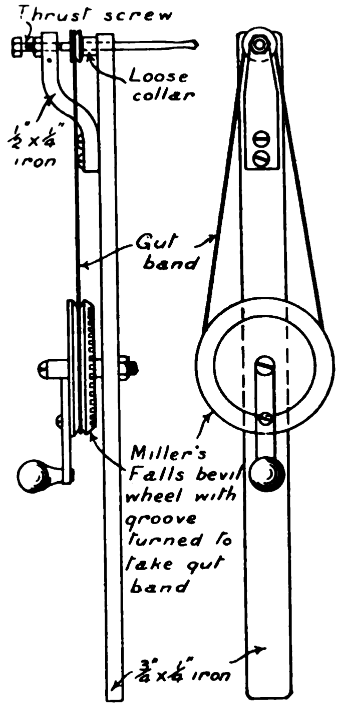
Workshop Notes and Notions.

[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 Device for Drilling in Awkward Places.

By G. C. N.

The sketch herewith will explain a simple drilling device that I have made for drilling small holes



A Device for Drilling in Awkward Places.

in places wherein I could not get my hand. As will be seen, the appliance consists of a length of 1¾-in. by 1-in. flat iron, at one end of which a hole is bored for the drill. A piece of ½-in. by ¼-in. iron is bent to the shape shown, and is attached to the long flat member. The bent piece takes the thrust of the drill by means of the stud and nut, as seen in the sketch. A small grooved pulley is driven tightly on to the drill, this is driven by a gut band from a grooved wheel, with handle attached—in my case, a "Millers Falls" bevel wheel, with a groove cut in it. The device proved very satisfactory for the purpose it is intended.

Head and Tail Stocks for a Home made Screw-cutting Lathe.

By Geo. H. Atkinson.

The accompanying drawings and photograph illustrate the head and tail stocks only of a 5½-in. screw-cutting lathe I am making. Taking the headstock first, A, B, and G are keyed on to the spindle direct; C C¹ D and E E¹ E² revolve round the spindle by means of ⅛-in. steel rollers; F revolves on G by means of rollers; the small circles shown in the sectional drawing, Fig. 1 represent circles of ⅛-in. steel balls, put in to minimise friction between the flanges.

The cradle casting for the headstock was planed to 4½ ins., and on top of this, back and front, was fitted two ⅞-in. square mild steel bars, between which are fitted the parallel gun-metal bearings for spindle, and the mild steel eccentrics for throwing the back gear in and out.

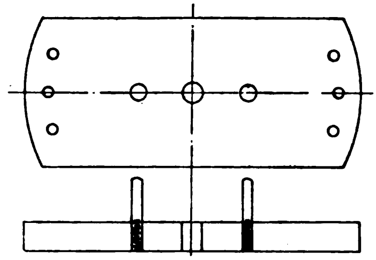


Fig. 3.—Fixed Plate.

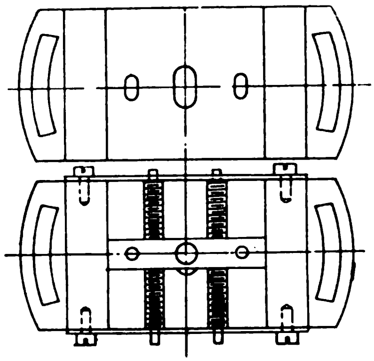
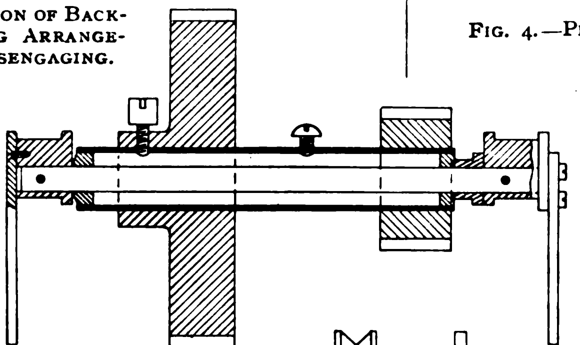


Fig. 4.—Plan Views of Swivelling Parts.

Details of Tailstock.

Fig. 2.—Section of Back-gear, showing Arrangement for Disengaging.



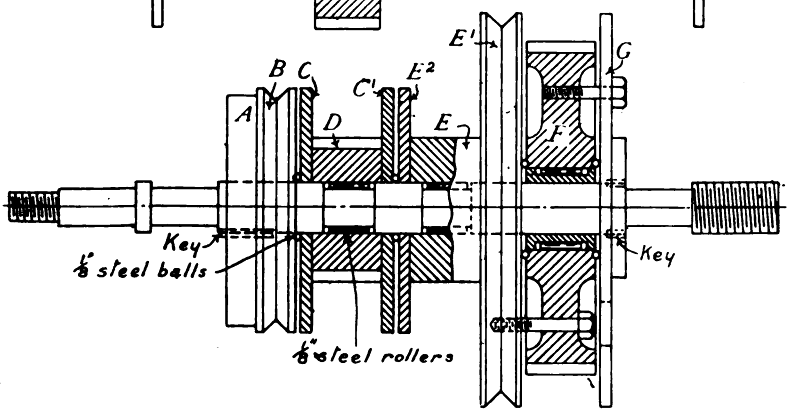


Fig. 1.—Section through Headstock.
(*Scale: Quarter full size.*)

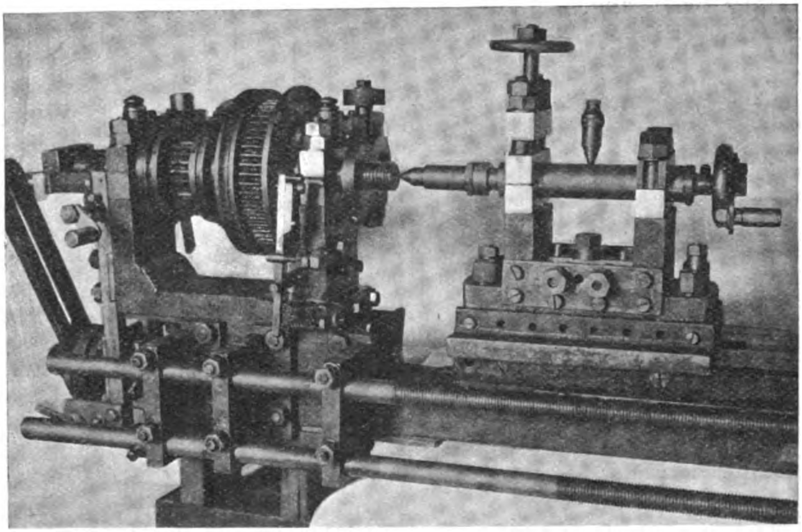
It will be noticed that I have dispensed with the usual 3-speed pulley on the spindle, having only a single 1½-in. pulley for a flat belt. I give two reasons for this: firstly, the lathe being foot-driven, a wide range of driving speed is possible; and secondly, the headstock gearing is designed to both increase and decrease speed of spindle.

For ordinary turning (*i.e.*, without the back gear in use), F is bolted to division plate G by three bolts and to the driving wheel E by three bolts, the heads of these passing right through division plate; C¹ and E² are bolted together by three countersunk screws.

When low gear is wanted, the front lubricator is pulled out and the three bolts holding E and F together are withdrawn by screwdriver. When high gear is wanted, B C and E F are bolted together and C¹ E² and F G are unbolted. This last arrangement is specially designed for driving an emery wheel between centres from the overhead gear. When the overhead gear is required for ordinary drilling or slotting, C¹ E² and E F are disconnected and overhead spindle driven by gut belt from E¹.

The handle at back of headstock is for throwing the change wheel gear in and out of action to save wear of teeth. The nose is screwed 1-in. Whitworth.

The tailstock, as shown on plan, has a swivelling motion for drilling at angles, and has also a parallel sliding motion of 5 ft. 6 ins. each way for taper turning with the saddle in use. The photograph also shows, in an unfinished condition, one of two outside guide plates fitting over the vees of bed. This is in addition to a tenon piece, which tightly slides along centre of lathe bed. When these V-plates are correctly fitted and finished, they will be sawn in two, so that the front halves can be removed at will to allow the tailstock to travel well up the saddle wings.



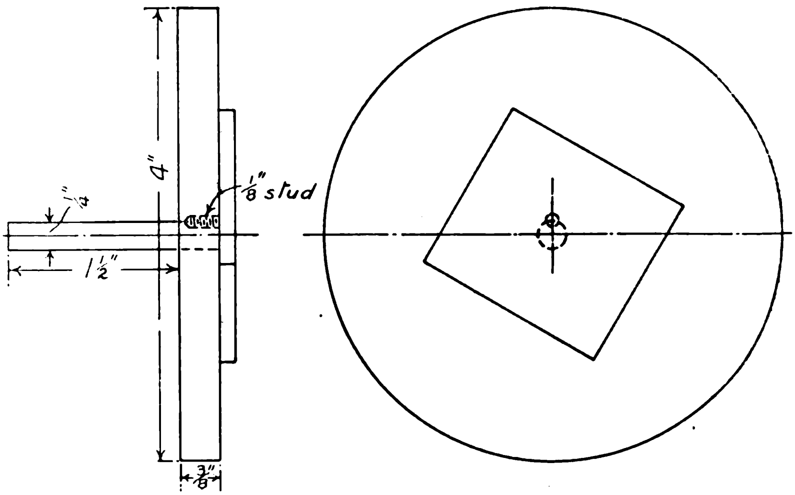
Showing Arrangement of Head and Tail Stock for Screw-cutting Lathe.

A Chuck for Holding Small Sheet Metal Work in the Lathe.

By G. S. R.

I have noticed that several models are being made lately from solid drawn tubing (for the cylinder), the flanges for the cylinder being cut from sheet metal. I have found it rather difficult to cut out these flanges, so have adopted the following idea.

The chuck is not intended to be the best size, but merely a size to suit my lathe—it would, doubtless, be better to have the rod larger diameter, but ¼ in. is the largest size my lathe chuck will take. The disc is made of wrought iron, 3 ins. diameter by ¼ in. thick, and is coated with solder on the face; the little ⅛-in. stud is screwed in and wrenched off, and the surface filed smooth. A piece of sheet metal is shown on it. I may say that I have turned and bored a small cylinder casting on this chuck which would have been impossible otherwise. The method of centreing is to put the chuck in the lathe, put a corner of a cutting tool or spike against it, and make several circles in the solder; the thing to be turned can be centred fairly well then. The work is sweated on to the face, and there is no likelihood of buckling.



Method of Holding Sheet Metal Work in the Lathe.

A Home-made Brazing Lamp.

By G. J. Wright.

The photograph herewith (Fig. 1) shows the brazing lamp I have just finished. The first thing was the preparation of a drawing to the best of my knowledge as to how it should be. The body of the lamp is made of two pieces of No. 18 gauge lead-coated steel (not having anything large enough in one piece); each side was flanged, and one side was groove seamed. The whole was then bent round the wood part of a shoemaker's tomboy, as near round as possible, and then groove seamed the opposite side up, and flanged the top and bottom ends. Two circular discs were cut out and flanged to fit the top and bottom. The whole of the body was well soldered up. A long strip of the same

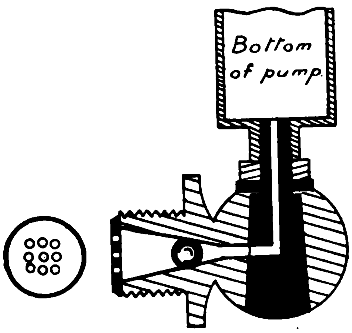


FIG. 2.

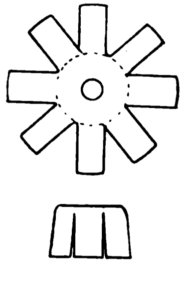


FIG. 3.

DETAILS OF BRAZING LAMP.

metal was wired on each edge and drilled and bent to receive the wood handle, and then soldered in position on the body. A wood handle was fixed by passing a long rivet through it. Four pieces of metal were cut out for the feet and soldered to the bottom to take the wear. The top fittings, needle valve and nipple, are all old petrol motor burner fittings. The vaporiser and nozzle and spirit tray are castings made at a local foundry from my own patterns. The pipe that conducts the oil from the needle valve to the vaporiser is an odd piece of ¼-in. gas pipe screwed into the needle valve branch and the other end into the vaporiser. The vapour pipe is a piece of ¼-in. copper pipe bent to shape and screwed into the top of the vaporiser. The part that receives the nipple is a piece of ⅜-in. brass rod 1 in. long; two holes are drilled into it at right angles to each other, one is tapped to receive the vapour pipe and the other the nipple. The part soldered to the top of the lamp body which receives the needle valve, etc., is part of a petrol motor dash fitting. The pump is that of an ordinary cycle, which I have fixed outside. The bottom fitting, which forms the ball valve as well as the pump fixing, is a small petrol cock with the handle of the plug sawn off and screwed up tight and fixed bottom upwards as shown in Fig. 2, and the bottom of the pump screwed on to the screwed part of the plug. The other part, which is soldered into the body of the lamp, has been enlarged on the taper to receive the ball, and a small disc of brass is made, with several small holes drilled through it, and soldered to the entrance of the hole to prevent the ball getting out of position. The top fastening of the pump is by two 3-16ths in. bolts, soldered by their heads to the body of the lamp, one each side of the pump barrel, and a brass clip secured by nuts. A screwed brass plug is soldered into the top of the pump plunger and a wood handle bolted on. The vaporiser is drilled out 3-16ths in. diameter, and four small screwed plugs are screwed into the ends of the holes. Two small screws hold the nozzle to the vaporiser. A small stud is screwed into the bottom of the vaporiser to which the spirit tray is screwed. The filler is part of an old oil-can. I had some trouble with the pump, the air passing the leather plug, so I made a thimble-shaped spring out of thin brass, as shown in Fig. 3, and fixed it inside the leather plug in place of the brass collar, and carefully inserted the whole into the pump barrel, and I have had no further trouble with it. The centre air tube is a piece of old ¾-in. cycle tube, driven through a hole cast in the centre of the vaporiser. After sundry adjustments with the nipple and nozzle, I got the lamp to work well, at the cost of about a gallon and a half of paraffin oil.

Repairing Metal Filament Lamps.

By E. P. Farrow.

It is not generally known that burnt-out "Osram," or other metal filament lamps can be repaired by shaking (when current is on), so that the broken ends of the filament touch each other and melt together. The above method is quickly performed and I have never had a failure.

Of course, the method will not answer in the case of carbon filament lamps.

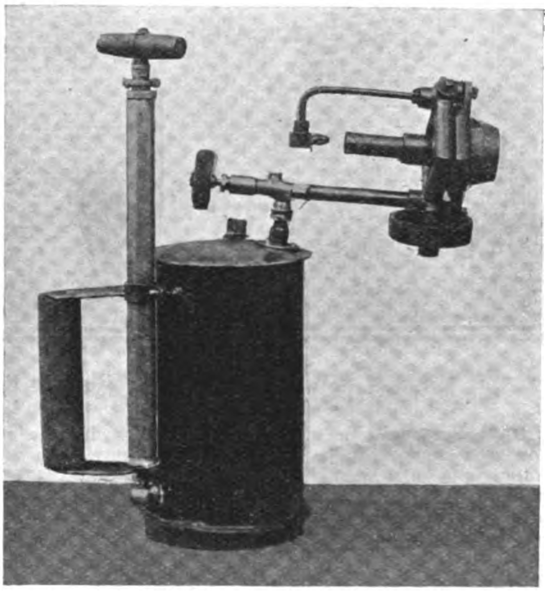
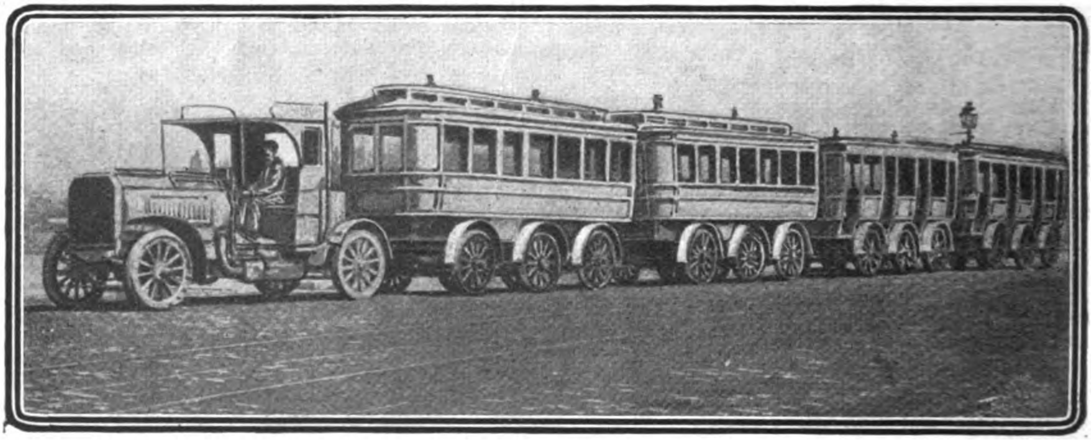


FIG. 1.—A HOME-MADE BRAZING LAMP.

WORKING MODEL LOOM.—Mr. Wm. Bell's model, which was illustrated in our issue of March 28, has been accepted for exhibition in the People's Palace Museum, Glasgow Green, for a period of six months.. Readers in that district will therefore have an opportunity of seeing this very fine specimen of miniature work.

The Latest in Engineering.

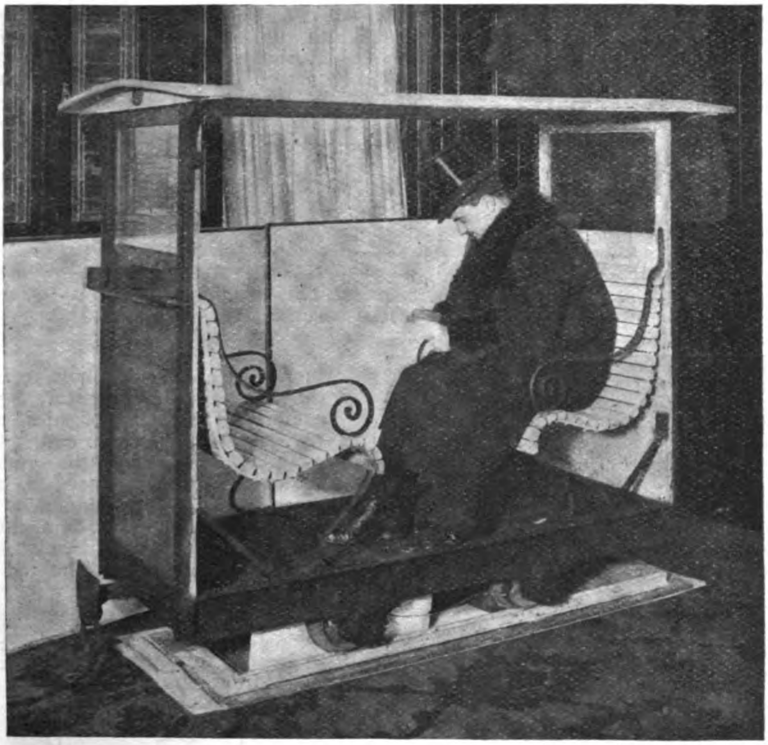
The Renard Road Train.—Although the Renard road train was invented so far back as 1903 by the late Colonel Renard (a well-known engineer officer of the French Army), and the first commercial train was delivered in 1905, it was not until the present year that a Renard train arrived in this country, and was on view at the Commercial Motor Vehicle Exhibition held recently at Olympia. We are indebted to The Renard Syndicate, Ltd., for the illustration given herewith. Following is a brief description of the system which, it may be said, is now running in France and other European countries. A light tractor is provided principally for the purpose of carrying the motor which generates energy for propulsion and for steering purposes. Each unit of the train is provided with a longitudinal driving shaft, gearing with a differential gear, on the shafts of which are fixed road driving wheels. The driving shaft is connected up to the motor on the tractor by suitable universal couplings, which allow a very large angularity of movement between tractor and unit and between units themselves, such as is required when necessary to turn round sharp corners, etc. Each unit of the train is provided with similar shafts and couplings. It is readily apparent that by these means the power from the motor can be equally and readily applied to each unit as they are coupled up. In addition to coupling up for taking off power, each unit is provided with radius steering rods, which are linked together, and finally to the steering arrangement on the tractor, the mechanism allowing the direction of each unit to be completely guided, compelling all to follow exactly in the path of the tractor, and applies equally to forward or backward motion. One of the advantages claimed for this system being the compensation of springs and axles allowing for all surface irregularities and the facile surmounting of any obstacle without strain or injury to components of units. The Daimler Motor Company (1904), Ltd., are the sole manufacturers for the world, except France.



A Renard Road Train.

Aluminium Magnesium Cell.—In a recent paper read before the American Electro-Chemical Society, a very interesting form of primary cell of the depolarisation type is described. The authors, Messrs. Cole & Barnes, describe a series of experiments with a cell in which magnesium and aluminium electrodes were used with potassium alum as electrolyte. This acted as a galvanic cell with the current passing from aluminium to magnesium inside. With hydrogen peroxide or oxygen as a depolariser an E.M.F. of 2 volts could be fairly well maintained. This is indeed remarkable at first sight, as both metals lie very close together in the electrolytic solution-tension series, but when it is remembered that magnesium very readily decomposes water containing sulphates—a fact not generally known—the whole resolves itself into another form of gas cell, and accounts for the high voltage obtained.

New Enamel-Covered Wire.—This is being introduced by Messrs. Connolly Bros., Ltd., of Manchester. There have been a good many attempts to produce such wire, and one of the difficulties has been to secure an enamel covering that would not crack or shale off with bending. Another difficulty was to secure a covering which would stand heat, and also the action of various solvents, such as acids, alkalis and water, and, above all, a covering that would be durable. The best things so far produced have been based upon oxidised oils, which are not durable, the oxidising process not being permanently arrested when the wire leaves the manufactory, and are not proof against alkalis. If they come into contact with alkalis a material forms in the nature of soap. Messrs. Connolly's enamel covering is based upon a special treatment of stearine pitch, which is by no means an oxydising process, as this process can, if necessary, be carried out in a vacuum. It is claimed to have been proved in every way capable of overcoming all the difficulties mentioned above. The new wire is intended to take the place of silk-covered wire in instruments and cotton-covered wire in motors, arc lamps, and other devices, and for many other obvious uses. It need hardly be said that the space factor is appreciably reduced on account of the extreme fineness of the covering that can be put on.



PASSENGER CARRIAGE FOR THE PROPOSED CHANNEL TUNNEL.

The Channel Tunnel.—Although for the time being the Channel Tunnel scheme is out of favour with the powers that be, the whole idea is one of great interest from an engineering point of view. As showing the very great attention which has been given to the details of the proposed undertaking, we may mention that a model of the bed the of Channel, showing the course of the Tunnel, was recently constructed to a scale of 1-20,000 horizontal and 1-1,000 vertical. The model is made vertically in two independent parts, so as to exhibit a sectional view of the different strata (variously coloured to facilitate examination), and especially the dip of the strata towards the north. These various strata have been ascertained by means of over 7,000 soundings, which brought to the surface more than 3,000 samples, all geologically accurate. The soundings took over two years to be performed from a boat right through the Channel. This important work involved the employment of a vessel chartered for the purpose by the French Submarine Tunnel Company; and thus it became possible to complete an extensive and careful survey. The undulations of the sea bottom are shown on the upper part of the model, so as to give an idea of the depth of the sea at various points of the Straits. The model also affords an indication of the proposed outlets of the Tunnel, both on the British and the French sides. On the French shore, entrance would be effected by means of an open viaduct, which would permit, should circumstances require, of its entire destruction from the sea, so as to render ineffective the very improbable seizure by an enemy of England of the Tunnel on the French side. This model was recently on view at the offices of the *Tribune* in London, and at the same time was also shown a full-sized model of an open-sided railway carriage to seat two persons, intended for use on the Tunnel service. This carriage we are able to illustrate in the accompanying photograph.

A Model Vertical Steam Engine.

By A. C.

THE following description is of a steam engine of the vertical type I have made. A side view is shown in Fig. 1 herewith, and a view from the front is also given.

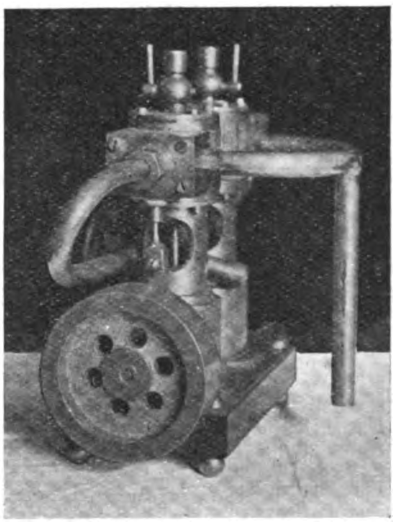


FIG. 1.—SIDE VIEW OF ENGINE.

At one time it was intended for a model steamer but the hull did not get finished, so the idea was abandoned. The cylinders are ¾-in. bore, ⅞-in. stroke, built in pieces, and soldered together. The cylinders are held in position by a brass tube, acting as guide bars for piston-rods. The lower tube contains the cranks, and, therefore, had to be made larger in diameter.

This tube was then sweated into the other with a piece of brass between to fill the gap. The cranks were also made in pieces, being pinned to a 3-16ths-in. silver steel shaft and soldered. The steam pipe diameter is ¼ in., and the exhaust 3-16ths-in. solid drawn brass tube. The stop valve and eccentrics can be seen in the illustrations. The flywheel is 2 ins. diameter, and contains holes to lighten centre and engage with propeller shaft. The lagging on the cylinders is made of boxwood, bored to fit cylinders. The lining on same is done while in the lathe by taking a cut across while the lathe is stationary. I have tried the engine under steam and it behaved first-rate. The whole has been mounted on a block of vulcanite with brass balls for feet. The brass parts have all been electro-plated, which improves the appearance

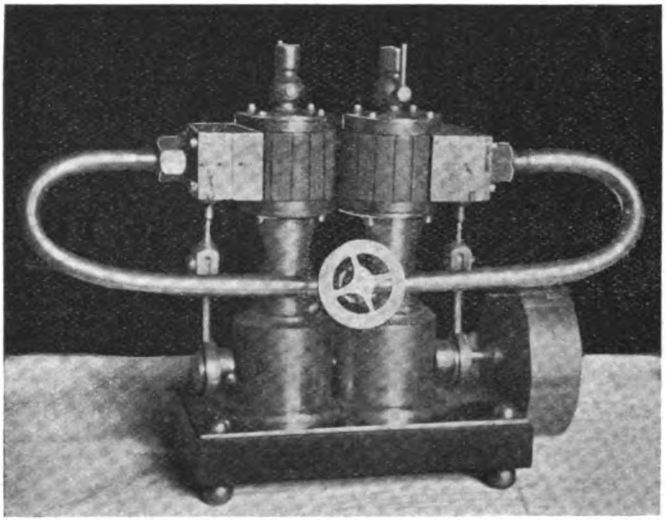


FIG. 2.—FRONT VIEW OF TWO-CYLINDER VERTICAL STEAM ENGINE.

How to Make Retort Stands and Clamps for Laboratory Use.

By NATHAN SHARPE.

THE writer has endeavoured to set forth clearly below the methods adopted by him in making retort stands, clamps, and rings for his own laboratory, in the hope that they may be of use to beginners and others.

The retort stands have bases measuring 8 ins. by 5 ins., cut from 1-in. hardwood. A small chamfer, about ⅛ in. deep, improves the appearance and the bases are finished with fine sandpaper and

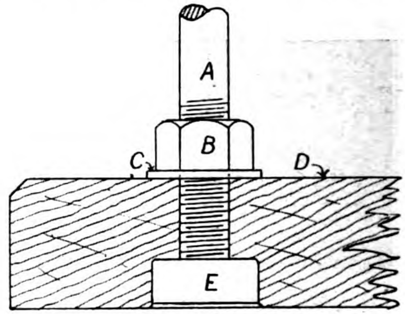


FIG. 1.

shellac varnish. The hole to take the rod is ⅜ in. diameter, bored equidistant from both sides, and 1½ ins. in from one end. The method of securing the rod is shown in Fig. 1. The ⅜-in. hole is enlarged on the underside of the base D, by means of a chisel, to take the square black ⅜-in. nut (Whitworth) E. The rod A,

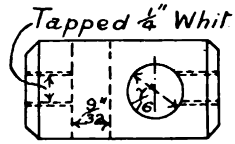


FIG. 2.

of commercial ⅜-in. rod iron, 18 ins. long, is screwed at one end for a distance of 1½ ins., and has a hexagon steel (or brass) nut B run on to it, the chamfered end toward the unscrewed end of rod. The black nut being in position, the rod is screwed down through the base into it, a washer C of ⅞ in. outside diameter having been previously slipped on under the hexagon nut. When the lower end of rod is just through the black nut, the hexagon nut is tightened down with a spanner upon the washer

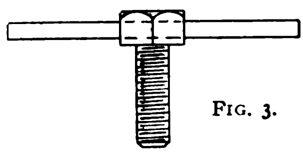


FIG. 3.

and base. The rod is, of course, held stationary during the latter operation. The rod may not be truly perpendicular to the base, but a little careful pressure will easily rectify that.

The clamps and rings next claim attention. The writer is a staunch upholder of the "bosshead" system of fastening rings, and so forth—namely, that in which the stem of the ring is not permanently screwed into its clamping head, but is free to slide to and fro through it, clamping in the required position by means of a separate setscrew.

The bossheads in this case (see Fig. 2) are made from ⅝-in. square wrought-iron bar. Pieces 1½ ins. long are sawn off with a hacksaw, the ends squared up, and a chamfer worked round them. At a distance of ½ in. from one end, a hole 7-16ths-in. diameter is bored right through, centrally in one face. This is the hole which runs on the upright-rod of the stand. At the same distance (½ in.) from the other end, bore a hole 11-32nds in., or 5-16ths in., in diameter, in a direction at right angles to the hole already bored, *i.e.*, through one of the unpierced faces. The reason for these two holes being so much larger than the size of rod to be used is that commercial rod iron is always larger than nominal size. Two ¼-in. tapping size holes must now be drilled centrally in the ends of the bosshead, breaking through into the holes already

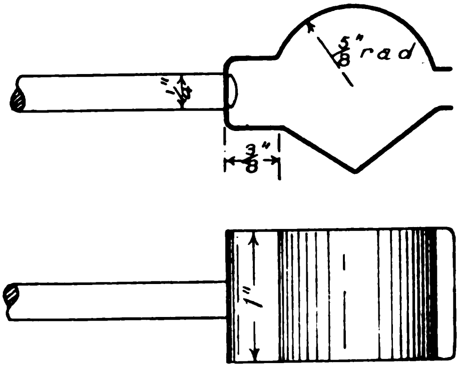


FIG. 4.

bored. These must be tapped to suit the ¼-in Whitworth setscrews from which the clamping screws are made.

If sawing wrought iron presents too much difficulty, a cast-iron stair-rail rod may often be picked up of the required dimensions. The pieces may be got from this by nicking deeply all round with a file, after which a smart tap with a hammer will usually make a clean parting.

To make the clamping screws, the writer used ¼-in. brass square or hexagonal-headed set-screws, ¾ in. long. Through the head of each a hole about ⅛ in. diameter was bored, and the body part, about 2½ ins. long, of a 3-in. wire nail, minus point and head, driven tightly in, so that it projected equally on both sides. A finished screw is shown in Fig. 3. If setscrews are unobtainable, ¼-in. iron rod, bent into angles or "elbows," with one limb screwed, and the other filed and emeried up, will do equally well, though not so neat.

The rings are bent from ¼-in. iron, the tail in all cases being 7 ins. long. The most convenient sizes are 2½ ins., 3 ins., 3½ ins., measured inside the ring. They should be obtained from a smith, who should be instructed to bend them round a mandrel, and who will do the job for very little. They need not be welded, but that is a matter of taste. All the iron work, the rings excepted, should be given a coat of black japan, or varnish, which will make the stands look as well as any bought article.

This article would be incomplete without some reference to clamps for holding various pieces of apparatus. The right and left-hand screw clamps as sold are very good, but rather costly. To take the place of these, to a great extent, the writer uses spring clamps, as shown in Fig. 4. Although each size only grasps within fairly narrow limits, anyone who makes a set will find that their cheapness, usefulness, and ease of construction—one may be made in a quarter of an hour—will amply repay him for his labour. As will be seen, each size consists of a ¼-in. iron shank, shouldered at one end, on which is riveted the clamp proper. This is made from sheet brass, about 20 gauge, and from ½ in. to 1 in. broad. One jaw is curved to a radius corresponding to the nominal grasp of the instrument, and the other jaw is of angular formation. This shape gives a very good grip, and may, if desired, be lined with thin cork. This, however, is by no means absolutely essential.

A clamp for burettes, tubes, etc., is shown in Fig. 5. The drawing needs little explanation, except for sizes. The clamp is of some hardwood, 1 in. square in section, and 3 to 4 ins. long. The clamp shown is to take a ⅝-in. tube; the centre of gripping hole is ½ in. from the extreme end; the centre of spring hole, which is ⅜ in. diameter, is

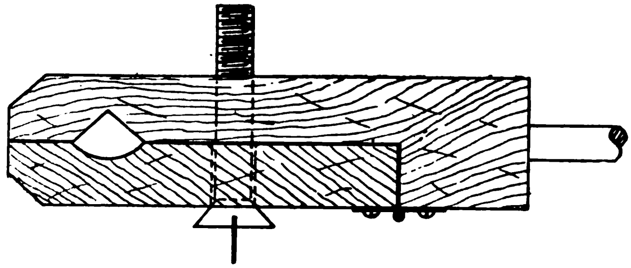


FIG. 6.

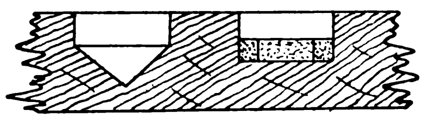


FIG. 7.

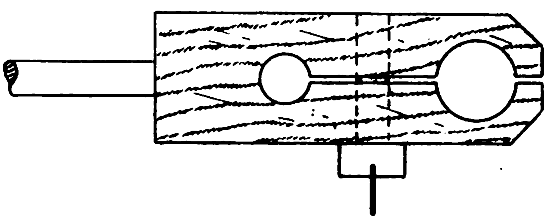


FIG. 5.

1 in. from other end, into which a ¼-in. shank is driven or screwed. The jaws are drawn together by a wing screw, made from a ¼-in. cheesehead, with a piece of sheet brass soldered into the slot.

Fig. 6 shows a more ambitious article on much the same lines. One jaw here is hinged, thereby giving greater range. The wing screw in this case is a countersunk head-screw, having plenty of clearance in the moving jaw.

Finally, a word about test tube stands will not be amiss. The shape and dimensions of these are so familiar as to need no remark; but, as sometimes met with, they have serious faults. In the school where the writer first experimented, the holes to receive the bottom ends of the tubes were barely 1-16th in. deep; and consequently tubes, especially those smaller than the holes in the rack, were very liable to fall out and be broken. Moreover, if a test tube was set down incautiously, it immediately lost its bottom, since it came down upon a flat surface. To prevent this, stands were made with holes as shown in Fig. 7. The hole is either bored the required size, and then the bottom cut down with a countersunk bit, or else a ring of cork is glued in as shown. The result is that the tube now rests on a ring, not a point as before, and the danger of breakage is therefore much lessened.

A Design for a Small Model Undertype Engine.

By Henry Greenly.

I.—General Arrangements.

In inflicting readers with another design for a model compound horizontal undertype steam engine and boiler—to give the machine its full title—the writer has, in making the usual apologies for an offence of this sort, to plead extenuating circumstances. The previous design was published in The Model Engineer for January, 1903, since which time The Model Engineer has had many new readers; furthermore, the present drawings are for an engine of much smaller size and simpler construction. The latter is an important difference. Whereas many model engineers would find it impossible, from sheer lack of sufficient tools and a large enough lathe, to say nothing of the first cost of materials, to build up the more powerful engine, the model now illustrated is one which any reader possessing a 2½-in. centre single-geared lathe should be able to manage without difficulty. Whilst retaining the compound principle, the mechanism of the model is much simplified. The boiler is of the standard water-tube type, with all joints brazed, and is, therefore, one which is much less trouble to build, and less costly, besides being more efficient than a flue-tube boiler, especially when the only available means of firing is by a plain methylated spirit lamp.

Readers may be interested to know, also, that the writer is putting forward the design as one which, of all small model engines and boilers, he would prefer for his own use. To this end he is showing his good faith in ordering one to be built from one of the well-known model engineering firms, and hopes in the near future to be able to submit some practical tests with the finished engine.

Considering the *raison d'etre* of the design. It is almost an axiom that you cannot expect to drive a dynamo and get any current worth having from an engine fired by a methylated spirit lamp of ordinary dimensions. But the point is not one which has absolutely been settled, and it is the writer's desire to produce an engine that, given the very best workmanship in both boiler and machinery, will drive a small dynamo and produce enough to charge a small 4-volt cell. It is, he admits, expecting a good deal from both engine and boiler; but there is no reason, if the best can be obtained from the steam, and frictional losses and electrical are reduced to a minimum, why the object should not be accomplished. We do not say that, reckoning the cost of fuel, it will be an economical method of charging an accumulator, but, considering the interesting hours to be obtained by making and using the proposed machinery, most readers would prefer it to using primary batteries for the same purpose.

The first question to settle is—To charge a 4-volt cell, what electrical energy is required? Reckoning on a maximum charging rate of ¾ amp., the total watts, allowing for a higher E.M.F. than that of the cells, equals, we will say,

$$5 \text{ volts} \times \tfrac{3}{4} \text{ amp.} = 3\tfrac{3}{4} \text{ watts.}$$

Now, as 746 watts is equivalent to 1 h.-p., then

$$3\tfrac{3}{4} \text{ watts} = \frac{3\frac{3}{4}}{746} \text{ h.-p.} = \text{say,}$$

$$\frac{3{\cdot}75}{750} = \frac{375}{75000} = \frac{1}{200} \text{h.-p.}$$

This is, of course, the theoretical horse-power required at the dynamo; but we must not forget that a small dynamo is a very inefficient machine, and that there will be transmission losses, losses by friction in both dynamo and engine, to say nothing of the inefficiency of the whole steam plant as a thermal engine.

But we will proceed to get at the indicated horse-power of the engine. The cut-off is provided in both cylinders; and, therefore, we need not consider the effects of expansion in each cylinder individually. The boiler is shown on the general arrangement as pressed to 80 lbs. per sq. in.; but while this is the pre-determined blowing-off point, it does not mean that the boiler will maintain this pressure when the engine is working at full load and speed.

The indicated horse-power of the engine will be the sum of indicated horse-power of both cylinders—that is,

I.H.-P. of the H.-P. C. + I.H.-P. of L.-P. C. = Total I.H.-P.

The cylinder ratio is ·3 to ·75*, which are respectively the *areas* of the H.-P. and L.-P. cylinders. This means that, according to Boyle's law, under which

Pressure × Volume = a Constant Quantity,

$$P \times V = C,$$

if we have a pressure of 50 lbs. in the H.-P. cylinder when it is exhausted into the L.-P. cylinder, the pressure will fall in inverse proportion to the new volume. In dealing with pressure, we must always reckon the atmospheric pressure in addition to the gauge pressure; therefore, we get 50 + 15 = 65 as the absolute pressure.

The new pressure (that in the L.-P. cylinder) may be found as follows:—

As H.-P. cyl. press. × H.-P. cyl. vol. = const. quantity,
then 75 × 3 = 225.

* The L.-P. cylinder should be bored a bare inch diameter; therefore, we may take the area at ·75 sq. in. instead of ·7854 sq. in., which is the exact area of an inch diameter piston.

Therefore, as we know the constant quantity is 225, and the new volume

as $P \times V = C$,

then $P = \frac{C}{V}$

In the case in point—

$$\frac{P}{\text{(the L.-P. cylinder pressure)}} = \frac{225}{V \text{ (the L.-P.C. volume)}}$$

$$P = \frac{225}{7 \cdot 5}$$

L.-P. cylinder pressure = 30 lbs.

To prove the correctness of this, we multiply the two (the H.-P. cylinder and the L.-P. cylinder) pressures by the volumes, and we should get the constant quantity the same in each case—

As $P \times V = 225$, then

H.-P. cylinder $75 \times 3 \cdot = 225$,

L.-P. cylinder $30 \times 7 \cdot 5 = 225$.

Now we can proceed to estimate the horse-power developed in each cylinder.

We all know that :—

Average pressure × length of stroke (feet) × area of piston (inches) × number of strokes divided by 33,000 equals 1 h.-p.

Now, the average pressure in the H.-P. cylinder is the pressure driving it forward, minus the pressure which is locked up between it and the L.-P. piston. These pressures by virtue of the different volumes of the H.-P. and L.-P. cylinders, we found were 75 lbs. by 30 lbs. respectively. The effective pressure is, therefore, 75 − 30 = 45 lbs. We must, however, make some modification in this estimate, due to practical considerations. There is always a loss in the transmission of energy, and, therefore, we must reckon that the back-pressure in the H.-P. cylinder will be always slightly higher than the forward-pressure in the L.-P. cylinder, due to wire-drawing or throttling. We will, therefore, estimate the mean forward-pressure in the H.-P. cylinder on the assumption that the back pressure is 37 lbs.

75 (forward) − 37 (back pressure) = 38 effective pressure in moving the H.-P. piston. The indicated horse-power will then equal at 400 revolutions per minute (400 × 2 strokes per minute) :—

$$\frac{P.L.A.N.}{33000} = \text{I.H.-P.}$$

$$\frac{38 \times 1\frac{1}{4} \times \cdot 3 \times 400 \times 2}{12 \quad 33000} = \frac{1}{35} \text{I.H.-P.}$$

This brings us to the L.-P. cylinder. The forward pressure here will be practically the same as that calculated, say 29 lbs. instead of 30 lbs. absolute, and if we subtract from this (29 lbs.) the pressure of the atmosphere plus, say, 3 lbs. back pressure, due to the nozzled exhaust, we get 29 − (15 + 3) = 29 − 18 = 11 lbs. effective pressure on the L.-P. cylinder. This gives

$$\frac{P.L.A.N.}{33000} = 1 \text{ H.-P.}$$

$$\frac{11 \times 1\frac{1}{4} \times \cdot 75 \times 400 \times 2}{12 \times 33000} = \frac{1}{48} \text{ I.H.-P.}$$

The respective horse powers of $\frac{1}{35}$ and $\frac{1}{48}$ would appear bad to show cylinder proportions, but the writer has allowed for slight leakages of H.-P. steam into the L.-P. cylinder. These leakages will have the effect of reducing the mean forward pressure in the H.-P. cylinder and increasing that in the L.-P. cylinder, so that where they occur they more than equalise the work of each cylinder.* However, the total work theoretically to be obtained will be

$$\frac{1}{35} \text{ (H.-P. cylinder I.H.-P.)} + \frac{1}{48} \text{(L.-P. cylinder I.H.-P.)}$$

$$= \text{roughly } \frac{1}{20} \text{ I.H.-P. total.}$$

Now this is no less than ten times more than the energy delivered to the accumulator, so we can

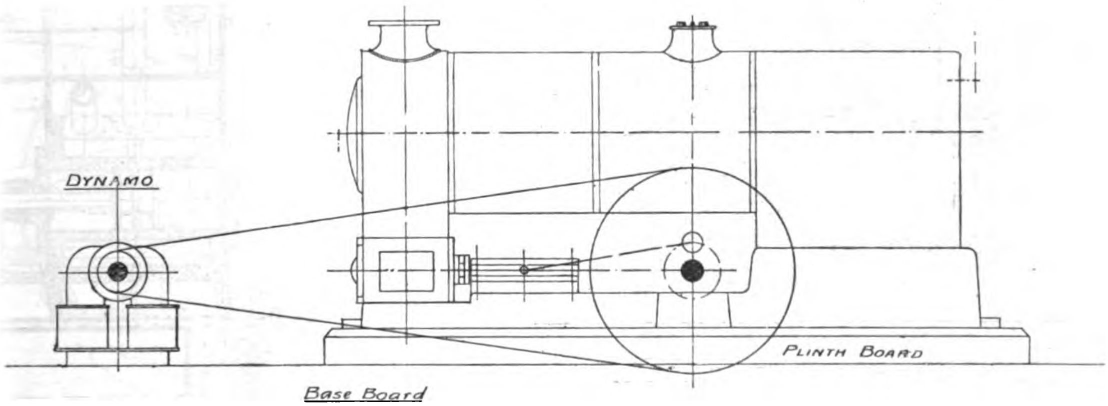
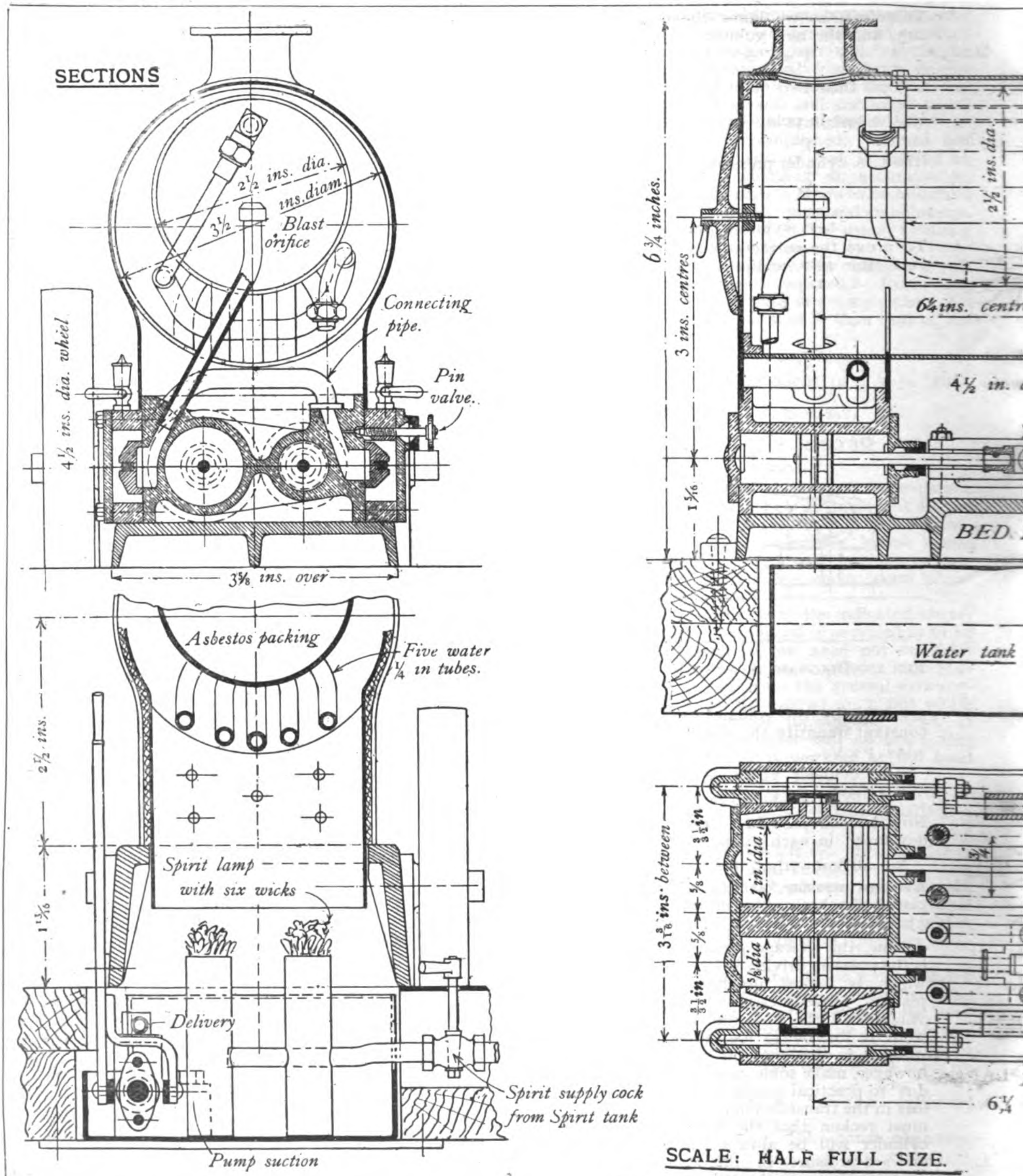


FIG. 1.—DIAGRAM SHOWING ENGINE MOUNTED ON BASEBOARD AND CONNECTED TO DRIVE A SMALL DYNAMO.

* In addition, a greater degree of efficiency than estimated in the boiler will result in a higher pressure being maintained. The effect of this will be to equalize the work of both cylinders as a reconsideration of the figures on the basis of say 75 lbs. boiler pressure will show.

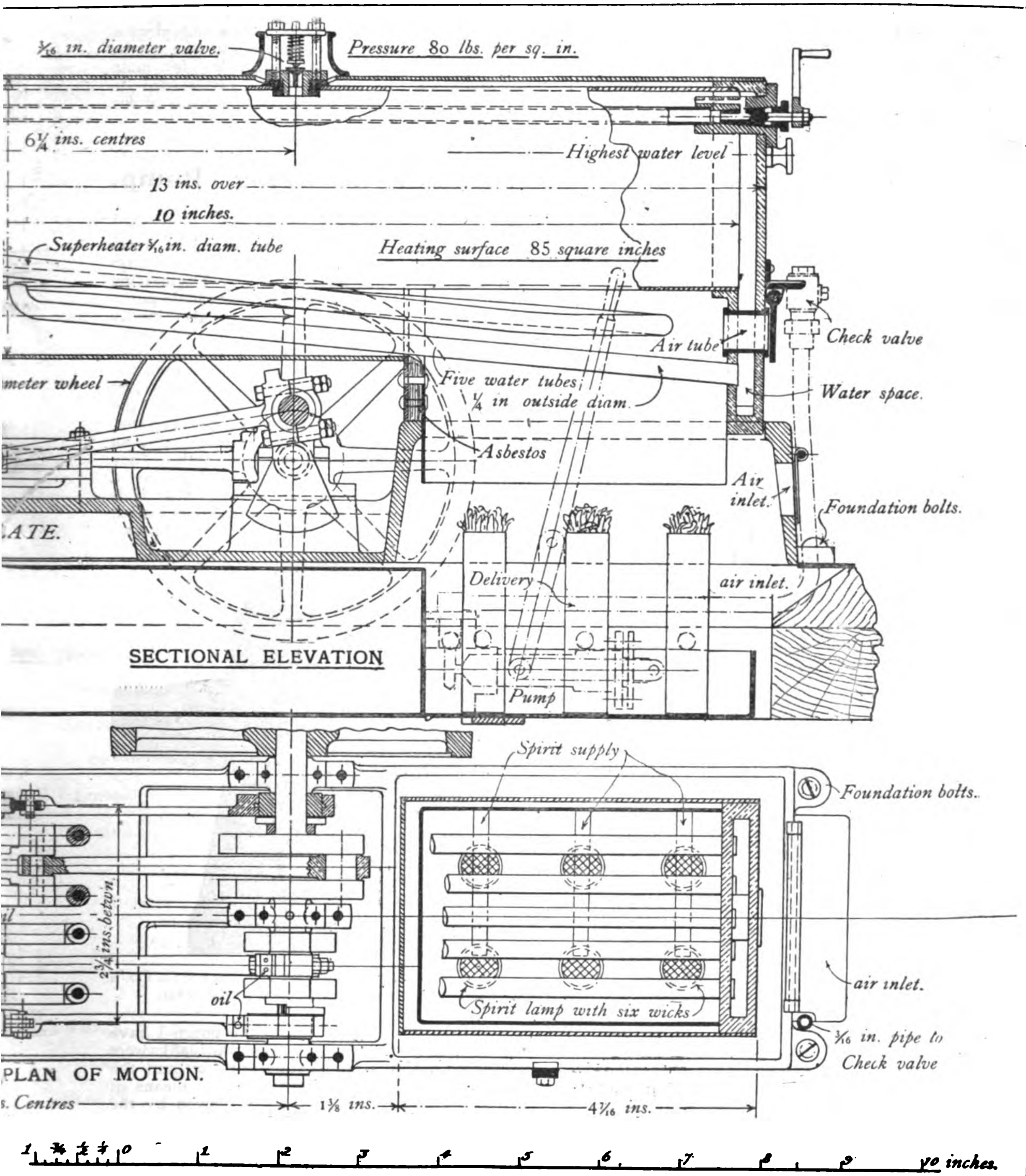


SCALE: HALF FULL SIZE.

A DESIGN FOR SMALL MODEL COMPO

For description]

By HEN



ND UNDERTYPE ENGINE AND BOILER.

GREENLY.

[see pages 346—350.

afford to part with nine-tenths of the power in electrical, mechanical, and heat losses. This would appear to be a big margin, but the writer would warn the builder that it is not so. Great care will have to be taken in every part of the plant to enable the remaining $\frac{1}{10}$ of $\frac{1}{20} = \frac{1}{200}$ h.-p. to be rendered available.

But what about the boiler and its evaporative power? With one charge of water—that is, with no cold water going in to make up the water used by the engine—the boiler should evaporate about 1 cub. in. per minute. The evaporation with a steady feed would not be more than ⅞ in. per minute. Therefore at 400 revs. per minute the pressure maintained will average about 65 lbs. at the stop valve, which, in practice, the writer has found can be maintained under load with a single-cylinder ⅝ × 1¼ engine supplied with a similar boiler.

To obtain such results a very high standard of workmanship is necessary; but to render to some degree nugatory the losses due to the use of H.-P. steam—which, by the way, is so advantageous in a small engine—the compound principle has been adopted. In spite of good workmanship and fitting, it is found that, however well they are packed, steam does get past the pistons of small engines, especially where the piston is too small to be provided with really satisfactory metallic rings. Valves also leak at the faces, and in a H.-P. simple engine all such steam goes to waste. The high boiler pressure is needed to take advantage of compounding and to prevent leakages in the boiler—which may be imperceptible, but are there all the same, the number of joints and fittings should be reduced to a minimum, and what there are should be most carefully made and packed.

If two ⅝ × 1¼ cylinders had been adopted, the pressure maintained would have fallen in proportion, and although leakages in the boiler would thereby be reduced, the total losses, due to piston and slide valve leakages, clearance spaces, would most likely more than balance those of the H.-P. boiler and compound cylinders of the present design.

The use of one H.-P. cylinder of ⅝-in. bore and 1¼-in. stroke will render priming less prevalent, as a much smaller volume of steam has to rise from the surface of the water, which is an important point in the design of model steam engines.

So much for the theoretical considerations. As will be seen by the general arrangement (drawings herewith), the engine is built up on a cast-iron bedplate. This rests on a wooden plinth, which may be painted to represent the cement or brick-work used in the original to face the foundations. The whole may then be put upon another board, which may extend beyond the engine and be used to support the dynamo pump or apparatus to be driven by a belt from the flywheel of the engine, as shown in the diagram (Fig. 1) herewith. Underneath the base may be placed the feed-water tank and pump. A feature of the cylinders is the starting valve, which also may be used to assist the L.-P. cylinder should the pressure in the boiler be too low to provide an efficient blast, or should any extra work be momentarily required from the engine. To enable the motion to be reversed, slip eccentrics are advised—that is, if engine efficiency is the principal thing desired.

Every part of the model will be detailed by full size drawings (where possible), as in the case of the writer's designs for the *M.E.* steam and electric locomotives, and, therefore, builders of the model need only refer to the large drawing for main dimensions and for information with regard to the general disposition of the various parts of the engine.

(To be continued.)

A Small Circulating Pump.

By STANLEY H. FREEMAN.

FOLLOWING is a description of a ¾-in. automobile circulating pump made from castings supplied to me by the Albany Engineering Company, who make this most excellent little pump commercially. The above firm have also kindly enabled me to show an illustration of this pump, with the end cover removed (see Fig. 1). A groove is cut across the face of the roller and also over the entire length of the tooth, forming a water-sealed joint, and when pumping against a pressure, the resistance compresses the water in the grooves, making each tooth its own valve, and securing an absolutely water-sealed joint on every tooth. They also state that the ¾-in. pump will work against a pressure of 300 lbs. to the sq. in., and that it is being used very extensively for forced lubrication purposes on high-speed engines and motor buses.

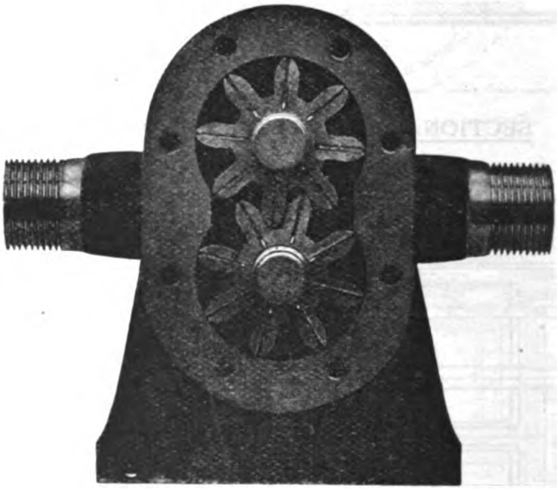


FIG. 1.—SHOWING THE ALBANY ENGINEERING CO.'S ROTARY PUMP—END COVER REMOVED.

The "Stauffer" lubricators to the pump I have made are from solid brass rod. The gear blanks were first turned up all over to standard size, and the teeth, of which there are eight, cut by means of the division plate, and a fly cutter driven by the overhead motion of lathe. The main casting was then faced up parallel, and one of the gear holes bored out to a good fit for the gear wheels; both holes were then plugged with hardwood, and the centre of the finished one found, the dividers set at the correct working centres of gears—*i.e.*, 13-16ths in., and an arc made on the plug in the rough hole, then, with the dividers set at a radius of ½ in., a circle was described as central as possible with the cored hole, and having its centre on the arc formerly made. The casting was then clipped to faceplate of lathe and the circle described round the rough hole, set true, and bored out.

To bore the long bearing, it was faced and then clipped to the faceplate and drilled with a flat

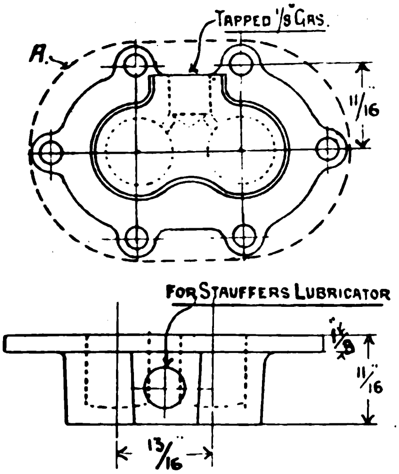


FIG. 2.—END COVER.

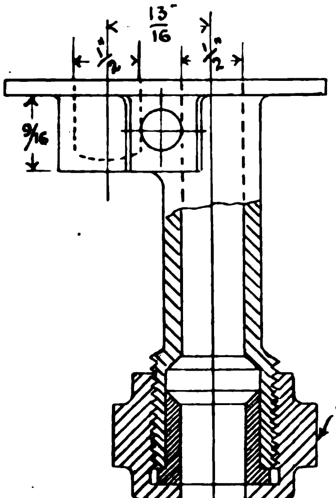


FIG. 4. PART SECTION OF LONG BEARING.

boring drill held in the slide-rest, by which means a perfectly true hole was obtained, the front end was recessed about ¼ in. for the packing, and follower and the outside screw cut for the gland nut.

The sides were next screwed to the main casting, and to do this the long spindled gear wheel was slipped in its bearing and then the gear into its barrel in the main casting; the two were fixed by means of external dabs of solder, and screw holes drilled and tapped. By this means the bearing

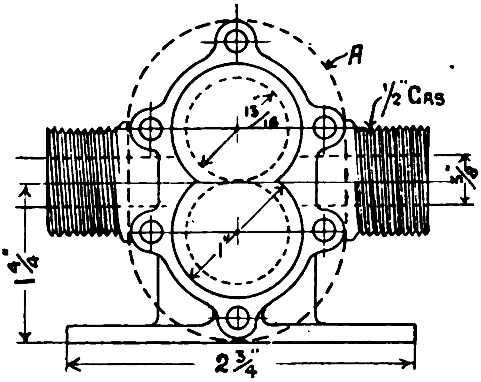


FIG. 3.—END ELEVATION OF PUMP.

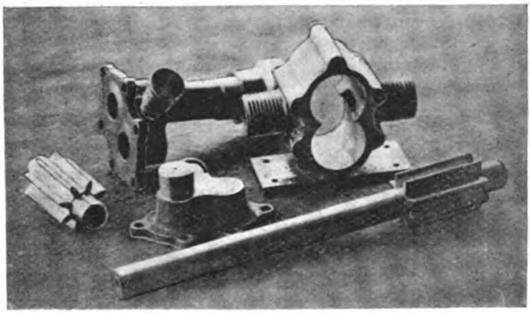


FIG. 6.—SHOWING THE PARTS SEPARATED.

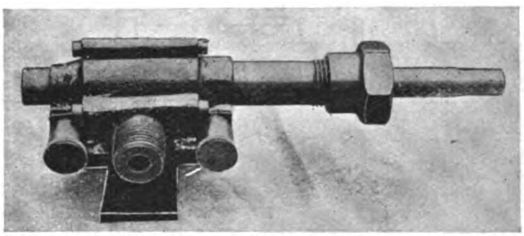


FIG. 7.—THE PARTS ASSEMBLED.

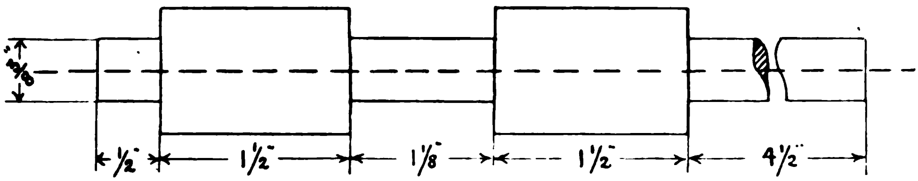


FIG. 5. GEAR BLANKS.

was got perfectly central with the gear barrel in main casting. The long bearing was used as a guide for the drill in drilling the bearing in opposite side. The two lower bearings were drilled on the same principle, using a sleeve guide in the barrel of main casting. The pump was then assembled and the gears made to mesh nicely by scraping the hard places on teeth. The lubricators mentioned above were then made and fitted, and oil, or rather grease, groove cut in each bearing. The body of pump was given two coats of red, and finished with copal varnish. I may say that, on testing, the pump gave a full ⅜ in. continuous stream of water drawing from a good 12-in. and forcing another 12 ins.

The grooves in the ends of the rollers were not cut in the gears of my pump. The castings are now made with flanges as marked A in the drawing, which is an improvement, making it only necessary to just file up the two edges flush, and rendering it much easier for tapping.

I may say that the photograph of the finished pump hardly does justice to it as the two ribs which look so terribly out of parallel are in reality practically parallel.

Model Making for Beginners.

A Simple Electro-Motor.

By James K. Cobb.

Although this little model was made by me some years ago, it may come as a suggestion to other beginners who may be wanting to construct a simple model of this description; sketches drawn to scale of the various parts are given. The working parts are arranged similarly to those of a horizontal steam engine, and the whole thing is of the simplest possible construction. Fig. 1 shows the baseboard, which is made of mahogany; the two standards for the shaft bearings (Fig. 2), and the two uprights to which the magnets are attached (Fig. 3), are also of mahogany. The standards are bored out ¼ in. to take small gas tubing (brass); these tubes should be fixed in with a little seccotine. The inside of the tubes will require smoothing out with a small round file to allow the shaft to run freely. The section lined parts, on Fig. 1, indicate the position of these standards. The uprights (Fig. 3) are dowelled into the board, as shown at Fig. 1. Midway between these uprights is a ⅞-in. by ⅝-in. hole through the board, this is to admit two small brass angle-pieces (Fig. 6); these are the bearings for the rocking-pin C (Fig. 5), which works below the top surface of the board. Figs. 3 and 4 show the magnet-cores and plates into which the cores are screwed or riveted; these cores should be made from the softest Swedish iron, and well annealed after being built up—four cores and two plates will be required. The bobbins (four in number) should be wound with No. 24 silk or cotton-covered copper wire, care should

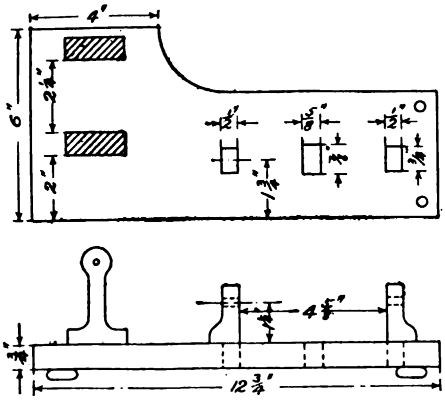


Fig. 1.—Baseboard.

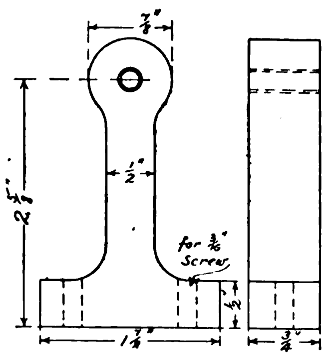


Fig. 2.—Bearing Standards.

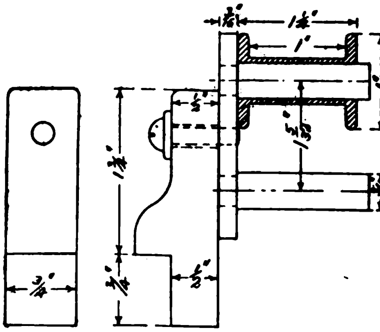


Fig. 3.—Method of Attaching Magnets to Standards.

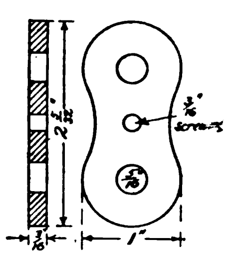


Fig. 4.—Core Plates.

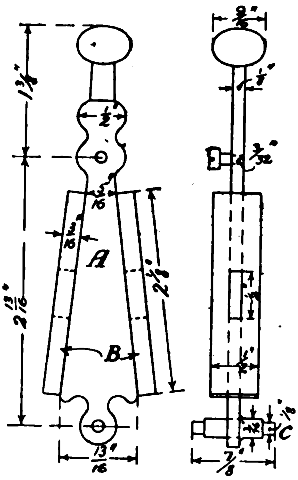


Fig. 5.—Detail of Rocker.

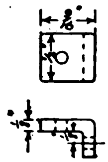
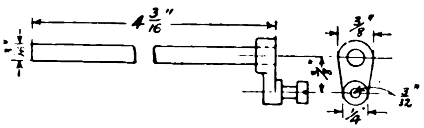


Fig. 6.

be taken that the connections between each pair of bobbins forms the figure 8; leave about 6 ins. of the commencing and finishing ends for connecting up on the underside of the board. The triangular rocking part A (Fig. 5) is cut out of ⅛-in. brass plate, this plate carries the two soft iron pieces B: these pieces are drilled out in the centre, as

FIG. 7.—CRANKSHAFT.



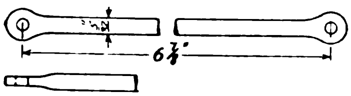


FIG. 8.—CONNECTING-ROD.

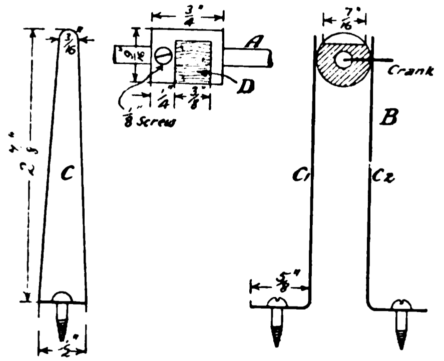


FIG. 9.—SHOWING BRUSHES AND CONTACT SLEEVE.

shown by the dotted lines, and afterwards drifted out to admit the two corresponding projections of the brass plate. These plates are secured by burring over the brass with a small hammer. The rocking-pin C is driven in a good fit, and further secured by soldering. Fig. 7 shows the crank; it is filed to shape from a piece of brass, and is driven on the 3-16ths-in. shaft a tight fit. The connecting-rod is simply a length of brass wire (Fig. 8) flattened out at the ends, then drilled to fit the ⅛-in. pins. Fig. 9 brings us to the most important part of the whole machine—this is the contact sleeve A, which transmits the current first to the one set of magnet coils, then to the other. It is made of brass, and is ¾ in. long by 9-16ths in. diameter. A gap ⅜ in. wide is filed out as shown at D, until about one-third of the circumference remains. This space is filled with a piece of box-wood; this is secured with a little seccotine. The wood should next be levelled down with a file, say, 1-32nd in. below the circumference of the sleeve.

Fig. 9 (B) shows the position of the sleeve segment, in relation to the crank-pin. The brushes C1 and C2 are shown in contact with the sleeve; these are made from thin springy sheet brass, about 26 gauge, and are secured to the board so that they bear slightly on the centre of the part of the sleeve occupied by the boxwood. A flywheel about

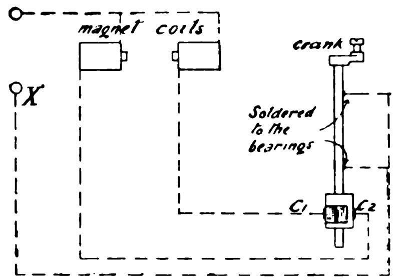
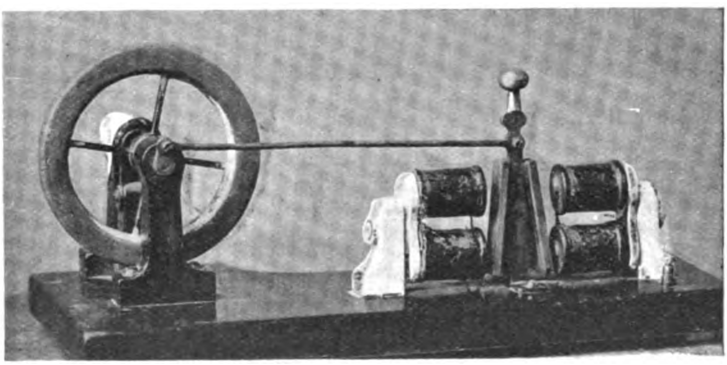


FIG. 10.—DIAGRAM OF CONNECTIONS.

4½ ins. diameter is required; it should not be too heavy. The one shown in the photograph has a hard wood rim, with steel spokes screwed into a brass centre boss. It is a good thing to fit a guard (sheet brass) over the two brushes, so that they will be protected from injury, as they are easily displaced. Two terminals now complete the fittings.

We will now follow out the circle of operations that take place during one complete revolution of the shaft. The crank commences from the back centre (nearest the terminals), when the contact sleeve touches the brush C1, the current goes through the right-hand terminal X, then to the contact sleeve by means of the shaft bearings, and on through the inside magnet coils to the other terminal. This causes the triangular piece to be pulled towards the inner magnet cores, the contact sleeve just leaves the brush C1 when the crank



A SIMPLE ELECTRIC MOTOR.

has reached the out dead centre, and travelling a little further round, the contact sleeve makes contact with brush C2, thereby causing the current to flow round the outer magnet coils and pulling the triangular piece back on its return stroke. I have also given a diagram of the connections. These should all be soldered where connected. It will make a neat job to hollow out the bottom of the baseboard for the wire to lie in, and small holes drilled through the board so that the wires can be run through where wanted. A cardboard cover should be put on the bottom of the board with seccotine; and, lastly, four rubber buttons should be fixed on, one at each corner at the bottom of the board.

Race for Model 12-metre Sailing Yachts to the New International Rule.

NINE starters out of an entry of ten put in an appearance at the match held, under the auspices of the London Model Yacht Club, at the Round Pond, Kensington Gardens, on Saturday, March 23rd, to compete for the first prize of £5 and a second prize of £1, offered by the L.M.Y.C.

The wind was light and variable at 11 o'clock, the hour appointed for the start, which was in consequence, postponed for half-an-hour, about which time it freshened considerably, but throughout the day kept varying in direction from N.E. to N.W. Considering that most of the models were only just completed in time for the race, some very creditable sailing was witnessed.

SOME OF THE COMPETITORS.

The following table gives particulars of the competing boats :—

Name of Boat.	Club.	Owner.	L.W.L.	Bow-tax.	Stern-tax.	B.	½ G.	3*d*.	S.A. allowed.	F.	Displacement in pounds and ounces.
Erycina ..	L.M.Y.C.	A. Brandram	*a*40·08	2·54	1·15	12·	9·13	2·04	2049	3·23	27·6
Gulnare ..	L.M.Y.C.	F. Collingwood	*a*39·0	2·85	1·23	12·	9·13	1·98	2275	3·29	26·12
Alderman ..	L.M.Y.C.	P. Tatchell	*a*39·32	2·63	1·3	13·55	8·57	·37	2353	3·19	28·9
Merry Thought	L.M.Y.C.	W. W. Beckh	*a*41·75	1·92	1·03	11·17	8·96	1·32	2328	3·41	29·6
Adelia ..	L.M.Y.C.	E. H. Bonney	*a*39·3	3·23	1·19	11·6	8·62	1·35	2340	2·62	26·6
Lily	M.Y.S.A.	S. J. Howe	*a*40·3	2·19	1·14	12·5	8·61	1·2	2287	3·09	26·10
Ripple ..	Serpentine	— Lewis	*a*41·7	2·1	1·13	11·45	8·76	2·16	1921	3·11	26·0
Serpentine ..	Serpentine	W. Hildersley	*d*41	1·9	1·12	11·94	8·76	1·56	2167	3	26·0
Mascot ..	Crescent	G. C. Paine	*d*41·5	1·18	1·88	11	8·55	3	1880	2·84	—

a = Actual Measurements. *d* = Designed Measurements.
The Scale of the Models is 1 inch = 1 foot.
For dimensions of actual 12-metre Yacht read feet instead of inches: displacement in tons = displacement in lbs. × ·77.
In reality the Boats are 1 metre rating, sailed without crew.

The scores at the end of the race proper were :— *Alderman*, 21; *Adelia*, 17; *Erycina*, 14; *Gulnare*, 14; *Lily*, 11; *Mascot*, 10; *Ripple*, 8; *Merry Thought*, 7; *Serpentine*, 6.

According to the conditions of the match, the two leading boats had to sail three more windward boards, each counting two points. *Adelia* won the first two boards, thus drawing level; but *Alderman* secured the third, and the match.—PERCY TATCHELL, Hon. Secretary L.M.Y.C., Kensington Gardens, Kensington, W.

The Society of Model Engineers.

London.

A SMALL party of the members visited, in the afternoon of Wednesday, March 27th, the works of the well-known biscuit manufacturers, Messrs. Peek Frean & Co., Ltd., at Bermondsey, and all present agreed that, under the guidance of Mr. John Carr, a director of the company, an exceptionally enjoyable afternoon was spent.

Mr. Carr, assisted by Mr. Foxall, began at the beginning by showing the party the huge store warehouse and cold storage rooms where such materials as flour, eggs, currants, sugar, etc., await the uniters. Attached is a small laboratory equipped with the necessary scientific apparatus for testing the purity and good condition of all ingredients, except perhaps eggs, for which chemical tests are hardly necessary; these, however, are all broken separately, and have to pass a strict examination. To explain in detail the numerous labour-saving appliances seen at work, in the shape of mixers, kneaders, rollers, etc., would take several pages of this journal, so a short explanation of the cutting machine, as being a most interesting one to watch, must suffice. The dough, after being rolled to a suitable and uniform thickness is fed in a continuous band over an endless webbed blanket, the biscuit shapes being stamped and cut by a brass die at the rate of from four to fifty-four, according to the size of the biscuit, at each stroke of the cutters, which descend at the proper interval in such a way that the band of dough remains unbroken with a series of holes in it where the biscuits were stamped out. This arrangement enables the biscuits to continue their journey on the endless blanket whilst the waste strip of dough is led off the blanket and into a trough to be again rolled and stamped. From the blanket the biscuits pass into trays, which are automatically fed into the machine. The full trays are then placed by boys in one end of the immense ovens, some 30 to 50 ft. in length, through which they travel continuously on endless chains at such a speed and through such a degree of heat as is necessary to completely bake and properly colour the particular biscuit being made by the time they reach the further end of the ovens, where the trays are taken away and the contents allowed to cool preparatory to packing.

The firm makes the whole of its biscuit tins and packing cases, and a visit to these two departments disclosed further labour-saving machinery and up-to-date methods for providing the millions of tins annually required for sending the products of the firm to the four quarters of the globe. A visit to the packing and labelling departments brought the purely sight-seeing part of the visit to a close, and the party, at the firm's kind invitation, sat down to an excellent and really needed tea, the inspection having involved what seemed a walk of miles. The usual acknowledgements having been made to Mr. Carr and Mr. Foxall, the party left, with many expressions of appreciation of the scrupulous cleanliness and good order of the works, each member taking away as a memento a box of the firm's products.

FUTURE VISITS.—On Tuesday, April 16th, a visit will be made by parties of the members to the Royal Mint, Little Tower Hill, E.C. Not more than eighteen in all will be allowed to participate, and this number will be split into three parties of six each, which will make the inspection consecutively at the following times, viz., 2 o'clock, 2.45 and 3.30. Notification should be given the Secretary at the earliest possible moment. On Thursday, April 25th, at 2.30, a visit will be made to Robertson's electric lamp works, Brook Green, Hammersmith. The party is limited to twenty, and notification must be given not later than April 22nd.

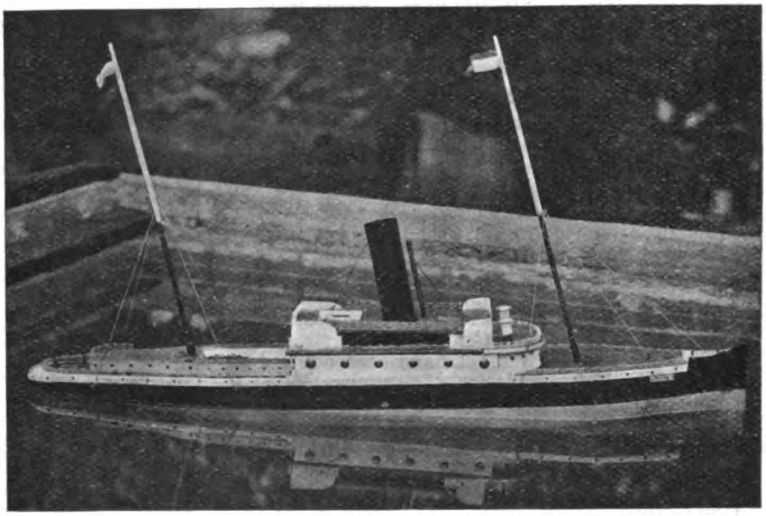
FUTURE MEETINGS at the Cripplegate Institute, at 7 o'clock: Wednesday, May 1st, short papers by members; Tuesday, May 28th, lecture by the Rev. W. J. Scott, on "Six-Coupled Engines on the Great Western Railway." Particulars of the Society and forms of application can be obtained from HERBERT G. RIDDLE, hon. secretary, 37, Minard Road, Hither Green, S.E.

Practical Letters from our Readers.

A Note from South Africa.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The accompanying photograph is of a model I have made out in South Africa, out of odds and ends which I have collected on different occasions, and thanks to the kind assistance rendered by your valuable paper, THE MODEL ENGINEER, I have completed my model and am well satisfied with the result—viz., a speed of 4½ miles per hour.



A SOUTH AFRICAN READER'S MODEL STEAM YACHT.

I built the hull of spare pieces of ⅞-in. pine first, glued together, then cut to shape and sprigged with fine brass sprigs. The deck, etc., is of ⅛-in. poplar and lined out to imitate planking. The railings are pins and ordinary cotton. The ventilators are old tubes out of central draught lamp turners. The funnel is a piece of 2-in. sheet brass tubing. The boiler, which gave me the most trouble, is vertical type with six tubes made of sheet copper brazed and screwed. The outside size is 10 ins. high by 7 ins. diameter, and is a rapid steamer. The firing is a bit of my own invention and has proved very successful, thanks again to your valuable assistance. In the bows of the vessel I fixed a brass container under the deck, and connected the burner with a piece of brass tubing with a tap to regulate the supply. The burner is an old burner off what is termed out here a blue-flame paraffin-oil stove, with brass ring and asbestos wick 6 ins. in circumference; and though it tried my patience terribly to get it working properly, it is at last a success and raises 30 lbs. of steam in five minutes or less if the oil is good (for believe me it varies out here).

The engine is an ordinary double cylinder, which I brought out here with me ten years ago, 1-in. bore cylinders, gun-metal bearings, and a perfect beauty when she is working. The shafting, couplings. and propeller (4½ ins. with four blades) I made out of odd pieces of metal. The boat is 5 ft. 6 ins. by 8¼-in. beam by 8 ins. deep. I may say we have a splendid sheet of water out on the open veldt here, which would hold its own with any of the boat ponds in England. The photograph was taken in the tank at the back of my house without water in the boiler or oil in the lamp, which cause the model to look rather high forward, but when filled and ready for sea she is as even on her water line as an Atlantic liner.—Yours truly,

Port Elizabeth, South Africa. W. H. BEBINGTON.

Cleaning Soiled Hands.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I should be glad of the experience of some of your readers as to the best means of cleaning one's hands after an evening at turning, fitting, and general workshop manipulation. I find the dirt, especially after working on cast iron, gets so deep into the pores of the skin that it is difficult to really whiten the hands for days.

As a professional man, the requirements of modern city life necessitate my appearing at business with hands that not only *are* clean, but which *look* clean as well. I have been advised to wear gloves, but, except for a long job at filing, I cannot tolerate them. I have found "Hudson's Soap Extract" reasonably good as a cleanser, and "Sapon" even better. I should be glad of any advice from those of your readers who work with their heads by day and their hands by night.—Yours truly, J. BEE.

Newcastle-on-Tyne.

An Alloy for Amateurs' Use.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In *Commercial Intelligence* the other day I read of an alloy which might prove of interest to some of your readers. Its name is Alzene, and it is composed of aluminium two parts, zinc one part. Its specific gravity is 3·3, and its tensile strength is 21,000. It is very rigid, but not quite so ductile as good brass, but it has exceptional properties which may be of great value to amateurs. It is most simply made, the metals merely having to be melted together in a crucible; even an open coal fire is sufficient for this. It melts at 900° F., and casts well, running into the finest portions of the mould. It is easily worked, speed in the lathe about the same as brass. Its strength, low specific gravity, and the ease with which it may be worked and cast, make it. I should think, of great value to model makers.—Yours truly,

Entwistle. FRANK H. PALMER.

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 cornor 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:—

[17,261] **Volt and Ammeters; Primary and Secondary Cells.** F. W. C. B. (Oxford) writes: I am making a voltmeter and ammeter as described in your handbook No. 24. I want the voltmeter to give a full deflection with 12 volts. It will be used mainly to test an 8-volt accumulator. I have made one instrument and tried it as an ammeter and voltmeter. For the voltmeter I wound on 1 oz. of No. 36 gauge single cotton-covered wire. On connecting 8 volts to this I only got a deflection of about 3-16ths in. to the pointer. Can you tell me some rule to go by? Should I continue winding wire till I get a sufficient deflection, or must I use stouter wire. Can you give me some idea as to the quantity of wire required? I have searched the last three or four volumes of THE MODEL ENGINEER without any information whatever. When I connected 2 or 4 volts to the voltmeter the needle was *attracted*. Can you explain this? The needle was also attracted with 8 volts when the movable iron was placed nearer the fixed one. I have used two iron nails well annealed for the action. The movable iron is ⅞ in. long and is attached to the spindle with two brass wires at each end and soldered. After experimenting I took about half the wire off and tried again with no better result. I then wound the wire on again and connected in parallel with the first lot with a much better result, but the wire got very hot and practically burnt the cotton covering. I then removed all the wire and wound 4 ozs. of No. 14 cotton-covered wire on (about four layers). On passing 2 amps. through this I get an attraction also. I want to get a full deflection of the pointer with 4 amps. With a greater current I got a slight repulsion. Should I add more wire or less? Kindly tell me what should be the right quantity. The bore of bobbin is 1-in., and the action is mounted in hardened steel pivoted bearings. I have made up six Daniell cells to in-

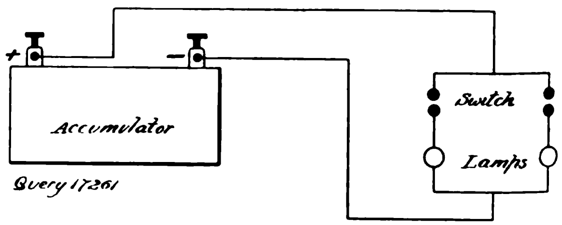


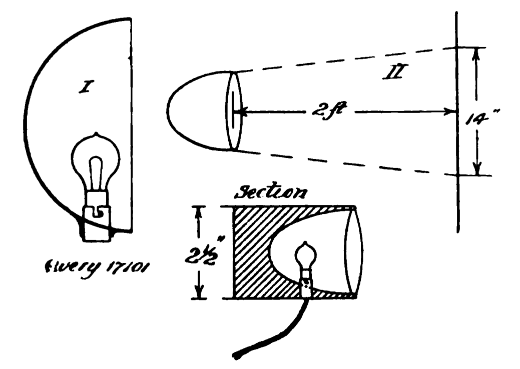
DIAGRAM OF CONNECTIONS FOR LAMPS IN PARALLEL.

structions given by Mr. Cyril Turner in a recent issue. Instead of getting 6 volts I only get 3½ volts. I used 3-lb. jam jars, each containing a porous pot, 5½ ins. by 2½ ins. (taken from old Leclanché cells) with a Leclanché zinc in each pot. The outer jar contained a cylindrical sheet of copper and crushed carbon surrounding it. The porous pot was charged with the solution stated. *Powdered* copper sulphate bought from a local chemist at 4½d. per lb. was used in the outer jar. Immediately on being made up the cells were connected to a 4-volt lamp, which did not burn to its full brilliancy. Were the jars too small, or was it because the porous pots were not new? Or, was the copper sulphate at fault? Please state how to remedy this. I want to make up twelve cells to charge an 8-volt accumulator for the electric lighting installation described in handbook No. 22. Which battery would you recommend—the above or the one described in the above book (gravity cells)? Kindly explain why an 8-volt accumulator, each cell containing two positive and three negative plates, 3½ ins. by 1½ ins., will not light more than one 8-volt 8 c.-p. "Osram" lamp to its full candle-power? I have two lamps connected as in sketch (not reproduced). When I put No. 1 switch on, No. 1 lamp lights to its full candle-power; but when I switch on other lamps the first one gets dull, and so on with each additional lamp. Each lamp takes ·7 amp. I have not tried more than four lamps.

(1) The pieces of iron have evidently—one or both—become permanent magnets to some degree. Demagnetise them, and well anneal, and try again. Also add more turns of wire to coil for use as voltmeter, and fewer turns for the ammeter. Are the iron pieces *quite* close to the coil? (2) Possibly the porous pots not being new and clean creates a high internal resistance, which would account for your trouble. We should prefer chromic acid cells. Your connections are at fault (see sketch).

[17,101] **Miscellany.** T. G. G. B. writes: Could you enlighten me on the following points. (1) What is the proper voltage for charging a 4-volt accumulator? Will 6 volts do? Mine has to be charged at ·5 amps. and my dynamo gives 2·5 amps. What resistance is necessary? (2) Could you send me a sketch of a switch by which a 4-volt or a 2-volt accumulator can be connected to a lamp? (3) Is the Hellesen dry battery suitable for lighting? (4) Could you let me know of one or two books on Electric Batteries and their prices? (5) What are "Osram" lamps made of? (6) Can you tell me of a firm who sell 4-volt tantalum or Nernst lamps? (7) In accumulators, what is the ratio of amp.-hours to area of plate? Does this mean *all* the plates? Does it mean both sides? (8) In an accumulator why do they have more positive than negative plates? (9) Could you tell me the sort of reflector to use with a 4-volt lamp in order to send out a diverging beam of light which at a distance of 2 ft. from a wall would give a circle of light about 14 ins. diameter? My diagram will perhaps explain what I mean. I intend the whole to be about the size of a cycle lantern with a lens in front, mounted in a piece of wood as shown for reading by. What shape and size reflector should I use? What size lens? (10) How long ought a 4-volt 5 amp.-hour accumulator to be charged for? Must it be charged for, say, twelve hours consecutively? (11) Where can I obtain small Edison Lélande cells? (12) Is there any way of telling (without a speed meter) if my dynamo is running at 3,000 revolutions per minute?

(1) 25 per cent. above that of cells to be charged. See recent replies on subject. (2) No switch is required—simply connect up to terminals. We do not see what your difficulty is. (3) For very small lamps. 4) "Galvanic Batteries," by Bottone, 5s. 4d. post free. (5) A metal—osmium. (6) Any of our electrical advertisers. (7) Reckon about 15 amp.-hours per sq. ft. of positive plate surface. Yes, both sides. (8) See handbook—"Small Accumulators, 7d. post free; also "Secondary Batteries," by "An Engineer," 4s. 3d. post free. (9) You can arrange this with any small simple lens by varying the distance of the lamp from it, and placed behind it and in front of a reflector. (10) See



REFLECTOR FOR A 4-VOLT LAMP.

handbook mentioned above, and Queries and Replies. (11) Any electrical firm mentioned in this Journal. (12) Provided there is no belt slip you can calculate it from speed of engine or whatever is driving it. See recent replies on speed of pulleys and shafting.

[17,484] ***Silver Chloride Cells.*** R. H. (Upper Edmonton) writes: I have some cells which I do not understand. Could you tell me what they are and how to charge them? They consist of two zinc plates, 6 ins. by 2½ ins. by ⅛ in.; between these there is a crinkled silver plate. They stand in glass jars, 5 ins. by 3 ins. by 2 ins.

Your cell may be a form of silver chloride cell, but is not of much practical use. You can use as electrolyte either common salt, or zinc, or ammonium chloride, in solution. Silver chloride is placed in the bottom of the cell in the form of powder, as a covering to the silver plates, or is fused in the form of a rod round a silver wire used as an electrode. The internal resistance of these cells increases with age, but can be kept down by the addition of a *little* hydrochloric acid added to the solution.

[17,385] **Leaky Boilers.** J. R. T. (Brighton) writes: Being a constant reader of your valuable paper, I should be much obliged if you could satisfy me on the following. I have a model copper riveted boiler which "sweats" under cold water in a few places. Is there any composition, which, if allowed to remain in boiler for some time, will effectually stop this without damaging the metal in any degree, and be permanent?

Putting oatmeal, flour and water, bran, or any such stuff in the boiler is not good practice and should only be resorted to in emergencies, and as a temporary expedient only. We therefore suggest that you well clean the various defective places with a three-cornered scraper, and "sweat" with solder. If this is properly done the boiler should perspire no more. If the boiler were made of steel, rusting the joint would soon fill up the small crevices, or resort could be made to the caulking tool to effect a speedier remedy.

[17,384] **Model Steamer Machinery.** R. L. (Kensington) writes: I am thinking of getting a launch engine, but I should like to know the capacity first. What length of boat do you think a ⅜-in. by ⅜-in. launch engine would drive, at what speed, and what dimensions of boiler do you think I should require?

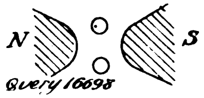
A 40-in. boat with a beam of 5 ins. and a draught of about 2 ins. would run well with a ⅜ by ⅜-in. engine. The dimensions of the boiler depends on the type chosen. Where a single flue marine boiler is to be used (see page 46 of the new edition of "Model Boiler Making"). the shell may be 4½ by 7½ ins., and the furnace tube 2 ins. diameter. The materials should be very light and the boiler should have eight to ten water-tubes ¼ in. diameter. The boiler may, with advantage, have brazed joints throughout, and should be fired by a benzoline or petrol blowlamp. The displacement of the boat, if of T.B.D. lines, will be 7½ to 8 lbs.

[17,438] **Boiler and Engine Proportions.** J. W. J. (Slough) writes: I should be greatly obliged if you would give me the dimensions of a Yarrow type water-tube boiler suitable to drive a double-cylinder engine of 2-in. bore and 4-in. stroke. (1) Would solid-drawn copper tubing 1-16th in. thick be suitable for the purpose, and all parts brazed, and maintain 80 lbs. working pressure?

You will want a very large Yarrow boiler to maintain 80 lbs. pressure on a double-cylinder engine 2-in. bore by 4-in. stroke. The engine will take about 15 cub. ins. of water per minute per 100 revolutions per minute, allowing a little for an early cut-off. Therefore, if the speed is 300 r.p.m. the consumption will be 45 cub. ins. per minute, and 4,000 sq. ins. of heating surface is the minimum we can recommend. This means 100 tubes 20 ins. long and ⅝ in. diameter, and a top shell of about 12 ins. diameter. If you have any experience of brazing, in an amateur way, you will know that it is out of the question in the present case. The boiler should be of steel and we recommend the screwing and back-nutting of the tubes into the top drum and the expanding of the tubes into the mud drums. The latter can be made of cast steel in two halves of elliptical shape, bolted together after the tubes have been fixed. The steam drum should be 3-16ths in. thick with a double riveted lap seam. The engine will, at the pressure and speed mentioned, give 2½ i.h.-p.

[16,698] **Experiments with Tesla Coils.** W. D. B. (London) writes: I have constructed a Tesla coil as described in Mr. P. Howgrave-Graham's articles which appeared in THE MODEL ENGINEER during 1903–4. I have tried this coil with a very good spark coil (giving a 7½-in. spark—continuous—in air) discharging as described in Mr. Graham's articles through Leyden jar condensers (½-gallon size as described) of varying capacities from one to seven jars and with an ordinary adjustable spark-gap, without any "blowing-out" contrivance. The amount of current in all the following cases varied from 1 to 7 amps. In all instances, however, except "G," the results were very unsatisfactory, only yielding a small spark about 1 in. to 1½ ins. long. The following sources of supply were used, viz.:—A. Current from 18-volt accumulator working through the spark coil with an ordinary vibrating break. B. 100-volt direct current working through ditto with Wehnelt break and adjustable resistance. C. Ditto all last, but with two Wehnelt breaks in series and adjustable resistance. D. The same as B and C, but with adjustable choking coils in the circuit. E. With alternating current from main (110 volts), single phase, 50 periods, discharging through spark coil with one Wehnelt break and adjustable resistance. F. Ditto all as last, but with choking coil in the circuit. G. By passing the alternating current before referred to direct through the spark coil without the intervention of any break, but with an adjustable

resistance in series to regulate the supply, I can only obtain a 6½-in. continuous spark in air from the Tesla coil and in a few seconds the primary of the induction coil overheats and the current has to be cut off. Now I should be much obliged if you would afford me the following information, viz.:—(1) Ought I to obtain the results described in your issues of October 27th, 1904, November 24th, 1904, and October 12th, 1905, by using the apparatus



described in experiments A to F inclusive? (2) If not, what apparatus is required to produce the described results? (3) With such a Tesla coil, what condenser capacity should give the best results under the various conditions described?

You should obtain perfectly satisfactory results with the arrangements described, though we are doubtful about C and E. The effect described in G suggests very forcibly that you need some device to quench the non-oscillatory arc at the spark-gap. Unless you are taking a far heavier current from the coil than it is made for, there is probably a quiet discharge across the gap, and this would, of course, necessitate the supply of a heavy primary current, as well as lowering the efficiency. Since describing the fan arrangement for blowing out the arc, Mr. Howgrave-Graham has experimented with a gap placed in a powerful magnetic field, and finds this greatly superior to the fan. We cannot specify condenser capacities for the different arrangements given, but the seven

and advise you to try 1 c.-p. lamps or a 2½ c.-p. lamp. (3) We should prefer a 16-slot armature, made 1¼ ins. diameter, and wound as Fig. 49, page 36 of our handbook No. 10, which you have.

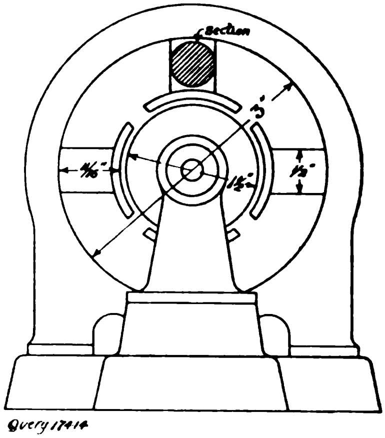


FIG. 2.—END ELEVATION.

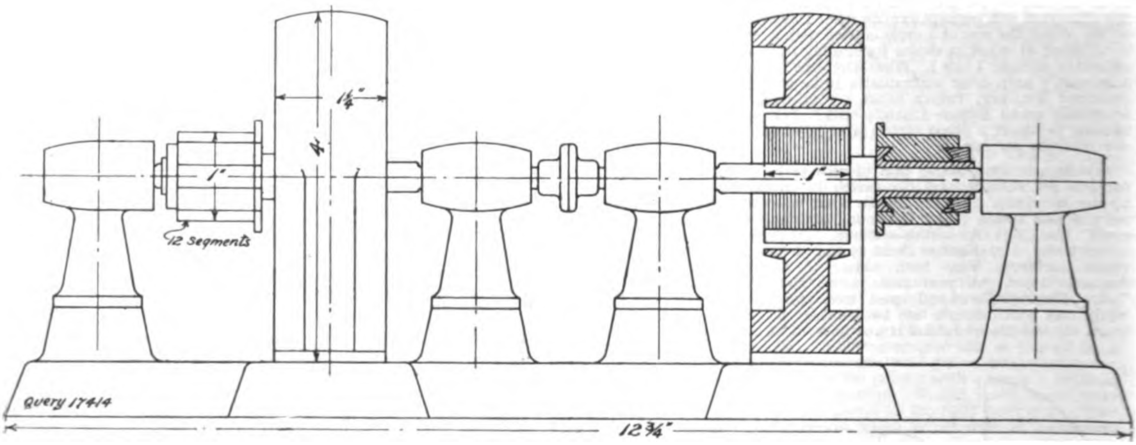


FIG. 1.—A SMALL MOTOR GENERATOR.

jars described by you ought to give excellent results with any of them. Have you tried a mercury break?

[17,414] **Windings for Small Motor Generator.** C. D. (Leeds) writes: I am about to make a model motor generator as per sketch, and would be much obliged if you would answer me the following questions. (1) Are the machines in proportion? (2) Would the one driven as a motor drive the other as a dynamo; if so, please say if I could get enough current from dynamo to light two 4-volt 4 c.-p. Osram lamps over switchboard? (3) I propose to use a 12-part armature and commutator in each machine; is this right? (4) Please say what capacity of accumulator I should have to use for motor. (5) Do you consider carbon brushes as efficient as gauze ones for models of this size? (6) Please say what size and amount of wire I should need for each machine. I may say I have your book, "Small Dynamos and Motors," but cannot find any windings for 4-pole models.

(1) Yes, but we should prefer to see more metal in the field-magnets, say, ¾ in. diameter for the pole cores and the yokes ½ in. or so deeper. (2) Yes, because you can adjust the output of the generator to suit the power given by the motor; but the motor will not drive the generator to full output. To do this the motor must be about double the electrical capacity of the generator. It is of little use to go deeply into figures for such small machines; you must make them as well proportioned and suitably wound as possible by judgment, and then give them a trial. We doubt if you will obtain anything like the output you mention,

(4) This depends on the length of time you wish to run without recharging. One having at least 15 ampere-hour capacity, and to give, say, 6 volts. If you do not get high enough speed, add more cells in series. (5) No; use gauze brushes. (6) Try No. 30 gauge for the generator armature and 26 gauge for the motor armature, single silk-covered. Get on as many new turns as you can; probably about 2½ ozs. will suffice for each armature. For the field-magnet of generator No. 24 gauge s.s.c. copper wire, and of motor No. 26 s.c.c. copper, connected in shunt to the brushes. Probably about 1 oz. will go on each coil. Get on as much as you can in the space. You can either use one pair of brushes for each machine, and cross connect the commutator, as shown in the diagram referred to in our handbook, or two pairs of brushes and cross connect opposite brushes instead of the commutator;

[17,480] **Resistance Board for Lamps and Coils.** M. P. (Kensington) writes: I wish to make a resistance board for a 200-volt direct current which will enable me to get from 1·8 amperes for working arc lamps, induction coil, &c. Could you tell me:—(1) What kind and gauge of wire would be best; (2) Where to get it, and the probable cost; (3) Resistance of a given length of the wire?

(1) Either platinoid or German silver would do; No. 18 S.W.G. German silver wire will carry just 8 amps., and no more, comfortably. It has a resistance of ·195 ohm per yard. Hence, to get a

flow of 1 amp. from a 200 volt supply you will need a resistance of

$$R = \frac{E}{C} = \frac{200}{1} = 200 \text{ ohms};$$

$$\text{to get 4 amps. } R = \frac{200}{4} = 50 \text{ ohms};$$

$$\text{to get 8 amps. } R = \frac{200}{8} = 25 \text{ ohms, and so on.}$$

From the above you can work out what length of wire you require. (2) Any of our electrical advertisers will supply you. Price, 2s. 3d. per lb.

[17,518] **Winding a 60-watt Simplex Dynamo.** W. H. S. (Seaforth) writes: I am constructing a dynamo of the "Simplex" type, as taken from "Dynamos and Motors," edited by Hasluck. I have made a slight alteration in the build. The commutator is of gun-metal, 1¼ ins. diameter, 2 ins. wide, 3-16ths in. thick, with copper gauze brushes. Instead of ring armature, I am having laminated cogged drum, with twelve sections and 6-part commutator (diameter 2½ ins. by 2 ins. wide, armature). The magnet is of wrought iron. What I want to know is—(1) If I wind armature with 6½ ozs. of No. 23 and fields with 3 lbs. of No. 22, will it give me the output of 60 watts 30 volts 2 amps? as your hand-book, "Small Dynamos and Motors" gives these windings for armature with diameter equal to length; if not, what winding will be best for me to use? (2) Will you kindly give me a sketch of how to wind armature for 12-section and 6-part commutator, as your handbook only gives 12-section to 12-part commutator?

(1) If the proportions are much the same, then you can use the windings given in our handbook for the output stated. (2) The windings for a 12-slot 6-part commutator armature are the same as for the 24-slot 12-part one shown in Fig. 47, "Small Dynamos and Motors"; only half the number of slots and segments are used respectively.

[17,524] **Forming and Charging Accumulator Plates.** E. S. (York) writes: I have found a difficulty in pasting my storage battery plates to get them to stand the forming process. I have got a few pasted with the usual red lead for positive and litharge for negative plates. I mixed it with sulphuric acid (diluted), as stated in your 6d. handbook, and when dry I put these (positive) in the saturated solution of chloride of lime, and a considerable amount of hissing and bubbling started, and the paste dropped out of the grids before I could get them properly into the solution. Could you please let me know how to overcome this difficulty and also the time they usually are in forming? The grids are 5 by 4½ by 3-16ths, and seven plates in a tank. I should like to know any difficulty I am likely to expect with the negative plates when charging. They are a yellow colour, and the plates that I have seen are a blue slate colour. Will these alter during charging; and, also, could you state approximately the charge and discharge rates for this battery. There are three positive plates per cell.

Your plates should have been pasted in a much more solid manner. The paste should be pressed well together—as hard as it is possible to make it. Allow to dry thoroughly, then immerse gently in a very weak solution. After plates are thoroughly wet, then you can pour in a very strong solution of the chloride of lime as required, and allow the action to proceed gently till over. The negatives are gradually formed by repeated charging and discharging, and will gradually become a slate colour as they get formed. Reckon 6 amps. per sq. ft. of positive plate surface as a safe charging rate. Discharge rate is about the same, and should not exceed this. Count both sides of positive plate. See also recent replies on this subject.

[17,523] **Conversion of Petrol Engine to Gas.** J. L. B. (Helensburgh) writes: I have a ¾ b.h.-p. petrol engine, which I have lately changed to gas by an arrangement as shown in the sketch (not reproduced). The engine will not run steadily, but is continually missing fire. I have tried every possible mixture; the valves are all right and compression good; the ignition is electric. When running dead slow on a very poor mixture it fires every time, but the explosions are of different intensity—one explosion may be violent and next feeble. The engine ran well on petrol. Could you tell me the cause or causes of the irregularity and how I can remedy it?

The fault most probably lies in the fact that gas and air need more careful mixing than petrol vapour and air. In many gas engines (when they are converted to petrol) it is found advisable to change the mixer, *i.e.*, the perforated bush through which the gas and air pass on their way to the combustion chamber, and use one of a modified type or form which allows a free passage for the vapour. Therefore it is possible that the reverse holds true in your case. The matter is one that should be treated experimentally. The varying intensity of the explosions may be due to the suction air valve not working easily in its bush, and causing a rich mixture to be drawn in at one time and a weak one the next. A gas-bag should be used, and the gas supply be perfectly free. Remember that when running at a slow speed the electric spark ignition should be later than at high speed. Upon this regulation the power developed by engine to a great extent depends.

[17,208] **500-watt Lighting Plant.** C. K. (Johannesburg) writes: I should be greatly obliged if you would kindly answer the following query. I have a set of castings to construct a 50-volt 10-amp. Kapp dynamo. What size wire should I require for the field-magnets and armature? I should also like to have a suitable switchboard for same. I may state that I have two single-pole knife switches and a double-pole cut-out. Do I require an ammeter and voltmeter? Will you kindly give me a rough sketch for a suitable switchboard for the above dynamo. I have also a ¾ h.-p. oil engine for driving the above dynamo. Could you tell me how much oil this will consume in one month? I intend to run the oil engine every evening from 6 o'clock to 10 o'clock.

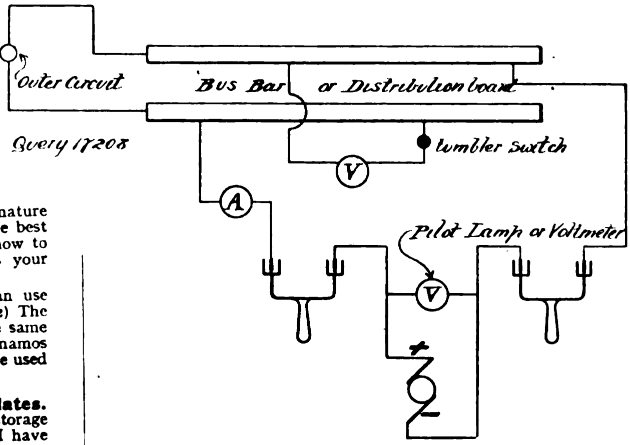


DIAGRAM OF SWITCHBOARD FOR A 500-WATT LIGHTING PLANT.

Armature, 3½ ins. diameter, 5 ins. long, wound with 2½ lbs. No. 17 S.W.G., and field-magnets wound with 10 lbs. of No. 21 S.W.G. An ammeter and voltmeter can hardly be done without. ¾ h.-p. will not be quite enough to drive dynamo at full load. At least 1 h.-p. will be wanted. Consumption of oil will be about ¾ to 1 pint per brake horse-power per hour. The arrangement will be as sketch.

The News of the Trade.

Paraffin Marine Motors for Boats and Launches.
Henry Butler, of Whiston Street Works, Derby, is manufacturing the "Hercules" marine paraffin and petrol motors, single and multicylinder, in all sizes, ranging from ¾ h.-p. to 30 h.-p. He is also prepared to supply promptly castings, &c., of these motors, "Hercules" gas and oil engines, &c. We recently had occasion to be in Derby and took the opportunity of accepting a long-standing invitation to visit Mr. H. Butler's works, where we saw one of his 20 h.-p. motors running with paraffin on test. The motors of this size are double-cylinder sets, 5½-in. bore by 6-in. stroke, and fitted with electric ignition, capable of starting on petrol from cold, and changing over to paraffin feed a few minutes after starting up. The sets are substantially built and the suction air valve arrangement is particularly well designed. Further details of these and other engines will be willingly supplied on application to the above address.

A New Business.
We are asked to state that new works have recently been opened at Nuneaton for purposes of model engineering, under the name of the Model Engineering and Electrical Company. The address is 43, Edward Street, Nuneaton. Mr. Arthur L. Scragg is the proprietor.

New Catalogues and Lists.

Fred. V. A. Lloyd, 15, Lord Street, Liverpool.—We have received an up-to-date list of photographic apparatus and accessories from this firm giving prices and particulars of several well-known stand, hand, and pocket cameras, and lenses; enlarging apparatus, chemicals, and printing papers are also included.

Components, Ltd., Bournbrook, Birmingham.—A copy of the 1907 list of Fleet bicycles, manufactured by the above firm, has been sent to us. The list is well illustrated, and will be sent post free to any reader making application.

The Editor's Page.

THE present season of the year usually brings to our Query Department a crop of letters asking us to work out various questions set in previous years' papers in the examinations of the Board of Education and the City and Guilds of London Institute. Evidently many of our readers are preparing for the forthcoming examinations in May, and are anxious for our help in coaching them up. Sometimes they are frank in their requests, and state that the questions are for examination purposes; but in others the problems are merely submitted as ordinary queries, although it is not a difficult matter for us to appraise them at their true value. We should like to take this opportunity of saying that we regard all examination questions as being beyond the proper scope of our Query and Replies column, and we cannot undertake to reply to them through this channel. The majority of readers who are preparing for the examinations in question are attending regular classes in the subjects they are studying, and they should apply to their teachers for the help and explanations they require. Even if they are not attending classes, there are many suitable text-books published in which selected examination questions are given and answered, and these should suffice for all requirements. One recent correspondent in a remote Irish town who desired help of this kind asked us if we could not possibly supply him with a complete set of questions and answers for the forthcoming examinations, for, as he naïvely suggested, the examinations would surely be held in London before they were held in his own town!

Answers to Correspondents.

C. P. (High Wycombe).—Thanks for your amusing letter. We have noted the subject of steam steering gears for future treatment.

W. (Windermere).—You will find a full description of magneto machines for motor work in "Electric Ignition for Motor Vehicles," by W. Hibbert, price 1s. 6d. net, post free 1s. 7d.

W. F. (Ramsbottom).—See recent articles on the subject, which has been dealt with fully. Also please comply with our rules in future.

"RAILS."—There appears nothing for it but keeping the ball and also the wires quite clean and bright. A heavier ball would perhaps help to get better contact, but no rolling contact will give the same good results as a sliding contact. Please comply with rules in future.

L. J. (Stratford).—We should advise you to begin on a smaller machine, unless you are experienced in the work. A good description is given in "Electrical Instrument Making," by Bottone, 3s. 9d. post free. See also articles on the subject in back numbers of this Journal. There is no 1s. book on the subject.

H. M. (Middlesbro').—You have evidently not complied with our rules.

F. W. S. (Gosport).—We would recommend you to obtain the "Handy Electrical Dictionary," by W. L. Webber, post free 1s. 1d. Also "First Book of Electricity and Magnetism," by Perren Maycock, post free 2s. 9d.

G. J. (Johannesburg).—The Macintire Combination Lathe was exhibited by Messrs. J. Christopher and Son, 39, Clerkenwell Road, London, E.C.

H. E. R. (Glasgow).—We thank you for your reply to our querist, but the information you impart has already been covered in our Practical Letter columns.

J. N. (South Leith).—Your letter and photograph are already in the press, so that it would be too late to insert the photograph with your letter, even if it were good enough.

R. H. (Croydon).—Your inquiry is too vague. See handbook, "Model Steam Engines," 7d. post free.

A. F. B.—Your request is being attended to, but requires some investigation. We hope to let you hear from us shortly.

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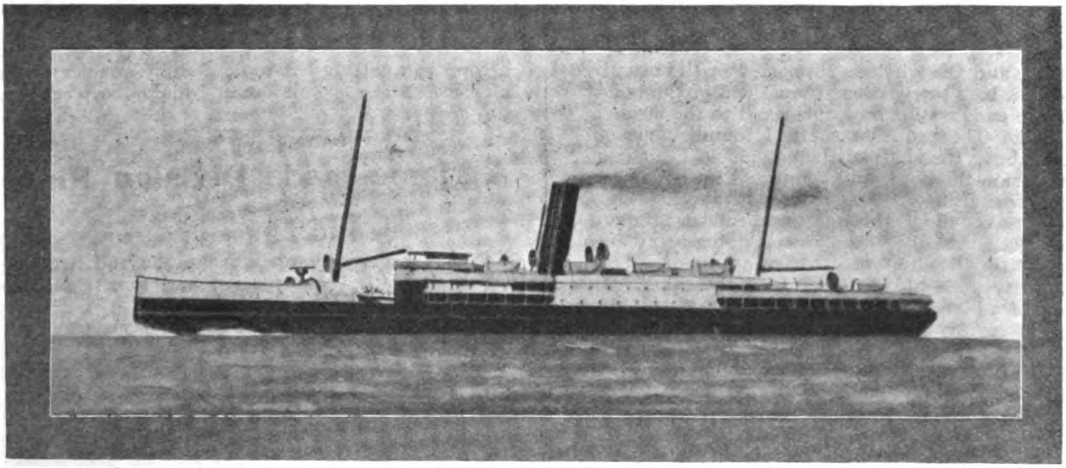
THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVI. No. 312. APRIL 18, 1907. PUBLISHED WEEKLY

A Model Ocean Liner.

By C. H. B.



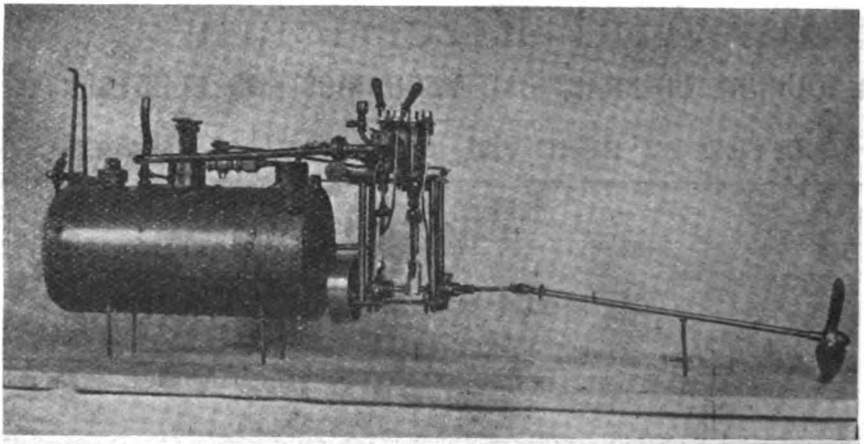
A MODEL PASSENGER STEAMER.

THE following is a description of a model liner which I have made during the winter:

The hull, which I had made for me, is made up in two pieces, a way which has not turned out well. It is 3 ft. 6 ins. long, 5½ ins. beam, and 6 ins. deep. The lower half was dug out in the usual way, the top half being cut out of the solid and joined by headless nails and knotting. This joint was always in a state of leakage until I took it apart and planed both surfaces flat, then glued and screwed them together, using very fine long screws sunk about ½ in. in the top portion; this seems to have made a good job of it. The next part to take on was the stern tube and shaft; these presented no difficulties. The tube is of copper pipe, ¼-in. bore, and the shaft is silver steel, 3-16ths in. diameter, the ends of the copper tube being bushed and the space filled up with tallow. The propeller is a three-bladed one, but I notice the boat heels over a good deal, so I am about to fit another propeller in the same shaft, revolving in the opposite direction, as described in THE MODEL ENGINEER a few weeks ago.

The boiler is brass, riveted and soldered, 4½ ins. diameter and 7 ins. long, with a single D-shaped flue, with four ½-in. cross tubes, and makes steam in under five minutes with a petrol blowlamp. It is fitted with two water test taps, safety tap and throttle.

The engine is a single cylinder, ⅜-in. bore by 1⅛-in. stroke, slide valve, and with the ordinary marine pattern connecting-rod. The engine has been rebuilt several times, it being in the first instance a slide crank. This gave a lot of trouble and never seemed to work well. The steam is taken from the dome of the boiler and passes through a coil in the smokebox. I see this method continually cracked up in THE MODEL ENGINEER, but by actual tests it seems to make no difference to the running of my engine. The engine is screwed on to the front of the smokebox, which I find a very convenient method, and the whole is supported in the boat by two cross-bars screwed on to each end of the boiler, with the ends resting on ledges fixed to the inside of the hull. The propeller shaft, I found, came out rather above the shaft of the engine, so I cut it off short inside the boat, and connected up by a short piece of shafting, 2 ins. long, with hollow ends, which fit over the engine shaft one end and the propeller shaft the other—this means doing away with bearings for the short piece. The whole derives its motion by pegs engaging one with the other. By means of a piece of tube with an engaging peg in it, made to revolve with the engine shaft, but to slide along it, I can obtain a free engine. This piece of tube is connected up to a lever which comes out slightly above the deck. The upper deck is made of three-ply wood, and is in one piece, but with the centre portion hinged. This enables me to get at the engine and boiler without taking the whole deck off. The deck supports are oval tacks, driven in from above, then all cut off level, and a wire is soldered on from one end to the other. The ventilators are of copper, stamped out, and a brass ring soldered to the mouth.



SHOWING MACHINERY OF MODEL LINER.

The boats, twelve in number, are cut out of wood, and slung on wire davits. The boiler is fed by a pump placed right forward, $\frac{3}{8}$-in. bore, 3-ins. stroke. The suction pipe is rubber, and can be put overboard for filling the boiler, or in the boat for drawing out any leakage. The piston of the pump is perhaps worthy of note, it being made by placing two leather cups, back to back, on the piston-rod, as in the oil pump of a motor bicycle.

The photographs show the relative positions of boiler, engine and shafting, and the boat as in the water. By the way she pulls in a bath I think I shall be pleased with the result. To enable me to see how the different little adjustments and alterations I am continually making tell on her power, I have fixed up a spring arrangement on one end of the bath, which shows me whether her pulling force is stronger or weaker. Originally, the dial of this instrument was divided into twelve parts, and she pulled at the sixth; now she pulls at the eleventh, and I have twice had to strengthen the spring. I have never attempted anything in the marine line before, and getting her to float right was very troublesome. The whole affair would keep getting top-heavy.

A Home-made Division Plate.

By T. GOLDSWORTHY-CRUMP.

THE accompanying photographs and drawings show the construction and means adopted for making a division plate to fit a $3\frac{1}{2}$-in. Drummond lathe. Of course, the same procedure could be followed to suit any lathe, and the modifications necessary would have to be considered in each individual case.

The first thing is to make a pattern of Fig. 1 somewhat larger in every way than the finished plate, so that the liability of blowholes, etc., may be reduced as far as possible. This can easily be turned up in soft wood, finished smooth and varnished. The casting should be in brass or gunmetal, and should have a rough cut taken all over before boring the central hole and chucking for the final turning. A $\frac{3}{4}$-in. mandrel should now be made and the plate bored out a good fit. A line should also be scribed 15-16ths in. diameter for centres of holes, as shown, to receive steel pins which engage with fittings on end of lathe mandrel. These holes should now be drilled and the plate can then be fixed to mandrel and soft soldered for further security. The plate is now ready for finishing between centres and should be highly polished.

The means adopted for the dividing of the plate are shown in photograph Fig. 8. A circular piece of wood, $9\frac{7}{8}$ ins. diameter by $1\frac{1}{4}$ ins. thick, was secured by screws to the faceplate, the centre being cut out with a fretsaw to allow the lathe centre to come through. The wood was now turned true on its face and edge, and the latter gradually reduced until the diameter was 9⅝ ins. bare. The circumference required being 30 ins. exactly.

A tin plate was now cut up 1 in. wide and soldered

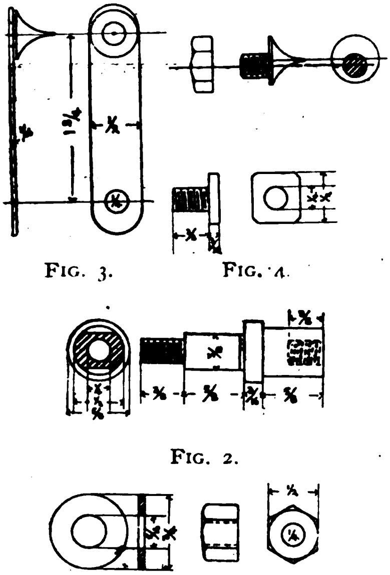


FIG. 5. FIG. 3. FIG. 4. FIG. 2. FIG. . FIG. 7.

DETAILS OF INDEX FINGER.

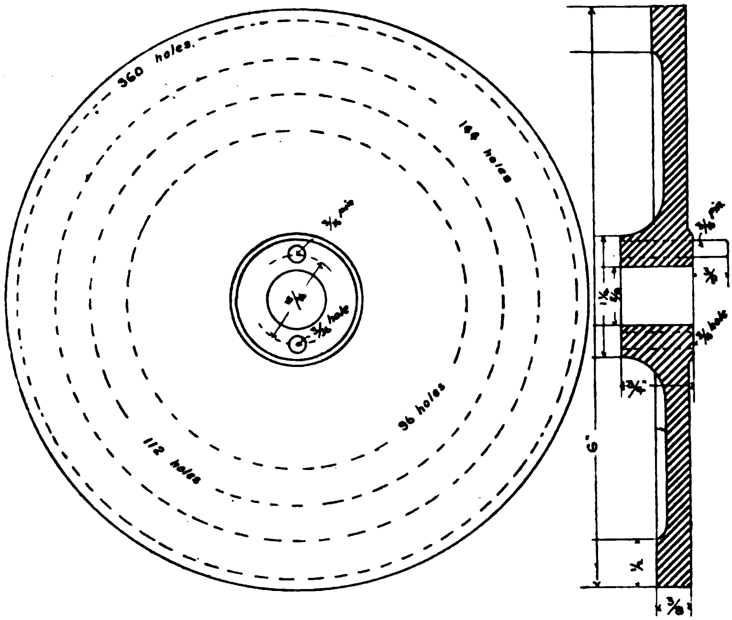


FIG. 1.—DETAIL OF DIVISION PLATE.

together to make a strip 31 ins. in length. Two holes were finely punched 30 ins. apart and the tin strip carefully fitted to the wooden edge so that the holes super-imposed. The strip was then removed

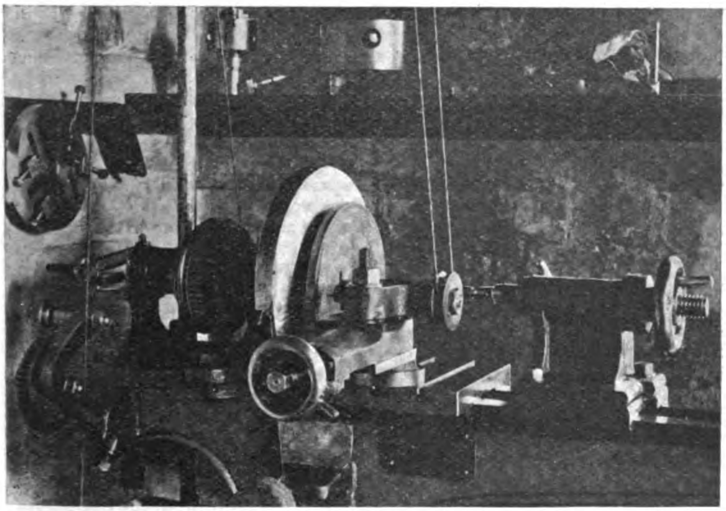


FIG. 8.—SHOWING METHOD OF DIVIDING THE PLATE.

and divided into inches, and then each inch into 12 parts, which gives the 360 divisions required for the outer circle. These marks were carefully punched with a very fine centre punch, and the strip refixed to the edge of disc. A makeshift index finger was now firmly fixed up as shown and the drilling spindle and overhead put in place and a fine drill inserted and the slide-rest adjusted to the diameter required for the 360 circle. The depth of the hole having been determined with a stop, the point of index finger was placed in one of the punched holes and the rapidly revolving drill was run into the plate by the lead screw until arrested by the stop. The drill was then withdrawn, and the index finger inserted into the next hole, the drill advanced and withdrawn, and so on for the whole circle.

The 112 ring should be next undertaken, and for this the wood disc is reduced to 9 ins. bare, which gives a circumference of 28 ins., and the tin strip is reduced and divided as before, but into ¼ inches, which will give the 112 divisions required.

After this one is completed, the disc is again reduced to 7⅝ ins. bare for the 144 circle which gives a circumference of 24 ins., and this is sub-divided six to the inch, and for the 96 circle the same size disc is used with the alteration of four divisions per inch.

The divisions being now completed, the plate can be removed from the mandrel and the holes counted out as shown in photograph (Fig. 10), the figures being either engraved or stamped.

The position and manner of using the plate on this particular lathe is shown in photograph Fig. 9, and the details of index finger in Figs. 2, 3, 4, 6, and 7. This fitting can be made of mild steel or brass, but the part shown in Fig. 3 must be spring steel. A piece of old saw or knife blade answers well for this purpose. This construction allows of a slight adjustment which at times is most useful. Should a fixed finger be required, this adjustment can be obtained as shown in Fig. 5.

It will be found necessary to reduce the length of the horn knob on back-gear spindle to allow plate to take place of change wheel. This is a very small matter and does not impair the lathe in any way.

Should any error arise in reducing the disc too much, it can easily be rectified by sticking strips of paper on, stamp edging being just the thing for this purpose.

The carrier on mandrel must be firmly secured to the wood disc by blocks and screws so that no movement is possible.

If the various operations have been carefully carried out, the result will be a most useful addition to any lathe.

In photograph (Fig. 9) a simple means of dividing for square or hexagon is shown by using the large gear wheel and an index finger

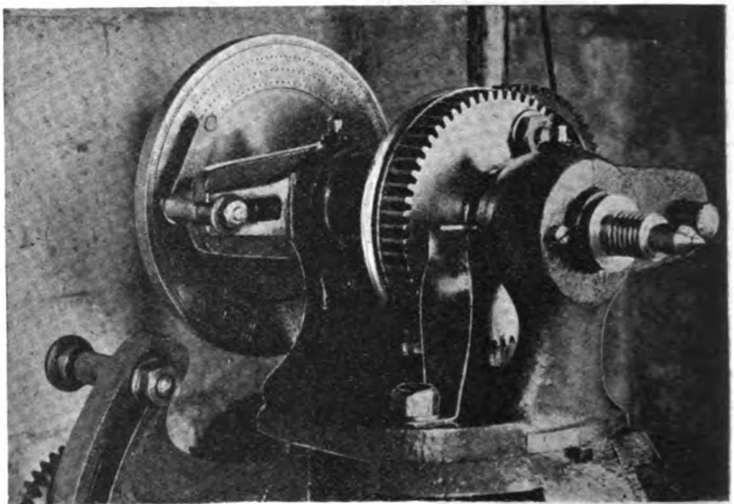


Fig. 9.—Showing Method of Using Division Plate.

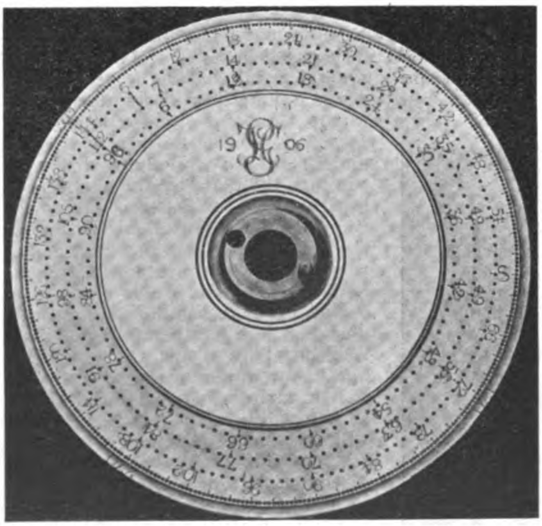


Fig. 10.—The Division Plate.

fastened under nut which is revolved into engagement with the wheel when required.

It is claimed that the largest producer gas power installation in the world will be that to be erected at Dallas in Texas. The total capacity of the plant will be 4,500 h.-p. Bituminous coal and Texas lignite will be the fuels used.

The Latest in Engineering.

American Steamboat Speeds.—In 1866 the *City of Boston* made 23 miles an hour on the Sound. These speeds compare very well with those of the latest river and Sound steamers. The best speed of the *Richard Peck* was 21·03 miles an hour. The *Priscilla* in 1894 covered 27·6 miles at the rate of 23 miles an hour. In 1899 the *Puritan* made her best speed—22·98 miles an hour. The *Albany* in 1880 made 23·26 miles an hour, and the *New York* in 1903 made 23·21 miles. The *Mary Powell* in 1873 showed a speed of 22·54 miles per hour, and the *Rhode Island* that same year covered 21·17 miles in one hour. The new *Hendrick* is said to have made a short run at the rate of 24 miles per hour.

Petrol Engine Igniting Tests.—According to *The Engineer*, tests recently carried out at the Daimler Company's works suggest that as much power can be got out of a petrol engine with accumulator and coil ignition as with the high-tension magneto apparatus. The accumulator ignition was of the single-coil and high-tension distributor type. In cases of accumulator ignition, where loss of power has been found with a separate coil for each cylinder, the loss has usually been found to be attributable to differences in the coils.

A Powerful Russian Locomotive.—The *Novoe Vremya* of March 10th describes an engine which was constructed at the Putiloff works for the Ryassan-Ural Railway. It is oil-fired, the petroleum being carried in a tender of unusual proportions. While hauling a complete mail train of twelve coaches, the "Crocodile"—as it is named on account of its appearance—developed a speed of 120 versts (79 miles) per hour. Leaving St. Petersburg at 6 a.m., it accomplished the distance to St.

Okuloff and back without replenishment of fuel, arriving at the Metropolis on the return shortly after 4 p.m.

A Large Electric Clock.—This has been fixed at the departure end of Piccadilly Station of the Piccadilly Tube. The dial is about 3 ft. in diam., and is divided into twelve sections of one minute each, with only one hand. Its object, says *The Railway News*, is to show the motorman how long it is since the preceding train left the station. As soon as a train leaves the station the clock starts recording the time, and continues until the next train comes in. Immediately that leaves, the single hand goes back to the starting point and begins afresh.

A Miniature Air Drill.—One of the large makers has discovered a demand for a miniature air drill (says the *Export Implement Age*), the size of which is no larger than a man's hand—5 ins. across. This midget, which weighs 2½ lbs., and which is modelled after the design of the larger tools, is extremely powerful, relatively, being capable of drilling up to 3-16ths in. steel. Its chief value is for drilling holes that have to be done accurately in pieces not otherwise readily accessible. The motor speed is extremely high, being 22,000 r.p.m., while the spindle speed is more than 2,000 r.p.m.

The Victoria Model Steamboat Club.

By "The Carpenter's Mate."

The Victoria Model Steamboat Club was the natural outcome of the frequent meeting at the Victoria Park lake of several amateur marine engineers, who, under the benign influence of kindred joys and troubles, could not remain strangers long It stands to reason that you cannot alter the pitch of the propeller of a man's boat, borrow his last drop of benzoline and use up all his matches, without getting to know him; and thus it came about that in July, 1904, a small band of enthusiasts assembled to launch the good ship, *V.M.S.C.*, the writer "signing on" as Carpenter's mate. Just prior to the formation of the Club, a few of the leading spirits approached the Park authorities with a request for some accommodation for the stowage of the models, and some small measure of protection from the too eager crowds of spectators, who hampered the sport by their pressing attentions. This may seem strange reading to those who do not know Victoria Park; but if any reader who has not already done so will pay a visit to the famous East End Bathing lake on a Saturday afternoon during the season he will get a view that he is not likely to forget. It is not unusual to see a thousand small boys, with a sprinkling of big ones, squatting on their

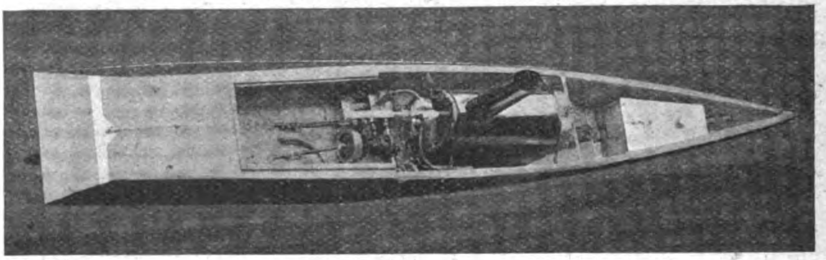
A Few of the Members and Boats of the Victoria Model Steamboat Club, in the Enclosure.

haunches waiting—for an hour or more beforehand—for the bathing bell to ring. Try to imagine the effect upon this gathering (who are simply chafing for something to turn up to kill time), when a model steamboat is suddenly put down in their midst, and the owner starts to get up steam. I never recall those days without a shudder. Getting up steam was a work of art then—small boys to the right of you, small boys to the left, at the front, at the back, and on top of you. A hail of questions of various degrees of intelligibility, and at the bottom of a dark pit with every vestige of daylight excluded by an overhanging wall of small boys, the perspiring amateur was getting up steam. Phew! Personally, I like the East End small boy; he is a keen critic, he will casually inquire:—"What's it go by, mister?" and getting no answer—as is sometimes the case—he will turn to his mate with a world of contempt in the ejaculation:—"Busted!" If you are lucky enough to win his admiration though, it is something to have. He will half kill his mate in a tussle to obtain the privilege of holding your boat still, and when she shoots away down the lake leaving a bouquet of foam behind her, he will look at you with absolute awe in those expressive eyes of his, and say—nothing! which is a great deal for an East End small boy. This request for special privileges was granted by the authorities, largely on the recommendation of Mr. C. Morman, the genial superintendent of Victoria Park—a gentleman who has won the esteem of all who are acquainted with his work, by his brilliant handling of what must be the most difficult park in England to manage. He was quick to see that the model steamboats added one more attraction to his park, for be it known that we get an entirely different crowd of spectators at other times than bathing days.

Sunday morning during the summer presents a different picture at the lake side. Victoria Park is not without natural beauties, and some of its views are really fine. It is not to be wondered at, then, that the wall of small boys on Saturday afternoon is changed on Sunday morning to a wall of charming young ladies. The members do not seem to mind this somehow, although it takes a little longer to get up steam. The privileges allowed us include a small enclosure—private to the members—and the use of part of a rustic building that had not been doing anything in particular before. This, fitted up with twenty-one lockers, constitutes the boat-house. We are sadly out-growing our accommodation, however, and it is hoped that the authorities will grant us a small extension.

The Club, at present, consists of about thirty members, owning a fleet of about the same number of vessels of all sizes and descriptions, from a fine model of the Steam Navigation Company's paddle steamer *Eagle*, 8 ft. 6 ins. long, and complete in every detail, down to an attempt to model *Yarrow Napier*. The members themselves are quite as cosmopolitan as the models. We have city men and labourers, business gentlemen, mechanics, and an actor.

The rules of the Club are simple in character. The subscription was fixed at a merely nominal figure (1s. per quarter), in order not to exclude the class of modeller whom the Club was especially intended to benefit, *i.e.*, the working man. The working man is not always a creature of libation and lassitude; sometimes he turns his attention to model engineering, and then he becomes quite a decent sort of fellow. A special feature of our Club is the indoor meetings. By the kindness of the Rev. Neville Dundas, the Vicar of Holy Trinity, Stepney, whom the Club boasts of as an honorary member, we are allowed the use of a class-room for these meetings, and very instructive and enjoyable they have proved. They were inaugurated by our indefatigable president, Mr. James C. Crebbin, who began by showing us the possibilities of the best work in model locomotives and encouraging us to go and do likewise with model boats.



MR. E. V. PIKE'S MODEL STEAMBOAT.

It is my purpose in this article to set forth in detail some of the novelties that have been produced under these conditions, but first a word as to the lake and the racing. The Victoria Park Bathing Lake was specially rebuilt for the purpose its name implies, and a very fine washing basin it is, measuring 300 yds. in length and 39 yds. in width. The bottom is concreted throughout, the depth of water varying from about 18 inches at the edge to 6 ft. 6 ins. in the centre. A granolithic paving surrounds the lake, fringed at the water's edge by a ledge of stone. From a model steamer owner's point of view the lake is marred by four very inconvenient diving platforms and a partly submerged chain dividing the lake in two portions. These obstructions have caused more wrecks and profanity than I care to remember. A 300 yds. run in one lap is almost an impossibility, and the trouble of bringing a fast boat of anything like large proportions to a dead stop at the edge is a bit of a nuisance, as we are not allowed to get in the water out of bathing hours. As a consequence of the several disabilities we labour under, the small boat is coming into favour among the members. We have at present some half-dozen boats built to the measurement of one metre over all, and I have hopes that we shall have a lot more. It is really surprising that more marine modellers do not go in for these little "terriers." You get twice the fun out of them with a quarter the trouble. I cannot say that the racing has been a success up to now, although we have witnessed some fine impromptu contests hastily arranged, when two well-matched boats happened to have steam up together. But model steamers are vastly different

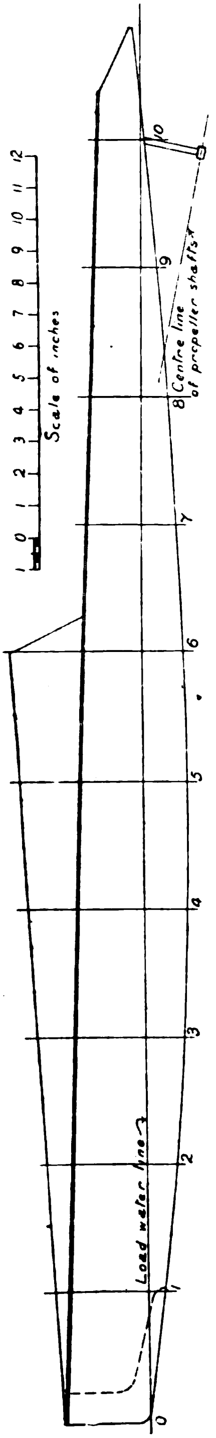


Fig. 1.—Sheer Plan.

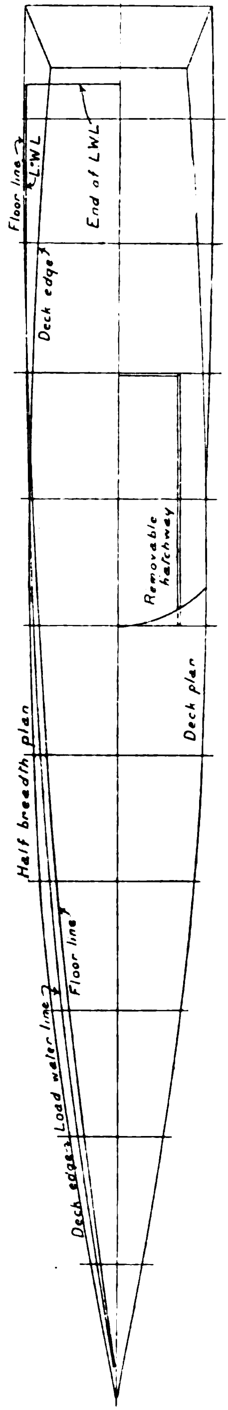


Fig. 2.—Deck Plan

Mr. E. V. Pike's Model Steamboat.

to their white-winged cousins. When half-a-dozen steamers nose the line and get the word to go, it does not follow that they do go. One competitor will beg for a few seconds' respite, as his lamp is not burning right; another will clamour to hurry up, as his water is getting low; a small boat fired with methylated spirit will obligingly cancel its entry by catching fire, and when they do get away—well! I advise all who are getting up races for low-powered model steamers to make the finishing line in the form of an arc with the starting point as centre, the radius the length of course decided on. Even then some of them will elude you by returning to their moorings. It is rather superfluous to say that there is a crying need for an efficient automatic steering gear for model steamers. The "Carpenter's Mate" has been credited with a small measure of skill in solving mechanical riddles, but his credit falls to the ground over the automatic steering gear for steamers. Here is a splendid chance for the readers of The Model Engineer to get ahead of him, and mark an epoch in model marine engineering. And now for the models. If I attempted to describe in detail all the boats belonging to the Club, there would probably be an order from the bridge to "shut off steam" and "stop the leaks," so I must content myself with describing the

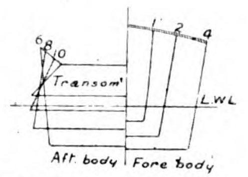


Fig. 3.—Body Plan.

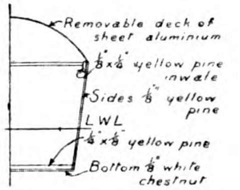


Fig. 4.—Half Section.

most interesting items. Mr. E. V. Pike is our newest member, and his popularity is assured by his laudable efforts to try something new. The accompanying photograph gives some idea of the arrangement of the machinery, and the drawings of the hull will make its peculiar shape clear. It may best be described as "sharpie" from the stem to the midship section, and from that point to the stern a punt upside down. She travels very cleanly, and pretty fast for her size. The engine is placed horizontally in the boat and drives the starboard shaft direct through a spring coupling. The port shaft gets its motion from a gear wheel on the engine bedplate transmitted also through a spring coupling. The feed pump is directly opposed to the cylinder, the ram being in line with and attached to the piston rod. It delivers through a small coil of tubing placed in a closed box in which the exhaust steam circulates and it keeps a constant level of water in the boiler. Readers will recognise the design of boiler, which is taken from The Model Engineer handbook on "Model Boilers." I must confess I was surprised at the efficiency of this boiler. I had admired the design before, but did not think it would be a success if reduced in size. The one under notice, however, will raise dry steam in two minutes, and maintain, as near as can be estimated, between 600 and 800 r.p.m. on the engine. The boiler is fired by a small blow pump, giving a flame about 7 ins. long by $\frac{3}{4}$ in. diameter. The total weight of the boat is only $9\frac{1}{4}$ lbs.

(*To be continued.*)

Planing and Shaping for Amateurs.

By A.W.M.

I.—Introduction.

THE work done by planing and shaping machines is the same in each case, and principally consists in the production of flat surfaces. Yet the two kinds of machine are quite different in design and method of operation. The planing machine is an instance of the idea of fixing the cutting tool and moving the work to meet it. The shaping machine is an instance of the converse idea, namely fixing the work and giving movement to the cutting tool. Both machines accomplish their work by the copying principle—that is, the cutting tool produces a copy of some part of the machine. The planing machine imparts a copy of the surfaces of the slides upon which the table moves to all cuts made by the tool in a longitudinal direction and a copy of the cross and vertical slides to all cuts made in a transverse or perpendicular direction. The shaping machine imparts a copy of the surfaces of the slides upon which the tool moves to the cuts made longitudinally and transversely and of its vertical tool slide as well to cuts made vertically. If these surfaces which are copied by the tool during its cutting action are not truly flat, the planed surface produced on the work will not be true. The irregularities of the machine slide surfaces will, in fact, be reproduced upon the work. To produce accurate planed surfaces, therefore, the first condition is to secure an accurately made machine. When buying a planer or shaper the purchaser should examine the slide surfaces, as upon the condition of these will depend primarily the accuracy of the cuts made by the tool. If these surfaces are found to be hollow or uneven, the machine will not plane flat. This need not

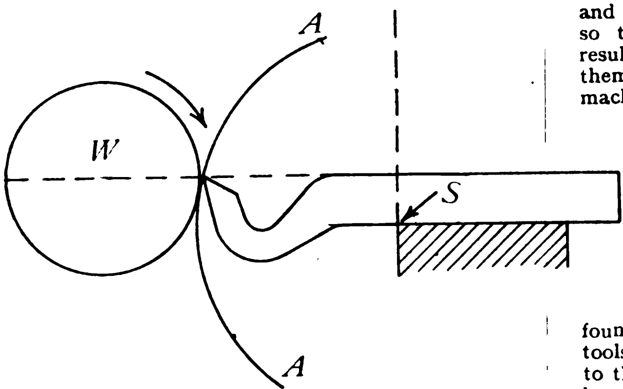


Fig. 1.

mean that the machine is useless because, the irregularity upon the surfaces produced may not amount to much; if the surfaces are small it is possible and not unusual to correct the irregularities by means of a file or scraper (see The Model Engineer for March 10th, 1904, page 221), but the fewer these irregularities are the less will be the supplementary correction required. Therefore, try to obtain an accurate machine if possible. A great deal of planing is done which seems to have come from machines whose operators have been instructed to "just knock the lumps off" as the workshop phrase goes. In factories where cost of machining is brought very low and for certain classes of work a single cut over the surface may be made to suffice. The writer graduated in a factory where planing was carried to a fine art, pieces being planed to gauges and fitted

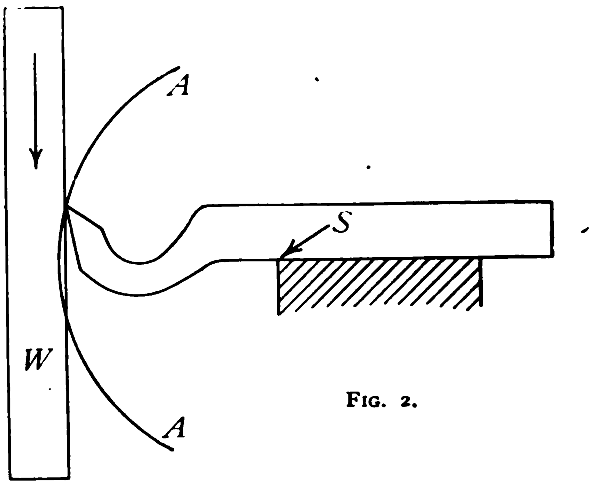


Fig. 2.

into place with little or no scraping adjustment at all. Wrought-iron surfaces left the tool in a polished condition and would scarcely show the mark of the cut taken by the tool. The amateur, to whom cost of production is secondary and pleasure in doing the work of primary place, may find as great a delight in manipulating a planer or shaper as turning with his lathe. There is an art in planing a true and well-polished surface and much scope for ingenuity in fixing the work so that it can be manipulated with successful results. But take care of your fingers. Keep them away from the work or slides whilst the machine is in motion, and never clear away the shavings from the point of the tool except with a brush or something that you can spare if accidentally crushed or torn. Owing to the reciprocating movement of the work or tool, it is very easy to get your fingers caught between some projecting part and the cutting edge. There is often a temptation to touch the shavings whilst inspecting the surface as it is produced by the tool.

The machine should be fixed upon a firm foundation so that it can work steadily and the cutting tools made to correct shapes. These are similar to the tools used for lathes—in fact, lathe tools can be used for planing work, but the proper tools will give the best results. A lathe tool is used to cut material which is moving continually in one direction, and which, therefore, always moves in a direction from the point of the tool towards the back. With a planer or shaper, however, the relation of movement between the tool and the work is reversed at the conclusion of each cutting stroke. At each non-cutting stroke, therefore, the movement is in a direction from the back of the tool towards its point. Any rubbing which may then take place between the work and the tool will tend to break off the point. In order to relieve this effect the tool-holders of planers and shapers are provided with a hinge arranged so that whilst the tool cannot swing backwards from the vertical line it can do so forwards. It will thus trail lightly over the surface of the work when the movement is from back to front and the point is preserved. Some machines are provided with a movement to open the hinge forward and lift the tool clear of the work when the non-cutting, or return stroke, as it is called, takes place; careful operators sometimes do this by hand when desirous of producing a very good surface. Under certain circumstances the tool must, however, be rigidly fixed, and this hinge movement cannot be used. It is necessary then for the operator to lock the tool-holder by some convenient means so that the hinge cannot open.

To economise the time taken up by the non-cutting stroke, planing and shaping machines are usually provided with a mechanism which increases the travel speed of the work or tool during this idle stroke as compared with the speed when the tool is cutting. It is called a quick return motion and is almost universal for single-cutting machines, as they are called—that is machines in which the tool only cuts during each alternate stroke or travel. To eliminate the idle time

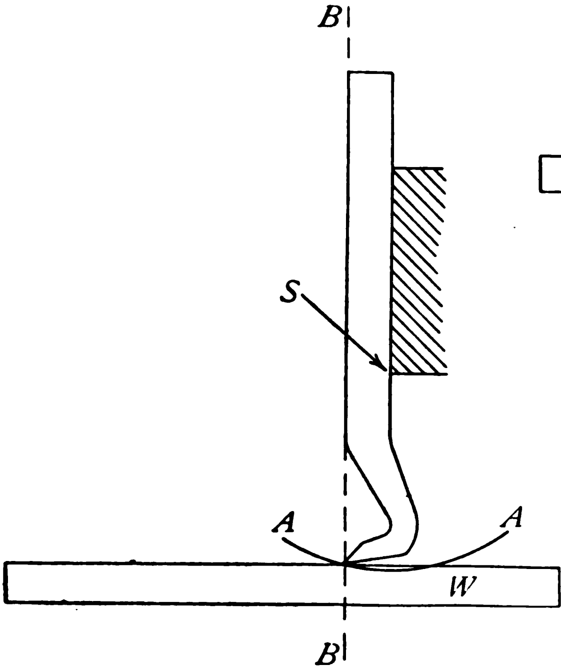


FIG. 3.

altogether, some machines are made to cut at each stroke or travel—they are called double-cutting machines. This method is used in the famous one introduced by Sir Joseph Whitworth: the tool is carried in a holder which can rotate horizontally through 180 degs.; by means of suitable gearing the tool is rotated by this amount at the end of each stroke and its point, therefore, presented in one direction and then in the reverse, so that it cuts during each stroke. The arrangement has received the name of "Jim Crow" tool-holder:

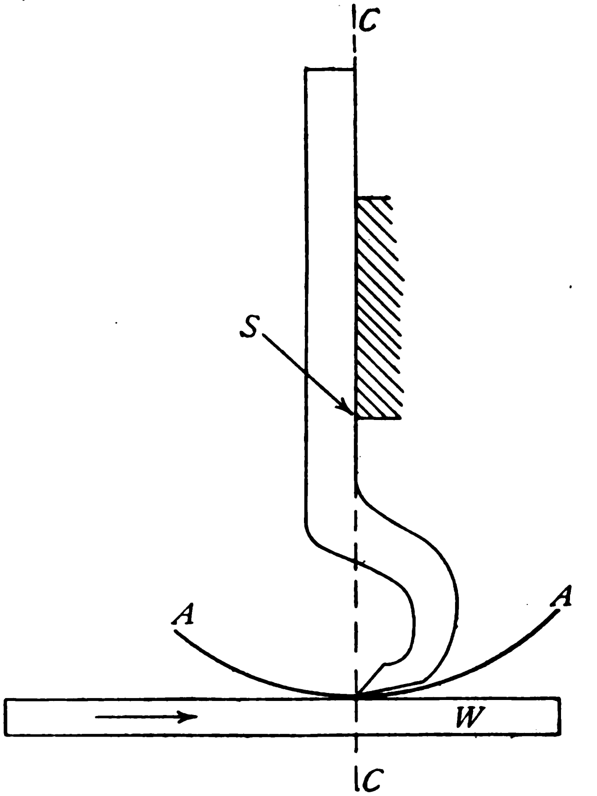


FIG. 4.

presumably it acts like a personage of that name described in an old comic song, as it "turns about." Another method is to use two tools, one pointing each way and fixed in separate tool holders; the third method is to use a double-pointed-tool fixed in a holder which is tilted automatically so that one or the other point is brought into action according to the direction in which the work is travelling. Double-cutting is not usually applied to shaping machines; the speed of travel must, of course, be the same in each direction. Small machines are generally single-cutting and the planers likely to be used in amateurs' workshops are frequently so designed that they are practically equivalent to shaping machines. Whilst both planers and shapers produce the same kind of surface, the planer came into being for the production of comparatively large flat surfaces and the shaper to produce comparatively numerous small flat and curved surfaces. As time progressed the two types have become merged together to some extent, and there are in use machines—called side-planers, wall or vertical planers, and so on—in which the tool moves and the work is fixed. These machines, however, are usually of very large size and are more suitably called planers, because a shaping machine is the idea of a mechanic's arm and file driven by engine power. James Nasmyth, the inventor of the steam hammer, was one of the first men to design and construct shaping machines, with the idea of creating a machine arm which could go on working all day without becoming tired and produce an even quality of work. One of the first planing machines originated in London early in the last century. The table (or platen, as it also called) moved upon wide rollers made and set with great accuracy; it was easier at that time to produce a large accurate straight surface by turning, the lathe and slide-rest being in existence; but lengths of flat surface were produced by hammer and chisel and filing. The term "chipping strip," which is even now in use, applied to the seatings for bearings, etc., was in fact at that time an accurate name, as the strip of metal was designed to enable a true seating to be cheaply produced by chipping with hammer and chisel. The old-time fitter would chip over these strips with such skill that little filing was needed to ensure a straight smooth surface. Now the planer or shaper produces the same result in much less time; but just as a gun depends upon the man behind it for good shooting so does the machine depend upon the operator, and if he is not skilled in his art the work produced may be inferior to that of the mechanic with his hammer, chisel and file.

Fig. 1 is a diagram of a lathe tool turning a cylindrical shaft. It is usual with lathe tools to make them so that the point or highest surface of the cutting edge is level with the top of the shank of the tool, as indicated. If any springing occurs during cutting, the point or leading edge moves on the arc of a circle A A, whose centre is the nearest point of support S. As the work W being cut is circular, the cutting edge of the tool will not tend so much to dig into the cut as to move out of it; when the bending takes place, due to the pressure of the metal against the edge, the tool tends to relieve itself. If, however, the tool is cutting upon a flat surface, as when facing a disc held in a chuck (see Fig. 2), the point does not tend to clear itself, but to dig in as shown by the arc A, and increase the pressure because the depth of cut will increase. If such a lathe tool is used in a planer or shaper, it will be operating under the latter condition (see Fig. 3) and will be constantly tending to dig into the work, and therefore to impair the accuracy of the surface produced. If the cutting edge is brought in front of the line B B, this effect will be increased.

If the tool is made so that its cutting edge is behind the line B B, the effect will decrease. Planer and shaper tools are, therefore, preferably to be made with their cutting edges level with the under part of the shank so that the cutting action takes place on the line C C, Fig. 4. If any springing occurs, the tool point then moves over the arc A and clears itself rather than dig in. Many planer and shaper tools are made and used which merely consist of straight bars of steel having cutting edges ground or otherwise shaped at the end. Various patterns of cutter bars or tool-holders also quite ignore this idea of placing the cutting edge at the line C C, Fig. 4. It is, however, the correct principle to adopt when the tools are specially intended for planing and shaping machines, but it is not essential.

(*To be continued.*)

Holders for Flashlight Lamps.

By "ORLANDO."

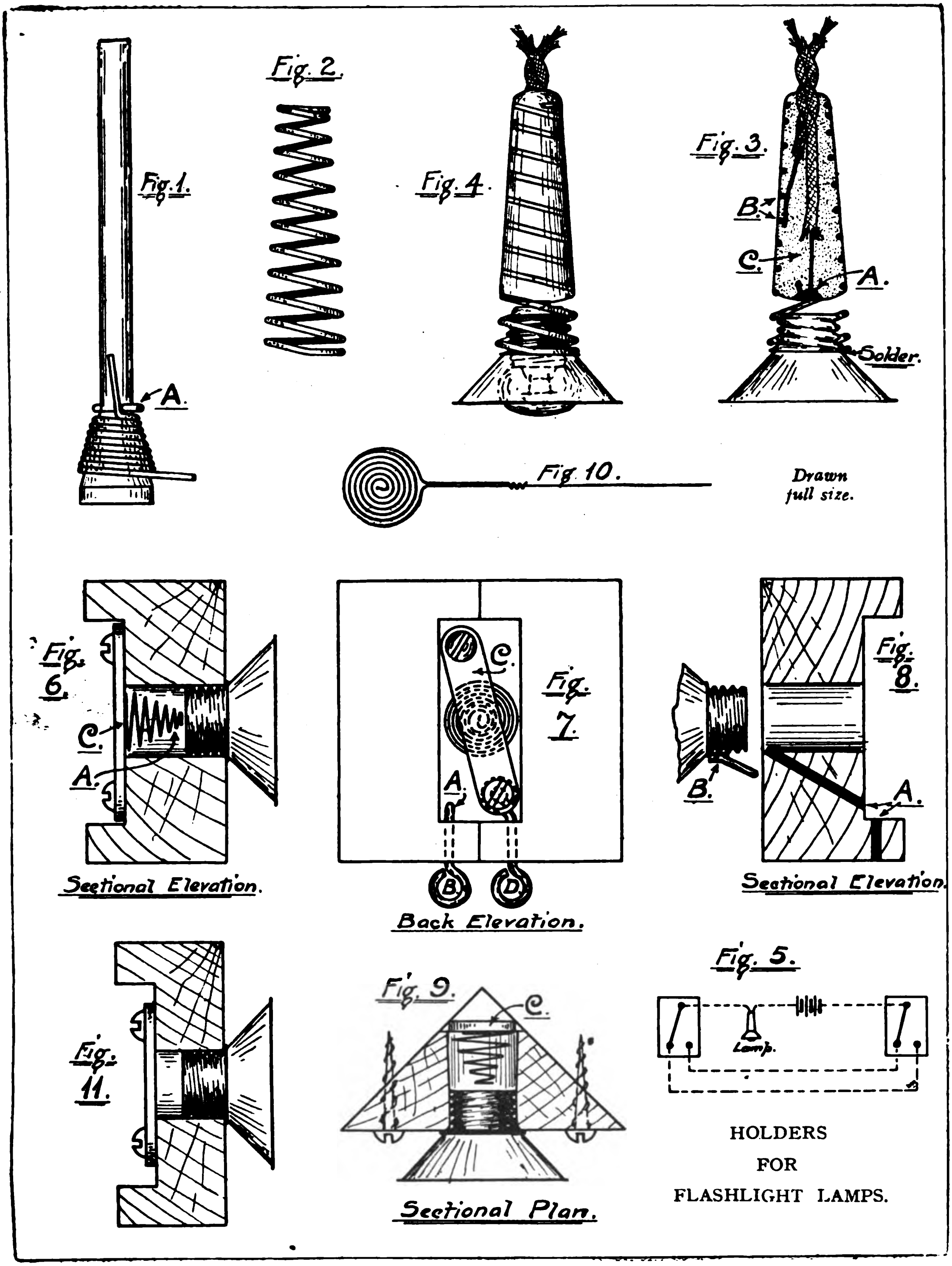
THE lamps used in pocket flashlights, being small and neat, are in many cases preferable to the usual bayonet catch lamp, and, having no loops to break off, they have an advantage over the loop lamp, and are more economical in every way. As there do not seem to be any holders or pendants on the market for these, perhaps a few hints as to making them would not be amiss. I have had several home-made ones in use for some time, and these I will describe, the first being a hanging one.

Fig. 1 shows a round piece of wood with one end made taper or conical, on which is to be made the spring shown in Fig. 2. The wire used is about 21 B.W.G. if of steel, but should be about 19 or 20 B.W.G. if of brass. A small length of wire will be noticed which goes through the wood at the small end of the cone (A, Fig. 1), and this is to hold the spring while winding. When the spring is wound, this wire peg is removed, thereby enabling the spring to be drawn off the wood.

The next step is to get a lamp, also the socket which it screws into, and the reflector which will be found ready soldered to the socket. A dealer generally has a few of these by him, which have come out of old pocket lights, and these can be obtained for a very small sum; but if not, a complete pocket light can be obtained for about 10d., including the lamp. Lamps bought separate cost about 5d. or 6d. Having got these, push the socket into the large end of the spring and solder neatly about ¼ in. of the first coil to the socket. Take the flexible wire by which the lamp is to hang, remove the covering at one of the ends, twist the wire threads together to make them as solid as possible, and turn the end over in the form of a hook. Put this hook with the points *upward* on a flat surface and fix a little solder to the bend (This is shown at A, Fig. 3). Then uncover the end of the other wire, make it a little shorter than the first one, and solder it to the inside of two of the coils as shown at B, Fig. 3. Place the first-named wire in the centre of the spring, and see that the hooked end is *not* further from the lamp socket than shown; the object of this is so that the spring will be slightly in tension when the lamp is screwed home and thereby making good contact.

Mix some plaster-of-Paris with water and let it be a fairly thick paste, and fill the interior of spring with it, by pushing through between the coils, (C, Fig. 3). Do not be afraid of leaving some on the outside of the spring; in fact, cover it entirely up to the soldered hook and leave it to set. When set, file off the surplus plaster level with the outside of the spring, give a coat or two of enamel, and you have the finished article (Fig. 4). I have had one of these fixed in the stairs for some time, with a switch at the top and another at the bottom of the stairs; and the wires are arranged as shown in Fig. 5. This arrangement enables the light to be switched on or off, from either switch, whatever position they are in.

The next holder is made to fix on a wall or in a cupboard, etc. Cut a piece of wood as shown in Figs. 6, 7, 8, and 9, and bore the holes shown in black (A, Figs. 7 and 8) for the wire. Solder a wire (B, Fig. 8) to the lamp-socket, thread



HOLDERS
FOR
FLASHLIGHT LAMPS.

it through the holes and push the socket into its place in the wood, fixing it there with seccotine. Then form a loop on the wire as at B (Fig. 7). Obtain from a tobacconists the article shown in Fig. 10, which is used for tobacco pipes, price one penny, and consists of two spiral springs; cut the straight portions off and pull out the centre so that is stands out as shown at A (Fig. 6); solder the outer coil of one of these springs to the strip of brass shown at C (Figs. 6, 7, and 9) and fix the brass to the wood with a couple of screws. Before tightening the lower screw, take a piece of wire, give it a turn round the screw, then tighten. Form a loop (D, Fig. 7) at the other end of the wire. These loops are the terminals.

If required, the small spiral spring may be dispensed with (Fig. 11), but is not so good a job as it does not allow the lamp to be screwed as far into the socket.

No dimensions are required as the drawings (with the exception of the diagram Fig. 5) are full size.

For the Bookshelf.

THE ELEMENTS OF ELECTRIC TRACTION FOR MOTORMEN AND OTHERS. By L. W. Grant. London and New York: Harper & Bros. Price 5s., postage 4d.

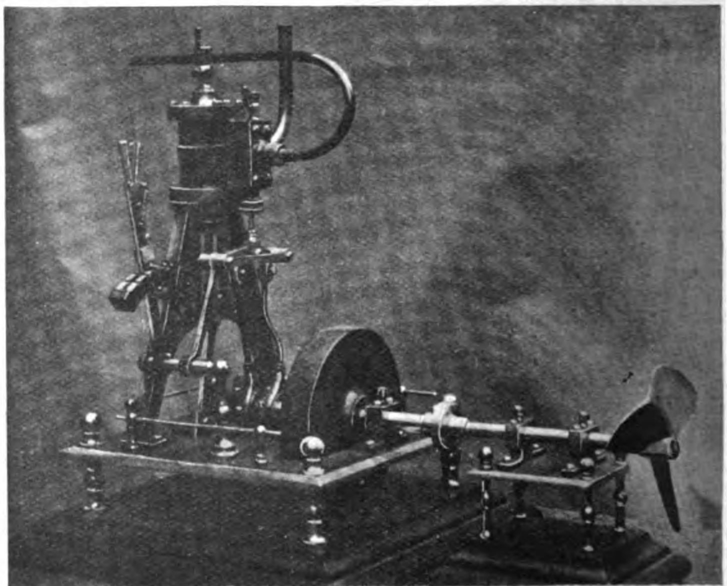
To the student of electric traction this volume may be recommended as a most useful and complete guide to the elements of this subject. Although the tendency, and indeed the practice, now-a-days is to specialise, which results sometimes in the exclusion of matter only *bearing* upon the subject, the author has in this case succeeded in a marked degree in making this work as nearly complete in itself as is possible in a volume of 217 pages. To successfully weave into one mass all that information and data which bears upon electric traction without omitting much that should be included, or incorporating anything that is superfluous, is a task which requires the skill of a real teacher and a trained and experienced engineer. The author has shown himself to be equal to his undertaking in producing a work which is neither stunted nor over-elaborated in any direction.

Chapter I is a readable Introduction, and Chapters II to V deal with the principles of magnetism and electricity, the dynamo and continuous current motors, and Chapter VI concerns Power measurements. The two following chapters are worthy of particular notice as they go very thoroughly into the subject of the "Mechanics of Traction" and the "Characteristic Properties of Continuous Current Motors." The last two chapters are devoted to a consideration of the "Application of Motors to Traction" and "Brakes"—mechanical, electrical, and magnetic. In conclusion, we can heartily recommend this work to the notice of every student of the subject.

A Model Launch Engine, made Twenty Years Ago.

By J. W. BARTON.

THIS model launch engine was made entirely on a home-made lathe without slide-rest, with the exception of the boring of the cylinder. The design was my own, but no drawings were made, so I had some difficulties to contend with. The patterns were not very difficult, but when it came to the moulding and casting it was quite different. A number of cylinders were cast before a perfect one was turned out. After getting the cylinder bored, I turned up a hardwood mandrel and fitted cylinder a driving fit, and so turned flanges. The covers and glands were all turned the same way (on steel mandrels), as by doing so I got all holes exactly in centre. The cylinder is 1½-in. bore, 2-in. stroke; piston is packed with cotton; the piston-rod is 5-16ths in. diameter; crankshaft, ½ in. diameter (built up); valve rod, 3-16ths in. diameter. Columns under bedplate were made from castings; grease cocks and lubricators from G.M. rod; link motion and reversing lever all of steel. These I found the most difficult job of all, having no drawings. As originally made it was fitted with a smaller wheel; but with a larger wheel and by disconnecting coupling it is handy for driving models. Another tedious job was the making of the nuts, studs, and bolts. When this model was made nearly twenty years ago, these accessories could not be bought so cheaply as to-day.



MR. J. W. BARTON'S MODEL LAUNCH ENGINE.

A CORRECTION.—On page 146 in the issue of February 14th, in the description of a "Bradbury" capstan lathe, 3-in. straight beds, should, of course read, 3-ft.

Locomotive Notes.

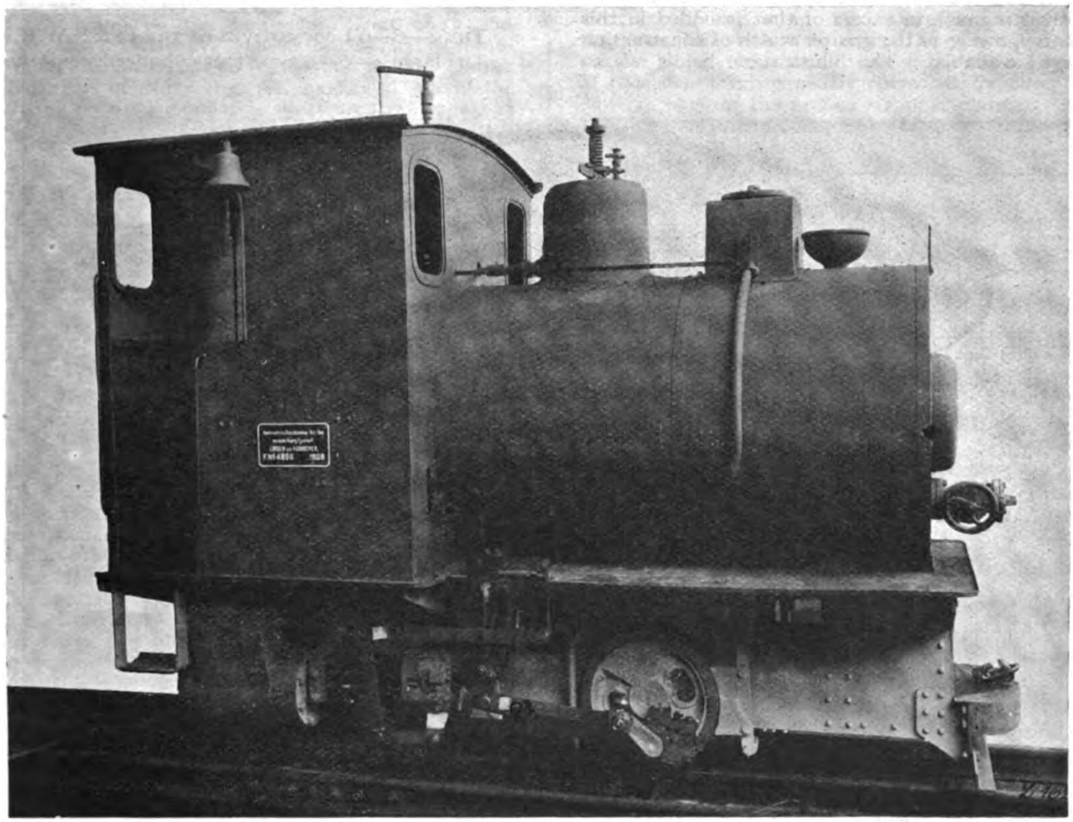
By Chas. S. Lake, A.M.I.Mech.E.

Compressed Air Locomotives.

Locomotives operated by means of compressed air are largely employed in some countries for working underground, and particularly where overhead space is a consideration and absolute freedom from fire and sparks is compulsory. In mines and about chemical or gas works, large warehouses, etc., these curious-looking engines are invaluable, and as they can be worked very economically, they serve the special requirements of such places as those mentioned above to the full. The place of the boiler in an ordinary locomotive is taken by a cylindrical storage tank mounted above and supported by two frames in the ordinary manner. The cylinders and other parts of the engine are arranged much as usual, the wheels being coupled together by side rods and valve and reversing gears being applied as is customary in steam locomotives. For underground purposes the air is compressed by stationary plant above ground, and is conveyed through specially strong piping to the head of the shaft and thence to the charging stations below.

The locomotives come to these stations to have their tanks charged in the same way as ordinary locomotives have to go to the coaling stage for a supply of fuel, and to the water crane for water. The charging operation is very quickly performed, occupying from one to two minutes, according to the size of the locomotive tank.

The latter is fitted with safety valves, and a sandbox is also mounted upon it. The compressed air passes from the tank to the cylinders through a reducing valve, and is controlled by a regulator valve with handle in the cab, as in the ordinary arrangement for controlling the supply of steam to the cylinders in steam locomotives.



A Compressed Air Locomotive for Work in Mines.

A good example of compressed air locomotive practice is illustrated on this page. The engine, one of several, was built late in 1906, by the Hannover'sche Maschinenbau Aktiengesellschaft for working in mines. It has outside cylinders and four coupled wheels. The air distribution to the cylinders is performed by slide valves actuated by Walschaerts' valve-gearing in a modified form. The footplate is provided with a commodious cab and roofing and a whistle and bell are fitted as seen in the photograph.

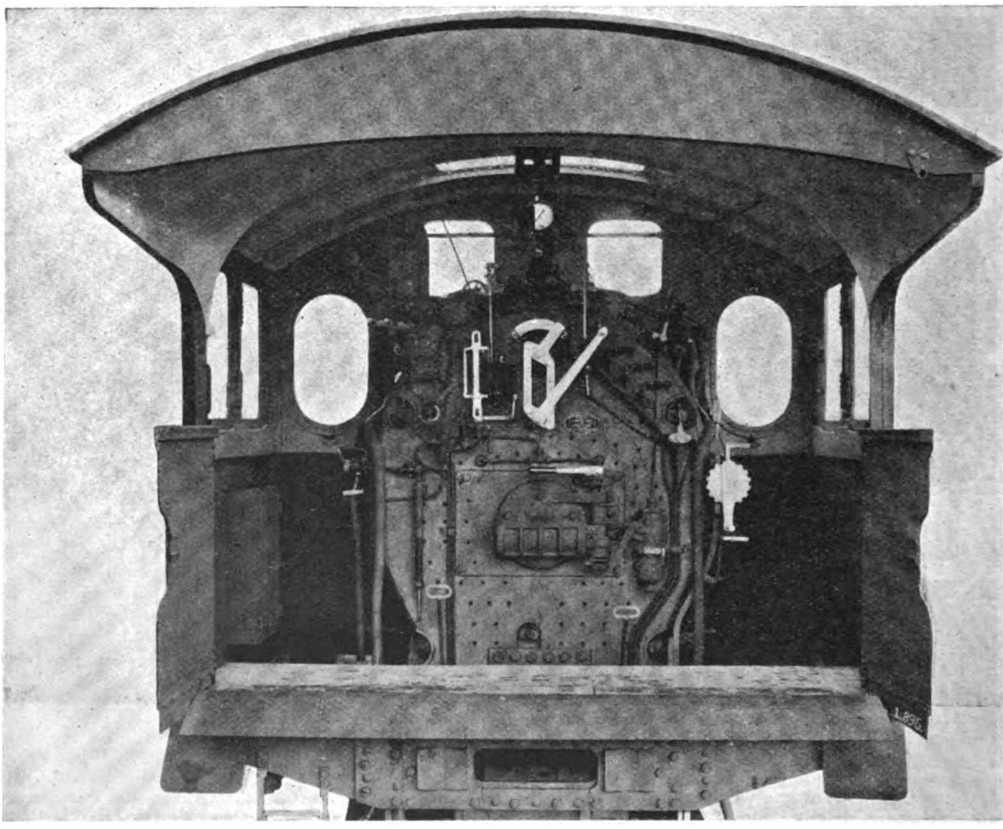
The storage tank is of large capacity, and upon it are mounted a dome and sand-box. The leading dimensions are as follows:—

Cylinders, 9½ ins. diameter.
Piston stroke, 16 ins.
Wheels, diameter 32 ins.
Wheelbase, 4 ft.
Weight in working order, 7½ tons.
Gauge, 2 ft.
Horse-power, 20.
Mean tractive power, 1,540 lbs.

German Locomotive Cabs.

The cab space in the majority of German locomotives is much in excess of that provided in this country, owing to the greater width of construction gauge available. The illustration below shows the interior of the cab and the footplate of one of a new series of eight-wheels-coupled (0—8—0) type goods locomotives just completed for the Prussian State Railways. It will be noticed that the regulator handle, or starting lever is attached, not directly to the end of the rod which actuates the regulator valve, but to a stem placed lower down, the two being connected by links engaging with cross pieces on the respective stems. The usual sector is provided and a tail piece off the regulator stem works in this, taking the place of the lever at this point. The idea of this arrangement is doubtless that of rendering the regulator handle more easily accessible to the driver.

The method adopted for opening and closing the firedoor appears to be a good one. The door is hinged at the side and to the top of the pin or rod of the hinge is affixed a handle, by moving which stops are made to engage and the door thus opened and regulated in any position. A very ample window space is provided, and doors opening out to give access from the cab to the running board outside are arranged one on each side of the firebox.



View of Cab Interior of New 0—8—0 Type Goods Locomotive: Prussian State Railways.

The 4—6—0 Locomotives of the L. & S.W.R.

The large 4—6—0 type four-cylinder locomotives designed by Mr. D. Drummond for the L. & S.W.R., and built at Nine Elms Works, at the end of 1905, have during the past winter been working fast goods trains between Salisbury and Exeter and *vice versa*. Five more engines of the same general type are now building at Nine Elms. These newcomers will, however, have four 16½-in. by 26-in. cylinders instead of the 16-in. by 24-in. cylinders of No. 330 and her sister locomotives.

New Locomotives for the Midland Railway.

There has just been completed at the Derby works of the Midland Railway a tank locomotive of a new type, which will, with others of the same design, be employed on heavy suburban passenger and other traffic on the main line. The wheel arrangement is 0—6—4—that is to say, there are six coupled wheels, followed by a trailing four-wheeled bogie under the footplate and bunker. The cylinders are placed inside the frames, and Walschaerts' valve-gearing is used for actuating the slide valves. On only two other English railways has this type of locomotive been employed—viz., on the Wirral, by the late locomotive superintendent, Mr. Eric Barker; and on the Lancashire, Derbyshire and East Coast Railway. These last-named locomotives were illustrated and described in The Model Engineer of November 1st, 1906, and one of the Wirral 0—6—4 engines is illustrated on page 123 of "The World's Locomotives." The four-wheeled bogie permits of a much larger coal capacity for the bunker, and the six coupled wheels allow of a greater proportion of the total weight being employed for adhesion.

A Design for a Small Model Undertype Engine.

By Henry Greenly.

(*Continued from page* 350.)

II.—The Bedplate and Bearings.

As a rule, in actual practice the bedplates or main frames of engines of the type we are modelling are built up of separate pieces, the main longitudinal members consisting of two channel bars. The cylinders are fitted between these girders at one end and a large casting, forming the ashpan, taking the weight of the firebox at the other. The bearings are attached to the top flanges of the channel bars, and the motion-plate gives the whole structure lateral stiffness in the centre.

Although channel bars of small section (in brass) are obtainable, the system of construction does not altogether recommend itself to the model-maker. It is much better to have a cast-iron bedplate complete from end to end in one piece. Such a bedplate provides a rigid and lineable basis for the machinery.

The bedplate shown in Figs. 2 and 3 is arranged so that the pattern can be made without core-boxes, although if the builder decides to have the doorway on the end of the "ashpan" cast in, he must provide a core-print and box for this opening. The core-print should come right up to the parting line, which will mean that an L-shape core will have to be provided.

The casting obtained, the whole of the machining of the top surfaces of the bedplate should if possible be done at one setting. Personally, the writer would advise a cut over the bottom edges first, this depending upon whether the casting really requires it, taking care that in bolting down the bedplate on the shaper or planing machine table the work is not sprung out of shape. If after the edges are planed, it is taken off and examination shows that there is a slight curvature due to the springing of the work, do not bother to reset and replace; but in setting the work on the table for planing the top surfaces, pack up with paper or very thin sheet metal the parts which are hollow, and do not naturally bed themselves on the table. When the bolts are tightened down, the top surfaces (the important ones) will, by this means, not be curved in a corresponding degree to those at bottom.

In cases where the machine tool is not large enough to cover the whole surface without moving the work on the table, the portion to be omitted at the first setting is the top of "ashpan," upon which the firebox will eventually rest. The accuracy of this is not all important, as in boiler work we do not work to millionths of a millimetre, and a slight error would never be noticed, even if it was not subsequently corrected by filing the bottom edge of the firebox wrapper-plate.

Where no machine tool is available, builders of the model will not find the work of filing the various

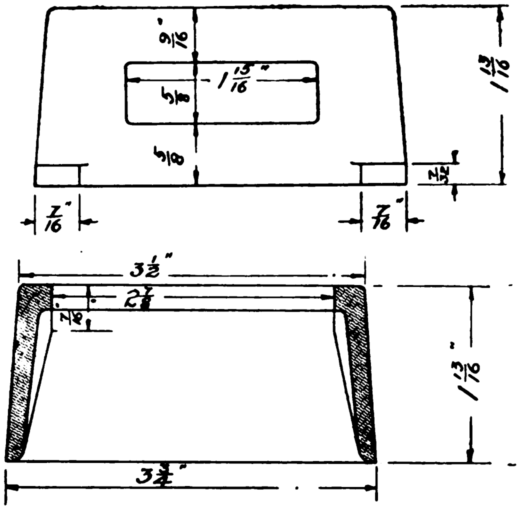


Fig. 3.—End View and Cross-section of Bedplate.

faces upon which finished work rests, or is attached, a very onerous task.

An adjustable gauge, in the shape of a bridge, may be easily made by taking a straight strip or rod of steel about 4½ ins. long, and drilling and tapping two holes—one at each end—in it, and inserting two long screws or pins, with their points projecting downwards.

Such a gauge would supply the necessity for a scribing block, and would accurately test most of the surfaces being filed, if the bedplate is laid on a piece of plate-glass or other level surface during the operation.

Having planed or filed all the facing strips level and true, proceed to line out the centres of the cylinders, slide-bars, and bearings.

The four holes for the cylinder-fixing bolts can be marked off and drilled 5-32nds in. clearing. If drain cocks are going to be used, then a larger hole (say ¼ in.) exactly in the centre of each cylinder may be drilled in the bedplate. The ⅛-in. holes for the slide-bar studs can be marked off, drilled, and tapped.

For the moment, however, the bearing centres and the holes for the studs should be marked out only, and the latter not drilled nor tapped. The same applies to the stud or screw holes which are required for the fixing down of the intermediate valve spindles, exactly at the point where the longitudinal and transverse centre-lines meet (*i.e.*, the centre of the bearing); the writer however, suggests that a ⅛-in. or 5-32nds-in. hole be drilled in each instance. Extreme care should be taken with the marking out, centre-popping, and drilling of these holes, as it is intended to rely to some extent on these holes for the general squareness of the engine and firm fixing of the parts attached.

This brings us to the bearings, which are illustrated to full size in Fig. 4. These bearings may be made entirely of gun-metal, and either studs and nuts or hexagonal-headed screws may be used as the fixing bolts and for the caps. The bearing in the centre must be split, and therefore it is suggested that the same construction be adopted for all three.

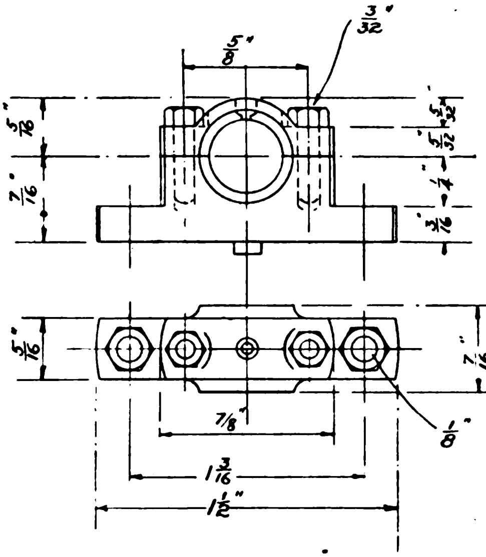


FIG. 4.—BEARINGS.

The first process is to clean the top of the bearings and under side of the cups to as nearly as possible finished size, and then to sweat each of the two parts together with ordinary tinman's soft solder. Mark them out and bore ⅜ in. for the shaft. The next process is to drill and tap for the cap screws and then unsweat, marking the pieces previously. To face the sides of the bearings put them all on a full ⅜-in. mandrel, tightening them in place by the cap screws; face each side and form the projecting fillet. Whilst this is being done, scribe a line with the point of the tool on the spigot on the bottom of the bearing and also the top of the cap where the oil-hole comes. By the use of the change wheels or other means of turning the headstock through an arc of exactly 180 degs., or by a scribing block from the lathe bed, scribe a cross-line so that two points—exactly at 90 degs. to the axis of the journal of the shaft and diametrically opposite to each other—are obtained on the bearing. By centre-popping these and mounting in the lathe, the bottom of the bearing can be faced, also the ends, which are circular, and the spigot on the bottom of the bearing turned to exactly fit the already provided hole in the bedplate. A spigot can also be left on the top of the bearing cap with advantage, and be subsequently turned up in the lathe to form a lubricator.

Such a method—if the work is done carefully—will ensure absolute precision, and when the bearings are finished the fixing-bolt clearing holes can be drilled, and from these holes those in the bedplate may be marked out, drilled, and tapped for the studs or screws.

Where the "ashpan" door opening is not cast in, two or three 9-16ths-in. holes should be drilled in the end of the casting and the opening filed out to finished dimensions.

Do not forget to drill the holes in the holding-down lugs and also to clean the firebox opening to finished size (see plan, Fig. 2). As the type of boiler is one which does not necessitate fitting the bedplate-casting to the boiler—the best and more usual practice where flue-tube generators built up of flanged plates are employed—there is nothing against finishing the bedplate to the stated dimensions at the firebox end. Any slight adjustments can be readily made in the finished boiler.

(*To be continued.*)

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 VISITS.—On Thursday, April 25th, at 2.30, a visit will be made to Robertson's electric lamp works, Brook Green, Hammersmith. The party is limited to twenty, and notification must be given not later than April 22nd.

FUTURE MEETINGS at the Cripplegate Institute, at 7 o'clock: Wednesday, May 1st, short papers by members; Tuesday, May 28th, lecture by the Rev. W. J. Scott, on "Six-Coupled Engines on the Great Western Railway." — Particulars of the Society and forms of application can be obtained from HERBERT G. RIDDLE, hon. secretary, 37, Minard Road, Hither Green, S.E.

Southsea Model Yacht Club.

AN open race for model yachts, promoted by the S.M.Y.C., took place at the Canoe Lake on Good Friday. Fourteen boats participated in the event, and the fleet was sent away in a light breeze before a large concourse of spectators. The contest lasted throughout the day, and terminated in favour of Mr. C. F. Coxen's (Kingston-on-Thames) *Bertha* and Mr. E. G. Burgess's *Sapho* being bracketed equal with a score of 21 points each; Mr. G. Spragg's *Doris* was next with 17 points, the fourth prize being taken by Mr. R. Holbrook's *Surprise* with 16 points. The runners-up were Messrs. Powell, Burgess, junr. (15 each), Messrs. G. Constant, T. Edwards (14 each), Mr. Clive Wilson (13), and Mr. Bignell (10 points). The regatta was a great success.

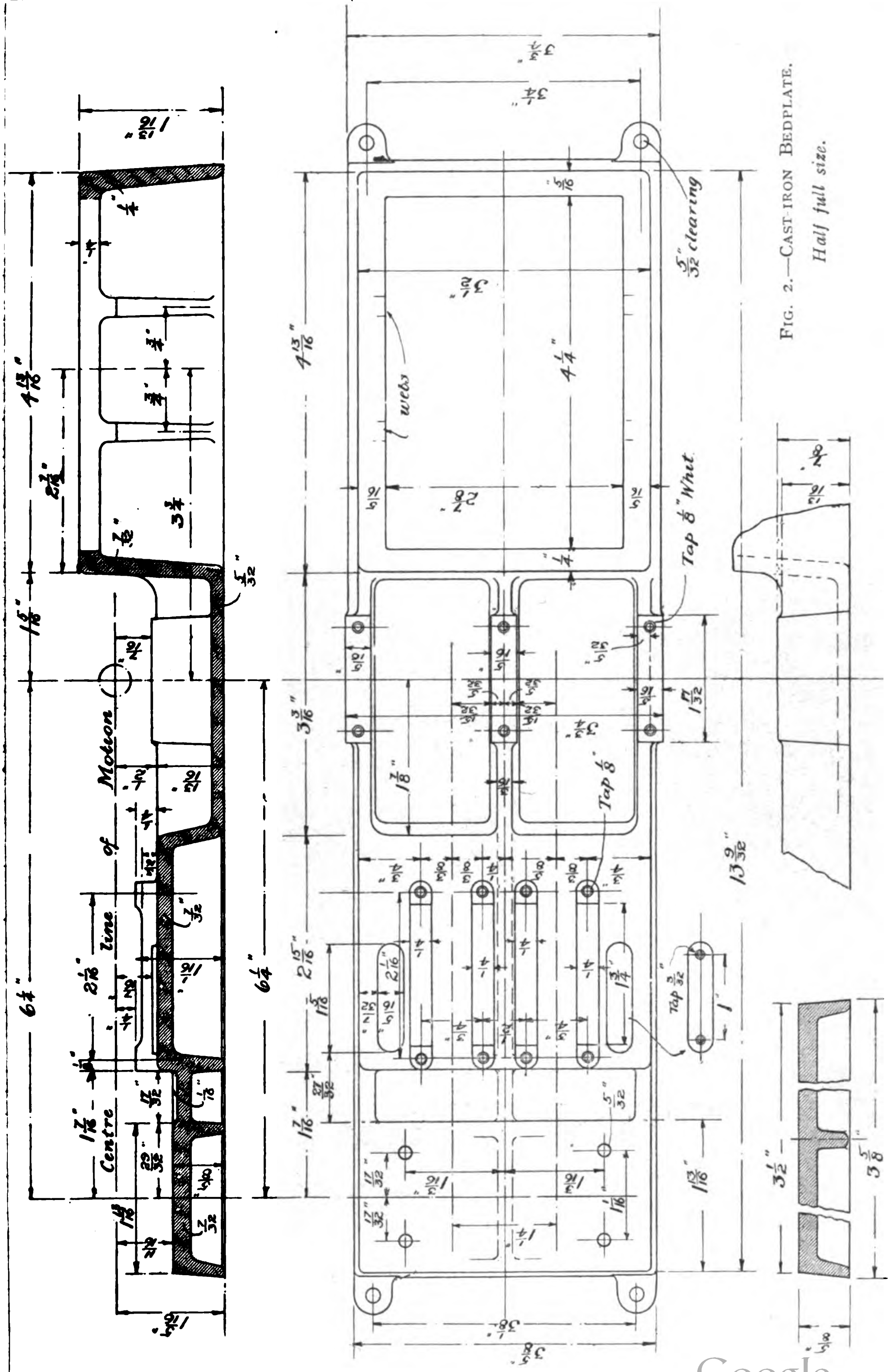


Fig. 2.—Cast-iron Bedplate.
Half full size.

DESIGN FOR SMALL MODEL UNDERTYPE COMPOUND ENGINE AND BOILER.

By Henry Greenly.

Clacton Model Yacht Club.

THE first race of the above Club took place on the water known as the "Saltings" (by kind permission of Philip Smith, Esq.), on Easter Monday. A good number of boats entered for the races, but owing to the unfavourable state of the wind, the mechanical section experienced great difficulty in steering straight (one "steam" boat especially persisted in describing circles). About 400 people witnessed the races. Mr. Bowden secured the silver medal as first prize in the sailing yachts, and Mr. E. Clark gained the silver medal as first prize for the mechanical boats.

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 intended for publication.]

A Prize Winner.

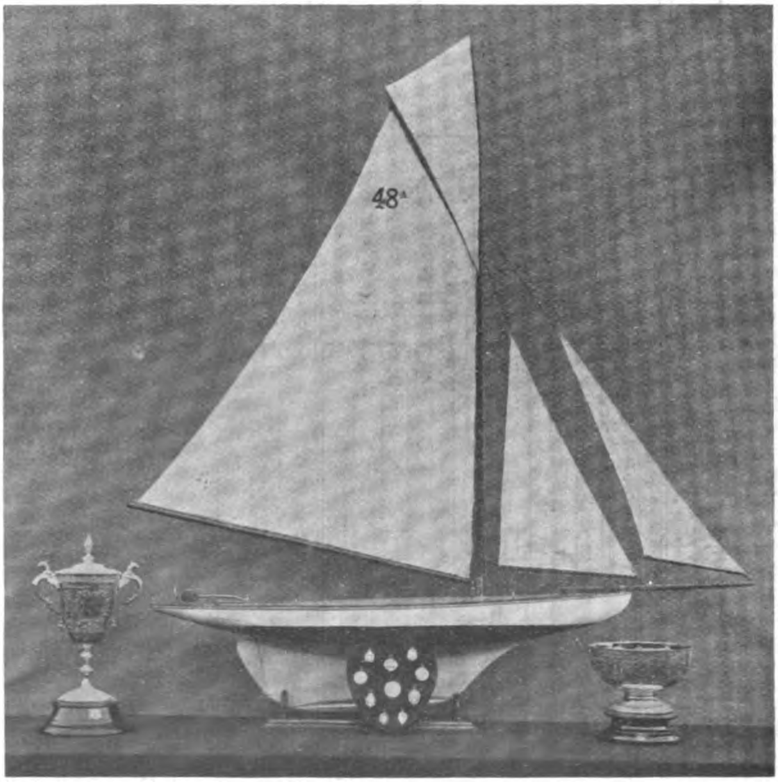
TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The photograph herewith enclosed is of my model sailing yacht *Kena*, and the two cups won by her. The cup on the right of the photograph is the Coronation Cup, and is of solid silver, presented to our club (the Leith Model Yacht Club) by Provost Mackay. The cup on the left of the photograph is the Stewart Cup, presented by a retired merchant in the town.

The dimensions of model are as follows: Length over all, 48½ ins.; L.W.L., 37½ ins.; beam, 9½ ins.; draught, 10 ins.; weight of lead, 12 lbs.

The Provost's Cup has been won three times in succession, and the Stewart Cup twice, and only lost the third time by a few seconds.—Yours truly,

South Leith, Scotland. JAMES NORVAL.



MR. JAMES NORVAL'S MODEL YACHT.

Rating Rules.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Your correspondent, "Wood Waster," in March 29th issue, referring to the new Rating Rule, says: "I do not consider that any arbitrary rule, such as the new rule is, can ever develop the ideal yacht." Believing this to be true, I wrote a few months ago asking if any correspondent would tell us what the objections were to model yachts being rated according to their displacement, or, in other words, their weight. The fact that every floating body displaces its own weight of water seems to point to this as the fairess and most natural way of classifying yachts. At larger yachts cannot be weighed, arithmetical rules are necessary for an approximate estimation of their displacement; but this necessity does not exist in the case of model yachts, and the adoption of arbitrary rules results in the attention of the builder being given more to the evasion of the rules than to the development of the ideal yacht. I hope some of your yachting correspondents will give us their ideas on this subject.—Yours faithfully,

ALBERT WILLAN.
Copmanthorpe.

SAFETY CHAMBER IN MINES.—In providing for the safety of men, some of the larger mines of Austria have prepared a so-called safety chamber underground, which is a strongly constructed retreat having a single entrance with a door that can be made tight against air and water by means of rubber fittings. Each chamber has three cylinders of oxygen, sufficient to enable thirty men to breathe three days. Respiratory apparatus is here at hand for parties leaving the chamber to reconnoitre or signal. In the safety chamber there are foods medicines, and first-aid appliances. The standard room as here built will accommodate twenty-four men for a reasonable time while awaiting rescue.

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 intended for publication.*]

House Lighting by Petrol.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Referring to Mr. B. Barker's petrol gas generator, published in THE MODEL ENGINEER, August 23rd, 1906, I should like to know how long the air supply should last at one pulling up of cistern, as I find, in making mine from instructions in your paper, that with only one light it is down in 20 minutes, although Mr. Barker mentioned drawback in air-chamber. I fail to see any practical use of generator if this is what is to be expected. If I am wrong in the working or making of same, perhaps Mr. Barker will be kind enough to put me right.—Yours truly,

O. HARTLEY.

Bradford, Yorks.

A Chemical Rectifier.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Having observed several enquiries of late in your journal as to the construction of chemical rectifiers, the following particulars of a successful apparatus which I have recently constructed may be of interest to your readers.

I am supplied from the main with an alternating current at 110 volts, 50 periods, single phase, and my apparatus yields a uni-directional current (pulsating, of course) up to 5 amps. for any length of time without over-heating, or as much as 8·9 amps. for a short time. The current is suitable for charging secondary cells, working induction coils, arc lamps, and most other purposes, but will *not* work a mercury vapour lamp.

There are four cells, each consisting of a battery stoneware jar, 10 ins. high by 7 ins. diameter, which are charged to within 1½ ins. of the top with *pure* potass phosphate (saturated solution). The jar tops are of well varnished mahogany, slotted to receive one plate of gas carbon 11 ins. by 6 ins. by ⅜ in., and one plate of aluminium 11 ins. by 6 ins. by No. 10 S.W.G., suspended in the solution in each jar. The method of connecting up the cells, which I have diagrammatically shown, utilizes both phases of the supply.

The three resistance lamps shown are of 2 amps. by 100 volts, each arranged in parallel. When the alternating current is first turned on these lamps light up fully, but dim down in a few minutes, as the cells "polarize" and prevent the alternating current from passing. When the lamps show only a dull red glow, they are cut out of circuit by the switch shown. Direct current can then be drawn from the apparatus at the points shown.

As a precaution against overheating of the electrolyte, I place all four cells in a watertight box about 2 ft. 3 ins. by 2 ft. 3 ins. by 10 ins. deep, charged with water. On no account must the electrolyte be allowed to exceed a temperature of 120° F., or it will be spoilt and the aluminium electrodes damaged.

Each cell is applicable to pressures up to 60 volts, and a set of four to 120 volts; but, of course, the lower the resistance of the D.C. load, the lower the voltage will be. For charging up my nine-cell secondary battery I use a lamp resistance in series with the rectified current and the cells, consisting of three 85-volt by 1·7 amps. lamps in parallel. I then have about 4 amps. at about 26 volts as a charging current.—Yours truly,

W. D. BUCKERIDGE.

West Kensington Park, W.

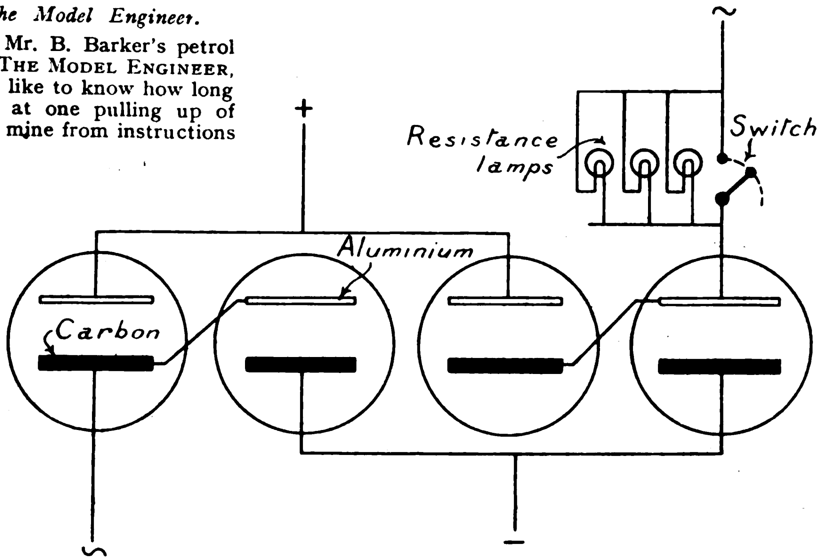


DIAGRAM OF CHEMICAL RECTIFIER.

Cutting Glass Bottles.

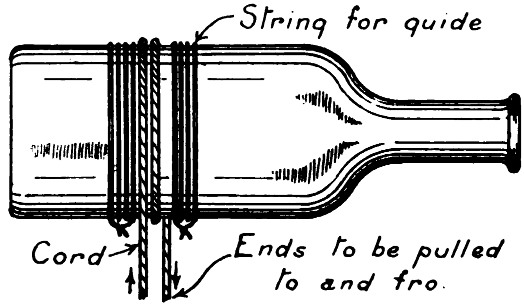
TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In your issue of March 21st, under the above heading, Mr. Green says he has tried a method previously given, but without success. I have cut the neck off a score or two of glass ink-bottles (and these were thick ones, as used for India ink) with very little trouble by filing a nick all round with a fine half-round file, using the sharp edge. It only needs the surface taking off, but if the nick is filed a little deeper a clearer cut is obtained. Tap the neck after filing.—Yours truly,

Rochdale. "ORLANDO."

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—If Mr. A. Green will try the following method of cutting glass bottles, he will, I think, be successful: Just above and below the point where bottle is divided lap a few turns of string and in the groove so formed take one turn round the bottle with blind or whip cord ; now let a friend hold the bottle firmly while he takes the two free ends of cord and saws vigorously to and fro for a few



A METHOD OF CUTTING GLASS BOTTLES.

moments, finishing up by plunging bottle quickly into water. The friction of cord round bottle causes heat, and the sudden cooling of the water causes rupture at that point.—Yours truly,

ERIC W. WHITE.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Tie a piece of cotton wool which has been soaked in paraffin round the bottle where it is required to be cut. Put a light to wool, and after it has been burning a second or two, plunge bottle into cold water, when it will come into two with a clean edge. I have not tried this way many times, but every time it has been successful.—Yours truly, H. W. HAWKINS.

Birmingham.

Evaporative Capacity of Model Boilers.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to the generally accepted rule of allowing 100 sq. ins. of heating surface per cub. in. of water evaporated, this would appear to be much under the rate of evaporation at which a Smithies' type locomotive boiler, fitted with properly proportional blast pipe and orifice, can work.

I have taken two careful tests of the water evaporated per minute by a model of the L. & N.-W. locomotive, "Experiment," built by Messrs. Carson and Co., of Birmingham, and I find that, with a heating surface of, at the most, 45 sq. ins., 1 cub. in. of water is evaporated per minute.

The trials were made on a testing stand with a light load applied, and I have no doubt that with an increased load this rate of evaporation would be much exceeded. The pressure maintained throughout the tests was 40 lbs. by gauge. The above rate of evaporation works out at approximately 2·2 cub. ins. per 100 sq. ins. of heating surface.

I have only tested one water tube boiler of another type, and in this case found that 2 cub. ins. of water were evaporated per 100 sq. ins. of heating surface.

It would be interesting to know the results of such tests on the various water tube types of boilers now used for model steamers. Perhaps some other readers of "Ours" might furnish additional information on this point, so all-important in boiler design. This would be just now especially interesting in the case of a boiler built to the prize design by Mr. D. Scott, in view of the criticism *re* this design by Mr. R. M. de Vignier in your issue of March 28th, 1907. In my humble opinion, the much more effective and rapid circulation of the water-tube boiler gives it a much increased evaporative capacity over the older types per unit area of heating surface.—Yours truly,

Dublin. R. L. B. STEBLE.

Queries and Replies.

[Attention is especially directed to the first condition given below and no notice will be taken of Queries not complying with he 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:—

[17,520] **Small Dynamo and Water Motor for Charging Screw-cutting Indicators.** W. H. W. (Lurgan) writes: I wish to make a small dynamo to charge a 20-amp. 4-volt accumulator for motor cycle. (1) What is the smallest dynamo output which will charge one such successfully? (2) What size water motor will I require to drive a small dynamo for charging one 4-volt 20-amp. accumulator? Head of water, 70 ft. Diameter of house supply pipe, ¾-in. lead pipe (outside diameter), leading to a brass screw-down cock with ⅜-in. internal diameter outflow. Wanted, diameter of wheel to which buckets are to be screwed and diameter of nozzle. (3) I have a Barnes' 4½-in. screw-cutting lathe with the following change-wheels: 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 88. The lead screw is 1-10th-in. pitch (ten threads to the inch). Can I use any change wheels whereby I may cut metric threads, and if so, what wheels?

(1) 40 watts, 8 volts 5 amps. (2) With a head of 70 ft. and a ¼-in. jet a well-designed Pelton wheel about 12 ins. diameter, running at 600 r.p.m., would give you ·14 h.-p. (3) *Re* screw cutting. For cutting metric threads your leading screw must have a thread which is a factor of the metre. The rule for finding the required change-wheels is the same in every case, but the thread to be cut will always bear some direct proportion to the thread on leading screw. Our screw-cutting indicators for two, four, or eight threads leading screw will assist you for ordinary work. Price, 3d. post free each.

[17,519] **Oil Engine Trouble.** W. J. (Margate) writes Would you kindly oblige me with following information. I have a ½ h.-p. oil engine with no lamp to heat vaporiser. But, according to directions, I have to heat up vaporiser with a blow-lamp until bright red, then turn on the paraffin oil. After that, lamp is supposed to be not required till starting engine again. The engine is quite new. Now I carried out instructions, but when I turn on paraffin oil (just dropping, as directed) I cannot get any explosion till after I have turned the flywheels many times every half hour; then I get a few firings of engine, and she will then lose again and stop—sometimes a back fire. I have regulated

oil-feeder, which is a needle thread one. The oil appears to drop correctly through the glass tube on oil regulator, but I experience awful trouble to get a little firing; and then stop. In fact, I keep varporiser red hot with blowlamp as directed all the time I am getting her to start. It seems as though the fault lies in the ignition. Do you think flywheel cog is placed back in the wrong cog on half-speed wheel and actuates the exhaust wrongly? They are not marked in any way. The engine is a ½ h.-p., but large enough for a ¾ h.-p.

Have you no guarantee from the makers that engine will run properly and give its rated output; or, is it one made by yourself? The trouble can only be overcome by careful trial and experiment, provided, of course, the design is all that it should be to begin with. The valve settings will make all the difference between good running and failure to run, and should be examined and adjusted as described in our handbook on "Gas and Oil Engines," by Runciman, 7d. post free. It is possible to have the vaporiser *too* hot, as well as too cold. Vary the temperature and also the quantity of oil supplied. The regulation of the air supply is also an important factor of proper running and should be adjusted to a nicety. If you have further trouble, after working on the foregoing hints, write us again giving fuller particulars of engine and say what you have already done to remedy matters.

[17,362] **Telephone Wiring; Ericsson's Rotary Switch.** G. E. M. (Keighley) writes: I should be very much obliged to you if you could explain the way in which the enclosed drawing of a switch is wired; also, if it is possible for me to be able to hear the conversation at the main telephone when the pointer is at the through position? If so, what connections are necessary?

The third or earth connection is not necessary in your case. We attach sketch of the usual arrangement of Ericsson's rotary switch. It consists of four springs, A, B, C, D, one end of which

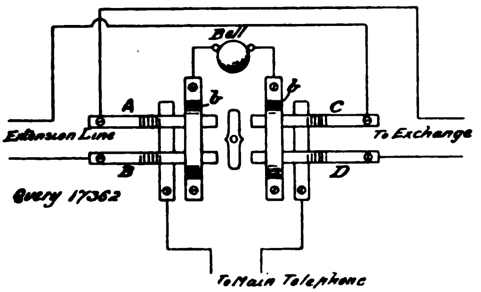


DIAGRAM SHOWING ARRANGEMENT OF ERICSSON'S ROTARY SWITCH.

is fixed to the baseboard, the other being bent upwards to make contact with either of the metallic bridges *b*. Two flat metal strips, screwed to the base, are placed under the free ends of A and B and C and D. In the position shown, the switch is "through." If it is moved to the right, A and D are depressed, connecting the exchange to the main telephone. If moved to the left, B and C are depressed, connecting the main to the extension telephone. The bell and indicator are joined to the two bridges, as shown. The simplest way to hear conversation between the exchanges and the extension line will be to put a receiver across the extension lines.

[17,512] **Wimshurst Machine.** W. P. (Hackney) writes: I am constructing a Wimshurst machine, and would like a little information on the following points. (1) Is it necessary to have Leyden jars; if so, what do they contain? (2) What is the best way to fix the brass balls to the glass rods? (3) Must plates be as close to each other as possible? (4) There are two plates (16 ins. diameter) of glass. What size spark should I get? (5) Also, can you tell me what size dynamo a Thompson's 2B motor will drive?

(1) Are lined with tinfoil, and sometimes lead shot is used inside. See handbook No. 18. (2) Bore holes to take ends of rods, and fix with shellac varnish. (3) Yes, without touching. (4) A matter for trial. It may give anything from 2 to 4½ ins. or 5½ ins. (5) Would drive a 10-watt dynamo if it was supplied with ample current.

[17,511] **Resistance for Small Lighting Plant.** L. B. writes: I have a 30-watt (10-volt 3-amp.) Empire dynamo, and I wish to rig up a small plant, if possible. I want to light up a kitchen, and I purpose having two 8-volt (2½ c.-p. each) lamps, but I want to have an arrangement so as to switch off one of the lamps without burning up the remaining one, which I fear would happen if no resistance be in circuit. Would you be kind enough to give me a description of a suitable resistance, and in what position it should be placed in the circuit? Should I be wrong in running a ⅛ h.-p. water motor off a kitchen tap without letting the water company know. That is to say, should I have to pay for the water used if the water company knew it?

If you use an 8-volt supply and use 8-volt lamps, you can have either *one or more* lamps burning at a time. No resistance is required when lamps are connected in parallel. If they were run in series, the supply voltage would then have to be 24 volts. *Then*, if you took one of the three away, the others would get too much current, and would burn out. *Re* water motor. You might, if the water company knew.

[17,449] **100-watt Dynamo: Partial Failure.** F. B. J. (Killinick) writes: I have just completed a small petrol engine and dynamo. The engine runs well, and I can run it at 600 or 700 r.p.m., preferably at 600, as it vibrates a good bit at 700. The flywheels are 9 ins. diameter, and the dynamo pulley is 1½ ins. diameter, the drive being 1-in. wide belt, and as the gear works out 6 to 1, I suppose the dynamo does 3,400 r.p.m. with engine running at 600 r.p.m., and about 4,000 with engine running at 700 r.p.m., making ample allowance for belt slip. I enclose sketch of dynamo field-magnets, which I got out of THE MODEL ENGINEER, July 5th, 1906, as they are almost exactly similar in design to mine, and probably came from the same foundry. A dynamo of this size, I find by reference to your book, "Small Dynamos and Motors," should give 100 watts, and according to the people I got the castings from, it should light six 8 c.-p. lamps. They supplied two 5 c.-p. 25-volt lamps with the castings, but when connected to the dynamo they only glow red, so I bought three 6-volt 6 c.-p. 1-amp. Osram lamps, and it will light the three rather well either in series or parallel when I drive the dynamo very fast—at, I should think, nearly 5,000 r.p.m.—or it will light two with the engine doing 700 r.p.m. and one brilliantly with engine doing 600 r.p.m. When the three lamps are in parallel, the engine runs light, but with the lamps in series the engine has much harder work. If the dynamo is run for about half an hour or so at about 4,000 r.p.m., the field-magnet gets rather warm and the armature very hot; in fact, one could not keep one's finger on the cogs. The armature is an 8-cog drum, and was ready wound in eight sections, so I do not know how much wire is on it, but it would easily hold another layer, or perhaps two. I wound the field-magnets nine layers deep with 22 D.C.C. I note in your answer to query which refers to enclosed sketch that you say there is not enough iron in the magnets, so I suppose the same applies in my case; but I want to know if, in your opinion, it is worth while to wind the whole dynamo again; and, if so, what windings you would advise and what output I may expect at 3,000 or 3,400 r.p.m., and what is the reason the dynamo is giving such a small output?

You should find out definitely what output dynamo is giving—by means of a volt and amperemeter. Judging by the effect on lamps, is a very slip-shod way of estimating output, unless you know exactly what current and voltage lamps are getting. The metal in the field castings is rather pinched, as you say; but perhaps you would get better results if you added a few series turns to the field winding. Try 3 ozs. of No. 16 S.W.G. on each field, connected in series with each other and in series to the main circuit. We do not quite understand how machine can run the lamps *either* in series or parallel, unless you also vary the speed to suit.

[17,452] **Keeping Commutators in Order.** G. H. (Bedford) writes: Can you tell me of a preventative for carbon deposit where carbon brushes are used? What is the best way of cleaning deposit off commutators? What commutator lubricants do you recommend? At present I am in charge of a factory plant (all electrical) where the day-load is 88 kilowatts. The evening load is 165 kilowatts. I have to attend to repairs and keep motors going. What berth do you advise me to look out for next? Do you advise me to go abroad; if so, where?

This will always deposit a little on the commutator, but can be cleaned off periodically with an oily rag—but no oil should be left sticking to commutator. Fine sandpaper may be used if it is very dirty. A little black lead and a touch of vaseline is a good dressing for commutators, but should be used sparingly. We think your best course would be to keep your eyes on the advertisement columns of various trade papers and to apply for anything which seems good and is in your line. We presume you wish to get some job with more substantial pay attached to it, but similar in character to the one you have at present. The actual choice, of course, rests entirely with you, as it is a personal matter.

[17,517] **Patents; Inking in Drawings.** J. W. (Manchester) writes: I shall be greatly obliged if you will give me some information on the following. I wish to patent an improvement in the make of an existing article by altering the shape of a portion of it. This will be done by a process of pressing, either in hydraulic or steam presses. Will you please inform me if I can take out in one patent the improved shape and also the processes for carrying this out. As an infringer could by several ways of manipulating dies arrive at my result, can I in this one patent protect all the ways I can foresee. Will you also inform me whether in making claims at the foot of a patent—if one of them should cover a patent or process already in existence—would this erroneous claim invalidate any other claims that were in order? During the action of drawing the paper appears to become somewhat greasy from the fingers, causing it to be difficult to get the Indian ink to take the paper freely. Can you inform me if professional draughtsmen

use any preparation for the paper, either before or after making the drawing, and before inking in?

(1) Our handbook on "Patents," 7d. post free, will help you in this matter, but we advise you to consult a patent agent and get him to put your ideas into proper shape and form. The cost is not high, and you cannot hope to carry the job through yourself —unaided—with so much satisfaction. (2) Clean off with rubber, then dust over with some powdered chalk or Fuller's earth, or you can use a little oxgall mixed with your ink.

[17,516] **The Engineering Profession.** G. I. W. (Carlisle): I should greatly value your opinion on the following points: (1) Which branch of engineering in your estimation—electrical, civil, naval, or pure mechanical—offers most opportunities for the highly trained young man in the present state of trade? (2) Is it very exceptional for men trained at Cambridge—after taking the Mechanical Tripos—to get work with a firm at a living wage without a previous course in the shops? (3) Do you consider that going through the shops is essential for all branches of the profession, or are there any exceptions? (4) What—from your experience—would you say are the prospects of a thoroughly trained engineer who is quite without outside influence at, say, the age of 26?

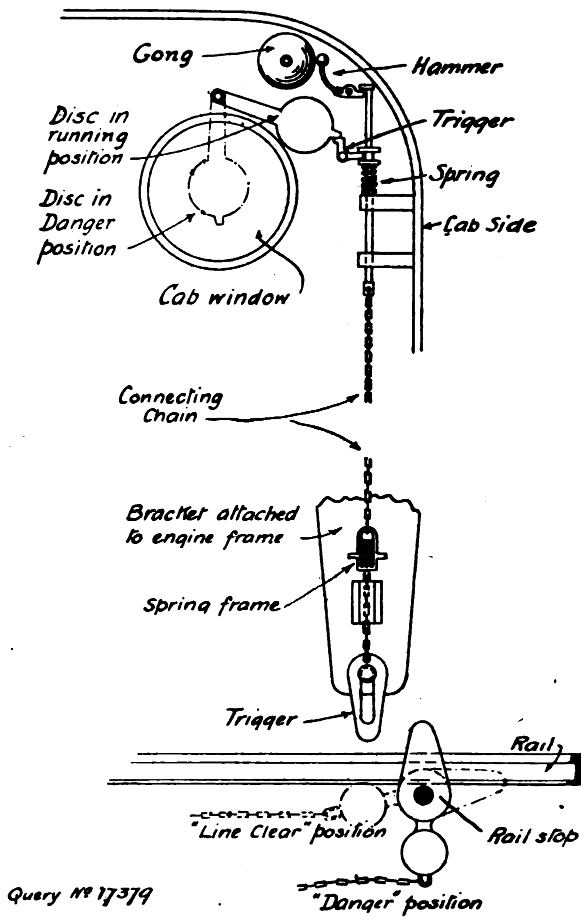
It is quite impossible to answer your inquiries definitely without a full knowledge of the circumstances of the case. Each branch of the profession offers good opportunities occasionally, and to make the most of any such it is advisable to have a good all-round knowledge of at least the elements of the several branches, particularly mechanical and electrical. As regards going through the shops, we should say most decidedly yes, it is essential. There may be exceptions, but, as a rule, a firm will ask you not—What do you know? but—What have you done? and—Where have you been? The engineer who gains most respect from his men is the man that can, if need be, take his jacket off and demonstrate how a job should be done, and, moreover, do it as well, or better, than his fitters. Experience in the shops and the drawing office, coupled with a good theoretical training, will enable you to reach most positions without any influence from outside, but you must keep a good look-out on what is going. Or, if you can get in with a good firm, you could work your way up to a good position if you make up your mind to stick at it. These remarks apply to all branches equally. Which you are going to follow is a personal matter, and can only be decided by the parties directly concerned. Your inclination is an important factor in the matter. We should say, specialise in that in which you are most interested.

[17,469] **Small Dynamo and Engine for Lighting, etc.** A. L. N. (Highgate) writes: I have a dynamo giving 6 volts 2 amps. at 2,500. I wish to charge an accumulator of 4 volts. (1) If I run the dynamo at about 1,700, will that give the above voltage (4 volts)? (2) I have made enquiries for an engine to drive the above dynamo, not wishing to give more than 30s., but find that the makers say that they do not recommend them for charging purposes. They suggested a water motor, but I have no main tap. Would there be enough pressure from cistern to drive my dynamo at 2,500? The house is a two-storey house, and cistern is right at the top. (3) If a water motor would not do, could I get a reliable little gas engine for about 30s. to drive 6-volt dynamo? If so, where would you recommend me to go for it? (4) About what price should I pay for an accumulator 4 volts 12-16 amp.-hours? (5) Could I use a 6-volt dynamo for charging a 6-volt accumulator, or must I allow for loss of current? (6) I am going to use an Osram lamp, 4 volts 4 c.-p. Does that 4 c.-p. mean that it will give the same amount of light as four actual spermaceti candles? (7) Please describe the difference between a dynamo that will charge accumulators and one that will not

(1) Probably. You can only tell by trial. Use a voltmeter or a 4-volt lamp. (2) A ⅛ h.-p. water motor would do the work comfortably, and provided you have an ample supply of water, you could use one. A head of 30 ft. would give you about 15 lbs. water pressure. (3) A reliable gas engine could not be had for this job at the price you mention. (4) Any of our electrical advertisers would supply you and quote price. See their lists. (5) See recent replies on the subject. Charging voltage (*i.e.*, dynamo voltage) must be about 25 per cent. higher than that of cells to be charged. (6) Supposed to. (7) An ordinary H-armature dynamo is not suitable. Tripolar or drum or ring armature machines are suitable.

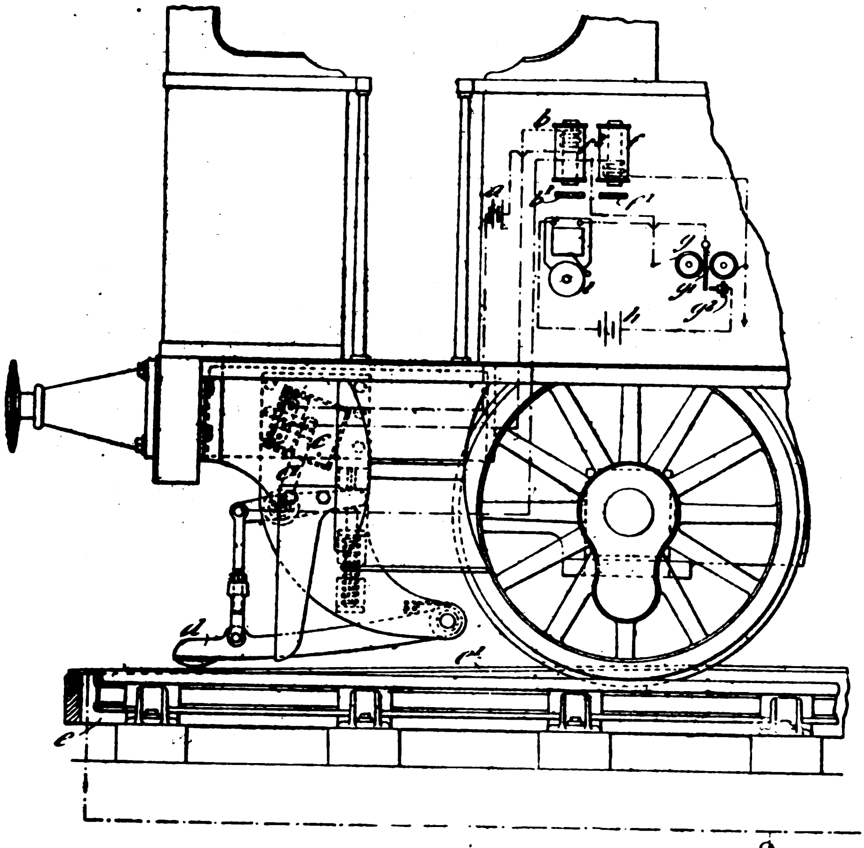
[17,379] **Railway Fog Signalling Apparatus** J. K. C. (Arbroath) writes: Would you kindly describe the apparatus employed for stopping trains when attempting to run past signals at danger? One system, I believe, shuts off the steam. Another, the brakes are applied; and still another, is where the siren or whistle is blown. Mention what railways these systems are worked on.

There are hundreds of patents bearing on the subject of your query, some of which are in use and some of which do not actually stop the train, but only warn the driver that the road is not clear when the signal is against the train. Mr. J. Crabtree's device which was, and is, we believe, still used on the G.N. and G.E. joint lines, is one of the latter class of apparatus. We include a sketch of the indicator, which it will be seen is actuated by means of a stop at the side of the rail which is in connection with the signal, and when the latter is at danger strikes the trigger on the locomotive releasing the indicator hanging above the cab window. At the same time a gong is sounded in the driver's cab. The attention of the engineman is thereby arrested by both visible and audible signals. If he fails to hear the bell he cannot help seeing the indicator-arm fall in front of the cab window. If the engine passes a second signal at danger, the bell will again ring whether the indicator is up or down, so the instrument does not fail to give a signal through any forgetfulness on the part of the driver. No signal is given if the signals are passed when they are showing line clear. On the Metropolitan District Railway (since the recent electrification of the line) automatic signals are used, the block sections being very short. To prevent the driver, or motorman, as he is now called, over-running a signal at danger, a rail stop, which moves in connection with the automatic electro-pneumatic signals, is employed. This rail stop is raised to a vertical

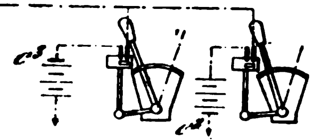


A Diagram of Mr. J. Crabtree's Fog Signalling Device as used on the G.N. & G.E. Joint Railway.

position when the signal is at danger, and should the train pass the spot at which this rail stop is situated, a trigger fixed on to the leading vehicle of the train and connected to a special valve on the Westinghouse brake system, engages the rail stop and the automatic brake is applied. The driver is by this means warned, and the train at the same time quickly brought to rest without the use of any special indicators or other signalling device. With this apparatus it was found on trial that a train running at full speed was brought to rest in 218 ft. (half its length) on a down gradient of 1 in 460. The rail stop is actuated by a pneumatic cylinder controlled by electricity. A recently patented device has been tried with success on the G.W. Railway. We reproduce herewith a copy of one of the patent drawings and some notes from the inventors' (Messrs. C. M. Jacobs and Robt. J. Insell) specification. We understand that the apparatus worked well even in snowy and frosty weather, which conditions are always a factor in the design of any electrical contact device. As will be seen by the drawing, the invention consists of a ramp or inclined plane at each signalling position which engages and operates a lever on the locomotive opening an electric circuit on the train or engine to give a danger signal. When the line is *clear* and the signal off, the signalman closes the connection of a wire or conduction with a battery in his cabin. As the train passes over the ramp the conductor becomes, through the lever carried by the train, a part of a second circuit carried by the train, which is thus closed. The current in this circuit restrains the danger signal, which otherwise would have been given, and at the same time operates an all-right signal. When this signalling device is to be adopted on a single line of railway, it is desirable that trains going in one direction should receive no signal at all at certain ramps, these ramps being supplied merely for signalling trains going in the other direction. Fig. 2 circuit that includes electro-magnet *f* is branched at *f*2, and in the branch is inserted a polarised relay *g*, whose tongue *g*1 can complete at contact *g*2 the circuit of a battery *h* carried by the locomotive, which circuit includes an electric bell *i*. When the signalman connects the positive pole of one battery with the conductor *e*1, the direction of the current through the polarised relay *g* is such that the tongue *g*1 turns away from the contact *g*2, and the bell, which is the all-right signal, is not sounded. On the other hand, when the signalman connects the negative pole of the other battery, with the conductor *e*1, the tongue *g*1 touches the contact *g*2, and the bell is sounded. The signalman has it in his power therefore (1) to give the danger signal by not connecting either battery with conductor *e*1; (2) to restrain the danger signal without giving the all-right signal by connecting one battery with the conductor *e*1; or (3) to restrain the danger signal and give the all-right signal



Jacobs and Insell's Signalling Device, showing Electrical Devices on Track and Locomotive.



is a side elevation of a part of a locomotive provided with signalling devices modified for use when the locomotive is running on a single line. In the circuit of the battery *a* carried by the locomotive are an electro-magnet *b* and a switch *c*. The armature *b*1 of the electro-magnet is carried by a lever not shown that controls the valve of the locomotive whistle, and when the magnet *b* is energised, as is normally the case, it retains the armature to keep the valve closed. The arm *c*1 of the switch *c* is operated by a lever *d*, in whose path, as the train travels, is a ramp *e*. When the lever rides up the ramp it is lifted sufficiently to move the arm *c*1 off the contacts of the switch *c*, whereby the circuit of battery *a* is broken, the magnet *b* is de-energised, and the lever carrying the armature *b*1 falls to open the valve of the whistle. The lever *d* is insulated from the mass of the locomotive, and the ramp *e* carries along its whole length an electric conductor *e*1, which can be connected by the signalman with either the positive pole of one battery or the negative pole of another battery. The circuit is in either case completed through the lever *d*, an electro-magnet *f*, the frame of the locomotive and earth. The armature *f*1 of the magnet *f* is also carried by the lever, which controls the valve of the whistle. It will be obvious, therefore, that whenever the conductor *e*1 is connected with either of the batteries, the magnet *f* is energised, and the armature *f*1 is retained, so that the whistle does not sound even though the circuit of battery *a* be broken at switch *c*. The by connecting the other battery with conductor *e*1. The device can be used in conjunction with the ordinary single line, staff, or ticket instruments. There are two specifications—No. 25,955 of 1905, and No. 12,261 of the same year.

[17,529] **Certificates of Competency for Engineer-in-Charge.** F. H. (Sheffield) writes: Kindly forward particulars as to obtaining a Board of Trade certificate of competency for driving stationary steam engines.

There is no certificate granted by the Board of Trade for stationary engine driving. Certificates of competency are only necessary for marine engineers (chief and second engineers). If you refer to *The Engineer-in-Charge* for April, May, June, 1906, issues, you will find some correspondence on this subject which will interest you. Copies can be had from the Publishing Department at this address, price 2d., or post free 3½d. each. Subscription per annum is 3s. 6d. post free.

The Editor's Page.

WE give in this issue the first instalment of a very interesting account of the history and doings of the Victoria Model Steamboat Club. We are sure our many model marine readers will find this article very attractive reading, and we should be pleased to learn that it had stimulated the formation or improvement of steamer clubs in other parts of the country. There are, of course, two or three organisations of the kind already in existence—notably, the excellent steamer section of the Wirral M.Y.C., and the model steamer club at Clapham. The number of model self-propelled boats has, however, increased so much during the last few years that we are sure many other successful clubs might be organised to the advantage of both the sport and the owners of boats.

* * *

Another article in the present issue to which attention may be directed is that on "Planing and Shaping for Amateurs." There must be many of our readers who are possessed of one or other of the several excellent designs of hand planing and shaping machines now on the market, and who will be glad of some practical wrinkles on their proper working, especially as this is a subject on which so little has been written. We may add that these articles are the outcome of a suggestion from one or two readers that such matter would be acceptable. If there are any special difficulties in connection with this subject which other readers are anxious to have explained, we shall be glad to hear of them and to pass such suggestions on to the author of the articles for attention.

* * *

Mr. George P. Ford, of Southampton, has favoured us with copies of two recent issues (March 30th and April 6th) of *Pitman's Journal*, to which he has contributed an article on "The Application of Phonography to the Study and Practice of Engineering." Mr. Ford therein points out some of the many different ways in which a knowledge of shorthand can be turned to practical account by engineers. While we feel very doubtful as to its value to mechanics for noting workshop instructions, it is unquestionably of great service for note-taking at lectures and meetings, and in the office, as well as on visits to works, exhibitions, and business outings generally. We ourselves have used the "winged art" of Pitman for over twenty years, and have found it of practical service on innumerable occasions. We can, therefore, cordially commend Mr. Ford's observations to those who wish for further enlightenment as to its uses for the engineer.

Answers to Correspondents.

"DISSATISFIED" (Peckham).—Quite a "model" grumble. Unfortunately, there are other readers who do not quite agree with your views and want just the things you do not want. It is curious, but the old proverb of one man's meat being another man's poison applies to technical journals as much as to other things, and there is still an empty pedestal waiting for the Editor who pleases all his readers all the time. However, we are glad to have your letter, which is evidently sincere, and we have several articles in hand which we think will please you.

"AN OLD REALER" (Oldham).—We cannot do a special design for you, but would refer you to the drawings on page 156 of our August 18th, 1904, issue, and page 273 of our March 23rd, 1905, issue. These are very near your requirements and could easily be adapted.

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

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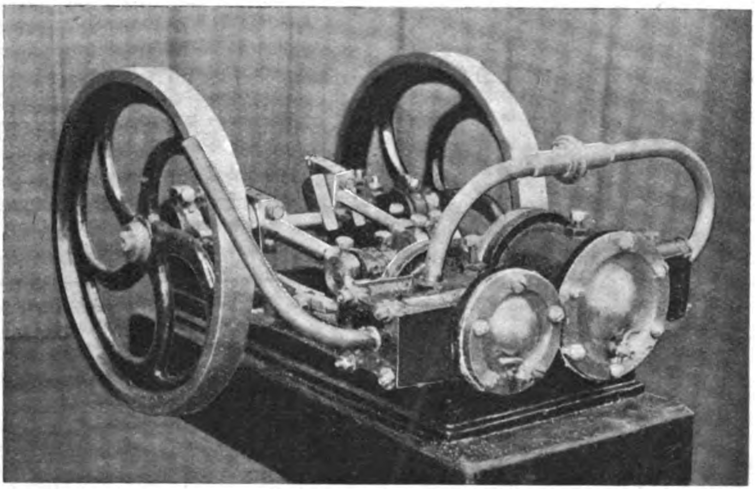
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XVI. No. 313. APRIL 25, 1907. PUBLISHED WEEKLY.

A Model Compound High-Speed Engine.

By ALEX. FOWLER.



MR. ALEX. FOWLER'S MODEL COMPOUND HIGH-SPEED ENGINE.

THE accompanying photograph and description refer to a high-speed compound engine which I finished recently. A friend of mine provided me with a complete set of castings and forgings for the above engine. Being really my first attempt at model making, I had little idea how or where to start. The leading dimensions of the engine are as follows :—High-pressure cylinder, 1¼-in. bore by 1½-in. stroke ; low-pressure cylinder, 1¾-in. bore by 1½-in. stroke ; valve travel, 5-16ths in. ; steam ports in H.-P. cylinder are ⅛ in. by ½ in. ; exhaust ports, ¼ in. by ½ in. ; L.-P. cylinder, ⅛ in. by ⅝ in. ; exhaust, ¼ in. by ⅝ in. ; diameter of crankshaft, ⅜ in. ; crank pins, ⅜ in. I tackled the cylinders first, boring them out, facing up the flanges, and fitting the pistons in a good fit. In boring out the L.-P. cylinder, about half an inch of the flange and a part of the body of the cylinder broke away owing to a blowhole in the casting, and I had forthwith to make a pattern and get another cast. The ports were cast in in both cylinders, so I had just to chip them oblong and clean them out with a file. I next faced up cylinder covers, fitted stuffing-boxes, and secured covers with set pins—five on H.-P covers and six on L.-P. covers. The steam-chests were next fitted on with four ⅛-in. studs on each, the valves being previously ground steam-tight to the valve faces with flour, emery, and water, which makes a very smooth tight job. The cylinders were next fitted on to bedplate parallel to one another. The bearings were then fitted and bolted to their places and holes drilled through the brasses to receive the crankshaft. The double crankshaft was next tackled, the webs being drilled and cut out in the usual manner to form the crank pins. The shaft was roughed down to nearly the finished size, and crank pins turned, which was successfully accomplished by fixing forgings on each end of shaft to obtain centres for crank pins, as shown in Fig. 1. The crosshead guides were then filed out at right angles to crankshaft. The crossheads, Fig. 2, were of cast iron, and I decided to make them of gun-metal, so I made a pattern and got a pair cast and fitted them into their places and secured piston-rods to them with 3-16ths-in. set pins. The connecting-rods are of the marine type, forked at little end, and are fitted with brasses at big end. A ¼-in. steel pin connects them to crossheads, the pins being secured by two 3-16ths-in.

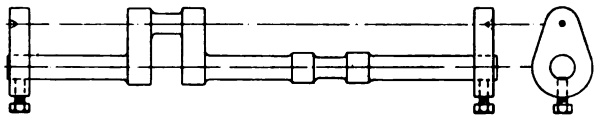


Fig. 1.—Crankshaft.

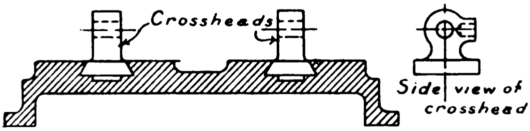


Fig. 2.—Section through Bedplate.

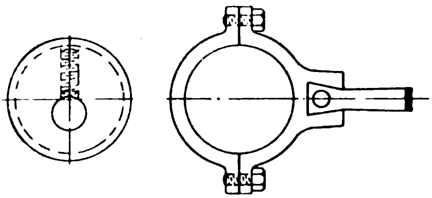


Fig 3.—Details of Eccentric.

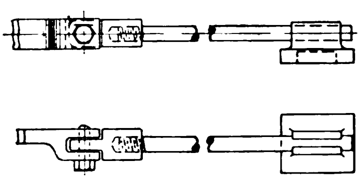


Fig. 4.—Valve Spindle.

set pins through each fork. The eccentrics were then finished and secured, as shown in Fig. 3. The method adopted to secure spindles to valves and allowance for adjustment is shown in Fig. 4. I put on two flywheels to balance engine when running at a high speed, the keyways being cut by hand with a cape chisel and then filed. Set pins with locknuts serve as lubricators. When the engine was finished and tested from the gauge glass of a donkey boiler it ran at a speed of over 1,000 revs. per minute, using very little steam. The high-pressure valve is set to cut off steam at half stroke. This model took eighteen months' spare time to construct.

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 Device for Drilling Holes in Castings.

By J. C. Phillips.

Some time ago I wanted to drill the holes in the base of casting shown in Fig. 1 by means of my home-made lathe and drill chuck, and possibly the method which I employed will interest other readers.

I made a stout wooden bracket (as in Figs. 2 and 3), which has a plate screwed on the back, with a countersunk hole for the poppet head to bear in, and a piece of wood fixed underneath to make a tight fit in slot of lathe.

Care must be taken to see that the upright piece is at right angles to the bed of lathe. A hole is drilled in the base, and a string passed through, to which is attached a heavy weight to

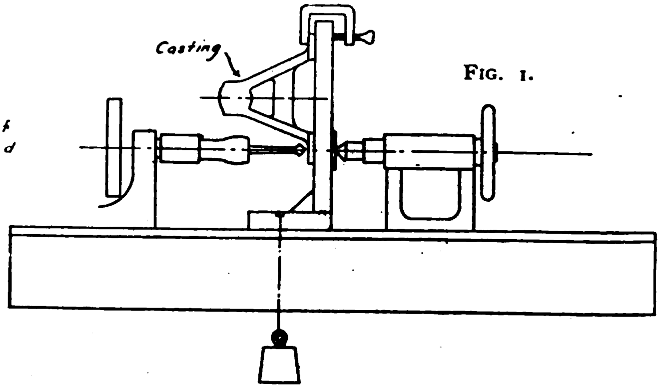


Fig. 1.

Fig. 2.

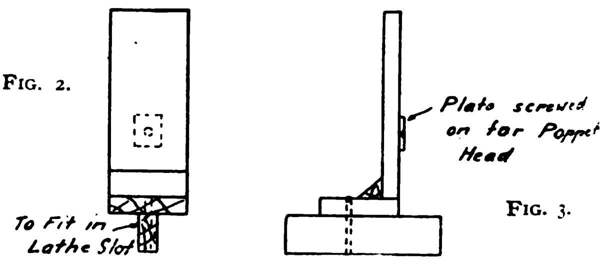


Fig. 3.

A Device for Drilling Holes in Castings.

keep the bracket steady. The centre of hole to be drilled is brought exactly in line with centre of headstock, in which position the work is clamped to the bracket (as shown), which will hold it quite securely.

The drill chuck is then screwed on, and the work is fed up by the poppet head in the usual manner. I have succeeded in drilling 7-16ths in. diameter holes in two castings ⅝ in. wide in this manner.

A Small Tapping Key.

By C. P. W.

Being in want of a tapping key, I made one as shown in Fig. 1, the wooden base (5 ins.

by 2 ins.) having a good coat of shellac varnish. In the centre of this a piece of ⅛-in. brass (p) is firmly driven in to act as a support to the pivot on which a key of wood (k^1) turns, a slot being made in it to take p: A hole at k^2 is also drilled to take a piece of steel wire, which is the pivot. The spring s is kept in place by a steel pin driven in the key, working in a ⅛-in. hole drilled in the base. The adjustment screw a^1 is a brass wood screw, bearing down on the small drawing-pin a^2. Under the knob c a piece of ⅛-in. brass rod is driven into

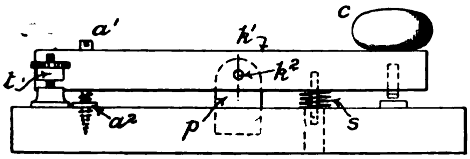


FIG. 1 —SIDE VIEW.

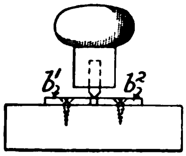


FIG. 2.—END VIEW.

A SMALL TAPPING KEY.

the key, the end of which is chisel-shaped (see Fig. 2). On depressing the key, the chisel-end makes contact between the two pieces of brass b^1 b^2, each one being connected to a terminal t, t, (Fig. 1) by wires carried in two slots on the under side of the base.

An Overhead for a Shilling.

By J. E. C.

Fig 1 shows the contrivance in position. The drum is attached by brackets to the ceiling over the lathe bed, with the tension-board fixed by stout hinges to the wall about a foot below.

Fig. 2 is a detail of the 6-in. drum and pulley wheel, driven off the flywheel of the lathe. The galvanised iron brackets H can be had from any

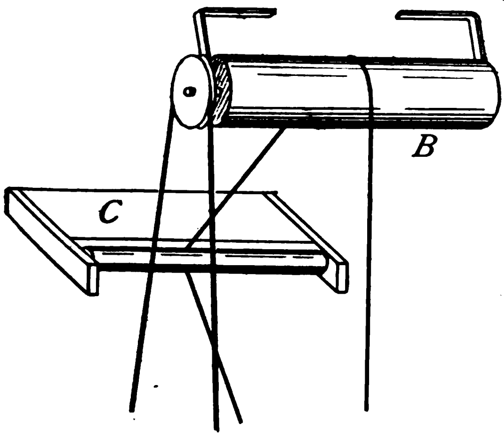
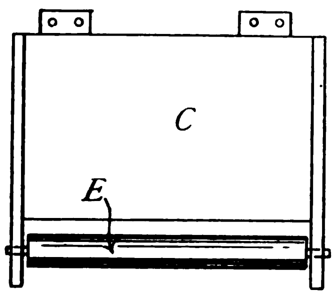


FIG. 1.—SHOWING GENERAL ARRANGEMENT.

FIG. 3.—TENSION BOARD.



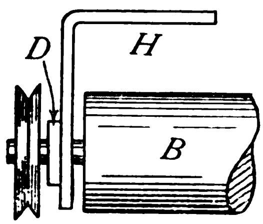


FIG. 2.—DETAIL OF DRUM AND PULLEY.

AN OVERHEAD GEAR FOR A SHILLING.

ironmonger, and are such as are used for fixing up small shelves. D is a piece of sheet brass screwed on to the bracket and bored to provide bearing for drum spindle.

Fig. 3 is the tension board. The weight of this 18-in. by 10-in. board hanging by its hinges is sufficient to keep taut the cord from drum to milling spindle; but, if desired, the tension can be increased by simply placing some weight upon the boards. E is a 2-in. roller for the band from drum to work over. This roller runs between two strips of wood nailed on to the sides of the tension-board and protruding about 3 ins. Any bits of scrap brass can be utilised for bearings.

This overhead is well out of the way when not in use, costs a trifle, and is reliable.

The Latest in Engineering.

Charing Cross Station's New Roof.—December 5th, 1905, was a notable day in the annals of British engineering; for upon it one of the most remarkable occurrences took place, viz., the failure of a portion of the roof over the South-Eastern and Chatham Railway Company's station at Charing Cross.

The roof was designed by the late Sir John Hawkshaw and erected about forty-one years ago. It was of single arched span, and covered a width of 166 ft., and the cause of failure—fully explained at the time—was the breaking of a welded tie bar.

The new roof, now very nearly completed, has been erected from the designs and under the superintendence of Mr. P. C. Tempest, M.Inst.C.E., Chief Engineer of the S.E. and C. Railway. It is 520 ft. in length by 166 ft. wide, and is of the ridge and furrow type throughout. In all there are nineteen roof bays, and the glazed area amounts to about two acres; the whole of the glazing has been carried out on Mellowes' patent system. The platform and running roads are covered by twelve transverse bays, and the circulating area adjoining the Company's hotel at the north end of the station s covered by seven longitudinal bays with gabled ends. This arrangement has a double purpose. It avoids obscuring the hotel windows and also does away with the necessity of employing columns to support the roofing over the circulating area, the presence of which would obstruct free movement of passengers and others about this space. The bays are carried by steel lattice girders of the continuous type. These rest at each end on the wall which flanks the station on each side, and two intermediate supporting columns take the weight between the walls.

The girders are 5 ft. 6 ins. deep, and are of mild steel throughout. The columns are also of steel, built up and riveted together. They are of fluted octagonal section, and connected by means of four pile-section channels. The base of each column rests on a cement concrete block measuring 5 ft. by 5 ft., the blocks being founded on the piers of the arches which form the viaduct upon which the station is built. For a height of 3 ft. 6 ins. above platform level the columns are surrounded by cast-iron plinths of ornamental design, whilst the tops are finished with ornamental mouldings.

Each column weighs about three tons complete. The walls on both sides of the station are finished at the southern, or outward, end with handsome stone ornamental piers and a wind screen has been erected which, on completion, will carry a hammered steel shield with the S.E. & C. Railway coat-of-arms in enamelled iron as a centre piece. Altogether, about 1,000 tons of steelwork are comprised in the work. The roof principals are mainly of the simple truss type, and are supported for the most part by the girders, the span in each case being 35 ft. The portion of roof over the circulating area is raised 6 ins. higher than the remainder, and here the principals have a span of 26 ft. only, the lower members being arched to clear the hotel windows. The height from platform level to underside of transverse girders is 23 ft. Ample ventilation has been secured by means of a lantern roof above the apex of each bay, and an open space has also been left down the centre of the roofing. The guttering is specially large, viz., 18 ins. by 6 ins. deep, to facilitate the work of clearing out refuse accumulating there. Smoke boards have been suspended from the girders over the running roads to protect the steelwork and disperse the fumes rising from the chimneys of locomotives. The roof presents a very handsome appearance, and its design combines great stability with economy in maintenance.

The steelwork, supplied and erected by Messrs. Handyside & Co., Ltd., of Derby, has been painted dark stone colour picked out with light grey at base and cap of columns. Mr. Tempest's representative on the site of erection was Mr. G. Ellson, who acted as Resident Engineer throughout. No interference with traffic and no mishaps occurred during the 5½ months the work has been in progress.

PRO-PLATINUM ALLOY.—An alloy by this name, invented in America, is said to possess all the properties of platinum, and can be substituted for that metal in electrical instruments. The alloy can be rolled into sheets and drawn into wire as easily as platinum itself, and is not attacked by acids. Its colour is greyish-white, and it is made by taking 4·2 lbs. of nickel, 16·5 ozs. silver, 0·5 oz. bismuth, and 53 ozs. gold.

The Construction and Repairing of Motor Bicycles.

By "SREGOR."

(*Continued from page 279.*)

IN the preceding article the method of building up the crank, flywheels, and pins, was shown, and the necessity of securing the two flywheels strictly in line with each other. It is the common practice to secure the crank-pins rigid with the flywheels, and this is possibly the best

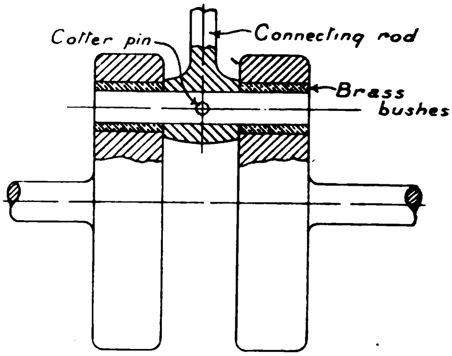


FIG. 78.

method, as it ensures the assembled parts being practically solid with each other. Another method is shown in Fig. 78. In this design the crank-pin is parallel, and is fixed to the connecting-rod end, and runs in bearings provided in the flywheels. This method provides double the amount of crank-pin bearing surface over the method of securing the pins to the wheels and using the end of the connecting-rod for the running bearing. Also, providing the pin holes are the same distance from the centre, the crank-pin locates the two wheels in line when assembled in position in the cases, this fact being a distinct advantage. It would be advisable to insert

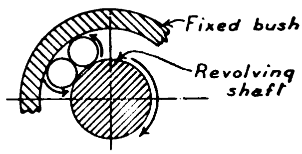


FIG. 80.

some form of elastic packing, such as a spring washer, between the side of the flywheels and the rod, or other suitable device, to prevent any side movement of the two flywheels, which would have more tendency to side movement and to create a noise than in the fixed wheels design—a defect which would be readily overcome by exerting a slight pressure to ensure each wheel having a tendency to press against the sides of the crank base. The defect would increase as the bearings wore. A roller bearing could be used in this design with advantage, from the fact that double the number of rollers could be used to receive the pressure than in the case of the connecting-rod end forming the bearing; also when a roller bearing is properly and well made, the rollers effectively hardened and true, a very slight amount of wear takes place. A design for a roller bearing is shown in Fig. 79, which illustrates a sectional view through centre of bearing. A sectional view of same is shown in Fig. 80. The various parts are

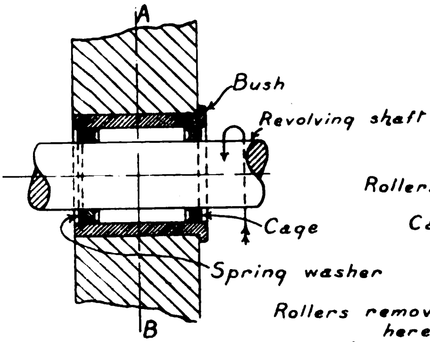
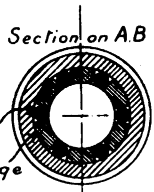


FIG. 79.

FIG. 81.



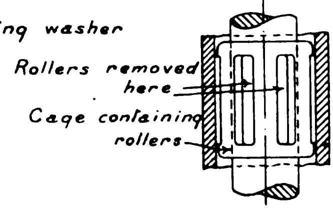


FIG. 82.

indicated, and consist of a hardened and ground bush, the internal diameter of which is just sufficient to receive the driving shaft and rollers without any perceptible shake when the rollers are in position. A roller bearing, to be a success, must be well made. The bore of the bearing bush should be perfectly parallel, and the rollers and shaft, carefully hardened and tempered. The possibility of the

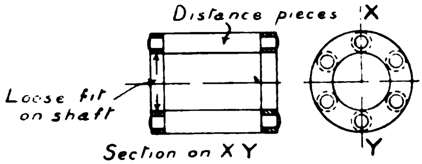


FIG. 83.

rollers breaking under the load is greatly increased by making the bearing loose. A roller bearing will run perfectly satisfactory even when it is necessary to use a reasonable amount of pressure to assemble the rollers in position, providing the running shaft is strictly in line with its fellow bearing. Another important point is the necessity of retaining each roller strictly parallel with the sleeve upon which it runs. This is ensured by designing the bearing to only just receive a given number of rollers with only a slight amount of clearance between each one, to allow free running.

The main objection to this method is the fact of the touching sides of the rollers running in opposite directions to each other, as shown in Fig. 80, which tends to grind the sides of the rollers together. A better method of retaining the rollers in their positions is to provide what is termed a cage, as shown in Figs. 81 and 82, which is machined to the form, from the solid piece. The slots which receive and retain the rollers must be strictly parallel with the bore, and every dimension such as to just ensure the cage to be quite free at all points. Another form of cage is shown in Fig. 83, which consists of two end-pieces, with the distance pieces equally spaced around and secured as shown. This design of cage should be assembled and finished in a suitable jig, which will ensure it being true. In a plain bearing, such as shown in Fig. 79, some precaution must be taken to prevent the cage working out at the end of the bearing. A spring washer, as shown in Fig. 84 in detail, and in position in Fig. 79, provides a stop. This is cut

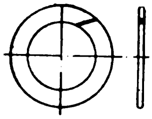


FIG 84.

across its side, which allows it to be readily fixed in position in the groove as shown.

In Fig. 85 is shown a suitable bearing for carrying the driving pulley of a motor bicycle. The special feature of this design is the arrangement of the bearing on the external part of the crank case. This would prove a suitable bearing for a two-stroke motor, from the fact that a great weakness in these engines is that as the bearing wears it admits the air

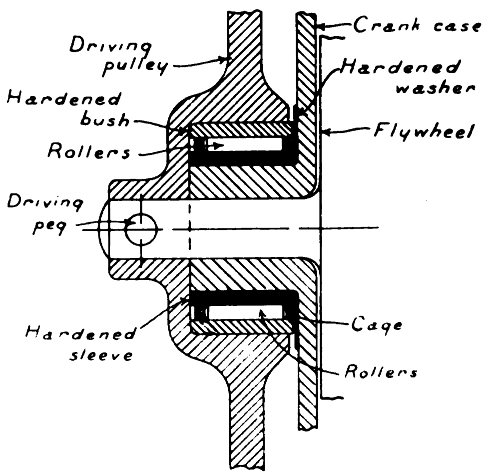


FIG. 85.

on the up-stroke of the piston and forces the moisture out on the down-stroke, and upsets the charge in the crank case. The plain shaft of the crank is a running fit in the case, which prevents the escape of mixture, a condition which is maintained by the roller bearing not wearing to any serious degree. A hardened washer should be provided, as shown against side of case, to prevent the end of roller cage cutting into the soft aluminium metal as it revolves.

(To be continued.)

The Victoria Model Steamboat Club.

By "The Carpenter's Mate."

(*Continued from page 367.*)

THE engine shown in the adjoining photograph is an object-lesson in cylinder capacities. It is fitted into the hull of the *Buzzer*, which readers will probably remember as a boat which took a certificate in the first Model Engineer Steamer Competition. This hull (which by now has provided some valuable data to work upon) was built to the lines given in the prize design by David Kidd, in The Model Engineer, Vol. III. It passed out of the hands of Messrs. Spinks and Thimbleby into those of Mr. G. F. Crowe. This gentleman promptly set to work to try and eclipse the *Buzzer's* previous performance. The boiler is a close copy of the old one, but with this difference, its various joints are caulked with soft solder. Mr. Crowe is noted for his perseverance, and well he has earned the distinction. I have seen him cheerfully set about the task of taking the boat to pieces (the deck is fixed down) and solder that boiler up again three times in so many months. Needless to say, his next boiler will not be soft soldered. As originally built, the engine was $1\frac{1}{4}$-in. bore, $\frac{3}{4}$-in. stroke, but the boat proved rather slower than before. A "post mortem" examination was held on it and it was decided to reduce the bore by putting a liner in the cylinder, bringing it down to 1-in. bore, which made it the size of the old engine. With this alteration the speed of the boat improved to about the same as the original.

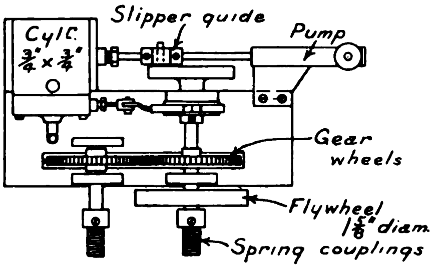
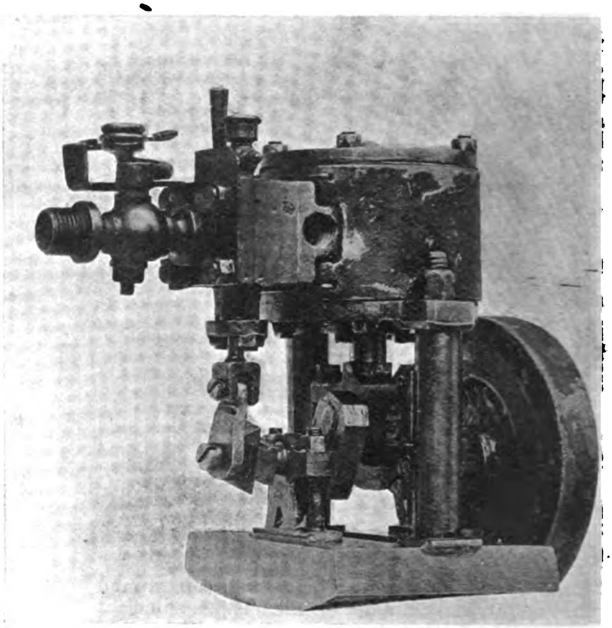


Fig. 5.—Plan View of Mr. E. V. Pike's Model Engine.

(*For description see last issue.*)



The Engine of Mr. G. F. Crowe's Model Steamer, "Veteran."

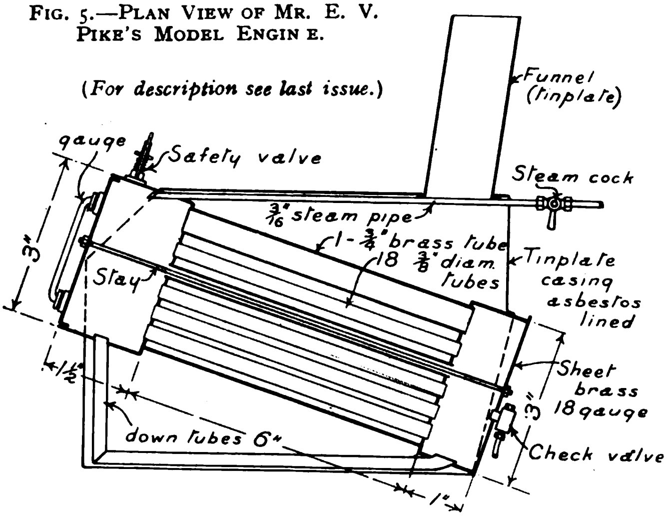
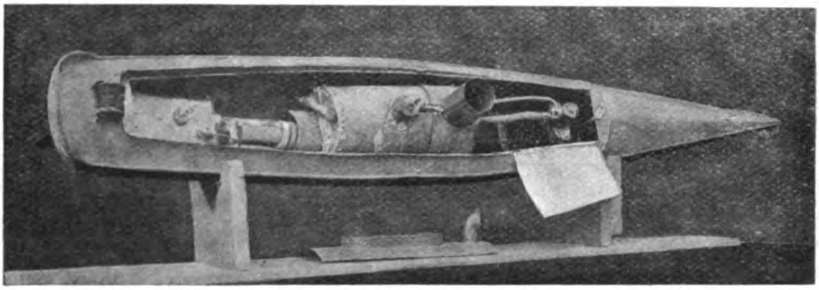


Fig. 6.—Mr. E. V. Pike's Model Marine Boiler.

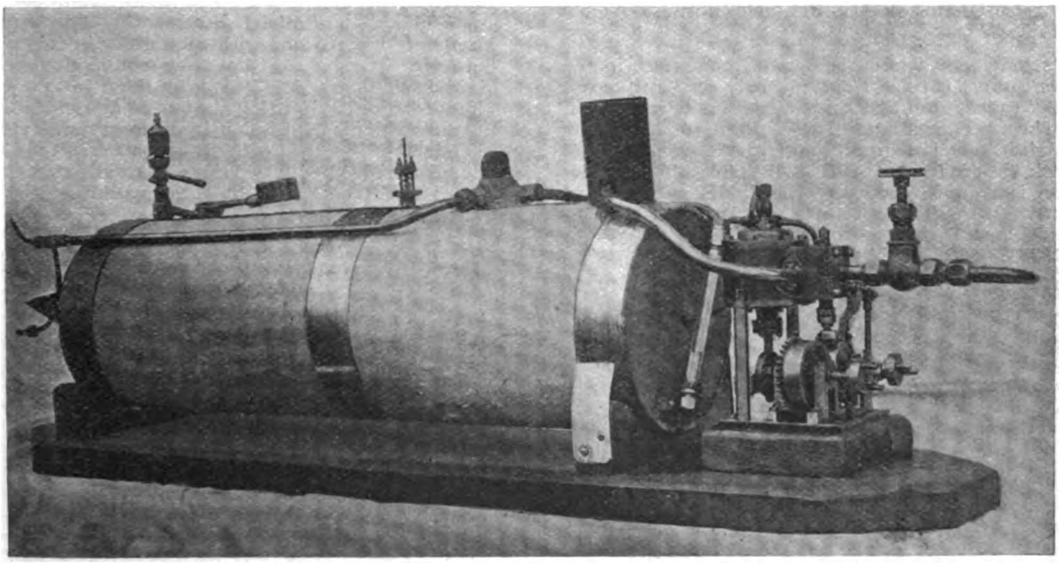
I have said that Mr. Crowe is noted for his perseverance, therefore I ought not to have been surprised when he announced his intention of still further reducing that bore. At present the cylinder has two liners in it, one inside the other, the bore being now $\frac{7}{8}$ in. diameter. Simultaneously the propellers were altered from triple (as originally fitted) to single and the improvement was very marked indeed; so much so that I get nervous when any one mentions a bore of $\frac{3}{4}$ in. in Mr. Crowe's presence.

The steam and exhaust ports in this engine are unusually large, and have not been altered. They measure 1-16th in. and $\frac{1}{8}$-in. by $\frac{3}{4}$ in. The valve gear will be recognised as that given by Mr. Halpin and reproduced in The Model Engineer handbook on "Machinery for Model Steamers." I can thoroughly recommend this method of making a return crank on account of the simplicity of getting the travel of the valve right. It has never given any trouble, although the engine has done some really hard work, having been in use now for two seasons, and "our" seasons are all the year round. It must be noted, though, that the various parts are made in steel, and a hard grade of bell-metal. The supporting pillars, which also act as guides for the crosshead, are tubes with a bolt passing through the centre, nutted top and bottom. They fit into shallow circular hollows in the bedplate and bottom cover. By slacking the nuts and giving the tubes a twist about their axis a new surface is presented to the crosshead shoes, thus providing a means of taking up wear. All the nuts subject to vibration in this engine are locked in a very simple manner. A thin square washer of sheet brass is placed under the nuts. When screwed down, one side of the washer is bent up with the point of a penknife to engage one of the flats of the nut, the other side being bent down to engage the side of the bearing cap. The flywheel is unusually large, but experience has shown this to be an advantage with this type of engine. The height over all is only 3½ ins.

The launch *Vectis*, an internal view of which is given by the accompanying photograph, is the work of Mr. H. Gaskill. This member's speciality is lamps, and his success with them entitles him to the sobriquet of "Aladdin." He begs to acknowledge his indebtedness to The Model Engineer hand-book for his initial success with lamps, but his own experience and improvements make his opinions worth having. It may not be out of place here to mention some of these. In the first place, he vetos the paraffin blowlamp, on account of the rapid carbonisation and consequent frequent pricking out which it entails. His lamps (benzoline) are now fitted with a clearing plug at the back of the nipple. When this is removed, the coil can be cleaned out thoroughly by blowing through. Another little improvement is his method of fixing the burner to the container. The burner coil itself is attached to the container by a blind union, the benzoline supply pipe being one of much smaller diameter (fitted with a pin valve), silver-soldered into the burner coil close to the blind union. This arrangement gives a better regulation of the flame, and enables everything to be taken to pieces for the inevitable cleaning. Mr. Gaskill's advice for all lamps is: keep them clean inside For the benefit of the uninitiated, it may be stated that a "blind" union is the same as any other union, except that the passage way is either blocked up or not made through.



Mr. H. Gaskill's Model Launch, "Vectis."



Mr. J. T. Spink's Twin-screw Installation.

It will be seen that the launch is a "front driver," the engine being placed in the fore part of the boat, and the tail shaft passing under the boiler. The arrangement has much to commend it, the deeper immersion of the propeller being a great point. The boiler has an oval furnace tube fitted with thirty-five vertical water tubes, silver-soldered in, and shows itself a splendid steamer. The wide stern will be noted as an attempt to adopt the new principles set up by the advent of the racing motor boat, but it is doubtful if this is an improvement for models. I may have something more to say about this question at some future time, but for the present I have got a good deal of other cargo to unship. One little point worth noting in this photograph is the reel of string on the deck at the stern. This reel, to which is attached about 3 yds.

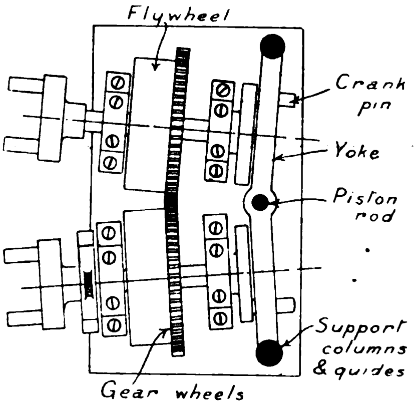


FIG. 7.—SHOWING ARRANGEMENT OF GEAR FOR MR. SPINKS' ENGINE.

of strong waxed twine, floats on the surface in the event of a "capsize," and not only serves to locate the "wreck," but acts as a salvage line to raise it by.

The neat installation shown fixed to the testing board in the photograph (page 391) is a fine piece of work, the production of Mr. J. T. Spinks. This gentleman is a great favourite with his fellow members, on account of a pleasant little habit of his. Whenever any of his less skilful messmates get "stuck" over a job, he quietly sets to and does it for them. This spirit of good fellowship which pervades all the members is not the least interesting feature of the Club, and it accounts for an attendance at the boathouse of a dozen or more on a frosty morning with no prospect of a run on account of ice. Under such circumstances they will turn up just for a "pow wow," swap yarns, and sell each other engines that won't work. The boiler in this installation is somewhat of a novelty. As originally built it was a return tube type having a flue tube 2 ins. diameter, fitted with eight water-tubes, and six ⅝-in. return tubes. It was desired to fire this with the oil spray, and in order to get a large combustion space, a "dry" firebox was built on the front lined with asbestos and fitted with deflecting arch. The whole of the tubes now act as flue tubes, there being no return. The engine is of the twin-screw type, the cylinder being placed midway between the shafts, and driving the two crank pins

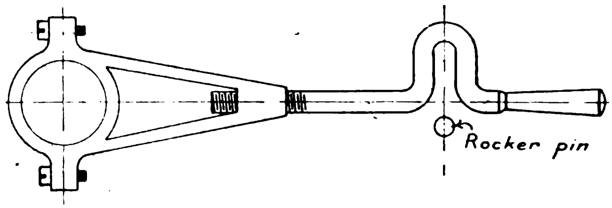
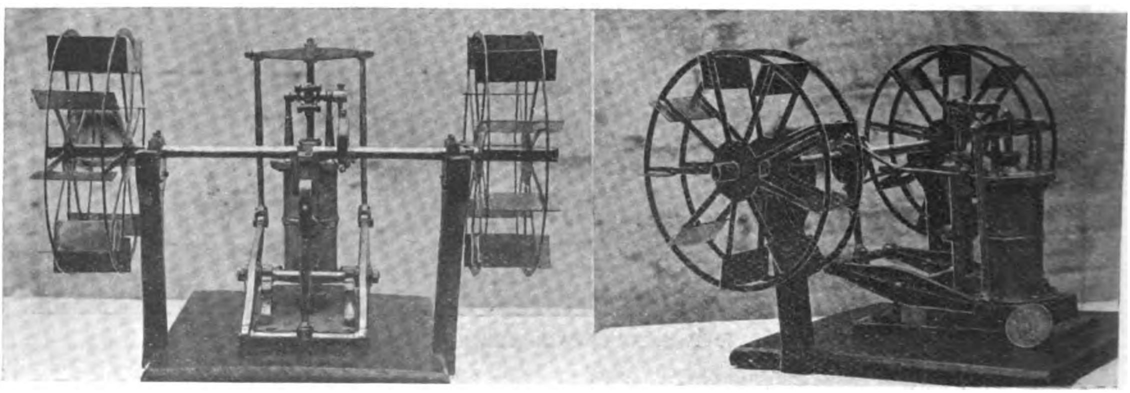


FIG. 8.—ECCENTRIC ROD, SHOWING METHOD OF ATTACHMENT TO ROCKER LINKS.

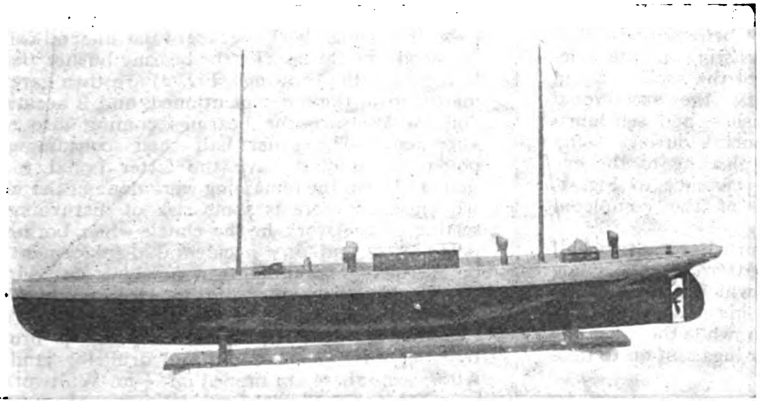
by a long yoke crosshead, similar to the engine described in THE MODEL ENGINEER handbook on "Machinery for Model Steamers." The engine shafts are not parallel with each other in this case, but are arranged to the same converging angle as the tail shafts, so as to bring them in line with these. In order to bring the yokes at right angles to the crank pins, it is made in the form shown in the sketch (Fig. 7). The cylinder has a bore of 1¼ ins.; the piston, fitted with two rings, has a stroke of ¾ in. With the exception of the bearing bushes, which are of gun-metal, the whole of the engine is made of cast iron and steel. I have not yet the particulars to hand of the testing of this plant, but have witnessed a perliminary run, and must say that it gives promise of a high efficiency. The boiler is



ENGINES AND PADDLE WHEELS OF AN OLD-TIME MODEL OF THE "COCK O' THE NORTH."

lagged throughout with asbestos, the front being arranged for easy removal if it is required to burn solid fuel.

The photograph (p. 392) shows a historic side-lever paddle engine, whose history, unfortunately, is somewhat nebulous. There is no reason to doubt its antique origin, however, and I shall be glad if any reader of THE MODEL ENGINEER who possesses the information will kindly supplement the meagre details I have been able to collect as to its past. The engine and hull is now in the possession of Mr. S. Parker, and is all that is left of a fully-rigged model, complete in every detail, of the *Cock o' the North*—the first steamship to leave the port of West Hartlepool. The particulars to hand are that this model was built some time about the early career of the original, to the order of a superintendent of one of the North of England shipyards, presumably the same yard that the prototype was fitted out at in the early twenties. Strange to relate, the one item of its biography which the various owners of the model seem to have handed down to each other with scrupulous persistence is that its first cost for making was £84, and yet the boiler has been destroyed, by an act of unconscious (?) vandalism. Such an "accident" is really deplorable to all lovers of engineering relics, and from a "model" engineer's point of view is fairly comparable with the act of that famous "nigger"—the black servant to an American millionaire—who put his dusky head through a Rembrandt, because it made faces at him. The hull presents a sorry spectacle, but still bears traces of the fine coloured carvings on the "frigate" stern, and I am hopeful of imparting sufficient fire into Mr. Parker to incite him to restore it to its original form. The bolt heads in the cylinder covers are an indication of its ancient make, and are worthy of note. These are "squared" with a circular portion to bed down on its seating, a slot for a turnscrew being cut in the top. The eccentric rod is attached to the rocker links in a peculiar manner, which I have not noticed in other representations of this type of engine (Fig. 8). By this arrangement the rod can be lifted off the rocker pin and screwed in or out of the eccentric strap, thus facilitating the setting of the valve in a central position. A penny has been placed at the side of the cylinder, which will serve as a scale to check the dimensions. As a matter of fact, this was a little subterfuge on the part of the photographer, who used it as an aid to focussing and forgot to remove it when he made the exposure. I have retained the photograph, however, for the above reason. Mr. Parker is noted for the neat finish of his work, and it is to be feared that the photograph of his electric launch does not do justice to the painting. Note that Mr. Parker does not "stick" a funnel in his boat and call it a "torpedo-boat destroyer." He would probably be the recipient of some chaff from his messmates if he did. No! the model is electrically driven, therefore he calls it an electric launch. The deck houses fit over raised coamings, in a similar manner to the lid of an ordinary tin box. A flat cork plug is cut to fit tightly into the opening in these coamings, and fitted with a thin leather loop to remove them by. This makes the boat watertight and unsinkable, and yet provides ready access to the interior.



MR. S. PARKER'S MODEL ELECTRIC LAUNCH.

(*To be continued.*)

Leeds Model Yacht Club.

THE Leeds Model Yacht Club has been revived, and is now in a very prosperous position, having a membership of nearly fifty, and a comfortable balance to start the new season with. During the past season model yachting was one of the sources of attraction to visitors at Roundhay, and had the honour of taking part in the annual Lifeboat Gala, where the racing was witnessed by thousands of interested spectators.

The Club also took a prominent part in a gala at Sunny Vale Gardens, Hipperholme, in September, when almost a score of members took their boats over to race for some prizes given by the promoter of the gala, Mr. Bunce and others.

Towards the end of the season the Club went over to Kirkstall Abbey and sailed on the pond there, which was flooded for skating. This pond has proved very suitable for the purpose, as it is in a fairly open position, and the sailing is not interfered with by rowing boats, as at Roundhay. Last season six new yachts were built, the majority of them 10-raters, and there are eight new boats being built for this season.

The Club is at present the holder of a valuable Challenge Shield, which will form one of the earliest and most interesting contests of the season. There are other prizes to be sailed for, including a valuable cup, kindly presented to the Club by Mr. Gilpin, The Mansion House, Roundhay—the cup to be sailed for at Roundhay Park. The Club has also a number of model steamers. Special races for these will be arranged for during the season. —M. J. McCAW, Hon. Sec., 24, Dorset Terrace, Leeds.

A Design for an Enclosed Dynamo or Motor.

By A. H. AVERY, A.I.E.E.

THE design for a small totally enclosed type dynamo or motor presented in this article has been prepared with special regard to simplicity of construction, and will, therefore, specially appeal to the amateur with limited tools and workshop conveniences. Several rather novel features will be noticed which have not before appeared in these pages—for instance, the casting of the pole-pieces both into the same half of the shell to avoid joints in the magnetic circuit; the exceptional length of the journals and bushes, and self-lubricating arrangements; the general outline being spherical and symmetrical is pleasing to the eye as will be gathered from the reference to Fig. 1, which shows the appearance of the completed machine.

Three castings only are required, viz., two half shells and one pulley. One pattern can be made to serve for both the shells, which are alike except that one contains the two inwardly projecting pole-pieces of the circular section, while the other has no pole-pieces, but contains four lugs cast on to take

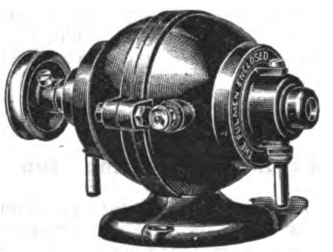


FIG. 1.—MR. A. H. AVERY'S ENCLOSED DYNAMO.

the brush holders. The lugs and pole-pieces are therefore not made fixtures to the shell pattern, but are screwed or pinned on so that the moulders can remove them at will. This also saves the necessity for a corebox to take out the interior of the shell containing the pole-pieces which would otherwise be required. A corebox for the oil reservoirs round the journals is the only other pattern needed. The patterns call for some little skill and experience in construction, but it is a good maxim to remember that it pays well to put time and care into pattern-making, and any extra expense on this score is amply repaid by the saving of time in fitting up the castings, and their improved appearance. If this stage of the work is too difficult for any reader, the fact that the castings can be purchased ready for working up may lend encouragement.

Besides the two shell castings, which must be of the very best annealed grey cast iron, and the brass or iron pulley casting, the following material will be required :—$\frac{1}{2}$-in. mild steel shaft; stampings; nut for armature; sleeve, clamp-ring, nut, and hard-drawn copper segments for commutator; $\frac{5}{8}$-in. by 5-16ths in. hard brass tube for bushes; $\frac{7}{8}$-in. brass rod for brush holders; $\frac{3}{4}$-in. brass rod for lubricators; some 60-mesh copper gauze for brushes and lubricator wicks; 4-ozs. No. 24 double silk-covered wire for armature, and 1 lb. No. 22 s.c.c. wire for fields; a pair of $\frac{1}{4}$-in. by $1\frac{1}{4}$-in. steel bolts, and sundry small screws.

Nearly the whole of the machining can be done on a 3-in. back-geared gap-bed lathe, and is of a simple and straightforward character.

Commencing the work on the shells, these are held by the fillet surrounding the oil reservoirs and chucked in a good substantial three or four-jawed chuck with the concave side outwards, and centred as nearly as possible. Taking first the shell at the commutator end, the outer face (where the two halves come together), the face of the inner oil-collecting hood, and the bore for the bearing bushes (letters C and B in the drawings, Fig. 2) are then carefully machined in the order mentioned, and if accurately done will ensure the bearings coming into exact alignment. The other half shell, containing the pole-pieces, should have the latter bored to size first, and then the remaining work done in the above sequence, as there is some risk of disturbing the setting of the work in the chuck when boring the pole-pieces, and any accidental displacement can be rectified before taking a finishing cut without spoiling the remainder of the work. When both shells are finished, a $\frac{5}{8}$-in. mandrel is passed through the bearing seats, the two outside lugs D brought together flush, marked off, and drilled 7-32nds in. Afterwards these are tapped out $\frac{1}{4}$-in. Whitworth in one half, and re-drilled $\frac{1}{4}$-in. clearing in the other.

Proceed with the armature next, centring the shaft and rough turning all over before finishing any part. Then cut the thread and turn to size where the stampings are assembled. After building up the core, tighten the clamp nut, and press or hammer it well up until quite solid and with the slots all in line: true the shaft if sprung at all, and finish all over to size and polish.

The commutator sleeve is turned from solid $\frac{3}{4}$-in. brass and the head recessed to an angle of 45 degrees; the clamp ring and steel nut are also finished at this stage. Next the copper segments have all fins or burrs removed at the ends, and are assembled in an iron clamp ring interleaved with pure natural mica 1-30th inch thick. Clamp up firmly and bore and recess the ends to size in a centring chuck, holding by the clamp ring and not the segments, and avoiding with particular care the formation of "bridges," or thin films of copper between adjacent segments. The tool must be very keen and the work run at a high speed: lubrication with turps is sometimes beneficial. A tube consisting of two layers of flexible micanite cloth is then cut to size, also four washers of the same material for end insulation,—all of 1-30 in. thickness. Two washers are slipped over the brass sleeve and the micanite tube, then the segments with the iron clamp still on, two more micanite washers, the brass clamp ring, and finally the steel nut. The whole requires now heating to about 250 degrees F. for a few minutes to render the micanite pliable, and the nut screwed up firmly before it cools. When cold the iron clamp can be taken off, the commutator finished on the outside, ends, etc., polished, and slotted at the back of the segments with diagonal sawcuts to take the armature conductors, which will be presently soldered in. Test for short-circuits from segment to segment, and also from each segment to sleeve, before leaving this part of the work.

The two hard brass bushes are simply plain tubes, faced at each end reamed to fit the shaft and make a

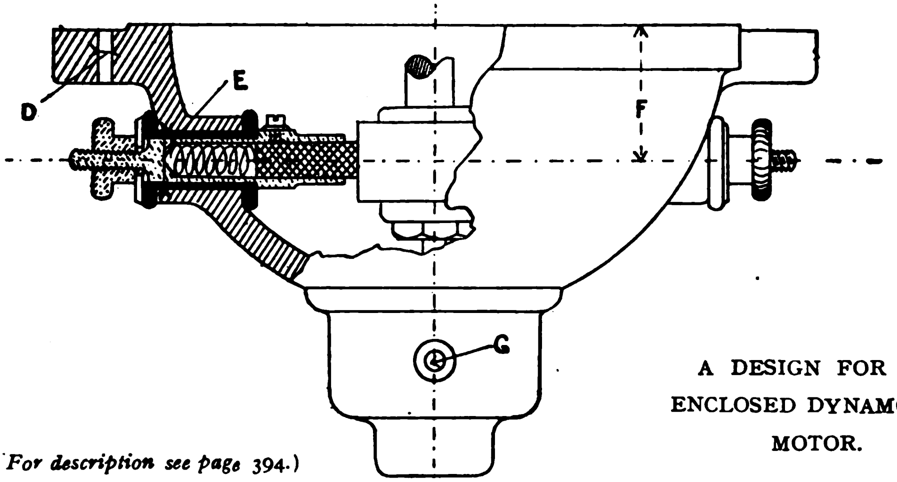


FIG. 3. SECTIONAL PLAN, SHOWING ARRANGEMENT OF BRUSH HOLDER.

A DESIGN FOR AN ENCLOSED DYNAMO OR MOTOR.

By A. H. AVERY, A.I.E.E.

For description see page 394.)

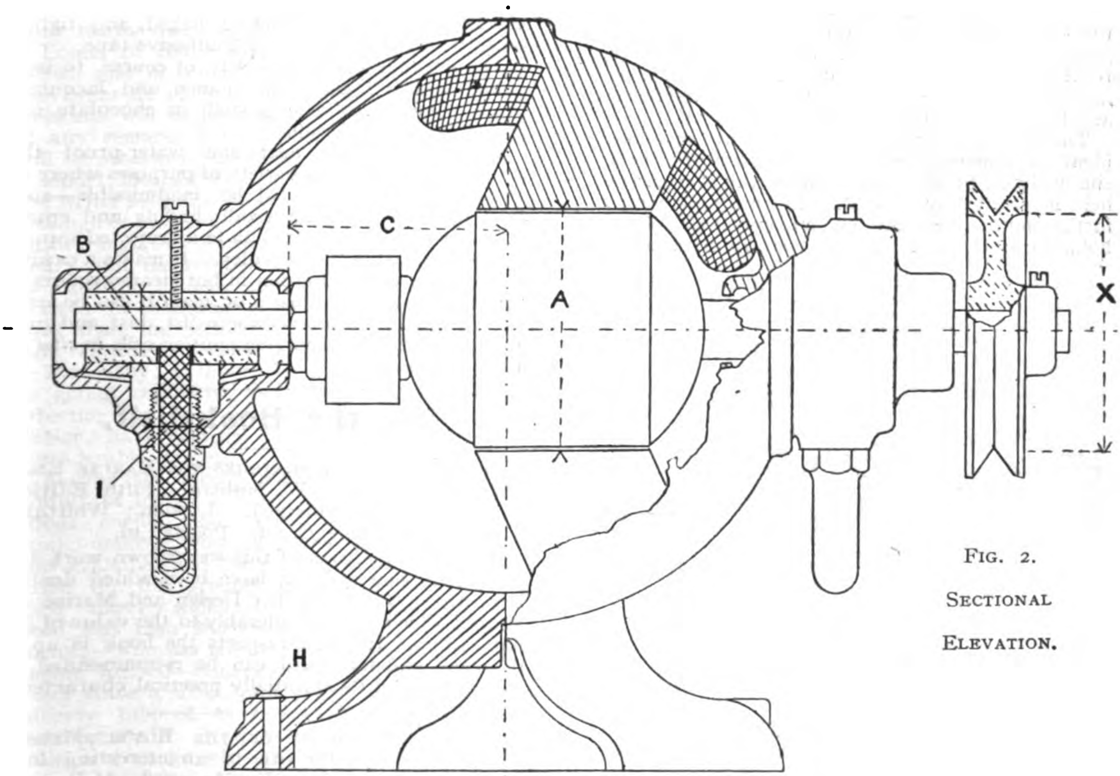


FIG. 2. SECTIONAL ELEVATION.

The dimensions of the No. 1 size of this machine are as follows :—

A	B	C	D	E	F	G	H	I	J	K	L	M
$2\frac{1}{16}$	$\frac{5}{8}$	2	$\frac{1}{4}$	$\frac{1}{2}$	$1\frac{3}{8}$	2 B.A.	$\frac{3}{16}$	$\frac{3}{8}\times 26$	3	$\frac{1}{2}$	$1\frac{1}{2}$	$\frac{7}{8}$

N	O	P	Q	R	S	T	U	V	W	X	Y	Z	&
$1\frac{3}{4}$	$\frac{7}{8}$	$\frac{5}{16}$	$\frac{3}{8}$	2	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{5}{16}$	$\frac{1}{2}$	$\frac{3}{8}\times 26$	2	$\frac{7}{8}$	$1\frac{1}{8}$	$1\frac{1}{4}$

Output as dynamo = 6V. 3A., 2,000 R.P.M.; Armature, 2″ × 8-Slot; Slots, $\frac{7}{16} \times \frac{5}{16} \times 104$
Conductors, 24 D.S.C.; Each Bobbin has 338 turns of 22 S.C.C. wire.

good driving fit in the seatings B. A couple of holes are drilled transversely through the centre of each bush—one to take a setscrew at the top, and one to admit the oiling wick which presses against the underside of the shaft. Before driving in the bushes a groove is filed from the oil-collecting hoods to the centre reservoir at the bottom of each bearing seat (or a small hole drilled through) to allow waste oil to drain back and be used over again.

and the core should have two grooves, for "binders," set in ¼-in. from each end.

After soldering the connections to the commutator three coats of best shellac varnish should be applied with intermediate baking under gentle heat.

The field coils are best wound on a circular wooden "former" ⅛-in. larger in diameter than the pole-pieces to allow for insulation, and with side flanges to prevent the wire spreading. Tie the coils with

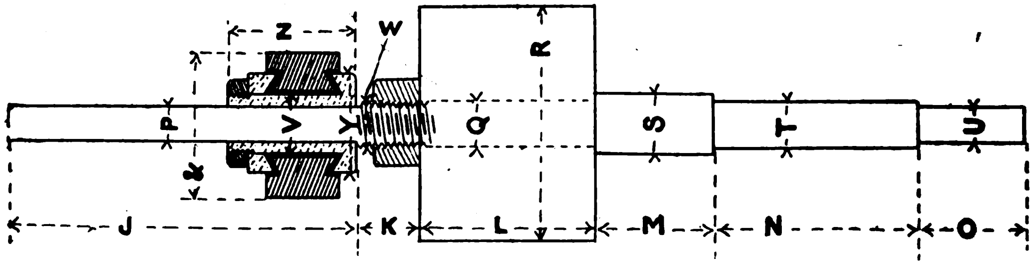


Fig. 4.—Arrangement of Commutator and Armature on Shaft.

The lubricators I are hollow tubes well fitted into the oil reservoirs and containing a felt or copper gauze wick, which is kept in light contact with the rotating journal by means of a light steel spring; a small oil groove along the interior bore of the bushes assists the distribution of the oil.

The brush-holders and brushes E are of almost identical construction to the lubricators, being simply brass tubes insulated from the iron carcase held in position by a washer and nut, and with a further milled head nut on an extension of the holder to serve as a terminal for outside connections.

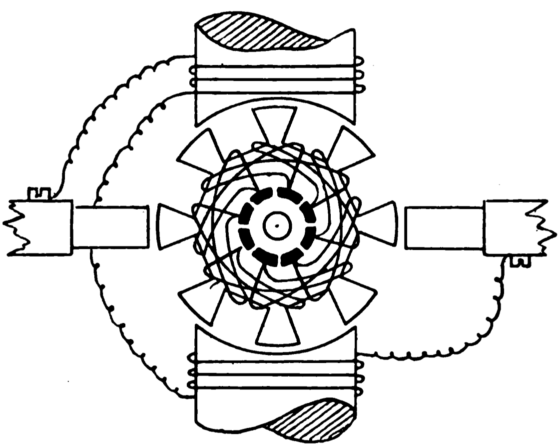


Fig. 5.—Diagram of Armature and Field-Magnet Windings.

The small screw shown in the body of the brush-holder is for connection to the field-magnet wires.

A diagram of the armature and field-magnet windings connected in the shunt is given in Fig. 5, and particulars as to gauge and number of conductors in the table of dimensions on page 395.

The armature requires carefully insulating with micanite cloth or vulcanized fibre 1-64-in. thick,

thread before removing from the former, after which they are well shellaced, baked, and tightly taped with two layers of black adhesive tape.

The finishing off may be left, of course, to individual taste. Dark green enamel and lacquered brass fittings may be suggested, or chocolate and plated fittings look well.

Being completely dust- and water-proof this machine is useful for a variety of purposes where an open type machine would be inadmissible—such as a motor for driving small buffing and emery wheels, which can be fitted on to a projected spindle at both ends instead of a pulley. It makes a capital motor for a ventilating fan in hot steamy rooms or where there is much dust; or again it can be used as a dynamo in situations where dirt, dust, and mud abound, such as for charging ignition cells *in situ* on an automobile.

For the Bookshelf.

Verbal Notes and Sketches for Marine Engineers. By J. W. Sothern. Fifth Edition. Revised and enlarged. London: Whittaker and Co. Price 7s. 6d. Postage 4d.

To the fifth edition of this well-known work two completely new sections have been added dealing respectively with Propeller Design and Marine Oil Motors, which add considerably to the value of the publication. In other respects the book is up to its usual standard, and can be recommended on the strength of its essentially practical character.

"A Short History of the Royal Mersey Yacht Club" is the title of an interesting little book written by John D. Hayward, M.D., and recently issued for private circulation by Willmer Bros & Co., Ltd., Chester Street, Birkenhead. The preliminary chapter, "Yachting on the Mersey," is followed by a more detailed account of the doings of the Club during its already long life—from 1844 to date. Not only Mersey yachtsmen, but others, will be interested in the perusal of these notes relating to the most invigorating and enjoyable pastime one could wish for.

Chats on Model Locomotives.

By Henry Greenly.

At the commencement of a new series of articles it is a common practice for the author to make clear his intentions with regard to the scope and arrangement of the following instalments. However this may be, it is somewhat difficult in the present case for me to define my future course of action. The heading would certainly appear to limit the scope to things appertaining to the model locomotive, but as the subject is one involving many side-issues, readers who are interested in model steam engines as a whole, may not fail to find something which will at least attract their attention.

My business will be to talk about the development of the railway locomotive, more particularly with reference to the effect of such developments upon the construction and design of model replicas. No branch of the subject will be beyond bounds, and no special order will be observed, except that the series will be continued—space permitting—week by week until such time as both Editor and reader become weary of it.

Points of controversial character may also be raised, and in connection with any such question, the opinions of my fellow model locomotive enthusiasts will be heartily welcomed. No criticism of any remarks I may from time to time make will be otherwise than courteously received.

Model locomotive and railway work has, the the writer feels, in some degree been passing through a slough of despond. The splendid work of amateur model engineers during the past seven or eight years, and the response of the trade with regard to castings, fittings, and accessories, has so improved the conditions of model locomotive building that there has seemed little left to discuss. But this remains to be seen.

Personally, I think the many advances made in actual locomotive practice, while not seriously affecting the main problems of model locomotive design, have changed the aspect of things to a considerable degree.

During the recent holidays I was showing a couple of friends a small 2-in. gauge six-coupled goods engine made by a well-known firm of model-makers, working under steam. No track was available, and the engine ran with the wheels lifted off the ground quite sweetly at a very high speed, which at times could not have been less than 800 to 1,000 r.p.m. One of my friends—who has recently completed a six-coupled engine himself—remarked that it was only a few years since a six-coupled engine would have been entirely tabooed as a suitable prototype for a working model. Now we see models of very small scale and gauge with six and even eight coupled wheels working quite successfully, without any of the faults predicted by the early "authorities" on model locomotives.

In actual practice the single-wheeled express engine has, since the time I penned my book on model locomotives, proceeded further towards total extinction. The 4—4—0 type is also being supplanted by the "Atlantic" (4—4—2) and the six-coupled bogie (4—6—0) types of locomotives. The result of this renders a reconsideration of

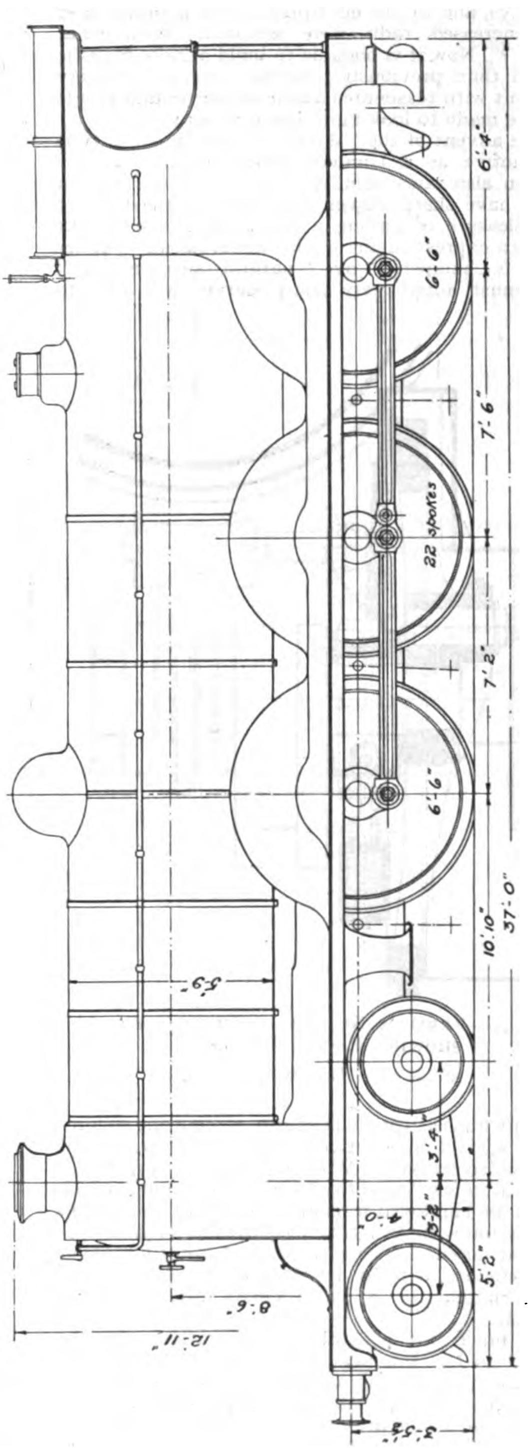


Fig. 1.—Side Elevation of the New Caledonian Railway 4—6—0 Express Locomotives, No. 903 Class.
(*Scale: 3-16ths in. = 1 foot approximately.*)

the curve question. For years I felt it my duty to urge the alteration of the standards for the tin railways, and by the enterprise of one manufacturer the increased radii were adopted. With what result? Now it is possible to build a more realistic model than previously; furthermore, the railway laid out with reasonable diameter curves and points can be made to look more like a railway.

The advent of the "Atlantic" and 4—6—0 type locomotive as a common object of the railway station also rams home the old axiom that if you must have sharp curves, you likewise must forgo the pleasure of having a model of a magnificent modern express engine. The model railway builder who is hampered by "natural surroundings" and must adopt very sharp curves will have to

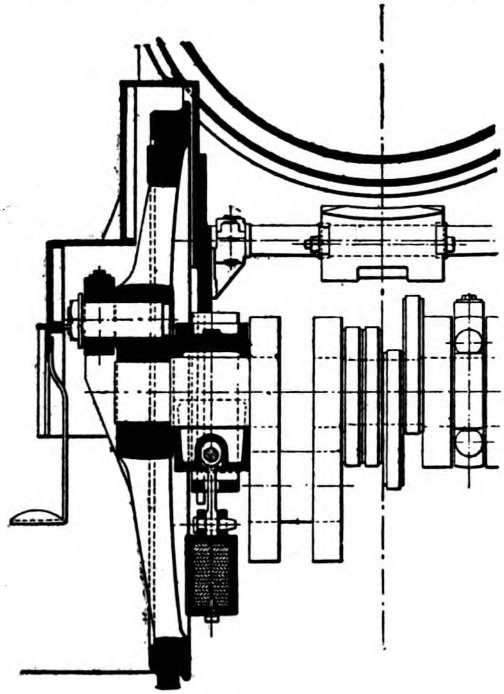


Fig. 2.—Vertical Section of Driving Wheel, showing Excessive Coning.

(*Scale: 7-16ths in. = 1 foot.*)

content himself with miniatures of shunting engines —the sort of locomotive which, as I have heard engine-drivers say, "Will run round a 'a-penny." There are a few types of passenger tank engines which might be employed in conjunction with small radii curves, but with the great length of the modern railway carriage and the ever-increasing size of passenger tank engines, a really respectable model passenger train running on a sharp curve does not seem possible.

So much for generalities. Attention may be turned to the practical consideration involved in modelling the new six-coupled express engines, designed by Mr. McIntosh for the Caledonian Railway. But before going into the more minute details of construction, I would like to point out that the new engines of this type have a slightly different wheelbase arrangement to the former class, Nos. 49 and 50.

Instead of having the coupled wheels placed equidistant, viz., 7 ft. 6 ins. apart, they are now spaced as shown in the outline diagram (page 397).

This allows a longer connecting-rod to be employed. In the actual engine the increase is 4 ins. —viz., 6 ft. 8 ins. to 7 ft.

From a model-making point of view the alteration makes practically no difference, except that it allows longer eccentric rods—which is a very good thing. The new disposition of the wheels does not make the engine any better for traversing curves, as it is the movement of the rear bogie wheel in an inside cylinder leading bogie engine which is generally the governing factor. It is little use cutting away the frames in a Caledonian six-coupled bogie engine (or, for that matter, in a long 4—4—0 type inside cylinder engine) for the leading bogie wheel to swing under them if the trailing bogie wheel cannot swing laterally to almost the same extent, owing to the presence of the cylinders and motion.

In the engine now being considered the use of valves on the top of the cylinders indirectly helps us in the matter of bogie swing, much more than in the case of the "Dunalastair III"* model locomotive design, which formed the subject of a series of articles in Volumes IV and V. The cylinder centres in the present six-coupled engines are, by virtue of the valves being placed above and not between, 2 ft. 0¼ ins. apart instead of 2 ft. 4½ ins.

Therefore the six-coupled engine, in spite of its having a longer over-all wheelbase, should not give any more trouble on a comparatively sharp curve than the earlier 4—4—0 type locomotive.

The slide bars do not come so near the side-frames, and with a slight reduction in the bogie wheel diameter, and by cutting away the frames for both the leading and the trailing wheels, a fair amount of traverse should be possible. The trailing coupled wheels should have some side-play—as much as the frames will allow—and the driving flange should be as thin as consistent with strength.

The possibility of adopting scale cylinder centres will, however, depend upon the type of valve motion employed in the model, and also on the scale of the engine. A reference to the full size drawing of the link motion for the "Dunalastair III"—on page 159 of "The Model Locomotive" —will show that in a ¾-in. scale model with the wider (2-ft. 4½-in.) cylinder centres there is not much room between the crank webs for the eccentrics, and considering both the construction and the subsequent wear and tear of the straps and

* "Dunalastair III is not the correct title for the third batch of the McIntosh 4—4—0 type engines, although it is the name most familiar to The Model Engineer readers. The original "Dunalastairs" were Nos. 721 to 736; the second class were the "Breadalbanes," Nos. 766 to 780; the third class were known as the "900" class (Nos. 887 to 902 inclusive); and these were the engines which formed the prototype for The Model Engineer design. The latest 4—4—0 type are the 140 class, viz., 140 to 144 and 145 to 150. These were illustrated in a Reply to Query (see The Model Engineer, February 1st, 1906).

sheaves, little reduction in the width of the latter is desirable.

With the 2-ft. cylinder centres the sheaves of a 3¼-in. or 3½-in. gauge model would have to be very thin, and in any case the one-piece method of construction (see photographic illustration on page 105 of "The Model Locomotive," and THE MODEL ENGINEER for March 1st and May 1st, 1901*) would seem to provide the best means of obtaining satisfactory results.

One of the most interesting features of the new engines is the excessive coning of the driving wheel centres. Considerable trouble was experienced with the driving axle-boxes of the first two 4—6—0 type express engines.

The whole of the thrust of the cylinders—which may be very powerful—in a six-coupled engine, where the driving is done on the first pair of wheels, has to be taken up by these boxes, and in the earlier Caledonian engines it was found that the cheeks of the boxes used to spread out, and pounding and other objectionable effects ensued.

The dimensions of the main bearings have now been increased. The driving journals measure no less than 10¼ ins. in length, that is, 3 ins. longer than those of the "Dunalastair III" class engines.

This improvement has been accomplished by coning the driving-wheel centres, as shown in the accompanying diagrams, the setting of the cylinders closer together of course helping matters considerably. This feature of the original engine means that in the model two patterns will be required for the driving and coupled wheels,† unless the expedient I have often resorted to where wheel patterns have been incorrectly made and have insufficient coning is adopted.

The *modus operandi* (applied to the present case) would be as follows:—Get a pattern made with the correct number of spokes in wood. With the balance-weight arranged to suit the coupled wheels, use this pattern for a preliminary brass casting, which (cleaned up) forms the final pattern for the iron wheels. Take another brass casting from the wood pattern (on which double shrinkage, say about ¼ in. to the foot, has been allowed) and place the casting on a suitable surface, face down, so that the rim only is supported. Hammer the boss of the brass casting, a piece of wood intervening, until the proper amount of coning is obtained.

Clean up this casting, add the large balance-weight in the correct position for a right-hand "crank-leading" inside cylinder engine.

Add also a round piece of metal to the back of the boss, so that the latter is quite level with the back of the rim; otherwise, in the process of founding (and where such is required, annealing the casting) the casting may sag in the middle and the wheel have no more coning than that of the original pattern.

The above may seem a tedious process, but it is really not so. The use of a brass casting as a pattern for the final wheels in iron or mild steel results in castings which require no cleaning work whatever to the spokes. It is better to only have to clean up the two brass patterns than to have to do the same to the six driving wheels. Furthermore, the wheels will not vary to such an extent in the matter of spoke thickness. Further notes on the "Caledonian" (4—6—0) engines will be included in the next article.

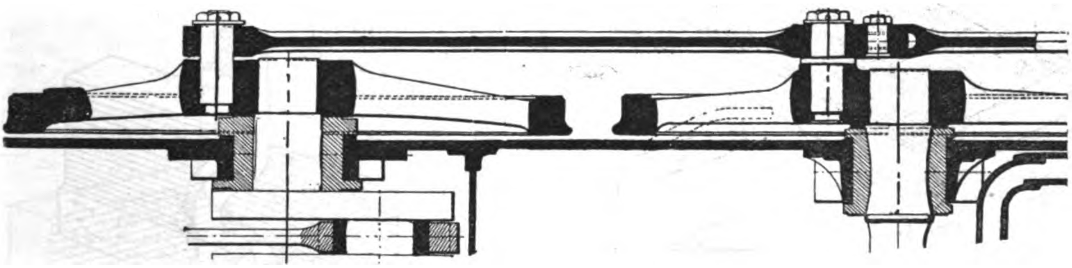


FIG. 3.—SECTIONAL PLAN TO A SCALE OF 7-16THS IN. TO THE FOOT, SHOWING DIFFERENCE IN THE CONING OF THE FACES OF THE DRIVING AND THE COUPLED WHEELS.

(*Note also the projection on the coupled wheel behind the collar of the crank pin.*)

(*To be continued.*)

* Readers will please note that the dimension given for the throw of the eccentrics in the 1901 articles is hardly sufficient. The error has been remedied in the drawing in "The Model Locomotive." I mention this because several gentlemen have had considerable difficulty with the valve gears of their model "Dunalastairs" owing to this slip.

† The necessity for providing the extra bearing surface is, of course, less in a model than in actual practice. However, accuracy in such a detail as wheel coning is very desirable.

A NEW metal called "hydeslite" is being produced at a works in Philadelphia. It consists of an amalgamation of various minerals, and when mixed with brass it is said to impart to it extraordinary strength. While common brass will crumble when exposed to great heat, experiments show that when mixed with "hydeslite" it will bend or roll hot, neither breaking nor crumbling.

A RIVAL of Professor Korn, the Belgian inventor Carbonelle, has succeeded in electrically transmitting portraits, letters, &c., between Brussels and Antwerp, a distance of 27 miles, but, instead of a photograph, it is an impression on a half-tone *cliché*, or block, which is transmitted, and which will afford a print on fine paper. The two instruments serve indifferently for sending or receiving, and the *cliché* is obtained in one minute.

Planing and Shaping for Amateurs.

By A. W. M.

(*Continued from page 370*).

II.—Tools: Their Shapes and Uses.

Two operations are generally performed by the cutting tools upon the work to be planed, namely—roughing and finishing. In the first, the tool takes what is called a rough or roughing

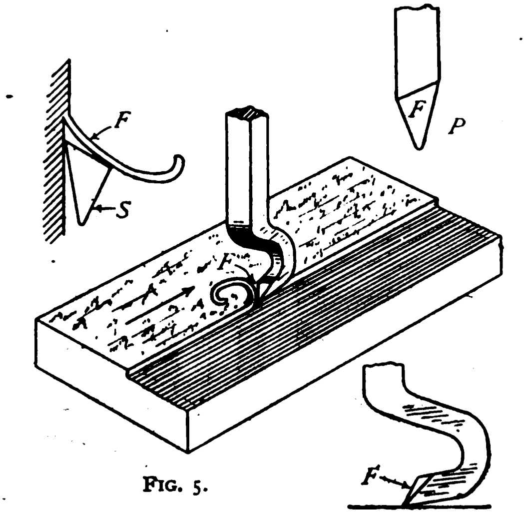


Fig. 5.

cut over the surface. The object of this is to remove any inequalities which may exist upon the casting or forging in its rough state without at the same time producing a high degree of finish by the tool during its passage. This roughing cut may be sufficient in cases where only moderate accuracy is required, but if the work is to be planed to a certain

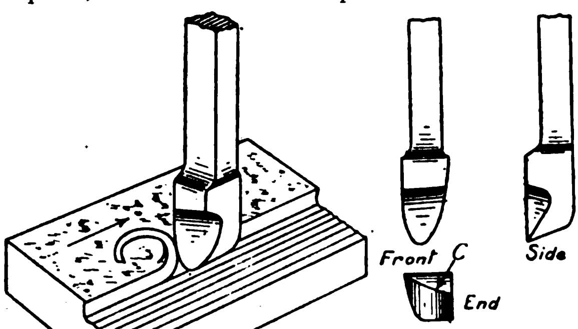


Fig. 6.

measurement, and to be as nearly flat as possible, a more refined cut is necessary. Sometimes the casting or forging is very much larger than it is required to be when in a finished state; the superfluous metal is then removed during the roughing operation, and several of these cuts may be necessary. It is understood that the word "cut" does not in this sense mean a single stroke of the tool, but its passage over the entire surface which is being planed.

Roughing and finishing cuts should be each made by a tool which is shaped to best suit the

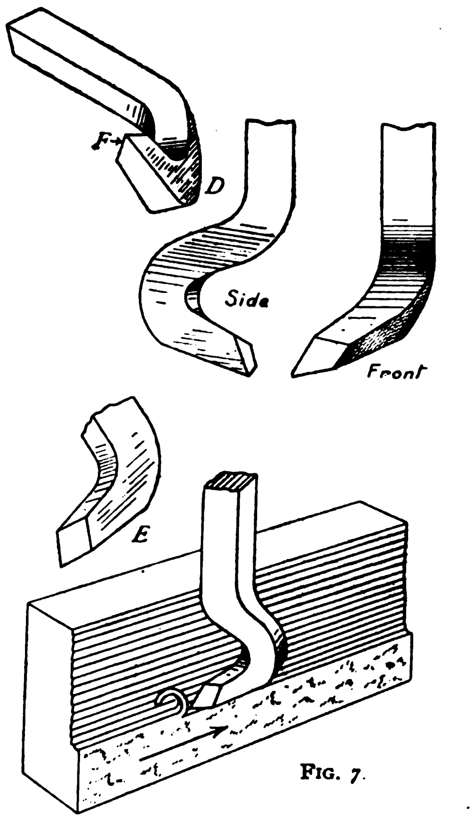


Fig. 7.

particular operation. When rough-cutting, the operator (in theory at least) desires to remove as much of the excess of metal in the shortest possible

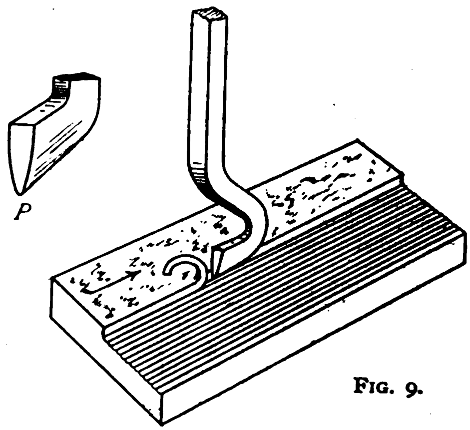


Fig. 9.

time. A roughing tool must therefore be made—of the most suitable shape—to take a deep cut at a comparatively coarse rate of feed. The shape is not necessarily the same as that for a finishing tool, which is required, primarily, to produce a smooth and accurate surface—also in a minimum of time consistent with this result.

Fig. 5 shows a front roughing tool suitable for

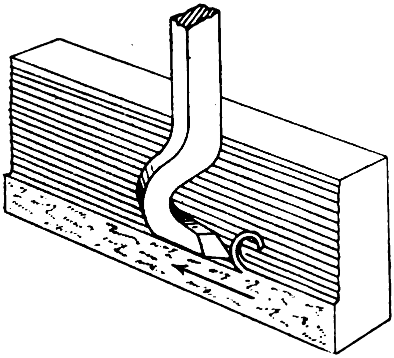


Fig. 8.

planing horizontal surfaces. The face F is ground so that it slopes sideways as well as backwards from the point. This assists in cutting away the metal

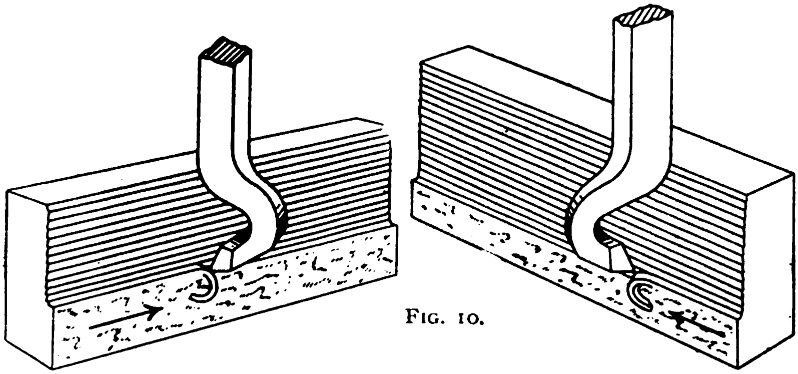


Fig. 10.

at the side so that the shaving slides easily away, as indicated in the small diagram S. Such a tool is to be used for planing wrought and cast iron or steel. The point should not present an acute angle

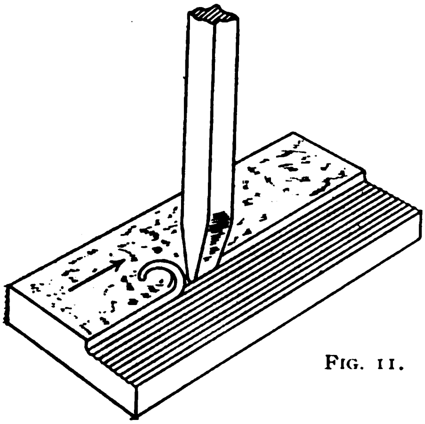
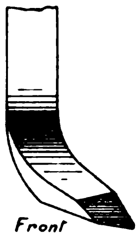
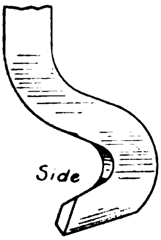


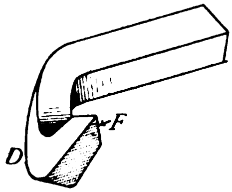
Fig. 11.

where the sides meet, but should be well rounded, as in the small diagram P. Another shape of front roughing tool for iron and steel is given in Fig. 6; it does not conform to the condition that the point should be in line with the under side of the shank, but being of rigid design, gives good results if not allowed to project far out of the tool-holder. The face is sloped sideways, as shown at C in the small diagram.

When the surface to be planed is vertical a side tool is required: Fig. 7 shows a pattern suitable for







roughing the side, which we may call the left-hand surface of the piece to be planed. It is similar in design to the tool shown in Fig. 5, but is bent to one side as indicated. The cutting edges are to be arranged as for the tool in Fig. 5: that is, the top face F should slope sideways, as shown in the small diagram D, and also backwards from the point, as in small diagram E. This is the tool to use for cutting iron and steel. The corresponding side roughing tool for right-hand surfaces is shown in Fig. 8.

In theory, the tools for cutting brass or gun-metal should have similar edges to those for cutting iron, but in practice they are made with angles much less acute, on account of the tendency of the point to dig into the surface. Fig. 9 shows a front roughing tool for brass and gun-metal. The tools for vertical side planing would be similar to those of Figs. 7 and 8, but their cutting edges should be made as obtuse as shown in the view P of Fig. 9. A pair of

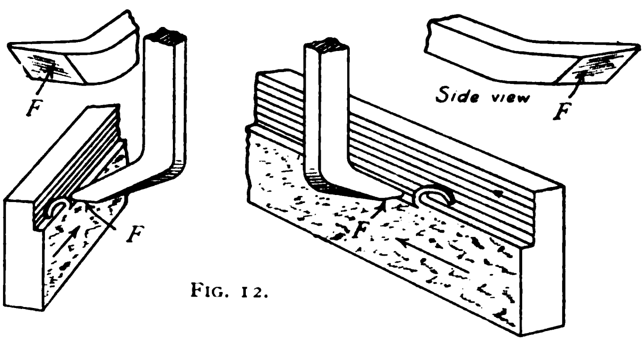


Fig. 12.

such tools is shown in Fig. 10. Brass roughing tools are sometimes made as Figs. 11 and 12, which show front and side patterns. They work very well, especially for light cuts in shaping machines, and correspond to the tool shown in Fig. 6.

(*To be continued.*)

Practical Letters from our Readers.

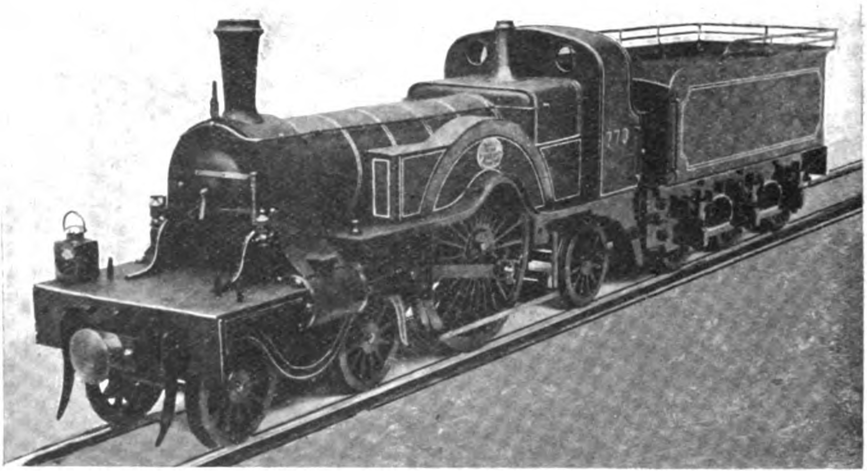
The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily intended for publication.*]

Model Electric Locomotive and Tender.

To the Editor of *The Model Engineer*.

Dear Sir,—The enclosed photograph is of a model electric locomotive and tender just completed by me for the well-known "Great Holmwood" model railway of Col. Harvey, of Norwich. A good portion of the model was actually built in the Holmwood workshop. Both engine and tender are fitted with a "Marshall" motor, the same as fitted to the electric car, illustrated in The Model Engineer some time back. This type and make of motor having proved so successful in the car, it was decided to fit the same to the model here illustrated. The bogie pin is fitted above the centre of trailing axle; the front part of bogie has a plate which runs over on rollers fixed to main frames. The engine trailing wheels also run over on rollers, to take the sharp curves on this railway. The gearing is arranged similar to that described with car. The tender has plenty of side play to leading and trailing axles to allow for curves. The switches are placed on the footplates, and take the form of ordinary reversing levers. The length over buffers is 3 ft. 6 ins.—Yours truly,

Norwich. R. W. Wright.



An Electrically-driven Locomotive for the "Great Holmwood" Model Railway.

Re Design for Windmill.

To the Editor of *The Model Engineer*.

Dear Sir,—I note the articles on above subject are now finished, but they do not appear to have provoked any comment up to the present. It may interest you to know that I have been running my small workshop by wind power for some years. I built my mills from designs that appeared in The Model Engineer, but the great trouble has been the irregularity of speed, as the sails are on the old principle—canvas on wood frames. I set either two, three, or four sails, according to the strength of the wind, and then regulate the speed as well as I can with the brake, which I can put on from inside the workshop; but if a strong wind gets up and finds you under full sail, the brake is no use, and the mill frequently runs away.

At the present time, I am building a set of self-acting sails, which I hope to get running during the coming summer. The principle is quite different from Mr. Powell's, but I think they ought to do all right. I have seen a large flour mill fitted with the same kind of sail. If you would care to know when I get them on and thoroughly test them, I will send you a description of them. Mr. Powell's system seems all right, but it would be difficult to apply to my mill as at present constructed, and I had my sails well under way before the articles commenced to appear. I note Mr. Powell's remarks *re* the so-called American type of mill, and though I have never had anything to do with one, I always had an idea that while they might do fairly well in light airs, they would be throttled with spent wind in a fair working breeze. I think a six-sail mill is the best that can be made. Mine at the present time has four sails. I should advise anyone building The Model Engineer mill to spare neither labour nor material in the construction of the tower. The windmill builder has not only to contend with the steady working breeze, but also the furious gale that will soon find out the weak spots. I found out my tower was no use as originally constructed, and there is double the material in it now. I should like to know if any other of your readers run their shops by wind power.—Yours truly,

Burton-on-Trent. Thos. A. Woodthorpe.

Re Competition No. 42.

To the Editor of *The Model Engineer*.

Dear Sir,—I am very much obliged to Mr. de Vignier for his criticism on my design for a model boiler, and will try to make clear the points he has raised.

In the first place, the boiler in question is not merely one on paper, but one that has been built and proved to do what is stated in the article, and is the result of a number of experiments.

Seeing that the design is for a model racing boat of the dimensions given, which could be built to have a total weight of 20 lbs., I think the boiler and engine specified will answer the purpose, when one weighing 14 lbs. more goes at a speed of 10 miles an hour.

The speed of the engine should be 2,000 r.p.m., driving three shafts at the same speed, with one propeller $3\frac{1}{4}$ ins. diameter, and two $2\frac{1}{2}$ ins. diameter, the pitch being about $7\frac{1}{2}$ ins.

The boiler will, and has, evaporated $1\frac{3}{4}$ pints, or 48 cub. ins. of water, from boiling point in five minutes with a suitable blowlamp.

Mr. de Vignier in his calculation takes the cylinder as being filled with steam at boiler pressure, which is 180 lbs. per sq. in., which I do not think will be the case, especially at 2,000 r.p.m. For such a speed, I have found it good practice to exhaust just before the end of piston stroke with a cut-off of about $\frac{7}{8}$ in. Allowing for a drop of 5 lbs. at the point of cut-off, the terminal pressure would be 133 lbs. per sq. in., and the M.E.P. would be 167 lbs. per sq. in. Allowing 7 lbs. for back pressure, etc., we have—

$$\text{I.H.P.} = \frac{160 \times \cdot 0625 \times \cdot 6013 \times 2000 \times 2}{33000} = \cdot 727.$$

Now, as 1 cub. in. of water equals 185 cub. ins. of steam at 133 lbs. pressure $\frac{1800}{185} = 9\cdot 7$ cub. ins. of water required by the engine.

The justification for a pressure of 180 lbs. is that, power for power, an engine can be made smaller, be less in weight, and, owing to the moving parts being less in weight, will run at a higher speed, and will also be a more efficient engine. There are a few more reasons, but I think these will suffice.

Mr. de Vignier takes exception to my way of calculating the heating surface, as it is customary to count only that which is covered by water, but in this case the heat gets all round the steam drum, and if it is not heating water it is heating the steam, which in turn heats the water, which gets mixed with it on its way to the superheater, arriving there in the form of a spray. The superheater is rather more of a flash boiler, being almost red hot, and the spray coming in contact with it, is quickly turned into steam, so I think I am justified in calculating heating surface as I did. As the strength of a tube is calculated at its weakest point, and as that point in my design is through the holes bored for the water tubes, an allowance will have to be made, as the spelter will not compensate for the metal removed.

In regard to the threading of water tubes, it was done to get a more efficient heating surface, not to gain more heating surface, as Mr. de Vignier takes me to have said. As I had to employ tubes of 20 B.W.G., having had thinner ones burned in the brazing operation, they were threaded for the purpose stated, and as the strength of them is more than sufficient, there is no objection on that score. I trust that the foregoing remarks will be sufficient to indicate to Mr. de Vignier that the boiler, as designed, has in every way fulfilled the purpose of the competition, and that it is capable of meeting its conditions.

Trusting you will find room for this in your paper, and thanking you in anticipation, I am, yours faithfully,

Leith. D. Scott.

Cleaning Soiled Hands.

To the Editor of *The Model Engineer*.

Sir,—Referring to "J. Bee's" enquiry, "Vim" is a good thing to use. It is a powder, sold in tins with perforated lids, and I have found it fairly efficient. Still better, and the best I know of, is a new liquid soap sold by cycle agents, under the name of "Lyxavon." It is sold in tins at sixpence and one shilling, the tins having a stopper with hole through, so that the liquid can be squirted out as from an oilcan. "Lyxavon" has a consistency similar to glycerine or thick oil, and in use, a little is poured into the palm of the hand, and rubbed over the hands. The addition now of a little cold water produces a fine lather, and the dirt literally vanishes, leaving the hands clean and smooth. I have no interest in the making or sale of the preparation named.—Yours faithfully,

Alfred Waterhouse.

Hampton.

To the Editor of *The Model Engineer*.

Dear Sir,—In reply to "J. Bee" in your issue of April 11. The only practical method of cleansing the hands is by rubbing well in some animal fat, such as dripping, or butter. The fat should be used exactly like soap, then the soap should be used on top of the fat, without water, and then warm water, used sparingly at first, and in the ordinary manner, until the fat, soap, and dirt come away nicely, leaving the hands clean and soft. Use a fibre nail-brush. Mechanics in engineering works, especially the apprentices, use some emery paper with the grease; but this of course is inadmissible if the hands are to be decently soft afterwards. I am a professional man myself and find the above gives the best results. The fat used must be of animal origin, vaseline is of no use whatever. A piece of fresh butter, the size of a walnut, well rubbed in to start with is the best. I wear gloves as much as possible, and beg them from my friends. Gloves should always be used when turning or working with cast iron.—Yours truly,

F. Gorham Ticehurst.

To the Editor of *The Model Engineer*.

Dear Sir,—I think the following will suit your correspondent "J. Bee," who wants to know the best means of cleaning his hands. Before commencing his job, if he will rub a little of the following lotion into his hand, and especially fingers, the dirt will be removed easily on washing after the job is over:—Zinc lotion, 3 ozs.; glycerine, 1 oz. Mix together in a bottle and keep on a shelf in the workshop.—Yours truly,

Manchester. Albert Nelson.

To the Editor of *The Model Engineer*.

Dear Sir,—Referring to Mr. Bee's letter on this subject, I, too, as a professional man have had to encounter the same difficulty.

I find mineral naptha copes successfully with all the dirt I accumulate during my nocturnal diversions.

Keep the naptha at hand in the bath-room (well corked, of course), and start washing with ordinary soap until, if possible, the suggestion of a lather can be obtained. Then pour about a teaspoonful or less into the palm of one hand, and go ahead. The naptha seems to act quite differently to paraffin, which works the dirt further in. Six pennyworth should last a winter. "Fels Naptha" soap would probably be equally good, but I have never tried it.—Yours truly,

"Lex."

[J. W. H. has successfully tried "Fels Naptha."—Ed., *M.E. & E.*]

To the Editor of *The Model Engineer*.

Dear Sir,—In answer to your correspondent, Mr. Bee, *re* the above, if he uses ordinary Brookes' (Monkey Brand) soap and hot water, he will find no difficulty in keeping clean hands and a good skin. I myself am an engineer by profession, and am engaged a good deal in the drawing-office, where clean hands are requisite, and although I work at nights on my lathe and, like your correspondent, get my hands in a fearful mess, I find no difficulty whatever in removing all dirt from the pores of the skin with Brookes' soap.—Yours faithfully, Ernest G. Norton.

Cambridge.

[Brooke's Soap (Monkey Brand) is also recommended by Mr. A. Norgate.—Ed., *M.E. & E.*]

To the Editor of *The Model Engineer*.

Dear Sir,—I am happy to assist Mr. Bee in this matter, more especially as I have been in the same predicament, viz., my work requires clean hands and it is difficult to keep them so. If Mr. Bee will rinse his hands *before* and *after* work with paraffin, or better, if possible a little stale petrol, he will find it much easier to keep them smooth and clean. Cassal, in his useful book, "Workshop Makeshift," speaking of the same, recommends his readers to wear worn-out dancing gloves, with the fingers and thumbs cut off at the first joint. He also adds: "If the precaution of filling the finger nails and the quick with paraffin wax before doing any dirty work is taken, the nails can be cleaned perfectly, and the skin under and around them will not become dirty and all but impossible to clean." I have slightly abridged Mr. Cassal's remarks to save space. I am inclined to think that if Mr. Bee used paraffin as mentioned above, in conjunction with soap powder or "Sapon" he would have no further trouble.—Yours faithfully,

Cranbrook. Sidney Russell.

To the Editor of *The Model Engineer*.

Dear Sir,—If J. Bee will obtain some "Manulav" soap, made by Price's Patent Candle Company, Ltd., for the use of automobilists, he will, I think, be quite satisfied, as I am, with the results. The lather—at first—feels rather gritty, but in a short time becomes quite soft and creamy. Its dirt-removing power is quite remarkable, and at the same time it softens the skin. If the grime be very bad, as when working in cast iron, wash the hands first in a little clean oil, and finish with the aforesaid soap.—Yours truly,

Edgbaston. Henry Lea.

To the Editor of *The Model Engineer*.

Dear Sir,—In answer to J. Bee's letter; he should first rub plenty of oil over his hands, and then use soft soap to get a lather with the oil. I have found this to make the hands perfectly clean. Any old engine oil will do; I use cylinder oil which has been used and filtered. Hoping that this will help J. Bee out of his difficulty.—Yours truly,

J. Allan.

To the Editor of *The Model Engineer*.

Dear Sir,—In answer to Mr. J. Bee, *re* Soiled Hands, let him try a soap called "Lasso," or if not this, to rub well with a lemon and then thoroughly wash in warm water.—Yours truly,

Kingston-on-Thames. F. C. White.

["Lasso" is also recommended by J. W. H.—Ed., *M.E. & E.*]

Re Design for Small Undertype Engine.

To the Editor of *The Model Engineer*.

Dear Sir,—With reference to the interesting design for small undertype engine in this week's Model Engineer, I should like to make one or two suggestions, excusing myself on the grounds that I have recently completed a model compound engine of about the same dimensions as that proposed.

Mr. Greenly shows ordinary screwed unions connecting the steam pipe and superheater. These

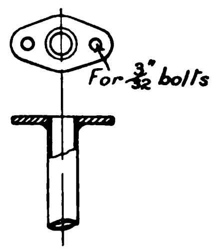


Fig. 1.

are convenient, but difficult for the amateur to make. I therefore venture to propose that flanges might be better, and have found flanges (as **Fig. 1**) give every satisfaction, while being readily cut from 1-16th-in. sheet brass and silver-soldered to pipe.

I quite agree with Mr. Greenly's remarks *re* l.-p. cylinder acting as a trap to catch steam leaking past h.-p. piston, and in order to prevent it getting past l.-p. piston as well I have adopted the following method of packing the latter (suggested, I believe, by a correspondent to the *Engineer* some years ago).

The piston is turned with one groove about $\frac{1}{8}$ in. wide by 3-16ths deep. In this is coiled a short piece of clock spring (see Fig. 2), wound tightly round with about 1½ turns, a piece of stamp paper being attached to end to prevent uncoiling. The piston is then packed with soft packing in the ordinary way and inserted in the cylinder. The spring is soon released by the moisture acting on the paper, and the packing pressed out against the walls of the cylinder.

I think this an improvement on the ordinary

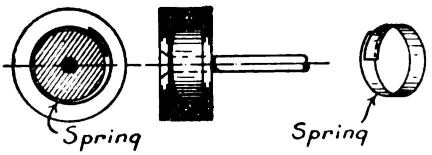


FIG. 2.

method of fitting a piston, and might be worth adopting in the present instance.

If the delivery pipe from the feed-pump could be coiled a few times round the inside of the firebox without complicating matters, the evaporative powers of the boiler might perhaps be increased a little.

Hoping the above may be of interest to those thinking of building this interesting model and be worthy of the notice of Mr. Greenly, yours faithfully, C. BLAZDELL.

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.

AN ordinary meeting of the Society was held on Tuesday, April 9, 1907, at the Cripplegate Institute, Golden Lane, E.C., Mr. Herbert Sanderson taking the chair and upwards of sixty members being present.

The minutes of the previous meeting were read and signed, and four gentlemen elected members. The dates of future meetings having been announced the Chairman called upon Mr. Ferreira for his lecture on "Model Making Wrinkles," and one of the most instructive and interesting lectures of the session was keenly listened to by the members present, and a large number of technical questions asked and answered; a full report of this lecture will appear in an early issue of this journal. On the motion of Mr. Percival Marshall a very hearty vote of thanks was accorded Mr. Ferreira.

Among the exhibits shown by members was a ¾-in. scale Atlantic type locomotive by Mr. Denvil, a finely finished overhead gear for lathe by Mr. Clayton, a donkey engine and pump by Mr. C. Barron, and a miniature G. W. Railway engine and track by Mr. Hildersley.

FUTURE MEETINGS.—Wednesday, May 1st, short papers by members on various subjects. Tuesday, May 28th: Lecture by Rev. W. J. Scott on "Six-coupled Engines on the Great Western Railway."—For further particulars of the Society and forms application should be made to HERBERT G. RIDDLE, Hon. Sec., 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:—

[17,513] **Model Marine Water-tube Boiler.** F. H. (Entwistle) writes: (1) Will a boiler like the one designed by Mr. Scott and illustrated in your issue February 14th (but having 330 sq. ins. heating surface), the boiler being 12½ ins. long, drive four ⅝-in. by ⅝-in. double-acting slide-valve cylinders at 1,000 revolutions and 80 lbs. boiler pressure (gauge), cut-off at one-third of stroke? (2) Is this cut-off about right for double-acting slide-valve cylinders at this pressure? (3) Should I be likely to get better results with single-acting cylinders, using the same amount of steam? What would be the best type to use? (4) How are the valves worked in a Brotherhood engine? Where can I get particulars? (5) Is the blowlamp, illustrated and described on pages 26–29 of Handbook No. 13—"Machinery for Model Steamers," large enough for above boiler? Is there any difficulty in getting these home-made blowlamps to work efficiently? If so, where could I get one suitable for my purpose? (6) Can you tell me where I can get Spence's "metal," which is a mixture of sulphide of iron, lead, and zinc, and which I understand melts at 320° F., and has exceptional casting qualities? (7) Can you tell me just what "pitch" is in a propeller blade and how determined? What blade area and pitch would be required to run off one slide-valve cylinder, ⅝ in. by ⅝ in., at 1,000 revolutions and be one of four to drive a 5-ft. boat?

(1) Yes, but a one-third cut-off is impracticable with an ordinary slide-valve. The steam-chest pressure would be about 50 lbs. (2) A cut-off about ¾ of stroke is about the right thing for a very fast engine. (3) The advantage would be solely in the better distribution of the weight in the boat possible with single-acting trunk engines. The single-acting engines will use more steam proportionately. (4) See THE MODEL ENGINEER of April 26th, 1906, for an idea of the most suitable method of arranging the valves. (5) The blowlamp is hardly large enough in the Bunsen tube. Make this portion 1½ ins. diam. instead of 1 in. The chief difficulty lies in the nipple, but if you get one of the Primus nipples, which will cost you threepence, you should have no trouble. The air opening may also require adjustment. (6) You might try Smith's, of Clerkenwell, London. We do not understand why you should adopt this alloy for a model steamer engine. (7) We would recommend you to read the excellent articles in our issues of March 19th and April 2nd, 1903, on the subject of propellers.

[17,510] **Model Steamer Machinery.** W. H. G. (Seven Kings) writes: I should be much obliged if you would answer the following queries for me. (1) What size engine would the boiler on page 17, Fig. 8, of "Machinery for Model Steamers" supply steam for? I propose using a ¾ or 1-in. bore by ¾-in. stroke engine for boat, of which I enclose sketch. I intend to use boat as a racer. (2) Would aluminium be strong enough for cylinder of engine with a seamless brass liner; also for connecting-rod?

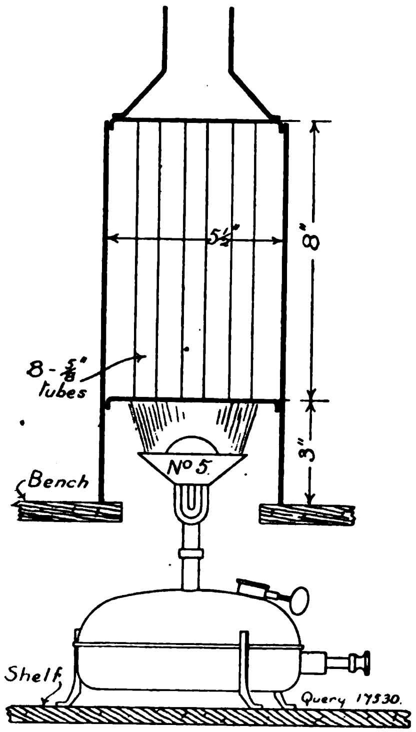
(1) A ⅝ by ⅝-in. engine (or a ½ by ½-in.) engine will prove quite large enough for a 3-ft. boat of narrow beam. (2) We do not advise aluminium; it is hardly worth it. Build the cylinder up of tube, and if you are specially desirous of a light engine for the speed and power obtained, then adopt a two-cylinder single-acting engine, cylinders ⅝ by ⅝-in.

[17,495] **Permanent Way.** R. C. (Wellington College) writes: (1) Would you kindly tell me which permanent way for model locomotives is the best—that with keys or that without keys? (2) What is the smallest circle a six-coupled Caledonian engine, ½-in. scale, could go round with any speed?

(1) The permanent way without keys holds by virtue of slight twists in the chairs. That with keys makes a very satisfactory track and provides a more perfect model railway. (2) About 16 to 18 ft. 6 ins. radius, according to amount of lateral play allowed in the bogie and in the trailing coupled wheel.

[17,530] **Firing Model Boiler.** E. C. (Walsall) writes: I have a 1 by 2 horizontal slide-valve engine and a vertical boiler 8 by 5½ ins. with eight ⅝-in. (inside measure) tubes flanged into the crown plate. It is fired with solid fuel and has no water span round the firebox. Size given does not include smoke or firebox. I have been using charcoal and find difficulty in maintaining more than 10 lbs. continuous pressure. Can you give me any suggestions for increasing the pressure? Would it be advisable to lead the steam pipe down one of the tubes and out at a hole drilled inside of firebox? The boiler shell is a seamless copper tube, ⅛ in. thick. The crown and bottom plates are strongly riveted in. What pressure should this boiler safely work at?

The boiler is quite unsuitable for use with solid fuel and we therefore can only recommend you to go in for an oil burner. A complete Primus stove should provide the best and the most satisfactory arrangement as regards attention required in working. You can get a No. 5 stove complete for about 13s. If the steam pipe is very long and the condensation of steam considerable, then you may take the pipe through the fire with advantage. The method suggested by you is a very suitable one. The boiler has



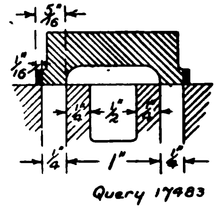
FIRING MODEL BOILER.

about 150 sq. ins. of effective heating surface and should work the engine (the steam being supplied dry) at 20 lbs. pressure and 250 revolutions per minute. Clean the boiler flues well before using the oil burner, so that the best efficiency may be obtained. The strength of the shell is much more than required. Assuming good riveting to the ends, the boiler should stand 60 lbs. quite safely. The cylindrical shell is all right up to 200 lbs. per sq. in.

[17,545] **Supply for ¼ H.-P. Water Motor.** J. E. (Armathwaite) writes: I have a dynamo 40 volts 3 amps. I wish to drive same with a Pelton wheel. The wheel is 1 ft. 6 ins. diameter, 3 ins. broad, fitted with twenty cups. My water supply comes from a reservoir 4 ft. broad, 10 ft. long, 3 ft. deep. The water comes in through a 2-in. pipe for a distance of 20 yds., then it falls 1 in. in 2 ft. for a distance of another 20 yds. I have put a nozzle on the end of the pipe down to 1½ ins. Do you think it will have enough power to drive the dynamo? Could you give me any idea of the horse-power the wheel might be?

This will only give you a head of 2 ft. 6 ins.—*i.e.*, a pressure of about 1¼ lbs., which is not nearly enough for the job. With a head of 10 ft. (*i.e.*, about 4¼ lbs. pressure) and a 2-in. discharge, you could get ¼ h.-p. out of your wheel fairly easily, but the water consumption would be large—viz., about 33 cub. ft. per minute. Would your source of supply meet this requirement?

[17,483] **Valve Proportions.** F. W. (Liverpool) writes Will you kindly inform me what valve to put on an engine 3 ins. by 3 ins., vertical single cylinder launch, reversing by wheel, every part correctly and particularly made by a practical engineer, properly finished, lagged and fitted with every detail, 17 ins. high over-all; steam ports, ¼ in. by 1 in.; exhaust, ½ in. by 1 in.; revolutions, 800; pressure, 80 lbs.; valve travel ⅝ in.? What horse-power, and would it drive a launch 20 ft. by 6 ft., and at what speed?



VALVE PROPORTIONS.

In giving you the following particulars, we are presuming that you can shift the eccentric on the shaft without trouble. If this is not so, we shall be glad to know its position in relation to the crank-pin. The latter, to a great extent, determines the amount of lap that can be given to the valve. As the combined width of the two ports is ¼ in.+¼ in. = ½ in., and the valve travel is ⅝ in., this leaves ⅛ in. as the total amount of lap that can be divided between the two ends of the valve. The lap will, therefore, be 1-16th in., and the total length of the valve 1⅛ ins. The lead may be 1-32nd in. The indicated horse-power at 800 revolutions and 80 lbs pressure will be approximately—

$$\frac{7}{8} \times \frac{7 \times 80 \quad 3}{12} \times \frac{800 \times 2}{33{,}000} = 5 \text{ i.h.-p.}$$

that is, if the boiler will maintain 80 lbs. pressure with the stop valve open to its fullest extent.

[17,446] **Accumulators, Fuses, etc.** D. H. W. (Ilford) writes: (1) How long will a 4-volt 15-amp.-hour accumulator light a 4-volt 4 c.-p. "Osram" lamp taking 1 amp.? (2) I want to make a water motor to give 1-12th h.-p. Could you give me the particulars for same? Would the water motor mentioned in THE MODEL ENGINEER Handbook No. 9, pages 7-10, but not made to reverse, give about the horse-power I want? Also I might want it to drive a dynamo at about 4,500 r.p.m. (a 30-watt dynamo). (3) What is the calculation for charging accumulators, viz., charging current — amps. per sq. ft. of positive plate surface? (4) Would the formula $\frac{\text{amp.-hours}}{\text{amps.}}$ (page 46, MODEL ENGINEER Handbook No. 1) be the right way to calculate how long it will take to charge an accumulator, if you knew the amperage that the charging dynamo could give? (5) Will it be infringing a patent if I construct a motor starting switch with "overload" and "no voltage" release, as mentioned in page 83-4 of the "Practical Electricians' Pocket Book"? (6) When does the new volume of *The Engineer-in-Charge* begin? (7) Could I charge say two or three 4-volt accumulators of different capacities, together in parallel, from a 6-volt 5-amp, dynamo, shunt wound? (8) If on a switchboard a single pole fuse was put to blow out at, say, 3 amps., and you were to change the fuse and put double-pole fuses, would the latter have wire in each to blow out at 1½ amps., or would they still have 3 amps. wire in each? (9) How long would a jelly electrolyte last in comparison to the ordinary water and sulphuric acid? How would you take it out to put fresh in? Would you kindly give me the formula for the jelly electrolyte? (10) Which is the simplest way of making the negative plates of an accumulator—by precipitated lead or by litharge and sulphuric acid? Do the plates made by the latter process need forming? If so, how?

(1) As you say the accumulator is a 15 amp.-hour one, it will give 1 amp. for fifteen hours, though its voltage will drop a bit before this point is reached. (2) We advise one of the water motors described in this Journal, of about 1-12th h.-p. (3) This has been dealt with repeatedly in these columns. Reckon 4 to 6 amps. per sq. ft. of positive plate surface for charging. (4) Yes, but allow 30 or 40 per cent. extra for inevitable losses in charging. (5) No, not if only for private use. (6) The new volume of *The Engineer-in-Charge* began in April, 1907. (7) Yes. (8) Still 3-amp. wire. (9) We have not any data as to their life, but they give very good results. The top will have to be taken off the containing cells. See page 573, December 10th, 1903, issue, Query 9,934. (10) Litharge and sulphuric acid. Yes; by repeated charging and discharging.

[17,177] **Scraping Surfaces for "Faced" Joints.** H. C. (Stourbridge) writes: (1) How are flat surfaces scraped and what tools are used? (2) What is meant by grinding in valves and how is this done?

(1) Flat scrapers are used for this purpose, frequently made out of old files. The job to be made flat is marked with a surface-plate and "marking" and the high places gradually removed by scraping in a judicious manner, only acquired by practice, with the above tool. The latter is ground down to a keen square edge and finished off on the oil stone, and is, of course, well tempered to not quite dead hard—a light straw is about right for ordinary work such as valve faces, etc. (2) Grinding in valves is usually accomplished by means of fine or coarse emery powder (as the case may require) and oil. This cuts both valve and its seat when the former is given a reciprocating rotary motion.

[17,553] **Accumulator Charging.** W. J. H. (Homerton) writes: I have a 60-amp. accumulator charged at 3 amps., also one of 5 amps. charged at ½ amp. What resistance do I want for each and how long do each take to charge? I have eight 220-volt 16 and 32 c.-p. lamps. My supply is 220 volts.

You only mention capacity of your cells, and say nothing about their voltage. All we can say is—make charging current about 25 per cent. higher voltage than cells to be charged, and you will be not far wrong. Or you can use your 16 and 32 c.-p. lamps and connect up so many in parallel. The larger capacity the cell to be charged has, the more lamps you can use in parallel to charge it. Reckon 5 amps. per sq. ft. of positive plate surface as a safe charging rate.

[17,517] **On Patenting.** J. W. (Manchester) writes: In your books on "Patents," page 26, it is stated, "It is better . . . discover you have claimed a part of another person's invention you may at any time have this claim struck out." By this reading one would take it that it was a mere matter of form and simply required writing a letter to have this done, but it would appear, (page 31), it is not by any means an easy matter and, in fact, it may not be possible to get it done at all. It is there stated, "Wish to remove some of your claims apply on Form F, costing £1 10s., or £3 if sealed . . . . It does not follow that the amendment will be allowed. . . . ." In Mr. Cole's book, advertised in your paper, it says: "If any part of the claim is successfully disputed, the whole patent becomes void." Perhaps you will clear up this matter for me, the claims being such an important part of an application for patent.

The matter is one of circumstances and depends much upon whether there is any opposition or whether in the opinion of the Comptroller the proposed amendment comes legitimately within the scope of the patent. The amendment may not be of such a character as to substantially enlarge the original claims. Any person opposing the proposed amendment must have an interest in the matter. If you have an invention which seems to have a really considerable value, it would be best for you to consult a firm of patent agents. Disputes n connection with patents are of a highly technical character, and personal opinions enter very largely into any question involved.

[17,485] **River Canoe Engine.** O. L. B. (Oxford) writes: I have a Stuart Turner No. 3 compound (1⅛ by 1½ by 2¼-in. cylinders). They claim 3 h.-p. at 175 lbs. steam. What speed would it drive an ordinary paddling Canadian canoe at 100 lbs. pressure? Where could I get a boiler small enough to fit in canoe and suitable to maintain 100 lbs. pressure while driving canoe with two people? Lastly, do you think it would be a success or is it too much of a toy?

The engine should be quite suitable for your boat, as a speed of 5 to 6 m.p.h. would not require more than about ½ i.h.-p., which at 100 lbs. pressure ought to be developed by the engine without an excessive speed being resorted to. The chief point to obtain efficiency would be to only fit the H.-P. engine with link-motion. Have this case-hardened, and use a slip eccentric for the L.-P. cylinder. Provide balanced cranks and case-hardened gudgeon-pins. Will you fit condensing apparatus? If so, run the exhaust pipe outside the skin of the boat to form the condenser.

[17,470] **Model Steamer Machinery.** R. L. (South Kensington) writes: I am going to make a model steamer and I should be glad if you could answer the following questions for me, Do you think a ½ by ½-in. marine engine would drive a 3 ft. to 3 ft. 6 ins. boat at a fair speed? If not, what size shall I require, also what size boiler shall I require for same and at what pressure?

The engine you have chosen will run the boat satisfactorily. As the draught of the hull will not be very great, to prevent the engine projecting above deck level adopt a trunk engine (single-acting) or else a double-acting slide-valve engine with a slide crank. For the boiler, we recommend a smaller size to that shown on page 46 of the new edition of "Model Boiler Making." The shell may be 4 ft. by 7 ins., and furnace tube 1⅞ ins. diameter. Use about ten water tubes, ½ in. diameter. Work at 25 to 30 lbs. pressure.

[17,564] **Miniature Petrol Engine.** A. S. B. (Providence, R.I.) writes: Would it be possible to make a gasoline engine of 1¼-in. bore and 1½-in. stroke that would run with any degree of speed, and also whether the two or four-cycle type should be followed? What speed would a motor, if properly constructed, run up to?

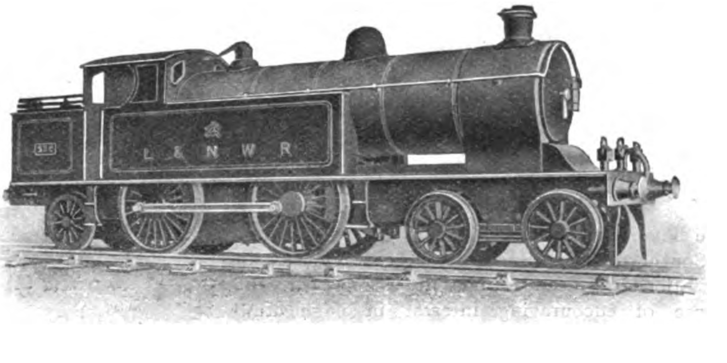
This could be accomplished, but it would be quite experimental work, and the speed required to obtain any appreciable power would have to be very high indeed. Some excellent results were obtained by Mr. Arkell some little time ago, who constructed a petrol engine of even smaller dimensions than your proposed engine. You should read the article in April 26th, 1906, issue, page 396, and subsequent articles on the same subject. The usual four-cycle (Otto) engine is recommended.

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.]

Model L.N.W.R. Tank Engine.

We illustrate herewith the ½-in. scale 2½-in. gauge model L.N.W. Tank Engine "528" which Messrs. James Carson & Co., Ltd., of 51, Summer Row, Birmingham, are now producing. The engine is exactly to scale: driving wheels, 3½ ins. diameter; bogie and trailing wheels, 1⅞ ins. diameter; cylinder, ½-in. bore, 1-in. stroke; water tube boiler of seamless copper, gun-metal downcomer, complete Joy's valve gear, the working parts, in accordance with this firm's practice, being of German silver. The engines are correctly enamelled, lined and lettered, the crest on the tank side being reproduced in gold. The models are an exact fac-simile of that exhibited at the last conversazione of the Society of Model Engineers, and are fully guaranteed, the boilers being tested to 100 lbs. steam pressure per square inch. Messrs. Carson will supply either the complete model, or sets of parts with all turning done, boiler assembled, etc., so that any amateur can complete the model without the use of a lathe.



JAMES CARSON & CO.'S ½-INCH SCALE MODEL L.N.W. TANK LOCOMOTIVE.

When sharp curves are not required, ⅝-in. bore cylinders can be fitted on any of their ½-in. scale models, which materially increases the pulling power of the model, and a guarantee is given that the steam pressure is maintained with the larger cylinders. For prices and further information readers should write to the above address.

New Catalogues and Lists.

A. G. Thornton, Ltd., King Street West, Manchester, have sent us their latest list of additions to their general catalogue of mathematical instruments and drawing office supplies. Amongst the new things are an improved cinograph, an improved protractor set-square, and the "Simplified" slide rule. The list will be sent to any of our readers upon application.

The Editor's Page.

THE recent exhibition of model flying machines at the Agricultural Hall, and the subsequent trials at the Alexandra Palace, have apparently been as full of interest to the general public as they have been to the technical world. It is true that at the trials most of the performances of the models were very disappointing, and the inventors' claims were far from being realised; but from several points of view the event has been a great success. No doubt many of the inventors have not had sufficient time to thoroughly try their ideas before entering the competition, and under the rather disconcerting ordeal of a public trial the best performances of which the various models were capable were not obtained. So much attention and ingenuity has, however, been brought to bear upon the subject that great advances in the performances of flying models may be expected in the near future, and if another competition is held next year we shall confidently expect performances of a much improved character. It may be remembered that as long ago as 1903 we arranged a competition for designs for model flying machines, and the successful ideas were illustrated in our issues of March 19th and April 30th of that year. We have in hand a very fully illustrated report of the recent Exhibition and trials, which will be published in an early issue. The problem of artificial flight is a very fascinating one, and might well be studied by those of our readers who want a change from the regular routine of their hobby.

* * *

Those who take an interest in full-sized airships may perhaps like to know that in the course of a few days we shall publish an illustrated book on the subject at the popular price of 1s. We hope to announce full particulars of this in our next issue.

* * *

We have been informed that, under the title of the Southern Institution of Junior Engineers, an association has been formed at Gosport for the purpose of encouraging interest in engineering matters among those resident in that district. The first president is Mr. H. Frost, who is the Engineer and Surveyor to the Gosport District Council, while the hon. secretary is Mr. A. H. Glasspole, 4, Chapel Square, Brockhurst, Gosport, who will be pleased to furnish particulars of membership on application. We may mention that this new organisation is entirely a local affair and has no connection with the well-known Junior Institution of Engineers, of London.

Answers to Correspondents.

C. D. (Salford).—If you will send your address we will send you a list of back numbers.

F. P. (Leeds).—The address of the Institution of Mechanical Engineers is Storey's Gate, St. James's Park, London, S.W. Full particulars of membership may be had on application to the secretary.

K. L. (Bristol).—B.H.-P. means brake horsepower, and is the effective or useful horse-power which an engine is capable of giving off at its flywheel. It is less than the indicated horsepower, which is the power actually developed in the cylinder of the engine, because a certain portion of the power so developed is used in operating the various moving parts of the engine itself. Brake horse-power is so termed because it is usually measured by means of a "brake" on the flywheel, and indicated horse-power is so named because it is calculated from a diagram drawing by an instrument termed an "indicator."

T. C. P. (Edinburgh).—Write to the Detachable Cycle Motor Company, Ltd., Jewry House, Old Jewry, E.C.

R. H. C. (Dulwich).—A solid bar, if material is sound.

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, etc., 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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THE
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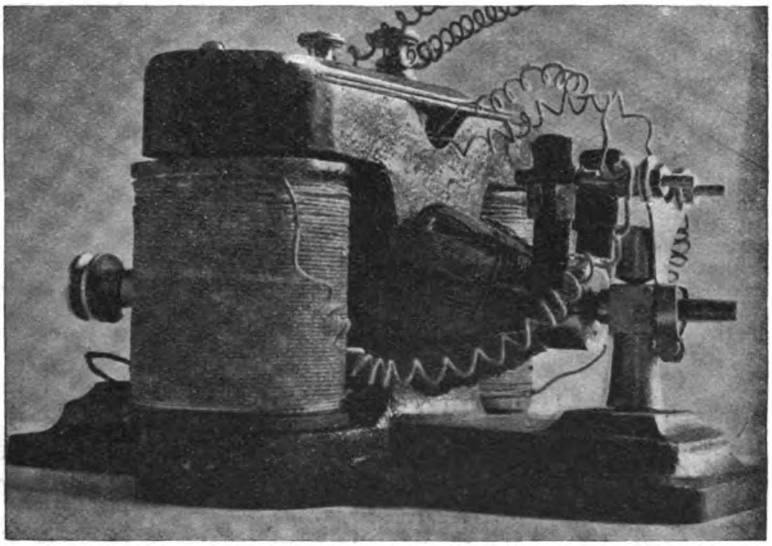
A Small Consequent Pole Dynamo.

By B. MOTT.



A SMALL CONSEQUENT POLE DYNAMO.

THIS dynamo belongs to the Manchester class, which is supposed to be a type very suitable for small high-speed machines. It was designed and built by myself with the help of handbook No. 10, which, by the way, seems to be a great favourite with model electricians. It is intended to supply current for charging accumulators, lighting, and general experimental work. Sometimes it is used for running a model electric railway. The voltage is about 15 to 20 at from 3,000 r.p.m., and the amperage is 4. It is a very interesting machine for a model engineer to make. When the castings for the magnet yokes were made, I was afraid that the iron used was too hard, so I placed them to cool inside a very large engine bedplate, which had been cast at the same time. This bedplate took a long time to cool down, so my castings were softened by cooling so slowly. The magnet cores are turned from wrought iron, and each one is wound with 1 lb. 4 ozs. of No. 21 D.C.C. copper wire. The armature is 2¼ ins. diameter, and contains 2¼ ins. of eight-slot stampings (100 pieces), with a fibre disc at each end. It is wound in eight sections with 7¼ ozs. of No. 20 D.C.C. wire. All the stampings are varnished separately and clamped up between a nut and shoulder on a ⅜-in. shaft. The commutator is of the simple kind so much desired by model engineers. It consists of eight brass sections mounted on a piece of fibre, which is screwed to the shaft. It is very simple and perfectly satisfactory. As the reader may have noticed in the photograph, the brush-rocker is rather uncommon. The original rocker was accidentally broken, and as it was necessary to run the dynamo before a new casting could be obtained, the present substitute was created out of the scrap heap in a very short time. It is made of sheet brass 1-16th in. thick, cut to size and bent into the shape shown, and is very firm, although it does not look so. It is clamped round the bearing with a small brass bolt and nut. The brass studs supporting the brushes are insulated from the rocker by thin ivory washers made from an old piano key. The copper gauze brushes are supported by holders of thin sheet brass, which swing on the brass studs, as can be seen. The necessary pressure of the brushes on the commutator is caused by a small red rubber band passing round the middle of both brushes. The pressure may be increased by placing the band nearer to the commutator or by using more bands. The pedestals, which are made of hard gun-metal, are held in position by screws passing up through the bedplate, and can easily be raised up, if ever necessary. They have each a bearing surface 1 in. long. The length of the shaft between the bearings is 5¼ ins. The over-all width of the dynamo is 7½ ins.; height, 5 ins. There are four lugs on the base for holding-down bolts. They are placed in the corners near the lower magnet yoke.

Planing and Shaping for Amateurs.

By A. W. M.

II.—Tools: Their Shapes and Uses.

(*Continued from page 401*).

TOOLS for finishing cuts are made with broad edges so as to remove a comparatively wide shaving of small depth. Fig. 13 shows a finishing tool for horizontal surfaces on iron and steel; the cutting edge should be made with slightly rounded corners as in the enlarged new K. A similar tool, useful for coarse feeds when finishing cast-iron surfaces, is shown in Fig. 14—the lower edge should be very slightly rounded. Figs. 15 and 16 show side finishing tools for left- and right-hand vertical surfaces in iron and steel; they are sometimes called knife tools, and may be made as Fig. 17, though Figs. 15 and 16 are the correct pattern. For

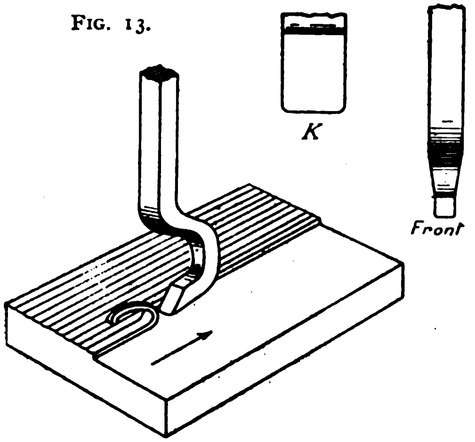


FIG. 13.

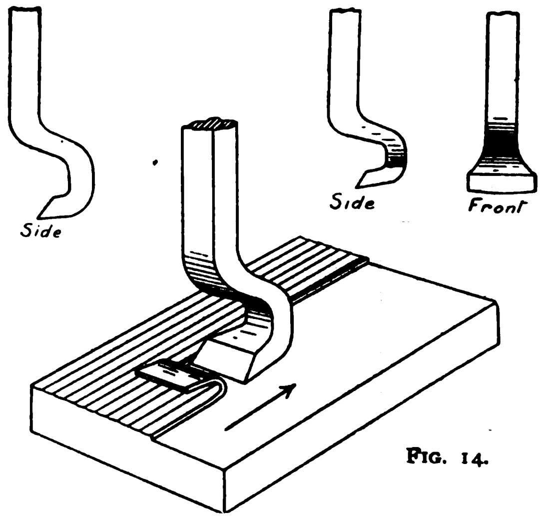


FIG. 14.

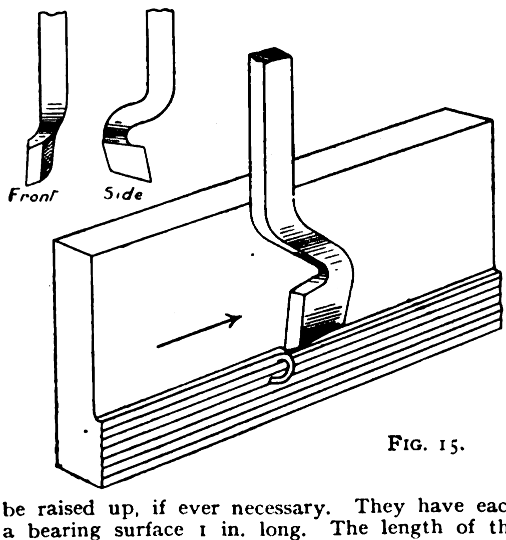


FIG. 15.

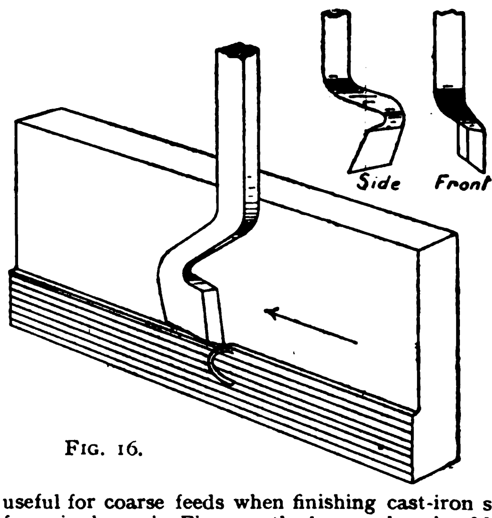


FIG. 16.

finishing cuts on horizontal brass and gun-metal surfaces the front tool should be made as Fig. 18, or Fig. 19 as an alternative. Vertical surfaces on

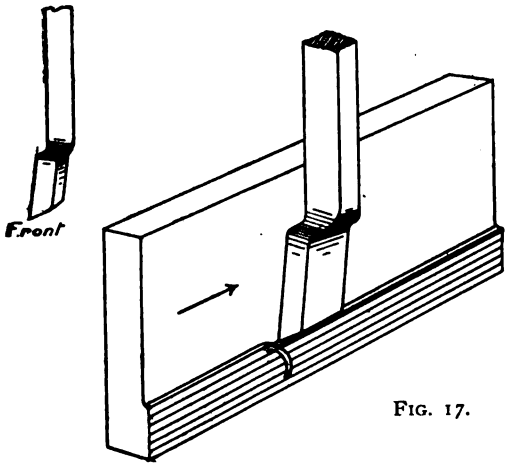


FIG. 17.

brass are finished with side tools similar to those shown in Figs. 15, 16, and 17, but having cutting edges much less keen than for iron and steel; other forms of side cutting tools for brass are shown in Fig. 20. These tools are all for use with single cutting machines.

Certain operations require tools of special shape,

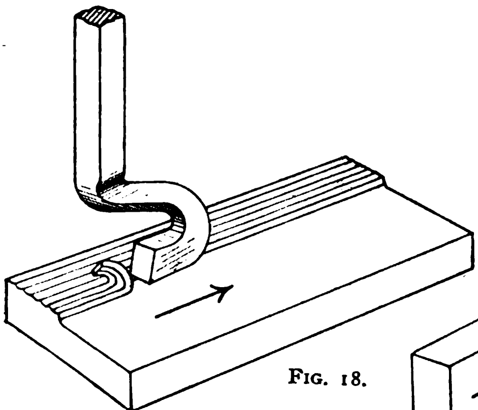


FIG. 18.

some instances of which will be given later. The angles of the cutting edges follow the same rules as applied to lathe tools and the reader may with advantage study the chapter on "Tools and Tool Holders," given in the handbook, "Practical Lessons in Metal Turning," by Percival Marshall. A good tool should be shaped so that it has sufficient strength to resist breaking whilst making a cut, and yet be keen enough to remove the shaving without tearing away the surface produced; the more acute the cutting angle the less will be the power required to drive the machine. These conditions conflict with one another, and must be also modified according to the metal to be cut. The first consideration is the angle of clearance or relief, R Fig. 21, between the edge of the tool and the work. It should be made as small as practicable for all tools, so that the maximum amount of support is given to the cutting edge. There is a limit, as, if made too small, the point will rub upon the surface instead of cutting it. About 3 degs. is considered a good clearance angle; it should be slightly greater for brass and gun-metal than for iron and steel. The cutting angle C can be about 55 degs. for wrought iron, 60 degs. for cast iron and steel, and 80 degs. for brass and gun-metal; 25 degs. for lead and similar soft metals. Copper is considered to be the

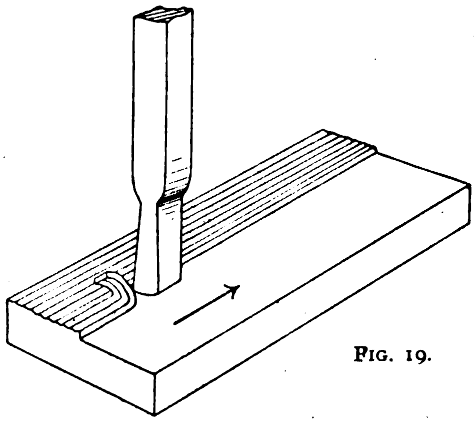


FIG. 19.

same as wrought iron. Exact angle measurements need not be made; the eye is a sufficient guide with some experience. The convenient amount to which side cutting tools, such as Figs. 7, 10 and 12, should be bent is also a matter for experience. Sometimes

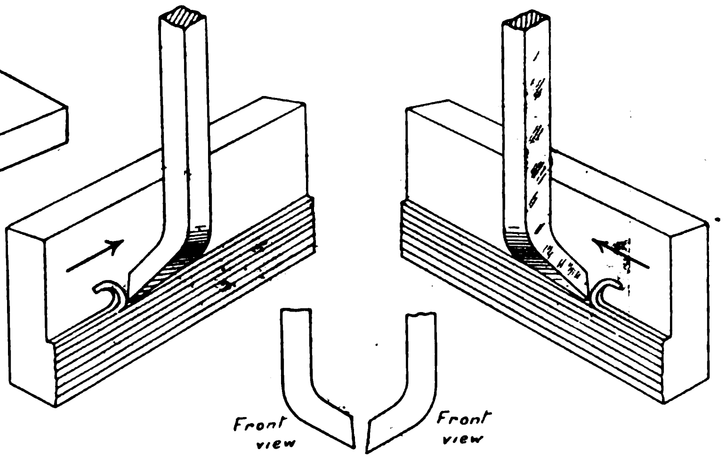


FIG. 20.

bosses or other parts of the work project above the surface to be planed, and it is then necessary to set the cutting edge more to one side than when these do not interfere with the passage of the tool. Very acute cutting points should be avoided; the tool will produce better work if the point is slightly round, as at P, Fig. 21.

Tool-holders, or cutter bars as they are also called, can be used for planing and shaping. A pattern should be selected in which the cutters can be held in positions which will be similar, as far as possible, to the shapes of the solid tools described. The tool-holders (also called tool boxes) of some planing and

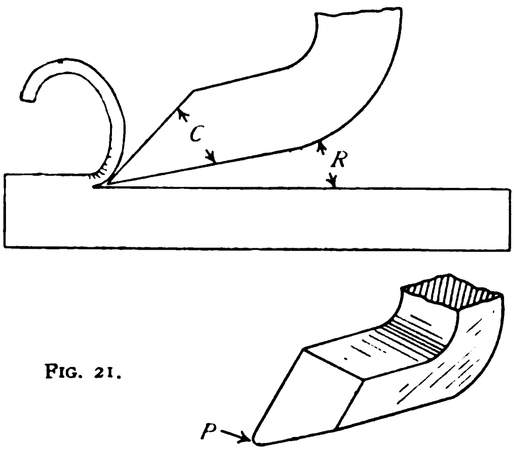


FIG. 21.

shaping machines are made to swivel through a small angle to the right or left, independently of the vertical slide. When this is available, tools for planing vertical surfaces are more easily adapted to their work, as the shank can be set at an angle sideways by inclining the tool-holder towards the surface to be planed.

(*To be continued.*)

WATER-WHEEL units of 12,000 H.-P. each—the argest, it is claimed, thus far attempted—will be used to drive electric generators in a power-transmission plant at Vallecito, on the Stanislaus River, in California. The operating head is 1,400 ft.

Exhibition and Practical Trial of Model Flying Machines.

THE proprietors of the *Daily Mail* having offered three prizes for model flying machines and aeroplanes in connection with their £10,000 prize full-size flying machine competition, eighty-six inventors produced models of various designs. A special exhibition of these models was organised by the Aero Club of the United Kingdom, and held at the Agricultural Hall, London, during the week of April 6th to 13th, in connection with Cordingley's Twelfth Annual Automobile Show. On Monday, April 15th, practical tests of some of the models were made at the Alexandra Palace, London, to determine the winners, the arrangements also being carried out by the Aero Club. Considerable public interest was aroused: at the exhibition the flying machine section appeared to attract the visitors to a greater extent than did the motor-cars, and at the trials over 3,000 people paid for admission between 12 o'clock and 5 o'clock, during which time the experiments were continued with an interval of one hour for lunch. Three prizes, of £150, £75, and £25, were competed for, no model which failed to fly a distance of 50 ft. being eligible for a prize. According to the official catalogue, 128 models were exhibited, in some instances several being sent in by one exhibitor.

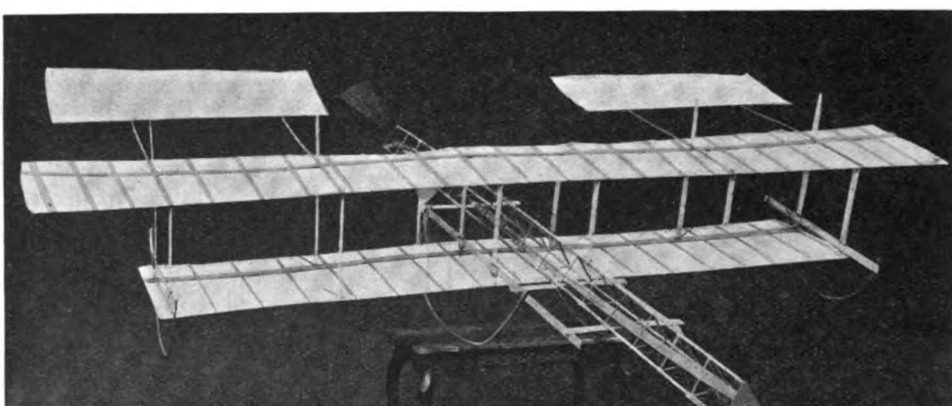


FIG. 1.—MR. A. V. ROE'S BACK-STEERING AEROPLANE.

Some were of very crude design and workmanship; others showed evidence of intelligent study, and were examples of good construction. A selection of designs is shown by the accompanying photographs.

Mr. A. V. Roe exhibited several large aeroplane models. Fig. 1 obtained the second prize, making good steady flights, one about 90 ft. in distance. The two small planes are to the rear and level with the upper of the main planes. A similar machine, but with a forward guide plane instead of the two rear planes mentioned, was tried, but did not fly so well. Fig. 2 is also one of Mr. Roe's models; it is of the type devised and tried by Professor Langley in the United States, but was not flown at the competition. The construction is generally of cane and wood for the framework, and tracing paper for the planes. Driving power for the propeller is provided by indiarubber elastic strips, which can be seen as a bunch inside the triangular girder fixed from front to back of the machine. These strips are each about ⅛ in. square, and a large number are used to form the bunch. Energy is stored by rotating the propeller until the bunch is twisted up tightly; when the propeller is released the bunch untwists and gives out the stored energy to the propeller. This method of driving the propellers was adopted by many of the other inventors in their models. The ski pattern of under-frame in Mr. Roe's models is made of bamboo, and serves to break the force of a fall. When the model reaches the ground the curved point usually strikes first, and the model runs forward like a sledge upon the framework, which springs, by reason of its elasticity, and prevents damage. This was successfully demonstrated at the trials, models by other inventors not provided with such an arrangement breaking their framework when reaching the ground at the end of a flight. The models as Fig. 1, by Mr. Roe, are 7 ft. 6 ins. and 9 ft. 6 ins. across the main planes, and the model as Fig. 2 is 10 ft. 6 ins. across. He states that his models have often flown a distance of 130 ft. when only half wound up, and that he has made them glide 72 ft. from a height of 6 ft. without any motive power or utilising the wind.

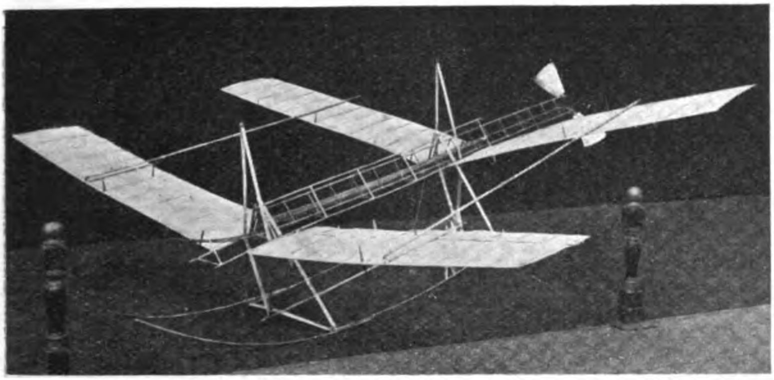


Fig. 2.—Mr. A. V. Roe's Aeroplane: Langley Type.

An example of a flapping model, as distinct from an aeroplane, is shown in Fig. 3; the exhibitor is Mr. E. Guilman. The four wing frames are provided with strips of calico suspended upon pivoted bars, and vibrate up and down. When moving in an upward direction air will pass easily between the strips of silk, but when the frames move in a downward direction the strips of silk close and offer a resistance to the air, imitating the supposed action of a bird's feathered wings. The upper and lower frames move in alternate directions—when the lower frame is rising the upper frame is descending. By this means a continued sustaining and lifting effect is produced. The connecting rods through which the motive power is transmitted receive their motion from two eccentrics driven by clock spring motors of circular shape, shown at the extreme lower part of the main frame. Steel tubing is used for the greater part of the framework. Total weight of model is 45 lbs. This machine was entered for the practical tests, but did not appear, as it is not in a finished condition. The model Fig. 4, by Mr. Henry Crouchley, is another machine driven by twisted indiarubber strips. It has two propeller screws, one at each end, the driving strips being in a bunch along the lower part of the framework and connected to the propellers by spur gearing so that they are speeded up. As the indiarubber untwists it will drive the screws in opposite directions, they must therefore be respectively of right and left hand pitch. The framework

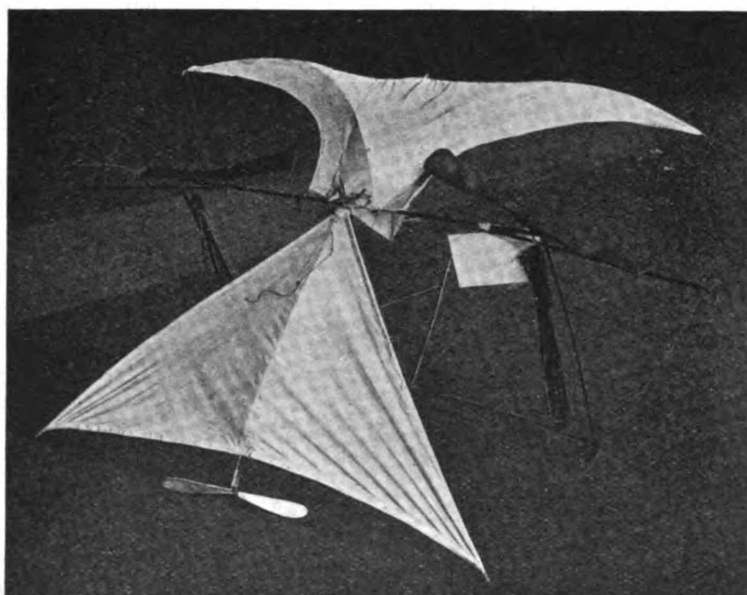


Fig. 6.—Major-General Baden-Powell's Aeroplane.

is of wood and the aeroplanes of linen. Three attempts at flight were made by this model at the practical tests, but without success. The balance did not appear to be correctly adjusted, as, after a horizontal movement of a few feet, the forward end tilted upwards and the machine fell to the ground.

A machine of the hélicoptere or ascensional screw principle, is shown in Fig. 5, made by Mr. H. A. Chubb. It is of substantial construction, the screw planes, made of stretched and varnished linen, measuring about 6 ft. between the tips and about 20 ins. in greatest width of blade. Steel cycle tubing is used for the framework, and the motive power is a small petrol engine fixed upon its side so that the crankshaft is vertical. The screw-lifting planes rotate in opposite directions, the lower ones being mounted upon a tube which is slipped over the spindle carrying the upper planes. A bearing socket for the lower planes is fixed at the apex of the triangular frame. The engine drives through spur gearing, and is geared down so that its shaft rotates at higher revolutions per minute than the lifting planes. This engine is fixed at the lower part of the triangular frame, and below it is a flywheel having a heavy rim carried upon bicycle spokes. The machine was exhibited and tried in the form as shown in the photograph. It is apparently incomplete, as no arrangement is provided to move it in a horizontal direction. Evidently a screw propeller is to be fitted to the horizontal tube which projects forward from the engine and the small vertical plane in line with it to serve as a rudder. The machine would therefore rise and be maintained at an elevation by the action of the ascensional screws and be propelled forward by the traction screw. At the practical tests this machine failed to leave the ground. The screws appeared to rotate at about 120 revolutions per minute. Probably some better results will be obtained with this machine, as the trial was of too short a duration to be a fair test. The wood support shown under the triangular frame merely carries the machine at starting, and remains upon the ground. At the conclusion of the official trials the machine was tried again, and the planes commenced to lift it upwards. With a slight push from the attendant it rose about 6 ft. into the air, turned sideways, and made a flight of several yards, scattering the crowd in all directions, before it fell to the ground.

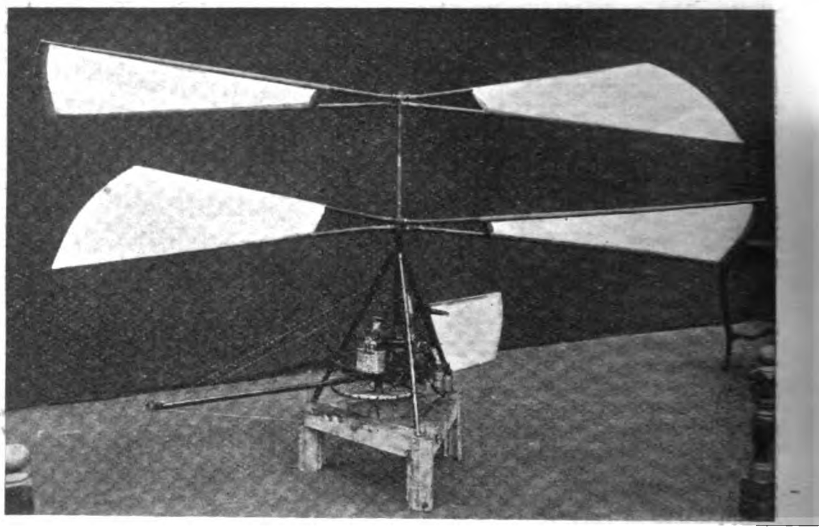


FIG. 5.—MR. H. A. CHUBB'S ASCENSIONAL SCREW MACHINE.

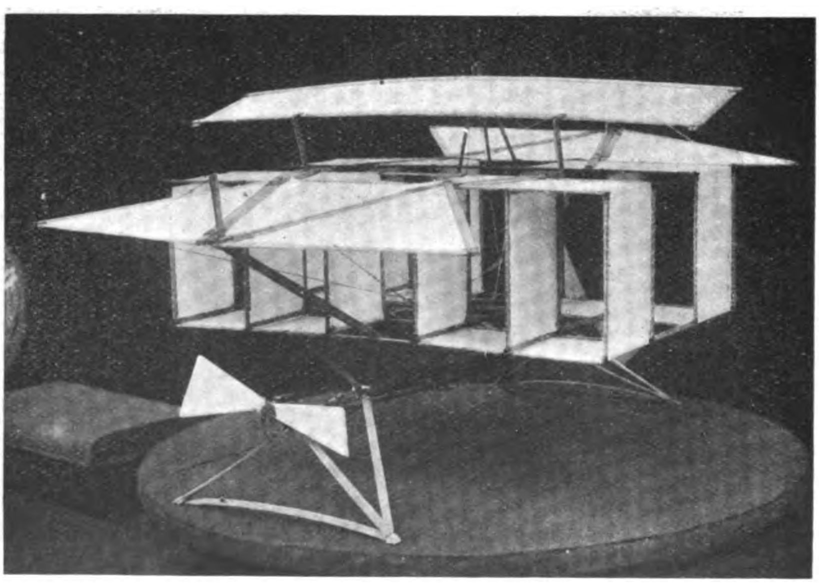


FIG. 4.—THE CROUCHLEY AEROPLANE.

Another model using ascensional screws is shown in Fig. 6, but fixed aeroplanes are fitted as well. These lifting screws are over the upper part of the framework, and made of aluminium. The propeller screw for horizontal movement is shown under the aeroplane in the front of the picture. Each screw is rotated by a bunch of indiarubber strips; those for the lifting screws are clearly seen in the picture. The designer of this machine, Major-General Baden-Powell, states that it is some years old, and exhibited as something of interest and not for competition: it was not tried at the practical tests, being merely constructed for experiments and to ascertain particular facts. Presumably the planes

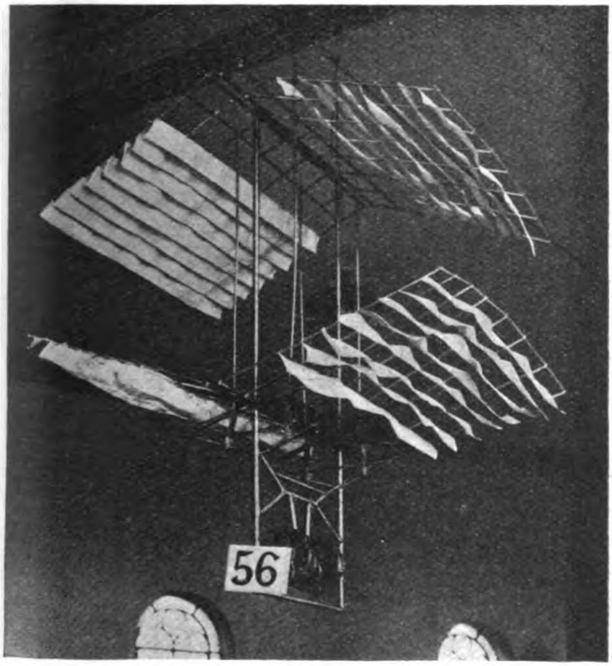


FIG. 3.—MR. E. GUILMAN'S MODEL FLYING MACHINE.

would come into sustaining action when the machine moved forwards and prevent an abrupt descent when the ascensional screws ceased to rotate.

(*To be continued.*)

THE CUNARD LINE.—The Cunard Steamship Company, Ltd., have issued an attractive and interesting booklet, entitled "A Pictorial History of the Cunard Line," illustrating the wooden paddle steamer *Britannia*, built in 1840, and several other R.M.S. of this line, including the *Lusitania* and *Mauretania* steel four-screw turbine steamers.

RADIOTELEGRAPHY.—On one of her recent journeys across the Atlantic, ays *Engineering*, the *Kaiser Wilhelm II* has sent radiotelegrams to the British steamer *Caronia*, when the distance, partly overland, between the two vessels amounted to 2,200 kilometres. This is a remarkable achievement, considering that the Marconi apparatus on board the *Wilhelm II* are only constructed for an average range of 360 kilometres. The difficulties are thus much greater than with the transmission of signals from powerful shore stations, such as Poldhu or Nauen; the ships can receive those messages, but not always respond to them.

A Design for a Small Model Undertype Engine.

By HENRY GREENLY.

(*Continued from page 376.*)

III.—CYLINDERS.

IN the last article the writer dealt with the machinery of the bedplate and the main bearings. The parts which rank next in importance are the cylinders. It is difficult to say whether the cylinders of a compound engine require more care in manufacturing than those of a simple high-pressure engine. Certainly any error which conduces to leakage of steam past the piston and valves of a high-pressure engine means, for the most part, absolute waste, and the clearances at the ends of the cylinder also represent lost steam. In a compound engine clearance losses are reduced by the fact that the steam which occupies the end spaces and the steam passages of the H.-P. cylinder are available for use in the L.-P. cylinder. Furthermore, any leakage of steam due to the inefficiency of the piston packing of the H.-P. cylinder (the one which is most difficult to keep tight) does not pass away up the chimney to waste, but simply increases the forward pressure on the L.-P. piston.

A reasonable amount of care should be taken, however, to see that the H.-P. piston and valves are steam-tight, otherwise the H.-P. cylinder will have no reason for its being. We might as well employ a single cylinder (1 in. diameter) and wire-draw the steam, so that with a boiler pressure of 60 to 80 lbs. only 10 or 15 lbs. pressure is maintained in the steam-chest.

The drawings of the cylinders included herewith are to full size, and comprise sufficient views for both pattern-making and machining purposes.

The two cylinders are cast in one, and are so arranged that no core-boxes are required, the circular cores for the cylinder bores being usually supplied by the founders.

The stroke of the cylinders is $1\frac{1}{4}$ ins., and reckoning the cover spigots to be 1-32nd in. deep and a clearance at each end of the cylinder of a somewhat larger amount, say 1-16th in., the piston may then be—

$1\frac{13}{16} - [(2 \times \frac{1}{32}) + (2 \times \frac{1}{16}) + 1\frac{1}{4}] = \frac{3}{8}$ in. thick,

which is an ample size. If desired, the clearance may be 3-64ths in. and the spigots 3-64ths in., instead of 1-32nd in., as shown on the drawings. The steam chests are separate castings and with separate covers, but when once the steam-chest castings are complete, they may be soldered on to the cylinders. This method renders any breaking of the joint between the steam-chest and the cylinder impossible when the steam-chest cover is removed at any subsequent time for the inspection or adjustment of the slide-valves.

In accordance with the writer's usual practice, tail spindle dummy glands are used on both the H.-P. and L.-P. steam-chests. While these fitments are always to be recommended as the best means of providing against leakages at the packed glands, they are of no use unless the stuffing-box and the dummy gland are in alignment. When this is so, very little wear on the packing will be observed, and therefore it is well worth taking special precautions (and making special tools, if necessary) to get the holes truly in line. As three points of contact are always difficult to obtain on a revolving or sliding rod, the hole at the bottom of the stuffing-box may be 1-64th in. larger than the diameter of the spindle—viz., 7-64ths in. instead of 3-32nds in.

It is not worth while making two patterns for the H.-P. and L.-P. steam-chests. A few minutes' filing will soon remove the projection provided for the starting valve on the H.-P. side if the two castings are obtained from the one H.-P. pattern.

sible. However this may be, the writer would recommend tenon pieces on both the inside and outside of the covers, so that the amateur who does not possess a four-jaw or dog chuck will have no difficulty in mounting the covers in the lathe to face and finish both sides.

The bore of both cylinders is shown parallel. Although there is little room for much increase in diameter at the ends—the width of the L.-P. cover joints is not very great as it is—the builder if he bores the L.-P. cylinder out 1 in. bore as recom-

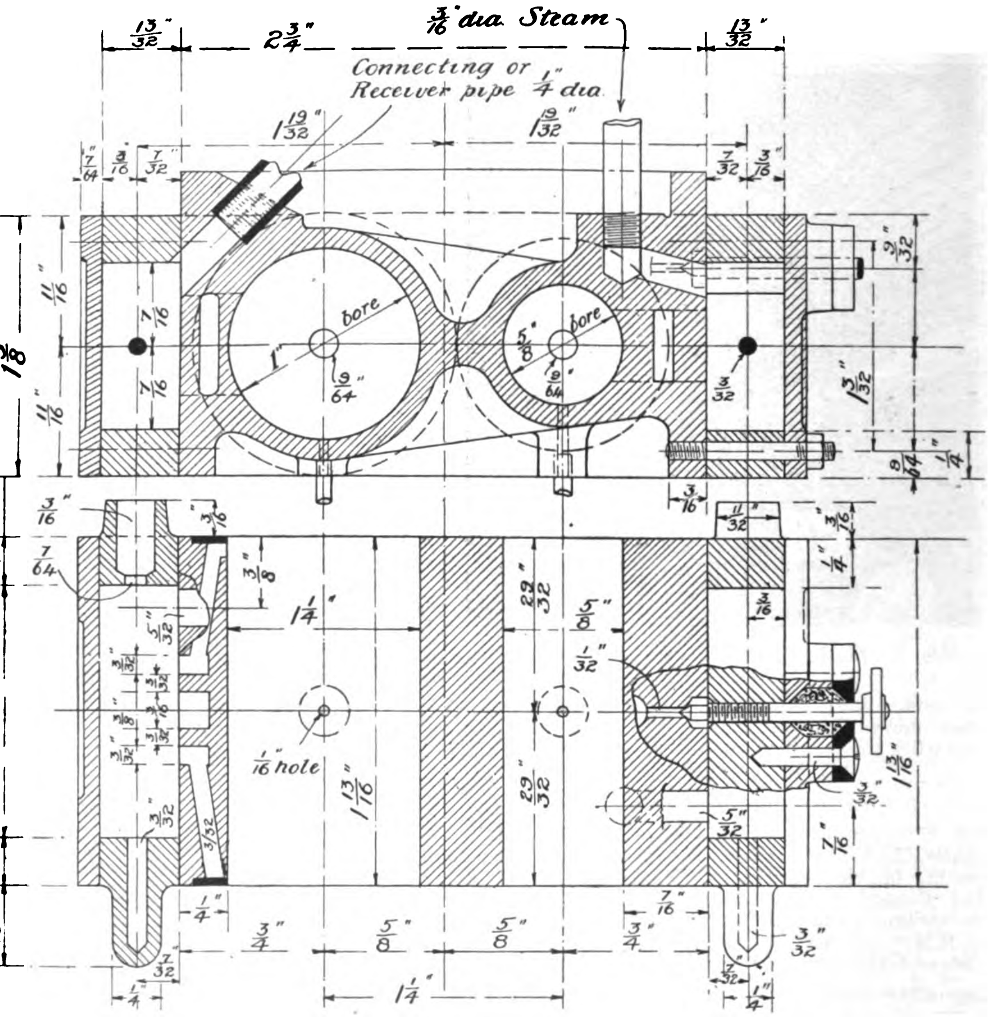


FIG. 5.—SECTIONAL VIEWS OF CYLINDERS. (*Full size.*)

Patterns in duplicate may, however, be used for the steam-chest covers, as it is suggested that the sinkings in the centre of the outside of the covers (which may ultimately be painted) shall in one case (L.-P. side) be circular and done in the lathe, and in the other left as the casting comes from the foundry, lathe work, owing to the presence of the starting-valve gland, being impos-

mended in the opening article, may arrange for a small amount of coning at the entrance of the bore. The diameter may be increased to, say, 1 1-32nd ins., and the coning extend for, say, ⅛ in. into the cylinder from each end. This, however, is left for the builder of the model to decide upon for himself.

As will be seen in Fig. 8, which is a full-size view of the under side of the cylinder casting, drain cocks are fitted only to the centre of the

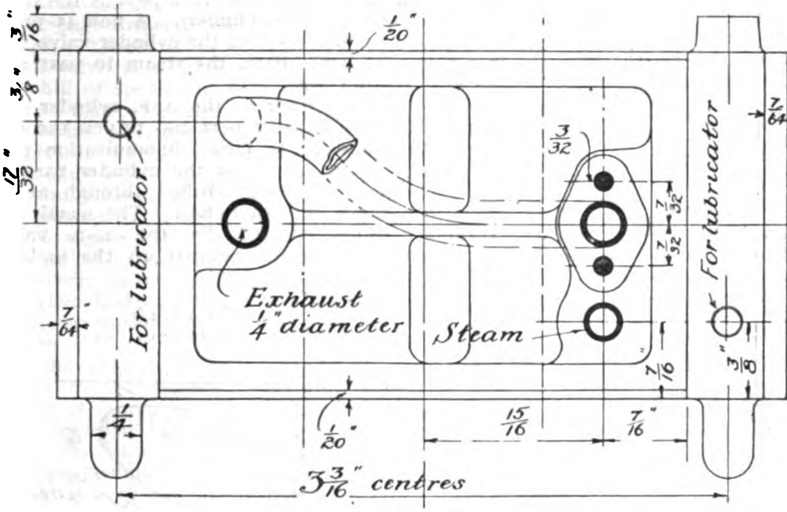


FIG. 6.—PLAN OF CYLINDERS, SHOWING PIPING.

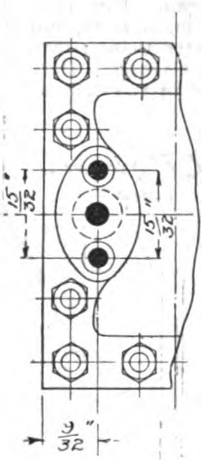


FIG. 7.
END VIEW H.-P. COVER, SHOWING STARTING VALVE GLAND.

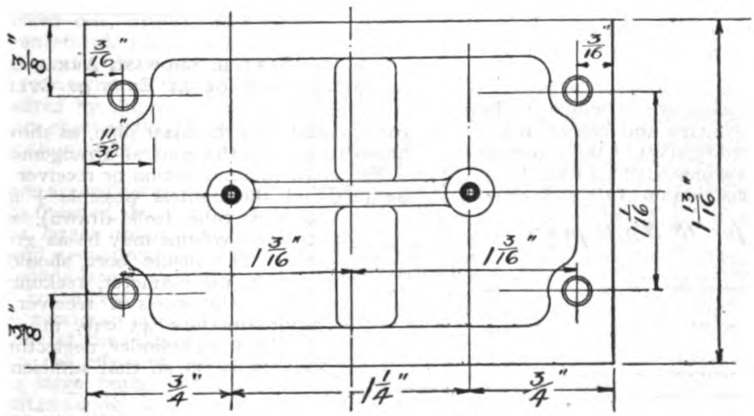


FIG. 8.
PLAN OF UNDERSIDE OF CYLINDER, SHOWING HOLES FOR FIXING STUDS OR SCREWS.

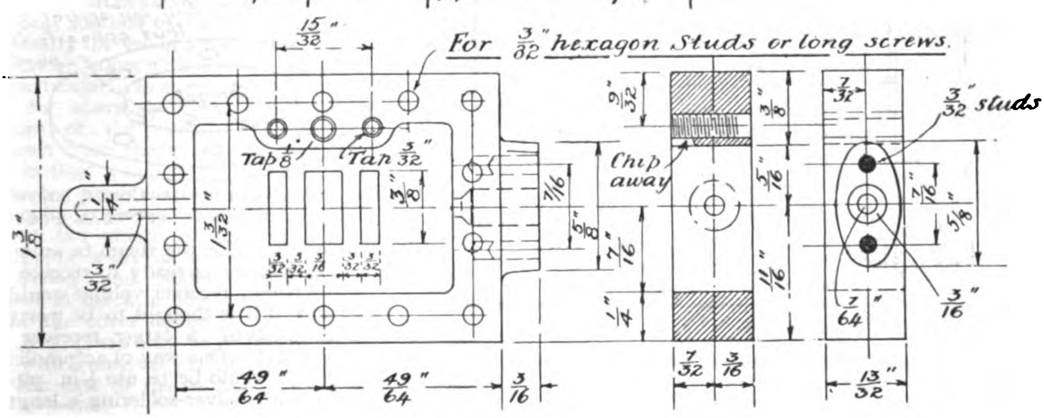


FIG. 10.—HIGH-PRESSURE STEAM CHEST AND PORTS.

cylinder. Personally, the writer would not bother about these at all, as the more joints there are in a model steam engine the greater will be the losses from leakage under working conditions,

The method in which they may be arranged is shown in Fig. 16. The cocks, for strength's sake, may be fitted into the bedplate, and the small diameter tubes connecting the cocks to the cylinders may be soldered in place after the cylinders are fixed down. This tube need not be larger than 3-32nds in. outside, and the hole in the cylinder not greater than 1-16th in. diameter—3-64ths in. would be better. Drill this hole before finishing the bore of the cylinder.

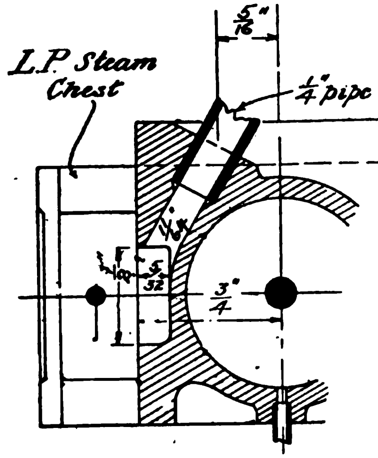


FIG. 9.—CROSS-SECTION OF L.-P. STEAM-CHEST IN CENTRE, SHOWING THE DRILLING OF THE EXHAUST PORT.

All the ports and passages are intended to be drilled out, and the facing strips and bosses on the top of cylinders are arranged to allow of this. To simplify any references to the various passages which may be made in detailing the construction of the cylinders,

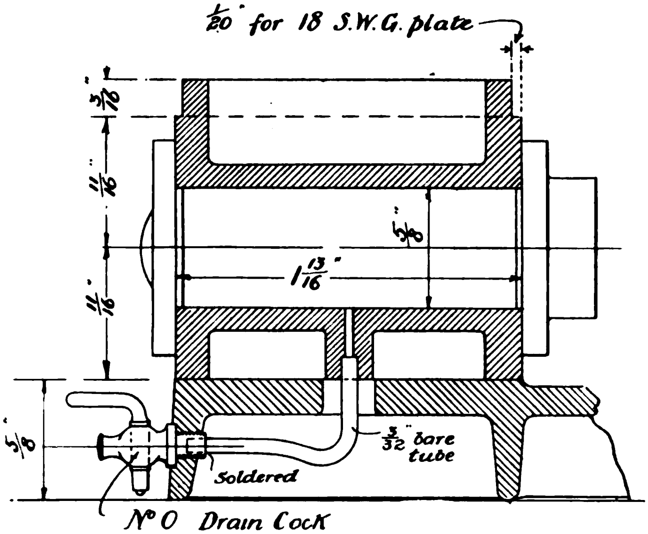


FIG. 16.—LONGITUDINAL SECTION THROUGH H.-P. CYLINDER, SHOWING DRAIN COCK AND REBATE FOR SMOKEBOX PLATE.

a few notes on the flow of the steam from the boiler through the cylinders and back again to the exhaust pipe may be included herewith, with good purpose.

The steam, in accordance with best practice, passes through the steam-drier or superheater, and joins a short piece of vertical pipe at the front left-hand corner of the cylinders. A hole (5-32nds in. diameter) is drilled from the cylinder valve face into this pipe, and allows the steam to pass into the H.-P. steam-chest.

After doing its work in the H.-P. cylinder, the steam enters the exhaust port and travels through the vertical passage to cross-communication pipe to the rear right corner of the cylinder casting, where it enters a passage drilled through at an angle into the L.-P. steam-chest. The usual distribution being effected by the L.-P. valve, the steam then goes to exhaust up the inclined

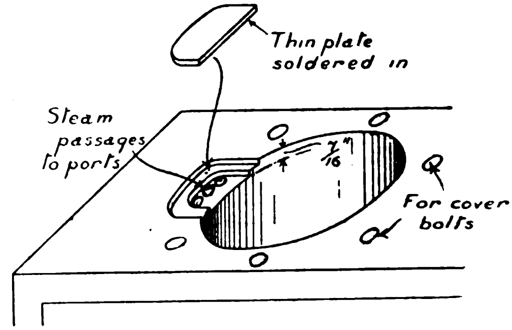


FIG. 17.—SKETCH, SHOWING ARRANGEMENT OF STEAM PASSAGE AT ENDS OF CYLINDERS.

passage and into the blast pipe, as shown in Fig. 9 herewith and in the general arrangement drawing.

The cross communication or receiver pipe should be made of the lightest possible 1/4 in. diameter copper tube (solid-drawn), so that the receiver volume may be as great as possible. The inside bore should be about 3-16ths in. diameter, reckoning all passages; this gives a receiver volume of approximately ·43 cub. in. The volume of the H.-P. cylinder, neglecting clearance spaces, is ·38, so that sufficient volume is

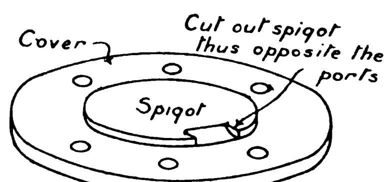


FIG. 18.—SKETCH OF COVER, SHOWING SPIGOTS CUT AWAY AT STEAM PORTS.

provided to enable the steam to wait until the L.-P. cylinder is ready to receive it.

An increased receiver volume would not hurt, and, if it is thought to be worth the trouble involved, a larger receiver pipe may be fitted. One way of accomplishing this object would be to use 1/4-in. pipe for the two ends, silver-soldering a length of larger pipe in between. Or, better still, as I shall suggest in dealing with the superheater later, the receiver pipe may be taken right through the fire and the L.-P. steam reheated.

Mention was made in the first article of the provision of a starting valve. This is shown in the cross-sectional view through the cylinders in the double-page drawing, and is detailed to full sizes in Figs. 5, 7, and 10.

The valve is a form of pin valve, and allows a "whiff of steam" to pass from the H.-P. steam-chest to that of the L.-P. when occasion so requires. The steam pressure in the receiver may in this manner be varied within wide limits, and the power developed by the engine altered to suit the requirements of the load. The effect of the arrangement is exactly the same as linking up a simple engine. At starting the pin valve is opened to its fullest extent (about two turns of the wheel is sufficient to do this), and the engine acting as a single-cylinder high-pressure engine, with late cut-off, but working steam wiredrawn to a reduced pressure.

As the engine attendant gradually shuts the by-pass to the receiver, the work of the H.-P. cylinder is increased, and when quite closed the fullest degree of expansion possible is obtained.

The pin valve for the starting arrangement is of very simple construction. The steam-chest is finished, as shown in Fig. 10, and is tapped with three holes—one $\frac{1}{4}$ in. diameter for the screw-down valve, and the others 3-32nds in. for the gland screws. The covers should be fitted before these holes are marked out, drilled, and tapped. The gland is a countersunk plate, as indicated in Fig. 5, and a clear passage of steam to the counterbored hole in the cylinder is ensured by chipping away a part of the steam-chest casting, as shown in the cross-section of the steam-chest (Fig. 10).

The ports are according to rule, except as regards those of the H.-P. cylinder, which are larger than necessary for the speed and steam pressure. They are, however, made larger on purpose, as the writer considered it advisable to provide the maximum area of passages for the flow of the exhaust steam to the receiver, the effect of clearance losses, due to large ports, not being of great moment in a compound engine.

The best method of cutting ports is undoubtedly the use of an end mill, and care must be taken with the L.-P. ports, more particularly as there is not much metal to spare between the valve face and the bore of the cylinder. Therefore, carefully mill down from the valve face first, to the depth shown in Figs. 5 and 9 (viz., 5-32nds in.), and then drill four 3-32nds-in. holes from the cover faces of the cylinder to meet the steam ports. The best finish at the mouth of the cylinder is obtained by chipping away as indicated in Fig. 17, and then fitting and soldering a plate (as shown sectioned in black in Fig. 5) to provide a proper face for the cover flange.

The H.-P. ports may be drilled down to a greater depth, which may vary from 9-32nds in. to 11-32nds in. in the case of the exhaust port, from the face of the cylinder.

The steam pipe connection should be a short piece of 3-16ths-in. pipe, screwed with a fine thread and soldered into the cylinder casting. The pipe should be long enough to reach well into the smoke-box (see general arrangement), and take the tail-piece of a stock pattern union.

The receiver pipe is shown with a flanged joint at the H.-P. end, and screwed at the L.-P. end. This screwing will only be possible if the engaging threads are very loose, and may be done simply to give the solder a better key. If the receiver pipe is taken back through the fire, then a screwed joint is advisable, a union being used in the smoke-box on each end of the receiver reheater pipe in conjunction with short pieces of pipe from the cylinders, exactly as used for the main steam pipe. The next article will deal with the valves and pistons.

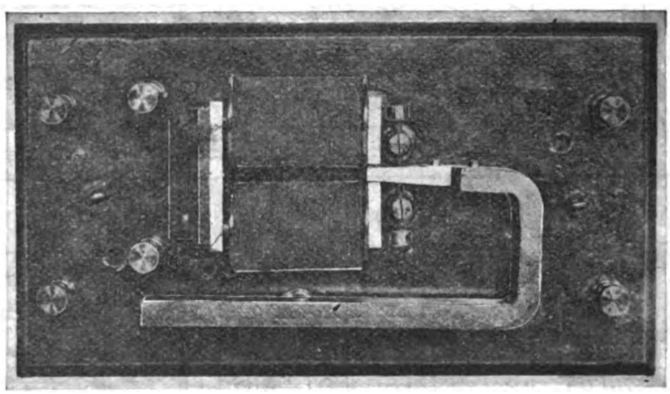
(To be continued.)

A Polarised Relay.

By F. E. Bornhardt.

The photograph and drawings show a simple polarised relay, which most of the amateur readers desiring one will be able to make.

The principle on which a polarised relay works is very easy to understand. The two bobbins (Figs. 2 and 3, B1, B2) are wound as in diagram Fig. 1, so that when a current flows through them the two magnet cheeks E1, E2, have a N. and a S. pole respectively. The permanent magnet M has its N. pole at the shorter end. Through magnetic



Mr. F. F. Bornhardt's Polarised Relay.

influence the armature piece A will also have N. magnetism. If we let a current pass through the two bobbins so that the pole-end E1 has a N. pole and E2 a S. pole, the armature A will tend to move

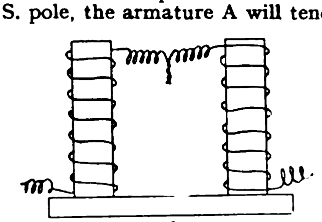


Fig. 1.—Diagram of Winding for Bobbin.

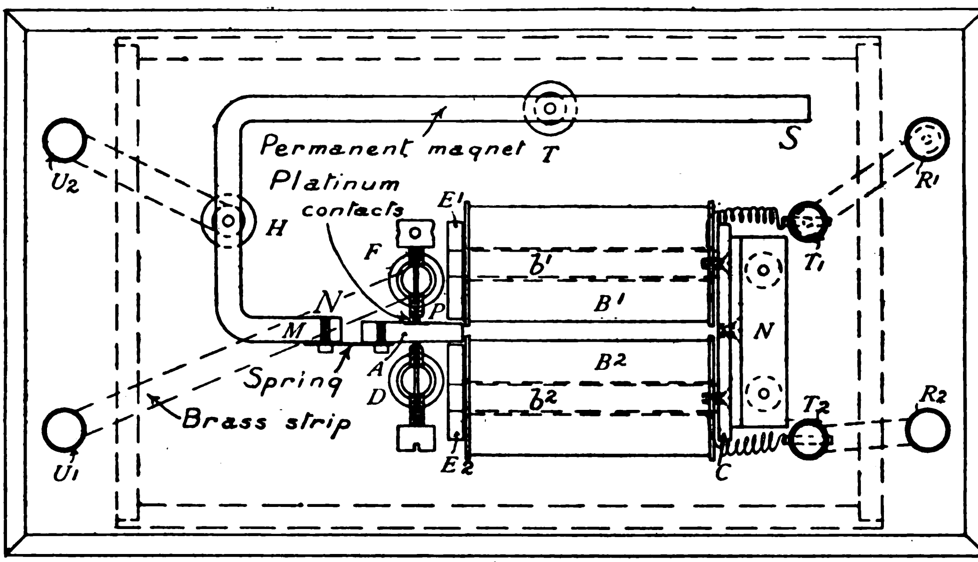
towards the S. pole E2, but this is stopped by the screw D. If we reverse the current, the poles of the electro-magnet will also be reversed: E1 will now have a S. pole and E2 a N. pole; the armature having a N. pole will be attracted by the S. pole of E1 and dispelled by E2, having equal poles; it will move towards E1 with double power, and make contact with the platinum of the contact screw F closing a local circuit. Very little current is needed to operate the relay, far less than half that needed for any ordinary one.

The construction is such that a lathe is hardly needed. The terminals and the contact-pillars (as used for induction coils) can all be bought. The

in two cheeks E1 E2, of soft annealed iron, which are riveted on. Their shape will be clearly visible from the drawings. The two cores are fastened to the soft iron plate C by means of two screws, which are countersunk into the plate C. The whole is fastened to the brass L-piece N, and thus on to the base.

The armature A is a piece of soft annealed iron connected to the permanent magnet by means of a very thin and flexible steel band spring (in fact, the thinner the better) and four small screws. The

Fig. 2.—Plan.



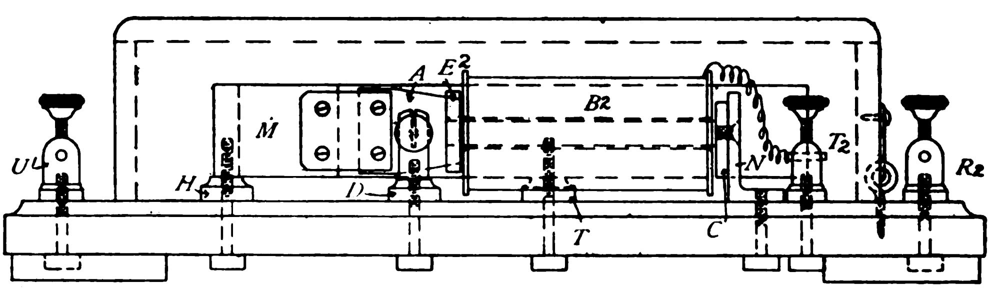


Fig. 3.—Elevation.

General Arrangement of Polarised Relay.

permanent magnet is a piece of steel forged to shape, hardened and magnetised. This is best done by passing over the poles of a strong electro-magnet. H and T are supports for fixing the magnet to the base. The bobbins B1 and B2 are built up of brass tubing and brass washers, a tight fit over tubes, which are soft soldered to the same. The two discs may be polished in the lathe and lacquered, as in my case, or black enamelled. These bobbins are a tight fit over iron core *b*1, *b*2, consisting of well annealed iron rod. The cores *b*1, *b*2 terminate

armature carries a small platinum contact, P, riveted in, which, when the armature gets attracted, touches the platinum contact on the screw in the pillar F.

The bobbins should be wound full of No. 42 double silk-covered copper wire; it need not be in layers. Joints should be carefully soldered. When winding the wire on it should frequently be tested for continuity with a battery and galvanometer or telephone. The inner ends of the wire may be soldered to the brass tubes. To make the finished bobbins look better, the last few yards of wire may be of a thicker gauge (say No. 26, green silk-covered preferable) wound on in an even layer. This may be attained by putting some dark green paper over the thinner wire, when the thicker wire can be wound on in a neat and even layer, spaces between the turns not being so visible, because of the dark paper underneath. The ends of the wire should be taken to the terminals T1, T2, which in their turn are connected to the terminals R1, R2 outside the cover.

The armature A should be set so that, when free, *i.e.*, not touching any of the two screws F and D, it is suspended exactly in the middle of the space between the cheeks E1, E2.

The whole relay is mounted on a French-polished mahogany base. The relay proper is under a wooden cover, also polished mahogany. All the brass work is highly polished and lacquered, also all iron parts. The permanent magnet is lacquered black. The finished relay looks quite professional.

If the bobbins of the relay are wound with No. 42 wire (about 2½ ozs.) the relay will have a resistance of about 2,180 ohms. The armature will move with a current of 1 milliamp. passing, making the relay an ideal one for wireless telegraphy, as a stronger current would certainly damage the coherer. Any details not mentioned in this article will be clearly visible from the drawings.

Chats on Model Locomotives.

By H. Greenly.

(*Continued from page* 399.)

CONTINUING the dissertation on the "points" of the new Caledonian 4—6—0 express engines as suitable prototypes for working models, I have prepared a front and cab view of the engine to supplement the outline side elevation drawing published with last week's chat.

One feature about Caledonian engines should prove interesting to the model locomotive builders, especially to those who start work by making drawings of their proposed locomotive to scale. The point is, that the very old standard of 4 ft. from the level of the rails to the underside of the footplating (*i.e.*, the top of the buffer plank) is still adopted on the largest and most modern engines on this line.

The retention of this dimension, which yet is the standard (within ½ in. or so) in railway carriage and wagon work, would appear to be a relic of Mr. Dugald Drummond's superintendency of the Locomotive Department of the Caledonian Railway. Its adoption, I am of opinion, adds considerably to the massive appearance of an engine which at the same time is provided with a high-pitched boiler, and some of the symmetry of Mr. McIntosh's designs, I think, is due to the fact that the footplating is placed at a normal distance above rail level.

Where a high footplating is used, as on the latest Midland compound engines and the new Great Western locomotives, the excellent effect of a high-pitched boiler is, to a large extent, lost. From a casual glance no one would think that the new M.R. compounds and the "North Star" G.W.R. engines had boilers of the same height of centre line as the Caledonian engines now being dealt with, or that the boilers of the first mentioned locomotives were only 2½ ins. lower than those of the G.N.R. No. 251 "Atlantics." The high footplating gives such a hunch-backed or high-shouldered appearance to the M.R. and G.W.R. engines, especially when they are viewed from the front.

Personally, therefore, I would enjoin those model locomotive builders who design their own engines to always adopt a scale reproduction of the older

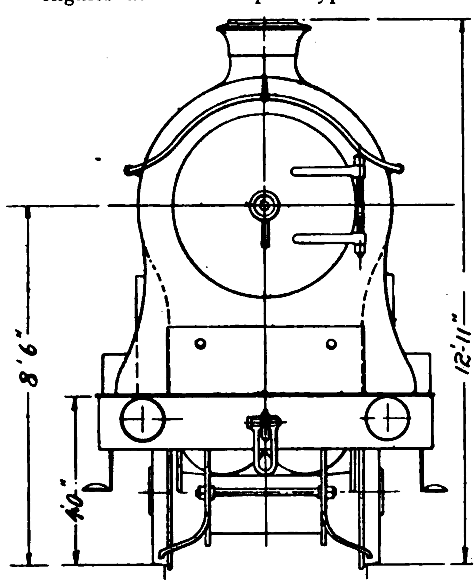


Fig. 1.—Front View.

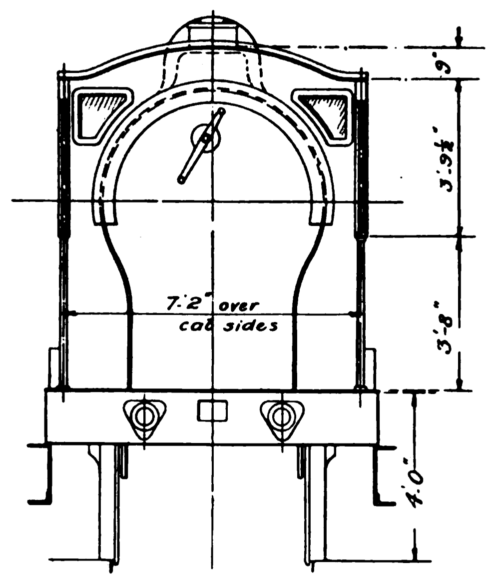


Fig. 2.—Rear View. (*Note the position of regulator.*)

Caledonian 4—6—0 Express Engine.

dimension of 4 ft. to 4 ft. 3 ins., excepting, of course, where they have a preference to extremes in general arrangement and external design. Whatever is done with the footplates (or running plates as some would call them) between the front and rear buffer planks, bring them down to the proper equivalent of 4 ft. (to 4 ft. 4½ ins. at the outside) at the leading end. This has been an axiom with me since I commenced drawing pictures of locomotive engines, actual and mythical, for my schoolfellows.

Last week I said something about cylinder centres and bogie swing. Turning up the drawings for the cylinders published on pages 119 and 163 of a book I have already referred to, which drawings it may be mentioned were done in collaboration with Mr. D. C. Glen, the late chairman of the London Society, I find that the cylinders are placed 1¾ ins. apart for a ¾-in. scale model. This is the same as for the "Dunalastair III" model (see THE MODEL ENGINEER for April 1st, 1901), and represents twenty-eight sixteenths (sixteenths in a ¾-scale model are equal to inches in the real), or 2 ft. 4 ins.

In the previous notes I mentioned that the cylinder centres of the new engines were 2 ft. apart, but that the adoption of this dimension would result in very thin eccentric sheaves. I am, therefore, inclined in a ¾-in. scale model to recommend that the crank web and cylinder centre dimensions of the "Dunalastair III" model be adhered to, the driving wheels being coned, as in the new six-coupled engines, and the journal and wheel seat being arranged to suit. The bogie swing is not so important in a ¾-scale model, as in any case large radii curves must be employed in conjunction with the type of engine now being considered.

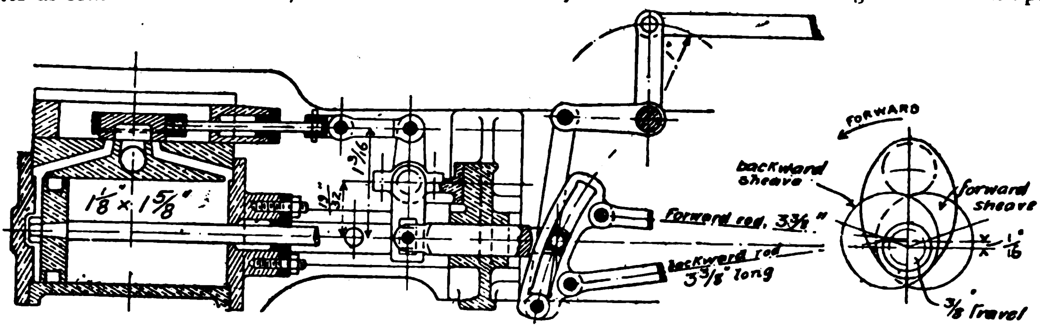


FIG. 3.—VALVE MOTION, SUITABLE FOR A ¾-IN. SCALE MODEL C.R. SIX-COUPLED LOCO., WITH LAUNCH ENGINE AND SLIDING INTERMEDIATE VALVE SPINDLE.

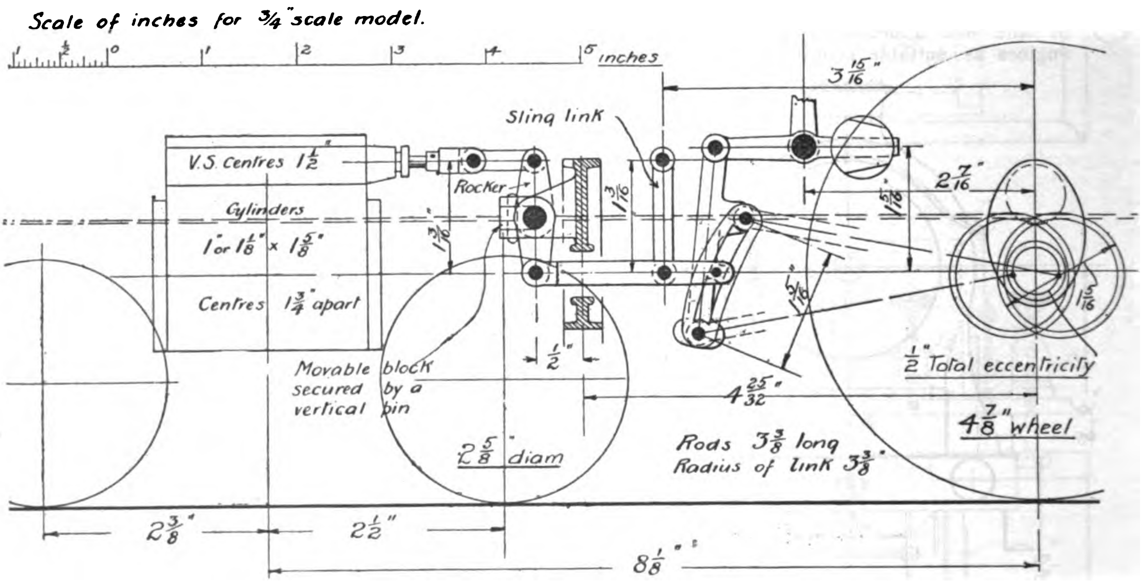


FIG. 4.—VALVE MOTION, WITH LOCO. TYPE LINK AND SLIDING INTERMEDIATE ROD FOR ¾-IN. SCALE MODEL, ADAPTED FROM THE PROTOTYPE.

Now as to valve gear. On page 163 and 164 of "The Model Locomotive" will be found a fully detailed general arrangement of a suitable valve motion, a portion of which we reproduce herewith. While this gear confirms the usual locomotive practice and is provided with a type of curved link, which is to be recommended where a rocking shaft and short eccentric rods are only possible, the use of sliding blocks in the rocker does not tend to eliminate "lost motion," the bugbear of all model link valve gears. I therefore include herewith a design for a link-motion which agrees more closely with that of the actual engines, and does away with the objectionable sliding blocks in the rocker. The cylinder centres adopted is that of the "Dunalastair III" model and of the cylinders illustrated in my book.

It will be noted that a link which is slung from

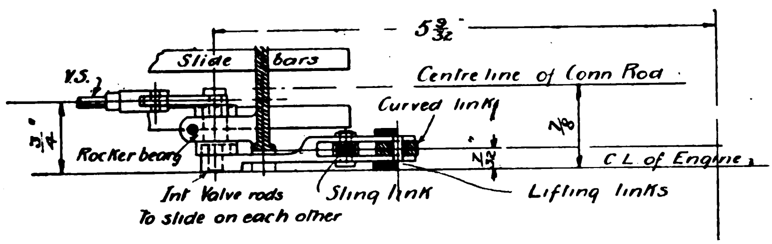


Fig. 5.—Half-plan of Motion (Fig. 4), showing Rocker and Intermediate Valve Rod. Centres arranged to suit existing Model Standards.

a point about the same height as the weigh-bar shaft takes the place of the sliding intermediate valve spindle. To obtain sufficient valve travel, the eccentric sheaves must be very large (they are large in the original, measuring no less than 1 ft. 7 ins. diameter over their working faces). The use of the type of curved link in which the eccentric-rod pins are pivoted behind the curved slot, allows of the eccentric travel being made approximately equal to the valve travel instead of the eccentric travel having to be $\frac{y}{x}$ times the valve travel, y being the distance between the eccentric rod pins, and x the maximum distance through which the die can move in the

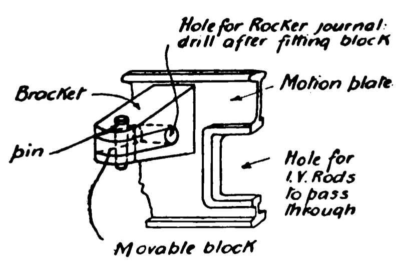


Fig. 6.—Sketch showing Rocker Bracket and Part of Motion Plate for Gear illustrated in Figs. 4 and 5.

curved slot after allowing the necessary clearance at the ends.

The above notes suffice for those who are desirous of building a model to ¾ or 1-in. scale, using the proper link-motion and its accessories. The next article will touch upon the mechanical details of smaller models, and will describe a new valve gear devised by the writer, suitable for working models of less pretentious character.

(*To be continued.*)

The Victoria Model Steamboat Club.

By "The Carpenter's Mate."

(*Continued from page* 393.)

Mr. J. Harrison, who is responsible for the well made vertical engine illustrated herewith (p. 424), is an amateur of more than ordinary skill in the arts. I cannot help making a brief reference to his work here. Like many other clever workers, he is extremely modest about his achievements, and does not consider he has done anything out of the ordinary. As a professional cabinet-maker, I could not help but admire, on the occasion of a visit to his home, a handsome 6-ft. sideboard. On making a discreet inquiry for the name of the maker, I was astounded to hear that he had made it himself entirely The construction, carving, and polishing are really well done and well above the standard of some of the professional work, therefore it is somewhat surprising to learn that Mr. Harrison has received no tuition whatever in the use of tools. Nearly everything in his home bears traces of his handiwork. Turning to examine his pictures, my attention was immediately arrested on beholding a fine carbon drawing of a Great Eastern "flier" nipping along a gully with the sunlight throwing shadows across the track from the wayside palings. Any one with a grain of the artist in him would recognise it as good work. Yes! Mr. Harrison did that too, and framed and glazed it

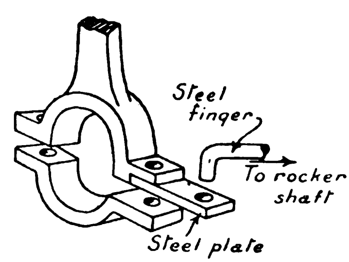
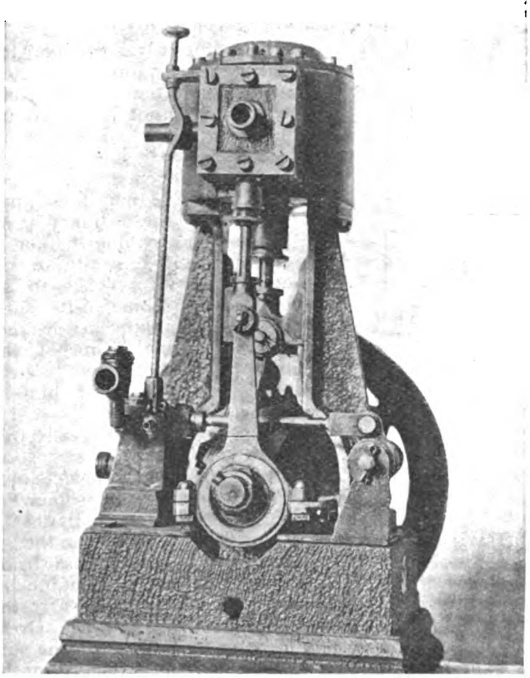


Fig. 9.—Eccentric Straps.

when he had finished it. He has recently turned his attention to model engineering, and his first finished model is the engine here shown. The bore and stroke are 2¼ ins. and 1¾ ins. respectively, and the novel feature about it is the method of driving the pump. The pump barrel is placed horizontally above and at one side of the shaft, the ram being worked from the eccentric strap through a rocker shaft. The actual connection with the strap is made by means of a steel finger, as shown in the sketch. A useful fitting will be noticed in the pet cock on the pump barrel. This is worked from the top of the engine through the medium of a long rod. A prominent feature of the engine is the employment of split lynch pins and washers to the parts where an ordinary nut or screw might work loose with the vibration when running. These little points, exemplify what experience has shown to be necessary

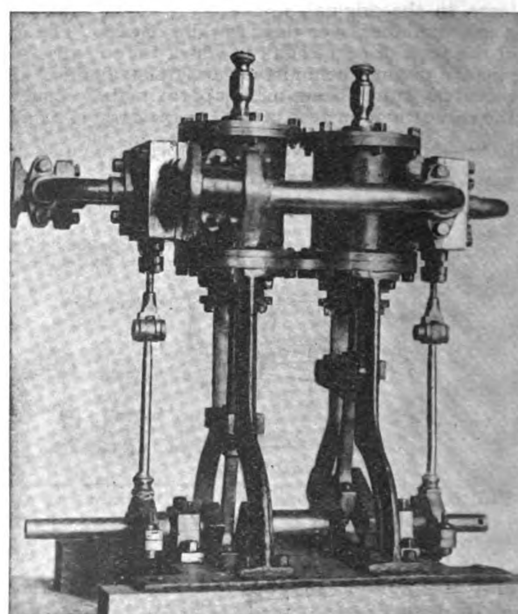


Mr. J. Harrison's Launch Engine.

in the construction of a model designated for hard continuous work. Perhaps the most interesting feature of this engine is that, with the exception of the various rods and screws, no part of it was turned in the lathe, yet the fitting is so good that it can be easily blown round by lung power, and there is no sign of shake in the motion.

The principal claim to novelty in the model shown on page 426 (which is the production of Mr. Henry Cousins) is that it is not a torpedo-boat destroyer. It is a good example of what can be done with a judicious arrangement of a few simple deck fittings, and is a pleasant change from the very much hackneyed T.B.D. As shown, it is a fairly close copy of one of the Thames Police patrol launches. The fittings comprise: Port and starboard mooring bitts forward, and ditto aft; forward companion, with open side panels, painted chocolate, with black roof; wheel, correct pattern, bright brass, and wheel platform, painted chocolate; spray screen, white, edged with bright brass wire; boiler hatch, chocolate, with black top fitted with port and starboard lamp brackets, these being coloured respectively green and red inside; funnels, bright brass, polished; engine hatch, fitted with glass top lights, each light (or window, as a model longshoreman would call them) being bordered by a bright brass wire beading. The hatch opens in two, hinged down the middle, painted chocolate with black top. A chain locker and flag-staff at stern, fitting into a brass socket, completes the deck fittings. The deck is painted a "pine-wood" colour and fitted with spray coaming at the stern, painted black outside, and ditto at the stem, painted white. The hull is chocolate below the water-line, and black above, with white line dividing. The method of making the name-plate is simple and effective. The letters and edging are cut separately out of a piece of sheet brass with a fret saw, and soldered on a flat plate. This plate is screwed to the hull and painted over with the rest. The finishing touch is got by rubbing the name-plate with fine glasspaper stretched over a flat pad, when the raised letters show up bright. No doubt the sentimentally inclined reader will be able to trace some analogy between the name of this vessel and one of the obstacles—or had I not better say one of the incentives—to the running of the boats mentioned in the first part of the article.

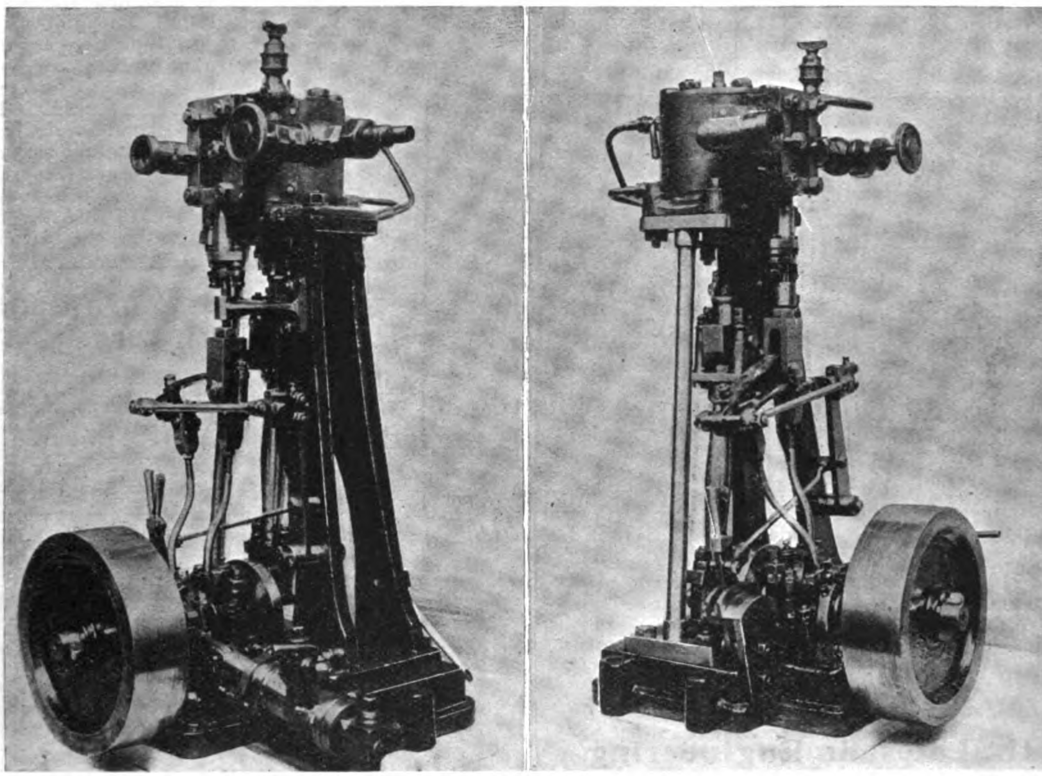
The fine vertical engine, of which two views are given on the opposite page, has one or two features which may be described as novel although its chief claim to attention is the completeness of the detail work. It is amateur work, and is all the more meritorious from the fact that its maker, Mr. J. T. Callaghan, is not a gentleman of ample leisure. Mr. Callaghan's little peculiarity is that he never gets tired. He will put in a full day's work at the London Dock, where he is employed as a craneman, and in the evening attend the L.C.C. Technical School, in High Street, Poplar, where he will make such good use of the brief time at his disposal as to win the approbation of teachers and principal alike. After that he will stroll home



Mr. R. W. Dormer's Pair-cylinder Vertical Engine

feeling as if he would like to commence work! Consequently, model engineering gets the benefit of his surplus energies. I cannot say whether Mr. Callaghan ever indulges in sleep or not, but I have certainly never been able to surprise him in that condition. At this juncture I feel it to be almost a duty (even at the risk of irrelevance) to pay a word of tribute to the splendid Technical School in the High Street, Poplar. This busy hive of instructive industry would well merit an article by itself, and an extremely interesting article it would prove, as the completeness of its plant for instruction is almost the last word on the subject. Everything, from the boiler-house to the drawing offices, is kept in the pink of condition by men and masters, who are adepts at their work. The instruction is of the most thorough and efficient order, and there are very few vacancies on the students' list. The "bored" youth who attends technical schools for the sole purpose of killing time seems to be conspicuous by his absence at this institution.

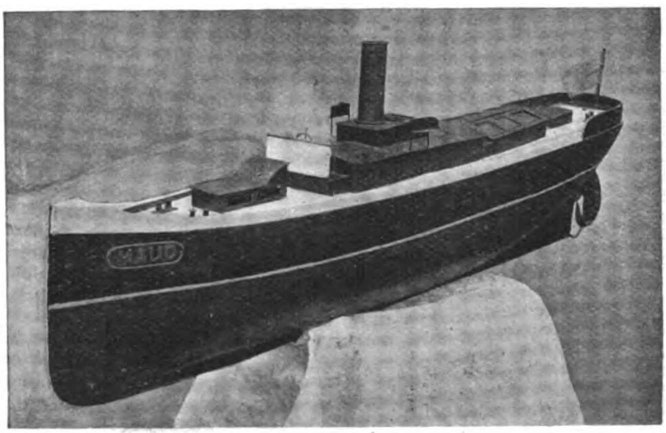
The engine shown would be technically described as an inverted vertical type, cylinder $2\frac{1}{4}$-in. bore, piston stroke 2 in.; total height, $16\frac{1}{2}$ ins.; bedplate floor space, 10 ins. by $9\frac{1}{2}$ ins.; pump, $\frac{5}{8}$-in. bore, $\frac{3}{8}$-in. stroke, driven by separate eccentric on shaft. The first point of interest is that means of taking up wear is provided for throughout, even the fork of the connecting-rod being fitted with split bearings and lock-nuts at each side. The two pipes from the drain cocks join into one and pass down one side of the standard, discharging on a level with the bedplate. The link is made up of two pieces of steel of the required shape spaced apart by distance pieces and bolted together. This provides an easy means of refitting when worn. The bent eccentric rods are not perhaps compatible with good practice, but they were rendered necessary by the employment of the disc half crank and the presence of the consequent intervening bearing. The cylinder has projecting lugs cast on the bottom end to bolt on to the front column and back standard. The method of bolting to the front column will be noted as correct Admiralty practice, and it gives the engine a fine appearance of solidity. Taken as a whole, the engine is not without artistic merit.



Two Views of Mr. H. Callaghan's Inverted Vertical Type Engine.

The pair-cylinder engine which is illustrated on the previous page is a well-finished piece of modelling, made by Mr. R. W. Dormer. The model has proved its merits under the practical conditions of hard work in a model steamer, and it shows what can be done in the way of reducing weight by the judicious lightening of the various parts, without sacrificing strength. It will be seen that the centre bearing has been dispensed with, and in order to give the crankshaft sufficient rigidity to overcome this absence of support in the middle, it is left much thicker at this part. This does not look like a saving of weight, but it must be remembered that the supporting web under the bedplate is dispensed with, too. The method of procedure in the making of the crank has been described before in The Model Engineer, but it may be new to some. It is first rough turned out of a piece of steel plate with the two crank pins both on the same axial line. The centre portion is then made bright redhot; one crank is put in the vice and the other given a quarter of a turn. The pipe union connections are elliptical-shaped castings bolted together, the three-way unions being exceptionally neat. Mr. R. W. Dormer has had experience of cracked tube joints through the expansion of the metal under steam, and this influenced him to put an expansion bend in the steam pipe of his model. It may not be a necessity for a model, but it certainly improves the appearance. The engine is all the more creditable to the maker from the fact that Mr. Dormer did the whole of the work, including the casting, himself.

In concluding this article, I am conscious that both in the selection of the subjects and in the descriptions of those selected, I have left out much that is of interest, but I must ask the readers of



MR. H. COUSIN'S MODEL POLICE PATROL LAUNCH.

THE MODEL ENGINEER (both the members of the Club and those who are not) to let me off as lightly as possible under the promise that (with the Skipper's permission) I will make amends on some future voyage.

The Latest in Engineering.

Testing a New Wagon on the G.N.R.—The interesting photograph, from which the illustration on the opposite page is reproduced, shows one of a new type of well or crocodile wagon recently built at the Doncaster Works of the Great Northern Railway, from the designs of Mr. H. A. Ivatt, Chief Locomotive Engineer. The body of the wagon is comprised of four deep steel girders, strongly braced together, transveisely, and raised at each end to afford clearance for the bogies, which latter are fitted with diamond pattern frames and oil axle boxes.

In the illustration, one of the famous 8-ft. single-driving express locomotives, designed by the late Mr. Patrick Stirling, is seen mounted upon the truck. The engine, in its then condition, weighed 44 tons, or 4 tons more than the load for which the wagon was designed. The latter, however, easily withstood the test, which was carried out at Doncaster. The locomotive, of course, stood too high for the loading gauge, but as the tests were confined to the yards in the vicinity of the works, this was a matter of no consequence.—C. S.L.

A New Pulley.—A new form of driving pulley is being introduced by Messrs. Walker & Holroyd, Bradford. The pulley, which is illustrated in the *Mechanical World*, is made up of two drawn steel stampings, each of which is concave in form. One half has a lip into which the edge of the other portion fits. This lip gives such rigidity that no other support from the boss to the rim is necessary. The boss is of cast iron, and is secured to the sides by riveting. It is claimed that these pulleys are from 30 to 40 per cent. lighter than ordinary cast-iron pulleys, and that as they are evenly balanced, they are suitable for guide pulleys running at high speed. Further, the concave formation and the absence of ledges obviate the accumulation of fluff, and as every part of the pulley presents a smooth surface, there is no danger of cutting the belt or the bands when putting the belt on.

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.]*

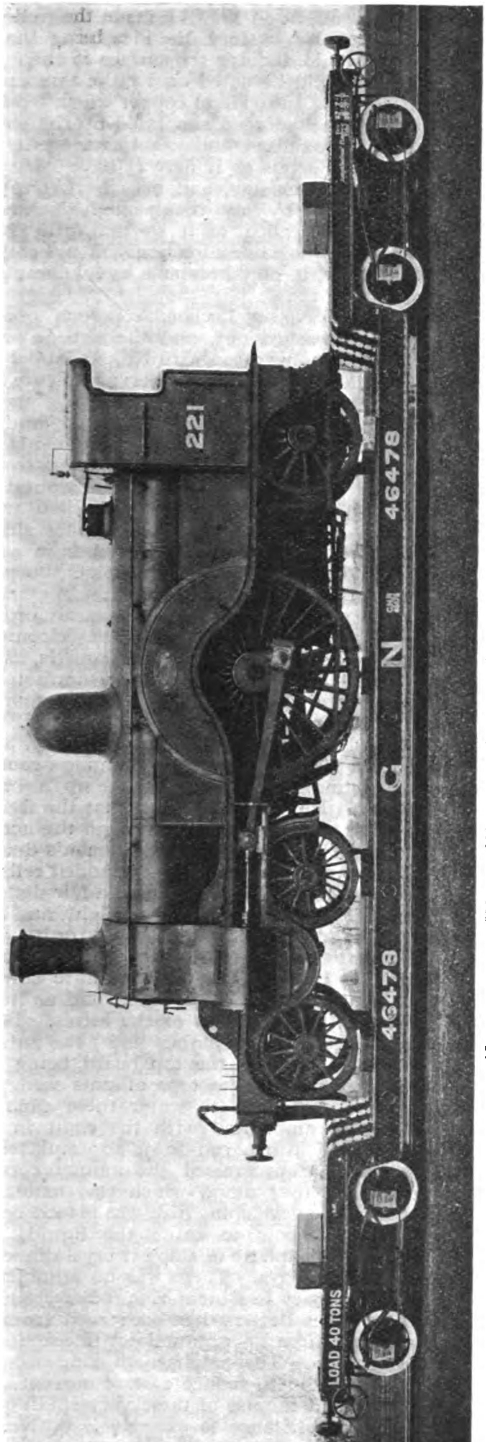
London.

ON Tuesday, the 16th inst., three parties of members, numbering eighteen in all, visited the Royal Mint, Little Tower Hill, E.C., and watched with much interest the several processes through which the precious metals have to pass before being issued to the public in the well-known form.

Future meetings at the Cripplegate Institute at 7 o'clock. Tuesday, May 28th: Lecture by Rev. W. J. Scott. On Tuesday, May 14th, a visit will be made to the Royal Arsenal, Woolwich.—HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

Aberdeen.—Model engineers in this district who would like to assist in the formation of a model steamer club are asked to communicate with Mr. WILLIAM PHILIP, 12, Cotton Street, Aberdeen.

TUNNEL BORING.—It is interesting to compare the rates of progress in the boring of large tunnels. The Simplon Tunnel, 1½ miles, was constructed at an average of about 28 ft. per day. The Hoosac Tunnel, 5 miles, progressed at 5½ ft. per day. The Mont Cenis Tunnel, 8 miles, was built at 8 ft. per day. The 4-mile Sutro Tunnel was bored at the average rate of 10·2 ft. per day. The Saint Gothard Tunnel, 9¼ miles long, was driven at an average of 14·6 ft. per day, and the Arlberg Tunnel, 6¼ miles, at 27·8 ft. per day.



NEW 40-TON WELL WAGON, GREAT NORTHERN 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 intended for publication.]*

The Renard Road Train.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—May I trespass again on your valuable space with regard to the above ingenious but complicated invention? I feel sure I shall not be robbing the late Colonel Renard of any of his numerous laurels when I point out this device is an old one, admitting the application to common road locomotion to be a novel one.

If reference be made to "Galloway's History of the Steam Engine," page 589, an illustration (evidently taken from a model) will be found of an invention by Mr. W. H. James of exactly the same nature, the only difference being that Mr. James' train was intended for use on a railway.

If you can refer to the *Auto-car* for 1904—I cannot give the exact date unfortunately—you will find a letter from me to the same effect and a rough sketch of the invention as actually carried out by Mr. James.—Yours faithfully,

Cranbrook. SIDNEY RUSSELL.

A Large Electric Clock.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Seeing a description of "A Large Electric Clock" in your issue for April 18th, I thought that possibly many of your readers would be interested in a description of a still larger clock, which is fixed in the church tower of the village of Cowbit, about three miles south of Spalding.

This clock has a 5-ft. dial, and was worked entirely by electricity. It was installed about twenty-five years ago, but the mechanism was far too delicate and complicated to be fitted in a dusty place without any protection, and so, after it had been working for a few months, it stopped. It has been idle ever since, and will shortly be replaced by a weight-driven clock.

The pendulum (which is 5 ft. long, weighs 75 lbs., and is mercury compensated) was kept moving by four large electro-magnets, and it used to send an electrical impulse to the magnets which moved the wheels, once every swing. There is an arrangement of contacts on some of the wheels, and every hour the current was sent through a pair of large electro-magnets (each wound with about 9 lbs. of D.C.C. wire), that pulled a very heavy iron armature to which was attached a mallet, so placed that a large bell received a blow every time the coils were excited. The pendulum and wheel magnets were connected to a battery of twelve large Daniell cells, and the striking gear was worked by three accumulators.—Yours truly,

Spalding. E. P. FARROW.

Cleaning Soiled Hands.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In reply to Mr. J. Bee's query in THE MODEL ENGINEER of the 11th inst., *re* the above, I herewith give my method, which I prefer to Hudson's or patent soaps.

Having filled the basin with *hot* water, pour about a teaspoonful of paraffin oil in the palm of the hand, working the oil well into the skin, as in the action of washing the hands, and paying special attention to the more dirty parts. Next dip the soap into the water and make a lather on the palms, working the hands well together, as before. Finish by using the nail brush and plenty of soap, washing off any paraffin remaining on the hands with soap and clean hot water. This method will also remove successfully tar or paint.—Yours truly,

P. E.

To the Editor of *The Model Engineer*.

Dear Sir,—If Mr. Bee will try a little rectified spirits of turpentine rubbed into the hands, and afterwards rinse them in hot water, then wash well with good quality carbolic soap, assisted by a nail-brush, I think he will find a way out of his present difficulty. Yours faithfully,

"Aptus."

To the Editor of *The Model Engineer*.

Dear Sir,—The following extract from Lord Grimthorpe's book on "Clocks and Bells" may be of use to J. Bee and others of your readers: "Working in iron with the common olive oil dirties the hands, whereas animal or sperm oil helps to clean them. It also preserves iron from rust far better and longer, and does not turn green on brass—*i.e.*, does not produce verdigris."—Yours truly,

W.

York.

To the Editor of *The Model Engineer*.

Dear Sir,—In answer to J. Bee's letter (Newcastle-on-Tyne), I should like to state that I have found the following treatment very good:—First of all get some earth and wash the hands with it and water as you would with soap, using plenty of earth. Rub the hands well for a while like this, then wash off with water. Next use a good rough flesh brush, Sunlight soap, and hot water, plentifully, to finish with. I have tried the above after a night's work with cast iron, which I think is worse than any other metal, and I have got splendid results. Trusting this may be of use.—Yours truly,

Leith. J. Wood.

To the Editor of *The Model Engineer*.

Dear Sir,—My experience has been that the only way to keep the hands really clean-looking is to keep the skin soft. I well rub in glycerine and cucumber every night, and use Gre Solvent for washing off the dirt (Salsbury, Long Acre). I find, however, Vim is nearly as good, and is considerably cheaper.—Yours truly, B. O. H.

A Modified Daniell's Battery.

To the Editor of *The Model Engineer*.

Dear Sir,—The cost of the depolarizer in primary batteries is a serious item, and if a means of dispensing with this at present indispensable adjunct could be devised, a distinct advance towards reducing the cost of current generated by this means would be accomplished.

With this object in view, I made the following modified Daniell's battery, the idea being that the electrolyte would dissolve the surface of the copper wire which would be acted on by the atmospheric oxygen, forming an oxide of copper which would be reduced by the hydrogen generated by the electrolyte and again oxidised, and so act as a regenerative depolarizer. Be this as it may (I have very little knowledge of chemistry, and may be wrong), the result obtained by my rough methods warrant attention being called to it so that others may experiment in the same direction and possibly improve it so that it may become a useful commercial article.

A worn-out No. 2 Leclanché porous pot was emptied and washed out, and the outside wound round from bottom to top with No. 20 copper wire. The coil was soft soldered at intervals to prevent it unwinding, and when commencing two coils were wound tightly round the bottom part and tied whilst being soldered together, to prevent them slipping off. A few inches of wire was left to make connection after the top coil was wound and fastened with solder. The pot was filled with a solution of sal-ammoniac, and a Leclanché zinc rod inserted. The cell was then placed in a saucer, as the liquid slowly percolates through the porous pot and runs down outside the wire.

This cell gave 1 volt—the same as an ordinary Daniell's—and 2 amps. on short circuit. It appeared to be as constant as the Daniells, as after being short-circuited through the ammeter for ten hours it still gave 1 amp., and after a short rest picked up again and gave 2 amps. as before.

It seemed a very promising arrangement, and I persuaded a friend to try it for charging accumulators, suggesting that he should make up a battery of five cells. He found, however, that the five cells did not pass sufficient current through the accumulator to deflect the needle of a Linesman's detector, using the low resistance coils, and he added cells until he had eight in series, which caused a fair deflection of the needle. He left them on all night, and in the morning found the accumulator was quite warm, showing that too much current had been passing.

After this I determined to try dilute sulphuric acid as exciter instead of sal ammoniac, as the cost would be quite one-fourth of the latter. I made a battery of eight 1-in. porous pots; the pots were suspended in a frame, the top board being bored with 1-in. holes and the tops of pots wedged in. With dilute acid 1 to 10 water these each gave 1 volt and ½ amp., and with the eight in series ½ amp. passed into a run-down accumulator, but as the charging progressed the ammeter pointer dropped back to ¼ amp., which was maintained. A photographic developing dish was placed beneath the suspended pots to catch the liquid, which appeared to be sulphate of zinc; it crystallised after standing a few days. There was no admixture of copper. Ordinary Leclanché zinc rods were used in this case. This battery has been used from time to time to charge an accumulator I use for gas-engine ignition. The sulphate of zinc would be saleable and help to reduce cost of current. I do not recommend the use of these very small porous pots, as the resistance is excessive. A No. 2 or No. 1 Leclanché, or perhaps a flat porous cell as used in Smee's battery, would be more suitable for practical purposes.—Yours truly,

Leyton. A. 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:—

[17,487] **Design for Boiler Firebox, Etc.** C. W. B. (Birr) writes: I have a riveted boiler, with steam dome of ⅛-in. wrought iron, see sketch enclosed (not reproduced). At present I am firing it with a benzoline blowlamp, as I cannot use gas, but I fail to raise sufficient pressure for my purpose with lamp. I shall therefore be greatly obliged if you will suggest some design for a firebox for the boiler. Failing above, will you tell me if acetylene gas is ever used for firing model boilers, and if so, where could I obtain a suitable generator for the purpose?

From your sketch we take it that the boiler is a 5-in. by 12-in. cylindrical boiler, without flues or furnace tube. The best way to make it steam is to fit some water tubes on the underside of the shell, as shown in the new edition of "Model Boiler Making," page 17. Or you may arrange it in a setting, as shown in Fig. 3 *b*, page 22. In place of a coal fire or a gas ring, use an acetylene generator, which can be obtained, with a suitable Bunsen tube stove, from Messrs. The Thorn & Hoddle Acetylene Company, Victoria Street, Westminster, S.W. If you think acetylene not suitable to your purpose, then try a petrol gas burner where the air is blown through petrol, as illustrated in our issue of August 23rd, 1906.

[17,561] **Model Steam Turbines.** W. M. (London) writes: I am going to build a model steam turbine with a 4-in. wheel, as described in your handbook. Would you be kind enough to tell me what size vertical boiler will be required to drive the same, working pressure 30 lbs. if possible? Please give me a few measurements and what to fire boiler with. One more question: With this little plant can I drive a 10-volt 1-amp. dynamo or a 6-volt 3-amp. dynamo direct coupled to turbine shaft?

The turbine you have chosen we find will require 16 cub. ins. of water per minute, if worked at 30 lbs. pressure. The boiler will, of course, have to work with natural draught, and therefore we cannot recommend one smaller than 18 ins. by 30 ins., with eighteen to twenty-four tubes 1¼ ins. diameter. As you will see, the whole plant is absurdly large. You will be developing something in the neighbourhood of 1 h.-p. to provide power for a 1-70th h.-p. dynamo. A little 1½ by 1½ vertical high-speed engine would do the work well. You would not be able to couple the turbine direct, owing to the very high speed at which a De Laval turbine runs. We must ask you to carefully read the handbook through again.

[17,533] **A Twin-Elliptic Harmonograph.** C. W. F. (Cornwall) writes: I have just completed a twin-elliptic harmonograph, as described by Mr. A. H. Avery in THE MODEL ENGINEER for January 21st, 1904, but have adopted the arrangement of your correspondent in THE MODEL ENGINEER for February 15th, 1906, n making some parts of wood. The following are the principal dimensions of my instrument:—Main pendulum (of ⅞-in. iron tube), 16 ft. long to middle of bob; weight of bob, about 40 lbs.; deflecting pendulum, various lengths and weights up to 3 ft. and a couple of pounds. My difficulty is this: the figures produced are well drawn, but are all similar in pattern, and start the pendulums how I may, the results are always of two or three styles, not a bit like those published in the article by Mr. Avery. I am inclined to think that my lower pendulum is too small, as the main pendulum is larger than the one he describes. Perhaps Mr. Avery would give a few suggestions as to size and weight, and also how to set the pendulums vibrating. I enclose a few of my attempts (not reproduced); these will, perhaps, make my meaning clear.

Mr. Avery has kindly replied to the above as follows: In reply to your correspondent *re* harmonograph difficulties, I should say that most of his difficulties are due to unsuitable ink and paper. Ordinary blue-black writing ink, such as that used in the samples sent is not of the slightest use, when fine figures are desired, and a paper with a hard smooth surface is also essential or it will rough up with the moisture and choke the glass pen. Judging from the scratchy appearance of the figures, it looks as though your correspondent had not obtained quite the best point to his glass pen, although the lines are fine; they are also uneven, and do not mark equally well in all directions. This may partly be due to the fact that the pen in its holder does not bear truly vertically on the paper when at rest, but is more likely to be caused from a rough pen point. All glass pens after having the tips cut off and ground square, should be slightly fused over in the flame of a spirit lamp. It requires much care not to close the capillary opening altogether in this process, but if correctly done leaves a nice polished fused edge to bear on the paper, prevents catching up and chattering of the pen over slight roughnesses of the paper, and greatly improves the evenness of the lines. The dimensions given by your correspondent could not be very well improved upon, and ought to give him an immense range of figures. The writer has obtained several thousands of varieties with a main pendulum only 7 ft. long. The pendulum rod in the present case (⅞-in. iron tube) is rather needlessly heavy; ½ in. 18 G. cycle tube would be an improvement, and would render the figures less liable to distortion. The ball suspension at top is of the utmost importance, and any defect in this will become apparent at once in the figures. Both the steel ball and the concave support must be hardened and well polished. Attention to the above details, together with the use of a good purple aniline ink—filtered if necessary—will ensure better results.

[12,900] **Emery Wheels.** H. M. K. (Birmingham) writes: Your advice on the following would oblige. What size and kind of emery wheel and speed should I use in the lathe for grinding lawn mowers?

Re emery wheel, apply to Messrs. C. W. Burton-Griffiths & Co., 1, 2, and 3, Ludgate Square, Ludgate Hill, London, E.C. Tell them what the wheel is for and they will advise you as to best grade and speed, also price. A small wheel should be used about 4 ins. diameter. The blades should be adjusted to work as close as possible with safety.

[13,114] **Examinations and Apprenticeships.** J. B. B. M. (Aberdeen) writes: I should be much obliged if you would answer me these questions. (1) What examinations are there the passing of which might put a young engineer in the way of a good appointment at the expiration of his apprenticeship? Where could I obtain particulars of them? (2) Does the fact of having served my time in a non-premium shop place me at a disadvantage as compared to young men paying a high premium? I may state that I am serving my time in an Aberdeen shop with a good variety of work, principally quarry engineering, and attend the evening classes of the city in Practical Mathematics, Applied Mechanics, Steam, and Machine Construction and Drawing. I am serving six years, of which almost three have expired. (3) Do you think it a good plan to go to sea, and, if so, what sort of an appointment would I stand a good chance of getting on coming ashore with either second or first class B.T. certificate?

The principal examinations are of a kind similar to those held under the City and Guilds of London Technological examinations, or Science and Art Department examinations. The chief thing, apart from influence, which has weight in securing an appointment, is a man's record of experience. Certificates of any kind, especially advanced or honours grade, or a Whitworth scholarship, or B.Sc. degree, all help, but the main thing is experience. You can scarcely expect to gain a good appointment at the end of your apprenticeship; such positions usually go to those who have attained ten or fifteen years good experience after they have served their time; of course, there are exceptions. Your class teacher will get you particulars of the Whitworth scholarships. (2) No, it makes no difference as regards your status. You should try and obtain a certificate from your employer at the end of your time to show that you have served an apprenticeship. The only advantage of a premium is that it sometimes enables you to obtain some theoretical training at the works and may cause you to be put into an appointment by your employers at the end of your time. (3) It is a good plan to spend a few years at sea if you intend to go in for such an appointment as engineer-in-charge of plant at a factory or central electric generating station. There are some fairly good positions to be obtained of this nature, and if you had seagoing experience and a first or second engineer's certificate you would stand a fair chance of obtaining such a berth. The chief thing is to make up your mind as to what branch of work you prefer and go ahead to get all the experience you can in that line. If you are going to keep to manufacturing, then get into all the workshops you can. You appear to be in a good shop to start with; we strongly advise you to faithfully serve your agreed-upon time there. Do not be too anxious to get into a responsible position at a very early age; there is anxiety with responsibility and high pay.

[12,937] **Petrol Engines for Dynamo Driving.** C. N. L. (Birkenhead) writes: I should like your advice on the following queries. I am thinking of getting castings of a 1 b.h.-p. water-cooled petrol launch engine costing £3. I do not intend using the engine for a launch, but should drive a 400-watt dynamo, 40 volts 10 amps., direct with it (the engine gives the above power at 1,500 r.p.m.). (1) Can you recommend this type of engine for this purpose, and would it be able to make runs of three or four hours without attention? (2) Are the firm and price about right for the castings of a reliable engine? If not, what price would you suggest as being appropriate? (3) Would

it be better to run the engine slower than 1,500 r.p.m., say 1,200 r.p.m.? as perhaps the wear would be great when running continually for four hours at 1,500 r.p.m. Would this be so? (4) At 1,200 r.p.m. it should give well over 3 b.h.-p., and it would therefore be powerful enough at that speed, I suppose, for the 400-watt dynamo? (5) Would you recommend tube or electric ignition for long runs without attention, and would internal or external flywheel be most suitable? (6) Would the said dynamo be capable of maintaining an arc powerful enough to project pictures (from an ordinary lantern) of 6 ft. square; or would a higher voltage and lower amperage dynamo be more suitable, say, one giving 50 volts at 8 amps.?

(1 and 2) If you have any doubts on these points we should advise you to get prices and particulars from one or two other firms as well and compare what they offer for the money. It is not always advisable, however, to take the lowest-priced article. You should make sure that the set is fairly complete and of good material. A water-cooled engine should be able to work for several hours at a stretch, but may require a certain amount of attention. (3) Certainly, there is less wear and tear at the slower speed, but 1,200 r.p.m. is a slow speed for a 400-watt dynamo; it would mean a larger size machine. (4) You will not obtain 400 watts with only ½ h.-p.; probably not more than about 300 watts. (5) Electric ignition by preference. External flywheels are to be recommended. (6) You require 45 volts for such an arc lamp, as it is necessary to use a small resistance in series with the arc to keep it steady. Dynamo should be compound or series wound; 8 amps. would give you a very fair picture.

[17,497] **Model Pipe Unions.** W. B. W. (Surrey) writes: I should be much obliged if you would tell me the best way of making unions for steam pipes, also how to make a T-union? Must one be a left-handed screw?

The best union is the cone union, and, as made, these have tail and spigot-pieces larger in diameter than the pipe for which they are used. Fig. 1 shows a section of a stock pattern union, such as you can buy from 1s. 4d. upwards. Where such unions are

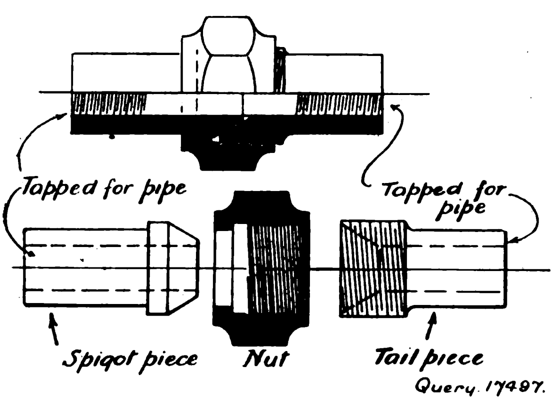


Fig. 1.—Standard Pattern Cone Joint Union.

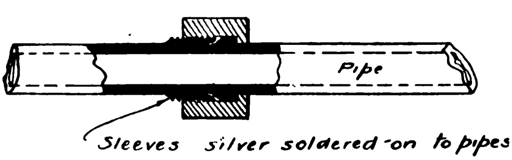


Fig. 2.—Another Form of Cone Joint Union.

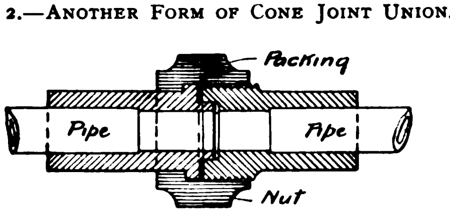


Fig. 3.—Flat Joint Union.

not applicable, you may adopt the section shown in Fig. 2. The two thickening pieces, or sleeves, as shown in sketch, should be silver-soldered on to the tube. In some cases (at the male piece of the cone) this must be done after the nut has been slipped over the pipe. The type of union shown in Fig. 3 is an alternative, but this is not so good as those with ground cone joints, packing being required to effect a steam-tight joint. You may modify the above to suit T-pieces; the nuts should be on the pipes leading to the tees. The threads may be all right-handed threads.

[17,521] **Concerning Small Turbines.** G. R. T. (Talgoo writes: Will you please answer the following. I have your handbook, "Model Steam Turbines," and wish to know if it would be practicable to apply a condenser to the larger De Laval type turbine on page 61? Would it be necessary to alter discharge nozzles? How many square feet of cooling surface would such a condenser contain, and of what capacity must the air pump be? How many cubic inches of water will it be necessary for a boiler to evaporate per minute to supply this turbine? Can you recommend any books on turbines?

The turbine you mention is not designed to work condensing. Nozzles, gear, and wheel would have to be altered, and the condenser and air pump would complicate matters. We think you might get "Steam Turbines," by Carl C. Thomas—New York, John Wiley & Sons; or London, Chapman & Hall. We could only design the plant for you at a cost of £2.

[12,956] **Electric Motor for Model Battleship.** F. E. L. (Cambridge) writes: I intend to build a 1-10th-in. model of *King Edward VII* type of battleship. I wish to drive the battleship mentioned above (3 ft. 6 ins. by 7·8 ins. by 2·7 ins.) by an electric motor. (1) Will 1½-in. by 2½-in. H armature be sufficient for this purpose? I see an H armature is advised in "Small Electric Motors," though this is not at all confirmed in the paragraph on H armatures in "Small Dynamos and Motors," both by Mr. Powell. (2) I propose to wind this motor for 10 volts 3 amps. and to use five or six carbon zinc bichromate cells in series. What should be the area of each zinc plate? (3) Would you be so good as to say how carbons are capped with lead? In running the battleship with the electric motor, I intend, for the present, at least, to use a single screw. (4) Should the screw shaft work directly on the motor shaft without gearing? (5) If so, what diameter and pitch of screw should be used? (6) Will the list be considerable owing to use of single screw?

(1) An H armature can be used, but a tripolar would be better. The motor should be series wound; the size you mention should do. (2) Make your zinc plates as large as possible in the space you have at disposal. (3) You will find information on the capping of carbons in The Model Engineer for July 14th, 1904, page 46. (4) A matter of choice as regards direct-coupling of screw. We are inclined to advise gearing down so as to let the motor run as fast as possible, as it will economise your battery power; say, gear down about 4 to 1. (5) Pitch and diameter of screw can only be accurately determined by experiment. Try one of 2½ ins. diam., three blades, 6-in. pitch; you will probably have to try several if you wish to get best results. (6) Not necessarily

[12,920] **Small Motor Construction.** J. W. (Kilmarnock) writes: I bought your book on "Small Electric Motors" (No. 14 of The Model Engineer series), and intend making the four-pole motor shown in same, but as I do not fully understand the instructions in the book, would you please answer the following questions. (1) Is the field-magnet the shaded part in Fig. 13? If so, what is the part from g to end at bearing cap? If these are the laminations, how are they held on, and what are they made of, and is there any working parts inside? Can said field-magnet be cast in brass or must it be iron? (2) Can you recommend any firm where they would stamp the armature at a low price? (3) Is the commutator ring slit? (4) What are the commutator bars, and how are they electrically connected? (5) Where are the four loose ends *w*, *w*, *w*, *w* connected to? (6) How many windings of wire are needed for bobbins? (7) What do the batteries consist of?

(1) The shaded part is the field-magnet; the dotted lines from *g* to the bearing at right-hand end of machine merely show the dimensions for the different sizes of this machine, as specified on pages 29 and 36—that is, the motor is made more powerful by increasing its length the diameter of the armature remaining the same. It is absolutely essential that the field-magnet is cast in iron or soft steel or made of wrought iron; brass will be useless. (2) The stampings for armature can be procured from the Electrical Sundries Manufacturing Company, 152, Grey Mare Lane, Manchester; or, Mr. A. H. Avery, Fulmen Works, Park Street, Tunbridge Wells. (3) Yes, your sketch of commutator ring is correct. (4) The commutator bars are the four segments of the ring as per your sketch; they must only be electrically connected through the armature winding. (5) The ends *w*, *w*, *w*, *w*, are to be all soldered together as explained at bottom of page 32. (6) Get on as much wire as you can in the given space, only providing that all similar coils are equal in either armature or field-magnet respectively. (7) Batteries may be either accumulators or primary batteries of the bichromate pattern; the larger the cells the longer they will run without recharging. The more cells you join in series with each other the higher will be the pressure and the greater the speed of the motor. You will find useful information in our sixpenny handbook on "Electric Batteries." The voltage and current required for the various sizes of this motor are given on page 36 of "Small Electric Motors."

[17,486] **"The Model Engineer" Steam Locomotive.** J. W. R. (Canada) writes: What is the least safe working radius of railway for THE MODEL ENGINEER electric locomotive when running at full speed and light?

In reply to your query, 20 ft. is the minimum radius we would advise under the conditions you name. The superelevation should be not less than ½ in.

[13,230] **Step-up Transformer.** W. H. S. (Putney) writes: I wish to design and construct a step-up transformer to work a Tesla coil similar to that described by Mr. Howgrave-Graham, and also suitable for carrying out the induction experiments described in his earlier articles. The electric current available is 205 volts 50 amps. Can you tell me (1) The most suitable voltage to step-up to? (2) The maximum current likely to be required through the primary? (3) The current the primary should be designed to carry? (4) Are there any peculiarities of design or precautions which belong to step-up transformers in distinction to step-down transformers? (5) Can you refer me to any work or paper in which the construction or design of a step-up transformer similar to the above is described?

(1) It is advisable to be able to step-up to several voltages, and for this purpose the primary of the transformer is divided into sections so that more or less turns can be used, the various sections being connected to a series of terminals. It is usual to step-up to a maximum of about 8,000 volts with lower divisions of about 6,000, 4,000, and 2,000 volts. (2) About 500 watts are required. At 205 volts, we think if you reckon on 4 amps. as a maximum, it will be about correct. (3) Say 5 amps. (4) Yes, in this case. The secondary consists of two sections of wire wound in the same manner and with the same precautions as if it was the secondary of an induction coil, each layer of wire being insulated with several thicknesses of thin paper. No. 38 or 40 gauge silk-covered wire is used. The secondary winding is permanently immersed in oil, and its ends must be highly insulated, the terminals being carried on ebonite pillars. Some experience is required to construct such a transformer, and you are quite likely to have a number of breakdowns before you get the insulation to stand. (5) We are unable to refer you to any published description of these transformers, but you could probably obtain a complete set of materials to construct one from Thompson & Co., electrical engineers, of 28, Deptford Bridge, Greenwich.

[13,229] **Polarised Relay.** W. M. (London, W.) writes: I have what is supposed to be a Siemens polarised relay, the coils of which have a resistance of 10,000 ohms shunted by a 1,000 coil, and a condenser in series. Can you tell me why both are used? Would not a suitable resistance coil alone do as well? The object is, I suppose, to destroy the back E.M.F. of coils when circuit is broken.

The object of shunting the relay with a condenser and resistance is to increase the speed of working by neutralising the induced current in the relay coils which is set up when circuit is broken. A resistance coil alone would not achieve the results, as it would not give any appreciable back discharge or have any appreciable capacity to absorb current; both these properties are possessed by a condenser. The object of the resistance is to regulate the time in which the condenser will be charged and will discharge. If the resistance coil was wound round an iron core it would give a back discharge and also take time in absorbing current, and an arrangement of this sort is used for telegraphic work as a shunt instead of a condenser in some cases.

[13,266] **Pidgeon Influence Machine.** J. E. N. (Dublin) writes: (1) Is the Pidgeon influence machine superior in all-round working to a Wimshurst? (2) Has it been described in THE MODEL ENGINEER? (3) Can you give the name of any makers of above machine, and who would supply parts? I should be glad of the name of a first-class maker of influence machines, even if parts could not be obtained from them, as well as name of people from whom parts can be obtained.

(1) The Pidgeon influence machine is stated to be superior to the ordinary pattern of Wimshurst machine, but we have no actual experience to support the assertion. The machine is very well planned and well made mechanically, and its principle of three revolving plates instead of a pair should produce an increased effect. (2) This machine has not been described in THE MODEL ENGINEER. A description, with illustrations, is given in a small book called "Influence Machines," by Gray. (3) We do not know who are the makers or if the machines are on the market. Messrs. J. J. Griffin & Sons, Ltd., of Sardinia Street, Lincoln's Inn Fields, are good makers of influence machines, and we believe they would supply parts. You can obtain particulars of the Pidgeon machines by obtaining his Patent Specification No. 22,517, of 1899, British Patent.

[13,287] **Motor-driven Phonograph.** R. B. J. (Glasgow) writes: In THE MODEL ENGINEER dated November 10th, 1904, you advise a motor for driving a phonograph, on page 452. In driving a phonograph there is a great deal in the speed for different songs. I want to know how you propose to get these different speeds? Take, for instance, my machine, which is an Edison "Gem." Well, you see with the present drive one is able to adjust the speed by putting friction on to a cone, but when this belt is taken off and put as I suggest, this does away with all the machinery under the machine, and therefore the motion for regulating the machine is also no use. I hope you quite understand me. Of course, if you can, suggest any better drive, or how the speed of motor can be altered.

The speed of an electric motor is easily varied by raising or lowering the volts applied to its terminals. This can be effected by using more or less cells of the battery in series or by a regulating resistance. Briefly, this consists of a suitable coil of wire which chokes back the current and a moving switch which cuts out wire to raise the speed and conversely cuts in wire to lower the speed; the switch is moved by means of a knob. With a properly arranged regulating resistance of this kind you can get any speed you like by very fine graduation, it being only necessary to turn a knob by your finger and thumb. If you wish to understand more about the subject, we advise you to read our handbook, "Small Electric Motors," price 6d. The motor should have ample power so as to run at a slow speed and thus avoid the slight singing noise produced by a high-speed motor. A speed of 1,000 r.p.m. is practically noiseless with a well-made motor.

[17,490] **Locomotive Engine Cleaning.** E. C. (Bayswater) writes: Could you tell me if it is possible for me to get a situation on a railway (locomotive department) as engine cleaner? I have just left the Army. I am told I am too old. My age is 23: height 5 ft. 6 ins. With what little money I have I am willing to pay a small premium if you know of a Company, or what chance I would have on a foreign railway. I have been abroad for a short time.

We are afraid we cannot help you much, as we are almost certain that at your age you would not be accepted by an English Railway Company without some personal influence. Most foreign companies employ natives for cleaning locomotives. Possibly you may be able to get a suitable job with a contractor or on a colliery line. Would a position as an assistant motorman on one of the tube railways suit you?

[17,548] **Painting Model Locomotive.** S. C. F. (London) writes: I have a locomotive built after the Smithies' style. My outer boiler casing is 3¾ ins. diameter, and I wish to enamel it. But seeing that it is, of course, exposed to very great heat, I ask you if you can recommend me some good heat-resisting enamel suitable for it.

Maurice's "Porcelaine" or Aspinall's enamel will do as well as anything, but the enamelling of a water-tube boiler is always a trouble if light colours are employed. Can you not make the outer tube double thickness?

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.]

Electrically-controlled Model Railway Installation.

At the trade exhibition held at Bingley Hall, Birmingham, the London and North-Western Railway are exhibiting at their stand an electrically-controlled model L.N.-W.R. system, which has been constructed by Messrs. W. J. Bassett-Lowke & Co., Northampton. Readers in Birmingham who were unable to see a similar set which was on view at the last S.M.E. Conversazione should take this opportunity. The model represents a small section of the line, and is correct in every detail. The locomotives are driven and controlled electrically. The signals are also placed in connection with the controlling circuits, so that the "engine-driver," who may be stationed at any convenient position on the line, cannot run his engine into any portion of the line not placed in "line clear" position by the "signalman." The locomotives can not only be controlled as regards starting and stopping, and run at various speeds by the "driver," but can be reversed without the operator having to touch the engine in any way. By this means, and the use of automatic couplings fitted to the rolling-stock, the locomotives can be run into a siding, made to automatically pick up some trucks, run out again, and then "fly shunt" the vehicles into another siding, without handling or interfering with the rolling-stock in any way. We understand that the model will be shown at the forthcoming exhibition in Dublin. For further particulars and prices of similar installations, readers should apply to the manufacturers as mentioned above.

New Catalogues and Lists.

The British Cycle Manufacturing Co. (1901), Ltd., 1 and 3, Berry Street, Liverpool, will send post free to all readers making application, "The Cyclists' Enquire Within," which is a very useful pocket compendium, containing valuable information for cyclists and motor cyclists.

The Editor's Page.

WE have received the following interesting communication from the Hon. Secretary of the Clapham Steam and Sailing Club :—

' Doubtless many of your subscribers interested in model speed boats also read your contemporary, *The Motor Boat*, and may have seen there the correspondence that appeared in that journal in the latter part of last year. It was the intention of our Club, if we induced the London County Council to carry out certain improvements and provide accommodation on our pond, *to put up a trophy for international competition for model motor boats.* Unfortunately, however, we have up to the present been unable to induce the Council to do anything for us (although the matter comes up again for consideration next May), consequently the idea of an international competition has had to be abandoned, as far as we are concerned, on our water. As already mentioned in your columns, this Club numbers amongst its various craft Mr. Arkell's motor petrol boat *Mairama*, of which great things were expected in THE MODEL ENGINEER'S Speed Competition, but which, for reasons given by me when returning times of trials, turned out very disappointing. We have also other members with motor craft either built or building, and as these craft are far too speedy for competition with the ordinary steamers or electric boats of the Club, we should be pleased to hear of anybody willing to enter a boat, petrol or otherwise, for competition on our water. I may mention that whilst sailing on the pond several of the spectators have mentioned that they had motor boats which they were going to bring up to race us, but which, we are sorry to say, have never materialised. The club is willing to put up a gold-centred medal suitably inscribed, for a race; THE MODEL ENGINEER to appoint the umpire; the race to come off as soon as possible on our pond. We can offer a clear run of about 145 yards, with a width of about 55 yards, which is not such a bad stretch of water for such a race. Rubber boots are necessary for controlling the boats, which we should be pleased to provide for competitors. Should any of your readers be willing to arrange a meeting, if they will communicate with me it will receive immediate attention. Before closing I would like to mention that although this Club was only formed last October, the membership now numbers nearly sixty, both sailing boats and steamers being well represented. Races for both classes are held every Saturday, sailing boats in the afternoon, and steamers after 5.30 p.m.; and if we could only get the accommodation we are asking for, and which other Clubs seem to be very fortunate in having obtained, we expect the number would considerably increase.—G. F. YOUNG, 'Fairholme,' Old Park Avenue, Nightingale Lane, Clapham, S.W." We need hardly say that we shall be pleased to give any assistance in our power in the furtherance of the sporting event suggested by Mr. Young, and if sufficient entries are received to ensure a good race, we should be happy to contribute in some way to the prize list.

Answers to Correspondents.

J. F. G. (Peckham).—Cotton & Johnson, 14, Gerrard Street, Soho, or Smith & Sons, St. John's Square, Clerkenwell.

G. H. (Clifton).—The two firms you mention are the only important ones we know of. For smaller firms consult the trades directory.

Q. L. B. (Lincoln).—Whitneys, 117, City Road, E.C., would supply you. A dynamo of 50 volts, 5 or 6 amps., would do.

F. B. (Rochdale).—Your letter has had attention. Yes, we shall be pleased to assist if you are still in difficulties.

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, etc., 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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THE

Model Engineer

And Electrician.

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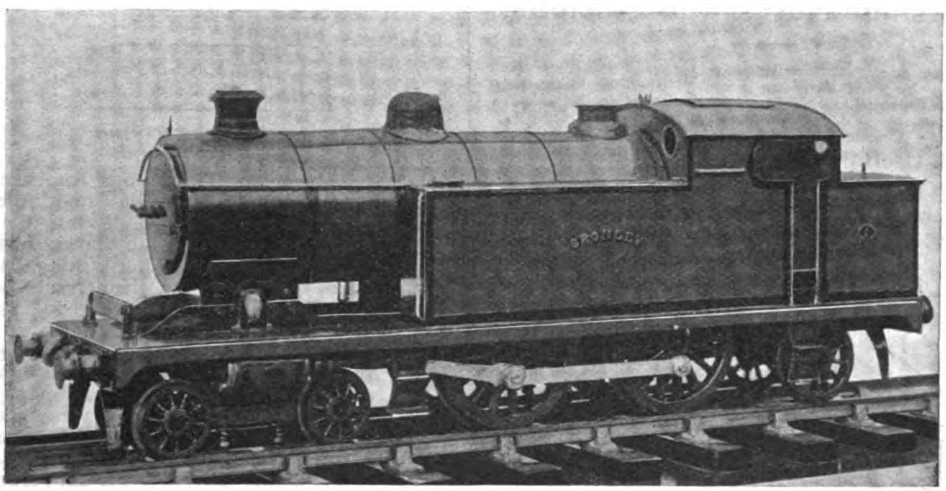
A Beginner's Model Locomotive Work.

By W. PAGE.



MR. W. PAGE'S MODEL LOCOMOTIVE.

THIS photograph illustrates my first model locomotive. It is built to 7-16ths in.-scale, gauge 2½ ins., but is not a correct model of any particular type. The drawings were made just over three years ago, and I have been building it in my spare time since then. No bought parts have been used, except the trailing wheels, which are of brass, and on these I have put steel tyres as the flanges were too wide. All the other wheels are of cast iron, from my own pattern. The frames, buffer beam, and footplate are held together by ⅛-in. angle brass, riveted. The side tanks, cab, and bunker are of sheet brass, made to take off in one piece, to get at the boiler.

The boiler is of the Smithies type, outer shell is a piece of brass tube 1-32nd in. thick, 9¼ ins. long. The inner barrel is a piece of solid drawn copper tube 1-16th in. thick, 1¾ ins. diameter, 7¼ ins. long; the downcomer and back of boiler are in one, and from my own pattern, in gun-metal; the back and front of boiler are screwed together with 3-32nds in. brass screws and silver-soldered; it has four ¼-in. water tubes, silver soldered in. (This has been tested with 60 lbs. of steam turned on at once, and has stood it all right.) The regulator is of the model locomotive type, the steam pipe is carried from the smokebox, over the fire and back again, to form a superheater. The funnel, dome, and valve casing are turned from the solid. The bogie has side play controlled by two springs as well as turning movement; all the wheels have springs. The coupled wheels have an equalising bar, the springs of which can be seen in the photograph. The trailing wheels have 5-5 32nds in. of sideplay. The buffers and drawhook are made as near as possible like the original ones. The eccentrics are of the slip pattern, from a back number of THE MODEL ENGINEER; they are driven by pins. The cylinders are 7-16ths in. bore by ⅞-in. stroke, steam ports 1-16th-in. by 3-16ths-in.; exhaust port ⅛ in. by 3-16ths-in. The following are the chief measurements:—Length over all, 16¾ ins.; width, 3-3-16ths ins.; height from rail level, 5¼ ins.; height of boiler centre above rails, 3-11-16ths-ins. Wheels: Bogie, 1¼ in.; coupled, 2⅝ ins.; trailing, 1 9-16ths ins. Wheel base: Bogie 2⅝ ins.; from bogie centre to driving 4½ ins., driving to coupled 3⅜ ins., coupled to trailing 3¼ ins.: total, 11 ins. I made the spirit lamp as advised to use with THE MODEL ENGINEER locomotive and I cannot get it to work properly, so I am trying to make a small blowlamp. I have had this at work, but cannot so far keep the pressure up. The engine I have had at work propped up—I have no railway yet—and she runs very well.

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 Anvil or Truing Plate.

By J. H. P. BOLDERO.

This can be made as follows:—Procure an iron, such as is used for domestic purposes. Next prepare two pieces of hard wood (5 ins. long,

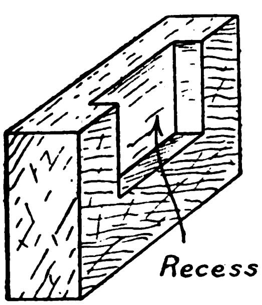


FIG. 1.

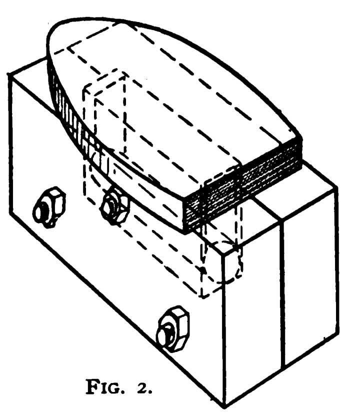


FIG. 2.

A USEFUL ANVIL.

4 ins. or 5 ins. deep, and 1¼ ins. thick); cut in each piece a recess equal to half the thickness of the handle of the iron, as shown in Fig. 1. Having done this, next drill three holes in each half for ¼-in. bolts; now mount the iron in the blocks and screw up the bolts, and the anvil is complete (see Fig. 2). It will be found a very useful addition to the amateur's workshop.

Simple Methods of Making Small Patterns.

By F. H. BRAMWELL.

I find the best method for making small patterns is by building them up from thin wood. Three-ply fretwood, ⅛ in. thick, is very useful, as it does not split. For other thicknesses the thin wood of which cigar boxes are made is the best material.

I will just give two or three simple examples of patterns I have made myself.

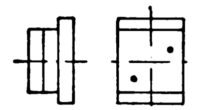


FIG. 1.

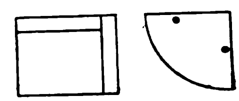


FIG. 2.

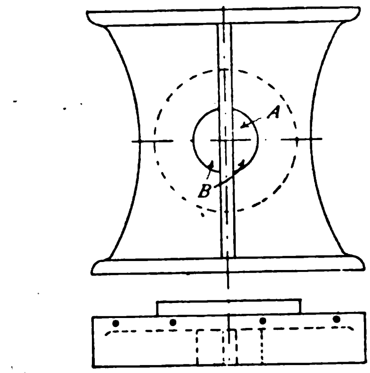


FIG. 3.

PATTERN-MAKING.

(1) Axle-boxes for THE MODEL ENGINEER Locomotive.—One pattern was made for both the leading and driving axle-boxes. To do this the flanges were made ⅛ in. thick and the bearing surface was made ¼ in. wide. After casting, the axle-boxes were filed to their respective sizes. From a piece of ⅛-in. fretwood two pieces 9-16ths in. square and one piece 9-16ths in. by ⅜ in. were cut out and glued together, as shown. This was further secured by a couple of small sprigs. These small sprigs I made by breaking up needles into convenient lengths. This pattern was then smoothed up with fine sandpaper and red enamelled.

(2) Corner Brackets for supporting Foot Plating.—This pattern was made by sprigging three pieces of ⅛-in. fretwood, as shown. They were also glued together. I then finished up the pattern with fine sandpaper and red enamelled it.

(3) Bogie Frame Casting.—This was made almost entirely from five pieces of ⅛-in. fretwood, as shown. These were sprigged and glued together. To complete the circular boss (A), two small pieces (B) were cut out from a small piece of wood with a penknife, and glued in, as shown. This pattern was then finished up with sandpaper and black enamelled.

These examples will be sufficient to show the method. This method is very useful to those with a limited supply of tools, as the only ones needed are a fretsaw and some sandpaper.

In these very small patterns no allowance is necessary for contraction on cooling, and sufficient draw is obtained by slightly tapering the pattern by rubbing with sandpaper. I may say in conclusion that I do not cast myself, but that I always take my patterns to the nearest foundry.

How It Is Done.

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

Turning and Cutting the Teeth in a Shaper Quadrant.

By Alfred Parr.

THIS article deals only with such operations to the quadrant as can conveniently be accomplished in an ordinary lathe, and it will therefore be assumed that the flat surfaces have been tooled previously by planing, shaping, or milling them; also that the tool box has been machined and left a tight fit between the walls of A_1 and B_1 on the quadrant (Fig. 3).

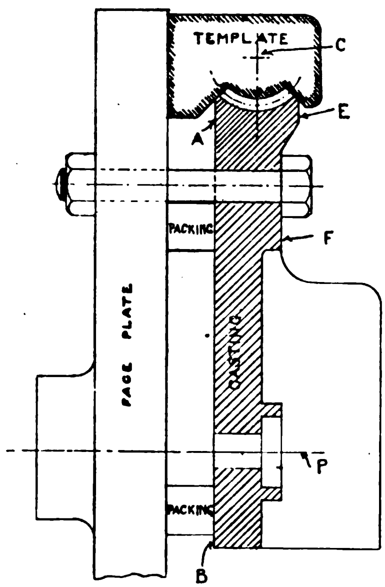


Fig. 1.

A tight fit is here suggested, because until all the scale has been removed and the work reduced to its proper dimensions, no attempt at a final fitting should be made, it being frequently found that castings "yield," *i.e.*, change their shape after the various tooling operations are completed.

Commence, by placing the face A B of the quadrant on a true plane, then by the aid of a scribing block, mark out the lines for centre C, and faces E and F. Now, it will be observed that the quadrant is already provided with a radial slot cored in the casting, and a point P must be found which will form a centre for this.

From the centre P, using the slot as a radius, arcs can be struck, which serve at once to show any irregularity in the coring of the slot.

Then from the same centre, the true position of the top of the quadrant can be struck out, this will indicate exactly how much metal is to be removed then, finally a circle should be described and dotted around the point P, which will, when bored, be the pivot hole upon which the quadrant will centre.

The quadrant is now ready for fixing, and to simplify the turning a pair of parallel strips should be secured to the lathe faceplate; the strips being so placed as to be clear when the hole through P is bored, also when the quadrant is turned on its outer diameter, and bevels, as shown in Fig. 1. After securing and properly setting the work, a balance weight must be attached to the faceplate immediately opposite the quadrant, then with the gearing out and the belt removed, the plate should be rotated by hand, and the weight carefully adjusted until there is a perfect balance, and the plate will stop anywhere in a revolution.

The precise form of the portion to be turned should be scribed out on a thin strip of steel, and from this a gauge formed by filing away the metal beneath the lines. The exact distance from the centre line C to the face of the plate should be measured, and accurately marked on the gauge, the edge of which, after it is carefully finished to the line, can be then laid hard against the plate frequently during the process of turning, until there is perfect coincidence between the two.

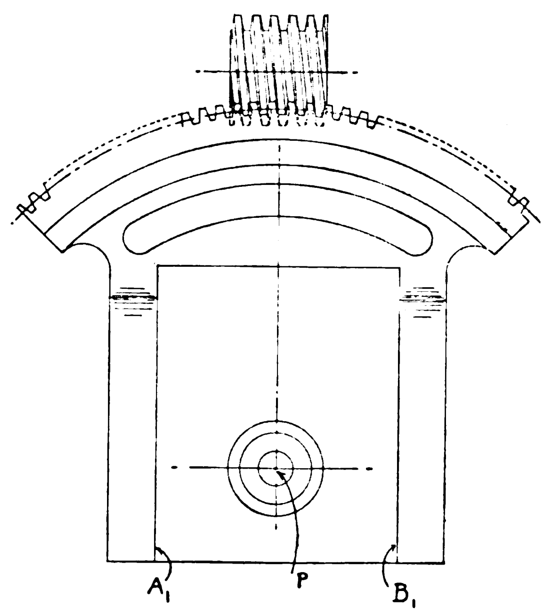


Fig. 3.

It may be here remarked that all work of a similar character can be tooled while it is attached to the faceplate with much better results than could be obtained by supporting the work on a mandrel between the centres of the lathe, deeper cuts can be taken, and altogether the job is much firmer, and attended with less vibration.

It is, however, equally important to note that in all such work the weight of the overhanging plate with all that it carries, is detrimental especially to the conical bearing supporting the fast headstock spindle at the front end.

Now, to keep the spindle cones in proper contact the pivot holes may be drilled and roughly bored out, so as to admit a small shaft or loose fitting mandrel. This mandrel although not in direct contact with the work, can be adjusted between the centres so that there will be a uniform thrust given to the spindle of the lathe, and thereby support the overhanging weight as far as possible.

When practicable, the best thing to do is to use a tool bar, instead of troubling to forge special tools. A stout bar, made with a square slot near one end, and having a set screw as shown in Fig. 4, can be conveniently made without forging, from a piece of square steel, mild steel will do very well, then a few short tools can be used, preferably those from a small lathe.

If, however, these are not to hand, a similar set to those shown in Fig. 5 will be found useful, for the purpose. The tools need not be more than 7-16ths in. square, and can easily be drawn down and forged to the various forms required. A =roughing out tool; B, C, D and E=right and left hand crank and knife tools respectively. F is a spring or radius tool used for finishing the concave surface of the quadrant.

The tools A, B, C, are intended to rough out the radius and bevelled edges of the work, and may be followed by a pair of bent tools similar to G, H. (Fig. 6.)

Before the work is reduced to its proper dimensions, the tools may with advantage be reground and dressed on an oil stone, as it is important in this case that the final tooling operations should be smooth, clean, and decisive, because there can be no hand scraping resorted to on account of its shape. After

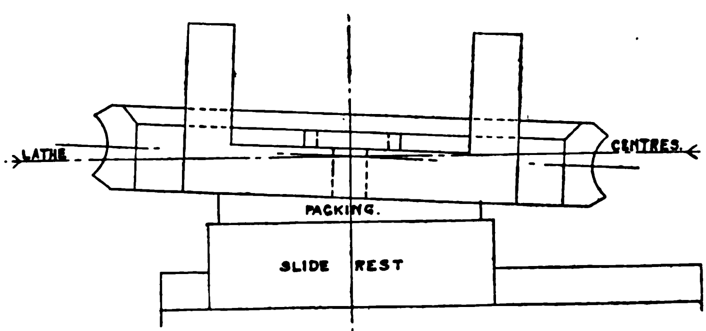


Fig. 2.

this is satisfactorily done, the casting is ready for polishing, but, before the lathe is rotated at a high speed, the belt should be removed and the balance weight carefully readjusted.

A piece of hard wood, can be cut out similar in form to the gauge, and a slot cut horizontally at the back just to fit on the tool bar.

It is an awkward job to polish such work as the quadrant, and unless the emery cloth can be wrapped and nailed fast to the wooden block it will be a troublesome task. Emery cloth should be torn in strips, the full length of the sheet, so that it may be properly secured. There is another important thing in the use of emery cloth, by having it in long strips it may be used more easily, and with economy. The cloth should be twice the width required for any given work, and then doubled (lengthwise), by so doing the cloth will take a bite

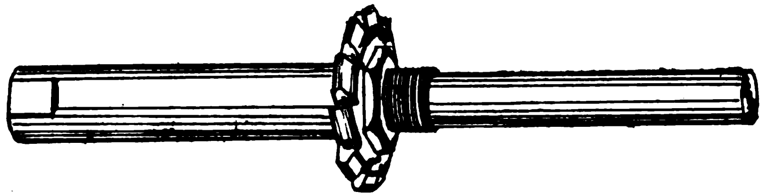


Fig. 7.

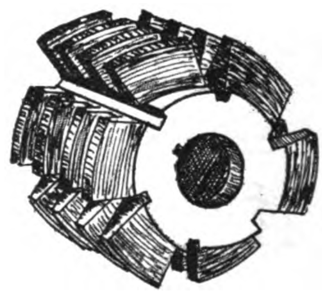


Fig. 8.

on the polishing stick as well as on the work. The above precaution should always be taken in polishing work in the lathe, whether a stick is used or not, as it acts as a check when the cloth is about to seize, and, therefore, to a great extent prevents slipping, and possibly accidents to the hands or fingers of the operator.

Before the quadrant is finally bored, a sharp pointed vee tool should be fixed in the tool bar, and a fine line cut, just to pass through the centre C, and another line made on the bevelled edge indicating exactly the depth to which the teeth are to be cut.

The pivot hole can now be finally tooled and reamed. By thus boring the hole last there will be perfect truth when the work is mounted on an axle, and the teeth cut. A further advantage will be found when the pivot is fitted in its place, the bearing although very shallow, will be quite straight since there has been no bulging by inserting a mandrel.

A special rest will have to be made, or suitable taper packing strip, which will support the quadrant whilst the teeth are cut with a gear cutter, carried on a mandrel (Fig. 7), the mandrel being supported between the centres of the lathe and driven in the ordinary way. The proper angle to which the top rest must be made is decided by the size and pitch of worm it is intended shall be used finally to gear with the quadrant. The arrangement is shown in Fig. 2. It will be understood that the milling cutter is only used to make a number of suitable incisions at fairly uniform intervals on the rim of the work, whilst the quadrant is lying on the inclined rest.

To do this a suitable change wheel can be attached to the quadrant, and the whole made to move one tooth at a time. This is affected by having a

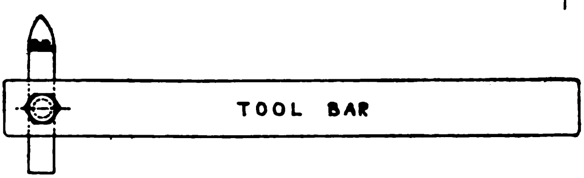


FIG. 4.

vertical stud screwed into the rest, and controlled by a stout nut and washer at the top.

When the quadrant is first placed on the rest the centre line C is just on the centre of the lathe and exactly opposite the centre of the milling cutter. That is to say, a point on the line C coincides exactly with a line passing through the centre of the milling cutter spindle (Fig. 7). This obviously gives a precise amount of metal to be cut above and below the fine line C. A piece of flat iron is then bent at right angles so as to form a foot and is secured by a small bolt to the transverse slide, and at the opposite end a hole is drilled and squared to admit a stud, on the outer side a coil spring is passed on to the stud, and then a knob is screwed on to keep the spring in place. The extreme end of the projecting stud just fits a space between two teeth of the change wheel.

When the vertical stud has its nut released, out, and the work and slanting rest removed from its fixing on the lathe.

The flat-topped rest is now put in its place again, and the quadrant again mounted on a vertical stud and packed (if need be) to the height of the centre line. A "Hobbing Cutter" (Fig. 8), that is, a steel worm with a series of grooves made in it and properly hardened and tempered, is secured to the cutter mandrel, and the lathe started.

The quadrant is only partially gripped on its axis, and therefore, when the teeth of the cutter and those of the work are brought directly in contact, the quadrant rotates and the teeth are cut and finished to their proper form during such rotation.

Finally, care must be given especially as the work nears completion, and the lathe stopped, before the root of the worm collides with the delicate tops of the newly formed teeth. It may be mentioned that a thin steel plate made to the same diameter as the quadrant could be cut out, and the pitch indicated by fine divisional lines extending to its extreme edge, the plate being secured to the quadrant instead of the change wheel—in this case an index finger would take the place of the spring and tooth arrangement.

(*To be continued.*)

ORIGIN OF THE STEAM WHISTLE.—It may not be generally known, says the *Railway News*, that the steam whistle originated through an accident on the Leicester and Swannington line. In May, 1833, the driver of a train observed a horse and covered cart approaching a level crossing, and although he blew his horn, the man in charge of the cart paid no attention. The horse passed over the rails, but the engine caught the corner of the cart,

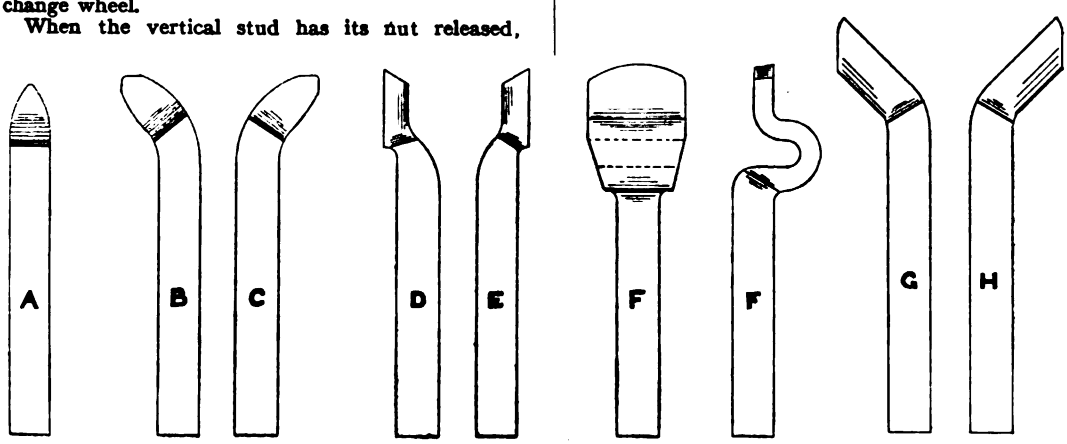


FIG. 5. FIG. 6.

and the knob pulled hard, the spring is compressed, and the wheel can be moved forward one tooth, then, by letting go the knob, the wheel, is guided into its proper position by the fitting tooth formed at the end of the spring stud. The work being again gripped fast to the rest, another incision is made by moving the transverse slide towards the revolving cutter.

In this way the whole of the teeth are roughed

which, with its contents, was completely smashed up. The manager of the line reported the circumstance to Mr. George Stephenson, and suggested that a whistle which steam could blow should be fitted on the engine. Stephenson ordered one to be provided, and a steam trumpet was accordingly constructed by a musical instrument maker in Leicester, and tried at West Bridge Station in the presence of the board of directors.

Exhibition and Practical Trial of Model Flying Machines.

(*Continued from page* 415.)

THE model Fig. 7 is by Mr. Joseph Deixler, and was entered for the practical tests, but did not make an appearance. It has driving screw propellers at front and back, but no lifting screw, elevation being produced by the action of small planes fitted at the front and back of the main plane. Power is supplied to the propellers by the twisted indiarubber strips shown in lower frame, through belts and pulleys.

Fig. 8 is a model by Mr. W. Cochrane, and one of several exhibited by him. It is constructed of corrugated aluminium. There is a two-blade propeller at the rear similar to that at the forward end. They are driven by twisted strips of indiarubber which lie inside along the axis of the body. A pair of small fins are fitted at front and rear for the purpose of giving direction up or down. The adjustment is made by bending them according to the amount found necessary by trial. The indiarubber strips are twisted before starting by rotating the propellers with the hand; the machine is then held in the air and released. Weight of machine complete, 4¼ lbs.; sustaining surface, 9 sq. ft. Mr. Cochrane states that this machine has flown 120 ft. in 6 seconds. At the practical tests, however, it only flew a few feet, falling to the ground almost as soon as released in the air. A similar machine was also tried having a pair of actual seagull's wings fitted to a mechanism which would give them a flapping movement, the driving power being indiarubber strips; at the rear a bird pattern tail was placed for steering purposes. This machine failed to fly; the wings gave one or two beats, and it described a short curve to earth within a few feet of the point of starting.

Major R. F. Moore's flapping machine model is shown in Fig. 9. It is driven by a clockwork motor placed at the top of the framework. The wings all rise and fall together, being raised against the tension of the helical springs which pull them down with a rapid movement at each stroke. Each wing turns upon a bar fixed upon the framework. It was entered for the practical tests, but did not put in an appearance. The flight is expected to be both upward and forward.

The machine shown in Fig. 10 is designed by Mr. H. Burge Webb. Its framework is of split bamboo and planes of silk. Length over all, about 5 ft.; width, 4 ft. 6 ins.; height, 2 ft. 6 ins.; total weight, 1¾ lbs. approximately, of which about 19 ozs. is taken up by the propeller and driving apparatus. Power is supplied by indiarubber strips twisted by a small ratchet-controlled handle at the rear end. These strips can be seen inside the tubular structure which forms the axis of the machine. The pointed planes to right and left of the top plane are adjustable; a steering plane is placed in front just above the propeller, and an adjustable tail at the rear of the machine, which may be placed at various angles of inclination to direct the elevation of flight. This machine appeared at the practical tests, and Mr. Burge Webb states that it had not been tried previously. The propeller was held by a release pin after being wound up, this pin being pulled away by means of a cord as the machine was started. This arrangement did not act well at first, and disturbed the direction and balance of the machine, which, however, rose from the ground at the second trial, turned to one side, and circled towards the spectators, where it was captured to prevent damage. A third attempt was made, this time from a platform about 5 ft. in height, but the machine did not obtain sufficient speed for a prolonged flight, and merely soared to earth, breaking the propeller. According to Mr. Burge Webb, he continued his trials later in the day. The machine repeatedly raised itself from the ground, but did not fly to any considerable distance, owing to want of balance.

The third prize of £25 was awarded to the model shown in Fig. 11, exhibited by Mr. W. F. Howard. At the practical tests this and a sister machine

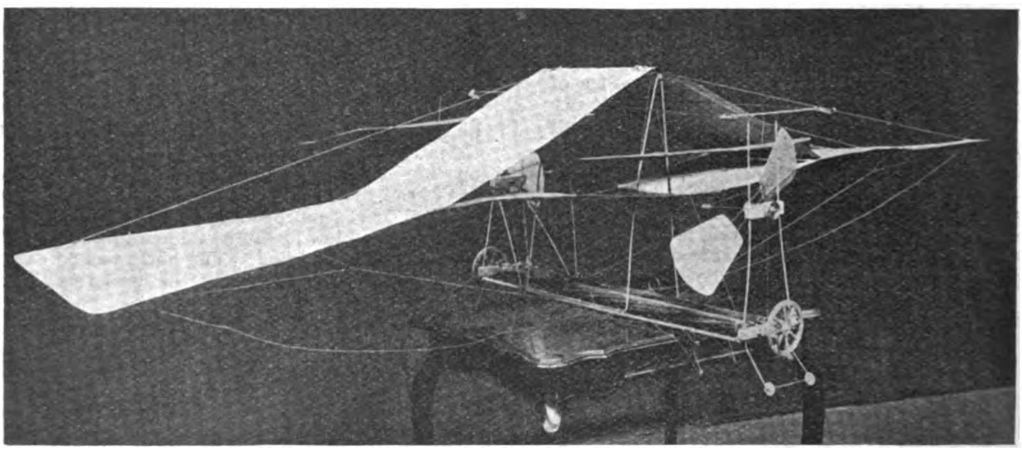


FIG. 7.—MR. JOSEPH DEIXLER'S AEROPLANE.

by the same maker made a number of very successful flights both in the hall and in the open air. These models are of very simple construction, the plane being made of tracing paper stretched upon a wood frame. Propulsion is by means of a comparatively small screw driven at high speed by a clockwork motor, which is attached to the forward vertical strut; the blades of the screw are of wood. The machine did not raise itself from the ground, but was held by the starter above his head, and launched with the plane in a horizontal position. This machine flew a distance of about 80 ft. in the hall, and during the afternoon trials in the open air flew 108 ft. 6 ins. It was obstructed by the spectators, who had gathered across the course, so that a better performance would have possibly been obtained if the way had been quite clear. This was, however, the record flight of the day, beating Mr. Roe's machine, Fig. 1, as regards distance. Length of flight was not the only point considered by the judges, and Mr. Howard was awarded the third prize; the premier honours, therefore, rested with Mr. Roe. The first prize of £150 was withheld, no machine being of sufficient merit.

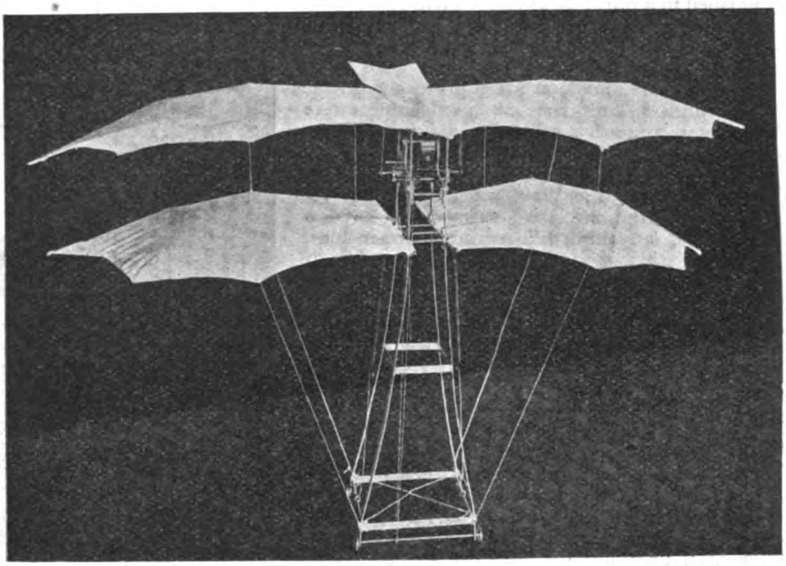


FIG. 9.—MR. R. F. MOORE'S AEROPLANE.

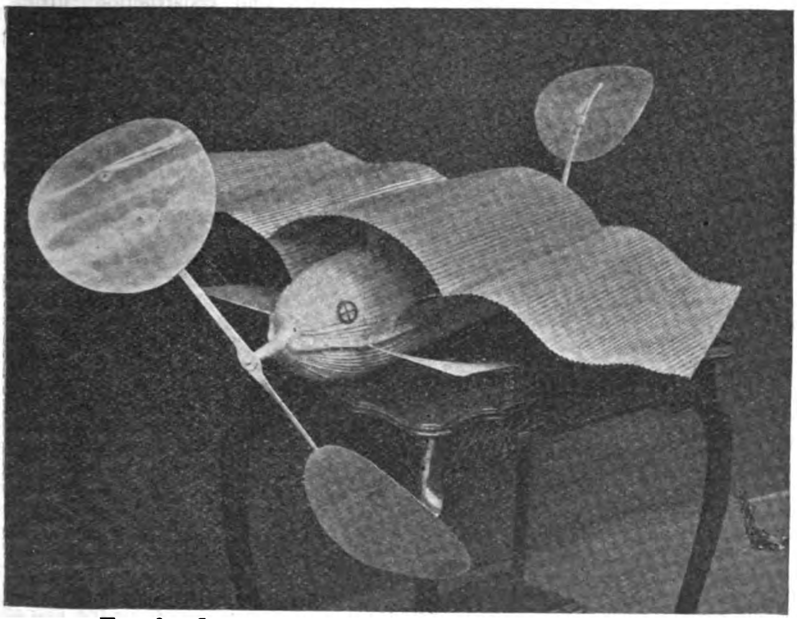


FIG. 8.—COCHRANE CORRUGATED ALUMINIUM AEROPLANE.

This exhibition and officially conducted trial may be regarded as very successful, taking all the circumstances into consideration. The fact that they were held by an important institution, the Aero Club of the United Kingdom, and judged by such scientific men as Professors Huntingdon and Waynforth, of King's College, London, shows that the problem of aerial navigation is being seriously considered. The fact that so many machines were produced shows that some progress, however modest, is being made towards a practical solution. From the model engineer's point of view it was remarkable that so many competitors made use of the india-rubber strips twisted up for motive power. Another feature was the marked success of screw propellers working in air. That upon the model Fig. 11 was a tiny thing compared to the size of the aeroplane, yet it worked very well indeed, and Mr. Howard, who followed his model in its flight, required to run fast to keep up with it. He used a length of ribbon attached to his wrist and to the rear strut of the machine, and ran behind during the flight, allowing the ribbon to hang slack. By this means he could check the machine at any moment, and catch it before it fell to the ground, thus guarding against damage. Only one machine of the flapping wing type was in evidence, and that absolutely failed to fly.

Very probably many of the machines had been finished in a hurry so as to get them to the exhibition in time, and had not been tried. It is therefore not fair to judge them by their performances at the tests. Rumours were that several made unofficial attempts early in the day, and finding that their machines were not yet properly adjusted, abandoned the idea of competing. It appeared to the writer that the screw propellers generally were too small. Mr. Burge Webb's machine, Fig. 10, was the only one that seemed to have a screw of anything like suitable dimensions. Though this model was not successful, it really did fly, instead of merely gliding, and raised itself from the ground, whereas the successful machines of Messrs. Roe and Howard were launched at a height, and though skimming along very well, must be regarded as gliders, and not flyers, judged upon their respective performances.

That most important point, the preservation of equilibrium, had not been completely solved, and the want of this caused several machines to fail. Even Mr. Howard's model on one occasion, when flying unattached, lost its balance and suddenly dived to the ground, breaking the forward strut. Other machines seemed to have insufficient driving power, and some quickly reached the ground and were driven along the floor in various directions, their propellers rotating in air.

When regarding the results of these trials, however, it should be noted that they are far behind those achieved by Mr. Lawrence Hargrave, of

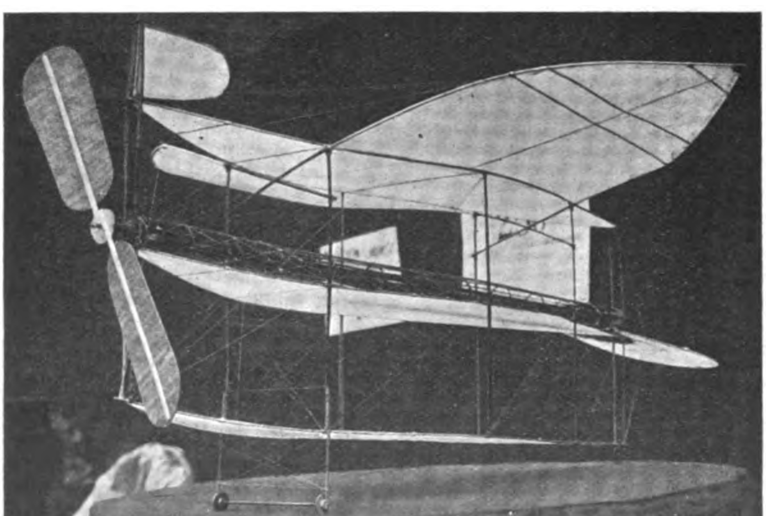


FIG. 10.—MR. H. BURGE WEBB'S AEROPLANE.

Sydney, New South Wales, in regard to length of flight. Some of the models made years ago by this gentleman of flapping wing and screw propelled types flew distances of 368 ft. and 512 ft., and at an approximate speed of 10 miles per hour (see "Flying Machines, Past, Present and Future," Percival Marshall & Co.). One competitor used rockets fixed to the rear part of the framework of his model as the propelling power. Besides having to fly a

FIG. 11.—MR. W. F. HOWARD'S MODEL AEROPLANE.

minimum distance of 50 ft., the models were required to weigh not less than 2 lbs. or over 50 lbs. The speed, steering, design and construction, lifting effect, stability, method of starting, and practicability were also taken into account in judging the models. The other judges were Colonel Capper, Chief of the Military Balloon Section at Aldershot, Mr. Patrick Alexander, and Mr. Roger Wallace, chairman of the Aero Club.

Mr. Roe gave a good example to makers of flying models. His machines were all provided with a flexible cane underframe, so that they received no damage when falling to the ground, the impact being taken by this special frame arrangement. Without a provision of this kind models seem liable to be damaged when falling at the termination of a flight. The spectators thoroughly enjoyed themselves, and made merry at the expense of the unfortunate machines and their operators; the latter, however, seemed to take the jokes in good part, and may console themselves by the knowledge that success is gained through failure. It is still an open question whether vibrating wings or rotating screws give the better effect; there is room for experiment with either.

Chats on Model Locomotives.

By Henry Greenly.

(*Continued from page* 423.)

IN fulfilment of my promise, the following notes and drawings deal more particularly with the question of valve gearing for a smaller model of the 4—6—0 type Caledonian express engine than that which formed the subject of last week s article.

It needs no effort to understand that the various designs for link motion submitted in connection with the modelling of the chosen prototype to a scale of ¾ in. to the foot are quite out of the question in the case of a 2-in. gauge model. With crank webs ⅛ in. thick and cylinders ⅞ in. apart, the total width of the sheaves could only be 3-32nds in. Not reckoning the necessary clearances, the flanges to the sheaves, which would be required to prevent the straps coming off and fouling one another, would reduce the wearing surfaces to almost nothing. In addition to the small wearing surfaces possible in such an arrangement, the mechanism would resemble watchmaker's work rather than an example of ordinary model locomotive work, and would be beyond the skill of the average amateur model-maker.

By the use of the gear I am about to describe, such close work will not be necessary, and at the same time the model may be provided with the feature many locomotive enthusiasts deem so advantageous—viz., "reversing from cab." Although the latter embellishment does not mean much to me personally—I would just as soon have slip eccentrics, simplicity and efficiency incarnate—I am forced to admit that the adoption of some device which enables the owner of the model to reverse the motion from the cab is a step further towards more perfect realism in the model. Added to this, it gives him something more to do in driving his model.

In a small engine, however, to obtain the greatest measure of success the valve gear should not be in any way complicated. The gear shown in the sketches herewith is one of the results of attention I have given to the problem. In many of its attributes it is like Joy's valve gear, but the curved slides, the making of which has troubled so many model-makers in the past, have been "modellyfied" out of recognition, and the correcting motion is Heywood's, as used on the Duke of Westminster's light engines.

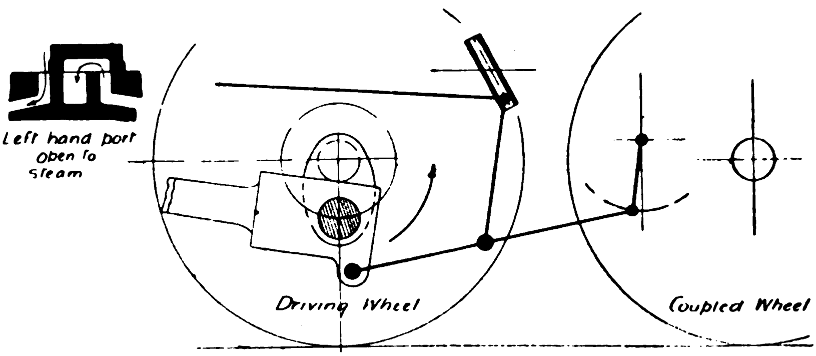


FIG. 4.—Left-hand Port open; Big End on the Bottom Centre.

It was these engines which gave me the suggestion, and I have pleasure in passing it on and showing how the arrangement of correcting motion may be adapted to a model 4—6—0 type engine of the Caledonian pattern. The very easy method of making the slides shown in the drawings herewith was really intended for use in connection with a modification of Joy's valve gear which I have recently worked out and recommended to one of our leading model manufacturers. This gear I will submit to my readers in a future article—possibly the next one—as there is no reason why it should not be employed in the type of locomotive we are now considering.

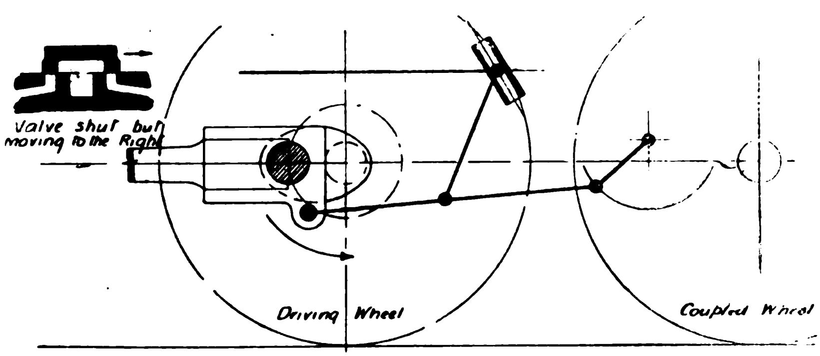


FIG. 3.—Diagram showing Action of Proposed Model Valve Motion, with the Slide in Forward Gear.

(*A*) *Big end on the front dead centre; die block in centre of slide, valve commencing to open left-hand port.*

My idea in not proposing it at the outset is this;—In any 2-in. gauge model with inside cylinder there is none too much room for the mechanism, even when only one slide bar is used for each cylinder, let alone four, as would be correct practice in a model Caledonian engine. Having a comparatively large amount of space—space which can serve no better purpose*

* It may be hinted that the firebox could with advantage be extended forward. Experience shows, however, that you can have the firebox of a small water-tube boiler too big.

than to contain the valve motion—I suggest the arrangement shown on the full-page drawing opposite. The proposed gear should therefore prove acceptable to those readers who eschew fine work and whose "fingers are all thumbs," for, whatever may be said against it, the placing of the gear in this position certainly does distribute the mechanism over a larger space.

As I have already said, to obtain the maximum degree of success on a small working locomotive the

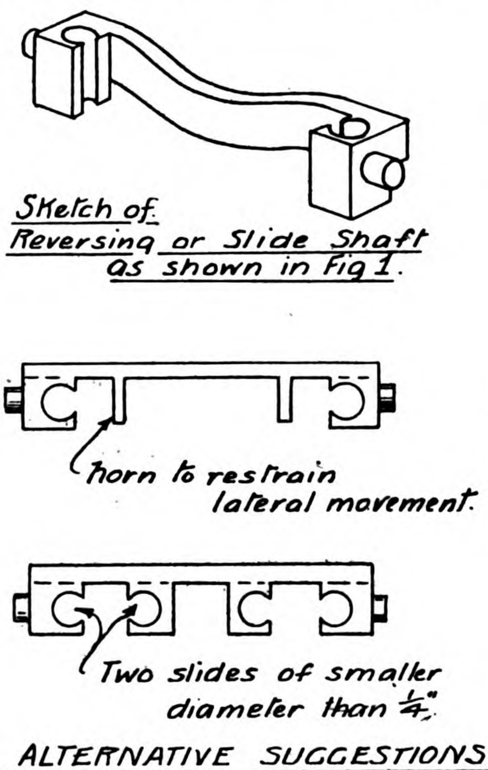


Fig. 2.—The Reversing or Slide Shaft and Alternative Arrangements.

(Not to scale.)

valve gear should not be too complicated. Other desirable features are that the number of joints should be reduced to the minimum and the rapid wear and tear of the parts of the gear prevented by the provision of large rubbing surfaces and case-hardened pin joints.

The gear shown in the drawings can be made to fulfil most all of these conditions. Nothing could be simpler to make. The eccentrics go at one sweep, the gear being actuated from a pin joint on the big end of the connecting-rod.

The curved links and the lifting links of Stephenson's motion and the curved slides and anchor links of Joy's radial valve gear are eliminated.

A full set of Stephenson's motion, as arranged, say, for the Dunalastair III model, which, by the way, has no rocking shaft such as would be required for an engine with valves on the top of the cylinders, without the pins numbers nineteen parts, as shown below :—

Eccentric sheaves	4
Straps and rods	4
Curved links	2
Lifting links	4
Die blocks	2
Intermediate valve spindles	2
Weigh shaft, with three arms	1
Total parts	19

Joy's valve gear, adapted for a 7-16ths-in. scale model, would require—

Anchor link bracket or shaft	1
Anchor links	2
Correcting links (duplicate)	4
Vibrating links (duplicate)	4
Radius rods	2
Curved slide (four faces) and weigh shaft with one arm	1
Die blocks	4
Total parts	18

The proposed motion requires—

Correcting link bracket or shaft ..	1
Correcting links (duplicate)	4
Connecting links	2
Vibrating links (duplicate)	4
Radius rods	2
Die blocks	2
Slide consisting of two holes and one arm	1
Total parts	16

Of course, some one may say the die blocks may be omitted from the Stephenson's link motion and also from the Joy's valve gear. This would show a saving in parts, but pins running the curved slides without die blocks cannot be expected to last very long in good condition. The wear and tear would be excessive and the hauling power of the engine soon fall off, as would become evident by the speed and the beat when the engine was loaded up.

In Joy's gear—if the gear is modelled correctly—the slides will have to be machined by using fly-cutters, or by turning the slides separately in the lathe and then attaching them to the weigh shaft. The proposed gear does away with this. The position of the slides renders the curvature practically unnecessary, and all that is required is to drill two holes ¼ in. in diameter parallel with each other and exactly through the horizontal axis of the weigh shaft.

The dies are produced by simple turning, that is, where a piece of rod is not obtained the right size to fit the hole.

For a particular job, the slides can be duplicated and two dies per cylinder employed, as indicated in the sketch (Fig. 2) herewith, or a horn can be cast on the shaft to restrain any lateral play in the motion.

No fine work is required, as in the case of the vibrating and correcting links of Joy's valve gear. All the link gear may be made out of stuff of ample dimensions. Bright rods may be used, and the only care that need be exercised will be

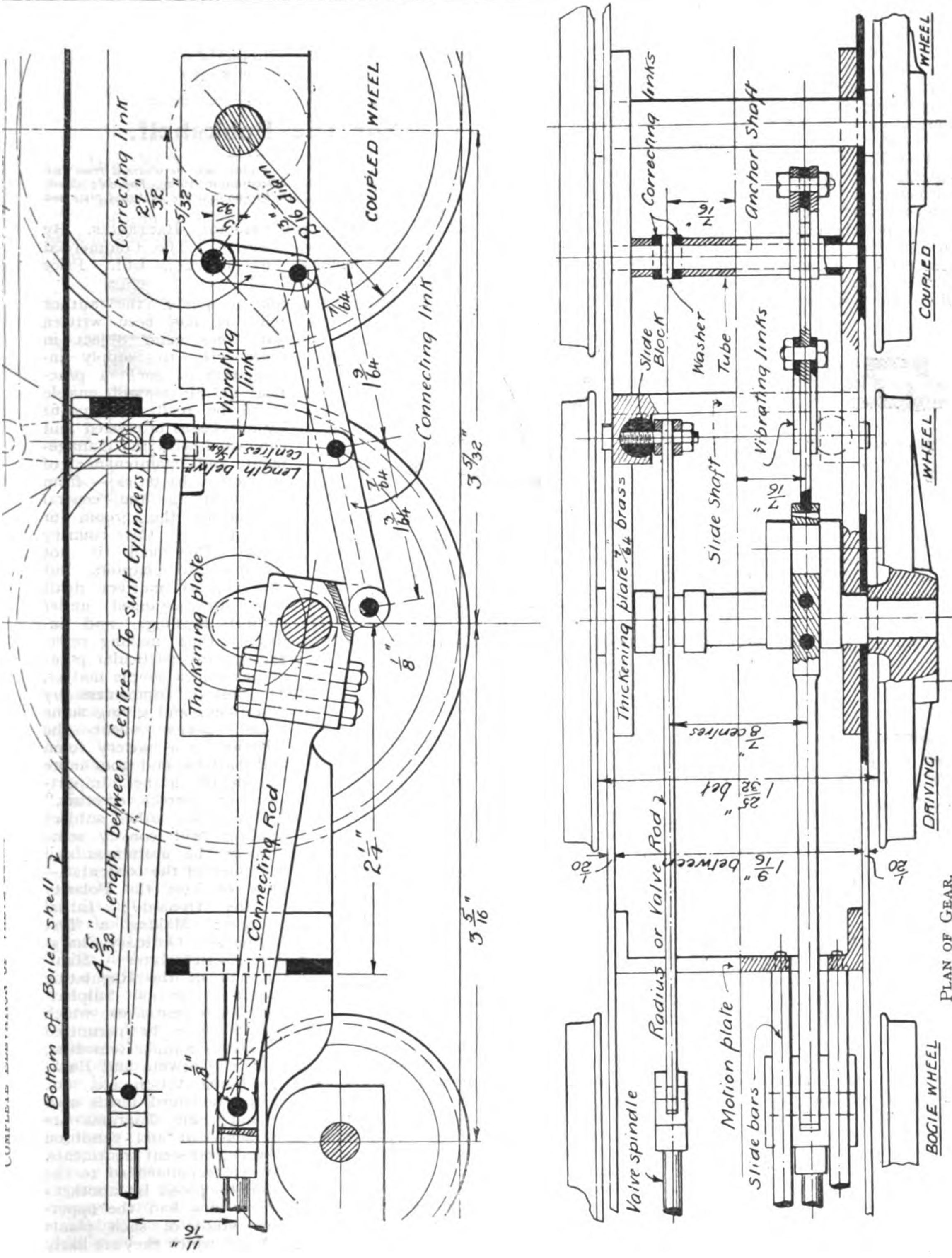


Fig. 1.—Proposed Valve Motion with Heywood's Correcting Motion, adapted for use in Model Six-coupled Bogie Express Engines. *Scale: Full size for $\frac{1}{16}$ in. scale model.*

to accurately mark out the lengths and centres and to correctly drill the holes for the pins.

The builder should also be particular in marking out, drilling, and erecting the main frames, so that the axle-boxes, and bearings hole for the weigh shaft and fulcrum, or anchor shaft for the connecting link, are square with the frames and the relative positions of crank axle, weigh shaft, and anchor shaft conform to the dimensions set out in the drawings. Otherwise, the necessary correction will not be obtained. In case of any inaccuracy in erecting, adjustments may be made by bowing the connecting link either up or down so that when the connecting-rod is on either dead centre the top pin joint of the vibrating link (the centre of the die block) comes exactly in the centre of the slides, as shown in diagram Figs. 3 and 5.

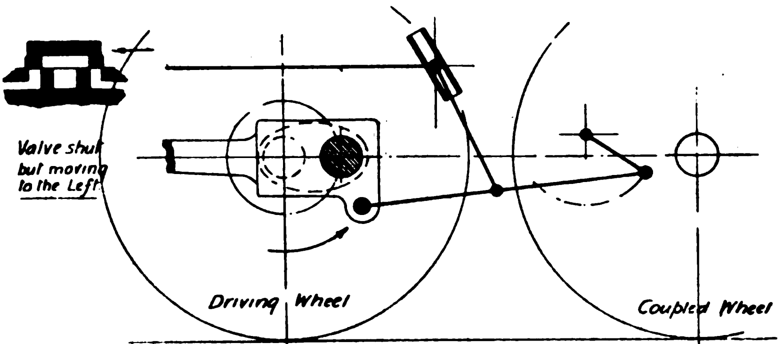


FIG. 5.—BIG END ON THE BACK DEAD CENTRE; VALVE COMMENCING TO OPEN RIGHT-HAND PORT.

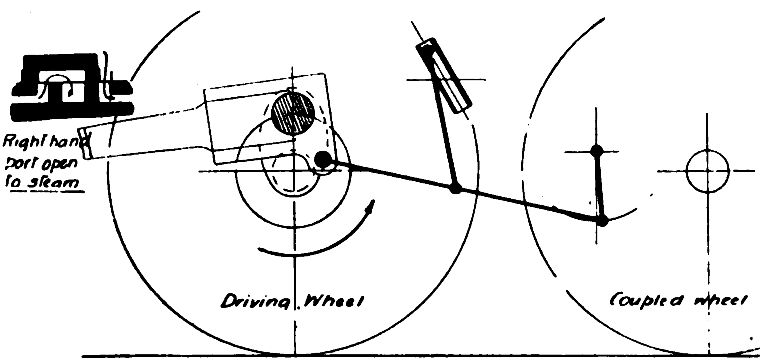


FIG. 6.—BIG END ON TOP CENTRE; RIGHT-HAND PORT FULLY OPEN TO STEAM.

There may be some readers who are not conversant with the design of radial valve gears who would like some explanation of the use of the correcting link. What does it correct? Speaking generally, correcting links are used to render nugatory the effects of angularity in the more important links or rods of the gear. They equalise the steam port openings on both sides of the piston. While explaining the action of the correcting motion I shall, however, challenge the necessity of providing a corrected motion at all—that is, in a small scale engine the valves of which have no lap and lead. This exception from the general principles laid down makes it possible to simplify Joy's gear to a considerable extent.

(*To be continued.*)

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 TREATMENT OF STORAGE BATTERIES. By W. R. Vicarey. London: The Commercial Electro-chemical Analysis Co., Ltd. Price 2s. 6d.; postage 1½d.

This little handbook or guide, the author tells us, has been written with one main object in view, viz., to supply information of such a practical nature as will enable it to be read with profit by all classes interested and connected with the management and maintenance of secondary batteries — from the man in the central station to the groom or gardener of the country house. The book is not divided into chapters, but the various matters dealt with are arranged under subject headings, and indexed, thus making reference to any particular point in question a simple matter. The author commences by describing, and giving some sound advice anent the selection of a battery room and battery, and goes more into details in the "Importance of correct erection." A few of the other subject headings will convey some idea of the usefulness and character of the contents:—How to Test the Polarity of the Dynamo; Initial Charges; Making a Test Discharge; Ordinary Charging; Electrolytes; Manipulation of the Regulating Switch; Gradual Sulphating; Circumstances which should never be permitted to exist; Simple Remedies; Temperature of Electrolyte; Growing and Buckling; Rests of Cells; Local Action, etc., etc. A glossary of some of the technical terms used is given at the end, and some diagrams are included, showing the behaviour and condition of various sets of cells under different treatments. The guide can certainly be recommended to the notice of those who wish to profit by another's experience, and who have not had the opportunity of making a close study of such plants (whether large or small), for which they are likely to be made, to a greater or less extent, responsible.

Planing and Shaping for Amateurs.

By A. W. M.

(*Continued from page* 412.)

III.—Methods of Holding the Work.

THIS branch of the subject is of great importance. A considerable portion of the art of using a planing or shaping machine consists in holding and setting the work to be planed. The table of a planing machine is usually a flat

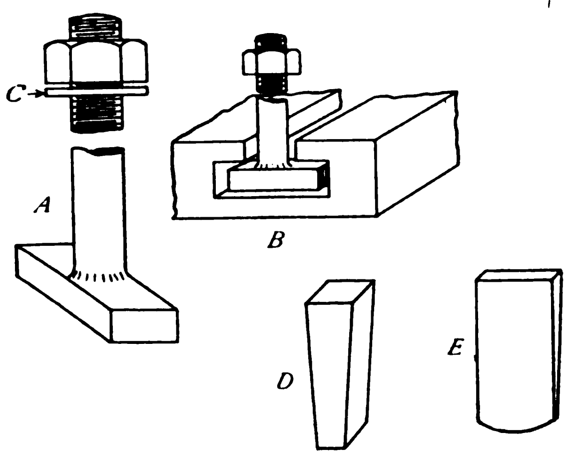


Fig. 22.

surface, provided with a number of rectangular holes, or T slots. A shaping machine is usually provided with one or two tables of a similar kind, but having a side surface, also at a right angle to the top surface. The work must be secured to the table, so that it cannot be moved lengthwise by the pressure of the tool as it cuts forward through the metal, or sideways owing to side pressure exerted by the tool. It is also necessary that the work should be held down securely.

Special patterns of vices are made for holding the work. They are provided with both holes and suitable under surfaces, so that they can be bolted to the work table of the machine. These vices are very useful for small pieces, such as keys, levers, pedestals, bearing brasses, etc. Large castings, such as frames, bedplates, and cylinders, or bars and strips of considerable length require fixing direct to the work table. As the table merely presents a flat surface containing some slots or holes, and the work may be, for example, a complicated casting or a comparatively thin plate or strip, there is considerable scope for ingenuity in devising the method of holding the particular piece so that it will not only be rigid against the thrust of the tool, but will also not tilt or be lifted up by the cutting effort. The novice may well be puzzled to discover how to fix some pieces which have no projecting lugs to which holding-down bolts can be applied. It is here that he will find difficulties, and some knowledge of workshop methods will be very useful to him.

The equipment of a planing or shaping machine should include an assortment of bolts, plates, wedges, and packing pieces to be used expressly for fixing work to the table. Certain jobs may require special plates or wedges, and these after use will add to the variety of the assortment, until a selection may be made to suit almost anything met with in the ordinary course of work. Until such an equipment has been acquired, the machine will be limited to the jobs which can be held in a vice, so that it is advisable to set to work and make some plates and fit them with bolts at an early opportunity. The bolts should be of various lengths, of a size to suit the slots provided in the machine table and screwed for about three quarters of their length, so that there is ample range for the nut to be screwed home according to the height at which the clamping plate happens to come with various jobs. Rectangular heads are advisable, and they should be made to fit easy in the T slots of the table (*see* A and B, Fig. 22). By this means the bolts are prevented from turning when the nuts are screwed up. It is most annoying to use bolts which will turn round in the slots, and very much hinders the quick fixing of work. These tools may be made from ordinary square head black bolts, the heads being filed or machined to fit the slots, and the shanks also turned and re-screwed if they are too large; two flats may, however, be filed next to the head to avoid turning down the shank. Probably it will be necessary to take large size bolts, in order to obtain sufficient metal in the heads to fit the slot; the shanks will therefore be too large, and require reducing in diameter. Hexagon nuts should be used, as they are more convenient than square nuts. Each bolt is to be fitted with a loose washer C, as the nuts will tighten up better than if the washer is omitted.

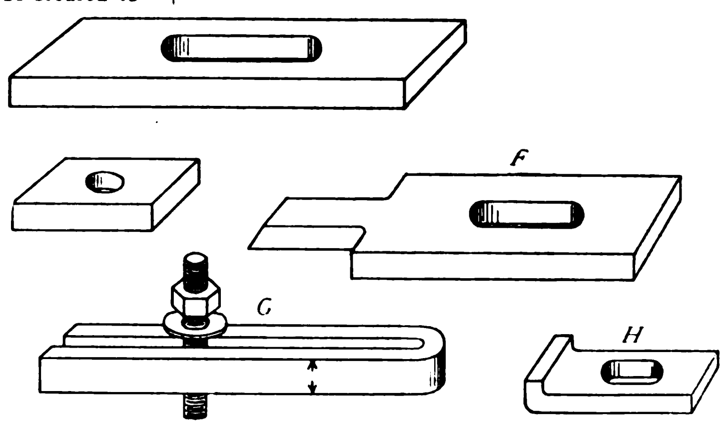


Fig. 23.

An assortment of iron wedges (D and E, Fig. 22) will be useful. Pattern D is to be generally used for preventing work from sliding along the table and is driven tightly into the slots; but will also be useful as a key for tightening up a piece of work at the side. Pattern E is a very thin, flat wedge, and useful for driving underneath the work as a support. Various patterns of clamping plates are shown in Fig. 23; an elongated hole to take the

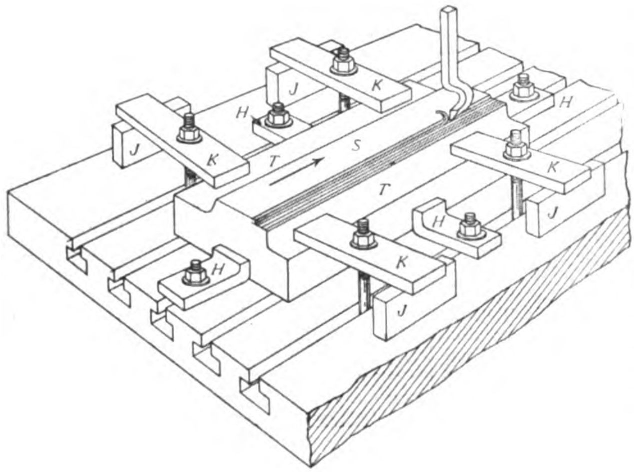


FIG. 24.

bolt should be provided, as it permits the plate to be adjusted into position with facility. The finger plate F is useful to place between lugs or in place where a broad plate would be in the way of the tool. A simple and very useful form of clamp is shown at G: it consists of a piece of bar iron, bent into the shape indicated; it should be comparatively deep in the direction of the arrows so that it is stiff and does not bend under the pressure of the nut. The plate H is a stop: when bolted to the table it takes the thrust of the work, due to the pressure of the tool, and prevents it from moving.

Fig. 24 shows a general method of holding a piece of work on the table. The clamping plates K bear at one end upon the

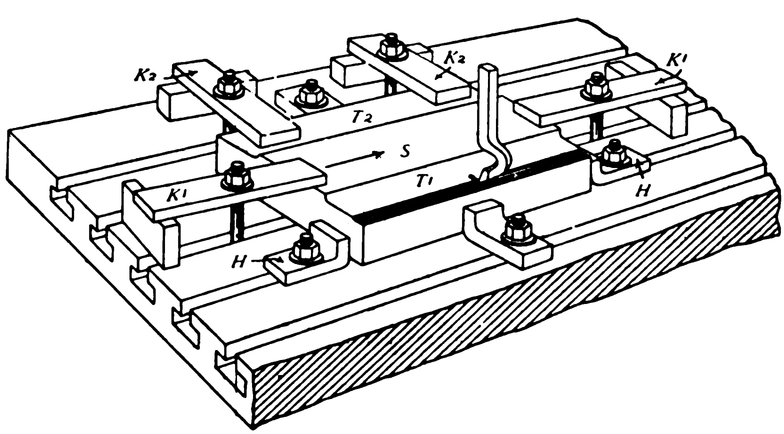


FIG. 26.

work, and at the other upon distance pieces J. When the bolts are tightened up, the pressure is taken by the distance piece and the work the latter is therefore pressed down upon the bed. The stops H placed against the ends and sides prevent any sliding effect between the work and the table. It rests with the judgment of the operator to decide how many plates or stops to use. If the cut taken will be light, the work need not be so powerfully held as if a heavy cut is to be used; but it is well as a rule to fix the work as firmly as possible and rather take too much precaution against movement than not enough.

In Fig. 24 the surface S to be planed only extends across a portion of the casting; the surfaces T, T are to be left rough or planed at a later operation. The clamping plates K can therefore bear upon T, T without interfering with the tool. But if the surface S to be planed extends across the entire width of the piece, the plates K would be in the way of the tool. Fig. 25 shows a method of clamping the casting, so that the top surface is without any obstruction, and may be planed all over with one operation. Wedges D are driven between the stops H and the casting, acting as keys to clamp

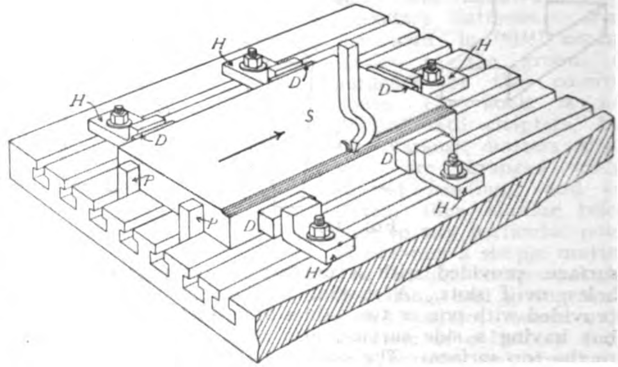


FIG. 25.

it firmly in position. The wedges P, P are driven into the table slots and act as stops; they are shown as an illustration of their use in general. In the particular instance two stops of the pattern H could be very well used instead.

Fig. 26 is the same piece of work shown in Fig. 24, but the surfaces T being planed as referred to previously after the surface S is finished. The clamping plates K1 are shifted to bear upon the casting at places near to the surface T1, but out of the way of the tool. When the near surface T1 is finished, the plates K2 are transferred to bear upon T1, leaving the surface T2 clear to be planed in its turn. The stops H are moved to one side in each instance, so as to be more directly in line with the thrust of the tool.

(To be continued.)

How It Works.

IX.—The Walschaerts Valve-Gear.

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

THE modern locomotive depends very largely for its success upon the valve-gear with which it is fitted. Accuracy in the distribution of steam to the cylinders directly affects, and in large measure, the general efficiency of the engine, and although in a given design all other essential features may be present, it would be useless to look for the best working results from a locomotive unless the mechanism which actuates the slide-valves is not only well designed, but also constructed and maintained with every possible care.

How often it happens that those who have the running of locomotives under their charge offer, as an explanation of an indifferent performance on the part of such and such an engine, the statement that "the valves are wrong," and by that they mean that the fault lies not so much in the valves themselves, but in the mechanism which propels them. You may have the big boiler, large-sized cylinders, and all the other adjuncts to the modern large and high-powered locomotive; but if the slide-valves and valve-gear be out of order, sometimes only slightly, the engine can never give real satisfaction or be a credit to those responsible for its working.

In view of these generally accepted facts, it might appear at first sight that apparatus upon which so much depends ought, first and foremost, to be of the most simple possible character. Anything in the way of complication of details ought to be avoided, the number of parts reduced to a minimum, and the whole easy of repair and renewal. Doubtless this is so, but we must be prepared to advance with the times; different conditions impose different methods, and if we are to have improved results it may sometimes be necessary to sacrifice extreme simplicity in design and accept something rather more complicated, but which is capable of giving more scientifically correct results. In this country there is a great dislike to anything complicated in designing locomotives, and this view is, or rather was until comparatively recently, more emphasised where valve mechanism is concerned than perhaps in connection with any other part of the engine. Times change, however, and now there is to be noted a disposition to resort to other methods, which, although new on our own railways, have been successfully employed elsewhere for a number of years past. Those who follow the subject of locomotive engineering, and especially with a view to watching the efforts which are being made to economise steam consumption, will have noted with satisfaction the increasing use which is being made of the Walschaerts valve-gear by British locomotive superintendents and others responsible for the designing of locomotives in this country. This gear is almost universally employed upon the Continent, and it is growing in favour in the United States also. It is, of course, much more complicated than the "Stephenson" link-motion, but it possesses certain very definite advantages over that and many other gears and, for outside cylinders especially, it is perhaps the very best which can be employed. It is thought by the Editor of this paper that a description of the gear and the manner in which it works must certainly be of value to readers, many of whom have enquired on more than one occasion where they can obtain a concise and clear description of it, and although short explanations with sketches are given in some of the text-books, they do not answer the purpose of general enquirers. Before passing on to a study of the gear itself, it may be of interest to many to know something of its inventor and his career.

M. Egide Walschaerts was a native of Belgium. An exceptionally clever engineer, and generally a shrewd man, he remained, through force of circumstances, a foreman in railway workshops all his life. He was associated with the first railways and locomotives introduced into Belgium, and was connected with them until shortly before his death, which occurred in 1901, at Saint-Gilles, near Brussels, at the age of eighty-one years.

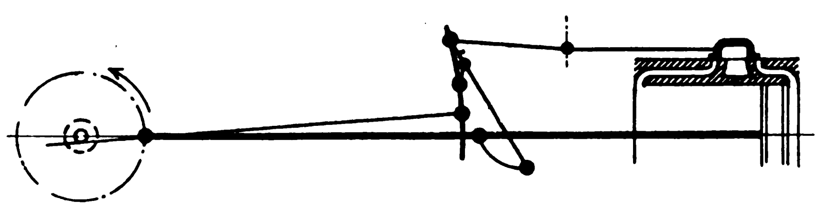


Diagram of Original Walschaerts Valve-gear in 1844.

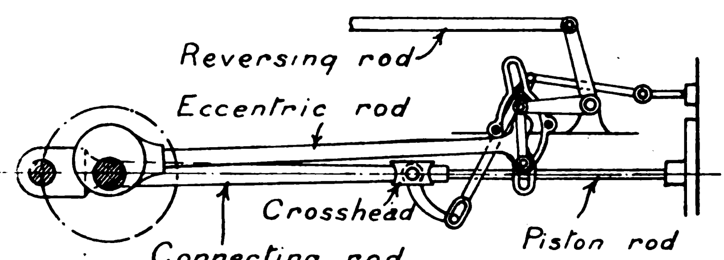


Fig. 1.—Original Walschaerts Valve-gear, 1844.

M. Walschaerts was born at Malines, in 1820, and at twenty-two years of age, viz., in 1842, he entered the shops of the State Railways as a fitter. His adaptability for the work and the skill he displayed secured for him two years later the position of foreman at Brussels-Midi. He now seemed to be on the threshold of a career which before long would establish him in a high position in mechanical engineering circles, and was believed to be well on the road towards becoming locomotive superintendent. Unfortunately, however, he became a victim of the prejudice which still exists against the man from the ranks, and lacked the certificate required in Belgium from those appointed to administrative positions on railways.

Being obliged to stick to his post in the works in order to earn his living, Walschaerts found it impossible to devote himself to those studies which, despite his status of birth, would certainly have equipped him at any rate with the necessary qualifications for the higher positions, and here was partly the reason why he did not rise to the top level in his particular sphere of action. Apart from this, however, he was above all anxious to be regarded as a practical engineer. Reports, investigations, and other clerical work had no attractions for him, and this combination of circumstances was directly responsible for his remaining in the lower grade throughout his long and useful life.

He invented the well-known valve-gear in 1844, but the regulations of the management did not allow the foreman to work a patent for his own profit in Belgium. On Oct. 25th of the same year, however, Walschaerts took out a French patent for the gear to whether the pin is nearer or further from the end of the link, and it is this oscillation which is communicated by an arm of a lever to the pivot of the swing lever worked off the crosshead. The central portion of the link could not therefore be utilised for operating the gear; it required to be enlarged so as to allow for the play of whichever of the pins was not engaged. The inventor's reason for using two separate pins fixed to the crossarm of the **T** end of the eccentric rod instead of a single pin placed centrally with the rod (which could have enabled the gear to be reversed without necessitating the central enlargement of the link) appears to have been that as the eccentric rod is raised or lowered according to the position of the weighshaft, this is equivalent to a small alteration in the angle of advance, and hence for a given length of slide, in order not to increase the effect of obliquity, it was necessary to reduce the amplitude of the arc of rotation of the eccentric rod. Such was the Walschaerts valve-gear as applied to a number of locomotives in 1844, and since that time various

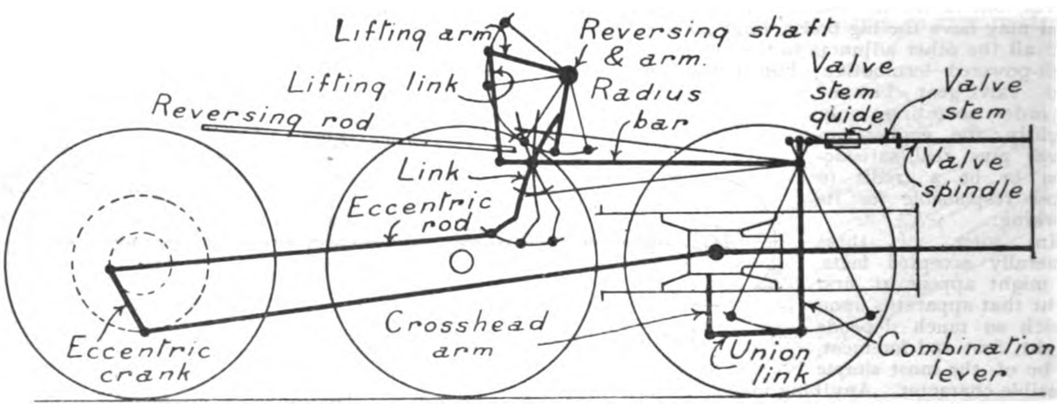


Fig. 2.—Nomenclature of Parts, Walschaerts' Valve-gear, as adopted by American Locomotive Co.

and an immediate result was the adoption of the latter on several of the leading railways in France. The gear was a very different device then to what it is now, as will be gathered from a comparison of the diagrams which accompany the present article, but the main principle was the same, and the later forms are representative of improvements in the design of details rather than in perfecting the method upon which the gear is operated. In the original gear (see Fig. 1) the link was formed of a piece which oscillated on a fixed shaft in respect to which it is symmetrical, but it has an enlargement at the centre so formed that the ends alone could be moved without slack by the block, which consisted substantially of a plain pin which engaged it. The single eccentric rod terminates in a very short **T** head carrying two pins, the arm of the weighshaft acting on the eccentric rod and maintaining its position at any desired height in such a manner that the lower pin is engaged in the corresponding end of the link or the upper pin is engaged with the upper portion of the link which reverses the direction of the running. The angle through which the link oscillates varies according improvements and modifications have been introduced—all tending to increase the working efficiency of the gear and bring about improved steam distribution.

We may now turn our attention to the Walschaerts valve-gear as found to-day. Of course, any example which may be selected to illustrate the apparatus must be accepted as representing its adaptation to the exigencies of the particular requirements of a given case. For the purpose now in view, one example from modern locomotive practice may be considered as good as another as illustrating and describing the gear. Modifications in its exact form and proportional differences which must exist in it as between one class of locomotive and another do not at all affect the principle involved; they only mean that the gear has been adapted in its arrangement and dimensions to fit in with the rest of the design. Every valve gear is subject to modifications in this way, and only among locomotives built from the same drawings and belonging to the same series is it customary to find that the valve-gear and other detailed parts are interchangeable.

The diagram Fig. 2 shows in graphic manner the general scheme of the Walschaerts valve-gear, and if this is studied in conjunction with the other illustrations and the following description of the method of working, a correct idea of the matter will be obtained.

The motion of the valve is derived both from the crosshead and the eccentric crank from the driving axle, the lap and lead being imparted at the extremities of the stroke by the crosshead connection when the eccentric crank is in its middle position. The eccentric crank in this position imparts its fastest movement to the valve to give a very quick opening, and the crosshead in advancing from the dead point effects an approximate uniformity in the combined motion given to the valve just as though it were derived from a single crank or eccentric set with an angle of advance corresponding to the lap and lead. In other words, the valve travel is controlled from two perfectly distinct movements—one taken from the crosshead; and the other from the return crank on the driving wheel crank-pin (for outside cylinders), or from an eccentric on the driving axle for inside cylinders.

These two sources of motion are connected together by a system of levers, so that the movement of the valve is the same as that derived from a stationary link. Reversing is effected by means of a link and sector. The motion derived from the crosshead is designed to place the valve in position for the beginning of each stroke with a constant lead for all lengths of travel. The second movement is transmitted by the return crank (or eccentric, as the case may be) through the arm to the fulcrum of the lever and thence to the valve spindle.

(To be continued.)

Notes on a 1 h.-p. Oil-Driven Electric Light Plant.

By A. O. Griffiths.

A FEW notes on experiences in running an electric light set, consisting of oil engine and belt-driven dynamo, might be of some interest to those who may think of installing this form of current generation. The set referred to consists of a petroleum engine 3½-in. bore, 5¾-in. stroke, driving by a 2½-in. belt an overtype drum dynamo with a capacity of 15 amps. at 50 volts.

The above, both of home manufacture, were to be tried as a mode of lighting a small cycle shop, with grocer's shop adjoining, in the country, where there is no gas, something a little better than oil lamps being desired. The main anxiety, as will readily be understood, was whether it would be perfectly reliable, and some little hitches, and the way they were overcome, is what I think might be of a little interest; the thing was all right in theory, but what about practice? The set has now been running fifteen months, pretty nearly every night. It is one thing to run a set say in one's own workshop, where, if there is a slight hitch, it is nothing to stop for five minutes, set it right, and then be off again. It is a different thing to light a shop in a public street, where every flicker is remarked on, and a total stoppage for even a minute makes one wish one had never been born. But oh! the compensations when one can smile a superior smile on the wretched oil lamps across the street, and survey their cool, clean, brilliant rival in one's own window, feeling as reliant as on the great central station in the city!

The dynamo can be dismissed in few words; it has caused absolutely no stop. The only trouble connected with it was, that the bearing next to pulley used to get terribly hot and required standing over with an oil can in hand for ten minutes together at times; it would drag the voltage down from 50 to 40, or less, if not watched. The belt was crossed, and engine set to run overhand, *i.e.*, the explosion took place on bottom half of revolution. This did little good. An absolute cure was effected by cutting out an oil-well in the body of the bearing, and converting it into ring-oiling, using a thin ring from an old free wheel for ring, and cutting a slot with a hacksaw in the bush, which is of Babbitt metal. Instead of requiring to be dosed every night, once in three weeks is quite often enough to look at it. I should just like to state here that I do not see why a 2½-in. belt should have to be so tight for the power it transmits, for it requires to be kept fairly tight. The average load does not exceed 130 c.-p. or so, say 1 h.-p. The belt travels about 1,900 feet per minute. Pulleys are 18 ins. and 3¾ ins. diameter, centres about 5 ft. apart. By the tables it should easily do three or four times this.

As to the engine. This is the uncertain factor in the reliability of the set. The first trouble to be tackled was, that although everything might work perfectly on commencing the night's run, in a short time the engine would be racing furiously, and the voltage steadily dropping. It was some time before it was discovered that the top of the small reservoir supplying the oil to vaporiser being left open, the vibration of the engine caused some paraffin to spout out of it in fine spray on to the belt; hence the slipping. Once found, soon remedied by fitting a good lid.

Trouble No. 2.—Exhaust valve casting getting a blood-red heat when running at full power, spoiling the valve and asbestos joint and causing the latter to blow out every few nights. This baffled me for two or three weeks. I finally found that in my anxiety to ensure a free exhaust, I set valve to open too early in the stroke. An alteration in the timing effected a perfect cure.

Trouble No. 3: Noise.—When it is mentioned that the room in which the set is situated is only about 10 ft. by 6 ft. or so, and that it is adjoined on two sides by houses, and on another by a road, it will be seen that this is an important point. Even a 1 h.-p. oil engine can make a rare clatter if not looked after. Remedy:—a glance at old Model Engineers soon settled the exhaust noise. A pit, 2 ft. cube, was dug in the floor of room, the exhaust led into one bottom corner, the hole filled with moderate sized stones, and tiles put down again, all crevices being plastered up, except where the exhaust exit pipe leaves, at opposite top corner going to chimney. It is now absolutely silent, and it takes no room, as that part of floor is used just the same as the rest. Of course, all brasses are carefully looked after, and never allowed to slack, also the air inlet is furnished with a good size pipe. Result:—satisfaction to self and neighbours. This point does not affect the reliability, but it is important nevertheless.

Trouble No. 4.—Irregular speed.—By this I do not mean the inherent cyclic variations of the explosive engine; the one in question has two flywheels of 18 ins. diameter, and runs at 380 revolutions per minute. It does not cut out explosions at all, and while an experienced eye might detect the "trade mark" of the oil engine in the lamps, no ordinary spectator would probably see any flicker. The irregularity referred to was very annoying, as at times the speed would vary between half and full for hours together. After careful watching it was found that the cause was invariably an infinitesimal speck of dirt from the oil on the face of the ⅜-in. brass wheel valve which "dripped" the oil into the vaporiser. I suppose that, the valve being so large, the amount of lift from the seat was so small that the slightest suspicion of dirt would cause trouble. The oil had always been poured in reservoir through a petrol strainer, but this was not nearly fine enough; two layers of muslin were tried, with better results, but finally it had to be strained through four, with satisfactory results.

Trouble No. 5.—Blast lamp for heating tube going out. This did not exist for long; it was simply a matter of thoroughly cleaning lamp and nipple. One thing might be mentioned in this connection. At one time, even if the lamp went out, the engine would run on for five minutes or so before slowing to any extent, giving one a chance to discover the fact, and light up, avoiding a stoppage. Later on, a heavy pressure was found necessary to keep the tube hot enough, also if the lamp went out, the engine stopped dead in about twenty seconds. This was cured accidentally by overhauling engine and improving the compression, after which the lamp used *less than half* the oil, and, indeed, was found almost unnecessary.

The above points may seem to some hardly worth while writing about, but the fact is that attention to them made all the difference between the installation being an intolerable nuisance and being a pleasure to run. That is why they are chronicled here.

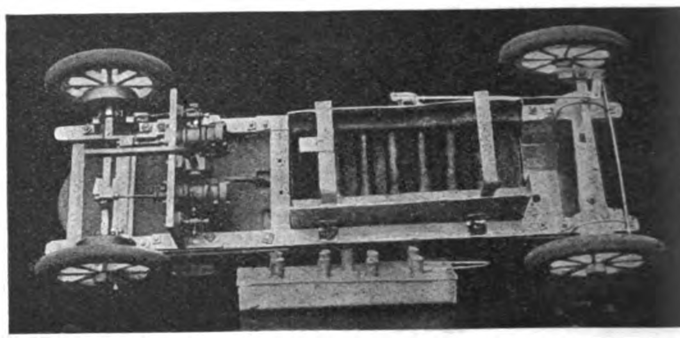
A word about expense of running. A gallon of paraffin, costing 6½d., runs the installation, giving 128 c.-p. for 6 hours. It figures out at a shade over 2d. per unit. Some favour petrol-electric sets, but give me, for stationary work, a substantial oil engine running at a comparatively slow speed. I sum up the respective advantages thus:—Petrol—compactness, direct coupling, instant starting; oil—slower speed of moving parts, greater safety, and, greatest of all, economy. I make it less than half the cost of petrol.

I may add that, a storage battery for 50 volts being far too expensive to think of, a set of plates, cells, and separators was bought of a firm advertising in this journal. These were made up into a 6-volt battery of three positives, and four negatives in each cell, which was charged through a 32 c.-p. lamp continuously while running. From the battery, wires run to three 6-volt 4 c.-p. Osmi lamps in the shop window and over the counter, controlled by one electric bell switch. This is found extremely handy if the "engineer-in-charge" is detained a few minutes from starting the main supply at lighting-up time, or on other occasions when a light is wanted for a short time.

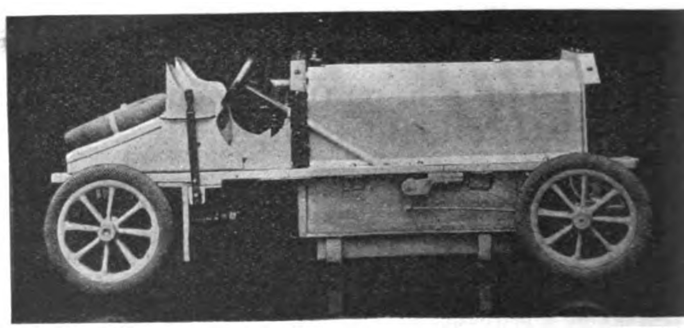
A Model Motor Racing Car.

By H. S. Ward.

THE following is a description of a model motor racing car which I have made, for which steam is the motive power. The boiler is made of sheet copper, with six tubes across the bottom, and is placed under the bonnet and is fired by a spirit lamp. The cylinders are one



UNDERSIDE VIEW OF CAR.



MR. H. S. WARD'S MODEL MOTOR CAR.

pair of ⅝-in. by 1¼-in. D.A. oscillating, placed under the seat, and drive direct on to rear wheels. The frame and support for cylinders is made in aluminium from patterns I have made. The car is fitted with one rear band brake, and the steering is after the same as used on present motor-cars. The wheels were cut out with a fretsaw, and are shod with indiarubber rings. The whole is painted with a good slate-colour enamel, and with steam well up it travels at a good rate. The whole length is 18 ins., and it weighs, when filled with water, etc., 10 lbs.

Re COMPETITION No. 42.—In Mr. Scott's letter on this subject on p. 403 of April 25th issue, the cut-off in cylinder was stated to be ⅞ in.; this should have read "with a cut-off of about ¾ in."

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 intended for publication.*]

Re Mr. Arkell's Model Steam Engine.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Since seeing photograph of Mr. Arkell's steam plant for model speed boat, which appeared in issue of April 26th, 1906, I—as I daresay many other readers—have been struck by the extreme suitability of design of such engine for the purpose in hand. But I fail to see how he lubricates the top end of his connecting-rods. Without such lubrication the engine would be useless. If Mr. Arkell will kindly explain, I am sure he will be thanked by many readers placed as I am.—Yours truly, GEORGE BROWN.

Grays.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I note the point raised by your correspondent as to the lubrication of the little ends of the connecting-rods in our four-cylinder engine. It certainly looks as if there would be a difficulty in getting oil to them, but as the top half of the ends are cut away all but two very small strips, the greater part of the pins are exposed to the smallest splashes of oil which get thrown up by the high speed of the engine. The engines have been made seven years, and the pins have never been renewed. If they showed any tendency to run hot, an oilcan with a long tube bent to go up under the pistons would be sure to get there.

We were very satisfied with these engines, which can run at a very high speed with very small frictional losses owing to the absence of glands to be kept tight.—Yours faithfully, H. ARKELL.

Battersea Rise, S.W.

Re Competition No. 42.

TO THE EDITOR OF *The Model Engineer.*

SIR,—Since my return from South America I have been reading up the numbers of your valuable Journal which have appeared during my absence, and you will understand that the description and illustrations of Mr. David Scott's boiler interested me greatly.

Mr. Scott's renown as a high-speed boat builder is sufficient guarantee that any design due to him must be considered as worthy of very careful consideration before entering into any criticism.

I understand that the boiler illustrated has been tried with success; otherwise, it would appear to me that the water-tubes were liable to be choked by the steam generated therein, the two legs of the U being practically equal in length, and no visible provision being made to ensure circulation of the water through the said tubes.

This question of circulation is most important in all boilers, but particularly so in models where steam and water spaces are of a necessity much cramped.

I have read through Mr. R. M. de Vignier's long letter, but fail to understand exactly what he is driving at. He shows that he has not quite grasped the question when he assumes that 100 sq. ins. of heating surface will only evaporate 1·25 cubic ins. of water per minute; whereas, with a powerful blowlamp and a disregard for fuel efficiency, as much as 5 cubic ins. can be obtained, and the total water evaporated by Mr. Scott's boiler—even when taking Mr. de Vignier's corrected heating surface—would be 8·82 cubic ins. per minute, which, with a fairly economical engine, should give about ¾ i.h.-p. In the paragraph where Mr. de Vignier discusses the steam consumption, he appears to consider that the engine would be designed to take steam for the whole stroke, whereas no sane man with any mechanical knowledge would think of putting such an engine in a high-speed boat.—Yours faithfully,

V. W. DELVES-BROUGHTON.

Upper Norwood, S.E.

Cleaning Soiled Hands.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In answer to J. Bee's enquiry with regard to keeping one's hands clean and tidy after doing dirty work, I have found from experience as a motorist who looks after his own car, and as an amateur engineer, that "prevention is better than cure." Before commencing work I rub well into my hands some Lanoline, inserting under the nails and working it into every pore. I then wipe off the excess from the palms on old newspaper, and proceed with the work. You see, if all the pores and cracks and interstices in the skin are already occupied by the grease, the dirt cannot occupy the same space, and there being a layer of grease between the skin and the dirt facilitates removal by washing with hot water and soap, and at the same time the hands are left soft and pliant and in a condition repellent to dirt afterwards, as there is, I find, a trace of the Lanoline left in the pores after the washing.

Now to get the hands dirty and then to remove the dirt by means of strong detergents containing abrasives, such as Monkey Brand soap, and many special soaps, only leaves the hands rough and the pores and interstices ready to gather dirt quickly again, though, as I sometimes set to work on a dirty job without due preparation of my hands, I have to have resource to some of these special soaps. In this case I find it best to rub in Lanoline first and wipe with paper, and perhaps repeat this again before washing, afterwards rubbing in some emollient, such as a quick-drying glycerine and cucumber preparation, to allow one to proceed with one's occupation and at the same time be softening the skin.

The great secret is—keep the dirt out of the pores, keep the skin soft and pliable, and after washing in hot water thoroughly rinse the hands in cold to close up the pores and to wash away thoroughly all traces of soap.

The Lanoline I use is a more crude variety than the more expensive and perfumed kind put up in collapsible tubes. I obtained a 2-lb. tin at my chemists at a comparatively cheap rate, and so am not afraid of using plenty.—Yours truly,

"LANOLINE."

Historic Railway Carriages.

To the Editor of *The Model Engineer*.

Dear Sir,—Do you think you could prevail on our friends Messrs. Alfred R. Bennett and Ernest W. Twining to write about, and illustrate in colours, the old four-wheeled and six-wheeled railway carriages, the cotemporaries of the "Historic Locomotives" which they have so splendidly reproduced by pen and brush in their recent publication? The above on carriages would be a good accompaniment to the work on locomotives, and I am sure would command as good a sale. I would be glad to become a subscriber.

In reference to railway accidents, an extraordinary one happened at North Cray, Kent, in 1869, of which an old gentleman had a photograph (he has been dead some years, or I would get a copy and send it to you). He said a passenger train by mischance was turned into a siding in which were some 8-ton railway trucks laden with coal. The locomotive knocked away one pair of a truck's wheels; this let one end of the truck fall on to the line. The locomotive ran up the incline thus formed, and settled itself down on top of the load of coal in the second truck. The photograph shows the locomotive in this position (it is apparently one of the small engines of Sharp's type), and my old friend said that a few of the carriages were badly smashed, and some of the passengers killed and others severely injured.

I saw the accident at West Drayton (in 1873 I think it was), where the Exeter to London express ran, at sixty miles an hour, into a goods train shunting. The trucks were smashed wholesale, and some large blocks of Bath stone were, by the upward bowing of the train of trucks in the collision, hurled far into the fields on each side of the line. This "giving" of the goods train must have absorbed the shock, as the express locomotive, "Prometheus" (a broad gauger), had only its front wheels knocked under it, and no carriages were badly wrecked or passengers killed, the rear guard of the goods train being the only person killed.

In reference to one of your correspondents mentioning a book called "The History of a Ship from its Cradle to its Grave." the publisher's address is George Routledge & Sons, London.—Yours truly,

Thomas M. Parr.

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 at the Cripplegate Institute at 7 o'clock. Tuesday, May 28th: Lecture by Rev. W. J. Scott. On Tuesday, May 14th, a visit will be made to the Royal Arsenal, Woolwich.—Herbert G. Riddle, Hon. Sec., 37, Minard Road, Hither Green, S.E.

A new type of projectile, which, according to Sir Howard Vincent, will pierce any armour yet made, has been introduced by Hadfields Steel Foundry Company, Limited.

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:—

[10,833] **Motor Power for Model Launch.** G. W. (Huntingdon) writes: I have a model steamer which I am not quite satisfied with, and am told by a friend that if I fitted same with a powerful electric motor and accumulators I should get greater speed. Is this so? The boat in question is 54 ins. long, 6 ins. beam, and 5 ins. deep, of yellow pine, made on the lines of a twin-screw torpedo-boat destroyer from your book on "Model Steamer Building." (1) What make of motor would be most suitable to drive this boat at high speed? (2) Size of accumulators? (3) Firm where I could obtain same? (4) Approximate cost?

(1) We cannot say if you will obtain greater speed by adopting electric motor and battery; it depends upon the relative power output of the two particular sets of propelling machinery, but you will certainly obtain interesting information and comparisons and will probably not regret making the experiment. The motor should have wrought-iron fields and a drum armature, and be generally of light construction. A suitable design is given in No. 5, Vol. I, of The Model Engineer, also in Chapter 2 (Figs. 1 and 2) of "Small Electric Motors," armature 1¼ ins. diameter, wound with No. 26 D.S.C. wire, and fields wound with No. 20 D.C.C. wire. Allow motor to run at as high a speed as possible. (2) Accumulators to give 12 volts 2 amps. (3 and 4) Apply to one or more of the firms advertising in The Model Engineer. Information on model electric launches is given in No. 95, Vol. VIII, and No. 115, Vol. IX, of The Model Engineer. If you desire to use twin-screws, you can either have a single motor with gearing or two motors.

[17,595] **Small Induction Coil Working.** B. M. (Derby) writes: I shall be pleased if you can help me in any way to account for the partial failure of ½-in. spark coil. The trouble is that the spark is extremely thin and weak, and purple in colour. I have tried several kinds of contact-breakers and three condensers of varying capacity, used singly and together (in parallel). I have tried 2-, 4-, and 6-volt accumulators. The best results were obtained with 4 volts, but, although I have obtained sparks as much as 1¼ ins. long, the *character* of the spark remains the same. With mercury break no spark could be obtained (except a violent green spark at the mercury). The dimensions were obtained from your book on "Induction Coils," and are those of ½-in. coil, but the secondary is constructed as described by Mr. Pike in The Model Engineer some time ago, and consists of eleven double sections, wound with No. 36. All the sections contain the same bulk of wire, but the five central ones are wound with D.S.C. and the others with D.C.C. There is at least 1¼ lbs. of secondary wire; is it possible to have too much? The insulation between primary and secondary is rather more than 1-16th in. The sections are insulated by means of waxed blotting-paper discs (two between each). One of the condensers is insulated with the same kind of paper; is it too thick? I also used lead foil, as I could not obtain tin in Derby. I enclose a few samples of materials used. You will see by the disc the size of the sections. These are wound to within ¼ in. of the edge. A single section is ⅛ in. thick. They are all connected to form one continuous coil. I am quite certain that the connections are all correct; all the sections have been tested separately.

We cannot say there is much the matter with your coil if it gives this spark length. The thinner the paper in condenser is the better, provided it is a perfect insulator. Try various sizes of condenser, and follow up whatever gives you better results. The primary wire you send is No. 17 S.W.G., not 18.

[17,538] **Small Lamp Supplies.** C. F. N. C. (Ware) writes: (1) Could a battery similar to that used for a pocket flash-lamp be made to light a cycle lamp, or must an accumulator be used? What power lamp would be necessary? (2) Would a motor run from a battery be suitable to light an electric lamp to give sufficient light for an ordinary room? If so, what power lamp and motor would be required? If not, what is the cheapest method? (3) How are batteries, as used for placing in pocket flash-lamps, made? What power lamp would be required?

(1) Yes, for a short time. Accumulators are preferable, of course, and can be recharged again and again without taking to pieces each time. A dry cell once exhausted has to be refilled. Small 4-volt of nearly 1 c.-p. (2) A motor does not *generate* current. If you wish to light a lamp, do so by coupling up to battery direct. (3) A form of dry cell, described in handbook "Electric Batteries." See previous reply.

[17,468] **Ammeter for Cells and Dynamo.** M. S. T. (Saltley) writes: I require a small ammeter. I presume (1) connecting ammeter across accumulator terminals would ruin same by short-circuiting, but (2) can same be used safely across dynamo terminals without any resistance in circuit? I might add that I have greatly benefited by reading THE MODEL ENGINEER and various Handbooks. Any information in regard to following queries would much oblige. (3) Can tantalum be obtained in sheets and round rods; also cost of the former metal? Has same been alloyed with tool-steel for high-speed turning, etc.? Particulars relating to palladium would also be esteemed (in regard to cost and any other information). Would same be much superior to spongy platinum for lighting gas, etc.?

(1) Yes. (2) No. Some resistance must be in circuit, as that of the ammeter will be practically nothing. The latter alone in circuit will short-circuit the dynamo just the same as the accumulator. (3) Townson and Mercer, 89, Bishopsgate Within, E.C., would probably supply you and give you price on application. Palladium is much superior to spongy platinum from the point of view of its catalytic action or property.

[17,450] **Running Motors in Parallel.** W. H. (Notts) writes: A is a motor running for twelve hours a day without stopping, requiring 20 amps. at 120 volts. B, C, and D are requiring 15, 20 and 25 amps. respectively, and are running irregularly, sometimes for one, two, or all of them to run together. B, C, and D have their own regulator switches. Is it possible to connect as shown so that A receives 20 amps. only, without any resistance switch at all? Could fuse wire be applied at F without melting when other motors were running or not? I have asked several persons this, but none can answer with certainty.

If motor A is designed to run on a 120-volt circuit, then it will run without any outside resistance in circuit, but at starting a suitable resistance must be used. If each motor is connected across the mains, one will not affect the other at all, because you are running them in parallel, not in series. It is advisable to have a fuse in each motor circuit, or else an automatic cut-out. As you show them, all motors are using one return wire to negative main. This makes no material difference in the working, provided the return is large enough to take the total current flowing.

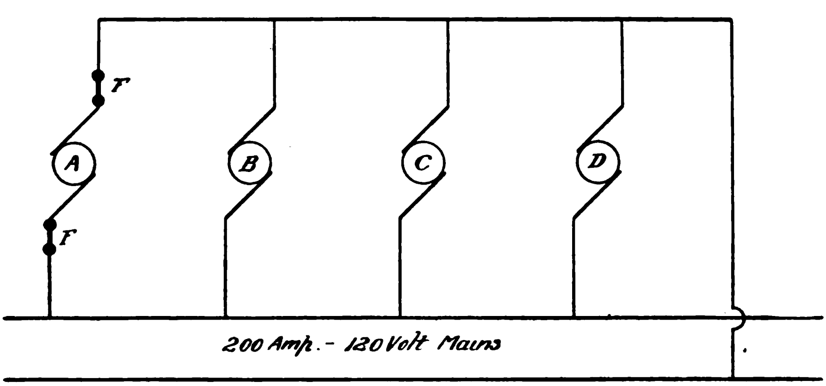
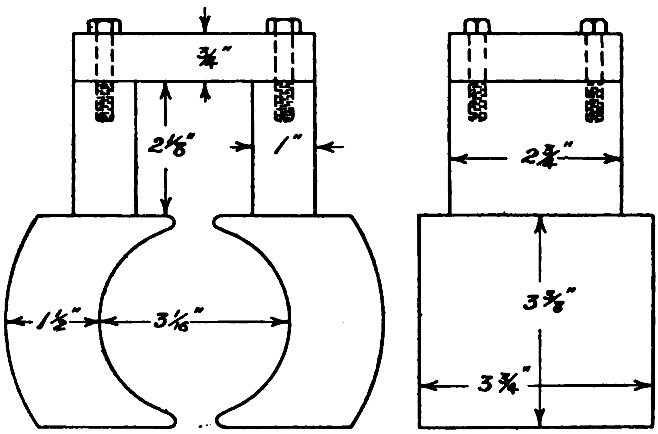


DIAGRAM OF CONNECTIONS FOR RUNNING MOTORS IN PARALLEL.

[17,369] **Small Undertype Dynamo Windings.** A. H. M. writes: I should be much obliged if you would kindly answer the following questions. I have an undertype dynamo with 24-slot armature wound in 24 sections, 3 ins. diameter, 3¼ ins. long, wound with No. 26 S.W.G. for 110 volts. The field-magnet cores are 1 in. by 2¼ ins. by 2⅛ ins. long. I should like to know what size and quantity of wire to wind fields (shunt wound) at above voltage? Does it matter about using a mild steel yoke piece instead of cast iron? What would be probable output in current? What speed would be required, and what power to run at full load? I have a dynamo as sketch (not reproduced) with round field cores, 1⅜ ins. diameter by 1 in. long, and pole-caps 2 ins. long. The armature tunnel is bored out 2·05 ins. The armature is an eight-cogged drum, 2 ins. diameter by 2¼ ins. long, built of laminations. What size and quantity of wire shall I require to wind armature and fields for 12 volts, to be connected in shunt? What current could I expect at full output? What speed should I require to drive it at, and power required? The pole-pieces are bolted on by a ⅜-in. bolt each. How many 12-volt lamps of 2 c.-p. would it light?



UNDERTYPE DYNAMO FIELD-MAGNETS.

Armature, 15 ozs. No. 24; field-magnets, 6¼ lbs. No. 25. Use wrought iron in preference. Output of machine, about 1·5 or 2 amps.; speed, 2,800; brake horse-power required to drive at full load, nearly ⅛. *Re* the ironclad type machine with 2-in. by 2¼-in. armature for 12 volts, wind armature with 6½ ozs. No. 20, and fields with 2¼ lbs. No. 21 Output about 50 watts. Speed, 3,000 revs. Brake horse-power, 1-7th. Reckon 3½ watts pe candle-power.

[17,539] **Old Lamp Caps.** W. B. M. W. (Horwich) writes: Several of the largest manufacturers of electric incandescent lamps take back the caps of the spent lamps and extract the platinum. There are, however, some dealers who buy them and do this themselves. Can you inform me of the cheapest way to do this? The only method I know of at present is crushing the cap and cleaning the platinum with acid. This, of course, takes a long time in the case of several thousands, as each cap has to be handled separately.

The only way of dealing with lamp caps is to knock out the filling and clean the platinum with acid, and this is the method adopted by the largest manufacturers. It should be noted, however, that lamp caps have not the value they once had, as the amount of platinum used is now reduced to the smallest possible figure, owing mostly to the low price at which a lamp has to be produced and also to the evolution of the high-voltage lamp, with its long leading wires, which are often supposed by the uninitiated to be "all platinum."

[10,707] **Electric Pocket Lamp and Battery.** G. R. (Tranmere) writes: I bought an electric pocket lamp (6¼ ins. long by 1½ ins. diameter) for 4s. 6d.; supposed volts, 4,000 flashes; refills, 1s. 3d. I send you by this same post one of the three parts of dry cell (?) in the hopes that you will kindly help me in making my own refills for same. The three parts were connected by a short wire, as on the one I send, and a disc of cardboard between each cylinder.

The sample you sent us contains the ordinary ingredients of a dry cell—*i.e.*, carbon rod surrounded with crushed carbon and manganese dioxide wrapped in a piece of cloth, or fine canvas, or linen. This constitutes the porous pot and its contents. Outside is a mixture of sal-ammoniac crushed fine, a small quantity of sawdust mixed with it, and the whole lot made up into a thick paste with a substance very much like glycerine. Directions for making up a similar cell are given in handbook, "Electric Batteries," 7d. post free. The cell you sent gave just 1 volt. The outside, of course, is zinc, and forms the opposite pole of the cell to the carbon rod.

[10,802] **Shocking Coil Construction.** G. W. K. (Kensington) writes: I have been making the shocking coil described in THE MODEL ENGINEER handbook, "Induction Coils for Amateurs," and I have had great difficulty with the iron wire core. I made it and fixed it in the paper tube, as described, but after a time I found it impossible to pull out the draw tube. I took it to pieces and found that though the tube had slipped quite easily over the core previously, it would not do so now. I made some more cores, wiring them very tightly before soldering, but always had the same breakdown. I consulted a friend upon the subject, and he told me that iron wire cores were no good to use with draw tubes—they always bulged outwards in the middle, as mine had done. But other people use them with draw tubes, because I see Mr. Lee's bazaar coil has a wire core and draw tube. I don't know whether the thickness of the wires causes this trouble, so enclose one for your inspection. (1) Can you tell me my mistake? I softened the wires, as directed. (2) Could you also tell me the best and easiest way of making a Leyden jar suitable for use in the experiments described by Mr. Vincent Williams in THE MODEL ENGINEER for November 19th, 1903. I do not quite see how to do it from the illustrations. (3) Could you also tell me where I could obtain a gold-leaf electroscope? I have consulted several lists advertised in THE MODEL ENGINEER, but unsuccessfully.

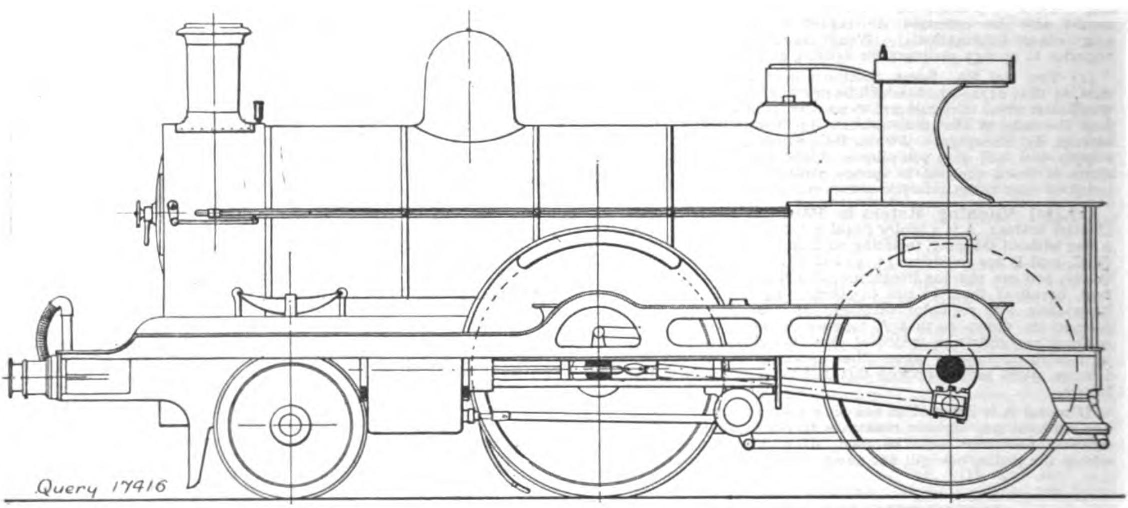
(1) Make your iron core slightly smaller, and bind round the middle where it bulges with some strong thread, not metal wire; perhaps your draw tube is short and pushes against the end of the iron core inside when the tube is home. (2) The Leyden jar consists of a glass jar coated inside and out with tinfoil to about halfway up the sides. Stick tinfoil over the bottom, both inside and out, as well as the sides. The glass where not covered with the tinfoil should be well coated with shellac varnish. The top of the jar is closed by a cork or wood lid, which should be well shellaced or coated with paraffin wax. The knob and rod are to be made of brass. At the bottom of the rod is fastened a small brass chain, which rests upon the inner coating of tinfoil. Do not shellac the surface of the tinfoil; the cover is merely a support for the rod, and need not be airtight. (3) Gold-leaf electroscope can be obtained from any of our electrical advertisers.

[17,526] **Finding Horse-power of Steam Engine.** R. C. (Woolwich) writes: I have a vertical boiler and engine combined, cylinder 6-in. bore, stroke 6 ins., doing 200 r.p.m. at 30 lbs. pressure. I should like to know horse-power of same.

Assuming the mean effective pressure on piston to be 20 lbs. per sq. in. and the engine double-acting, the indicated horse-power works out at 3½. A more practical way for you to adopt, and, indeed, the only way if you wish to arrive at the actual amount of useful work your engine is doing, is to make a brake test. The method is the same as described in a recent article in *The Engineer-in-Charge*. See November and December, 1906, issues, 2d. each or 3½d. each post free.

[17,416] **L.N.W.R. Three-cylinder Compound Locomotive.** H. C. (Bolton) writes: Will you oblige me with a side elevation of the L. & N.W. Co.'s "Precursor" and tender; also—if you can afford the space—of the same Company's compound locomotive "Ionic" and tender, and say which will make the best working model to ½-in. scale?

You will find drawings of the "Precursor" in our issue of November 24th, 1904, and the tender in the Query columns for June 28th, 1906. We include herewith a drawing of the "Jeanie Deans" class (2—2—2—0 Webb compound), to which the "Ionic" referred to belongs. The driving wheels were (these engines are now broken up) 7 ft. 1 in. diameter, with twenty-two spokes; leading wheels 4 ft. 1½ ins.; height to top of chimney from rail level, 13 ft. 1½ ins.; height of boiler, 7 ft. 10½ ins.; centres of H.-P. cylinders (apart), 6 ft. 6 ins. As regards making a good steam model, the "Precursor" has a larger boiler and better cylinder arrangement. However, if the curves of the railway are very sharp, the "Jeanie Deans" type may offer some advantage, as the leading wheel is mounted on a pony truck. You may either use two outside H.-P. cylinders or a single cylinder between the frames driving on to the leading driving wheels, making the outside cylinders dummy. A picture of the "Jeanie Deans" forms one of our locomotive engravings (No. 489), of which we still have a few left. For further information as to external details, kindly refer to this plate.



"JEANIE DEANS" CLASS WEBB COMPOUND (THREE-CYLINDER) LOCOMOTIVE, L.N.W.R. CO.

(*Scale: 3-16ths in. = 1 foot.*)

[17,367] **55-watt Ring Armature Dynamo.** O. Q. (Kentish Town) writes: I shall be very grateful if you will give me some information on the following. I have a 2½ by 2½ petrol cycle engine rated at 2½ h.-p. at 1,800 r.p.m., which I wish to use for a direct-coupled electric lighting set. I have a D.C. ring armature, 6 ins. diameter by 3½ ins. long, wound with 19 S.W.G. I want, if possible, to use the above armature. Will you kindly give me a dimensioned sketch of the best field-magnets, also wire to suit same? Please give output that I might expect. Can you give me any information on a spark coil. I have the coil, but not the condenser. Can you tell me how much tinfoil I should require for the above coil? The coil measures 2 ins. by 3 13-16ths ins. wire space, and is wound with 19 S.W.G. primary. I do not know the quantity. The measurement of the secondary is .3 mils. I was told that it

was a ¼-in. spark, and I wish to use it for firing the above engine.

Use a Manchester type field-magnet, as Fig. 13 in "Small Dynamoes and Motors," 7d. post free, and make magnet cores 2¼ ins. diameter and yokes 1 in. thick by 3½ ins. wide (*i.e.*, equal to length of armature). Centre to centre of field-cores will be about 11½ ins. or 11¾ ins. Wind fields with 15½ lbs. No. 20 S.W.G. The output of machine should be approximately 550 watts. *Re* coil. Try a condenser of forty sheets of foil (4 ins. by 3 ins).

[10,812] **Spark Coil Construction.** J. J. K. (Glasgow) writes: Having read your book on "Induction Coils for Amateurs," I first made a shocking coil, which was a success. I then determined to make a 4-in. sparking coil, which is now finished, but I cannot get more than a 1-in. spark with three 1-pt. size bichromate cells, and without condenser attached not more than ¾-in. I was careful to put the sections on so as to have the current flowing continuously in the same direction, and have tried the length of spark by connecting the outside ends of 4, 8, 12, 16, 20, 24, etc., sections, and the length gradually increased from about ¼-in. up to 1-in. I may say the inner ends of the sections were drawn up between the paraffined paper discs and the ebonite tube, and the soldered ends, I have no doubt, are touching the tube in places. Does this matter? The outside ends of the wires (secondary) are tucked down close to the section. Should they be tucked down between the paraffin discs? Again, in winding the section, I was not careful to do it evenly, the section-holder being clamped together and attached to a sewing machine. I filled up the space between section and tube with hot paraffin. When all sections were on I immersed the whole in paraffin to get thoroughly soaked, and then pressed flanges up and left to cool. There is some fault somewhere, and I should be much obliged if you or any of your readers could give me an explanation. Is battery power sufficient? I notice in a recent issue of THE MODEL ENGINEER Mr. J. N. Harvey, of Kidderminster, has experienced some trouble with making coils, but I cannot gather from his remarks where the fault lies with my coil. He also says he has obtained Mr. A. T. Hare's book on the construction of larger coils. Could you say where I could get this book? Could you send me design for construction of a rotary mercury break, or let me know where such may be purchased?

As you obtain a ¾-in. spark without condenser, and only a 1-in. spark with it, the fault is probably in the condenser; either it is pierced or wrongly connected, or not of suitable size. Try a new condenser made in several sections, so that you can add more or less capacity and try the effect on the spark length. The joins between the sections should be coiled up so that they do not present projecting points which tend to spark, and tucked down between the paraffined discs. Provided you have not caused any short-circuited turns, the uneven winding of the secondary sections will not make much difference; the battery power should be sufficient if the cells are in good condition. Read carefully Chapter 5 in THE MODEL ENGINEER Handbook No. 11, "Induction Coils." In this chapter full particulars are given on how to make a 4-in. spark coil; a mercury interrupter is also described in Chapter VI. Hare's "Induction Coils" can be had from this office, 6s. 4d. post free. Mackenzie Davidson's patent rotary mercury break can be had from Harry Cox, Ltd., Cursitor Street, W.C., which firm makes this particular type of interrupter, or it could be obtained through any of our advertisers.

[10,703] **Outfit for Model-making.** H. J. (Aston) writes: Should be extremely obliged if you could advise me on the following. Could I start model-making for a hobby on a very small scale with tools to the value of £5, and please give me a list of the few things I should require, how best to purchase them, and their probable cost? Would you advise trying a small bench lathe, as is often advertised in THE MODEL ENGINEER, or a cheap new one, same as Holmes's or other of your advertisers sell? It is my ambition—after a few months' practice—to try and make throughout a simple vertical boiler and a horizontal engine (about 1-in. or 1¼-in. bore). Also please say which of your Handbooks I ought to get besides your book on "Turning."

Our handbook, "Metal-working Tools," will give you a good idea of what is desirable to begin with. £5 would buy a very good set. The small bench lathes are good value for money and although you cannot do special work on them, they are extremely useful for all sorts of little jobs. See handbooks, "Model Boiler Making," "Simple Mechanical Working Models," 7d. each post free; also "Metal Turning," 2s. 2d. post free.

[10,700] **Electric Bell Failure.** R. H. (Newcastle) writes: I have recently fitted up an electric bell which worked properly for two days, after which time it completely failed. I examined the Leclanché cell and found it was at fault, as only a very faint and scarcely noticeable current could be detected—on the terminals being placed on the tongue. I took the porous cell to pieces and recharged it without any improvement. Trying another Leclanché that I had, for first time it failed also. I have also tried both weakening and strengthening the sal-ammoniac solution, but without any better results. Can you tell me where the fault lies? Thanking you in anticipation of a reply in due course.

Either the bell is exhausting the cells by ringing continuously, or there is some leak in the circuit which allows a current to flow continuously, and so in time the cells become run down. A Leclanché cell, if it works well for two days, will not go wrong suddenly without any evident cause. The above is most likely the cause of your trouble. Our handbook, "Electric Bells and Alarms," would assist you; 7d. post free.

[17,600] **Running Small Alternating Current Motor for 80-volt Supply.**—A. R. (Beswick) writes: I have a 12-volt motor which runs on both continuous and alternating current, and wish to know if I can run it from an 80-volt supply.

If you insert a few lamps or other suitable resistance into the 80-volt circuit, your motor will run quite as well as on the lower voltage supply without such extra resistance. You do not mention what current motor takes, but by inserting first one lamp in series with it, and then adding more *in parallel*, you will soon see what current it requires.

[17,542] **Vertical Steam Engine.** B. S. A. (Bishop's Court, Australia) writes: I would assume it a favour if you would answer the following queries. I have a small vertical steam engine, which I want to use for a launch. It has two cylinders (3-in. by 3-in.). Would you tell me (1) What power they would develop? (2) What sized horizontal boiler would be required? (3) What thickness of mild steel for shell and end plates? (4) What sized boat would it drive?

(1) Working at 50 lbs. pressure and 250 r.p.m., the engines will develop—

$$\frac{33\text{ (average assumed pressure)} \times 7 \times \frac{1}{4} \times 250 \times 2 \times 2}{33{,}000} = 7 \times \frac{1}{4} = 1\tfrac{3}{4}\text{ h.-p.}$$

Other powers in proportion to the speed or steam pressure. (2) You require a boiler with about 4,000 sq. ins. of heating surface. This may be of the pinnace type, as shown on page 42 of "Model Boiler Making" (new edition). The shell should measure at least 24 ins. diameter by 40 ins. long. (3) The plates can be 5-16ths in. thick, with double-riveted lap-jointed seams. Pressure, 60 to 70 lbs. per sq. in.; rivets, 9-16ths or ½ and 1¼ to 1½ ins. pitch; tubes, forty (1-in.). (4) 14 ft. 6 ins. to 16 ft. long. Displacement should vary according to the nature of the water to be sailed upon and speed required.

Further Replies from Readers.

[17,519] **Oil Engine Trouble.** Some years ago I bought a small gas engine which had proved to be useless on account of the same trouble as "W. J.'s" The ignition tube was of ½-in. gas barrel, and I got over the difficulty by making the tube longer, I think quite 2 ins., and drilling out the inside, also taking a cut off the outside, leaving all bright. This reduces the thickness of tube and takes off the scale, thus allowing it to become hot enough inside to ignite the charge. Strange to say, tubes treated in this manner last longer than those not so treated. Up to the time I fitted electric ignition to my engine I always cleaned up the tubes in this manner. I find electric ignition such an improvement over tube that I should never think of using tube again.—A. GREEN.

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 the asterisk have been based on actual Editorial inspection of the goods noticed.*

* A Reducing Scale.

Those of our readers who have from time to time to make proportionate reductions or enlargements of drawings, prints, or photographs, will be interested in the new patent Reducing Scale which Messrs. John Haddon & Co., Salisbury Square, London, E.C., are supplying. The instrument we have received consists of two right-angle brass scales, which are attached at their apex to a slotted steel bar and adjusted by means of thumb screws. The scales may also be divided on one side into picas for the use of printers, thereby showing the amount of type required for a given size of illustrating block. The instrument is manufactured by the well-known firm of Chesterman and Co., Sheffield, and is capable of measuring work up to 144 sq. ins. area. Further particulars and prices will be sent on application to Messrs. Haddon & Co.

Solid Drawn Tubes and Rods.

Messrs. H. Rollet & Co., 12 & 13, Coldbath Sq., Rosebery Avenue, London, E.C., make a special feature of solid drawn tubing in copper, brass, bronze, steel, aluminium, and other metals, in various sections and sizes, for all kinds of model engineering and scientific instrument work. They also hold large stocks of bright drawn brass rods, both round and hexagon, and also of special quality charcoal iron rods, for fast and easy screwing and turning. Another speciality is drawn brass rails for model railways. Readers requiring any rod or tubing should write for prices.

The Editor's Page.

OUR new book on flying machines is now ready, and we venture to think it will be found of interest to the many people who are following the attempts made by various inventors to solve the problem of flight. The book is divided into five chapters, as follows :—I, Introduction ; II, Dirigible Balloons ; III, Flying Machines ; IV, The Art of Flying ; and V, Flying Machines of the Future. Although it is mainly intended as a popular exposition of the subject, it includes information of technical value which may assist the reader who has the idea of experimenting on his own behalf. A number of drawings are given of various inventors' ideas, and in addition there are twenty-two plates of photographs of machines which have actually been built. The authors of the book are Messrs. A. W. Marshall, M.I.Mech.E., and Henry Greenly, both of whom are well known to our readers. The price of the book is 1s. net, and it may be obtained through any agent for THE MODEL ENGINEER, or post free 1s. 3d. direct from our office.

* * *

We have also just published another new book, for which many of our readers have been anxiously waiting. It is Mr. Howgrave-Graham's long-promised treatise on "Wireless Telegraphy for Amateurs." In it Mr. Howgrave-Graham not only fully explains the principles of wireless telegraphy, but gives detailed drawings and instructions for enabling the reader to construct a thoroughly satisfactory outfit for working over moderate distances. The delay in the appearance of the book has mainly been due to the author's desire that only completely successful apparatus shoud be described, and for the best part of two years he has been engaged in constructing and testing in actual work the various appliances he recommends. The price of the book, cloth bound, is 2s., or post free 2s. 3d.

* * *

Messrs. James Carson & Co., Ltd., write :—" Our attention has been called to reply to Query No. 17,495 in your current issue, and we must ask you, as we are, so far as we know, the only makers of a ½-in. scale six-coupled C.R. model, to correct the statement made in the reply. Our six-coupled C.R. models will negotiate *with ease* and at full speed a curve of 7 ft. 6 ins. radius without the provision of lateral play in the coupled wheels. We must also take exception to the statement that the permanent way without keys depends for its rigidity on slight twists in the chairs. We are prepared to prove that it is the cumulative friction of the chairs which makes the track rigid."

Answers to Correspondents.

F. R. (Manchester).—The book that will help you is "Model Sailing Yachts; How to Build, Rig, and Sail Them," to be obtained from this office, 1s., post free, 1s. 3d.

"TENAX."—This solder is obtainable from Mr. Wm. Simpson, 41, Elphinstone Road, Hastings. See also the issue for March 10th, 1904.

C. W. (Canning Town).—We regret we are unable to put you into touch with a purchaser for your invention.

"GAS ENGINE."—The term is used when the distance from centre of engine driving wheel to centre of the pulley being driven is very little.

G. L. T. (Bishop Auckland).—Thanks for your letter and photograph.

J. A. A. (Coventry).—Drawings of an inch scale model L.T. & S.R. tank locomotive were given in the issues for January 1st and 15th, and February 1st, 1902 (Vol. VI).

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, etc., 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.

M.B.—Italic Headings—

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

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

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

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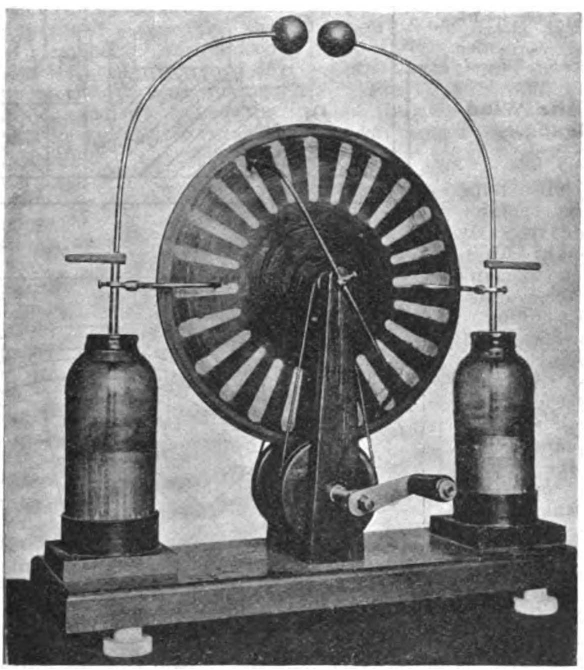
A Simple Wimshurst Machine.

By F. Robertson.

HEREWITH is a photograph of a Wimshurst machine, which shows my first attempt at any form of statical machine, and I did not expect to get anything like the results actually obtainable, namely, 2-in. to 3-in. sparks, and in a very warm room from 3-in. to 4-in. sparks can easily be got.

The plates, 10 ins. in diameter, are of ebonite, less than 1-16th in. thick. Such thin plates are not to be recommended, and would not have been used, only I had some sheets of that thickness by me. Two ordinary cotton reels were used for the bosses, one end being cut off and a groove cut in each for driving. Two pieces of brass tubing were fitted inside the reels: a thin brass washer was first soldered to one end of each piece, and threads cut and nuts fitted to the other ends. When in position the washers grip the plates against the face of the reel, making the whole firm. The spindle for the plates is of steel, ⅛ in. diameter, and for the driving pulleys ⅜ in. diameter. The driving pulleys are 3½ ins. diameter, and are made from a wire bobbin such as is generally received with 1 lb., or over, of wire. A deep groove was first cut with a knife and finishing touches given with a rat-tail file, the whole being held firmly on the shaft by a screw running through centre of bobbin. White metal bearings were made for the driving pulleys, which run quite silently and without any shake.



Mr. F. Robertson's Wimshurst Machine.

Collectors, neutralising rods, and dischargers are all made from ⅛-in. copper rod. Pieces of brass were fitted with screws and soldered to the centre of neutralising rods. The screws grip the projecting ends of steel spindle, enabling the rods to be set at any angle. The same plan was adopted for fixing the collectors, and is very convenient. Leyden jars were made from two ordinary pint bottles cut close to the neck and coated inside and out with lead foil to a height of about 3 ins. A cotton reel was cut in halves and each half fitted with a ¼-in. brass tube through centre, 2 ins. of tube being left projecting. The half reels were placed in the necks of bottles, the large ends of the former being just large enough to prevent them slipping inside. Hot compound was run between the necks and the reels.

To fix the Leyden jars to the base, circles ¼ in. larger than diameter of jars were cut out of two squares of wood (3¼ ins. by 3¼ ins. by ¾ in.). Strips of stout brown paper were cut and glued in the form of a narrow cylinder 1½ ins. wide, the jars being used as a size. The paper cylinders were then glued into the circles cut in the squares of wood. The latter being then screwed to the base, not the slightest movement of the jars is possible. The collectors slip over the brass tube projecting from the Leyden jars, and can be fixed at any height by screws, as in the case of the neutralising rods. The rods for the dischargers are an easy fit inside the tubes, enabling balls to be revolved and the spark length varied.

The stand is 16 ins. by 6 ins., and the supports 9 ins. high, painted black. When first finished, the number of sectors on each plate was twelve, but as no results could be got from the machine the number was doubled. The machine will now excite instantly in any weather, although the results are slightly better when the weather is quite dry. It will be noticed that the only balls used are on the dischargers. This does not seem to affect the efficiency of the machine to any considerable degree.

How It is Done.

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

Patterns in Stucco for the Windmill Revolving Head.

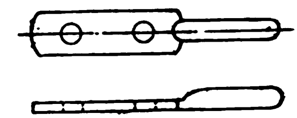
By "Pat."

The following method of making the patterns for the revolving head of the windmill recently described in The Model Engineer will probably be new to many readers: but as it would prove a pretty large undertaking for an amateur to build and turn the patterns in wood, this method may be of interest.

To make the pattern for the lower casting :—

A moulding board A (Figs. 1 and 2), about 28 ins. or 30 ins. square, is first required. If one cannot be got on loan from the iron foundry, make one of deal about 1½ ins. thick, with battens on the back (as shown) to hold it fair. See that it is true and flat. For the template C (Figs. 1 and 2) a piece of wood about 15 ins. by 8 ins. by 1 in., and another 6 ins. by 5 ins. by 1 in., are required. Plane them smooth and draw the half-section of the pattern on the larger piece, marking the four dotted lines D D D D (Fig. 1), which indicate the position of the outside and inside edges of the spaces between the arms. Now cut out carefully to the outline of the inside of the casting, and bevel the edge similar to a loam board. If a piece of sheet zinc is cut to the outline and screwed to the face of the template, the template being relieved behind it, a clearer finish will be obtained. To finish the template screw an iron pin (Fig. 3), about 5-16ths in. or ⅜ in. in diameter, exactly on the centre-line; the pin is lopsided so that its centre will coincide with the face of the template and screw the smaller piece of wood across the end. This is to keep the template from tilting when in use.

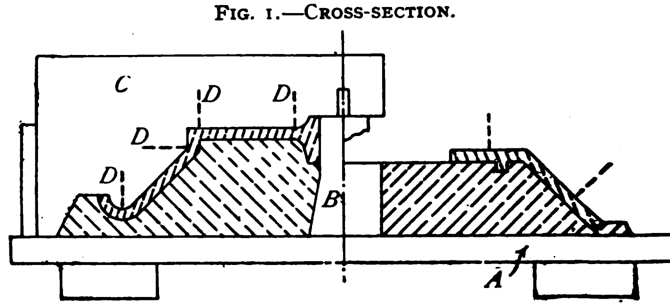
Fig. 3.



The moulding board should be rested on trestles, or a box, at a convenient hei ht, so that the operator may get round it when pulling the template, and it is a safe plan to fix it down to prevent it turning with the template.

The block of wood B (Fig. 1) is the same length as the distance from the bottom edge of the template to the top of the bearing boss. It is screwed to the centre of the moulding board, and has a hole bored in the top end to fit the pin (Fig. 3).

Fig. 1.—Cross-section.



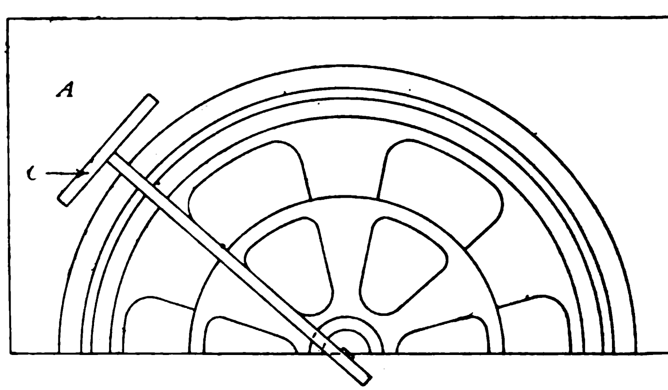


Fig. 2.—Half Plan.

Method of Making Patterns in Stucco for the Windmill Revolving Head.

It is shown turned to the size of the hole for the bearing, so that the pattern will leave its own core; but it would be well to make it smaller, and put a core print on instead. The next operation is to sweep up the block on which the pattern is made. It will save time and stucco if pieces of engine ashes, cinders, or broken brick are laid on the board to help to make up the thickness of the block. Now coat the template and the part of the board it bears on when turned round, with oil. This is to keep the stucco from adhering. It would be best now for a novice to get someone to help him. I ought here to mention that the stucco—or, as perhaps more commonly known to readers, plaster of Paris—may be obtained from a lime and cement merchant, or a sculptor and modeller. In this district (Edinburgh) a 2-cwt. bag costs 4s. 6d.; 1 cwt. will be ample for the job, and there will be some to spare in case of accidents.

To prepare the stucco, say, for the block of the lower casting, put about 2 galls. of water into the mixing dish (a bucket, pail, or basin), and with a scoop, a tin can, or the hand, drop the stucco gradually into the water, so that it will not form into knots. To get the correct consistency, which is that of cream, practice is required; but it is safe to stop adding stucco when it has risen nearly to the surface of the water. Stir well with a stick, and, when well mixed, proceed to put on to the board. Get the template in position, and pull round, holding it well down on the board. Any that gathers on the front of the template may be used, if it is quite soft, to fill up portions where required; but if it is beginning to harden, throw it away and mix more to fill up the deficiencies. Let one mix the stucco and the other pull round the template. When mixing the stucco, put the stucco into the water, not *vice versa*. Add stucco until it is of the consistency of cream: do not attempt to finish the block with one mixing. It will probably take three or four. When the block has hardened give it a coat of shellac varnish, and when ready to sweep the pattern on, give it a coat of oil. The template will now have to be cut to the outline of the outside of the casting, and the sheet zinc altered to suit and screwed in place. Oil the template well, and sweep on the pattern. An old dish or tin can will be found convenient for pouring the stucco on with. It must be swept up as quickly as possible, or the template may catch and drag the pattern round or break it. When finished, remove the zinc from the template, and proceed to mark off the arms. Draw a circle where each of the lines D strike the pattern. This is easily done by cutting a small vee in the edge of the template where the lines cut, resting a draw-point in them with its point touching the pattern, and turning the template round. Divide one of the circles into six parts, and mark the width of the arms at each point round the circle. Replace the template, and use it as a straight-edge to draw the radial sides of the arms, folding it to each of the twelve points, as shown at Fig. 2, and next draw the round corners.

To cut out the spaces, bore a hole in each with a centre-bit, cut round with a keyhole or other small saw, and finish with ordinary wood chisels and gouges. Now lift the whole pattern off the block. Do not attempt to force it. If it does not come easily, rap the moulding board with a mallet, and if it refuses still, cut it through between the arms with a thin saw, and lift it off in two or three pieces. It will do equally well this way, and is more convenient for the moulder to draw out of the sand. Finish by sandpapering and varnishing.

To make the pattern for the upper casting:

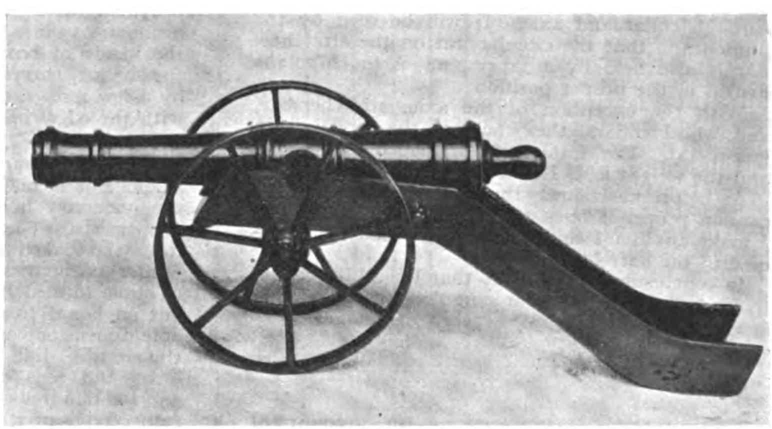
Proceed as for the lower, and where each of the guide-wheels come, attach thin pieces of wood cut to the required shape with thick shellac varnish. Also fit on two pieces to carry the pedestals. I would advise casting the pedestals separately and bolting them on; but if it is desired to work to the drawings given, shellac and screw them on, putting the screws through the stucco into the wood, and have the bosses for the bearings loose dovetailed and the lugs for the tail hinge skewered on.

A Model Gun.

By A. M. H. Solomon.

The piece of ordnance depicted in the photograph herewith is a copy of a model made in Woolwich Arsenal about fifty years ago. I had a pair, one of which got lost or stolen, so I made this one to match, as they form nice ornaments on a sideboard.

Firstly, a drawing was made, and then patterns of the side-frames and cannon. The wheels were cast, using a wheel of the intact model as a pattern.



Mr. A. M. H. Solomon's Model Gun.

All the other parts were made out of the solid, fitted and turned as far as necessary.

The side-frames are ¾ in. deep and 3-16ths in. thick, and were filed up to a nice smooth and bright surface, then fixed temporarily together by two small rivets, and the holes drilled for trunnion, stretcher-bar, and axle. Next the frame was built up; the stretcher-bar is turned to a shoulder at each end; the ends project through outside each frame, are threaded, and have a circular nut, which holds the frames rigidly in their places and the correct distance apart. At the base near the front a cross-member is inserted, ¾ in. wide and 3-16ths in. thick. This piece, which braces the side-frames together at the part where they rest on the ground, is held in position by a couple of steel screws on either side, which go through the frame into it.

The axle is made of a piece of ⅜-in. square brass, and has the ends turned to form the bearings for the wheels. The frames have a projection under each carrying a square hole, and the axle is fitted through them, shouldered on the inside, and held in position by a set screw.

The cannon itself was made in the following manner, and, as I see now, is open to considerable improvement. A pattern was made of the barrel portion only, and with a core right through, and a separate casting was made of the little hub back end with the knob on it. The hole did not come out quite central, consequently, to true the cannon, I had to plug up the front end for ½ in. and drill it out centrally that distance. The rest of the interior of the barrel I did not touch, but simply turned up outside quite bright, and afterwards sweated and pinned the rear end with the knob on, and then turned it quite smooth and bright in the lathe, like the rest. Turning the knob, of course, meant manipulating both slides of the slide-rest simultaneously. The trunnions were then made and sweated and pinned on the body of the cannon.

The wheels were next tackled: rims and centres turned, hole for bearing bored, and the spokes and insides of rims filed up smooth and bright. The wheels, which are 3½ ins. diameter, are held on the axles by means of a turned collar on the outside, which is secured by a taper pin driven through collar and axle. It will be seen by the photograph that the circular nut on the stretcher-bar is also held by a taper pin. A touch-hole is drilled in the proper position.

With the exception of the axle, stretcher-bar, and wheel collars, the whole of the model is in gun-metal. The total over-all length is 10 ins., and the weight is 3¾ lbs.

As before mentioned, the method of making the cannon proper is open to improvement, and when I make another I shall have it cast solid, and bore or drill the barrel out.

In conclusion, I would say that I shall be pleased to lend the patterns to anyone desirous of making one of these ornamental weapons of defence.

ACCUMULATOR MAINTENANCE.—An account of some researches that have been made on the maintenance of accumulator capacity is given in *l'Industrie Electrique*. The capacity of negative plates diminishes with time. This may be remedied by adding to the active material, before pasting, finely-divided coke, gypsum, or pumice-stone. This procedure not being applicable to plates already in use, it has been found that the same result may be obtained by the addition of certain organic substances to the electrolyte. The best substances to use are albumen, glue, gum, starch, sugar, and phenol, also pyrogallic, tannic, and oxalic acids.

Wheatstone Bridge & Variable Resistance-box.

By "BRIDGE."

THE following article and drawings show a design for a Wheatstone bridge of the direct-reading type. The arrangement, as shown, will be found very convenient in use, and can be applied to the measurement of resistances of conductors and electrolytes, etc., within certain limits. It may also be used as a variable resistance for experimental purposes, providing the current does not exceed ·5 ampere (about). The design is the outcome of considerable experience with the bridge in laboratory work, etc., the points of special note being as follows:—(1) The entire absence of plugs, thus overcoming the inconvenience of them getting thrown about and damaged and the trouble in making them; (2) the ease with which the battery and galvanometer connections can be changed; (3) practically direct reading; (4) the provision of a dial containing resistances of 1-10th of an ohm, this being especially useful for certain kinds of measurements, such as low resistances. The range of measurements is as follows:—

Ratio arms equal, from ·1 to 500 ohms, with an accuracy of ·1 ohm;

Ratio arms 10 : 100, from 1 to 5,000 ohms, with an accuracy of 1 ohm;

Ratio arms 100 : 10, from ·01 to 50 ohms, with an accuracy of ·01 ohm.

More will be said later about the measurement of such low resistances as ·01 of an ohm. The construction of the apparatus will now be described.

The Box.—This may be made and finished in whatever way the maker desires, and must be provided with a deep lid; the measurements inside are 13 ins. by 7 ins. by 4½ ins. deep. Round the inside of box is a ¼-in. beading, upon which the board carrying dials rests, being fastened by a few screws, the board, when fixed, being flush with the edges of the box.

The Dial-board.—This board, which carries the dials, etc., measures 13 ins. by 7 ins. by 7-16ths in. thick, and is made from well-seasoned hardwood, the necessary holes being drilled carefully to the proper sizes (shown on drawings). Afterwards, it may be soaked in melted paraffin wax if the maker wishes to increase the insulation. The diameter of circle formed by contact studs requires dividing out on board to get centres of studs, as no workable dimension can be given. There are four dials: the tenths dial, containing eleven studs; the units and tens dial, containing ten studs each; and the hundreds dial, five studs; giving resistances respectively of 1, 9, 90, and 400 ohms, and a total of 500 ohms. If the maker desires he can make the box a little longer, and put more coils in the hundreds dial, thus increasing the maximum reading.

The ratio arms of bridge contain two resistances of 10 ohms and two resistances of 90 ohms, giving ratios of 10 : 10, 100 : 100; 10 : 100; and 100 : 10. It may be wondered why these resistances have been made so high; it would be cheaper to use lower resistances, still keeping the same ratio, but the best plan is to make them as shown, as the values are the same as are put on the very best instruments, and is the result of experience gained in their manufacture.

Levers for Dials and Ratio Arms.—The levers for resistance dials are shown (Fig. 2) made in two methods. The one showing the milled head is to be preferred to the other, although it calls for more work. The levers are formed of three layers of hard, springy brass, about 1-32nd in. thick, each being bent over at one end to press on to contact studs; the layers are soldered together at the pivot end with washers 1-16th in. thick, the joint being well sweated. A small rivet is put through close to the pivot end, as shown on drawing. The milled nut is made of brass (being much easier for constructional purposes than ebonite), and is tapped out 3-16ths in., also the boss of lever. The spindle for swivel stud is of 3-16ths-in. brass, and should be a good fit. One end is screwed 3-16ths in. for ½ in. of its length, the other end turned down to ⅛ in. and screwed. When fitting these parts together, screw lever on to spindle as far as the thread will allow; then screw milled nut hard up against lever boss, finally sweating the whole thoroughly and fitting a pin, as shown. Care must be taken to get each end of layer which is bent over to make a good contact with stud; although the layers are shown touching one another all the way along, the adjustment of the ends must be such that each layer can adjust itself without dropping on to the one below. The locknuts at end of spindle are for taking up any wear and for keeping lever boss pressed down on to pivot, but not so hard as to interfere with the moving of levers.

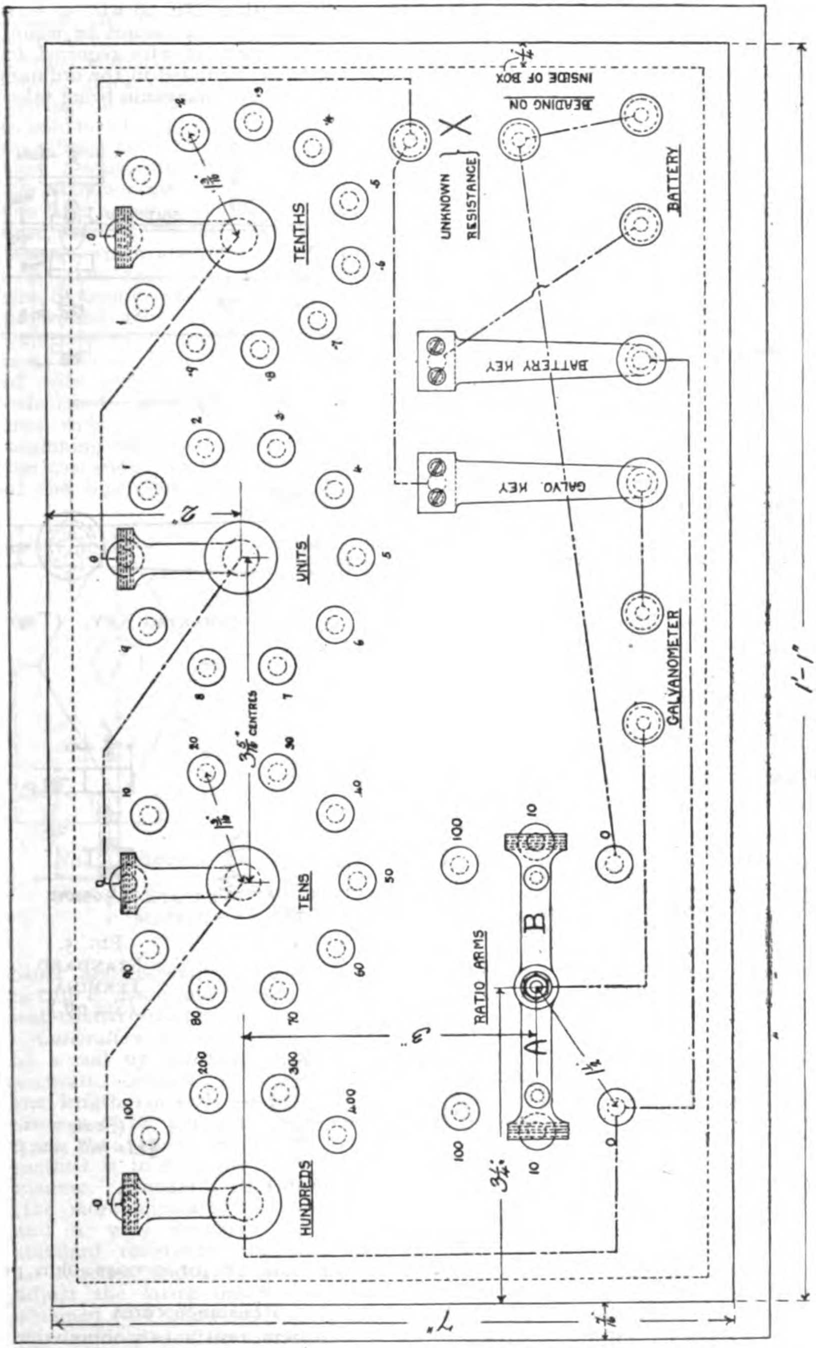


FIG. 1.—PLAN OF BOX SHOWING DIAL BOARD. (*Half full size.*)

WHEATSTONE BRIDGE AND VARIABLE RESISTANCE.

The ratio arms have levers constructed in the same way as described above, the pivot being the only difference; full particulars may be got from Fig. 2. All pivots are bolted to board and provided with large washers for soldering the connecting wires to. The contact studs are all the same size, and no doubt, can be purchased ready-made; the threaded end of each has a narrow groove cut in it for soldering the resistance wire in.

Terminals and Circuit-breaking Keys.—There are six terminals required—two each for battery, galvanometer, and the unknown resistance; the shank must be long enough to pass through board the use of this material reducing to a minimum any variation of resistance due to a rise in temperature. The tenths coils are made from No. 18 S.W.G., because the length of No. 26 wire to form ·1 of an ohm is so short that it cannot be wound non-inductively. The length of wire required for the various resistances is calculated in the ordinary way, the specific resistance of manganin being taken

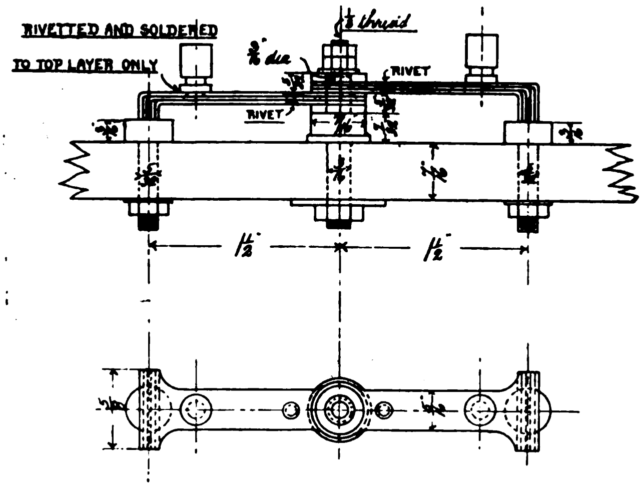


FIG. 2.—LEVER FOR RATIO ARMS. (*One off.*)

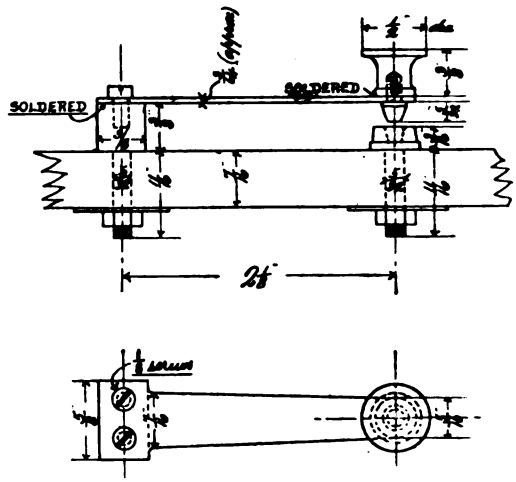
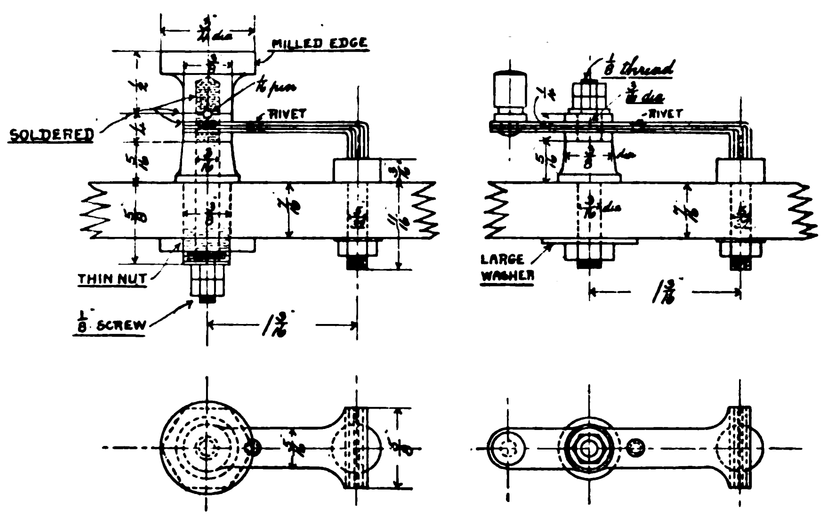


FIG. 3.—CIRCUIT-BREAKING KEY. (*Two off.*)



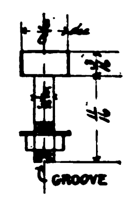


FIG. 5. STANDARD TERMINAL. (*Six off.*)

(*Scale: ⅔rds full size.*)

FIG. 4.—ALTERNATIVE DESIGN OF LEVER FOR DIALS. (*Four off.*)

DETAILS OF WHEATSTONE BRIDGE.

and allow for a back nut. The keys for battery and galvanometer circuit are of the usual design, with the exception of the contacts, one being cone shaped, and is pressed down into a suitably shaped hole in the other, thus forming a clean contact each time.

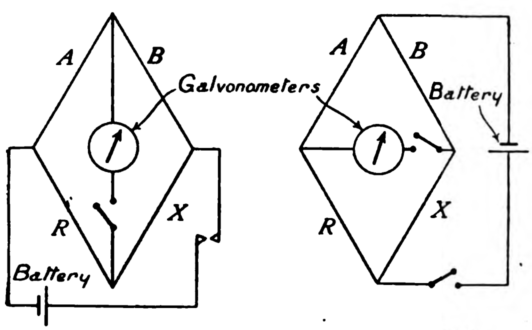
Resistance Coils.—The whole of the resistance coils with the exception of the tenths coils are made from No. 26 S.W.G. D.S.C. manganin wire, as 42 microhms per cub. c.c., or ·000042 ohm per cub. c.c. The formula is:—

$$\text{Length} = \frac{\text{Resistance} \times \text{area}}{\text{Specific resistance in ohms.}}$$

All the values are in centimetres, being reduced to inches afterwards. The length required for 10 ohms is calculated below:—

$$L = \frac{10 \times \cdot 00163}{\cdot 000042} = 388 \cdot 1 \text{ cms.} = 12 \cdot 75 \text{ ft. approx.}$$

The other lengths can be obtained from this result, except the tenths coils, which have a different diameter wire and must be calculated separately. If the wire is wound on a metal bobbin, the bobbin must be split longitudinally to prevent induced currents in bobbin. Another method is to use a wood stem 3-16ths in. diameter, glueing thick cardboard ends on, one end having two lugs on for screwing up to board. The diameter of bobbins must be such that they will go in between, or at least close to, nuts of contact studs to which they belong. In the case of the hundreds coils the diameter may be a little too large, owing to the length being limited by depth of box. However, reference to the article on coil-winding calculations, which appeared in THE MODEL ENGINEER some time ago, will enable the maker to get the size of bobbin easily. The wire in all cases must be wound non-inductively, so as to prevent self-induction in the coil. This method of winding is as follows:—Having cut off the required length of wire (which should be slightly longer than calculated), double in two, which gets the two free ends together; then wind on to bobbin, beginning with the closed end and finishing with the free ends. In this method the magnetic effect of one wire neutralises the magnetic effect of the other and prevents induced currents when the circuit is made and broken. Each layer must be well coated with paraffin wax.



No. 1 *Method.* *No.* 2 *Method.*

FIG. 6.—DIAGRAMS SHOWING ALTERNATIVE METHODS OF CONNECTING.

Calibration of Coils.—To determine the resistance of a coil by calculation only is not sufficiently accurate, because of the inability to measure the length correctly, and, again, the specific resistance of the particular alloy might differ slightly from that given in electrical tables. The best method is to calibrate each coil in the following manner. Procure a standard resistance of 1 ohm (the more accurate the better), a standard cell, and a very sensitive galvanometer. Put the standard resistance, the cell, and galvanometer all in series, and a variable resistance also. Now adjust the latter until a readable deflection is obtained (say about 20 to 30 degs.); then take standard ohm out, and substitute a 1-ohm coil to be tested, adjust the length of wire until the same deflection is obtained; the correct length of wire is that between the edges of terminals. Do not count that which is clamped under terminals. Carefully mark the true length of wire, so that when it is put in box the wire can be pushed into the solder up to the marks on wire. The standard ohm and the ones which are tested can now be used in series for the calibration of other coils, the rest of the coils being treated in a similar manner. The tenths coils require testing against a standard coil of 1-10th of 1 ohm; in each case the galvanometer will require shunting, so as to keep the deflection reasonable. This method is for those who cannot send their coils away to be calibrated. Those who attend a technical college will no doubt be able to calibrate their coils with a post office box, this being one of the best methods. Anyone wishing for more accuracy can again test the coils after they have been fixed in box, and any errors corrected by pushing the wire end in or out of solder, as the case may be. In all tests keep the connecting wires short and as thick as possible. Special attention must be given to the calibration of the tenths coils, the resistance of connecting wires being taken into account. It is advisable to solder the connections when testing low resistances like these.

Connecting Wires.—The wires for the various connections of box must be made from as large a gauge as possible; the resistance of the total length must be kept very low, and should not exceed ·002 ohm, the joints being well soldered in all cases.

Method of Measuring.—To have the bridge arranged in the most sensitive manner the different arms A, B, R, and X should be as nearly equal to one another as possible, also the battery and galvanometer, whichever has the greatest resistance, should join the junction of those two arms of bridge having the greatest resistance to the junction of those two arms having the lesser resistance. There are only two ways of connecting up, which are shown in the two diagrams (Fig. 6). A sketch of these figures pasted in lid of box will be convenient for reference.

In making measurements, the ratio of A to B depends on what the unknown resistance is, always remembering to have the most sensitive arrangement of bridge, as before mentioned. Let us take an example. Suppose the unknown resistance is fairly high, say 400 ohms. First make A and B each as nearly equal to the unknown; in this particular case A and B will each be 100. Now adjust R (*i.e.*, the dials) until the galvanometer shows no deflections on pressing the keys down, always remembering to close the battery key before the galvanometer key. When the value of R has been added up, the unknown value can be determined from the following equation:—

$$A : B :: R : X \quad \text{or} \quad \frac{A}{B} = \frac{R}{X} \therefore X = \frac{B}{A} \times R$$

In this case the ratio of A to B is unity, therefore R is equal to X. The same result would be obtained if A and B were each 10. The galvanometer and battery will be connected as shown by No. 1 method. The lettering of the terminals and keys shown on drawing are for No. 1 method; if No. 2 method be used, then put battery on galvanometer terminals and galvanometer on battery terminals; then the letters on the keys will be reversed.

No mention has yet been made with regard to the galvanometer. Any type may be used; the more sensitive, the more accurate will be the results.

It has previously been stated that with a ratio of A 100 and B 10 resistances as low as ·01 of an ohm can be measured. This, however, can only be done with accuracy when the various errors of the bridge have been determined, the most important errors being—(1) the resistance of the connecting wires, part being in different arms of the bridge; (2) resistance of contacts between the moving levers and studs; (3) any errors which may arise from slight inaccuracies of calibration of coils. Errors due to connecting wires can be calculated from electrical tables: those due to contacts are variable, depending on cleanness of surfaces, so the cleaner they are kept the better. Errors arising from inaccurate calibration can be corrected. The best method for determining these errors would take too much space to explain; those who wish to read about these things will do well to get such a book as "Absolute Measurement in Electricity and Magnetism," by Gray. Anyone who requires further information about the description or other points which are not quite clear I shall be only too pleased to assist.

How It Works.

IX.—The Walschaerts Valve-Gear.

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

(*Continued from page 449.*)

IN the construction of the Walschaerts valve-gear the desired travel of the valve, the lead, and the maximum cut-off which determines the lap

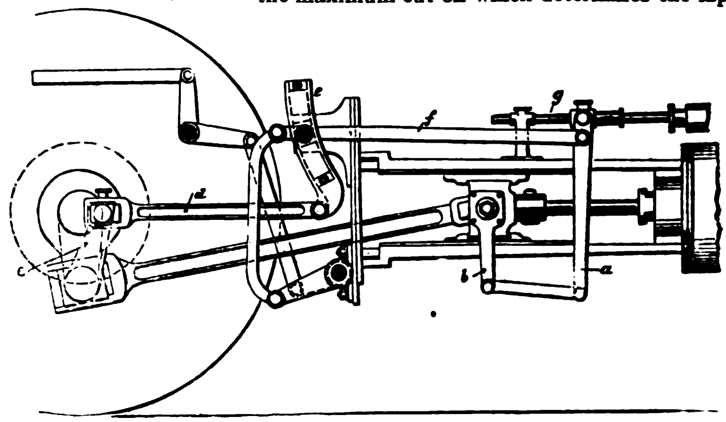


Fig. 3.—General Application of Walschaerts Valve-Gear for Outside Cylinders.

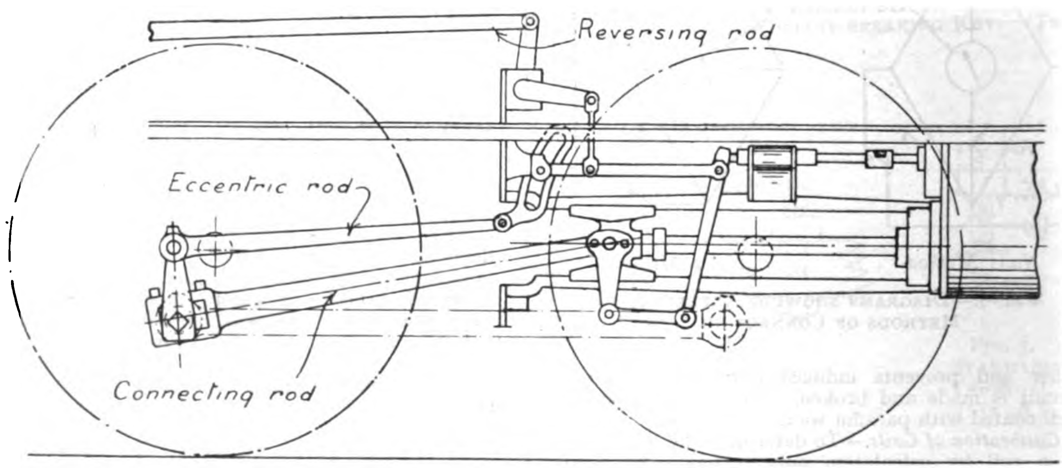


Fig. 4.—Walschaerts Valve-Gear for High-pressure (Outside) Cylinders. Great Northern Four-cylinder Compound Express Locomotive No. 1300.

(*Built by the Vulcan Foundry Co., Ltd.*)

A Lady Amateur Turner.—Lady Gertrude Crawford, wife of Capt. J. H. Crawford, 32nd Lancers, Indian Army, has been admitted to the freedom of the Turners' Company, in recognition of her skill as an amateur turner. She has been a frequent exhibitor at the exhibitions held at the Mansion House by the Turners' Company, and has been the recipient of first-class certificates for excellence and originality of workmanship. Lady Gertrude said that it was from her father, the late Earl of Sefton, that she received her first lessons.

of the valve, are first selected. The stroke of the piston being given, the combination lever is proportioned so that a motion equal to the lap and lead is given to the valve when the crosshead moves from one end of the stroke to the other. The link is so located that the radius bar will have a length of at least eight times (and if ten or twelve times, so much the better) the travel of the link block, and the radius of the link should be equal to the length of the radius bar. The chief point of difference between the Walschaerts and Stephenson motions is that the former gives to the valve a constant lead at all cut-offs, whereas the latter produces an increase of lead which becomes excessive at short cut-off. The Walschaerts motion as usually constructed does not lend itself as freely to adjustment as does the Stephenson motion with independent eccentrics, and for this reason it is not as liable to get out of order.

In the drawing (Fig. 3) *c* is the return crank, fixed on the end of the crank pin in the driving wheel, which communicates a reciprocating movement, through the rod *d*, to the slotted sector *e*, which latter is pivoted at its centre. The motion of the sector is communicated through the radius link *f* to the fulcrum of the lever *a*, and thence to the valve spindle. The radius of the sector curve is equal to that of the link *d*, and, the two being fair at the beginning of each stroke, the lead remains constant, as before explained, independent altogether of the position of the slide block in the sector. The lever *a* is linked at its lower end to the stud-bar *b*, which latter is secured at its upper extremity to the cross-head by which it is reciprocated with a vibration equal to the stroke of the piston. The upper limb is very short, and is so proportioned as to reciprocate

cylinders, and the sector takes its reciprocating movement from a return crank in the usual manner. When first built this engine had two sets of Stephenson motion inside the frames for actuating the four slide valves, but later this arrangement was taken out and the present one substituted.

The drawing Fig. 4 shows the valve-gear for the high-pressure cylinders of No. 1300 engine built for the Great Northern Railway by the Vulcan Foundry Co., Ltd., of Newton-le-Willows, Lancashire.

For the Bookshelf.

THE TWENTIETH CENTURY BOOK OF RECIPES, FORMULAS, AND PROCESSES. By Gardner D. Hiscox. London: Crosby Lockwood & Son. Price 12s. 6d. net; postage 6d.

There is probably no book so useful on the shelf of a workshop as a good book of recipes, and the present volume seems an excellent example of its class. It is true that it covers many more subjects than usually come within the scope of workshop

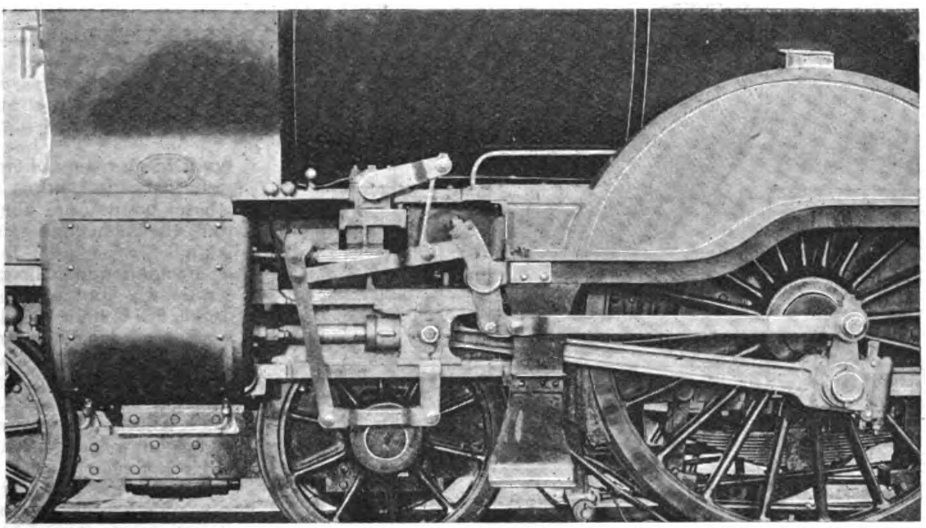


FIG. 5.—WALSCHAERTS VALVE-GEAR APPLIED TO OUTSIDE CYLINDERS. G.N.R. FOUR-CYLINDER SIMPLE ENGINE NO. 271. (*From "The World's Locomotives."*)

the valve spindle *g* through a space equal to twice the linear advance, and thus to place the valve in position, with constant lead at the beginning of the stroke. The illustration Fig. 4 is taken from D. K. Clark's "Steam Engine."

The American Locomotive Company have, in view of the increasing demand for the Walschaerts gear in the United States, adopted specified nomenclature for all the parts of the gear, and in one of their recent catalogues have published a diagram with the names of the parts shown in place. This diagram is shown in Fig. 2 (*see* page 448).

The remaining illustrations show the Walschaerts valve-gear as fitted to two four-cylinder locomotives on the Great Northern Railway. The photographic reproduction, Fig. 5, shows the gear as fitted to the outside cylinders of the four-cylinder simple engine No. 271. The valves work on top of the

operations, but the only disadvantage attaching to this is that the book will probably be frequently abstracted from the workshop shelf by the powers that rule the domestic portion of the owner's establishment. Thus will its general utility be vouched for. From the workshop point of view we find that the matter has been well and carefully selected, and includes the following subjects among many others: Adhesives, alloys, amalgams, belt pastes, boiler compounds, bronzing, cements, ceramics, cleaning preparations and methods, dyes, electro-plating and electro-typing, enamelling, fireproofing, glass, inks, lacquers, leather, lubricants, metals, paints, photography, plaster, plating, polishes, rubber, solders, treatment of steel, stone, varnishes, waterproofing, and wood stains. It is stated that there are nearly 10,000 recipes in all, and the book covers nearly 800 pages.

Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page* 348, *Vol. XIV.*)

IN drawing a cube we define it by means of lines representing the edges where two adjacent faces meet. There are an unlimited number of positions in which a cube may be drawn in relation to the planes of projection. The edges of the cube may be taken as the intersection of the planes in which the various faces are situated. A sphere has no edges, and hence it can only be represented by means of a circle of a diameter equal to the diameter of the sphere. A little reflection will make it clear that the character of the lines defining the cube is quite different to that of the line defining the sphere. A sphere may be considered as the surface described by a (semi)-circle revolving on its diameter; in the same way, a cylinder may be conceived to be described by a straight line revolving around a parallel line as an axis; and a cone by a line revolving around an intersecting line as an axis, the point of intersection being the apex of the cone. In projecting points on the surface of a sphere, cylinder, or cone the idea of these revolving lines is of great assistance in defining the proper positions in various views.

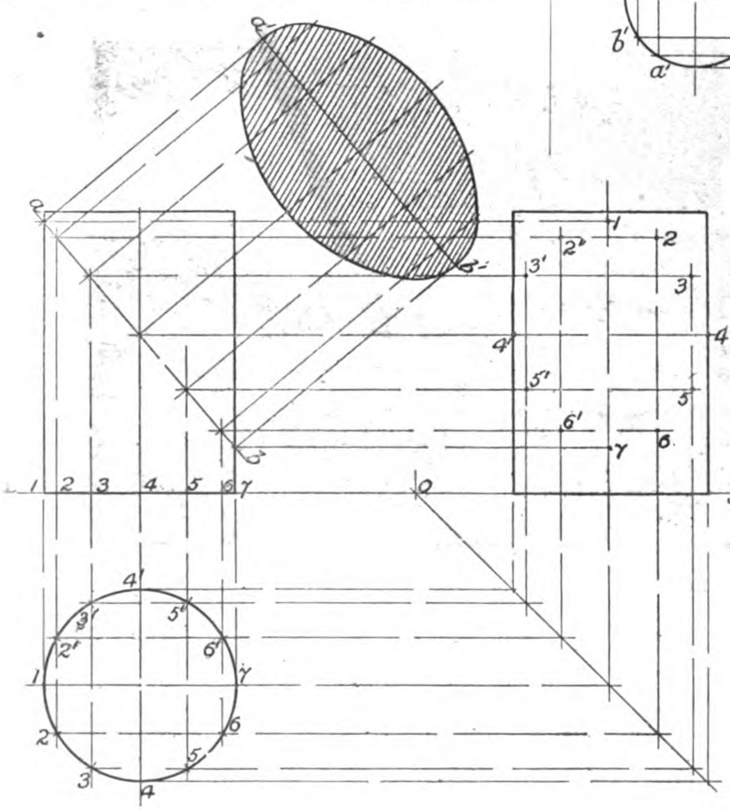


FIG. 33.

In mechanical drawing so many instances occur of the intersections of plane faces with turned surfaces—spherical, cylindrical, and conical—that it is desirable to give some careful consideration to the subject. To this end, we introduce a few problems in solid geometry.

Three views of a cylinder are given (Fig. 32)

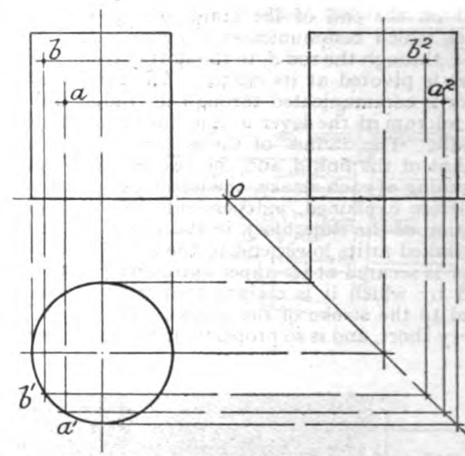


FIG. 32.

and the elevation of two points *a* and *b* on its surface. Project these points as they appear on the plan and side elevation.

From *a* and *b* drop the verticals *a a'* and *b b'* cutting the circle in *a'* and *b'*. Through *a* and *b* draw horizontal lines across the side view from *a'* and *b'*, as in Fig. 25, project lines cutting these at *a*2 and *b*2. Any plane passing through the points *a* and *b* will also pass through *a*2 and *b*2. Suppose that the cylinder is cut by a plane passing through *a* and *b* (Fig. 33) at right angles to the plane of projection. We could by projecting a number of lines on the surface of the cylinder and cutting this plane, as 1, 2, 3, etc., find the corresponding points on the side view as shown, a curve drawn through these points giving the intersection of the cylindrical and plane surfaces. To obtain the true form of the intersection, project at right angles to *a b* the lines across the line *a*1 *b*1, which is parallel to *a b*. To get the various offsets, measure the half the distance 2 to 2, 3² to 3², etc., from *a' b'* on the corresponding lines.

To project points on the surface of a cone we may either draw lines from the apex through these points, as in Fig. 34, or by means of circles passing the points, as in Fig. 35. The former method is generally preferred.

There are, however, several cases where the

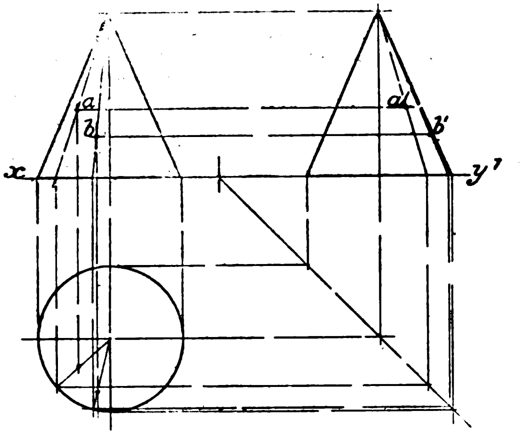


FIG. 34.

method of using circles for the projection of points on a cone is convenient, and it has the further advantage of being applicable where the apex of the cone is not available. By the use of circles we can also project points on trumpet-shaped surfaces, and examples will be given later of this method of projecting various details in connection with work to be turned in a lathe.

We have given in Fig. 36 an example of the method of projecting the intersection of a plane with a cone, the conditions being identical with those given for the example shown in Fig. 33. All lines passing through the points 1, 2, 3, etc., must in the case of the cone meet in the apex.

The projection of points on a sphere is a very simple matter. Let *a* (Fig. 37) be a point on the surface of the sphere defined by the given circle; draw a vertical line passing through *a* and extending to the boundary line of the sphere in both directions. We may conceive this line to be a circle on the sphere passing through the point *a*. This circle may be projected on the side view, as shown; a horizontal line *a a*1 will intersect the circle at the exact position that the point *a*1 will occur in the side view, no plan being necessary as in the case of the cone to determine this. The point *b*1 may be determined to correspond with *b* in a similar manner.

It does not matter if we invert the process and draw the circles first, as shown in Fig. 38, where a sphere is intersected by a plane passing through the points *a* and *b*. Draw several circles having the same centre as the sphere. These circles are projected to the side view, enabling various points where the plane intersects the sphere to be deter-

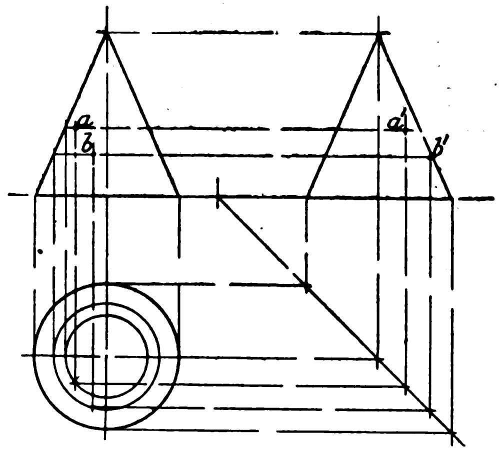


FIG. 35.

mined, a fair curve joining these points gives the outline of the part of the plane within the sphere. Note that the oval (shown hatched) is the elevation of the intersection; the true shape is a circle of a diameter equal to the line *a b*.

As an example, the student is required to draw

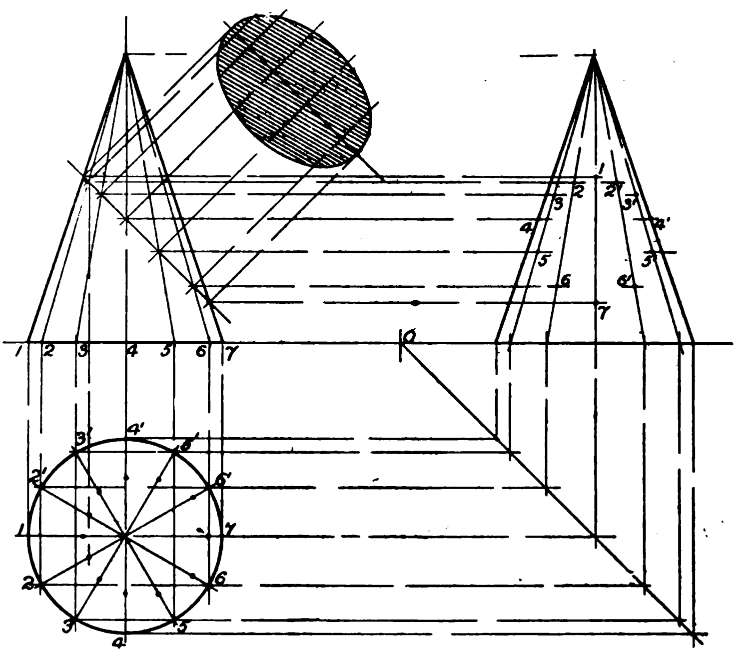


FIG. 36.

a cone 2½ ins. diameter at the base and 3 ins. in height, and its intersection by a plane at a distance of ½ in. from and parallel to the axis.

Begin by drawing the ground line *x y* (Fig. 39), next the plan, which will be a circle of 2½ ins.

diameter, through the centre erect the line representing vertical axis of the cone. Measure off 3 ins. above the ground line for the apex, and complete the elevation. Draw a line parallel to the axis at a distance of ½ in., cutting the plan and elevation; this will represent the "trace of a plane." From any convenient point (O) draw a line at 45 degs. to enable the side view to be projected; complete the side view; draw at convenient distances a number of lines horizontally across

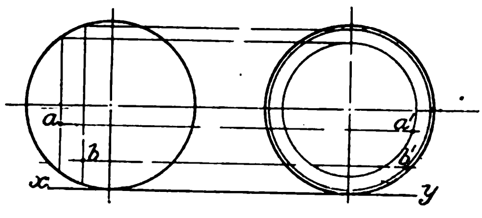


FIG. 37.

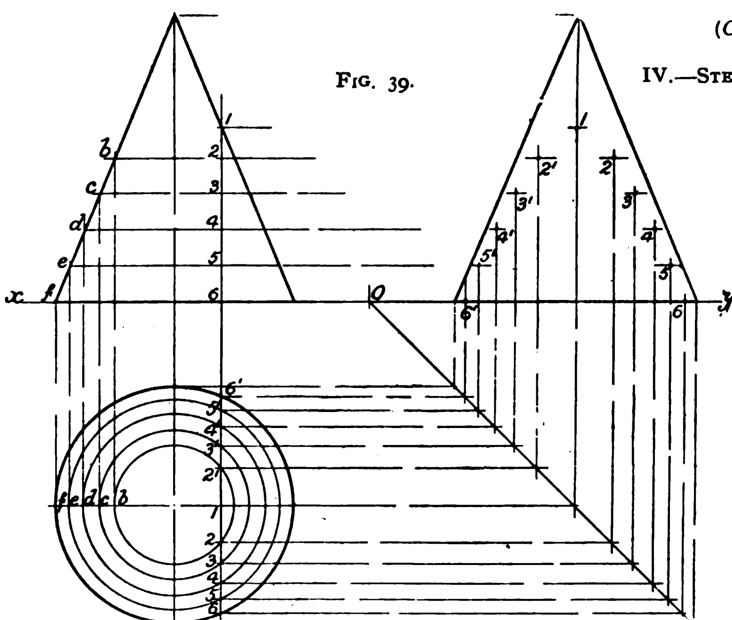


FIG. 39.

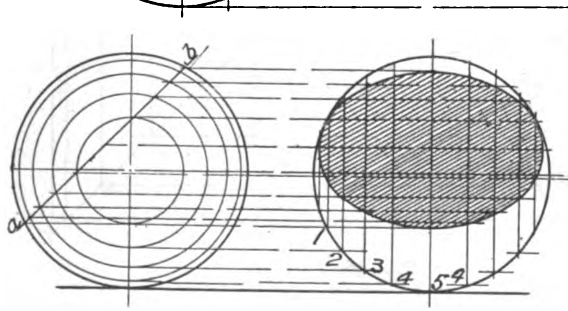


FIG. 38.

the front view, as $b2$, $c3$, etc., which may be assumed to represent circles round the cone. Three circles may be projected to the plan, the corresponding circles being $b22^1$, $c33^1$, etc.

We have now a series of circles cut by a vertical plane, the plan showing two points of intersection to each circle, as $2\,2^1$, $3\,3^1$, etc., giving the horizontal distance between these points. Project these points (as shown) to the side view by means of lines to meet the relative lines from the front view. A fair curve may now be drawn through the points, as in Fig. 38. If correctly drawn, the result will be a hyperbola, vertex being at 1. All the sections of a cone have very important and useful properties, of which we may have an opportunity to speak later. The methods of projecting these are given, as being necessary to enable the student to draw correctly the examples following.

(To be continued.)

A Design for a Small Model Undertype Engine.

By HENRY GREENLY.

(Continued from page 419.)

IV.—STEAM PORTS PROPORTIONS, VALVES, AND VALVE SPINDLES.

ALTHOUGH the previous article dealt at considerable length with the construction of the cylinders, one point of importance was omitted—viz., shall the cylinders be cast in iron or gun-metal? Each material has its disadvantages, the only one of moment in connection with cast iron being the tendency of this material to rust when the engine is not being used. No trouble should now-a-days be experienced in obtaining good soft cast-iron or clean castings.

With gun-metal cylinders, iron valves are almost essential to best practice where dry steam is used at a high pressure and temperature. Where brass and brass are working together under such conditions, a sticky deposit made up of particles of brass is formed between the rubbing surfaces and materially increases the friction. The application of oil does not seem to improve matters. The friction is lessened only for the moment; as soon as the oil runs away the old trouble reappears. With iron this drawback is practically non-existent. The writer believes in lubricating cast-iron cylinders and slide-valves. In considering the pistons, cast iron presents certain advantages, of which the writer will speak later.

The accompanying drawings include views of both the cylinder covers, valves, valve spindles, and intermediate valve spindle guides. Figs. 10 and 11, which were published with the last article, show, in addition to the valve chests, the dimensions of the high- and low-pressure steam ports.

In the case of the H.-P. ports the usual rule for small engines of medium speed is exceeded. The rule is as follows:—

Steam port width = 1-16th of stroke of piston.
Exhaust port width = $\frac{1}{8}$ of stroke of piston.
Length of ports = $\frac{1}{2}$ of piston diameter.

With a cylinder of the same size as that of the H.-P. cylinder of the present model, this would give 3-16ths in. by $\frac{5}{8}$ in. long, the idea being to provide as large as possible steam port area for the passage of the exhaust. The L.-P. ports conform to rule as regards length, the width of the ports agreeing with that of the H.-P. cylinder. This is advisable, as any

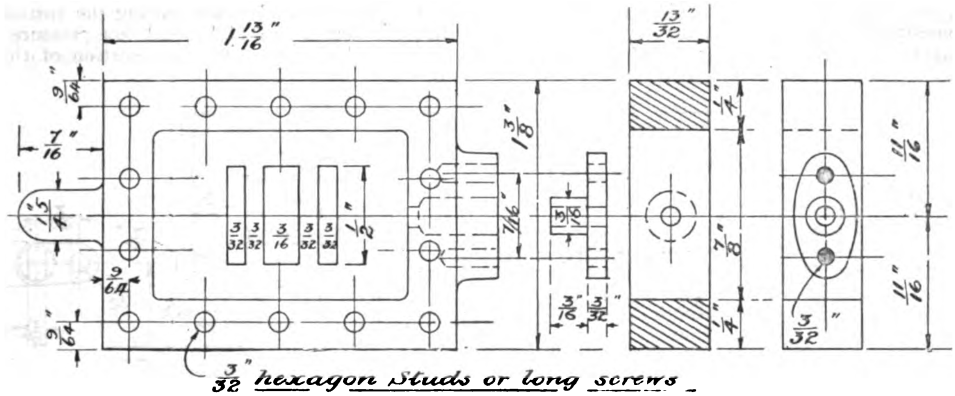


Fig. 11.—Low-pressure Steam Chest and Ports.

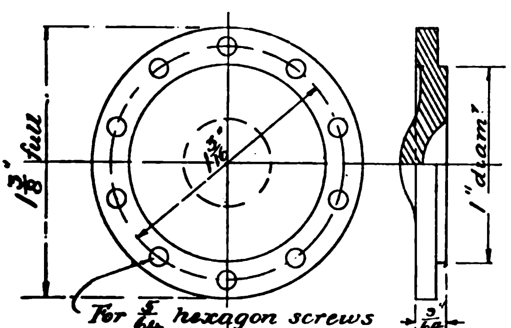


Fig. 12.—Low-pressure Front Cylinder Cover.

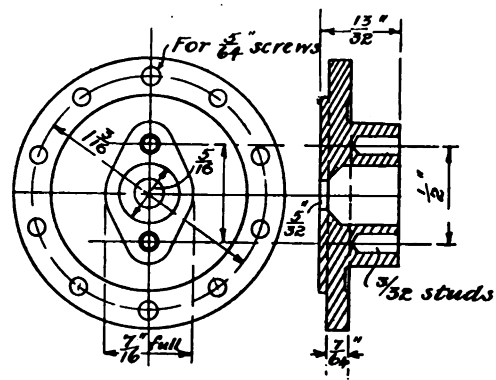


Fig. 13.—Low-pressure Back Cylinder Cover.

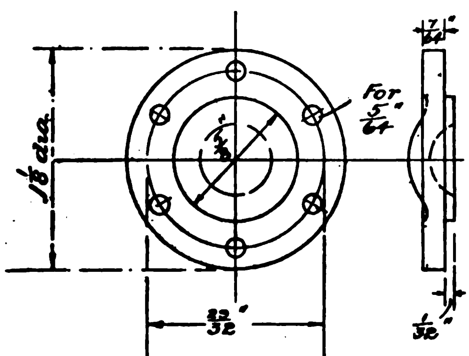


Fig. 14.—High-pressure Front Cylinder Cover.

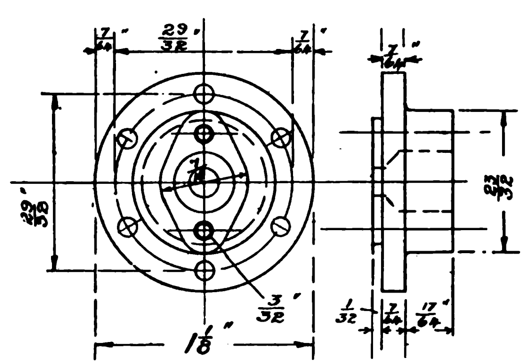


Fig. 15.—High-pressure Back Cylinder Cover.

Steam ports: 1-16th of 5-4ths = 5-64ths in. wide.
Exhaust ports: $\frac{1}{8}$ of 5-4ths = 5-32nds in. wide.
Length of ports: $\frac{1}{2}$ of $\frac{5}{8}$ = 5-16ths in. long.

Instead of this we have H.-P. ports 3-32nds in. and difference would necessitate a corresponding alteration in the throw of the eccentrics.

No novel feature is presented in the attachment of the valves to the spindles. The valves are first roughly shaped to the drawings from a piece of drawn brass rod* (where gun-metal cylinders are used), and then the exhaust cavity can be marked and chipped out with small chisels to the depth of 3-32nds in. in each case. Where a vertical slide forms one of the common objects of the workshop, the valve may be mounted in the vice, and with a small home-made end mill the cavity may be milled out to exactly the depth required. The

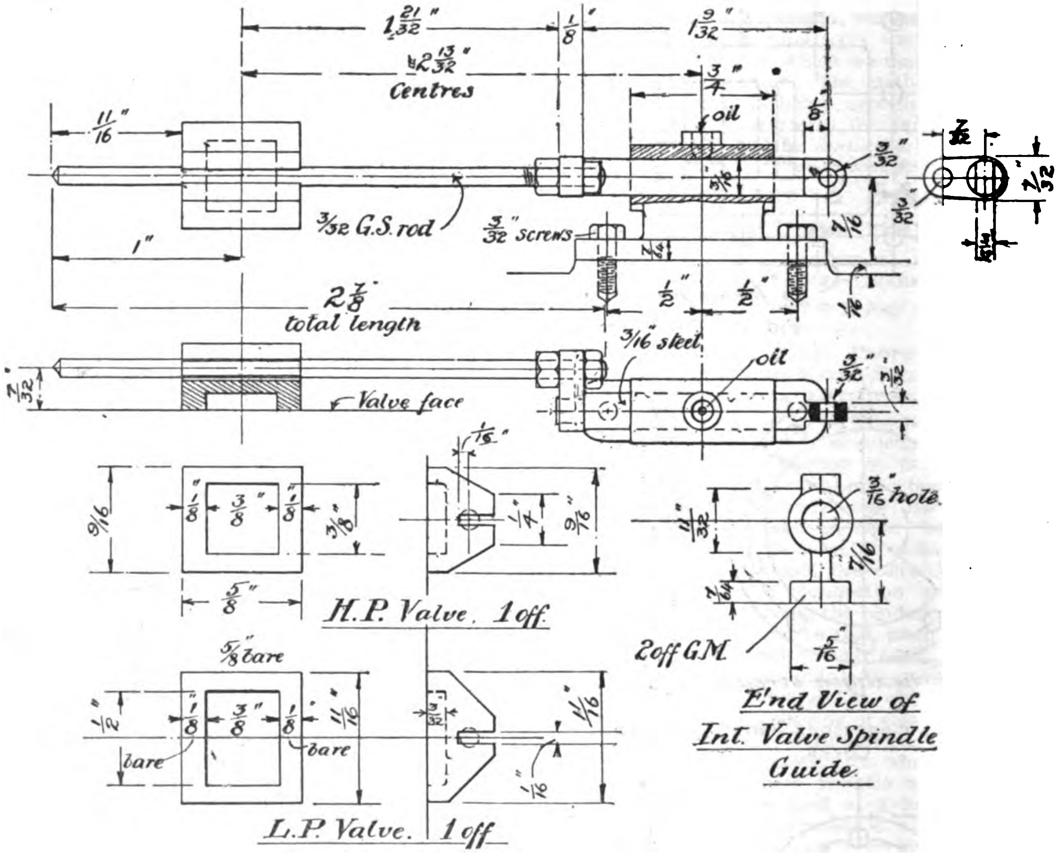


Fig. 19.—Valves and Valve Spindles. (*Full size.*)

radius of the corners will, of course, vary with size of the end milling tool, but if a hole of about 3-64ths in. diameter is first drilled in each corner of the valve, the maker should find it no trouble to make the corners of the cavity square in the usual way with a small chipping chisel.

When the cavity has been prepared the slot may be milled, sawn, or filed in the back of the valve, and the valve spindle filed to fit in the slot, as shown in the hand sketch herewith. The point to note in fitting the valve to the spindle is that while lateral and longitudinal slackness should not be present, the valve should be capable of rocking slightly, readily falling to the valve face of the cylinder when both the parts wear, and more particularly, of lifting from the face to allow of the escape of trapped water. The lift of the valve need not be more than 1-64th, as indicated in the drawings.

It will be noticed by comparing the two sketches that the lap of the high- and low-pressure valves varies slightly owing to the insertion of the word "bare" after the dimensions. By this the writer intends to convey that it is advisable to provide this valve with less advance, which means, of course, a later point of cut-off and compression on the L.-P. side of the engine. The valves may be machined to exact dimensions, and on erection the L.-P. valve may receive a couple of strokes with a smooth file, reducing the lap a small amount. No lead need be provided, but the H.-P. valve may be set with about 1-100th in. lead. The lap of the H.-P. valve is, of course, 1-32nd in.

The valve spindles may be made of hard German silver rod, 3-32nds in. diameter, with much advantage. As the eccentrics must be placed nearer the centres of the cylinders than the valve spindles, as a reference to the general arrangement drawing will show, an intermediate valve spindle should be used. This feature makes it possible to employ a

* The use of drawn brass rod provides a slight difference in the materials of cylinder and valves, which is very desirable. German silver is also suggested as a very good material for valves.

good and yet simple form of adjustable joint between the main and intermediate valve spindles. The writer abhors the practice of cranking eccentric rods.

The intermediate valve spindle and guide requires little description. The guide may be of gun-metal. The casting should be bored first and the base carefully filed so that it is true with the tool. Several processes might be adopted to ensure

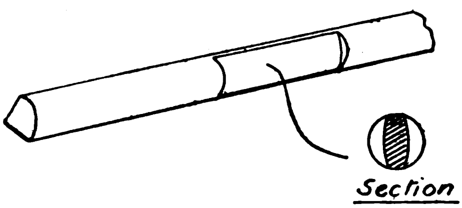


FIG. 20.—SKETCH OF VALVE SPINDLE.

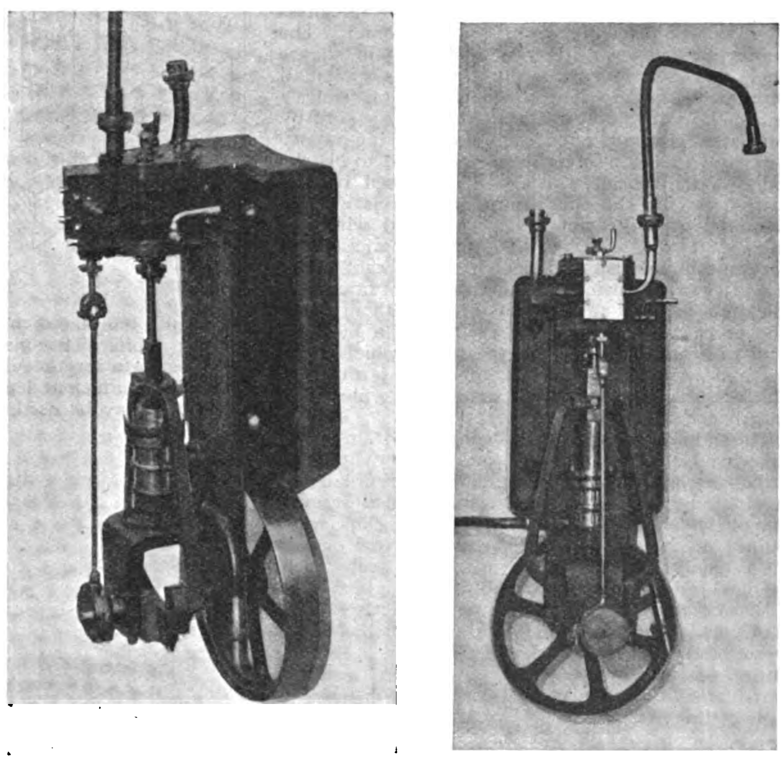
accuracy in this direction by machining only, but it is questionable whether many would care to prepare mandrels, etc., for such a simple job. The cranked piston of the intermediate spindle should be faced in the lathe, the chuck holding the spindle portion so that when the nuts are tightened up there is no tendency to twist the spindles out of line. The nuts may also be faced by placing them on a piece of rod, screwed to a shoulder, running in the lathe. To set the intermediate valve spindle couple the two spindles together firmly, and with the intermediate spindle placed in its guide, fix the latter down to the bedplate in such a position that it slides freely to and fro. Any slight adjustment may be made by filing the base of the guide, for as long as the bore of the latter is truly parallel to that of the spindle, it does not matter if there is a trifling difference in their heights from the bedplate, as the crank lug of the intermediate spindle will allow of this. The lug may be fixed by riveting to the shouldered-down end of the spindle, as indicated in the drawings. Do not finish off the vertical faces of the knuckle joint until the valve spindles have been erected and the eccentric rods and straps are made. When this is done the knuckle may be fitted and the hole rimered out to size.

(*To be continued.*)

A Built-Up Model Donkey Pump.

By ALFRED HALLIDAY.

THE photographs here reproduced show the front and side view of a small donkey pump, built up in my spare time entirely of scraps. The cylinder, a gun-metal bush, is 3-16ths in. thick, 1¼ ins. bore, and 1 in. stroke, double action. The ends were cut from a piece of ⅛-in. brass plate. These were softened and the backs bent to a right angle for riveting to the back plate. These were then sweated on to cylinder. The valve face was cut from a piece of gun-metal, the ports drilled and filed out. The steam ports are 5-32nds in. by 5-16ths in., and exhaust ¼ in. by 5-16ths in. One side was hollowed out to fit side of cylinder, then sweated and studded in place. The steam chest is built up of ⅛-in. brass, the sides, top and bottom sweated and studded to valve face. The cover is held in place by six ⅛-in. screws, cut from French wire nails. The top and bottom cylinder covers were cut from



TWO VIEWS OF MR. A. HALLIDAY'S MODEL DONKEY PUMP.

a piece of ¼-in. brass plate and filed down to 3-16ths in. They are held in place by six ⅛-in. studs and nuts to each. Three studs go right through from top to bottom; the rest are screwed and soldered in the ends. The studs were cut from ⅛-in. French nails. The gun-metal piston is 5-16ths in. thick, with a 3-16ths-in. groove, which is packed with asbestos thread and tallow. The piston-rod is 3-16ths-in. silver steel. The cylinder was next studded and riveted to the back plate, which is a piece of cast steel 8¼ ins. long, 2 ins. wide, and ¼ in. thick. The pump bed and crank carrier were next forged from a piece of old iron, 2 ins. wide and ⅜ in. thick. This job took about 2½ hours' hammering and constant running to the kitchen fire, which was used for a forge, and a 7-lb. weight for an anvil. It was then filed bright all over, drilled, and riveted to back plate, 5½ ins. from bottom of cylinder. The pump was next cut, drilled, and turned from a piece of solid brass 1⅞ ins. long and 1⅜ ins. diameter. This is held to the bed by five 5-32nds-in. screws, cut from a ¼-in. galvanised iron nail. The plunger is ½ in. diameter, with two grooves cut in the bottom end and packed with cotton and tallow. The gun-metal clack valves are ½ in. and 5-16ths in. and work in a brass chamber, sweated to back of pump. The valves have a lift of 3-16ths in. The crankshaft is built up in accordance with a wrinkle gained from The Model Engineer, and I find it makes a good sound job. The shaft and crankpin are ¼-in. diameter silver steel, and the webs ½-in. by ¼-in. wrought iron. The bearing brasses were made from the solid, afterwards sawn in two, and pieces of brass the thickness of saw-cut, fitted to form a true round. The connecting-rod was made from a piece of ¼-in. square steel, and bent to shape by the aid of a small paraffin blow-lamp and a small pair of smith's tongs, the joint being made at the top by ⅛-in. by ¼-in. steel straps riveted each side, leaving a gap ½ in. by ¼ in. for plunger to be connected to piston-rod. The flywheel, which was purchased from a scrap-heap for the small sum of 2½d., is 4⅜ ins. diameter, and the rim ⅞ in. wide, and with the balance it weighs 15 ozs. The eccentric straps were cut in one from a piece of ¼-in. brass plate, and afterwards sawn in two, and pieces of brass, the thickness of saw-cut, fitted to keep them true. The eccentric sheave was turned from a piece of ⅜-in. iron and keyed on to the shaft, which gives the gun-metal slide valve a travel of 5-16ths in. The key-way was cut with a small square file. The eccentric-rod is ⅛-in. silver steel.

The top lubricator and cylinder drain cock were hand-made from scrap brass. The cylinder is mahogany lagged, the lagging being held in place by four small brass bands and round-headed screws. The engine is backed on a piece of teak, 4 ins. wide and 1¾ ins. thick, the back being hollowed out to fit a small vertical boiler, which it keeps well supplied with water.

It works well and pumps very quietly. The unpolished steel and iron work is enamelled dark green, and fine red lined. My lathe is a home-made wooden arrangement, but with a little contrivance I managed to turn and polish most parts of this little model.

The Telegraphone.—The longest distance over which the human voice has been transmitted is believed to be from Montreal to Winnipeg, 1,430 miles, over a special copper wire along the Canadian Pacific Railway. This wire, which has intermediate connections only at North Bay and Fort William, was installed by the railway company for its telegraphone system, by means of which two messages—one by telephone and the other by telegraph—can be transmitted simultaneously over the wire.

Planing and Shaping for Amateurs.

By A. W. M.

III.—Methods of Holding the Work.

(*Continued from page* 446.)

A comparatively long bar of small cross section is somewhat difficult to hold directly upon the table, and is more conveniently clamped against an angle-plate (see Fig. 27). A short bar can, of course, be held in a vice which

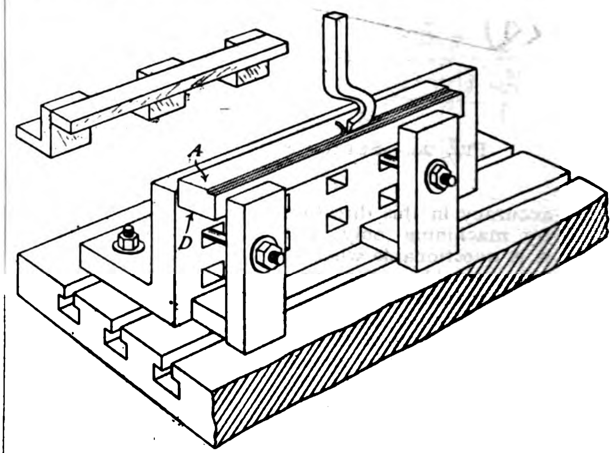


Fig. 27.

would be placed with its jaws lengthways with the table. The method shown in Fig. 27 is a substitute for the vice. If no angle-plate is available of sufficient length, two or three short angle-plates may be used, according to the length of the

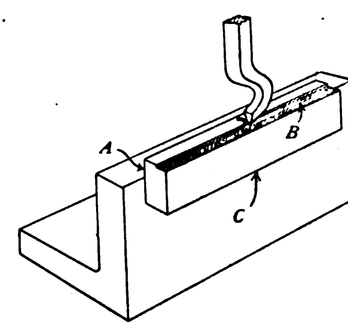


Fig. 28.

bar, as suggested by the small sketch, Fig. 27. When such a bar is to be planed all over, the way to proceed is as follows:—Plane one side A (as in Fig. 27), then take the bar out and clamp it as in Fig. 28 with the planed side A against the angle-plate. Now finish the top-side (B) as Fig. 28; take it out and reverse it end for end so as to bring the newly planed side underneath, still keeping the side which was first finished against the angle-plate,

Side C will now be on top; plane it and then clamp the bar as in Fig. 27, but with the remaining rough side D on top. Plane it and the bar will

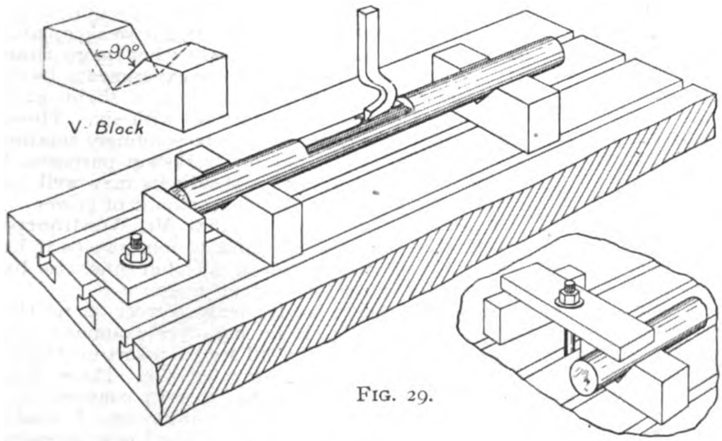


FIG. 29.

be finished with the surfaces all square to one another.

A circular piece of work, such as a plain cylinder or shaft, is conveniently held in V blocks. These are rectangular pieces of iron, usually planed all over, and having a V-shaped slot cut so as to be accurately square with the bottom surface (see small sketch Fig. 29). A pair of such blocks are an useful accessory to a planing or shaping machine. Fig. 29 illustrates the way to hold a shaft for the purpose of planing a keyway in it. The clamping plates should press where the

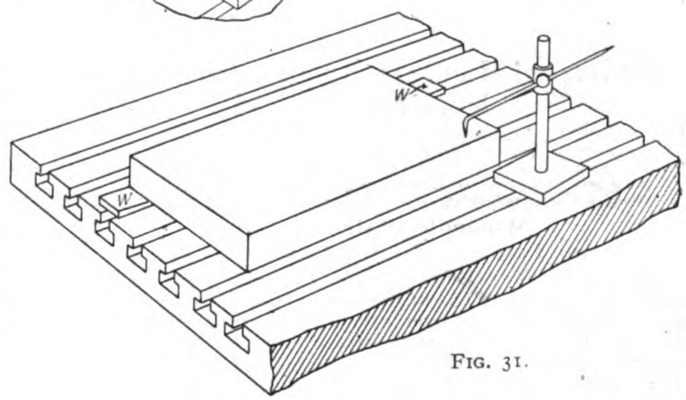


FIG. 31.

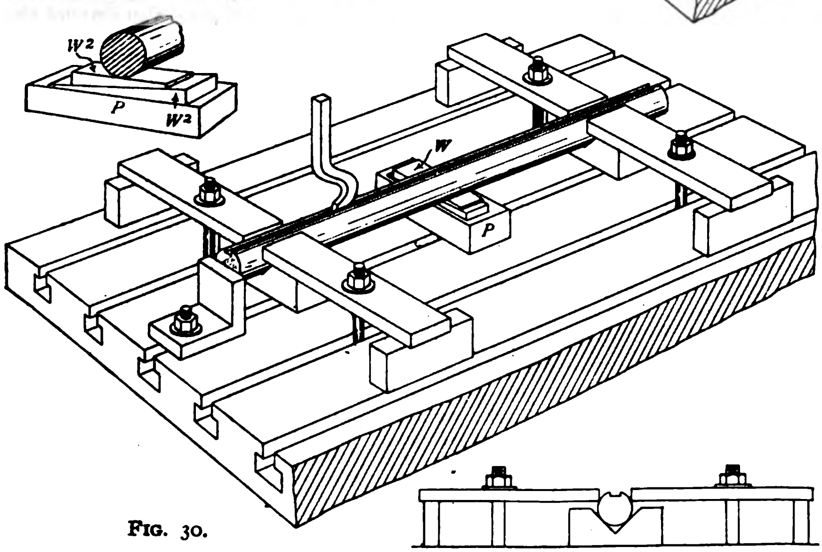


FIG. 30.

shaft is supported by the V-blocks to avoid bending it. If it is likely to spring under the pressure of the tool, something should be wedged underneath it; this is called "packing." If the keyway is to be planed along the entire length of the shaft the clamping plates (Fig. 29) would obstruct the passage of the tool. This may be obviated by the arrangement of pairs of plates adjusted to press equally on either side of the centre line (Fig. 30), just sufficient space being left between the ends of the plates for the tool to pass. The shaft is shown supported in the centre as previously referred to. A block of iron (P) is placed under the shaft midway between the V-blocks to support it; a thin wedge (W), or pair of wedges (W2 in small sketch), may be used to make up any difference between the height of P and the underside of the shaft.

Centre and guide lines should be marked upon the work, when necessary, before it is clamped to the table. (Information on marking-**off these lines is given in THE MODEL ENGINEER, Vol. X, page 282, which commences a series of articles upon the subject.) The cuts made by the tool will be parallel to the table of the machine for horizontal surfaces and perpendicular for vertical surfaces. The surface of the table is, therefore, the base to which the centre and guide lines on the work must be adjusted, or the tool will not follow these lines when cutting. A scribing block, or surface gauge, as it is also called, and a try square are almost indispensable for adjusting the work into position, whether it is clamped to the table or in a vice.**

Fig. 31 is an example of setting a plain rough slab of metal which requires to be planed upon one surface only; the amount of metal removed to be

as small as possible consistent with obtaining a smooth surface—to be just cleaned up only, as they would say in a factory. For this to be done, it is necessary, therefore, to adjust the slab so that the upper surface is parallel to the table. The surface gauge is set with the bent end of its scriber rod to just touch the surface of the slab. It is then moved to various positions, and if it will not scratch against the slab at all of them, some thin wedges (W) or packing pieces are driven under the low parts of the slab to raise it up at these places. When the scriber will scratch against the slab at a fair average of places, the upper surface will be approximately parallel to the table, and a minimum depth of cut will plane it level. The clamping plates or wedges are now applied, and the slab fixed in position. Before planing the surface, however, it should be again tested with the surface gauge to prove that the clamping process has not disturbed the adjustment. This final test should always be applied, because the work is sometimes disturbed by the clamping plates and wedges.

(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 intended for publication.]*

Windmill Design.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—May I be permitted, as one born under the shadow of one of the largest windmills in this country, and, moreover being, as I am proud to say, the son and grandson of two of the most experienced and best known wind-millers in Kent and Sussex, to add a few words to Mr. Woodthorpe's very interesting letter?

In the first place, Mr. W.'s experience is exactly in accord with what is well known, viz., a windmill with cloth sails *cannot be properly regulated.* Practically there are only two systems of self-acting sails. (The proper expression employed by the old millwrights is "sweeps," the expression "sails" being strictly only applied to the canvas cloth spread on the sweeps.) These two systems are briefly "spring" sweeps, where each sweep separately is regulated by a spring and consequently the mill has to be pulled round by hand and each sweep "sailed out" before starting; and, secondly, what is known as the "patent" sweeps, where *all four* sweeps are acted on at once. In both of these systems the place of the "cloths" is taken by a series of flaps called "shutters," which swing on pivots, and are acted on by a system of rods and links in the different manner previously stated.

I quite agree with Mr. Woodthorpe respecting the American type of mill—they do *not* give so strong a drive as those with four or six arms, but they run steadier, which is the reason many persons prefer them to the older type. I think, however, Mr. Powell mentioned this in his excellent article. I might mention I know two large windmills, one in Kent and one in Sussex, both, as far as I am aware, still at work; one has five and the other six sweeps, but the former is decidedly the more powerful and efficient mill. Although a multi-"sweeped" mill possesses important advantages, experience has most conclusively shown that little, if anything, is gained over the old four-armed type to compensate for the increased cost and complication. The drive is steadier, undeniably, but weaker; and this is noticeable very distinctly when more than six sweeps are employed, while experiments have also shown that although there is a slight gain with five, there is none whatever with six. These facts apply, of course, on a correspondingly smaller scale to small mills, but for workshop purposes I quite admit that a gain in steadiness may well be secured by the loss of a small amount of power.

I mention this to explain that Mr. Woodthorpe would be well advised to stick to four sweeps if he wants all the power he can get; but otherwise by all means keep to six, but no more.

Mr. Woodthorpe is decidedly correct as to the tower of the mill. If he has ever examined the tower of a large mill he will see what sort of strains have to be met and provided for. There was formerly a large mill in the eastern counties the tower of which was an old lighthouse. I could multiply instances *ad lib.*, but I fear I have already trespassed far too much on your valuable space. If Mr. Woodthorpe can procure *Traction and Transmission* for June and July, 1903, he will find an article therein dealing with the subject and perhaps of a little assistance to him.

In reply to the last paragraph of Mr. Woodthorpe's letter, a builder at Bethersden (about twelve miles from here) drove his workshop for many years with a small six-"sweeped" mill, and it continued to work until his removal. The mill drove the saws (one circular, about 2 ft. 6 ins.), a lathe, grindstone, and drilling machine, and could manage the whole in a fresh breeze. The sweeps were about 14 ft. long each, as far as I can remember, and the mill was erected with a short but strong tower on the roof of the workshop. There is another—but only four sweeps, I believe—also driving the machinery of a carpenter's shop at Heathfield, Sussex; but of this I am unable to give particulars, having only seen it exteriorly.—Yours faithfully,

Cranbrook. SIDNEY RUSSELL.

An Old-type Prize Model.

To THE EDITOR OF *The Model Engineer.*

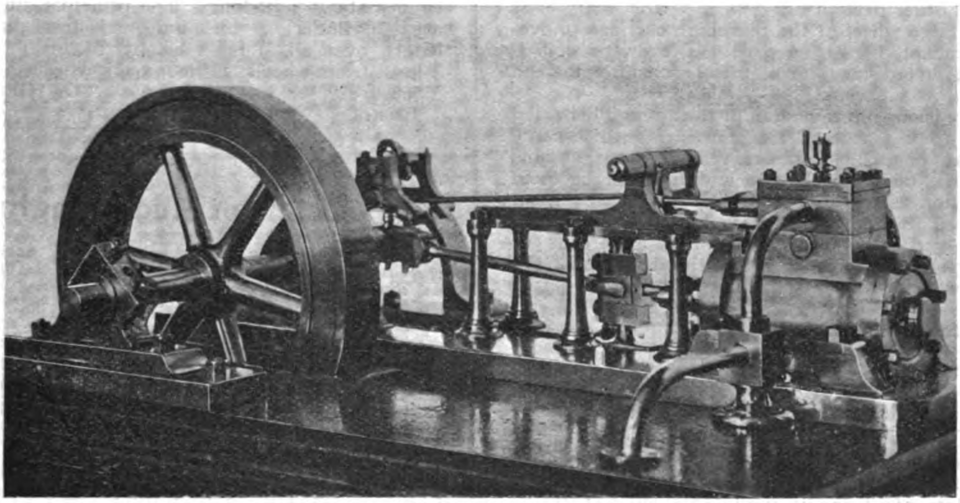
SIR,—I send you herewith two photographs and description of a prize model steam engine I have recently purchased through the advertisement columns of THE MODEL ENGINEER. I have been induced to send them by the fact that the model possesses some peculiarities which I have not previously seen in any steam engine. I thought these features might perhaps interest many of your readers. The reversing gear is worked by a single rod, and without any eccentrics. The link motion (quite different from the ordinary link) is held in place by a circular support resting upon an arch placed at the end of a crankshaft, and opposite the crank. The reversing lever operates directly upon this circle, which spans the link. The link obtains its motion from two rods—one of which is fixed to the end of the crank-pin in a perpendicular position, and the other is fixed to a right-angle pin projecting from the crank-pin *rod.* It is a very peculiar arrangement, and I am afraid no description of mine can convey a clear idea of it.

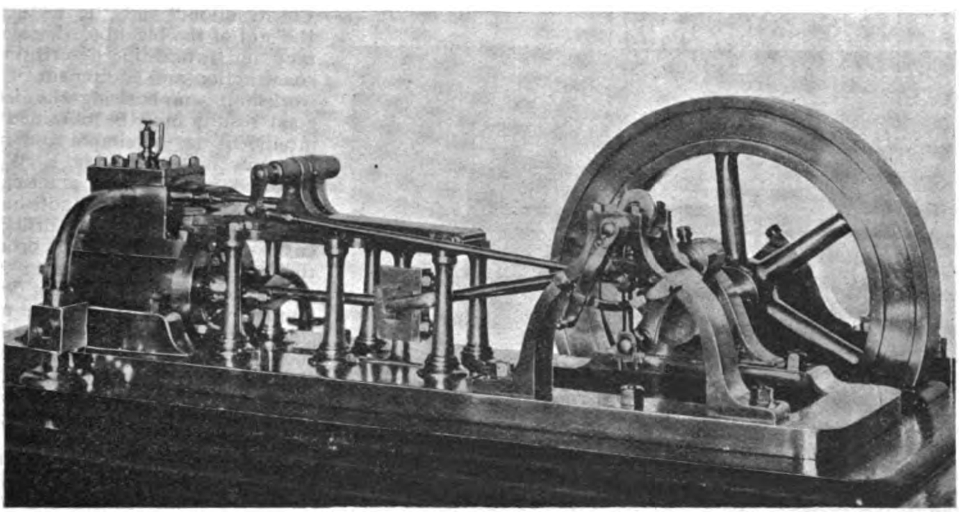
The guide-bar is another peculiar feature of the model. There is only one bar, as the bed forms the other support for the crosshead. The bar is upheld by six turned pillars, $2\frac{1}{4}$ ins. high. I should be glad to know whether any of your readers have seen the peculiarities of this model in any other engine. The model was made by the late Mr. Joseph Robson, Shildon, co. Durham, who won twenty-seven prizes with it. The tickets are now in my possession. There are twenty firsts, one special, four seconds, two thirds. The first prize was gained at the Darlington Industrial Society's Show in 1876, when there was a very large number of competitors.

The whole of the model is of polished gun-metal and steel, no part being painted. Even the spokes of the flywheel are polished—with very fine effect.

The leading dimensions are:—Bore, $1\frac{1}{8}$ ins.; stroke, $2\frac{1}{2}$ ins.; diameter of flywheel, $8\frac{1}{4}$ ins.; width, $1\frac{1}{8}$ ins.; diameter of crankshaft, $\frac{5}{8}$ in.; length of bearings, $\frac{7}{8}$ in. The bedplate (gun-metal) is $\frac{1}{2}$ in. thick. The workmanship and finish are of the very highest order.—Yours truly,

Darlington. J. SHORES.





TWO VIEWS OF A WELL-MADE MODEL HORIZONTAL STEAM ENGINE.

Re Overhead Gear.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I was much interested in the article on pages 314–5, describing an overhead gear for the lathe, and I have never previously seen in print a description of this particular overhead gear. It is practically identical with the one supplied by the Pittler Company, which I purchased several years ago with my Pittler lathe. My object in writing to you is to advise anyone who requires a really efficient overhead gear to make one of this pattern.

It is, I believe, impossible for the belt to slip, and slipping is a trouble I have always been bothered with previously when using other designs. So good is the grip that if a milling cutter pulls up under too heavy a cut, the lathe flywheel will slip, rather than any detail of the overhead. On two occasions, when working with an unduly slack driving band, the latter broke under the sudden jerk caused by the cutter seizing, instead of slipping on the pulley as with other patterns.

The large wheel of the travelling carriage (moveable bracket, Fig. 3, on page 314) answers well if made as an ordinary spoked wheel of cast iron instead of wood as suggested.

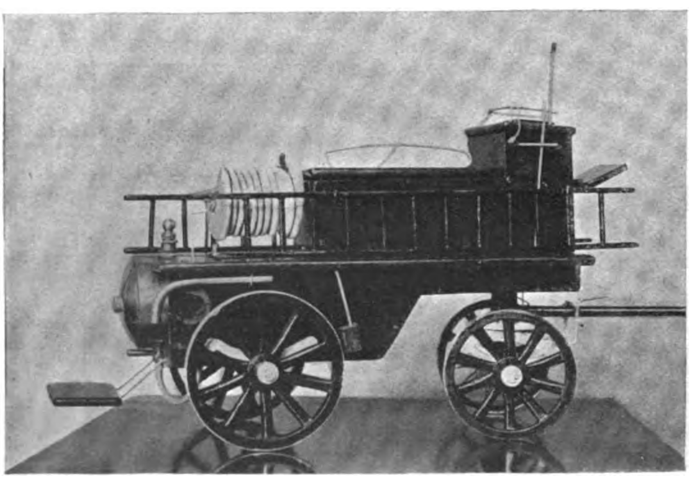
There is one improvement in the design illustrated that I would suggest. The short arms which carry the bar on which the travelling carriage runs should be made to slide to and fro, and be fixed in position as required from time to time by a set screw. This allows the travelling carriage to be placed vertically over the milling apparatus or drilling spindle, irrespective of the distance of the pulley wheels of the latter from the line of the lathe centres.—Yours truly,

Newcastle-on-Tyne. J. Bee.

Model Chemical Fire Engine.

To the Editor of *The Model Engineer*.

Dear Sir,—The following is a description of a small chemical fire engine which I have just finished. This class of engine is used for small outbreaks, and is very efficient to deal with fires in the initial stages. It consists of one or two cylinders containing from 40 to 100 gallons of water, in which sodium bicarbonate has been dissolved. The sulphuric acid is contained in a glass bottle inside the cylinder, and is released by a lever which is external. As soon as the acid mixes with the soda, carbon dioxide is formed which rapidly rises to about 160 lbs. pressure, and when the valve is opened the gas forces the water out. The amounts used for making the gas are : ½ lb. of soda and 1 fluid oz. of acid for each gallon of water.



A Model Chemical Fire Engine.

In the model I found that I could not make the acid container small enough, and so I was obliged to fit a cycle valve, and when the engine is required a few strokes of a bicycle pump supply enough pressure to deliver a jet of water 5 ft. high for 2½ minutes. The wheels were turned in oak, and then the spokes cut out with a fretsaw. She is fitted with two ladders, also brakes on the back wheels, and a winding reel for hose which is india-rubber about 3 ft. long. The principal dimensions are :—Cylinder, 4 ins. long, 1¾ ins. diameter; length over all, 9 ins. ; height, 6¼ ins. ; breadth, 4 ins. ; front wheels, 2⅝ ins. ; back wheels, 2¾ ins.—Yours truly, G. Hindson.

Bristol.

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.*]

An ordinary meeting of the Society was held on Wednesday, May 1st, at the Cripplegate Institute, Golden Lane, E.C., Mr. Sanderson taking the chair, and about fifty members being present.

The Secretary having read the minutes of the previous meeting, new members elected, and other formal business disposed of, the Chairman requested Mr. Blankenburg to give his paper on "Workshop Construction," and the lecturer, with the aid of the blackboard, gave a very racy and interesting description of the construction and equipment of his own workshop, emphasising the fact that good results mav be obtained by the intelligent use of simple and inexpensive raw material. Mr. E. W. Fraser followed with a very practical paper on the proper method of hardening and tempering lathe tools, drills, milling cutters, etc., and having brought to the meeting some prepared samples of steel let down to differing degrees of temper, was able to show the members clearly the different colours denoting the various degrees of hardness. On the motion of Mr. Percival Marshall, a hearty vote of thanks was accorded the lecturers for a very interesting and useful evening.

Future Meetings.—The last indoor meeting of the Session will take place on Tuesday, May 28th, when the Rev. W. J. Scott will lecture on "Six-Coupled Express Engines on the Great Western Railway."—Herbert G. Riddle, Hon. Sec., 37, Minard Road, Hither Green, S.E.

To Readers in the South.—We are informed that owing to the request of the Junior Institution of Engineers, and to avoid confusion of names, the Southern Institution of Junior Engineers will in future be known as the Southern Junior Engineering Association. Reference was made to the formation of this Association in our issue of April 25th last.

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:—

[10,836] **Small Motor Generator.** T. F. S. (Tufnell Park) writes: Can you kindly assist me in the following? I think of building two machines alike (Manchester type), 3-in. cogged ring armatures, castings stated to be 120-watt machines—one as a series motor (wound in sixteen sections) to run from 240-volt main, coupled to the other, shunt-wound as generator in twelves sections for 10 volts. What output could I expect from generator, conditionally that both machines are carefully constructed? I should like to get 90 watts, but I am afraid these figures are rather high.

A great deal will depend upon the design of the machines; if they will really give 120 watts each if wound as generators, you may be able to put 200 watts into the one which is wound as a motor without overheating, especially for short periods of running. Taking this figure as the power put into the motor, you can expect to obtain about 70 watts, that is, 10 volts and 7 amps., from the generator. It is doubtful if the combined efficiency of the machines will be as good as 40 per cent. You can gain something by winding the field-coils of the generator to suit 240 volts and separately exciting them from the mains, as by this means the generator armature will not have to produce the exciting current.

[17,500] **Small Petrol Motor Design.** E. W. W. (Atherstone) writes: (1) Do you think the enclosed design suitable for a small petrol engine (shown in Figs. 1 and 2), 2½-in. by 3-in. stroke, 1,000–1,200 r.p.m.? I have shown the valves 1 in. over-all on the head. (2) Do you think that this could be reduced? (3) Cylinder walls ⅛ in. thick. Is this enough? (4) Water-jacket for cylinder is of brass tube, spun over as shown. Will this do, or must it be brazed? (5) In your issue for June 7th, 1906, Vol. XIV, No. 267, "Sregor" suggests steel tube, oval section, for connecting-rod. What size and gauge should you suggest for this size (rod 7 ins. centres)? (6) What power should engine develop?

(1) Such could be made to work, no doubt, but we do not see what provision you have made for getting valves out for grinding in, etc., in a convenient manner. (2) For a high-speed you need quite this opening. (3) Yes, if sound material is used. (4) We would suggest a metal-to-metal joint, made tight by means of a good tightening band, as Fig. 3; or, make it without the recess at R, so that it can be drawn off if required for cleaning out water space. (5) Half inch by ⅜ in. outside would be suitable in your case for a hollow connecting-rod, ⅛ in. thick. The power can only be roughly estimated, as it depends on the details of design and workmanship to a very large extent. (6) Anything from 1 to 1½ h.-p. may be obtained.

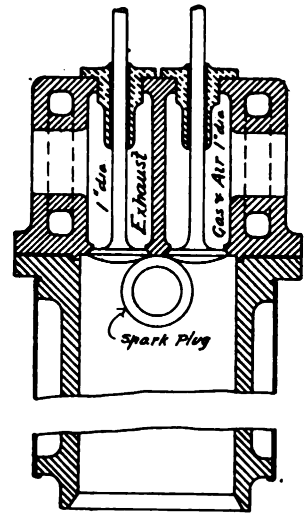


FIG. 1. SECTION.

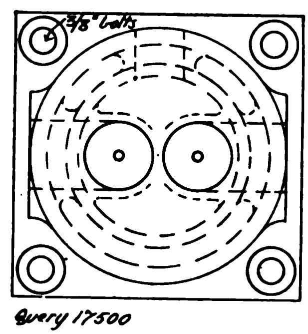


FIG. 2. PLAN.

SMALL PETROL MOTOR.
(*Scale: ⅓rd full size.*)

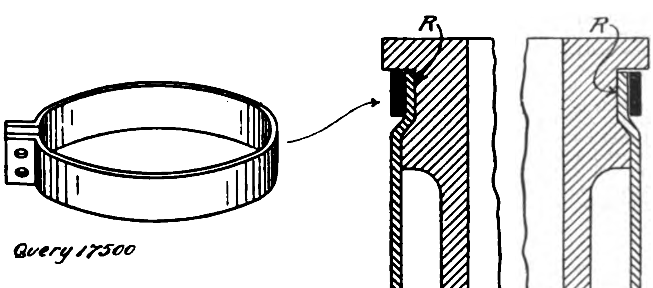


FIG. 3.—METHOD OF ATTACHING WATER-JACKET TO CYLINDER.

[17,634] **Marine Engineering.** J. A. S. (Fartown) writes: It is my intention to adopt marine engineering as a profession, but as I am rather in a fog as to the qualifications I have decided to consult you. Could you tell me where to apply for regulations, etc., and what books do you recommend for the theoretical part? Also what is your opinion of the profession?

If you get the "Regulations relating to the Examinations of Engineers in the Mercantile Marine" from Eyre & Spottiswoode, East Harding Street, E.C., 7d. post free, you will find full particulars which you require. "Marine Engineering," by Constantine, 5s. 4d. post free, and "Verbal Notes and Sketches for Marine Engineers," by Sothern, 7s. 10d. post free, can be recommended. Also Reid's "Handbook for Marine Engineers," 12s. 6d. *Re* our opinion of the profession. It may be summed up by saying it is all right if you like it. Further than this, it is interesting work, but to *make* a good chief you must not only be thoroughly capable, but have confidence in your own competency and be entirely dependent on your self. The responsibility, too, is very great at times, and the pay attached to second and third engineers' positions is not all that might be desired. The good and the bad times are fairly well balanced if you are not particularly unfortunate. But remember *every* boat is not "a home."

[17,481] **Power and Propellers for Model Boat.** W. R. T. (Anerley) writes: I shall be very pleased if you will kindly put me right on a few matters. I am making a model T.B.D. (4 ft. 6 ins. by 6 ins. by 3½ ins.), which I propose driving by one of Thompson's 3C Motors (8-volt 3-amp.) and two accumulators (4-volt 9-amp.). (1) Will the above machinery suit the boat? (2) Will gearing down be necessary? (3) How long will above accumulator drive the motor? (4) Will one propeller or two, as in your issue of Jan. 3rd, 1907, be better? (5) In either case, what will be sizes of propeller or propellers?

(1) Yes. (2) No. (3) 3 amps. is rather a heavy discharge rate for so small an accumulator. We should recommend a larger one, though you can try this one and see how it goes. (4) A matter of choice. You could easily give the two propellers a trial, as per January 3rd, 1907, issue. (5) Use about 2 ins. diameter and fine pitch.

[17,537] **Measuring Instruments for Alternating Current.** J. H. (Great Marlow) writes: Are any of the volt and ammeters described in the last four volumes of THE MODEL ENGINEER suitable for alternating currents (three-phase)? Are the volt and ammeter described in "Experimental Science" suitable? How are they connected to three-phase alternating currents? If none of these are suitable, could you give me a sketch of voltmeter to register from 0–125 volts and ammeter from 0–20 amps., both for three-phase? I am rather in the dark concerning measuring instruments for three-phase alternating current. Could you recommend a book on it?

The ammeters and voltmeters described in No. 110 (Vol. VIII), No. 62 (Vol. V), and No. 70 (Vol. VI) of THE MODEL ENGINEER can be used for alternating currents, either single-phase or polyphase, also the ammeter described and illustrated in Fig. 210 of "Experimental Science," Vol. II. The voltmeter described in the same volume—in Fig. 209—is not suitable for use with alternating current; the hot-wire instrument described in the same book could be used as an alternating voltmeter, but not as an ammeter. The instrument which would probably give best results is that described in THE MODEL ENGINEER, No. 70, Vol. VI, for both ammeter and voltmeter. With instruments for measuring alternating currents the following precautions must be observed—all iron parts which are acted upon by the current should be laminated when possible; bobbins round which coils are wound are preferably made of a non-conducting material, but if made of brass or other metal, should be cut through with a saw so that a continuous circle of metal is not formed (one cut is sufficient); large plates of metal in the neighbourhood of coils carrying the current should be avoided as much as possible; the instruments should be calibrated with currents having the same periodicity as the circuit on which they will be used. A suitable winding with this ammeter would be 3-16ths in. diameter fine stranded flexible wire for a current of 20 amps., and No. 40 s.c.c. copper wire for a voltmeter to read 125 volts. Follow the instructions given in the article for adjusting the amount of wire. An ammeter should have as low a resistance as possible, a voltmeter as high a resistance as possible. With polyphase currents, the current in each phase is measured separately by putting the ammeter in each circuit; to measure the volts, you connect the voltmeter across each phase in turn. You should study a book on polyphase electric currents, such as that by Prof. Sylvanus Thompson, or "Polyphase Work," to be had from this office, or "Standard Polpyphase Apparatus and Systems," by Oudin.

[17,543] **Oscillating Cylinders.** R. A. writes: Being my first attempt at model engineering, I would be very much obliged if you would answer these few questions as early as possible. I have an oscillating cylinder, 1½-in. bore, 3¼ ins. long. How could I arrange cylinder for a 2¼-in. stroke; also, what size of a hole should I drill in cylinder for steam port?

You do not say whether you also have the steam distributing block. To alter the stroke from 3¼ to 2¼, add ½ to the piston on the side next the cover with the stuffing-box. The port may be a 3-16ths in. diameter hole, but we cannot say unless you send a drawing to scale or dimensions of the cylinder. You will find a reply to a query on this subject in our issue of March 16th, 1905, which should be useful to you. Your name and address should be given, and to ensure a reply enclose a stamped addressed envelope. See also our handbook No. 28, "Model Steam Engines."

[17,551] **Model Boilers.** J. W. (Tolworth) writes: I have a J-type mill engine (horizontal), 1 in. by 2 ins., and require a boiler for the same. Would a vertical 6 ins. high, 3½ ins. diameter, one tube do; or a locomotive boiler, 2½ ins. diameter, 8½ ins. long? If not, will you kindly give me particulars for others and where to obtain them at a reasonable price?

The smallest centre-flue vertical boiler that will work the engine satisfactorily is a 7-in. by 14-in., but such boilers are better for use with solid fuel. We therefore recommend a 6-in. by 12-in. boiler, with about six to eight tubes (⅜ in. diameter). You can work this with a gas-ring, Primus stove, or by a methylated lamp. The latter, however, is a rather expensive method. A horizontal water-tube boiler—for which castings and materials can be obtained from Messrs. Stuart Turner, Ltd., Shiplake, Henley-on-Thames—would suit your requirements. Send for a leaflet giving prices and other particulars.

[17,547] **Electric Lighting Plant.** F. S. (Yeovil) writes: I want to light two small rooms with electric light. I have got a horizontal slide-valve engine (cylinder 1½ ins. by 3 ins.), which, I think, will be strong enough to drive the necessary machine. Please will you tell me what power boiler and dynamo to get suitable to do the work and what lamps, etc., to get?

The speed at which the engine should work would be from 300 to 400 r.p.m. Reckoning on the former speed and a pressure of 50 lbs.—which, we presume, the cylinder will safely stand—the indicated horse-power will be approximately—

$$\frac{7 \times 35 \times 3 \times 400 \times 2}{4 \times 12 \times 33{,}000} = \frac{4}{10} \text{ I.H.-P.}$$

This should give roughly—

$$\tfrac{1}{3} \text{ of } \frac{4}{10} \times 750 = 100 \text{ watts output}$$

with a well-made and designed dynamo. Choose a 150-watt design from our handbook, "Small Dynamos and Motors," and work to the drawings on page 37 (Fig. 11) of "Model Boiler Making" for the steam generator. A steel shell may be adopted with advantage, and the tubes may be expanded in instead of being double-nutted, as shown; 100 watts will give you 25 to 30 candle-power, voltage, say 25.

[17,626] **On Charging Secondary Cells.** A. H. M. (Sutton) writes: (1) In No. 1 of your handbooks, "Small Accumulators," at the bottom of page 45, you say—

$$C = \frac{E}{R} = \frac{25 - (10 \times 2{\cdot}25)}{5}$$

What I do not understand is, where you get the 25 from. Is it the E.M.F. of the charging dynamo? I cannot find anything to explain it. (2) Will you kindly tell me when I should leave school and go to some engineering place like Birmingham University, as I am going in for electrical engineering? I shall be 17 next November. (3) What is the best place to go to and what examinations shall I have to pass to get in?

(1) Yes, the E.M.F. of supply current. (2) This depends entirely upon many unknown factors—how far on you are at present, etc. Generally speaking, 16 or 17 is a good age to begin your technical training. (3) There is not a great deal to choose between the various technical training colleges, and we think you would probably get on as well near home as away from home. The secretary of any college would send you particulars, on application, as to qualifying examinations for entrance.

[17,555] **Steam Pipes: Jointing Material.** C. E. H. (Birkenhead) writes: (1) Is there any objection to the steam entering the steam chests at the side instead of through the cover? In the engine I am constructing, which is of the launch type, the valves are between the cylinders (½-in. by ⅝-in.), and I am therefore almost obliged to adopt the former method. The valves are not held against the faces by springs, but the valve rods work in tail-pieces and the chests are fairly roomy. (2) What is the best thing to use for making cylinder cover and steam chest joints on a comparatively small model such as this one?

(1) None whatever, unless the inlet is so arranged that it tends to lift the valve off its working face. The fact of the steam chests being roomy leads us to think that you will have no trouble. (2) We strongly recommend paper. Thin brown paper is as good as any other, but it must be free from lumps in the texture. For very small engines use typewriting paper.

[17,637] **Resistance Board for Small Power Supply.** E. J. H. (Fareham) writes: I would be pleased if you could give me some information on the following. I wish to construct a resistance board for dentistry. I wish to construct it so that I can get from a 6-volt secondary battery any current from zero to the full capacity of cell. What size wire and quantity? Can you recommend any book on the subject?

There is no work devoted exclusively to this subject. By using a number of coils in series of, say, No. 30 S.W.G. German silver wire you can regulate the current from 1 amp. down to any fraction of an ampere at will. No. 30 gives 2·8 ohms per yard: therefore, at 6 volts you will get

$$\frac{6}{2{\cdot}8} = 2{\cdot}15 \text{ amps. approximately}$$

with 1 yrd. of resistance wire. This is rather more than the wire of this gauge should carry for continuous working, however.

[17,549] **Model Locomotive Design.** G. E. (Crawley) writes: Will you kindly answer me a few questions concerning a small 2½-in. gauge locomotive which I am designing? What I want to know is, Which would give most power—two ordinary H.-P. cylinders (½-in. bore by 1-in. stroke) to work at 60 lbs. pressure, or a compound, having cylinders ½ in. by ¾ in. by 1 in. stroke, the H.-P. cylinder to work at 65 lbs? I want to design a locomotive that will give as much power as possible and at the same time be reliable. The boiler I have designed is (inner tube) 2½ ins. diameter by 9½ ins. long, with seven 3-16ths-in. water-tube tubes, the whole to be constructed of copper and brazed together.

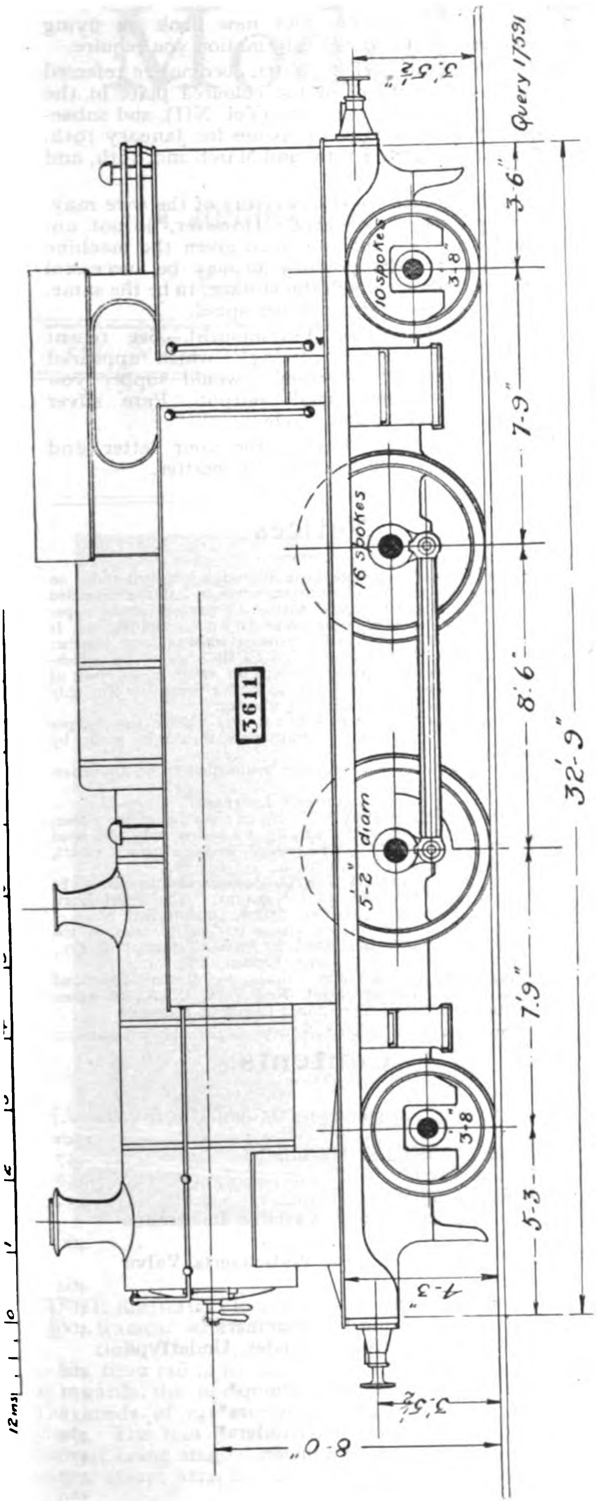


DIAGRAM OF 2—4—2 TYPE PASSENGER TANK ENGINE: GREAT WESTERN RAILWAY.

Would this boiler supply enough steam at the given pressure to either the H.-P. cylinders or the single H.-P. cylinder in the compound; also, would link motion be too heavy for the above cylinders? If so, I propose to use simple loose eccentrics.

With sufficiently careful work, the compound engine (two-cylinder) should give the most power, but we would not go in for a compound engine from the point of view of obtaining more power, but rather to make the water last longer. The compound should work at about 70 to 80 lbs., and the cylinders should be ½ in. and ¾ by 1-in. stroke (see design for cylinders in "The Model Locomotive," by Greenly, page 129, Fig. 145). If you want the maximum power, look carefully to the design of the boiler and provide the locomotive with as large a one as possible consistent with good appearance. You will find five tubes (¼ in. diameter) do better than the larger number of 3-16ths-in. tubes. By all means adopt the slip eccentric gear.

[17,591] **G.W.R. 2—4—2 Type Tank Locomotives.** T. B. (Hanwell) writes: Can you kindly supply me with a drawing of a Great Western Railway tank engine, 2—4—2 type, No. 11 class?

We reproduce herewith a sketch of the No. 11 class of 2—4—2 type G.W.R. tank locomotives. We have no dimensions of width. As you live on the G.W.R. system, and can see these engines, perhaps you will measure the width of footplates, also how far it is from the edge of the footplates to the sideplates of tanks, and, further, how much the cab sides are set in from those of the tanks. The distance between buffers is, of course, standard, viz., 5 ft. 9 ins. A post-card giving the above dimensions would no doubt be useful to other readers.

[17,630] **Toy Gas Engine Failure.** T. P. (West Hartlepool) writes: I would be exceedingly obliged to you if you would give me some information on this gas engine. The model is made according to directions enclosed on the drawings (not reproduced), but I cannot get more than 3 or 4 revolutions. Have fitted new piston with groove lined with asbestos, but this makes it no better. I sent to makers for advice and they say that burner is either too close or too far away, and should be regulated. I tried that but with no success.

In engines of this type, which can be made to run at a high speed, but from which no appreciable power can be obtained, the main thing is to have all working parts quite free. A small gas-bag of soft rubber (something like a football bladder) is often an advantage if placed on the burner supply. Much depends on the nicety of adjustment of the gas supply, and we can only advise you to make careful adjustments until you get better results. Your piston should be a perfect fit in cylinder and not dependent on packing in the grooves to make it fairly gas tight. Try the effect of enlarging and reducing the size of ignition hole into cylinder, and also see that the exhaust opens and closes at the right moment. We advise you in future not to go in for this type of engine, which fires its charge at or below atmospheric pressure.

[17,619] **Water in Gas Mains.** T. H. O. (Crewe) writes: Being a reader of your publication, THE MODEL ENGINEER, I should be glad if you would kindly furnish me with information upon the following points. What is the cause of the accumulation of water in gas mains? What is the approximate quantity accumulated, say, for example, in a 6-in. main? What methods are adopted for draining off same?

This is due to a certain amount of water vapour being condensed when the temperature of the mains in which the gas is flowing is lower than that at which the gas was when it was being "cleaned" at the gasworks. In the process of cleaning the gas comes in contact with water and becomes situated, to a certain extent, depending on the temperature prevailing. The mains are drained of this water, and the water pumped out of the collecting boxes periodically. The latter are situated at the lowest level of any given system or branch of a system. The quantity so collected depends on the distance of the point in question from the source of supply. No definite figure can be given, as it varies greatly. Not only water but oil is collected in this manner—the oils used by the gas people to give a higher luminosity to the coal gas, and which are mixed with the gas, of course, in the form of vapour.

[17,633] **Atlantic Telegraph Cables.** A. C. R. (Cuckfield) writes: Would you kindly give me a little information about the present Atlantic telegraph cable. (1) What is its thickness at shore ends and in the middle? (2) What is the section? (3) Number of tons to mile? (4) Where can I get a small section, say about 2 ins. thick, of exactly the same construction or very near it? (5) If any charge would be made for it, about what would it be? (6) If it broke is there any means of telling how far away the break is by means of electrical instruments?

(1 and 2) There are eleven Atlantic cables, all of different dates and types, and for complete details we must refer you to Bright's "Submarine Telegraphy." (3) The deep sea section varies between 400 lbs. to 650 lbs. of copper and 400 lbs. of guttapercha per nautical mile. (4) You might try Messrs. Siemens Bros., or any of the cable-making concerns. (5) Could not possibly say. (6) Yes. There are a variety of methods of fault localisation, the method used depending upon the nature of fault, such as whether it is a complete disconnection, a "dead" short-circuit, or a "partial" earth. These would take too much space to explain here, but see Kempe's "Handbook of Electrical Testing."

The Editor's Page.

A SUBJECT on which we are often asked for advice is how a lad without influence and without the means of paying a premium may become an apprentice in an engineering works. As this may meet the eye of many who are in this position, or who have a friend or relative in this position, we may say that the only way we know is to make application in person or by letter to all the firms who by reason of their location or class of work are considered suitable. A glance through the advertisement pages of the leading engineering and electrical papers will furnish the names and addresses of firms doing various classes of engineering work, and though many of these probably have more names on their books than they are able to find vacancies for, it is quite possible that here and there will be a firm who are willing to make an opening for a likely lad. Generally speaking, openings are more likely to be found in small or moderate sized shops than in large ones, and a more useful all-round training is likely to be obtained, but refusals are certain to be met with, and the applicant must make up his mind to try firm after firm until he finds the opening he is seeking. Once he obtains the desired start he must rely on his own industry and ability to do the rest. We are also asked to furnish the names and addresses of firms who take apprentices without premiums, but this we cannot well do. Even were it possible for us to give such addresses, it would be found in most cases that vacancies were not in existence just when required.

Answers to Correspondents.

J. G. B. (Edinburgh).—You will get a good idea of the output of your dynamo if you look up the sizes given in "Small Dynamos and Motors," and compare them with the dimensions of your machine. You do not give us size of armature or field-magnets, so we cannot say.

R. H. (Oldham).—If you refer to a liquid used as resistance, we should say no, not much use. *Re* making your own electric light, the cost would depend on how many lamps you required. If you give fuller details we should be pleased to assist you.

A. D. (Gloucester).—You should get "Electricity in Homes and Workshops," by S. F. Walker, 5s. 4d. post free. This gives a comprehensive account of the applications of electricity.

H. M. (Lincoln).—We can recommend the book "Polyphase Currents," by Alfred Still, 6s. 4d. post free.

S. C. (St. John's Wood).—Your letter deals with a fairly complicated matter, and not of very general interest. We will deal with it as soon as time and space permit. You do not appear to read the query columns, for many of your questions have been answered quite recently.

J. M. N. (Mexboro').—Our new book on flying machines will give the information you require.

J. M. (Peckham).—The electric locomotive referred to was the subject of the coloured plate in the issue of January 5th, 1905 (Vol. XII), and subsequently described in the issues for January 19th, February 2nd and 16th, and March 2nd, 16th, and 30th.

K. H. (Plymouth).—The covering of the wire may, perhaps, be rather thick. However, do not unwind armature till you have given the machine a trial, as quite possibly it may be successful when running, though the voltage, to be the same, will require a slightly higher speed.

H. G. J. (Landport, Portsmouth).—See recent articles on "Silver plating" which appeared in this journal. Whitney's would supply you with a complete small output. Pure silver must be used for the anode.

F. E. T. (Iffley).—Thanks for your letter and diagram; we will look into the matter.

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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THE
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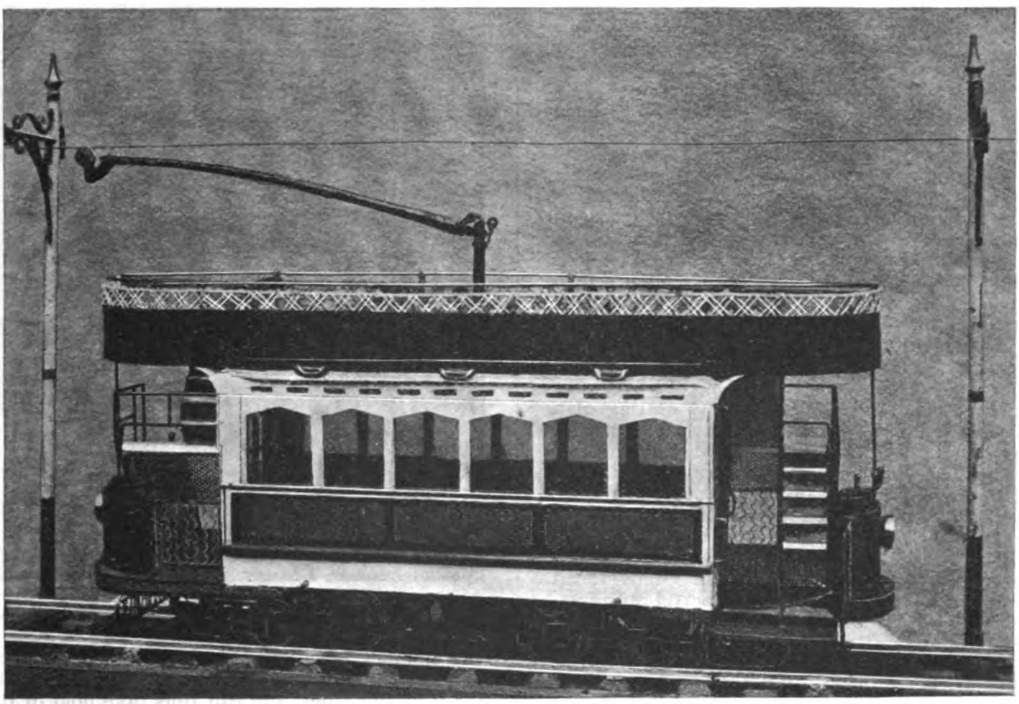
A Model Electric Tramcar.

By GEORGE GRIGSON.



MR. G. GRIGSON'S MODEL ELECTRIC TRAMCAR.

THE illustration herewith shows a model electric tramcar, which I have constructed in my spare time. The car is 26 ins. long, 6¼ ins. wide, and 11 ins. from rail to handrail, it being my own design as regards the upper deck and united stairway. The inside of car is nicely upholstered in green plush. The roof is painted white and gold lined, the rest being stained mahogany. There are eight leather straps attached to rather stout brass rods, which run the whole length of roof. The windows are fitted with roller blinds. There are eight lamps—four inside, two outside, and two headlights; all are connected two in series (4-volt lamps). The doors open and shut. The controllers are fitted with resistances, giving three speeds, with reversing switch at each end. The overhead trolley rises, turns, and falls in any position; also the seats are reversible. The motor I had cast to patterns I made, being similar to a Manchester type. The armature is built up of 8-slot stampings, and is 1½ in. by 1¼ in., with 8-segment commutator, and fields are series wound. It works light at 4 volts; a terrific speed at 8 volts with load. The gearing is 20 to 1 (cog gear), which works the car at very high speed. The cowcatcher immediately drops the net on touching anything on the track. The current is taken from the overhead wire, and returned by the rail. The car will run easily on sharp curves, being of the latest bogie pattern.

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.*]

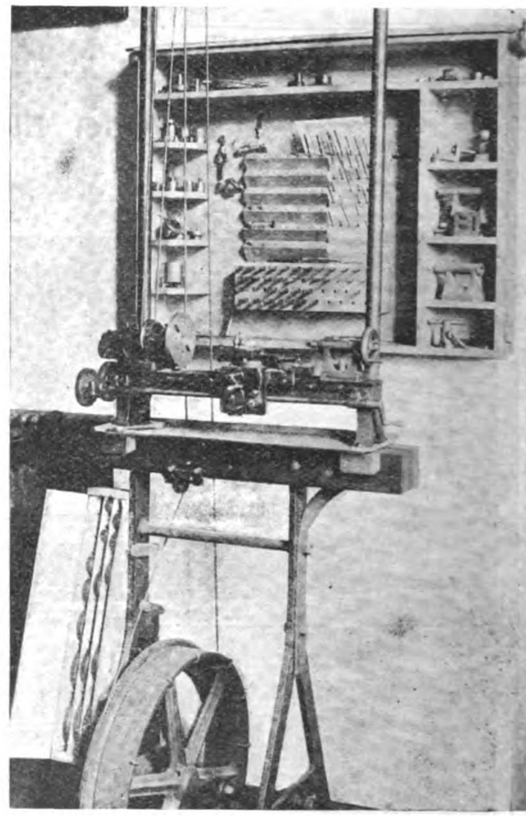
An Amateur's Home-made Lathe.

By ARTHUR BLAIKLEY.

The lathe shown in the accompanying photograph is a copy of a modern heavy engineering lathe on a small scale; it is 2¼-in. centres, cuts right and left-hand threads without change of gearing, and takes about 10 ins. between centres. I started by buying a set of castings for 2¼-in. slide-rest lathe with planed bed, and designed the tool to use these as far as possible. As a matter of fact, however, only the head, bed, and T-rest from the original set remain; for all the other castings I made my own patterns. There is nothing very original about the lathe itself, except its small size and the variety of work it is able to perform. I have done awkward faceplate jobs—saddle boring, fine and very coarse pitch screw-cutting—on it, and have found it so convenient and reliable on delicate and difficult work that I have never regretted not making a larger one whilst I was at it. About the two extreme jobs I have done on it so far have been the turning of a hydraulic cylinder (3 ins. by 10 ins.) and the cutting of a five-thread screw (1-10th in. diam. and 2-in. pitch).

The stand of the lathe is an old wrought-iron bottle-washing machine, the bearings of which are clamped between the two pieces of wood shown, thus making a foundation to which to attach the bed. For the sake of driving milling cutters and such tools in the slide-rest, and another reason to be explained later, I work from an overhead countershaft carried on two gas barrel uprights. In order to get two countershaft speeds I made up a stepped rim on the side of the flat belt wheel with which the stand was fitted. I did this by building up in sections a stepped mahogany rim, and having bolted this on to the side of the original wheel, turned it up in position, someone else stamping for me. My second reason for using the countershaft was the following:—On the ordinary foot-lathe driven direct from the flywheel there is always a big jump in speeds between the slowest on the direct drive and the fastest with the back-gear. With this arrangement the flywheel is so large in comparison with that on the lathehead that its diameter may be regarded as practically constant, and you therefore get the advantage of the steps on the small cone pulley only. By driving from a countershaft, however, with a similar cone reversed to that on the head the increase or decrease of speed for each change is practically doubled, and you therefore get an even flow of speeds from direct to back-gear driving.

The amount of time I have to spare for using this lathe being very limited, I save it by having every tool as far as possible within reach, and, further, within reach of the hand that will use it or put it in its place on the lathe. Thus:—The change wheels are all in a rack directly under the place where they are wanted, and as each hole is too small to take a wheel larger than the one belonging to it, I can put my hand on the one wanted at once, and use it without troubling to look at



MR. ARTHUR BLAIKLEY'S HOME-MADE LATHE.

the number of teeth. Again, I have the T-rest at one side of the lathe and the hand-nut and bolt for it at the other, and can thus take hold of them with the hands in which they will be used, and fit up the rest without any fumbling about; the same in taking it down. As I am left-handed, the position of some of the tools in the photographs may not appear so convenient to your readers as they are to me. The rack shown at the back has places for about 150 tools, chucks, and cutters, and as all have their own places, and can be seen at a glance, no time is lost in looking for them. I make it a rule never to alter a tool or drill, but always to make fresh, and so am rapidly getting a collection that will deal with any job that comes along, and, further, as tools used on iron or steel become at once too blunt for brass, I have two distinct sets, and never use one for the other. Above the tool and drill holes are tables showing standard screw-thread pitches and diameters, and also one showing the speeds to use for given diameters in different materials. There is a spring roller-blind to draw down over the tool racks to keep out the dust when the lathe is not in use, and a lid to the gear-wheel box to prevent chips getting into the teeth. I find the spring roller takes up practically no room, and is more convenient to open and shut than doors or a lid.

Now readers with few tools at their command may be interested to hear the actual means I used in making this tool. I bought the bed with the rough planed off, and having filed and scraped it as true as I could, used it as a surface-plate for finishing the different slides. I got the use of a screw-cutting lathe for two Saturday afternoons to turn and cut the lead screw and nut, turn the cone pulleys, screw the nose of the mandrel, and bore the fiddle, but all the rest of the work I did either with a hand-brace and drill or a small lathe I had made up from a dentist's polishing head. Of course, as soon as the slide-rest was done, I fitted up the lathe and used it for boring and turning the lead screw brackets, bolted on to the faceplate with angle-plates, turning the change gear-wheel blanks and many other parts, for which it was much more solid and reliable than the little polishing lathe. The change gear wheels were machine-cut in London. The first firm I asked quoted £5 5s., which rather frightened me, but the second one did the job to my complete satisfaction for 28s. This goes to show the importance of asking more than one firm before placing an order. The little wheels on the rocking-plate, for changing from right- to left-hand lead screw feed, are made out of ½-in. cast steel pinion wire. These cannot be seen on the photograph, as they are encased to keep out the dust. It took me about six years of spare time to get the lathe into its present condition, but I must confess the work was very intermittent. I still add to it, and do not suppose that I shall have done making fittings, grinding and milling attachments for many years to come. The photograph is a general view, showing how the wood rim is attached to the flywheel, the gear-wheel box, tray, and rack-traversing gear. To the right of the photograph may be seen angle-plates, lever tailstocks, and a steady-rest in course of making.

The Latest in Engineering.

Locomotives for Lumbering.—Locomotives of the "Snow" type are in use for logging work in certain lumber districts of the United States. In the Indian Reservation the Northland Pine Company works trains of up to nine sleds of logs hauled by such engines over snow roads. The nine-sled train carries about 105,000 ft. of timber, while the ordinary loads are from 50,000 ft. to 75,000 ft. The timber sleds have 4-in. runners, 8 ft. centre to centre. The locomotives used are supported at the front end by a pivoted sled, which practically takes the place of the bogie or leading truck. The trailing end is also carried on runners, while an endless chain 12 ins. wide, running on two large wheels, bites the road surface. Vertical inverted engines are placed on each side of the smokebox and drive horizontal shafts running back to driving wheels. The weight of the engine is carried by the runners, while the movement of the chain propels the locomotive. The front sled is controlled by chains. The boiler is of the locomotive type. The engines (empty) weigh about 15 tons, and 18 tons in working order. A speed of from four to five miles an hour is attained with loads, trips of from four to ten miles in length being made. For shorter hauls than four miles they are not considered economical. It is stated that one engine will thus accomplish the work of from thirty to forty horses. —*Engineering.*

The Brennan Mono-Railway.—The inventor of this system of transport, Louis Brennan, C.B., is also the inventor of the Brennan torpedo. The latter invention was purchased by the British Government in 1887 for the sum of £110,000, and has since been preserved as a State secret.

The mono-railway exists at present only on a small scale, the model shown in the accompanying photographs being just large enough to carry a man of ten stone weight. It clearly demonstrates, however, the practicability of the system, and gives evidence of having a great future before it, as by its means vehicles—which, it is believed, will be of colossal dimensions, more like moving hotels or ships on shore than the usual form of railway carriage—will travel at velocities of probably from two to three times that attainable at present. At the same time there will be a complete absence of lateral oscillation in the carriages, and a great increase in the smoothness with which they run.

The principle upon which the mechanism acts, in order to impart stability to the vehicles, is utilised in nature on the grandest scale in steadying the movements of the heavenly bodies in their orbits. At the same time it could be seen and studied in the child's spinning top, which remains upright from precisely the same cause. This principle is called the gyrostatic action of rotating bodies, and is unquestionably the most difficult to explain, as it is to understand, of all the movements which are known in mechanics. It is not proposed to go into a description of this principle here, but anyone who buys a gyroscope top will find, on spinning it, how different all its movements are to those with which we are familiar.

The characteristic feature of this system of transport is that each vehicle is capable of maintaining its balance upon an ordinary rail laid upon sleepers on the ground, whether it is standing still, or moving in either direction at any rate of speed, notwithstanding that the centre of gravity is several feet above the rail, and that wind pressure, shifting of load, centrifugal action, or any combination of those forces may tend to upset it.

Automatic stability mechanism of extreme simplicity, carried by the vehicle itself, endows it with this power. The mechanism consists essentially of two flywheels rotated directly by electric motors in opposite directions at a very high velocity, and mounted so that their gyrostatic action or stored-up energy can be utilised. These flywheels are mounted on high class bearings, and are placed in exhausted cases, so that both air and journal friction is reduced to a minimum, and consequently the power required to keep them in rapid motion is very small.

The stored up energy in the flywheels, when revolving at full speed, is so great and the friction so small, that if the driving current is cut off altogether, they will run at sufficient velocity to impart stability to the vehicle for several hours, while it will take from two to three days before they come to rest.

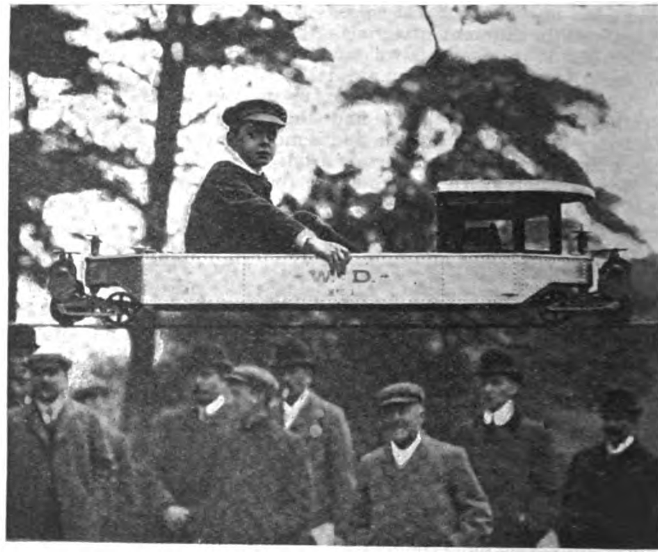
The stability mechanism occupies but little space, and is conveniently placed in the cab at one end of the vehicle. Its weight is also small, about 5 per cent. of the total load being considered an ample allowance for the first vehicle.

The road wheels are placed in a single row beneath the centre of the vehicle, instead of in two rows near the sides, as usual, and are carried on bogies or compound bogies, which are not only pivoted to provide for horizontal curves on the track, but for vertical ones also. By this means the vehicles can run upon curves of even less radius than the length of the vehicle itself, or on crooked rails or rails laid over uneven ground, without danger of derailment.

The motive power may be either steam, petrol, oil, gas, or electricity, as considered most suitable for local conditions. In the first instance, however, it has been decided

Testing the Mono Railway.

to use a petrol electric generating set, carried by the vehicle itself, for the supply of current to the road wheel motors and to the stability mechanism. Such a vehicle will have the great advantage of being always ready for immediate use, the gyro wheels being kept constantly



Carrying a Passenger along a Suspended Cable.

running by current from a small accumulator while the engine is at rest. In order that the vehicle may be able to ascend steep inclines, the wheels are all power driven, and change gears are provided for use in hilly country. It is also possible to run free wheel down hill at great velocity, so that a good average rate of speed can be attained.

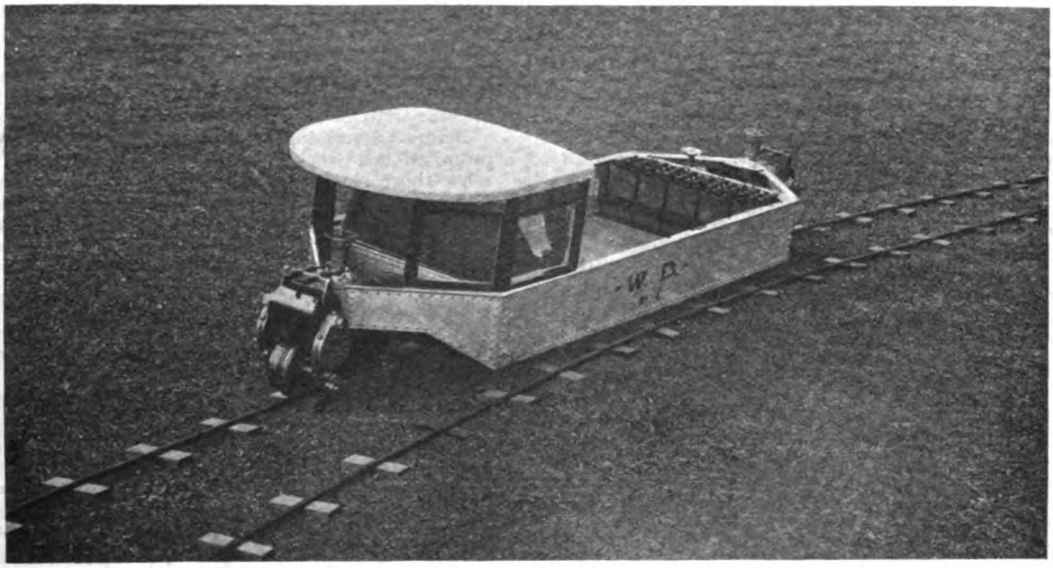
Brakes capable of being operated by pneumatic or manual power are provided for all the wheels.

The rail, which is of ordinary section, only requires to be the same weight as one of the rails on an ordinary line in order to carry the same load on the same number of wheels in each case. The sleepers also only require to be one-half the length to give the same area of support to the vehicle.

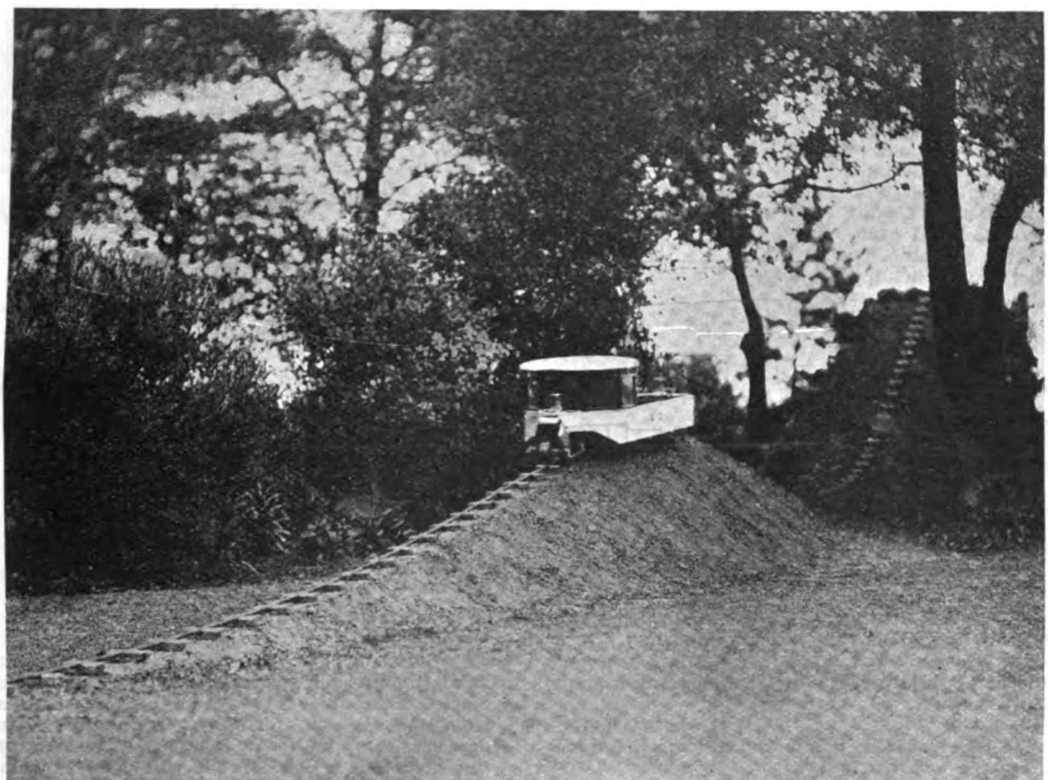
Bridges are of the simplest possible construction, a single wire hawser stretched across a ravine or river being all that is necessary for temporary work. These hawsers can be built up on the spot from separate wire rope strands, so that the transportation of them becomes an easy matter. Strange to say, the lateral swaying of the hawser does not disturb the balance of the vehicles, and the strongest winds will fail to blow them off. In other cases of bridge building a single row of piles with a rail on top suffices, or a single girder carrying the rail may be conveniently used.

The expenditure of fuel will be considerably smaller than on ordinary lines owing to the absence of flange friction on curves, and to the vehicles running without oscillation or jolting.

It is stated that the aeronaut, Mr. Roy Knabenshue, has invented a remarkable gas engine for a new airship built to carry two persons. The engine weighs only 54 lbs., but generates from 12 to 16 horse-power. It is of the two-cycle pattern.



Rounding a Curve.



Ascending an Incline.

TRIALS OF THE BRENNAN MONO RAILWAY.

For description] [*see pages* 483—484.

Chats on Model Locomotives.

By HENRY GREENLY.

(*Continued from page* 444.)

SINCE penning the notes on the proposed valve gear for a model 7-16ths-in. scale six-coupled express engine of the "Caledonian" type in the issue for May 9th, I have made some practical experiments with the object of finding out whether or no the double-slide method of making the reversing shaft, suggested in the alternative sketches (see Fig. 2, page 442), is really necessary to success. The engine fitted with the motion was a horizontal engine temporarily made up out of stock parts, the cylinder measuring ½ in. by ⅜-in. stroke. No correcting motion was employed, and it had at first a single slide-block.

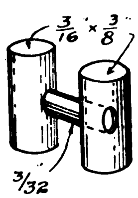


FIG. 1. SKETCH OF DOUBLE BLOCK AND PIN.

On trial under steam, the conclusion I came to, after allowing for minor faults in the design and construction, was that the single slide-block would be quite satisfactory with perfectly fitting pin and knuckle-joints, but that, as I had suspected, the single circular slide-block would tend to rock axially where the pins were not a dead fit, and lost motion at the valve would be the result.

To allow for such shortcomings in the matter of fitting (and also for wear and tear on the parts) the two-block method may be adopted with advantage.

The use of two blocks and slides per cylinder (see the lower sketch, Fig. 2 in last article, for an idea of the construction of the reversing shaft) means that the tapping of the slide-block and the fitting of the stud and nut will not be necessary. The two slide-blocks—made out of steel rod preferably—should be turned to size and drilled with a 3-32nds-in. hole in the centre. A pin should be fitted, when the blocks will present the appearance indicated in the hand-sketch (Fig. 1) herewith.

The slide-blocks may be 3-16ths in. diameter instead of ¼ in., which will save a little room and result in less metal being cut away from the reversing or slide-shaft.

Before describing the simplified Joy's gear promised last week, I think it will be as well to show those readers who are not familiar with the design of radial valve gears why it is usually necessary to provide some form of correcting motion. I will deal with the proposed gear for the model "Caledonian" engine, and also show how to set out the motion for a larger or smaller locomotive than that which I am describing at present.

A reference to the full-size drawing of the gear (already mentioned) will show that the main movement (that is, the vertical movement) of the slide-blocks on the slides of the reversing shaft is obtained from the big end of the connecting-rod, which describes more or less of a circle. Having no provision for lap or lead on the valve, the horizontal movement of the pin joint is of no use—rather the reverse. The resultant of the vertical movement is a movement in a horizontal direction, which is timed a quarter of a revolution behind (or in front) of the crank-pin, and which is only present if the

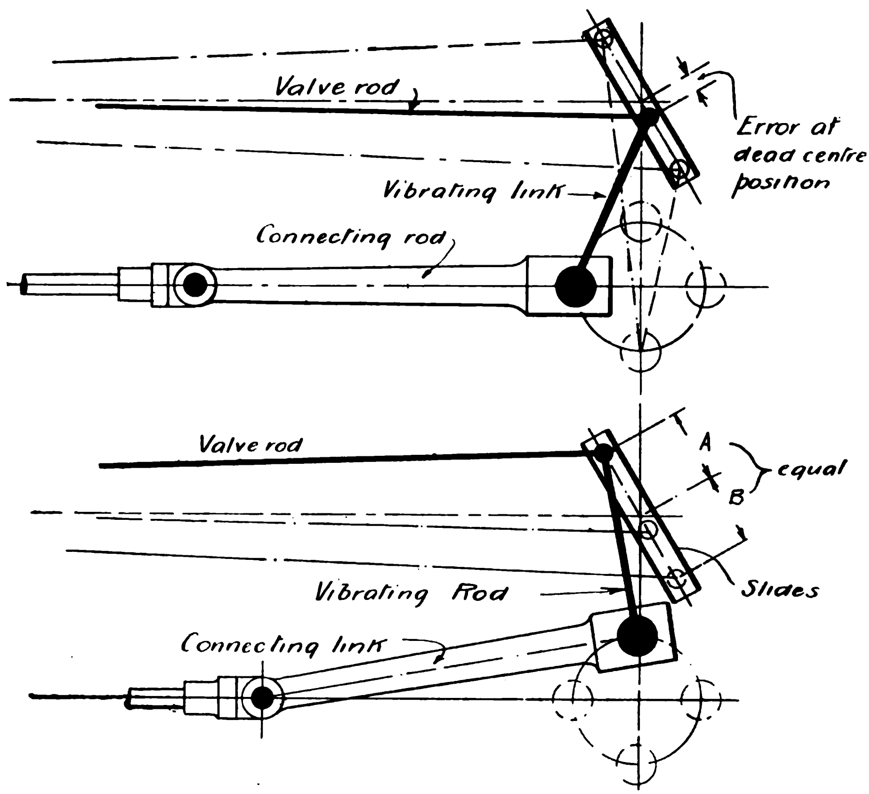


FIG. 2.—DIAGRAMS SHOWING THE EFFECT OF PROVIDING NO CORRECTING MOTION TO A RADIAL VALVE-GEAR.

(*This arrangement has a vibrating link of theoretical length and gives an error at the dead centres.*)

slides are tilted at an angle by the reversing rod and gear from the driver's cab.

It would be possible to actuate the slide-blocks from the big end, or crank-pin, direct, instead of bothering with the horizontal link or rod, which I have termed the connecting-link in the general arrangement drawings of the valve gear. This was done in the early forms of radial valve gears (like Hackworth's and Wolff's), but the very small vertical space which is allowable in a locomotive prevents such a gear being used. The distance between valve spindle and piston-rod is more or less limited and furthermore, the presence of the boiler would reduce further extension of the vibrating link impossible. It would require a vibrating link four or five times the length of the stroke of the piston to get a reasonably equal distribution of steam on each side of the piston. Under such circumstances as the above, the valve spindle would have to be placed $3\frac{1}{2}$ to 4 ins. above cylinder centres, which is, frankly, quite out of the question in a 7-16ths-in. scale 2-in. gauge model.

It is at this point the correcting motion comes in, and to emphasise the necessity for such a system of links I have prepared two sets of sketches which show a valve motion (not corrected) on the lines just mentioned, in which the vibrating link is approximately only twice the length of the piston stroke. The gear is actuated direct from the crank-pin.

The mathematical faculties do not require to be brought into play to see that with such an arrangement the slide-block will not move equally up and down the slides. The vertical component of the harmonic motion of the crank-pin will be upset by the angularity of the vibrating link when the big end is either on the back or front dead-centre.

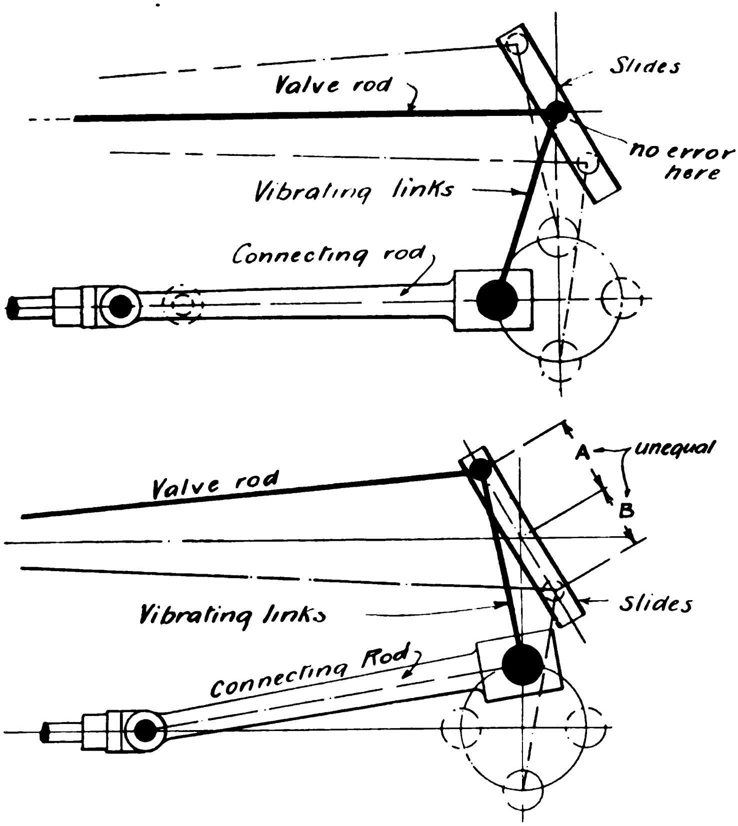


FIG. 3.—DIAGRAMS SHOWING AN UNCORRECTED RADIAL GEAR WITH THE VIBRATING LINK LENGTHENED TO NULLIFY THE ERROR AT DEAD CENTRES.

(*The error is simply transferred, and the valve travel is unequal on either side.*)

I have shown two arrangements, Fig. 2 and Fig 3. The first is proportioned with vibrating link the theoretical length (the same length as the distance between the centre of the reversing shaft and the centre of the crankshaft), and it will be seen that whilst the movement on each side of the axis of the reversing shaft is to all intents and purposes equal, the die block is not in the central position when the crank-pins are on dead centre. The error is shown in the upper view of Fig. 2, and, of course, varies with the length of the vibrating link. The valve, therefore, does not shut at the right time, the back or front port remaining open to steam according to the position of the driver's reversing lever.

If we lengthen the vibrating length to the extent of the error in the central position, the timing of the valve (a valve without lap, that is) will be correct, but the slide-block will move higher in the top half of the slide than in the lower, as indicated at A and B in the upper view of Fig. 3 herewith.

To overcome such inaccuracies, correcting motions are employed. Sir Arthur Heywood's motion is that adopted for the "Caledonian" model, as shown in the general arrangement drawing published in the previous issue to this.

The correcting motion serves two purposes. The first is, to reduce the amount of the vertical movement in the slide (which is excessive in the arrangements shown in Figs. 2 and 3), and, secondly, the link gear is so proportioned that it corrects the effects of angularity in the vibrating link.

The vertical movement is, of course, reduced by the fact that the horizontal connecting-link is a lever (of the second order, I believe), the F, W, and P points being almost equidistant.

Having adopted such a lever, we have to provide some means of slinging the outer end. A sling link is the simplest device, more especially as this link can be made to fulfil the second requirement. Therefore, we term it the "correcting" link.

Going over the diagrams (Figs. 3 to 6) I prepared for the last "Chat" article to show the action of the gear, the reader will find that the sling link (the correcting link) which supports the back end of the connecting-link is comparatively very short, and that the knuckle-joint of the two links swings through a rather large arc—somewhere about 90 degs. The joint, and consequently the horizontal connecting-link, is thereby raised a considerable distance when the crank-pin is on either dead centre (Figs. 3 and 5).

It is this up-lifting of the connecting-link that nullifies the effect of angularity in the vibrating link. Furthermore, it will be seen that the length of the correcting link and the position of the anchor shaft (the point of suspension) form the crux of the whole matter.

The leverage of the connecting-link is about 2 to 1, and therefore it follows that the length of the correcting link is approximately half that of the vibrating link.

To obtain accuracy, however, the valve gear should be set out graphically on paper and the method I have adopted for this is shown in Fig. 4 herewith. The process is as follows:—

Mark out the four positions of the pin joint of the connecting-rod and connecting-link* A, B, C, D.*, drawing a horizontal centre-line X Y through points A and D. With a suitable length of connecting-link (say C K) draw a line of the length C K, with K on the centre-line. With same length draw a line B to KB on the X Y line. Select a point F on the connecting-link which will move the slide-block up and down a sufficient amount to give the required valve travel with the slide-shaft at an angle of not more than 60 degs., as indicated at S L. The point F is represented by point FB on the B KB line.

Draw vertical dotted lines Fx and FY from points FB and F, as shown, and midway between these lines draw a line cutting the X Y line at G and the valve spindle centre-line at H. The point H is the position of the reversing slide-shaft, and G.H the length of the vibrating link, R being the distance from the crankshaft centre-line. With radius G H from point H scribe an arc P Q.

With radius C F from points A and D respectively scribe an arc cutting the Q P arc at LF and MF, projecting lines of the same length as the connecting link C K from points A and D through LF and MF respectively, as indicated. These will terminate at KA and KD as shown.

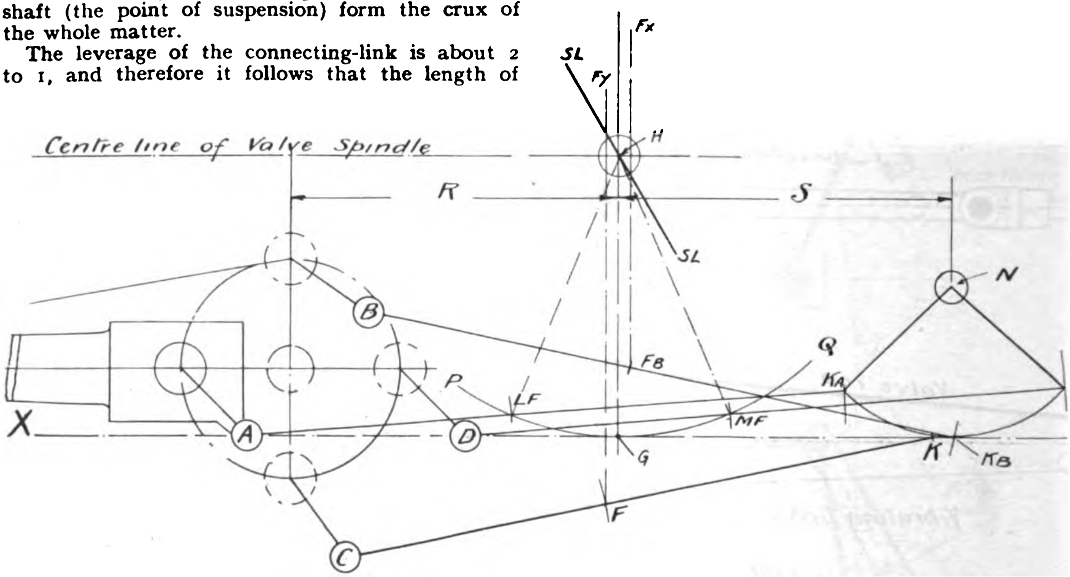


FIG. 4.—DIAGRAM SHOWING HOW TO SET OUT THE HEYWOOD TYPE OF CORRECTING MOTOR AS APPLIED TO A MODEL.

By trial and error find the centre-point N, from which an arc can be made to cut points KA and KD and at the same time touch the X Y line near K or KB. The distance N to KA, or, which is the same thing KB to N, is the required length of the connecting-link, and N is the point of the suspension, viz., R+S, distance from the centre of the crankshaft.

By making further diagrams it will be found that the die block moves through equal distances below and above the axis H of the reversing or slide-shaft.

(*To be continued.*)

* The peculiar position of this joint just behind and below the centre-line of the crank pin is intentional. The writer found that with the given valve and piston-rod centres a sufficient length of vibrating link was not obtainable without recourse to such an expedient.

GLACIER ice is now delivered to the larger consumers of European cities. There are so many railways in the Alps at present that it has been found profitable to gather this ice and transport it to the cities, where it is preferred to other ice because of its hardness and lasting qualities. This ice is blasted and mined in the same manner as stone is quarried.

How to Make a Wool Winder.

By J. C. Clough.

THE amateur mechanic is not always a single man, and the fact of his being the happy partner in a domestic establishment need not interfere with, or detract from, his enjoyment of the dear companionship of his lathe and bench. He may not be able to devote as much time to his tools as when single, but he has now more incentive for work of a decided useful character, as compared with the model engine or other mechanical toy productions of his bachelorhood. His better half is doubtless of a very domestic turn, and, likely enough, has to attend to the requirements, in the way of certain knitted garments of a number of young prospective amateur mechanics, and ditto wives of such.

How often have we seen him, sitting demurely enough in outward appearance, but inwardly chafing at being kept from some important piece of work, holding on his outstretched hands a

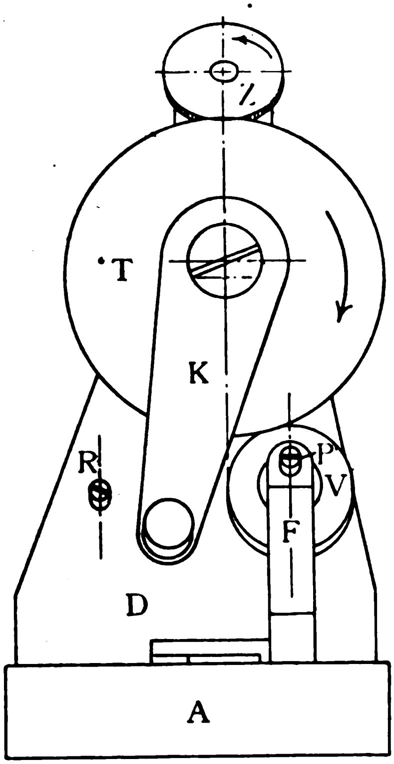


Fig. 3.—End Elevation.

tangled skein, whilst his devoted helpmeet vainly endeavours to wind the scribble into a ball!

The thought strikes him that this can be much better and easier done by a machine, which, clamped to the table and turned with a handle, would leave him at liberty, and at the same time make the winding a pleasure, instead of, as at present, an annoyance. Out comes the drawing-board and tackle, and the result, after much thinking and many alterations, stands revealed as shown in the elevations and plan, Figs. 1, 2, 3, and 4.

Wood being an easily wrought material, and quite serviceable for our purpose, forms the base and frame of the machine. The base A and the uprights D and E are of some free-working, straight-grained pine. The centrepiece, which forms the bearing for the tubular spindle B C, is made of hard wood, and the two cones H H and the bobbin J must be of a wood that will not easily split,

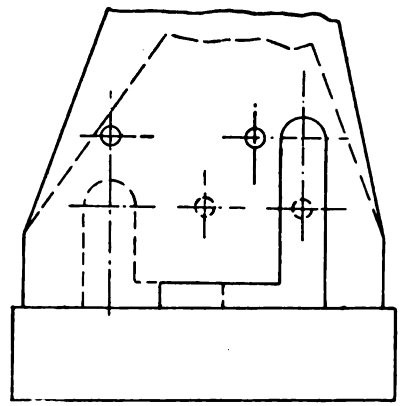


Fig. 4.—Part End Elevation.

whilst at the same time it need not be as hard as the tube bearings; the small brackets F and G may be of the same wood as the tube bearings.

The iron work consists of the wrought-iron spindles J N and M, the sack side and friction roller carriage *c* and *d*. The steel screws P, Q, R, S. The steel spindle on which the friction roller slides, the steel spring *a* and a coil spring made of the thinnest piano wire, and the wrought-iron handle K. Of cast iron are the main wheel T, the wormwheel W, the intermediate X Y, the pinions V and Z, and the friction roller. There are also the turned centre pins for the great wheel T, and for the intermediate wheel X—these, with their nuts, being of wrought iron.

The wrought iron and steel portions of these materials are easily obtainable, and it is scarcely worth while to make patterns for castings of the wheels, as they can be obtained very cheaply from the repairer of sewing machines.

The numbers of the teeth of the wheels are not very material, but the wheel T of 85 teeth, W of 60, X of 32, V and Z of 30 teeth each, are common in hand-sewing machines, and so easily obtainable. The pinion Y of 16 teeth will have to be cut, so notice that that wheel has a boss large enough for the purpose when making the purchase. When making the selection, observe that the pinions V and Z gear truly with the large wheel T, and that the boss of each is deep enough to allow of a setscrew being put in; the boss of T must also be deep enough to allow the handle K to be fitted on and held with a setscrew.

Now, before a start can be made on the frame, it is necessary that the angle at which the cone spindles are inclined should be obtained. The wheel W, which is to act as a worm wheel, will most likely have its teeth cut at right angles to its plane as is usual, so any screw gearing with these teeth as a worm pinion will work most freely when its axis is placed at such an angle with the plane of the wheel that the thread of the screw may be vertical to the plane of the wheel at the drawing, as Fig. 5, to double the dimensions of the worm pinion: this will be 1 in. long and ¾ in. diameter; set out along the top line ¼ in. and along the bottom line, first ⅛-in., then ¼ in.; now join the

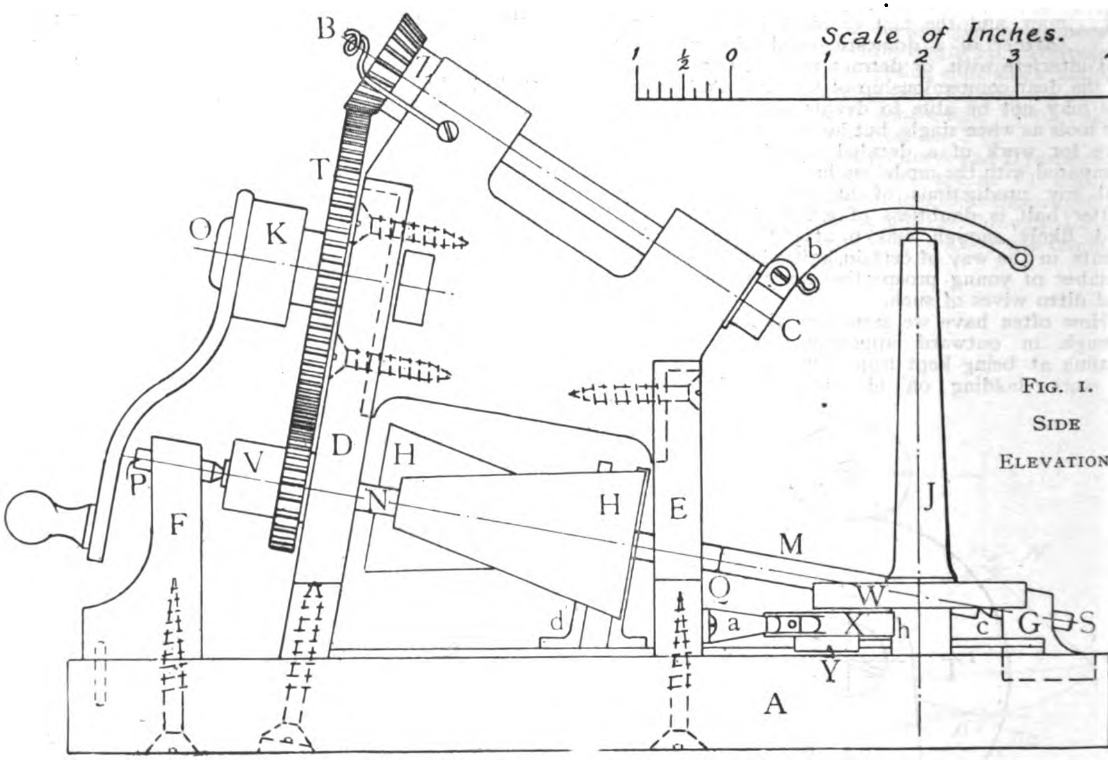


FIG. 1.
SIDE ELEVATION.

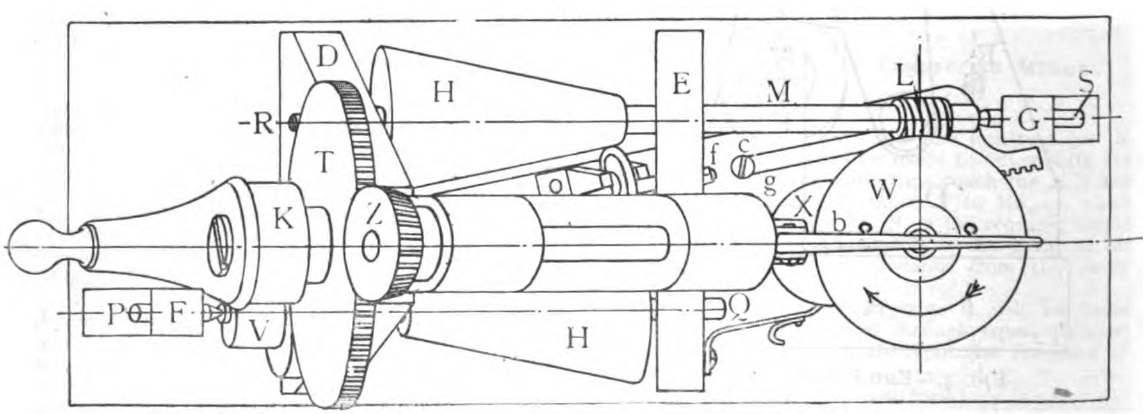


FIG. 2.—PLAN.

GENERAL ARRANGEMENT OF MACHINE FOR WINDING WOOL.

point of contact. First, find the pitch of the teeth of the wheel, which may be readily done by applying a screw chaser to them. Presuming it is found that an inch chaser—that is, 8-threads to the inch—gears well with the teeth, make a points set out, and the lines so obtained represent the thread of the worm pinion. Now a line drawn through the axial line of the worm, at right angles to the line representing the thread, will be parallel to the plane of the wheel, and the angle between this line and the axis of the worm is the angle at which the cone spindles are inclined.

After planing up the base A truly flat and square, proceed to form the uprights D and E, making the foot of D at such an angle that it will stand exactly at right angles with the cone spindles, whilst E is made vertical to the base.

Next make the centre-piece that forms the bearings of the tubular spindle B C. This is of hard wood 1 in. thick; it must be made to the dotted lines which indicate that it is let into the standards or uprights, which are to be recessed to take it, making a nice fit and keeping the angles very correct. As it will be seen, the axis of B C must cut the axis of J at a point about halfway up from the base. The standards and centre-piece are firmly held together by three screws, as shown dotted in Fig 1. Now, there is a way of putting in these screws which will prevent the splitting of the wood, which almost invariably follows the usual forcing by screw-driver, trusting to their gimlet point to make their way. First, in the part that takes the head, make a clean hole of the size of the neck so that the screw will pass freely. A twist bit, or sharp twist drill, is best for this purpose, as the ordinary gimlet leaves a rough hole, if it does not split the wood.

The hole for the threaded part of the screw is drilled to the size of the body of the screw at the bottom of the thread, and deep enough to take the length of the screw. In hard wood it is safest to tap this hole before putting in the screw, as it saves the time that is wasted in drilling out the

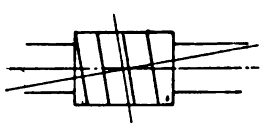


FIG. 5.

screw that frequently breaks off before it is home. A tap is easily made by filing a flat on one of the screws, taking a little less than half the thickness off the screw, leaving the cutting edge quite sharp but rounding off the following edge, which prevents dragging when withdrawing. A little grease should be used when tapping the hole, and the tap should be frequently withdrawn and cleared of the cuttings. This may seem a tedious process, but it saves a lot of trouble and disappointment. Before finally screwing the standards and centre-piece together, set out by the drawing the centres of the holes Q and R for the screws that support those ends of the cone spindles; also the centres of the clearances in each standard for these same spindles, and on the line joining these centres on each standard, and which is parallel with the base, set out at correct distances from these centres the centres for the spindle *f f*. These holes require to be drilled at exact angles with the surfaces of the standards. This may be easily done in the lathe by making packings of suitable angles.

A little extra care will be required in boring the bearings B C, so as to have them exactly in line.

The frame as a whole may now be fitted to its place on the base, and secured by screws, as shown dotted in Fig. 1.

The brackets F and G are to be made of hard wood, and secured by screws as shown, G being sunk ¼ in. in the base, nicely fitted, and F held to its place by a steady pin of iron wire.

Before the frame is screwed together it will be as well to make the clearances for the cone spindles and for the slide that carries the friction roller. These are shown in the diagram (Fig 4), the full lines representing the standard D; the dotted lines, the standard E.

(To be continued).

Design for a ½-in. Scale Model L. & N.W.R. Co.'s Locomotive, "Experiment."

THESE models, designed by the firm of James Carson & Co., Ltd., Birmingham, present a few features of novelty in construction which may be of interest to our readers. Externally, the engines are a very close copy of the prototype, wheel diameters being rigidly adhered to, and the only departure from scale in the wheelbase is a slight addition to the driving and coupled wheel centres, as it is impossible to obtain a satisfactory flange on a wheel made exactly to scale, and a precisely scale dimension of wheel centres would make the flanges of adjacent wheels touch one another.

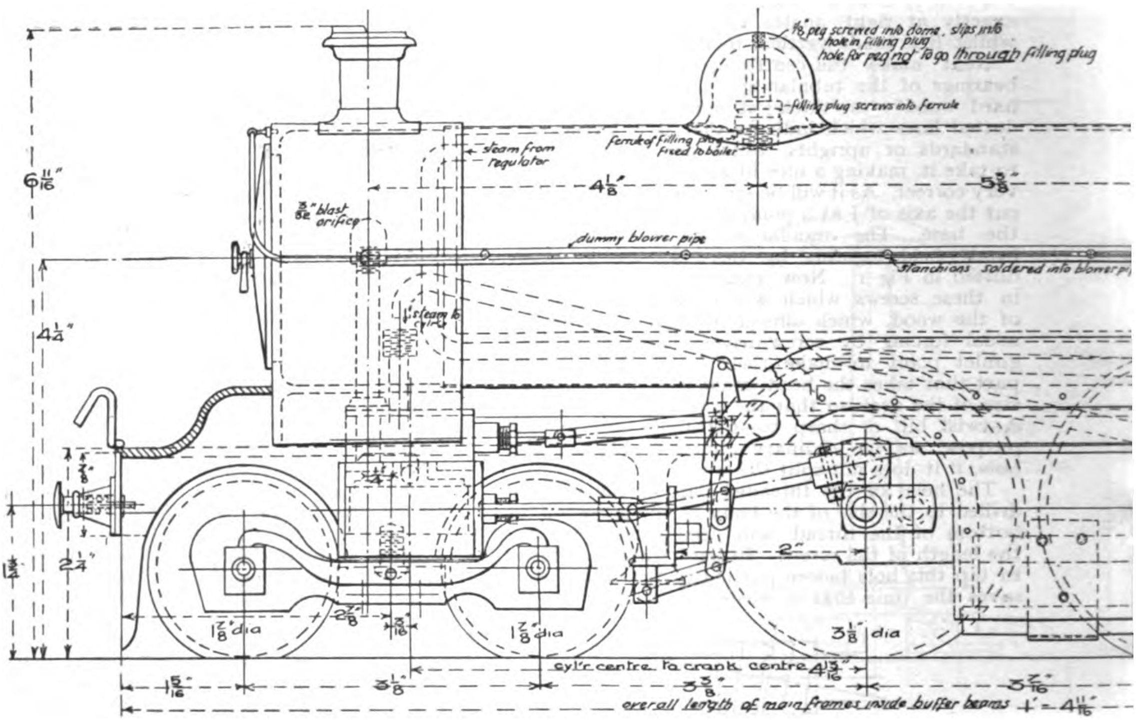
The prototype forms an advantageous one of the six-coupled engine, as the rigid wheelbase is short in comparison with such engines as the Caledonian, and as a matter of fact the small difference in over-all measurements of the "Experiment" and "Precursor" typ es will probably surprise anyone who is not aware of actual figures.

In the model referred to the boiler is of the water-tube type, the diameter of the true boiler being as large as possible, and the number of water tubes being kept down, according to the practice found advantageous by the makers, who believe that free flame-room for a methylated spirit fire is of greater importance than a large number of circulating tubes, and that the successful steaming of a model principally depends on the correct adjustment of the blast pipe.

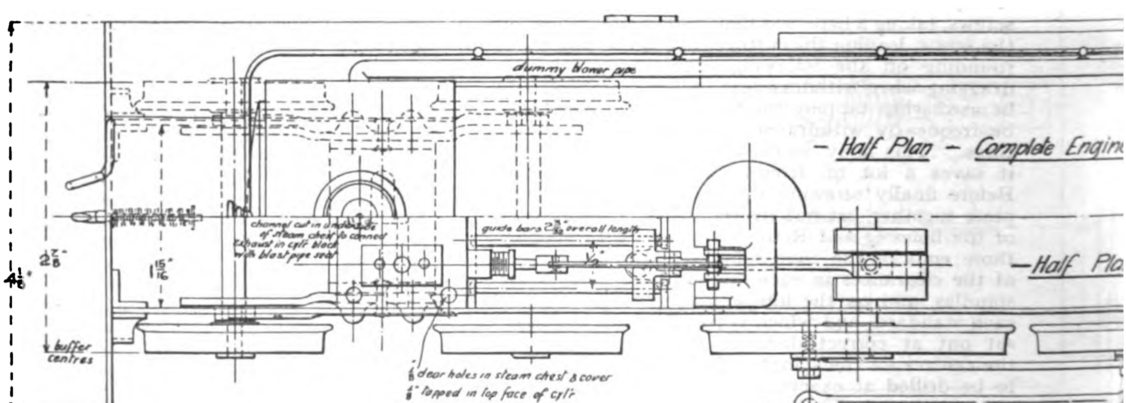
The cylinders, with valves on top, conform to the generally accepted size of ½-in. bore 1-in. stroke, although the makers inform us that they have not the slightest difficulty in steaming ⅝-in. bore cylinders when the maximum pulling power is required.

The valve gear is the well-known "Joy" type, but arranged without provision for "lap" or "lead," which offers no advantage in models of this scale. The parts of the gear are clearly shown in the detail drawing (Fig. 4), and should present no difficulty to any amateur, being made throughout of flat strip metal. The radius shaft, or curved slide, of course, requires a special tool to produce, although it may in case of necessity be made straight, or not curved, without *seriously* interfering with its action.

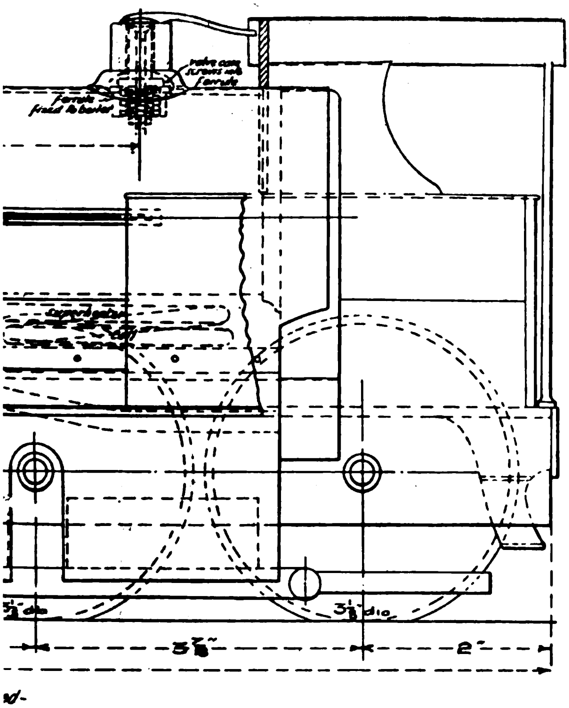
The bogie is of novel design, the sides being pivoted to the stretcher, and the whole bogie is therefore quite free to "wind" or twist to any inequality of the road. This avoids the necessity of equalising bars and springs, and is to all intents an absolute preventative of derailment. Axle-boxes have not been used, as no advantage is derived if the play be limited to anything like a scale amount, and on the other hand a large travel of

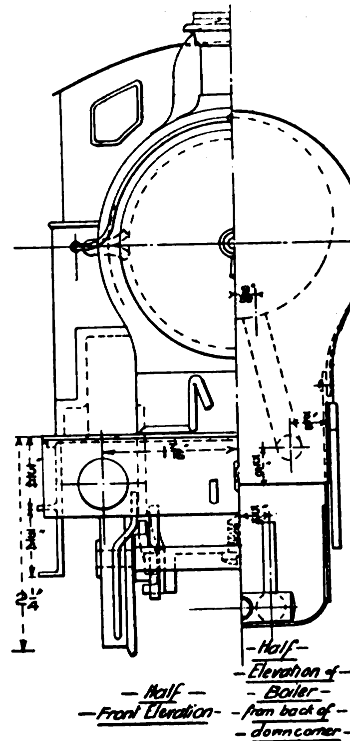


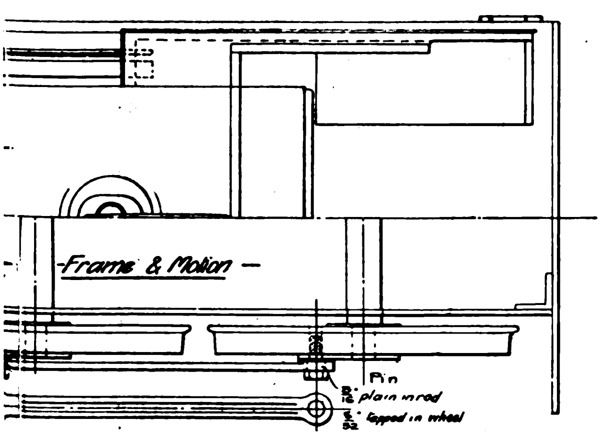
– *Longitudinal Elevation of Engine* – *near wheels, mainframe, & motion remo*



For description] *(Scale: H*







DESIGN FOR A HALF-INCH SCALE MODEL L. & N.W.R. EXPRESS PASSENGER ENGINE, "EXPERIMENT."

By

JAMES CARSON & CO., LTD., BIRMINGHAM.

(full size.)

[see pages 491—494.

the box means trouble and possible locking of the coupling-rods.

The firebox is long, a pair of wicks being placed in front of the leading coupled wheels, and the curve of the throat-plate should be noted, as this has been found to be a very important feature.

Messrs. Carson & Co. inform us that they have experimentally proved this on a model which was built with a throat-plate of ordinary design, and absolutely refused to maintain steam. Without any other alteration the curved throat-plate was fitted, and the engine at once steamed freely.

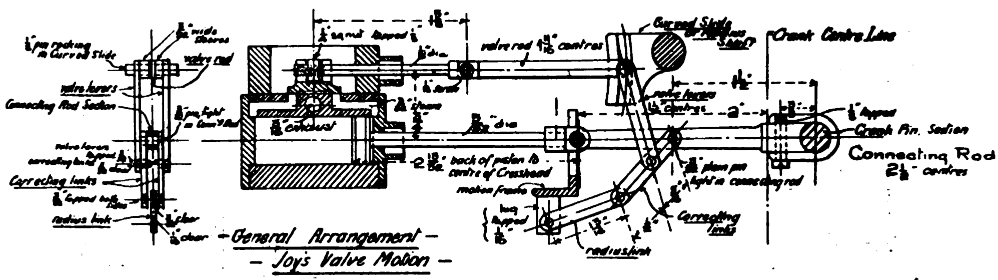


FIG. 4.

This feature, and the precise position of the blast, which the makers find must be obtained by experiment, constitute the most important points to be attended to.

In order to provide for short-radius curves—when scale bogie wheels and centres are used—the cylinder block may be cut away, as shown in the sketch (Fig. 5); or, if needful for very short radii, the bogie may be built with 1⅛ ins. diameter wheels placed at 3¼-in. centres, the cylinder centre being in the same vertical line as the bogie centre, and the engine so built can negotiate curves of 5-ft. radius. The difference in appearance, though, of course, noticeable to the trained eye, is not so great as would be thought.

The entire side footplate, splashers, and cab sides are cast in brass, making a very strong construction and one which effects a saving of much trouble to the amateur builder.

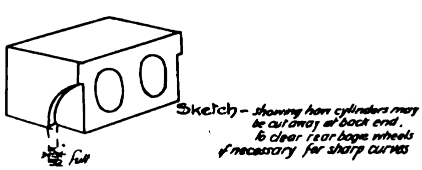


FIG. 5.

The models are designed to work at 40 lbs. pressure, and once the cylinders are thoroughly heated will give surprising results. Messrs. Carson inform us that they have had one engine, with ⅞-in. bore cylinders, which pulled a 10-stone man on a double-bogie truck, and takes easily at a high speed a train of fourteen large double-bogie vehicles as a regular thing.

We may add for the benefit of any readers who may wish to build one of these excellent models that castings and all materials and parts may be obtained from Messrs. James Carson & Co., Ltd.

Locomotive Notes.

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

A New Great Northern Locomotive Type.

The first of a new type of tank locomotive is now working on the Great Northern Railway in the London district. The engine is numbered 190, and has six coupled wheels leading and a pair of radial carrying wheels. The boiler is of large proportions for the class of engine, and is pitched about the same height above rail level as are those of the eight-coupled ten-wheeled tank locomotives on the same line.

The writer was on a recent occasion afforded an opportunity for noting the capabilities of No. 190. The engine handled a train-load of 150 tons with ease on the gradients of the High Barnet branch, and ran in front of time without being pushed in the slightest degree, with one of the most difficultly timed trains of the day. In a subsequent issue No. 190 will be illustrated and her leading dimensions given. For the moment it may be said that the new type presents an especially powerful and neat appearance, and several more engines are being built from the same drawings at Doncaster Works.

Hardly Correct.

Railway and Locomotive Engineering, of New York, is an interesting publication, enjoying a considerable vogue among railway men in the United States. The controlling spirit is Mr. Angus Sinclair, who originally hailed from "Bonnie Scotland," and who may even now be encountered sometimes making holiday in that delightful region known as the Highlands. Like all other papers, *Railway and Locomotive Engineering* occasionally goes a little bit astray when dealing with foreign railway matters. In its April issue two amusing (to those on this side) errors are made. The new Hook of Holland corridor express train of the Great Eastern Railway is illustrated, and described as belonging to the "London and South Eastern Railway," whatever that may mean. "New French engine and train" is the underline to a small reproduction showing one of the "City" class 4—4—0 type locomotives of the Great Western Railway built at Swindon Works.

No doubt there is among the many readers of The Model Engineer in America some one who will point out the little discrepancies mentioned above to Mr. Sinclair.

New Express Locomotives for the Swedish State Railways.

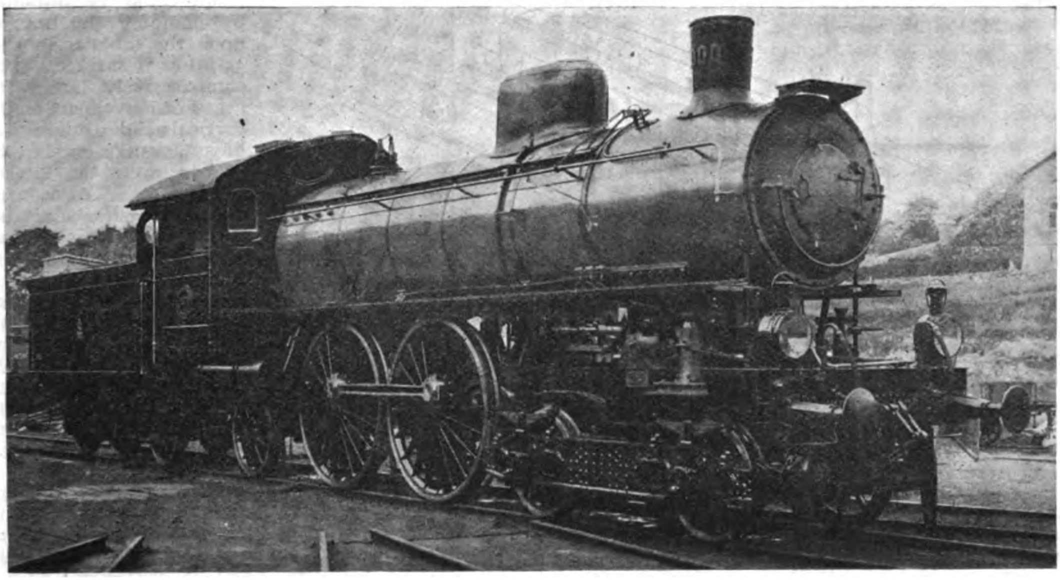
Until quite recently the most modern locomotives employed upon the Swedish State Railways for hauling express passenger traffic were not remarkable either in size or design. This has now, however, been altered by the introduction of a new series of engines, one of which is, by the courtesy of the builders, Messrs. Nydqvist & Holm, of Trollhättan, Sweden, illustrated herewith. The wheel arrangement, as will be seen, is 4—4—2, and inside cylinders are employed. The valve gear is of the Heusinger type, actuating piston slide-valves which work on top of the cylinders. A large and high-pitched boiler is provided, and the smokebox, which is of the extended pattern, contains a spark-arresting device. Superheating apparatus on Schmidt's system is fitted, and the working steam pressure is 170 lbs. per square inch.

The engine main frames are of the bar type, and constructed of cast steel; the bogie frames are placed outside the wheels, and the running board is lifted clear of the coupled wheels, splashers being dispensed with. The steam dome and sand-box (the latter mounted on the boiler immediately in front of the dome) are enclosed in one casing, and the cab, which is of very commodious design, has a pointed front to counteract air resistance. The tender runs upon six wheels with outside framing, and a wind screen or spectacle plate is fitted at the front end for protection of the men when the engine is running tender in front.

The following are the leading dimensions :—

Cylinders diameter, 19½ ins.
Piston stroke, 24 ins.
Bogie wheels diameter, 3 ft. 2½ ins.
Coupled wheels diameter, 6 ft. 3 ins.
Trailing wheels diameter, 3 ft. 8 ins.
Rigid wheelbase, 13 ft. 9 ins.; total wheelbase, 20 ft. 3½ ins.; total wheelbase with tender, 46 ft. 9 ins.
Boiler diameter, 5 ft.
Boiler distance between tube plates, 15 ft. 1 in.
Steam pressure, 170 lbs.
Heating surface: Tubes 1,316 sq. ft.; firebox, 124·6 sq. ft.: total, 1,440·6 sq. ft.
Grate area, 28 sq. ft.
Weight of engine in working order, 60 tons 10 cwt.
Adhesive weight, 29¼ tons.

The engine is fitted with the vacuum brake.



New Atlantic Type Express Locomotive: Swedish State Railways.

The "Decapod" in America.

The ten-coupled or decapod type of locomotive is much resorted to in America for freight or goods train haulage. Some of these ten-coupled engines are of enormous power and size, and usually additional leading or trailing truck wheels, and sometimes both, are provided. At the present time the American Locomotive Company are building, for the Buffalo, Rochester and Pittsburg R.R., some exceptionally large 2—10—0 locomotives, having cylinders 24 ins. diameter by 28 ins. stroke, coupled wheels 4 ft. 4 ins. diameter, and a total (engine) wheelbase of 28 ft. 4 ins. The boiler will carry a working steam pressure of 210 lbs. per sq. in., and will be fitted with combustion chambers attached to the front end of the firebox, and measuring 3 ft. in length. The boiler itself is of the coned pattern, having a smallest diameter of no less than 6 ft. 8 ins., and the total heating surface is to be 3,535·5 sq. ft. Walschaerts valve-gearing is employed for actuating the slide valves, which work above the cylinders. The grate area in these engines is to be 55·5 sq. ft., and the centre of the boiler will stand 9 ft. 8 ins. above the level of rails.

Planing and Shaping for Amateurs.

By A. W. M.

III.—Methods of Holding the Work.

(*Continued from page* 474.)

FIG. 32 is an example of an angle bracket clamped in position for planing the surface. We assume that it is desirable to so plane the surface A that it will be as near parallel as possible to the under surface B. The bracket must therefore be set so

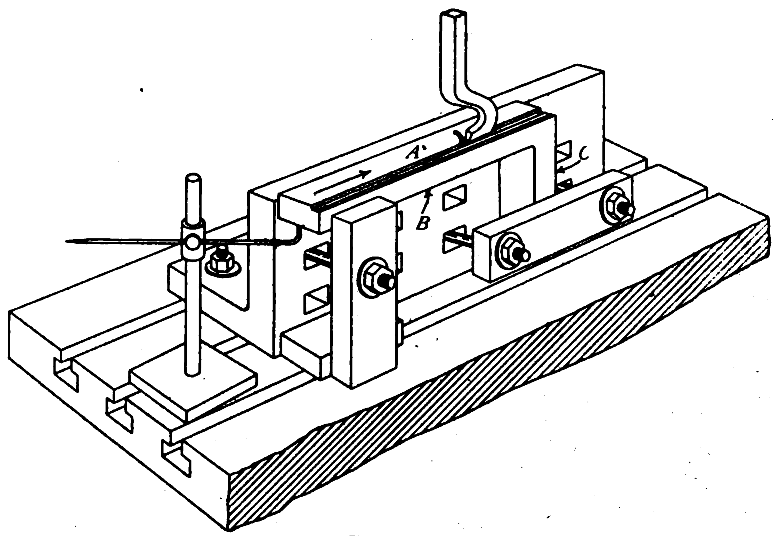


FIG. 32.

that surface B is parallel to the table. To do this, clamp the bracket lightly to the angle-plate and try surface B with the scriber rod as shown, applying the point to various places and adjusting the bracket until its surface B is scratched by the scriber when placed in an average number of positions. Obviously, if the surface gauge is moved to any part of the table the scriber point always remains at the same height, and therefore if it just touches a number of places on a surface, that surface must be parallel to the table. When adjusting such a piece of work to position, the best way to proceed is to clamp it lightly and then to tap it with a hammer so that it is shifted by a small amount at a time into correct place. The bolts are then to be firmly tightened up ready for the process of machining. If heavy cuts are to be taken over the surface A it may be necessary to support the casting by packing pieces wedged between B and the table.

An alternative method of planing this bracket is given in Fig. 33. It is placed as shown but with surface A overhanging one of the slots in the table. Surface A will now be planed by means of a side tool (as Fig. 7), fed downwards by the vertical slide of the machine. The tool will cut in a perpendicular line to the table as it is fed downwards, so we must set surface B at right angles to the table (or A, according to the one we desire to work to) by the aid of a try square (as shown) packing up the bracket by thin pieces of metal until the surface is true to the square. By placing the bracket so that surface A overhangs one of the slots the tool can complete its downward movement without cutting into the surface of the table. Plate K is used as a stop to prevent the bracket sliding along the table under the pressure of the tool.

Surface C can be planed so that it will come square to surface A by the method shown in Fig. 34. Obviously, surface D must now be subservient to C, because we have to plane A and C at a right angle to one another. The same result could be obtained by clamping the bracket upon the table as in Fig. 35; but if surface C was comparatively large, the range of movement of the vertical slide might not be sufficient to enable the tool to cover the surface at one cut. Also, as a general rule, it is advisable to make use of the cross slide of the machine in preference to the vertical slide, using the latter as far as possible for adjusting the depth of cut only. Surfaces produced as in Fig. 34 by front cutting tools are likely to be more accurate than those produced as in Fig. 35 by side cutting tools.

When adjusting a piece of work—such as the bracket in Figs. 33 and 35, or the shafts in Figs. 29 and 30—so that it will be in line with the cut taken longitudinally by the tool, a scriber point is convenient to use in the tool box. For example, the shaft should

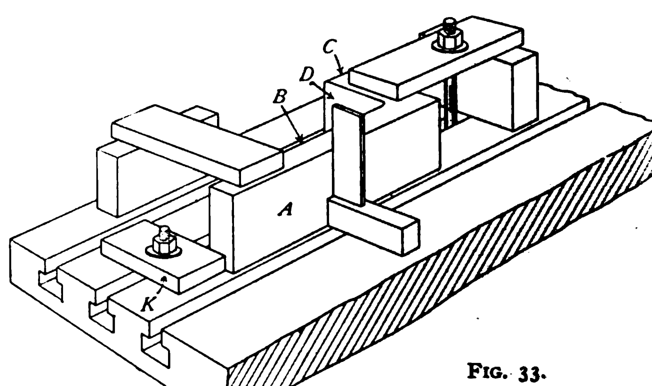


FIG. 33.

have a centre line marked down its length and ends, a straight pointed scriber (Fig. 36) would

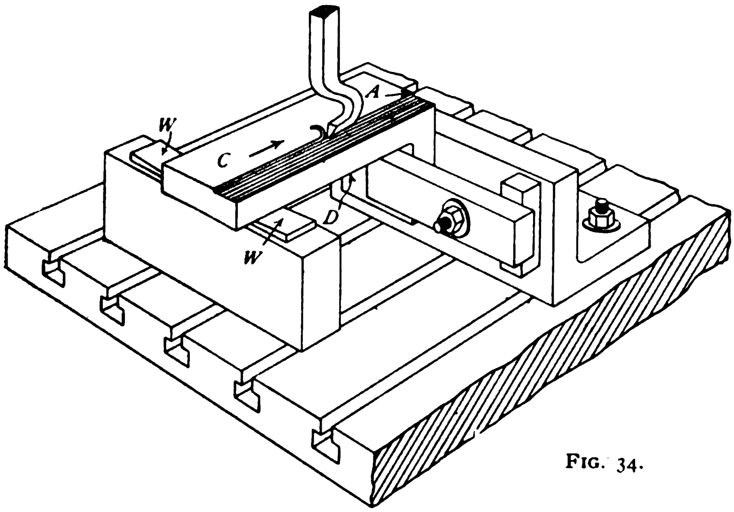


FIG. 34.

then be fixed in the tool box to represent the tool. Its point would be set to nearly touch the centre line on the shaft at G, and, the table of the machine being moved slowly by hand, will trace the cut which would be made by the tool. If the shaft is then adjusted so that the scriber point follows the centre line from G to F, and is clamped in that position, the keyway will be cut truly central along the shaft. For setting the bracket, a bent scriber point will be convenient (Fig. 36). If it is placed to just touch the surface at G, and then the table is moved by hand and the bracket adjusted until the scriber point touches all the way from G to F, the tool will make its cut in line with the surface C. If the scriber point is turned to point the reverse way and set to touch surface D in a similar manner, the cut taken by the tool over the surface C will be parallel to D.

Another example is given in Fig. 37, which shows a bedplate clamped in position for the purpose of planing the seatings for the bearings and the chipping strips P. A centre line is marked through the bearing seatings, and the bedplate being adjusted so that the scriber point passes along this centre line, the bearings will come into their correct position. The cuts taken by the tool will follow the centre line in direction. As the bedplate is provided with holding-down lugs, the holes in these can be drilled and serve to take bolts for clamping in position upon the planing machine table. We assume, however, that the distance between centres of these holes measured across the bedplate is not exactly equal to the distance between the table slots, and therefore only one pair of lugs can be used for this purpose (as shown). If all the holes happen to come opposite to slots in the table, the plates K, K could be dispensed with. When drilling holes with the idea of utilising them for holding down the work, it is important to mark them off in accurate positions with relation to any centre lines upon the work. Otherwise, when adjusting the centre line to

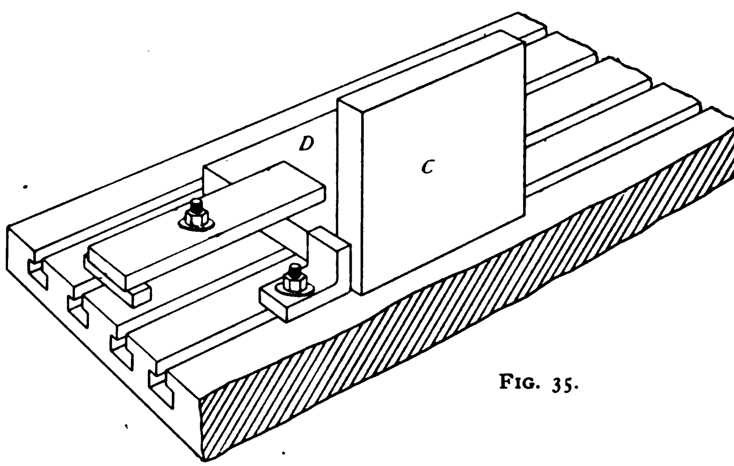


FIG. 35.

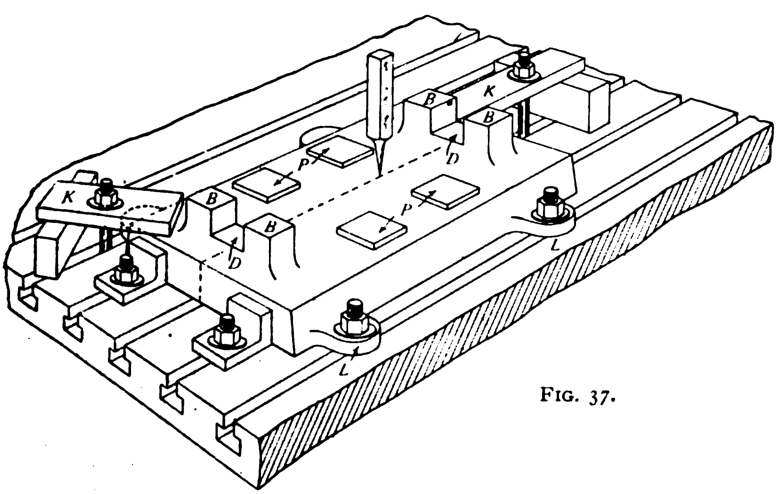


FIG. 37.

the scriber (as explained in Figs. 36 and 37), you may find the holes come out of line with the table slots and that you cannot use them. For example, in Fig. 37, if the lugs L had been carelessly drilled and were not parallel to the centre line marked upon the bedplate, you might find the play of the tools in the slots and holes insufficient to enable you to bring the centre line straight to the movement of the scriber. It is merely a matter of convenience after all, but makes for quickness in bolting down the work, if you can use holes already drilled and avoid rigging up clamping plates and packing.

The cut of the tool can be adjusted to the finished dimensions required by using the surface gauge. Suppose the surfaces P are to be 3 ins. in height from the bottom of the bedplate. Set the scriber of the surface gauge so that its point is exactly that distance above the table. You can then apply it to the cut made by the tool, adjusting the depth of the finishing cut until the point just scratches the surface produced. Suppose the top surfaces B should be planed 4 ins. above P; set the scriber point to that distance, and apply it as shown to the finishing cut taken by the tool over B. Surfaces D

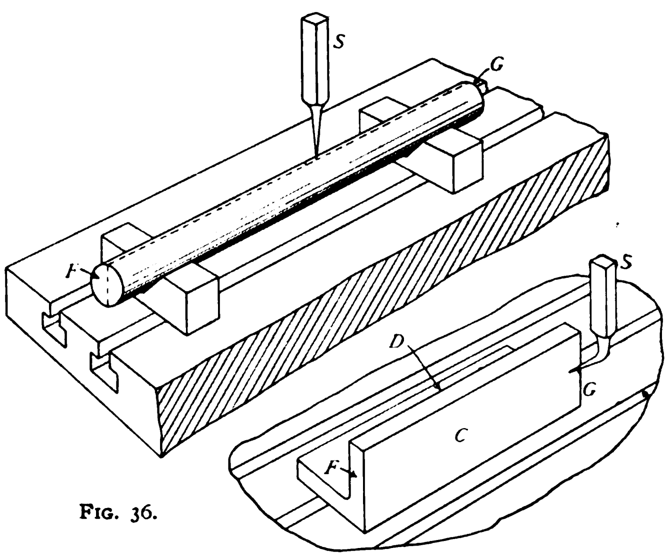


FIG. 36.

can, in a similar way, be gauged so that they are the required distance below B. To gauge the roughing cuts, set the scriber to allow for the finishing cut, and apply it in the same manner. A convenient way to determine the dimensions is to place a rule against an angle-plate (as shown in Fig. 38) upon the table of the machine, and set the scriber point to the desired mark. By the aid of a magnifying glass a fair degree of accuracy can be attained.

(To be continued.)

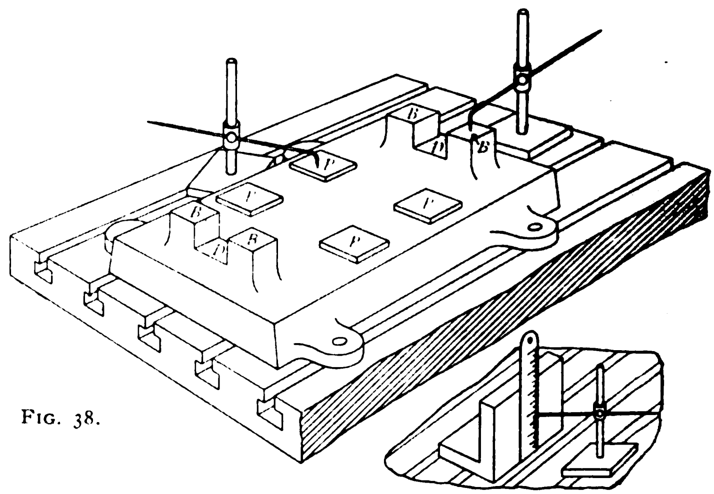


FIG. 38.

A New Illuminant.

THE Non-Explosive Gas Syndicate, Ltd., 43 and 45, Fortess Road, Kentish Town, London, N.W., recently gave a demonstration of a new illuminant known as "Cox's Air-Gas," which is now being used with success in connection with incandescent mantles. The method by which this gas is manufactured consists in adding about 2 per cent. of petrol vapour to air while the latter is being forced by means of a rotary blower, driven by a small hot-air motor, through a carburettor in which the petrol falls in small quantities over wire-gauze screens of large area, means being attached for regulating the supply of petrol so that a fixed mixture of air and petrol at a regular pressure is the result. The plant—including the motor, the blower, the carburettor, the petrol tank, and the gasholder—is very compact, and occupies but small space, the whole being carried on an iron stand. Ordinary fittings and burners may be used, all that is necessary with the burners being to close up the air-holes, as the gas has sufficient air in it not to require these air-holes. The petrol vapour being very much diluted with air, the gas is non-explosive. It is smokeless, non-corrosive, non-poisonous, and contains no sulphur, ammonia, or tar, and it is said that colours may be seen by the flame as in daylight. One inverted incandescent mantle, of the "Bijou" size, is said to give a light of 90 candles when consuming 6 cub. ft. of gas per hour, and one gallon of petrol is said to produce 1,000 c.-p. for twelve hours. The apparatus is at present made in five different sizes—namely, to produce 1,200, 2,000, 3,000, 5,000, and 8,000 c.-p. respectively.

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 intended for publication.]*

Re Modified Daniell Battery.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have read with interest Mr. Green's letter on the modification of the Daniell battery.

It may be of interest to him to know that I have used sal-ammoniac in place of sulphuric acid, which is more expensive than the former. A cell was fitted up in the usual manner, with a strip of copper immersed in the porous pot with copper sulphate, but sal-ammoniac is placed in the outer vessel with a zinc rod in place of sulphuric acid.

This battery was connected up in circuit with a bell, which it rang loudly for some fifteen minutes. The battery was then disconnected and allowed to rest for some hours, when it was found to be as strong as at first.—Yours faithfully, "AMATEUR."

S. Devon.

The Undertype Engine: Piston Packing and Flange Pipe Joints.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I am very pleased that your correspondent, Mr. C. Blazdell, finds the new undertype design interesting. With regard to the proposal to use flanged joints, I am afraid, apart from the difficulty which might be experienced in fitting them together in the smokebox of such a small engine, that the flanges, if made in brass, would bend on tightening up the bolts, and a really tight joint would not result. The metal, if the flanges were silver-soldered on, would sure to be soft, and therefore the thickness of such flanges, if used, should be quite double that shown in the sketch.

With regard to the piston packing. The method is illustrated in my book, "The Model Locomotive," and as far as I remember the suggestion was given to me by Mr. Arthur Bowling some five or six years ago. The stamp-paper dodge of temporarily holding the spring is, however, novel and very good.—Yours faithfully,

Watford. HENRY GREENLY.

The Windmill Design.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Being a constant reader of THE MODEL ENGINEER, and greatly interested in the subject of windmills as a motive power, I was very pleased to see the letter by Mr. Woodthorpe in your issue of April 25th. I, for one, should be greatly obliged for a description of his self-acting sails; perhaps there are other readers as deeply interested in the subject as myself who would also welcome it. I often wonder why the humble windmill is not used more than it is for amateur's purposes, being a cheap power, but I suppose the irregularity of speed is the chief obstacle in the way. I, like Mr. Woodthorpe, would also like to know if there are any other readers who run their shops by this power, and to have a description of them if it could be arranged.—Yours truly,

"WIND-POWER."

Six-coupled Locomotives.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I have read with much interest the articles on the above that have recently been appearing in your excellent Journal, and in consequence of the opportunities I have in associating with various railway engineers, perhaps I may be allowed to make one or two comments upon the articles in question.

It is stated that in the earlier type of Caledonian locomotives (which, I presume, refer to Nos. 49 and 50) that the strain upon the bearings caused the hornblocks to splay out. This is not correct, as when recently visiting Mr. McIntosh I was shown No. 50 in the shops, and the bearing was taken out in my presence. The small amount of wear was particularly pointed out to me. While discussing these two locomotives, perhaps it would be interesting to your readers to know that the bore of the cylinders of 49 and 50 are 20 ins., and not 21 ins., as is so often given.

Mr. McIntosh told me that he had never intended or thought of giving these locomotives a cylinder of 21-in. bore. Perhaps the use of the same patterns as the eight-coupled goods locomotives has brought about this error.

The heating surface of the Cardean class (which to my knowledge, has never been published) is 2,400 sq. ft., made up as follows:—Firebox, 148·25 sq. ft.; tubes, 2,851·75 sq. ft.: total, 2,400 sq. ft. The spacing of the tubes being greater and the smokebox let into the barrel, causing the heating surface to be smaller than one would expect. However, I must say the steaming of "Cardean" is a great improvement over Nos. 49 and 50. For, with a load of 375 tons, "Cardean" mounted the Beattock Bank quite easily; the safety valve blowing, and the steam pressure remaining steady at 203 lbs. per sq. in.

Mr. McIntosh told me that he retained the low footplate level of 4 ft. from the rails, not because Mr. Drummond instituted it, but in order to give the locomotive a neat, bold appearance. To such an extent does this gentleman study the neat outline that in consequence of a quiet chat, the ugly, deep lip of "Cardean's" chimney has been cut down in all the new Caledonian locomotives.

It may be interesting for your readers to know that one of the huge North British "Atlantics" is being fitted with the New Century Engine Company's latest arrangements, and a great improvement in the steaming and power of the locomotive is promised.

With regard to the new four-cylinder 4—6—0 Great Western locomotives, they are doing better work than the "Atlantic" No. 40, which, together with the compounds, I might add, were the best riding locomotives I have ever travelled on.

As regards the details of the new "Pacific" locomotive (which is now being constructed) I am not at liberty to divulge, but I might state that they will exceed even the most advanced locomotive enthusiast's wishes.

The gigantic "Pacific" four-cylinder compounds which are now being built in France will be found to have a new arrangement of cylinders, but details and the drawings I have been requested to keep secret for the present. Those dimensions given in one of the daily papers were not correct.

However, the above is sufficient to show that 1907 will prove to be a great year in the development of the modern locomotive. Trusting that these few lines may be of interest to your readers, I am, yours faithfuly,

"COMPOUND MODEL LOCOMOTIVE."

Re Motor Bicycle Construction.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The statement in your last issue in the article on "Construction and Repairing of Motor Bicycles," that a crank-pin fixed to the connecting-rod and revolving in bushes in the flywheels offers double the surface for wear over the usual system is surely written under a misapprehension. The power is always taken off one end of the crankshaft, and the other merely drives the valve gear. One end of the fixed crank-pin would therefore do nearly all the work, and would, when wear took place in the bush, tend to twist the connecting-rod and cause trouble with the gudgeon pin.—Yours faithfully,

H. S. P.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In replying to the letter of H. S. P., *re* arrangement of crank-pin bearing, I beg to point out that the article is to the effect that this method positions the alignment of the two flywheels when assembled together (the previous article explaining the necessity and care required to ensure this, when the pin is finally secured). At the same time, I mentioned that the fixed pin type was more solid, etc., and later, stated that the roller bearing was suitable, from the fact that there was practically no wear, compared with the plain type. I quite realised your correspondent's points, and while mentioning this type as an alternative to the usual design, I do not claim any advantage only as above stated. I shall be pleased to answer further questions if necessary.—Yours truly,

"SREGOR."

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.]*

Model Yacht Rating.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Your correspondent Mr. Albert Willan asks, "What are the objections to model yachts being rated according to their displacement, or, in other words, their weight?" This is a question that came up many years ago in a paper called the *Model Yachtsman*, which has now ceased to exist. The objection taken to weighing models was that it would produce a very shallow light boat with deep keel and excessive beam. Though to have displacement simply as a rule for any one club is undesirable, yet it is in reality the fairest way of bringing boats together of various types and built under different measurement rules, and as such I think should be introduced for inter-club contests where boats are built under different rules. Some would, of course, object to such a test—for instance, the tonnage cheater built under the 1730 rule, which is generally a very much larger boat than she passes off for. When a 10-ton boat, so called, was able to carry 20 tons of lead on her keel, to say the least of it the tonnage was a misnomer.—Yours truly,

O. H. OAKES.

Holiday Races for Model Yachtsmen.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Would you do me the favour of inserting this letter in your excellent paper, as I know that there is no better way of reaching model yachtsmen? During the six years which I spent as secretary of a model yacht club I found that there were a great many model sailers who would be glad to know of some place at which to spend a pleasant holiday and at the same time enjoy their favourite sport. Miss Penruddocke, a lady deeply interested in the sport, has generously offered a gold medal for a race at Southampton. The idea is to invite model yachtsmen to spend their summer holiday and sail for the medal at Southampton, the races to extend over a week. The conditions are to be water-line length only (unless a majority wish for the sail area rule, $\frac{L. \times S.A.}{6,000}$). There could be no better place in which to spend a holiday than Southampton, for there are boat trips daily, and the New Forest is quite near. We have a nice little lake, with concrete sides and a draught of water about 3 ft. near the edge.

I should be glad to hear from anyone who would care to enter for this medal. The boats should not exceed 36 ins. water-line (3 ft.), and there should be no shifting ballast. I have undertaken the organisation of the race only up to the day of sailing, when I wish to resign the management into the hands of an umpire, as I wish to sail. Entries to close on June 10th. I shall be glad to know:—

(1) Do you wish to sail on the length, or sail area (10 raters) rule?

2. What date would you be able to sail—that is, would any time from August 1st to September 15th suit you?

(3) Could you sail for the week or only for one day?

These are the conditions which Miss Penruddocke would like to see accepted, but I believe she would be willing to modify them, and nothing would please her more than for the competitors to develop this scheme by adding other races during the week.

I am willing to undertake the correspondence, provided it does not reach too great an extent.—I am, Sir, yours faithfully,

G. E. HOPCROFT,
(Late) Hon. Sec., S.M.Y.C.
Church Street, Shirley, Southampton.

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 last indoor meeting of the Session will take place on Tuesday, May 28th, when the Rev. W. J. Scott will lecture on "Six-Coupled Express Engines on the Great Western Railway."—HERBERT G. RIDDLE, Hon. Sec., 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.

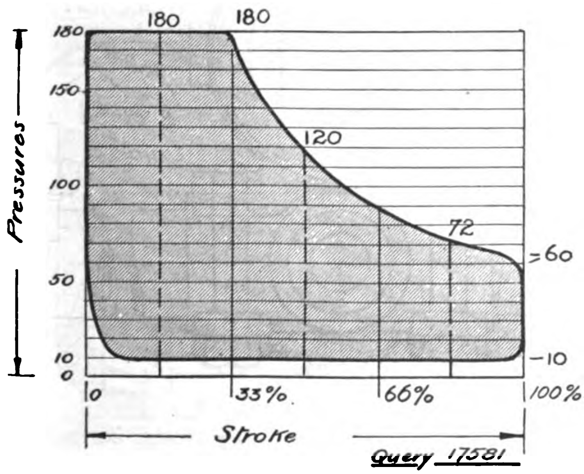
Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, 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:—

[17,581] **Locomotive Tractive Force.** F. A. G. (Walton) writes: As I am a reader of your most valued paper I should be pleased if you will answer the following. (1) What would be the average pressure in a cylinder 19-in. by 26-in. stroke, valve at 30 per cent. cut-off, steam pressure 180 lbs. per sq. in.? (2) I want to be able to prove that a locomotive with 26-in. inside cylinders and a 9-in. crank in the wheel for coupling-rods is as likely to slip as an engine with 26-in. cylinders and 13-in. cranks in the wheel for coupling-rod (engines to be four- and six-coupled). How could I find how much work is transmitted to the tread of same wheel, and how much is taken by the back wheels through the coupling-rods of a four- and six-coupled engine? I want to be able to work out both 9-in. and 13-in. cranks in the wheel.

(1) The average forward or effective pressure, not reckoning for more than 10 lbs. back pressure would be

$$[(180+120+72) \div 3] - 10 = 114 \text{ lbs.},$$



as shown on the diagram herewith. (2) Assuming mechanical perfection in all the parts, there can be no difference in the amount of work transmitted to the coupled wheels by a 13-in. centre coupling-rod and one centred 9 ins. from the crankshaft. The coupling-rod with the smaller travel will, of course, be subjected to greater strains, but the horse-power transmitted will remain the same under similar circumstances. Of course, no work is transmitted by coupling-rods until the driving wheels tend to slip. The total tendency to slip in the whole of the wheels (leaving out of the question local conditions) depends on the proportion of tractive effort to adhesive weight. With a mean pressure of 114 lbs. the tractive effort will be

$$\frac{D^2 \times L \times M\,P}{D\,W} = \text{tractive effort.}$$

Where D is the diameter of the cylinder, L the length of stroke and D W the diameter of the driving wheel (all in inches), and M P the average or mean pressure per sq. in.; with driving wheels 6 ft. 4 ins. diameter the

$$\text{Tractive effort} = \frac{19 \times 19 \times 26 \times 114}{76} = \frac{19 \times 1 \times 26 \times 114}{4} =$$

$$19 \times 13 \times 57 = 14{,}079 \text{ lbs.}$$

Reckoning 12 tons on each pair of driving or coupled wheels the tendency to slip will be in the following proportions:—

$$\frac{14079}{12 \times 2240} = \frac{1}{1\cdot 9} \text{ for a single engine.}$$

$$\frac{14079}{2 \times 12 \times 2240} = \frac{1}{3\cdot 8} \text{ for a 4-coupled engine.}$$

$$\frac{14079}{3 \times 12 \times 2240} = \frac{1}{7\cdot 6} \text{ for a 6-coupled engine.}$$

As the usual proportion is 1 to 4 or 1 to 5, a single engine would be built with larger driving wheels than 6 ft. 4 ins., and the weight on the driving wheels would be about 18 tons. If only 12 tons was permissible per axle an engine with wheels and cylinders of the above proportions would most likely be provided with six-coupled wheels and a proportion of tractive effort to adhesive weight of 1 to 7·6.

[17,669] **Small Gas Engine Electric Light and Charging Plant.** F. A. P. (Brixton) writes: Having been a subscriber to THE MODEL ENGINEER for several years past, I shall be glad if you can give me information on the following. I have a small gas engine, 3-in. bore, 4-in. stroke, supposed to be ½ h.-p.; fly-wheels, 12 ins. diameter. I wish to know what size dynamo it will drive with ease. I want it for charging accumulators and to light small workshop 10 ft. by 7 ft. What type dynamo is best and dimensions for same? Also what windings for field-magnets and armature will give the best results?

As the power developed by a gas engine depends not only on the cylinder size but upon its general design and other details, the only way to ascertain its actual capacity for work is to make a brake horse-power test, as described in our handbook on "Gas and Oil Engines," by Runciman, 7d. post free. We should say, however, that ½ b.h.-p. will be approximately the power you will get out of it, and it would drive a 300-watt dynamo fairly easily, or to be quite on the safe side, use a 250-watt size as described in "Small Dynamos and Motors," 7d. post free. A Manchester type as Fig. 12 would suit. Windings are given in tabular form.

[17,651] **Cut-in and Cut-out for Charging Purposes.** F. G. B. (Southport) writes: You have been kind enough in the past to help me on two occasions with your advice, and as a constant and most interested reader of your useful paper I am writing again to ask a similar favour. I want to make an efficient cut-in and cut-out for charging purposes. The experimental machine I have already made is constructed of two bobbins from an old bell, and is wired as per enclosed sketch. It acts well as a cut-in, though it gets rather hot after a time. I can adjust it to cut-in at 5 volts with ease, and in that particular it does all that I require. But it has this fault: as the current drops in voltage it fails to cut out. The bobbins still hold the spring arm down until the current is altogether cut off. I, of course, want it to cut out at, say, 4½ volts. Would you kindly let me know how I could make such a machine, how wire it, and with what wire, and also how connect up? If one of your books describes such a machine, kindly forward it to me; if not one of the higher priced technical books, which would be of service. I may say I have already quite a number of your excellent little publications, but none give the information I want.

There is no book dealing exclusively with the subject. We think if you used a very soft iron core for the electro-magnet, it would answer more quickly to any variation of voltage. The matter seems one of nicety of adjustment. We might also draw your attention to the cut-out shown on page 327, April 5th, 1906, and October 18th, 1906, page 369.

[17,642] **Reduction of Voltage.** H. S. (Norwich) writes: Kindly accept my best thanks for answering my last queries, but I must again trouble you. (1) Can you kindly tell me how to find the velocity and speed of driving belts in feet per minute? (2) Which is the correct way of counting the value of the resistance in ohms; for instance, it is wanted to insert a resistance, so as to work some apparatus that requires 50 volts 5 amps. from a 220-volt main. First way

$$\frac{\text{volts to be absorbed}}{\text{current to flow}} = R$$

$$\therefore \frac{170}{5} = 34 \text{ ohms.}$$

$$\text{Second way} = \frac{220}{5} = 44 \text{ ohms.}$$

The current value is the same in both cases, but there is a different value in ohms. Which is the way generally used, as I want to count for other values. (3) Is it correct that an electrostatic voltmeter never shows the drop in voltage, even if applied in the same place as a voltmeter that has a circuit right through it and shows the drop in voltage. For instance, in my query No. 2 one voltmeter shows there is a drop in voltage, yet I have heard that an electrostatic voltmeter does not, but always shows the full voltage as given by the supply mains, etc. Is this correct?

(1) Diameter of pulley × 3·14 × revs. per min. (2) If you will refer to March 5th, 1903, issue (Query Reply No. 8,106) you will find a full explanation of the matter. If the apparatus in question takes 5 amps. when connected to a 220-volt supply, then its resistance is $\frac{220}{5} = 44$ ohms. (3) It will show the voltage across the points at which it is connected.

[17,574] **Roscoe Lubricators and I.h.-p. of Engines.** D. G. (Thurso) writes: I would be much obliged if you would tell me how to improve the lubrication of a small twin-cylinder steam engine, 1½-in. bore, 3-in. stroke. The present cup is fixed to the T-piece where the steam pipe branches to each cylinder. I was thinking of fitting a larger one in same place, or would two separate cups be preferable? (2) What horse-power would engine develop running at 500 revolutions at 50 lbs. pressure?

Do not use oil cups, as they only supply lubricant to the cylinders in gulps. Fit a Roscoe displacement lubricator. We have prepared a design for a suitable lubricator which will bolt on the side of the T-piece, which you mention in your query. As the engine is evidently intended for practical work, we have not studied appearance from the model standpoint, but have provided a lubricator of ample dimensions. As it is advisable to let the oil mix with the steam by allowing it to drip in the path of the steam, and also to provide a fixing of sufficient strength to withstand the strain to which the fitting is subjected when the filling cup is removed and tightened up, we have shown the lubricator clipped on to the T-piece and the oil led to the steam pipes by two small copper pipes. A slight fall is shown in the oil pipes, and to make the connections more or less flexible the unions, with the drip pipes, should be placed 3 or 4 ins. away from the oil reservoir. The Roscoe lubricator acts, of course, by gravity. The steam condenses in the reservoir, and the oil being lighter than the water, it flows down the small pipe connected near the top of the lubricator into the engine steam pipe or cylinder. When empty of oil, the water is drained off by the pin valve and the reservoir refilled at the top cap. The lubricator must be absolutely steamtight. The engine will develop 7-16ths i.h.-p. per cylinder. With a boiler of 50 lbs. and a speed of 500 r.p.m., the calculations for indicated horse-power may be very much simplified. It may be stated as follows:—

$$A \times L = \text{I.H.-P.}$$

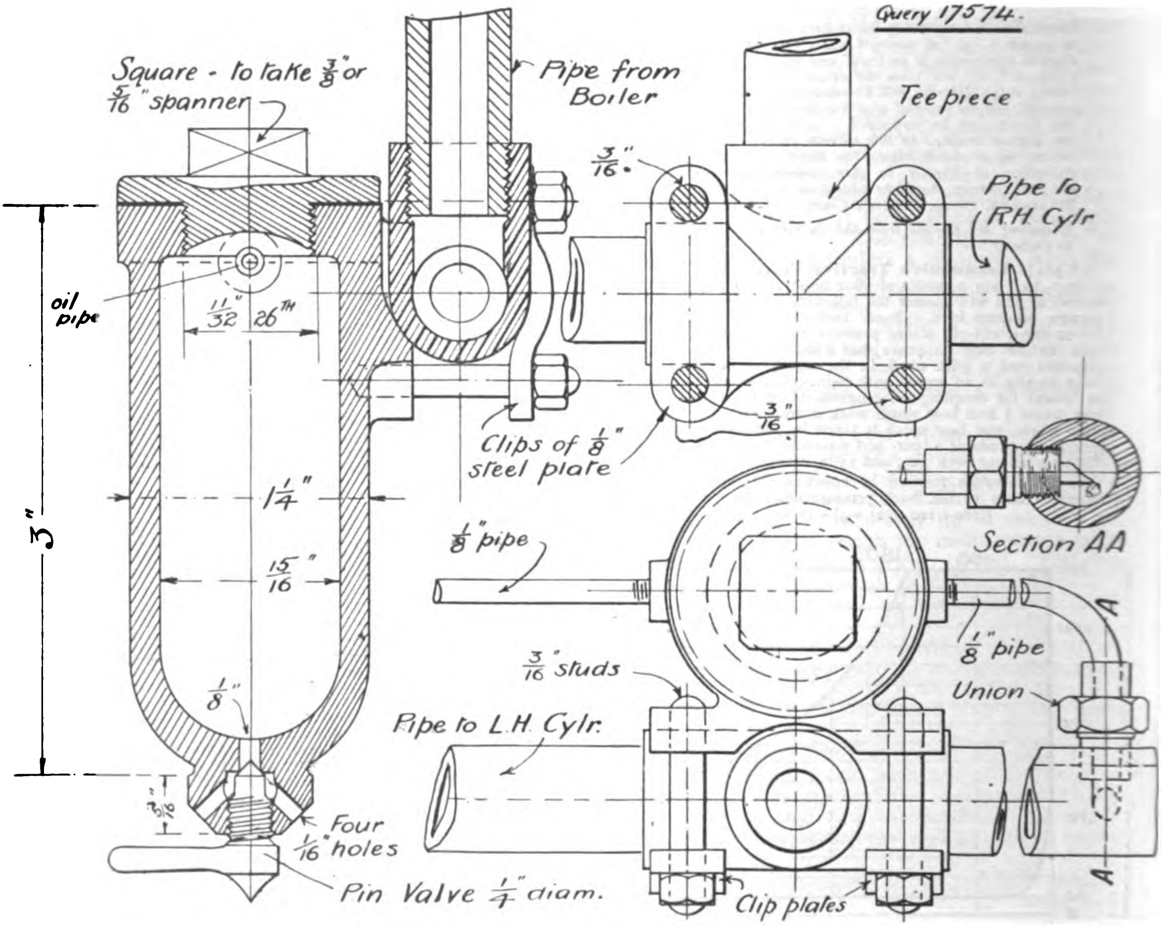
where A equals the area of the piston in square inches and L the stroke in feet. This is possible because the average steam pressure in the cylinder with a boiler pressure of 50 lbs. would, with ordinary valve setting, be 33 lbs., and the number of strokes of a D.A. cylinder running at 500 r.p.m. is 1,000. Therefore, the 33,000 and P × N of the usual

$$\frac{P \times L \times A \times N}{33{,}000} = \text{I.H.-P.}$$

cancel out, leaving

$$A \times L = \text{I.H.-P.}$$

The area of a 1½-in. cylinder is approximately 1¾ sq. ins., and the stroke is a ¼ of a foot (3-12ths); therefore the I.H.-P. = 1¾ × ¼ = 7-4ths × ¼ = 7-16ths I.H.-P. per cylinder = ⅞ I.H.-P. for a twin-cylinder engine.



"Roscoe" Displacement Lubricator for Small Power Engine.

[17,664] **Converting Petrol Motor to 'Run on Town's Gas.** F. D. (Tilehurst) writes: (1) Having bought a stationary petrol motor, cylinder 3½ ins. by 3½ ins., I now wish to convert same so as to use the town gas. I cannot seem to "hit" on the right principle. Could you give me a sketch showing how to do this—viz., how to make the gas air inlets so as to join up to the

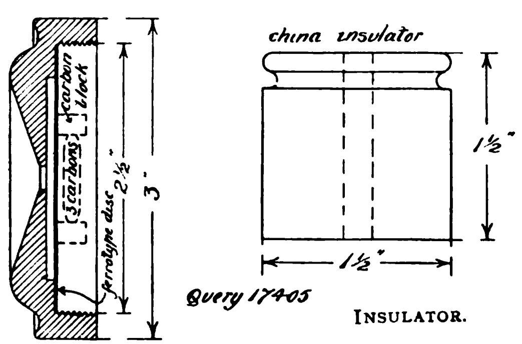
inlet pipe of motor; size of same 1 in. (2) Motor has mechanical valves. Could I, by altering timing, change over to opposite side so as to make the inlet the exhaust, and exhaust the inlet, as now it is rather difficult to get exhaust pipe away?

The chief difficulty would be to arrange for some means of thoroughly mixing the gas and air on their way to the combustion chamber. We could, perhaps, have given you more definite information if you had sent a clear sketch of your motor. As it is, we should advise you to fit up an auxiliary air valve in a separate valve-box, and mount the latter in any convenient way on the existing air port after having first dispensed with the mechanically operated inlet valve. By using a suction air valve, such as shown on the coloured plate (see January 4th, 1906, issue), you will get fairly good mixing, and we should say that this arrangement would work satisfactorily. As to changing over the air and exhaust as you suggest, we cannot say without seeing the motor or drawings of it; but most probably it would *not* be satisfactory, as in many cases special precautions are taken to keep the exhaust valve and seat and bush cool, which conditions would not prevail if the air became the exhaust. We trust these few hints will assist you, and, if still in difficulties, write us again and we will be pleased to assist you further if we can.

[17,461] **Running Gas Engine on Petrol.** C. J. (Luton) writes: Being a reader of your weekly journal, will you kindly answer the following questions, as you will by so doing greatly oblige me. (1) Is it possible to work a gas engine on petrol by connecting gas pipe to petrol supply? (2) If so, what would be the simplest means of heating tube, and where could I get directions for making same, as there is no gas here, being in the country? (3) What is the meaning of fitting petrol supply tube with fine gauze wire to stop back-firing?

(1) Generally speaking, it is possible, although some designs lend themselves more readily to conversion than others. (2) Use either spark ignition (see March 29th, 1906 issue) or else a petrol blowlamp. (3) To prevent the flame firing back along the pipe and igniting the main supply.

[17,405] **Telephones.** L. H. (Lenzie) writes: I should be very much obliged if you could give me some information on the following. I am constructing a telephone with three stations, each about 100 yards apart. I am following the instructions which you give in your handbook, "Telephones and Microphones" (fifth and sixth editions). Could you tell me what would be the best gauge for the line wire? I am using one line and earth I have made a pencil carbon transmitter but cannot get a satisfactory result from it, as it makes a kind of rattling sound when you speak into it. How can this be prevented? I have tried pushing the blocks closer so that the carbons are fixed together, but the result is still the same. The diaphragm is ferrotype instead of cardboard, as the instructions say, and is 2½ ins. in diameter, as shown in sketch. Please tell me which kind is the easiest to make and most suitable. I think the line wire to be used is No. 18,



INSULATOR.

SECTION THROUGH TELEPHONE RECEIVER.

but am not quite sure, and would be glad if you could inform me how much it is per lb. and where I can get it cheapest? Will the insulators, as shown in sketch, do for the line wire? I want about 320 yards of same.

(1) The transmitter will not work as made, and you should substitute a thin wooden board for the ferrotype plate or insulate the carbons from the present diaphragm. (2) The insulator you show will be quite suitable. (3) No. 18 wire; about 5 lbs. Price varies. Ask any of the electrical advertisers in our columns.

[17,488] **Model Locomotive Cylinder Arrangement.** H. E. (Edinburgh) writes: I was very pleased to see in a recent MODEL ENGINEER a design for a 1⅜-in. gauge "Atlantic" locomotive—a design I have for a long time been waiting for, and would be pleased if you would answer me the following queries. (1) In preference to two oscillating cylinders, would one double-acting cylinder, 7-16ths in. bore, by ⅞-in. stroke—placed between frames—act as well, and for appearance sake fixing two dummies outside? (2) Can you show me how to mark out the ports for the above cylinder, to be reversed in the same manner as described in No. 270, June 28th, 1906, MODEL ENGINEER. I have Handbook No. 28, but does not explain very fully. (3) Would boiler as sketched (not reproduced) be powerful enough for above cylinder? Fired by six ¼-in. wicks.

We are pleased to hear that you favour the design for the engine referred to. (1) Yes, you may fit the one double-acting cylinder, but without any special reason for doing so, we do not advise such a combination. The total friction of the moving parts will be increased by adopting the single cylinder inside the frames (the working one), and the two dummies outside. If you do decide to employ the single double-acting cylinder, then make the engine an inside cylinder type of "Atlantic." Otherwise adopt two slide-valve cylinders and couple on to the rear driving wheel. (2) You will find full particulars as to the mechanism of the cylinders in the article in THE MODEL ENGINEER for March 15th, 1902, to which Mr. Briggs refers in his article in the issue of June 28th, 1906 last. The Handbook No. 28 explains the general principles only. (3) The boiler should prove quite satisfactory. Six wicks is a rather large number for such a small locomotive. Try four at first.

Further Replies from Readers.

[17,497] **Model Pipe Unions.** Referring to your reply to "W. B. W." (Surrey) in THE MODEL ENGINEER for May 2nd *re* above, I think a cheaper and neater joint can be made by socket and back nut as in gas fittings. Recently I repaired a steam locomotive for a friend and made the joints in steam pipe in this manner. The T in steam pipe for branches to cylinders was in good condition, and I silver soldered the pipes into it, but the exhaust pipes were both led into funnel, being bent after screwing into cylinder, which was very unsatisfactory. I therefore made a T out of piece of scrap brass boring and tapping it throughout lengthwise and boring and tapping hole from the side—the outside of T was afterwards shaped. The exhaust pipe from one cylinder was screwed along sufficient to take the greater part of T and back nut, the other pipe was bent to meet, and the T screwed back over it. A piece of cotton covered with red lead was wound round pipe and the back nut screwed up. Both in exhaust and steam pipes perfect steam-tight joints resulted.—A. GREEN.

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 the asterisk have been based on actual Editorial inspection of the goods noticed.*

***For Cleaning the Hands.**

Most model engineers have experienced the trouble that naturally arises after a turn in the workshop of freeing the hands thoroughly and quickly from grease and grime, and restoring them to their normal state. We have recently given a severe practical test to a preparation known as "Ethol," a liquid soap manufactured by Messrs. Parke, Davis & Co., 111, Queen Victoria Street, London, E.C. A small quantity rubbed over the hands soon removed every trace of grease and dirt, which had previously been well worked in, the operation leaving the hands just as smooth and soft as before. Grease spots from clothing can also be removed by this fluid. The preparation is supplied in two sizes of screw-capped metal flasks, the smaller being suitable for the cyclist's pocket. A free sample may be had from the makers on application, mentioning this notice.

New Catalogues and Lists.

Gilbert & Co., 11 and 13, Gray Street, Waterloo Road, London, S.E., have sent us their 1907 list, which includes prices of material and appliances specially suitable for model makers' requirements, such as brass rod, silver steel, aluminium, screws, bolts, nuts, stocks and dies, twist drills, lathe accessories, belting, tool steel, files, vices, small drilling machines, etc., etc. The list will be sent to readers post free for two penny stamps.

Ward & Goldstone, Springfield Lane, Salford, Manchester, have sent us their price list of electrical motor-car accessories and accumulators, including small charging sets, switchboards, voltmeters, ammeters, galvanometers, sparking plugs, etc. The list will be sent to readers in the trade upon receipt of their trade card

The Editor's Page.

JUDGING by the correspondence we receive on the subject of inventions, a great many of our readers must be engaged in various schemes for the benefit of mankind and the corresponding lining of their own pockets. We have no wish to put a damper on the enterprise of any of our inventive readers, for indeed we regard such efforts as worthy of every encouragement, and we know of no more fascinating and instructive branch of model making than that in which new ideas are subjected to experiment and trial. At the same time we think it perhaps advisable to say a few words about the difficulties in the way of converting a success in the form of a model or experimental machine into a success from the commercial point of view. Many inventors fail to realise the fact that even when they have built a thoroughly successful sample of their invention the battle is only half fought. The work of organising the manufacture of the particular appliance at a competitive price, the capital outlay for possible special tools and plant, the advertising and travelling necessary for introduction of the appliance to the market, the protection of the patent against infringement, are all matters which have to be dealt with before the invention can produce a return, and they usually fall upon the shoulders of the people to whom the inventor wishes to dispose of his idea. Through not realising the importance of these points many inventors of really useful devices are prone to put too high a price upon their ingenuity, and so effectually alienate the interest of likely purchasers. In other cases inventors persist in inventing something which is highly ingenious, but for which there is no real demand. It is in any case no easy task to get an invention, however good it may be, placed on the market, and it is only by indomitable perseverance that success is usually achieved. Instances of this are to be found even in the career of so brilliant an inventor as the late Sir Henry Bessemer, and it has been the same with many of the clever men to whom the world is indebted for its various masterpieces of ingenuity. The reading of the life stories of successful inventors is a valuable tonic to the man who would follow in their footsteps and is often productive of increased admiration for the subject of the narrative as much for his business acumen and pluck as for his technical skill. The world hears much of the successes achieved by inventors, and but little of their failures. It is perhaps as much by their failures as by their successes that the greatest inventors have been spurred on to the achievement of their ambitions, and this knowledge should go far to put fresh heart into those who have met with temporary difficulties in the perfection or disposal of their ideas.

Answers to Correspondents.

W. D. (Belfast).—We do not know of a firm doing such a light motor of such small power. As the power increases, of course the weight per horsepower is reduced, but not in direct proportion to the increase in power.

H. K. L. (Newport).—Use No. 30 S.W.G. and get on as much as space will allow. It is largely a matter of trial to get best results. Add an extra cell or two in parallel if they appear to run down quickly.

L. SHEPPARD (Newport).—The idea is, in the main, correct, and conforms to usual practice. We have no drawings, and do not remember seeing full drawings of a modern road locomotive in any of the engineering journals. Your letter has been returned to us through insufficient address.

T. W. E. (Derby).—We thank you for your Workshop hint, but cannot see our way to insert the same.

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.

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All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, etc., 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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THE

Model Engineer

And Electrician.

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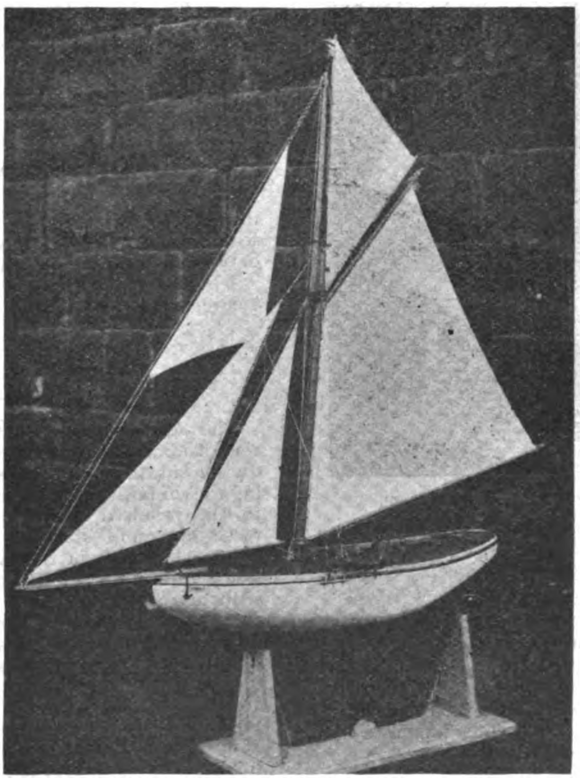
A Well-Made Model Sailing Yacht.

By A. BEGBIE.

HEREWITH are reproduced photographs and description of my model yacht, *Seagull*, which I made the winter before last. She is 36 ins. long and 10½ ins. beam, and 5 ins. deepest part of hull, with a 7-in. solid wood keel, with 10½ lbs. of lead screwed on the keel, and she has about 1,558 sq. ins. of sail in the larger suit, as shown in the first photograph. I made her out of a block of yellow pine, on the dug-out plan, and she weighs 22½ lbs. fitted up with sails, spars, and swing rudder. The stays and shrouds are made of fine piano wire, with brass rigging screws for tightening them up; on the shrouds I fixed lampscreens and lamps. The stanchions are brass, with fine wire threaded through the holes in top of stanchions. The boat and brass davits with blocks and falls, sail cloth, and other fittings that I could not make myself, I purchased from an advertiser in THE MODEL ENGINEER. The grating at the stern I cut out of boxwood with mahogany frame round it; the tiller is a dummy one, as I use a weighted swing rudder made of sheet copper, with two 1-oz. weights, with the bottom edges turned off and bored and tapped for a screw, so that I can move them to any position along the slot cut in the rudder; the spars are made of ash, the deck of yellow pine lined to represent planking, and varnished; the hull is enamelled sky green with gold bead round deck line, and the keel is bronzed, and, including the keel, is 9½ ins. deep at broadest part of yacht. She has proved to be a good sailing model, especially in strong winds. She can hold her own with most of the 10-raters; under the 1730, rule she measures out just over a 10-tonner I should like to know if in a race the 10-raters should allow the 10-tonners time allowance.



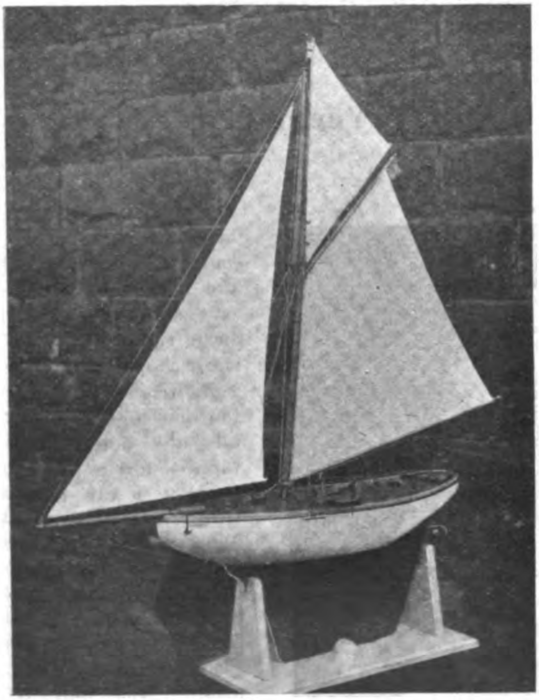
MR. A. BEGBIE'S MODEL CUTTER-RIGGED YACHT.

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.**]*

Polishing Steel.

It is said that a high polish may be obtained after nickel-plating on small steel articles, such as screws, by tumbling them with leather and dry rouge. The articles are placed in a tumbling-barrel with leather scraps. Some dry rouge is put into the barrel along with the screws and leather, and the whole tumbled for some time. The rouge coats the surface of the leather, and



MR. BEGBIE'S YACHT RIGGED AS A SLOOP.

(*See front page.*)

causes it to act like a polishing wheel. Canvas scraps may be used in place of leather.—*Engineer.*

Preserving Iron from Rust.

To preserve iron against rust, immerse it for a few minutes in a solution of blue vitriol, then in a solution of hyposulphite of soda, acidulated with hydrochloric acid. This gives a blue black coating which neither air nor water will affect.

A Note on Welding.

The following flux is recommended for welding steel and iron or steel to steel: Borax, ten parts; sal-ammoniac, one part; prussiate of potash, one part; iron filings free from oxide or rust, about one-third of a part. The mixture should be reduced to a powder in a mortar. Water is added until the mixture becomes a heavy mush. It is placed on a wood fire and stirred. A material of about the appearance of pumice stone is thus produced. It is then pulverised to fine dust and is ready for use. The flux is sprinkled over the metals, to be welded when they are at the welding heat.—*Mechanical World.*

Adapters for Small Lamp-holders.

By J. R. B.

The following is a method by which adapters for small lamp-holders can be made.

Procure a burnt-out capped lamp and break off the globe, taking care not to injure the wires inside the lamp in doing so. To these wires (A and B, Fig. 1) connect a piece of flexible wire, and then carefully bend them down level with the

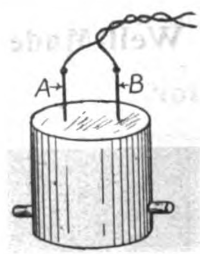


FIG. 1.

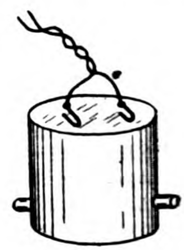


FIG. 2.

ADAPTER FOR SMALL LAMP-HOLDER.

top of the cap (Fig. 2). Now pour some melted sealing-wax over the top of the cap so that the bare wires are completely covered with it.

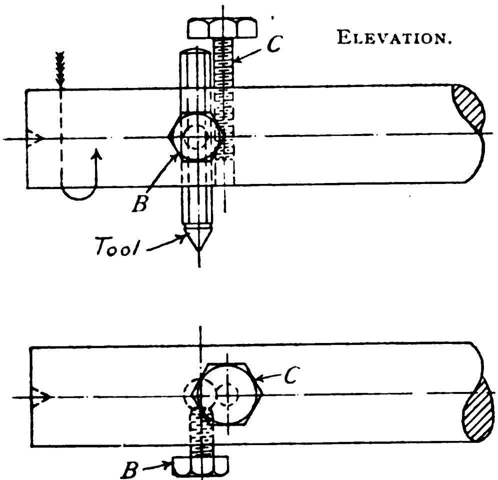
I find that the above adapters, if carefully made, answer very well indeed for low voltages.

Boring Bars and Cutters.

By "CONTRIBUTOR."

The accompanying sketches show the construction of a boring bar and method of using same to produce accurate results. In Fig. 1 is shown a plain boring tool in position, with screw for adjusting the tool to the required size. The tool is made from a piece of round steel of suitable size, which fits in the plain hole in the bar and is secured in position by the setscrew B at right angles to it. The adjusting screw C should have a fairly fine thread to obtain slow adjustment. The position of the tapped hole to receive this screw should be as close to the boring tool as possible, so that the head of the screw will overlap the top of tool to force it down. The tool can be readily adjusted to give a required depth of cut when it is provided with a fine thread, such as 40 per in., one complete turn of which will give 1-40th of an inch, or ·025 in.; a 1-25th of a turn will advance the tool ·001 in. The head of the screw should be hardened. A flat is provided on the tool for the locking-screw to seat.

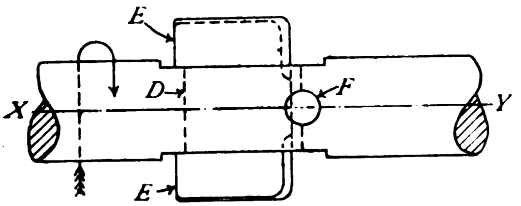
In Fig. 2 is shown a definite sized boring cutter, which is a very convenient tool for producing repetition work when accurately made. A number of these cutters can be made to fit the slot in the bar, and turned to their respective sizes and readily changed, as required, to obtain the necessary size of hole.



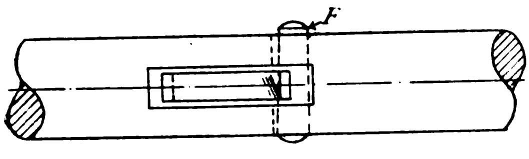
ELEVATION.

PLAN.

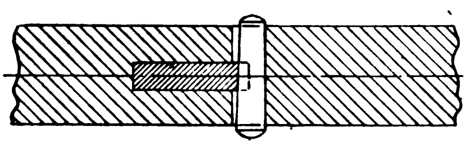
FIG. 1.—A PLAIN BORING TOOL.



ELEVATION.



PLAN.



SECTION ON X·Y.

FIG. 2.

As shown in elevation (Fig. 2), the one side of the cutter is recessed, as indicated at D, the two ends E E fitting on the flat portion of the shaft, which serves to position the cutter; the recessed part D fitting against the end of the slot in the bar, and held rigid in this position by the locking-pin F, which presses against the opposite side. This is a plain parallel pin, with a flat filed on it and slightly tapered, as shown in section, which shows a section through the centre of bar. The edge of tool against which the pin fits must be tapered to suit. It is important that the amount of taper is only slight, to ensure an effective lock that will not loosen by the vibration

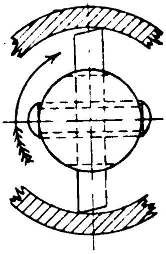
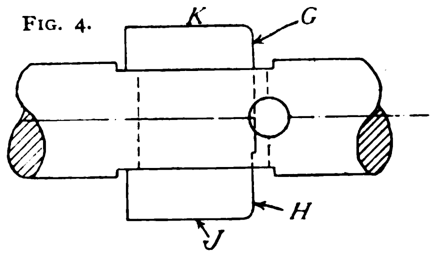


FIG. 3.
END VIEW, SHOWING
BORING BAR
IN
POSITION.

of the tool when in use. Both ends of the tool can of course be used as the cutting edges, but it is advisable to use the edge next to the locking-pin, the opposite end being most suitable to stand the strain of the cut. Fig. 3 is an end view showing the bar in position.

When the boring cutter is turned with its two cutting edges equal distances from the centre of bar, and the two leading faces in line with each

FIG. 4.



other, as is obtained when the cutters are turned up in the lathe, the maximum cutting capacity is not obtained from the tool, as the two sides of the bar are the same. When the cutter is arranged as shown in Fig. 4, the two sides perform a different operation. The edge G is in advance of edge H, and will consequently receive all the forward cut, while the side J is farther from the centre of bar than K, and will therefore cut a larger diameter than side K. By thus arranging the

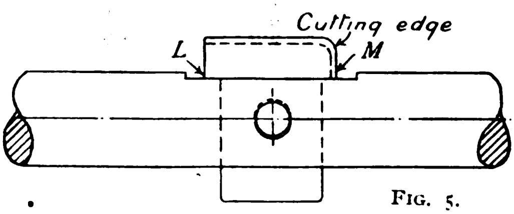


FIG. 5.

tool, two definite cuts will be obtained with one travel of the bar.

Another method of securing the tool to the bar is shown in Fig. 5. In this case the cutter is in the form of a T, as shown in the sketch. Only one side of the bar has a flat filed on, which receives the two projections L M. The body of cutter in this design fills up the whole of the slot in the bar, which ensures it being very rigid. The projections are held tight on the seats by the pin. In this case the pin is turned taper, and fits on its cylindrical outline, and not on a flat, as in the other design.

A Motor Regulator.

By "SWITCH."

AN owner or maker of a small-power motor from ¼ h.-p. upwards is often worried as to a way of controlling it. Possibly he does not always want to use it himself, and is reluctant to allow others to use it as he is afraid of careless handling. Possibly, also, he has tried to make a starting switch combining a "no-volt" release, but, as is usually the case, has failed to make a spring which performs its functions properly. The difficulty is that it is hard to make proper contact between the arm and contacts and also allow the arm to be easily controlled by the spring.

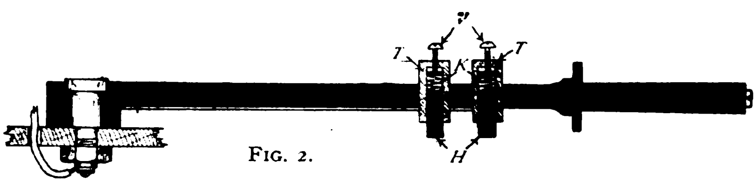


FIG. 2.

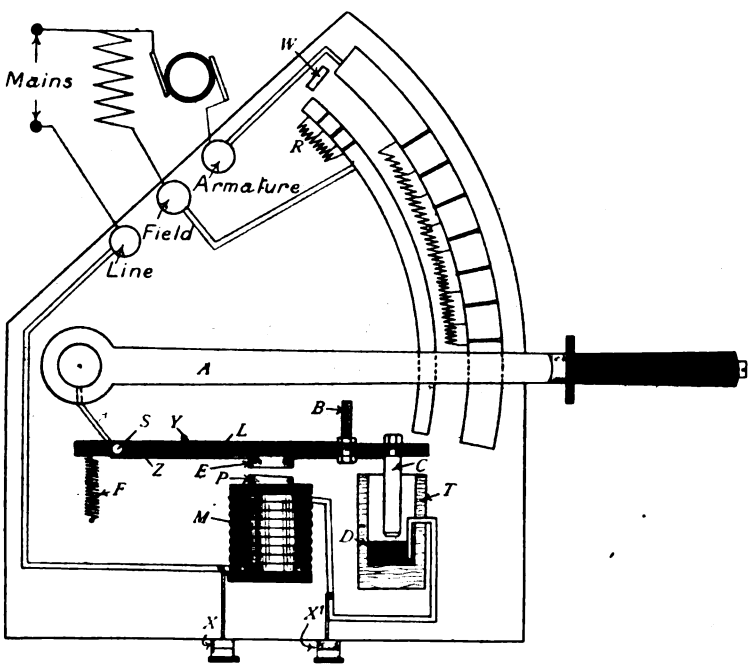


FIG. 1.

A MOTOR REGULATOR.

In this switch the magnet does not hold the arm, but closes a mercury switch. The arm actuates this movement. When the arm presses down the mercury switch (which is held up by gravity or by a spring) current flows through the coils of a magnet which holds this switch down. Then the arm can be moved over until full or any intermediate speed is attained. This immediately presents another danger, which is present in all switches. Suppose the operator presses the arm down until circuit is made to the motor through the mercury switch, and waits until the magnet holds it and then places the arm over to "Full" straight away. The motor may be heavily loaded, in which case a large excess of current would flow and probably damage the commutator and armature windings.

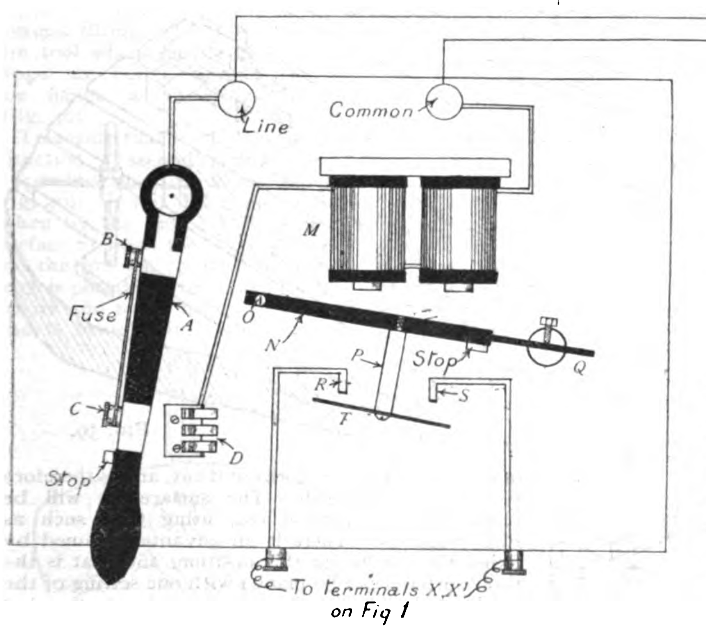
To prevent this a device known as an "overload" release is used. It is a simple device, seemingly unknown to amateurs. It merely consists of an electro-magnet inserted in the armature circuit which, when an abnormal current passes, attracts a piece of iron which cuts the "*no volt*" *release out of circuit.* In the case illustrated it switches off the motor. This prevents careless handling. It is illustrated separately, so as to be fitted to existing switches having a "no-volt" release.

In Fig. 1, which is the regulator, A is the arm which moves over the different contacts to regulate the speed. To start the motor, we press the arm on the pin B, this forces the rod C into the mercury D. A current then flows from one of the mains through the magnet coils M, along through the mercury and arm L to the arm A (through the pivot). This starts the motor. When sufficient current passes, the magnet M holds the arm down by attracting the piece of soft iron E. The arm A may then be moved over the contacts. If the circuit is broken anywhere, the magnet releases the arm which breaks circuit between the rod and mercury.

The resistance R looks unfamiliar. It is a method of inserting a resistance into the "field," which, as few amateurs seem to know, *increases* the speed. To stop the motor the best way is to have a switch in the circuit in a convenient place. Another way, not so good, as it burns the contact at the mercury, is to short-circuit the terminals X X', which cuts the magnet out of the circuit, thus releasing the arm.

If the maker intends stopping the motor by the former method, as it must be remembered that the handle cannot be put to any "off" position, the mercury trough T need only be made of fairly hard wood, as there is no spark on the break. Otherwise it should be made of glass tube with a layer of paraffin on top of the mercury. The magnet coils must be wound with a few turns of thick wire. For a small motor (to about ½ h.-p.), No. 16 S.W.G. wire would do. The spring F should have some method of control as some experimenting will be necessary. The rod C should be tapered, and is best made of brass. The resistance R should reduce the field through about 20 per cent. of its normal current. Fig. 2 shows a diagrammatic section of the arm A. T T are two brass tubes secured in the arm by set screws. H are copper rods which make the contact. They are forced down by springs K, the pressure of which can be regulated by the screws V. The arm itself is best made of fibre. A good way to connect the arm A to the arm L would be by a piece of stranded copper wire. This is a much better way than by joining pivot to pivot, as oil may accumulate and a bad contact be made. The whole switch, with or without the overload release, which is to be explained, should be enclosed in a substantial wooden case. The terminals X X[1] are useful, as wires can be taken from these and connected to bell-pushes. On pressing one of these, the motor stops.

Fig. 3 illustrates an "overload" release. The



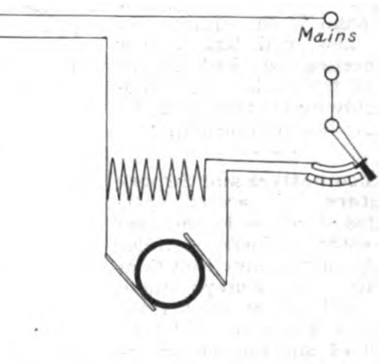


Fig. 3.

terminals marked "Line" and "Common" are merely a suggested method of connecting up. The release might be placed in the other side of the circuit equally well.

The arm and lever A is merely a knife switch, although it is somewhat disguised. It is made of insulating material—fibre or ebonite, &c.—and has two pieces of sheet copper B and C at either end; these are fixed on the lever by two terminals, and across them is a piece of fuse wire. D is the other contact of an ordinary knife switch. Thus, a fuse and switch are very easily combined. The current then goes through the magnet coils M, which are wound with a few turns of thick wire (say No. 12 or 10 S.W.G.).

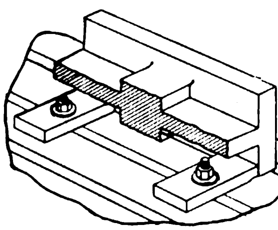
Under ordinary conditions when a normal current is passing, the magnet is not strong enough to attract the piece of iron N pivoted at O. But supposing the current becomes excessive the iron is attracted, which causes the piece of springy brass T to "short" the contacts R and S, connected to the terminals X X' (see Fig. 1), the use of which has already been explained. The weight Q is to regulate the point of lifting.

The Latest in Engineering.

Ice-Breaker for Canada.—Messrs. Vickers, Sons & Maxim, Ltd., have built at Barrow an ice-breaking and surveying steamer for the Canadian Government. The vessel, which is named *Lady Grey* has been specially designed for the purpose of breaking ice and thereby keeping the St. Lawrence River navigable during winter. Her second principal function is that of surveying the coast and channels for the Marine and Fisheries Board, and to render her suitable for undertaking salvage work the *Lady Grey* has been fitted with a powerful pumping installation. The vessel measures 172 ft. between perpendiculars; her breadth moulded is 18 ft.; normal draught, 12 ft., and mean, when breaking ice, 13 ft.; displacement, 1,055 tons; and speed, 14 knots. Special attention has been given to the design and construction of the hull, which is of great strength, to withstand the pressure of and to pound the ice. The ship is propelled by two sets of inverted direct-acting vertical triple-expansion surface-condensing engines with three cylinders, and cranks set at 120 degs. apart. The engines will, in the aggregate, develop 2,300 i.h.-p., running at 130 r.p.m. The cylinders are 19 ins. diameter (H.P.), 30 ins. diameter (I.P.), and 49 ins. diameter (L.P.), a common stroke of 27 ins. being employed. Piston valves are used for the high-pressure cylinders, trick valves for the intermediate cylinders, and double-ported flat slide-valves for the low-pressure. Stephenson link-motion is utilised for actuating the valves, and direct-acting reversing gear is fitted. Steam is supplied by four single-ended cylindrical boilers, 12 ft. 9 ins. diameter by 10 ft. 6 ins. long: the working pressure is 180 lbs. per sq. in. The vessel is equipped with two separate sets of propellers, those for use during summer being of a light form and those for the winter specially designed for ice work. Each propeller has three blades and is of the built-up type.

Smart Engineering Feat.—*Engineering* gives the following account of a smart piece of work recently carried out at Southampton on the s.s. *Earlford*. She was towed into the port with a cracked cylinder, and was placed in the hands of Messrs. Day, Summers & Co., Ltd., of the Northern Iron Works, on February 5th, with instructions to get on with the work at once. The engines were disconnected and lifted out of the vessel, and it was subsequently found that both cylinders were defective and required renewing. This, of course, necessitated two new cylinder patterns and two new cylinder castings. These were made, fitted up in the shop, and the engines lifted back aboard, the whole job satisfactorily completed, and the vessel sailed on March 20th, just six weeks from the day on which the work was taken in hand. In addition to the new cylinders a new connecting-rod had to be made, the engines were thoroughly overhauled, and the engine bearers renewed.

Locomotives and Superheaters.—The use of superheated steam on locomotives has made considerable strides lately on the American Continent. In Europe there are said to be over 1,600 engines equipped with one form of superheater or another, while in America some 260 locomotives of this type are in use or building. One of the most recent experiments in this connection has been carried out on the Atcheson, Topeka, [and Santa Fé Railroad. On this line a heavy tandem compound, after working for some time with cylinders 19 ins. and 32 ins. in diameter by 32-in. stroke, and boiler pressure of 225 lbs. per sq. in., was taken into the shops and converted into a superheater locomotive. A superheater was fitted in the smokebox, the high-pressure (19-in.) cylinders were removed, and the boiler pressure lowered to 140 lbs. per sq. in. It is stated that the engine operating in this form, superheat of only 30° to 40° being obtained, the economic results were within 5 per cent. of those obtained with the compound locomotives engaged in the same service, while repairs come to considerably less than with the latter.



A New Smoke Preventer.—The Direct Gas Fuel, Ltd., have recently patented a smoke preventer which consists of a cast-iron chamber fixed round the inside of the furnace-door opening of a boiler of any type, and provided with air-inlets. The air is drawn by a steam jet into the chamber, where it is heated and mixed with the steam, and in this condition passes over the fire.

Planing and Shaping for Amateurs.

By A. W. M.

III.—Methods of Holding the Work.

(*Continued from page* 498.)

An example is given in Fig. 39 of a bracket or standard which requires to be planed upon three surfaces S. It is too tall for fixing in a vertical position conveniently to plane S1 by means

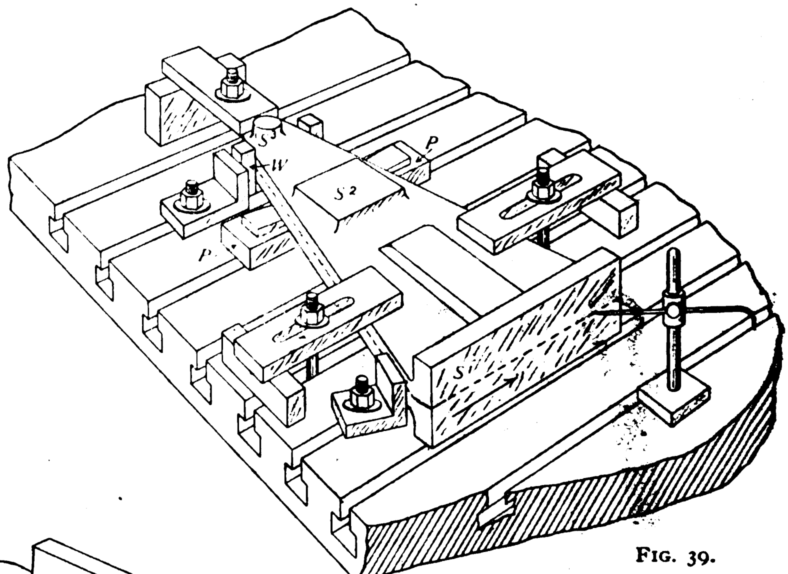


Fig. 39.

of a front tool with a horizontal cut, and is therefore placed upon its side. The surface S1 will be planed with a vertical cut, using tools such as Figs 7 and 15. There is an advantage gained by fixing the bracket in this position, and that is the three surfaces can be planed with one setting of the casting. To ensure that the web of the bracket shall be perpendicular to the surface to which it will be bolted, a centre line is marked completely round the casting as indicated by the dotted lines. If

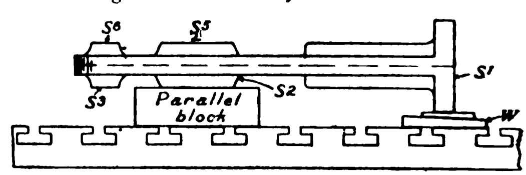


Fig. 41.

the bracket is set with this line parallel to the table of the machine the surface S1 will be planed at a right angle to it, and the surfaces S2 and S3 will be planed parallel to it; they will consequently be at a right-angle to S1. Packing pieces (P P) are placed under the web and adjusted in thickness until the centre line is parallel to the bed. It will be so when the scriber point of the surface gauge will touch the line at any part when set at one height. The scriber point moves parallel to the table as the gauge slides over its surface ; therefore, if the line coincides with the point when the latter is applied to it at any place, the line must be parallel with the table.

Any particular arrangement of packing pieces, clamping plates, and stops, will vary according to circumstances. If the web of the casting is comparatively thin and weak it would require packing pieces to support it at several places, and the clamping plates should be applied at places over or very near to the packing pieces. This will prevent the pressure from bending the casting. If the web is comparatively thick and strong, support at one place, as in the sketch, would be sufficient. The clamping plates could also be placed as shown. We assume that no plate stop is at hand of sufficient height to reach the web, so a wedge W is used, and supported by a plate-stop as a precaution against tilting. To resist the side thrust of the tool when surface S1 is being planed, stops are bolted against the rear side of the flange, as shown in the small sketch (Fig. 39).

To ensure that the bracket will be upright in each direction, a second centre line is marked upon it passing from the lower flange to the boss (see Fig. 40). If this line is at a right-angle to the cut taken by the tool, it will be perpendicular to the surface S1 when the latter is planed. Having first set the bracket so that the centre line upon the edge is parallel to the table, fix a scriber in the tool-holder and move the table until the second centre line is beneath it. Adjust the casting until the

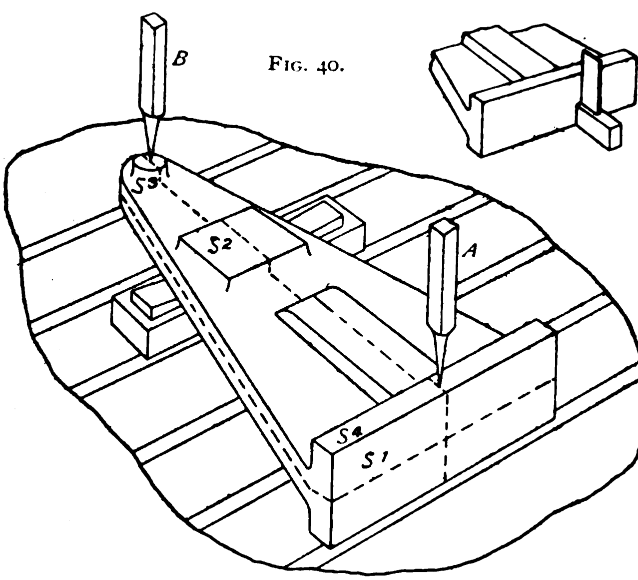


FIG. 40.

scriber point will touch it at any place when the tool-holder is moved along the transverse slide of the machine from A to B. The casting will then be at a right-angle in each direction to the cut taken by the tool over surface S1. In the one instance the centre line is parallel to the table, and in the other instance the centre line is parallel to the transverse slide of the machine, which is at a right-angle to the cut taken by the tool. After tightening up the clamping bolts, try the centre lines again to determine if the casting has moved out of place or not.

It may be that there is a similar boss and surface to S3 and S2 upon the other side of the web, and that they are to be planed accurately parallel to

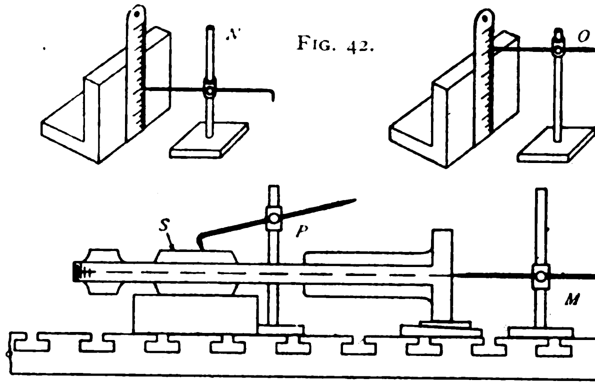


FIG. 42.

S3 and S2. The best thing to do would be to take a rough (but accurate) cut over the edge S4, upon which the casting can rest when it is turned over. If the packing is then adjusted so that this surface is flat upon the table, the new surfaces when planed will be parallel to S2 and S3. As an additional precaution, test the surface S1 by means of a try-square, as in small sketch Fig. 40, to be sure that it is perpendicular to the table, as it is not easy to see if so narrow a surface as S4 is flat upon the table or slightly tilted. A very small amount of error at S4 would be increased at S2 and S3.

An alternative to planing S4 would be to support S2 upon a packing piece which has been planed so that its upper and lower surfaces are parallel. Such packing pieces are frequently used to support work in this way, and they are called parallel blocks. The block should be of sufficient thickness to raise the flange S1 clear of the table (see Fig. 41). If the surfaces S2 and S3 are level with one another, the block, if large enough, would be placed under both so as to give better support. The clamping plates and stops can be applied as shown in Fig. 39, packing pieces W being placed under the flange, Fig. 41, to prevent the bracket from tilting or bending under the pressure of the plates. By means of a surface gauge and rule the distance of the finished surfaces S from the centre line can be determined in the way previously explained. Set the point of the scriber so that it touches the centre line M, Fig. 42 ; determine the height as at N ; then set the scriber to the distance at which the surface S is to be planed, as O, and apply the point as set to the cut made by the tool as P. Distance lines may of course be marked upon the casting at the same time as the centre lines, and it will not be necessary to use the surface gauge and rule. The method is useful, however, as bosses and strips are sometimes difficult to get at upon the marking-off table, and it is easier to make the measurement as described when the piece is in place upon the machine.

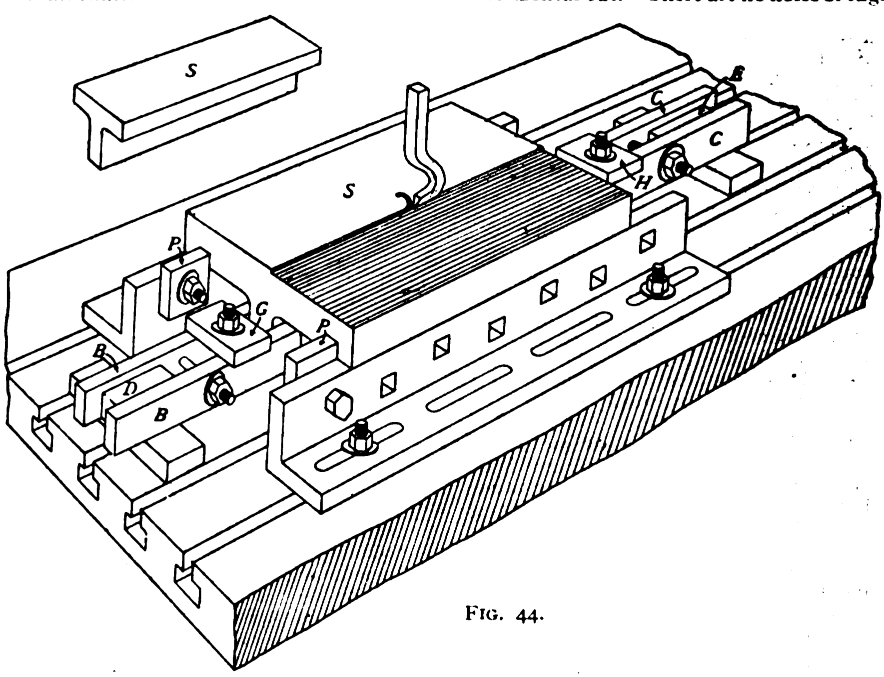


FIG. 44.

An example of a method of holding a piece which has no projections upon which the clamping plates can press is given in Fig. 43. The wedges W exert a vice-like action upon the sides, stops being placed

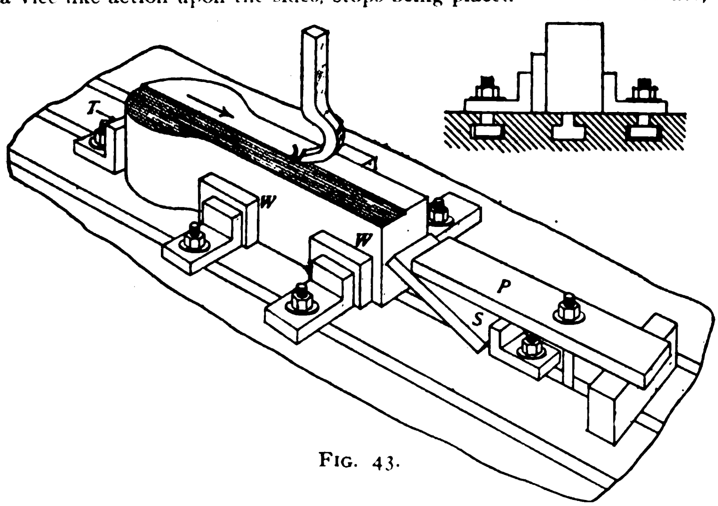


FIG. 43.

to take the thrust, as shown by the small sketch. A clamp P bears upon an inclined plate S, keeping the work firmly against the stop T, and pressing it down upon the table to resist any tendency of the tool to lift the work whilst taking a cut.

A casting of the shape shown by the small sketch, Fig. 44, is to be planed upon the surface S. It is of large size, and cannot be held in a vice. The surface S is beyond the capacity of the vertical slide of the machine, so that it must be planed by a horizontal cut. There are no holes or lugs by which it can be clamped down to the table. The diagram shows a method of dealing with the problem. A pair of angle-plates, or four smaller ones, placed one at each corner, will support the casting so that the web is clear of the table. Plates P P are bolted to the angle-plates to serve as stops and take the thrust of the tool. Two pairs of plates, B and C, are clamped upon the web at each end, distance pieces D E taking the pull of the bolts in conjunction with the web. Clamping plates G and H are bolted to press upon the plates B and C and hold the casting down upon the angle-plates. Packing wedges could be placed between the casting and the angle-plates to adjust the level of the surface if required, tests being made by a surface gauge as previously described.

(*To be continued.*)

MODEL YACHTING AT CLAPHAM COMMON.—The London County Council Committee on Parks and Open Spaces has decided to erect a house at the Long Pond, Clapham Common, for the accommodation of owners of model yachts, and to enclose the pond within a railing.

Chats on Model Locomotives.

By H. Greenly.

(*Continued from page* 488.)

THE previous article to this was completed with a description of a method of setting out a valve gear in which Heywood's correcting motion was used, and, I think, clearly showed the necessity for providing such a system of proportionate links in any radial gear working from the connecting-rod which has pretensions to universal use in models and large-power steam engines.

But the present company are more concerned with valve motions as applied to working models, and, at the moment, to gears intended for very between the frames—I have been thinking how to satisfactorily make a gear which will entirely meet the requirements tabulated above.

After coquetting with two species of link motions (see pages 154 and 155 of "The Model Locomotive") with more or less success, but not saving anything in cost of manufacture and rendering the building up any easier, and also after trying several methods of reversing slip eccentrics by gear wheels (a barbaric form of valve mechanism, some enthusiasts may say)—devices which I am willing to describe if any readers so desire—I alighted on the radical modification of Joy's valve gear shown in the accompanying drawings and photographs.

This gear, in conjunction with the method of making the slides of the reversing shaft described in the last two articles, fulfils, I think, nearly all the

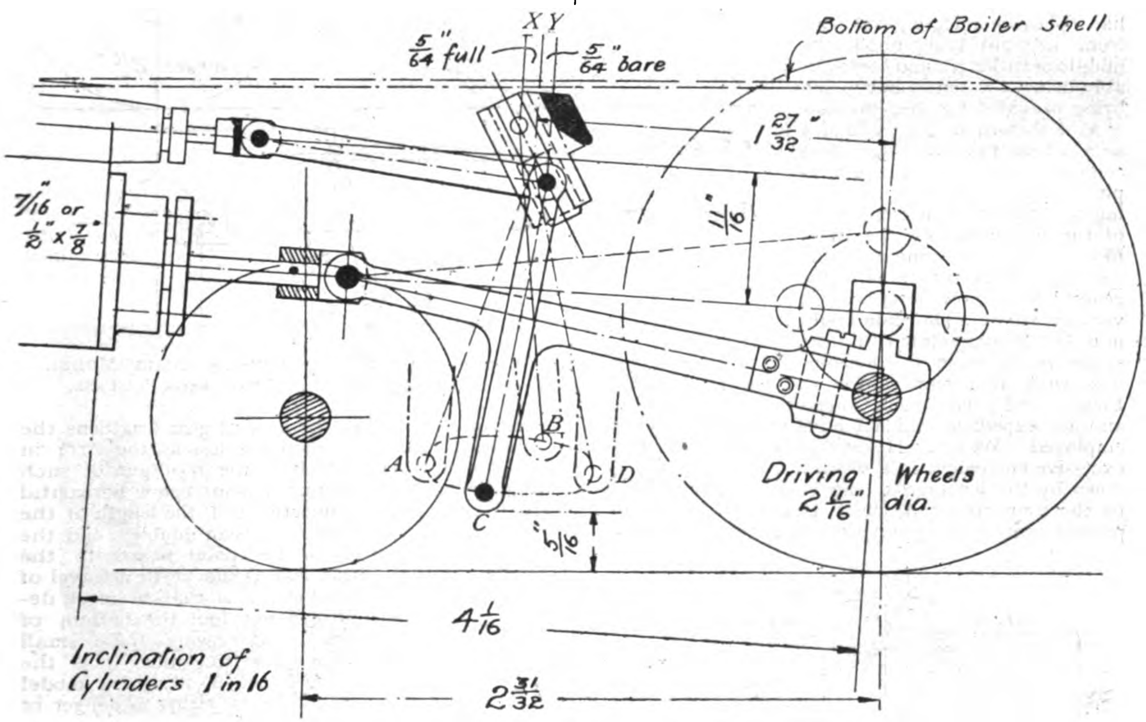


Fig. 5.—Diagram showing New Valve Gear applied to a 7-16ths-in. Scale Model of L.N.W.R. 4—6—0 Type Express Engine, "Experiment" Class.

small locomotives. Three things are desired by both amateur and professional alike with respect to small model locomotive valve gears:

(1) Simplicity of construction.
(2) Realistic appearance.
(3) Accuracy in the timing of the port openings, and the maximum resistance to wear and tear of parts, so that such accuracy may be long maintained.

For the past three or four years—in fact, ever since I first improved the design of inside cylinders for small model locomotives, and, by the simple device adopted in The Model Engineer locomotive of 1904, made away with the forest of pipes which was necessary previously to adapt ordinary stock pattern cylinders to a model with the cylinder conditions required of a reversing motion for model locomotive engines of ½-in. scale and below—that is for working engines of a size which makes complicated, although otherwise desirable, mechanisms almost impossible. This opinion of the value of the proposed device is strengthened owing to the popularity of L. & N.W.R. engines as prototypes for models. This railway company, as all readers know, employs Joy's gear on all their new engines. The type of cylinders already mentioned, as well as the proposed valve gear, is capable of being used on models of every new type Mr. Whale, the locomotive engineer of the company, has produced. The drawings show how the proposed gear can be made to suit the "Precursor" type, also the "Experiments." The gear may be adopted for models of the new six-coupled goods engines, and the new tanks being the same as the "Experiments" in most of the leading dimensions, the drawing Fig. 5 should be of use to model makers building the latter locomotive.

I have already traced the reasons for employing correcting motions in progressive stages in the last two articles, and by diagrams (Figs. 2 and 3) show, in last issue, the two ways in which the error may appear in a radial valve-gear, which obtains its primary motion from a point on the connecting-rod or from the crank-pin.

The present gear is another form of uncorrected valve motion. The primary movement being obtained from a point not on the crank pin or on the centre line of the connecting-rod, but from a point lying about the middle of its length and considerably below the centre line, a lug being provided for this purpose.

As I showed in Figs. 2 and 3 *ante*, where the vibrating link is connected direct to the crank-pin or big end of the connecting-rod, the vertical component of the movement of the slide-block—which movement is the one utilised in the three valve gears I have now described—is very excessive. The slide could not be accommodated in the space available in the locomotive with the gear shown in Figs. 2 and 3 last week, unless another expedient which I have yet to consider is employed. With the Heywood correcting gear this excessive movement in a vertical direction is toned down by the leverage of the connecting link, and by the connecting-rod, which is also a lever, in my present gear. The point described by the bottom joint of the vibrating link (Figs. 2 and 3) is a true circle, the vertical component being the same as the horizontal component. In the present case, however, as indicated by the point path diagram, Fig. 6 herewith, the joint traverses an elliptical course, the movement in the vertical direction being much smaller than that in the horizontal.

The angularity in each gear is, however, practically the same, and varies in extent with the stroke of the piston only—that is, with a given length of vibrating link. But the present gear lengthens the vibrating links, and therefore lessens the error in the valve travel, which is the resultant of such angularity. By selecting a point below horizontal centre line of the connecting-rod, the length of the vibrating link may be more than doubled, and the shifting of the point nearer to the crosshead lessens the vertical travel of the slide-blocks, so that in most designs it will not foul the bottom of the boiler. Reviewing these small difficulties of setting out, it is the usual experience in designing model locomotives to be either in danger of falling in with his Satanic majesty or tumbling into the deep sea. A desire to increase the size of any part seems always to result in its coming in contact with another portion of the engine. Therefore, things generally result in a compromise.

This applies in the present gear. We want a vibrating link of infinite length to be absolutely accurate theoretically, but the distance between the level of the rails and the bottom of the boiler says no to this, and we have to be content with a link of approximately the length shown on the drawings herewith. This means that a certain amount of error will be present, but where shall we allow it to appear—in the timing of the valve (see Fig. 2 last week), or in the amount of the port opening (see Fig. 3 of that issue)?

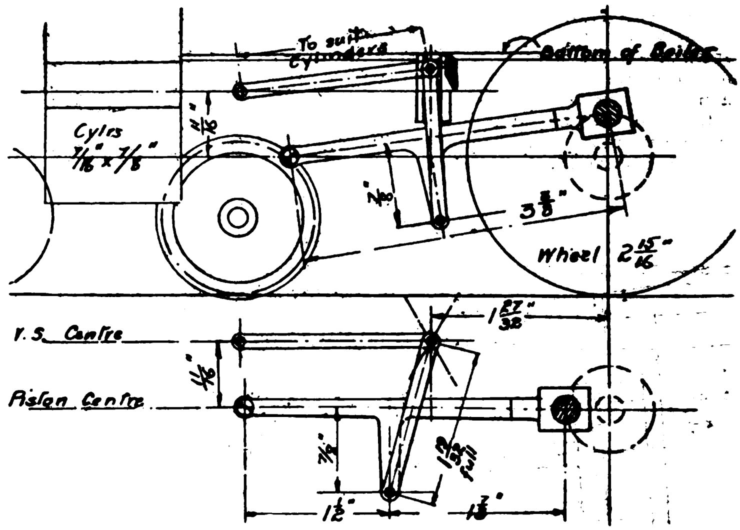


FIG. 7.—THE NEW GEAR APPLIED TO A 7-16THS-IN. SCALE MODEL L. & N.W.R. 4—4—0 EXPRESS ENGINE, "PRECURSOR" CLASS.

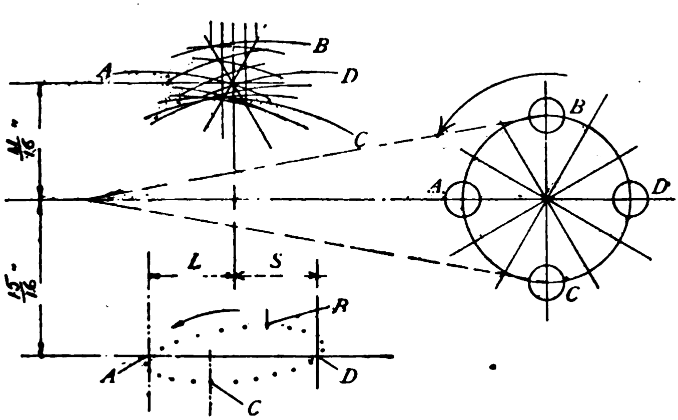


FIG. 6.—DIAGRAM SHOWING POINT PATHS OF BOTTOM AND TOP JOINTS OF THE VIBRATING LINK IN FORWARD AND REVERSE GEAR.

(*The error is exaggerated in this case by lengthening the stroke.*)

My idea is this: As in a model having no lap and lead the timing always bears fixed relation to the timing of the crank-pin—*i.e.*, the opening and shutting of the ports by the valve in every case synchronises with the passing of the crank-pin over the dead points in the traverse—if we take care of the timing the amount of port opening can go to the deuce. This is what I arranged in preparing the drawing Fig. 3 in last issue. The length of the vibrating link was increased, so that the angularity did not make itself apparent in the timing of the valve, which would be the natural result if I made the vibrating link the theoretical length* as indicated in the complementary sketch to the one just mentioned. But by simultaneously increasing the whole length of the vibrating link by dropping the bottom joint down almost to rail level, and also adding the small amount due to angularity, very accurate timing is obtained, and the error in port opening is reduced to a considerable extent.

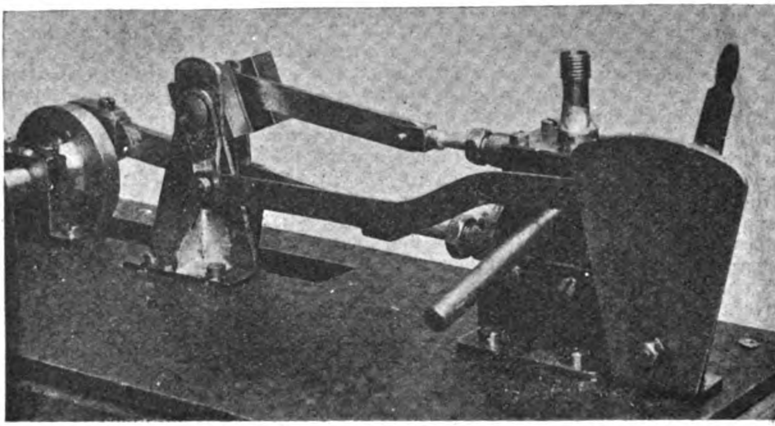


Fig. 9.—Another View of Experimental Model.

Before making any definite statement as to the value of the gear in model work, I had made for me an experimental model which I have already mentioned. This is shown in the accompanying photographs, Figs. 8 and 9. The cylinder is a stock pattern, having a bore of ½ in. and a stroke of ¾ in. The connecting-rod and valve mechanism is practically identical with that shown in Fig. 7 for the "Precursor" locomotive, except that the stroke is shorter—¾ in., instead of ⅞ in.—and the valve spindle centre is 1-16th in. higher, both of which features in some degree are favourable to the gear. This model since the double slides were fitted runs very well and no fault can be found with it.

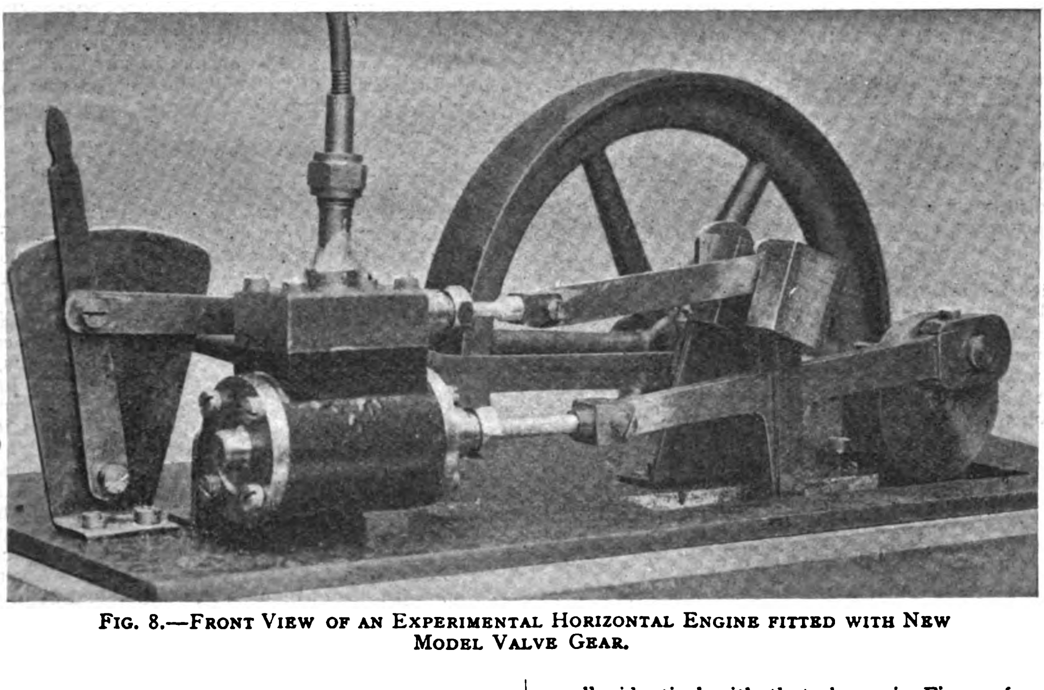


Fig. 8.—Front View of an Experimental Horizontal Engine fitted with New Model Valve Gear.

* The theoretical length is the vertical distance between the centre of the reversing shaft (or valve spindle) and the horizontal centre of the bottom pin joint of the vibrating link. In the Heywood correcting motion (see Fig. 4) this is the distance between the G and H points.

By an adjustment of parts the error of port opening which can be measured on the actual model (this is somewhat less than that which would appear to be correct on paper) is about 1-64th in. This means that whilst the timing of the valve is as accurate as on any model with a single eccentric reversing gear, or with any gear where "lap" and "lead" are not provided for, the port opens more on one side than on the other to the extent of 1-64th in. But the reversing lever provides that the slide-block can be tilted to such an angle that no port is ever less than full open. The error, which occurs at different ports in forward and reverse gear, opens the valve on to the port bar (the bridge between the steam and exhaust ports), exposing this to the extent of 1-64th in. But what does that matter? Only the same amount of steam can pass into the cylinder whether the port is only full open or more than full open. Moreover, the timing of the valve opening and shutting being correct, it does not seem that the use of a complicated correcting motion is warranted, as, unless "lap" and "lead" of the valve is desired, the best effects of the connecting motion are not obtained or required.

Then there is the use of straight slides in the reversing shaft. Theoretically they are necessary, but in practice as well as on paper the error due to having straight slides instead of slides curved to the radius of the valve rod is negligible. In model work theoretical considerations are easily upset; as I heard some one say the other day, the tightening of a gland makes havoc of the beautifully worked-out mathematical statements of efficiency we are so fond of preparing. The good fitting that can be obtained with the circular straight slides and cylindrical blocks already described more than compensate for any supposed trouble in this direction, as again the error due to this modification only shows itself in port opening and not in timing.

Previous to showing how to set out the gear and noting the disturbing effects of several possible adjustments in the centres and length of the joints, slides, and links, we will consider the number of the parts in comparison with Joy's gear as usually fitted to small engines.

In both cases the use of four slide-blocks is presumed, as now on the experimental model shown in the photograph slide-blocks may be dispensed with, and the top pin may be made to run plain straight slots, in the manner commonly adopted for small engines with Joy's gear.

PARTS OF JOY'S GEAR:

Reversing shaft	1
Slide-blocks	4
Vibrating links (duplicate)	4
Correcting links	4
Anchor links	2
Anchor link brackets	2
Valve-rods	2
Total	19 parts.

PARTS OF THE NEW GEAR.*

Reversing shaft	1
Slide-blocks	4
Vibrating links (duplicate)	4
Valve rods	2
Total	11 parts.

* If the lugs on the connecting-rod are counted in, it makes the number of parts as 13 to 19.

This means eight parts saved and a considerable number of joints. The reduction in the number of joints is always desirable, and I think that the gear I propose will therefore prove very satisfactory in the matter of maintenance.

I may mention, in conclusion, that a patent has been applied for for this gear, but I do not intend that any rights under such protection shall be exercised where an amateur reader intends making a model for his own use.

(To be continued.)

A Portable Wireless Telegraphy Installation.

By T. J. Northy.

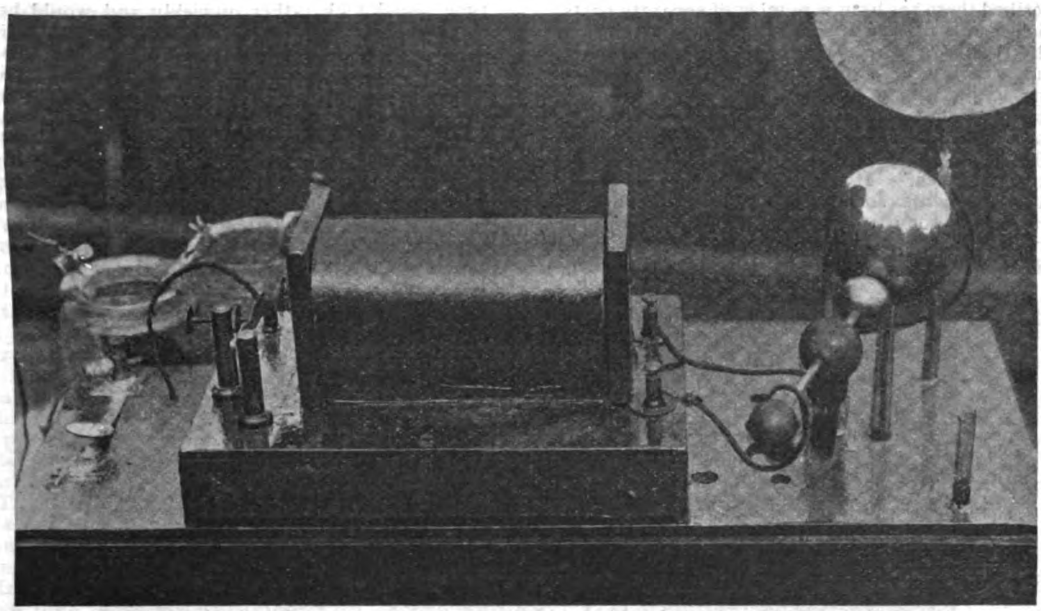
In this short article I am seeking to describe a portable apparatus for what is commonly called wireless telegraphy, but which—in this case, at any rate—means the use of the Hertzian waves for not only purposes of signalling, but for the lighting of lamps, the starting of motors, and the many other purposes which will suggest themselves to the reader. I address my "few remarks" chiefly to those, who, like myself, are glad of hints from "Ours," and who have not a large assortment of tools to handle. In the present case, a hammer, a screwdriver, and a soldering-iron make up the "tool equipment." Mine is a busy profession, which gives but little leisure for the fascinating hobby which I ride, but what is described below will suffice to show what can be done with the utilisation of odd quarters of an hour, and a diligent perusal of "Ours," especially in that most invaluable department, "Queries and Replies" columns.

The Transmitting Apparatus.

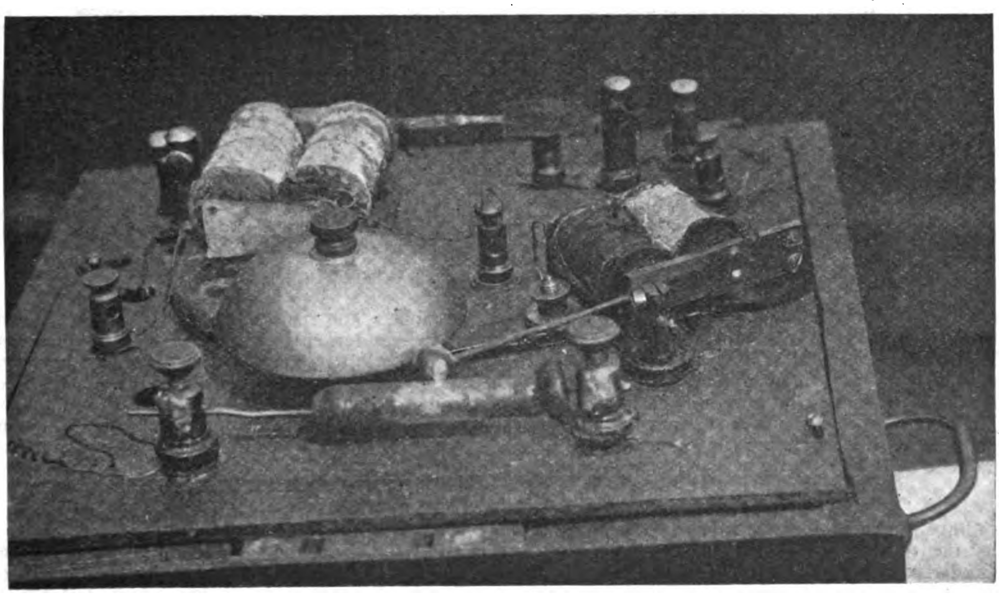
This consists first of all of a ½-in. spark coil, built—with a very slight modification—on the specification given in that admirable little book, "Induction Coils" (No. 11 of The Model Engineer series). It will be admitted, from the photograph, that it is a fairly business-like arrangement, though apart from the wires and the terminals, etc., the materials are of the most homely and economical description. The base, carrying the coil and containing the condenser and various connections, is an empty cigar-box. Casual observers have flattered me by imagining that the outer covering of the coil is of ebonite. It looks like it, but it is really nothing but a piece of cartridge paper, the blank cover of an old sale catalogue, neatly enamelled black. The coil stands on a box that at one time contained baking-powder, of which it still gives forth a not unpleasant aromatic reminder. This also carries the transmitter proper, which consists of a 3-in. brass ball, sandwiched between two 1-in. balls. Unfortunately, the third ball is, in the photograph, hidden behind the large ball, but its carrying pillar can be seen. The two front spheres noticed in the picture are of wood. The nearest forms an insulating knob for handling and adjusting, and the next is also a wooden sphere through which passes, with slight friction, the brass rod which carries the first 1-in. ball. The large ball is mounted on a brass rod which slips into the stem of a s all inverted glass funnel, passed through a hole in the cover of the box, and the funnel in its turn stands (in the box) on the remains of a flat glass battery cell, rescued in timely fashion from the dust-bin. The whole of the brass balls are, of course, highly polished. The skyward rod or mast carries a disc of zinc (6 ins. in diameter), which forms a valuable

THE COIL BATTERY.

This is shown in the picture and consists of a home-made 4-volt accumulator, but in practice I find nothing better than a bichromate battery.



THE TRANSMITTING APPARATUS.



THE RECEIVING APPARATUS.

sort of condenser for fattening and intensifying the spark. The "tapper" needs no description, whilst the various connections (by flexible wire) are easily seen.

The mast (which stands in a piece of glass tube for insulation) is, of course, detachable, and this allows the whole to be included in one box, keeping the apparatus free from dust, and to be carried about.

The Receiving Apparatus.

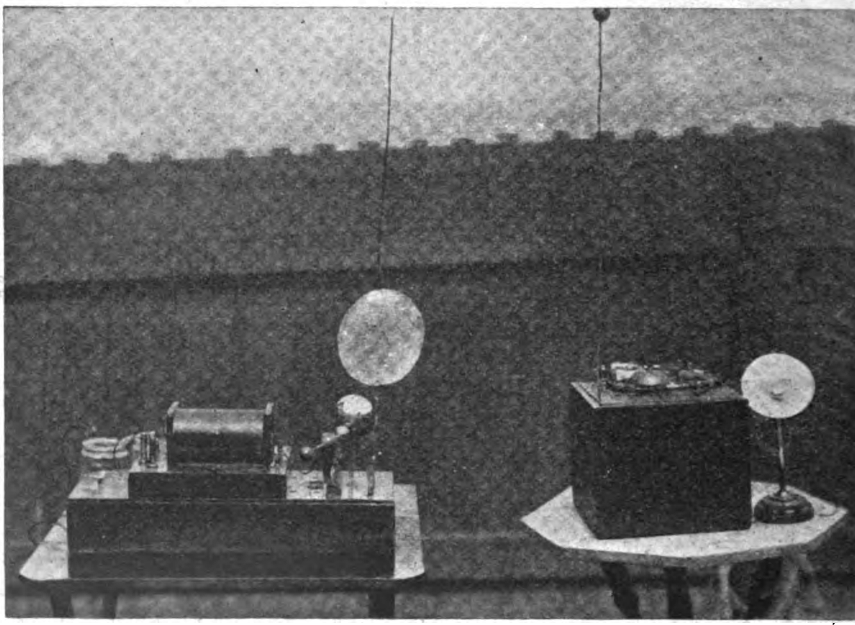
It is here that the greatest idea of portability comes in, and in several particulars readers will not grudge a claim for a little originality of arrangement. In most apparatus that I have seen described there has been a number of separate parts, which means the expenditure of a good deal of time and trouble in the fixing up and dismantling, besides taking up a great deal of room and not being easily moved from place to place. In this instance, I have lugged into service a spirit case. It originally contained departments for Hennessy's "Three Star," "Old Tom," "Best Scotch," and "Real Jamaica." It now contains the materials and instruments for calling into play ethereal forces which some of my friends contend are of a more serviceable and profitable character. Let us begin at the top. A rabbetted ledge running along the top inside carries a baseboard of mahogany. Here first of all will be noticed the coherer. I have made and used various kinds, but I like that shown the best, as being the handiest and most reliable. It consists of a piece of ¼-in. glass tube in which are two fairly tightly fitting pieces of brass rod, one of which is capable of sliding through a cork (at the small end at the left) for purposes of adjustment.

The Filings.

The filings in the coherer shown are of antimony, but (as mentioned in my letter in The Model Engineer recently) I find hard brass handy, economical, and useful. As the size of the filings is of some importance, I use two little copper gauze sieves for the purpose of getting a suitable size. It need hardly be added that there is a very large number of other metals, besides antimony and brass (including silver and nickel), that might be used for producing filings.

The Relay.

This is the part of such apparatus that is the dearest to buy, and is one of the most difficult to make if nice adjustment is aimed at. Most that I have seen described have armatures of the vertical type, which look rather unwieldy and would be of no use in this portable apparatus of mine. After a good deal of experimenting, I hit on the following plan. I made a double core of No. 22 soft iron wire (on ordinary bell bobbins), the wire being the same as used in the core of the coil, and I soldered thereto a yoke of soft iron. The armature is also of soft iron, carried on a horizontal spring of brass foil. This is supported to the right on a 1-in. hammer pillar, similar to that used on a small shocking coil. The contact pillar (of the same set), mounted on the other side of the baseboard, carries a screw which makes the most delicate adjustment possible. The second (and smaller) terminal carries underneath the baseboard a wire leading from the left hand of coherer to relay battery. It also takes (as shown) one wire from relay, the other going to the terminal to the right of the bell, which carries the wire to the right coherer terminal. The bobbins are wound with No. 40 single silk-covered wire.



Transmitter and Receiver Complete.

Bell and Decoherer.

From the contact pillar referred to there are connections (under the base) with the local battery. To the terminals shown are connected the wires coming from the bell, the hammer of which, it will be noticed, makes a very simple and convenient decoherer. The bell is, by means of a telegraph shaped terminal, capable of being moved on an axis for the purposes of adjustment.

If instead of ringing a bell one desires to light a lamp, or set a motor in motion, and so forth, you simply detach the wires from the bell and connect up the other apparatus in the usual way.

THE RECEIVER BATTERIES.

In this instance two dry cells are used for the relay; and two ditto will easily ring the bell. For any other of the purposes the box conveniently takes sufficient dry battery power—the cells standing upright.

In the third picture the mast will be seen. This fits into a piece of glass tubing cemented inside the box, and is thus thoroughly insulated—a short coil of wire being connected from the left-hand coherer terminal to a terminal soldered on to the mast.

The box is furnished with a fairly deep cover. This fits tightly over the whole, keeping it snug and free from dust. It is also handy in this sense: that one may after giving a friend a demonstration in the workroom carry it into the next room, or out of doors, and prove that in the case of the Hertzian wave "stone walls do not a prison make." All that has to be done is to mount it on a stool or small table, take off the cover, readjust the wires (which I purposely disconnect when not in use, to prevent the running down of the batteries or polarising the relay), set up the mast, and there you are.

The third picture shows the transmitter and receiver complete, a 4-volt fancy bracket lamp being connected up to the receiver, the bell being temporarily disconnected but not removed.

In conclusion, I would add that throughout I have observed the importance of the completest possible *insulation* in the whole of the apparatus.

For the photographs illustrating this article I am indebted to Mr. Fred. Dodds, the popular station-master at High Wycombe, an enthusiastic amateur photographer.

A FORTHCOMING EXHIBITION IN SPAIN.—An International Exhibition of Hygiene, Arts, Handicrafts and Manufactures will be held in the Crystal Palace, Madrid, from September to November next, under the patronage of the Spanish Government. We are given to understand that all detailed particulars with reference to this Exhibition can be obtained from its Spanish representative in London, Mr. A. Donderis, Spanish Art Exhibition, Compton House, 99A, Charing Cross Road, London, W.C.

A Design for a Small Model Undertype Engine.

By HENRY GREENLY.

(*Continued from page 471.*)

V.—PISTONS AND PARTS OF MOTION.

THE drawings with this instalment of the articles include pistons, piston-rods, cross-head, slide-bars, and connecting-rods. With regard to the pistons, we have already had one suggestion (see Mr. C. Blazdell's letter in issue of April 25th) which, I was told some years ago by the gentleman who tried it, worked very well.

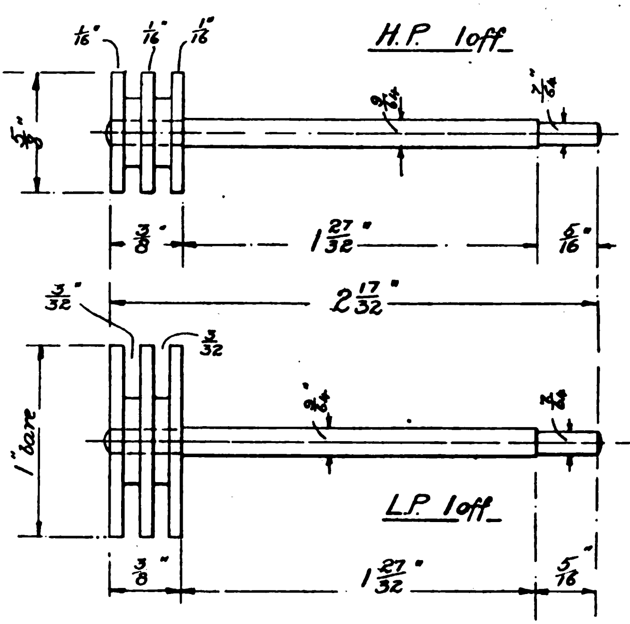


FIG. 21.—PISTONS AND PISTON-RODS.

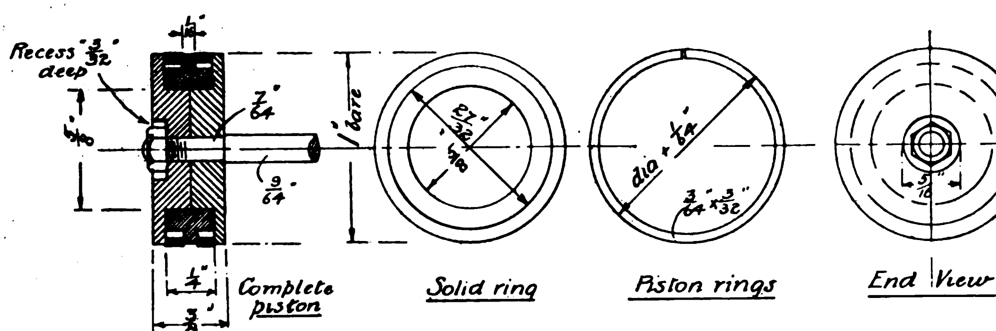


FIG. 22.—ALTERNATIVE DESIGN FOR LOW-PRESSURE PISTON, FITTED WITH TWO RINGS.

Seeing that there is some difference of opinion in the matter of piston rings for model cylinders below ¾ in. diameter, the writer would advise those who do not care to experiment with rings for the high-pressure cylinder to fit a plain grooved piston to this cylinder. The packing may be asbestos or darning cotton, and where the device described by Mr. C. Blazdell of coiling a piece of clock-spring in the groove and wrapping the soft packing round it, is not adopted, two deep grooves may be employed, as shown in Fig. 21. As the end of such packing generally gives trouble, a darning needle with the fibrous material threaded in it may be used, and at the last turn the end of the string may be "sewn" under the previous coils and trimmed flush with a pair of scissors. This done, it will be found that the piston will enter the cylinder without difficulty, and the end strand will not lap over the body of the piston and cause the latter to jamb in the bore.

As the model is a compound engine, and leakage in the H.-P. cylinder simply means increased forward pressure on the L.-P. piston, a pair of piston rings may be fitted to the latter, the H.-P. piston being simply packed with fibrous packing, in two grooves, as shown in the drawings.

As to materials. Cast iron being used for the cylinders, either steel, phosphor-bronze, or brass rings may be employed. The latter is the easier material to work up. The rings are rather too slight to be successfully made in cast iron. In any case, the writer does not recommend a solid piston with rings sprung over it, as in a petrol engine, as trouble may ensue owing to the rings being unduly stretched in the process of springing them over.

It is always wise to make such a small piston in separate parts. One method is shown in the accompanying full-size drawing (Fig. 21). The

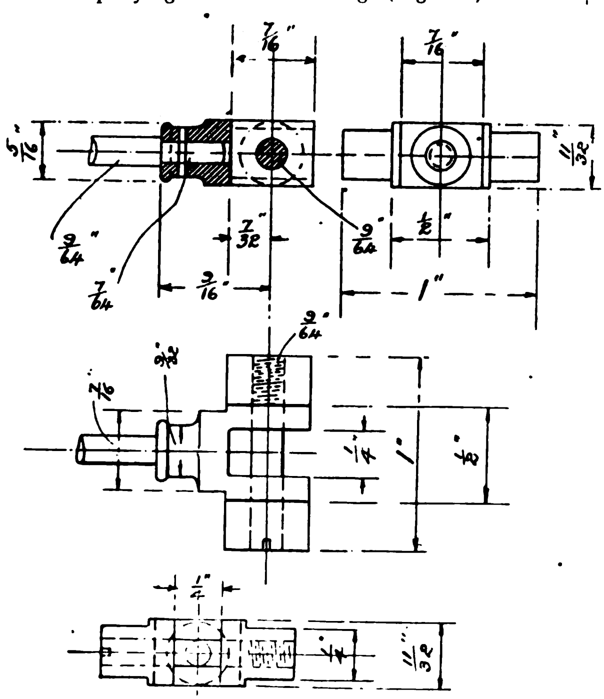


FIG. 23.—CROSSHEADS.

piston may seem complicated, but being for the most part all lathe work, the model engineer should find it not an unpleasant task to make. The two halves may be made from castings, the pattern providing for the parting down the centre. The back ring should be made a driving fit in the piston-rod—that is, sufficiently tight to enable it to be

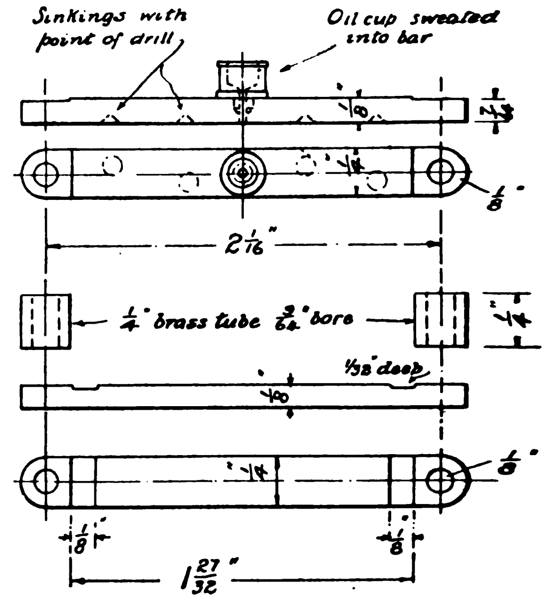


FIG. 24.—SLIDE-BARS.

skimmed up without recourse to soldering it to the rod. The other half should be tapped to take the thread on the rod and should be recessed for the locknut. Having marked the position of the two halves when screwed up tight, the front (that is, the tapped) part may be removed, after having taken a cut off the periphery and turning the groove for the solid ring shown in the drawing. The function of the solid ring is solely to form a distance piece for the Ramsbottom rings. This distance-piece should have no longitudinal shake when the parts are fitted together, but should not prevent the two halves of the piston from taking a bearing on each other. There would be no objection to a slight "floating" movement of the solid ring. That is, the bore of the solid ring may be made a "shade" larger than the spigots of the two halves of the piston body without detriment.

To make the piston rings, obtain a piece of thick solid-drawn brass tubing, about 1¼ ins. outside diameter; bore the tube 3-32nds less than the diameter of the cylinder and turn the outside down to about 11-16ths in. diameter, parting the tube to make rings ⅛ in. wide. Split the rings at an acute angle, and with a soldering-iron solder the split portions together again, gently squeezing the ring so that the ends meet. Place the rings on a mandrel with a very slight taper, and with the keenest of tools turn the rings to finished width and to exactly the diameter of the cylinder. Unsweat the joint with an iron and carefully file the slit 1-32nd wider than before with a small ward file. Although a few failures may occur, the ultimate result of this process should be two very satisfactory piston rings, which will be truly cylindrical when placed in the cylinder. When all the parts are made, a finishing cut may be given to the piston (the rings being removed), the two halves being screwed up into position on the rod, the job being placed between centres or being held by the rod in a self-centreing chuck.

Two "tommy" holes may be made in the front half of the piston body to facilitate the tightening up on the rod, and if a trial is desired, the same construction may be adopted for providing the H.-P. piston with spring rings.

The cylinders having been made and fixed, the next item will be the slide-bars, crossheads, and connecting-rods. These parts are identical for both the H.-P. and L.-P. sides of the engine. No special process can be devised for making the crosshead, unless a milling spindle is available, but in any case the pattern-maker should provide a tenon or chucking-piece on the opposite end to the circular portion in which the piston-rod fits. Such a tenon-piece will enable the maker to hold the crosshead casting in the lathe and to turn and bore the neck for the shouldered end of the piston-rod. The hole should be bored deeply so that it in some degree forms a guide in filing away the space

The connecting-rod may be made out of cast mild steel or bronze. If the former material is used, do not trouble about a brass liner. With regard to running condition, this refinement is not necessary to such a small model. Steel looks well, but if its rusting properties are deemed to be a disadvantage, phosphor-bronze or German silver may be employed. The rod is of round section with a plain-eyed little end and a marine pattern big end. The pattern should have centreing-pieces left on the ends and the big end should be cast solid with an allowance for the sawcut which is made to split the big ends after boring for the crank-pin.

It will be noticed that locknuts (reduced in thickness) are employed for securing the big end bolts. If desired, screws may be used driven from the back, the rod portion being tapped for the screws. Or, the caps may be tapped and a bolt used as shown in the drawings, only one nut being required in this instance. To ensure absolute parallelism, the connecting-rod may be mounted on the faceplate to drill for the crank and little end pins. Care must, however, be taken in bolting down, otherwise this method may prove less accurate

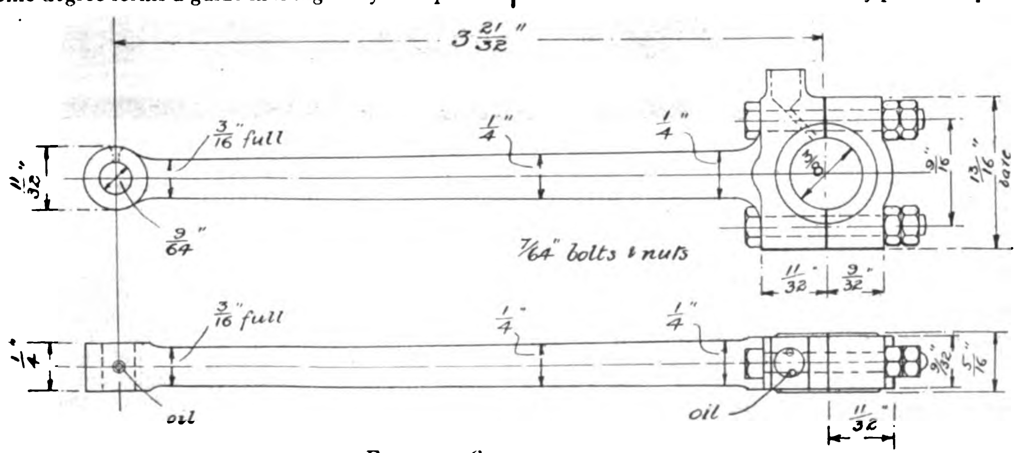


FIG. 25.—CONNECTING-RODS.

or the little end. The slides of the crosshead should be filed square with piston-rod, and should be an easy fit laterally between the guides.

The little end pin may be made out of a piece of Stubb's steel rod to the nearest size to 9-64ths in. diameter obtainable. One slide block should be tapped to suit a thread cut on the end of the gudgeon-pin.

The slide-bars are arranged to made strip steel. Bright stuff is obtainable, but if the reader has only black rod of the required section available, recourse will have to be made to draw-filing to finish the bars for the slides. Distance-pieces for the slide-bars can be made out of brass tube, slices being cut off in the lathe to the required thickness. Of course, pieces of steel rod may be turned to size and bored for the studs if the appearance of steel is desired in preference to that of brass. The top bar may be provided with a small oil cup turned out of rod brass. This oil cup should be soldered in place, as the writer's experience has been that oil cups fitted by screwing into thin slide-bars are likely to become loose when the engine is working, unless the thread is a very tight fit.

than drilling the rods in the ordinary way. In any case, the sides, big end, will require to be faced, and the projecting collar formed in the lathe. To do this, however, the big-end may be made to grip a mandrel, the rod being placed close up against a faceplate and made to act as its own driving carrier.

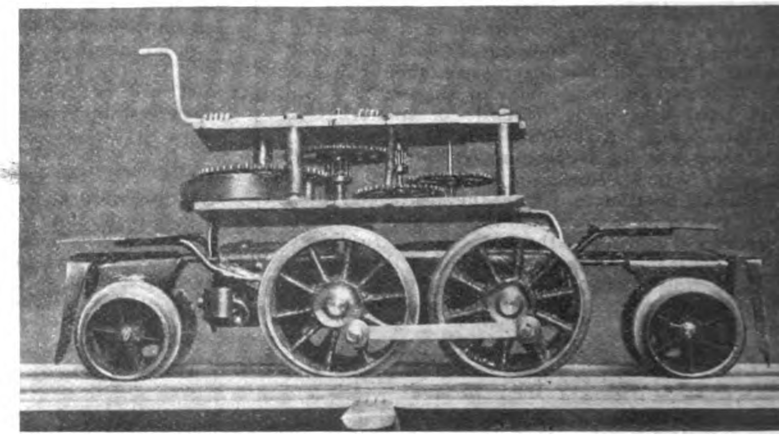
(To be continued.)

Clockwork Model of G.E.R. Tank Engine.

By ARTHUR GREEN.

IT is many years since I made a model engine. I have generally found sufficient odd jobs in the way of repairs to various articles, ranging from a watch to a tin kettle, to fill my limited spare time. But a friend of mine was in difficulties over a model locomotive for his little boy. He had bought several clockwork models, which promptly broke down, and came to me for repairs; but being somewhat tired of the need for the engines to go to the "shops" so frequently, he invested in a steam model. The advent of this proved a source of delight to the son, but caused considerable distress of mind to the lady of the house, owing to a bad habit it had of dropping oil and dirty water over the best tablecloth and drawing-room carpet, to say nothing of sundry slight scalds and burnt fingers.

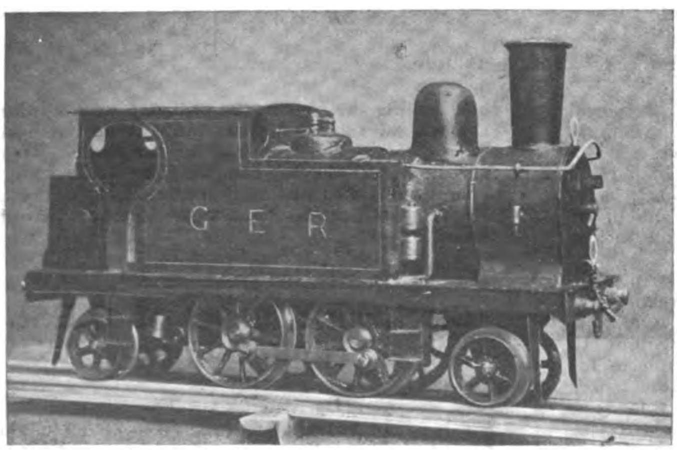
In a weak moment, and probably because I happened to possess a worn-out American clock movement and a whole sheet of tinplate—which seemed all that was necessary for the job—I promised to make him a model of a G.E.R. side-tank locomotive, the cost not to exceed 5s., and wishing to give full value for money, I promised to fit it with reversing motion so that shunting operations could be performed.



Showing Arrangement of Clockwork Mechanism for Locomotive.

I obtained four 1½-in. and four 1-in. wheels, and with these and a section of track as the basis of measurements, I made a full-sized sketch of the locomotive, working it up until it appeared fairly proportionate to the eye.

Now, being little fond of trouble, I was at considerable pains to scheme some simple method of making a reversing motion, and looking at the clock movement and spare clock wheels I had, I could see no possibility of fixing up a loose wheel to gear alternately with two adjacent wheels of the movement and a pinion on axle, and the only easy way I could devise was to fix two pinions to axle between frame and mount a crown wheel on centre pivot of clock—the pivot which carries the hands—to gear with them, making the whole clock movement rock from centres at axle level, so that one or the other side of crown wheel geared into one or the other axle pinion and thus obtain a forward or backward movement according to the direction, right or left, in which the movement was inclined. I found a disc wheel with teeth the same size as pinions (it was the first wheel in one of the Ansonia Company's Bee clocks), which was fairly substantial and appeared suitable for the crown wheel. I softened it by making red hot and dropping into water, and then hammered the teeth over on a round stake, bending them nearly at right angles with face of wheel. This was found to be satisfactory so far as gearing with pinions is concerned, and will, I should say, last as long as the other clockwheels. An oblong tin box—open top and bottom—was then made, and holes punched for axles of driving wheels to pass through. Two strips of tin were soldered to front plate of clock movement, bent at right angles and riveted to the ends of tin box so that it could rock, the rivets forming centres. I found this would run about the table in either direction very well. It was afterwards entirely remade in brass.



A Clockwork Model Tank Engine.

It was intended, and I very much wished, to make the model with front and rear outside axle-boxes, as these engines have, in my opinion, a much better appearance, and the side plates were cut out accordingly. But, owing to the sharpness of curve in track and long wheelbase of engine, it was found that there was not sufficient side play for the wheels. I tried the leading and trailing wheels loose on axle with a spiral spring between them to keep them to gauge, but the flanges mounted metals directly they came to the curve, and I could see it was necessary for the wheels to change direction. I then made pony trucks with a radius from centre to axle of about an inch, but the axle-box extensions on side plates were still in the way, and I reluctantly abandoned them and made new frames for inside bearings. I then found it would travel round the curve, but the driving wheels took a course a good deal out of the centre line of engine, and I then cut out the entire centre of footplate, leaving only sufficient to solder the side tank plates to, the idea being to have the driving mechanism entirely separate from the frame so that it could take its own course and push the engine, which was supported by the leading and trailing wheels only. This arrangement was not a success, and the pony trucks were then pivoted to driving wheel frame and an extension of frame carried out from each end to support the footplate.

The boiler, smokebox, firebox, outside plates for tanks, cab and bunker, were made and soldered to footplate, and it was then found that there was not sufficient width for the clock movement to rock sufficiently to put the wheels into gear. It was then necessary to make new narrower plates, and I found an old French clock plate, which when sawn down the centre formed two plates for the movement. It was an easy matter to mark off the position of pivot holes along a line drawn down centre of plate, measurements being taken from the old plates, and it was then I made the small D bits I wrote to you about a short time back. For such small work as this a watchmaker would use a bow-drill; the smallest drilling machine I had was a geared breast drill, but I found no difficulty in drilling through both plates, which I clamped together, with the very small D bits, and the depths of wheels were found to be correct, showing that the drills did not draw away from centre punch mark although they cut on one side only.

The main steam dome and dome carrying Ramsbottom safety valve over firebox were cast in lead and turned up, wood patterns being turned and tried on engine, until the proper size and shape was obtained.

It will be seen in the photograph that the smokebox carries the usual discs and destination board, also a very good imitation of the Westinghouse brake hose-pipe, which was made by bending a piece of wire to the shape the pipe hangs, fixing a small tin clip near top of bend, winding a piece of bouquet wire up and down, and finally sweating all together with solder; the end of the wire was hammered out flat and shaped to resemble coupling.

The Westinghouse donkey pump was turned out of a piece of ¼-in. brass rod, and is a good imitation. Boiler supply pipes are of brass wire, as are also the cylinder lubricators. A piece of brass wire was soldered round boiler where it joins smokebox to form moulding, and was cleaned up after boiler was painted.

The leading dimensions are: Length over buffer beams, 8¾ ins.; width of footplate, 2¾ ins.; length, including tank, side plates, cab and coal bunker, 6 ins.; cab door opening, ½ in. by 2¼ ins.; rail level to footplate, 1¾ ins.; side frames, ¼ in. wide; buffer beams, 7-16ths in. wide; driving wheel centres, 2 ins.; leading to trailing wheel centres, 6¼ ins.; boiler, 1¾ ins. diameter; smokebox, 2 ins. from footplate; funnel, 1½ ins. high; dome, 1 in. high from top of boiler; dome carrying safety valve, 3-16ths ins. high, ⅞ in. diameter; safety valve, ⅜ in. long by ⅛ in. wide by ¼ in. high; whistle, ⅛ in. diameter; cab, 2½ ins. wide; look-out windows, ½ in. diameter; discs, ⅜ in. diameter; buffers, ¼ in.; Westinghouse pump, ¾ in. high by ¼ in. diameter; side tanks from footplate, 1¾ ins.; cab from footplate, 2¾ ins. high; diameter of dome, 15-16ths in.; diameter of funnel, ¾ in. at top, 11-16ths in. at bottom; tail lamp, 7-16ths in. square, ⅜ in. high; side rods, 2 ins. centre to centre; name plate, oval, ½ in. long by ⅜ in. wide; track, 1⅜ ins. gauge.

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 intended for publication.]*

Colouring of Rail Motor Coaches.

To the Editor of *The Model Engineer.*

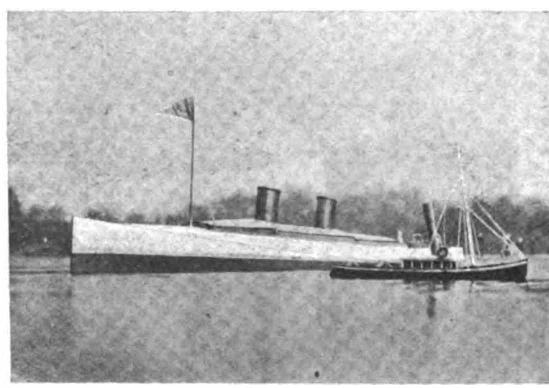
Dear Sir,—Could any reader give me particulars as to the colouring of the new Taff Vale Railway Company's rail motor coaches.—Yours faithfully,

Suffolk. C. H. B.

A Silver Medallist of the 1906 Model Speed Boat Competition.

To the Editor of *The Model Engineer.*

Dear Sir,—The following is the description of my model steamer *Era*, which is one of the speed steamers of the Wirral M.Y.C., of which I have been a member since its formation in 1898.



The Model Steamer, "Era."

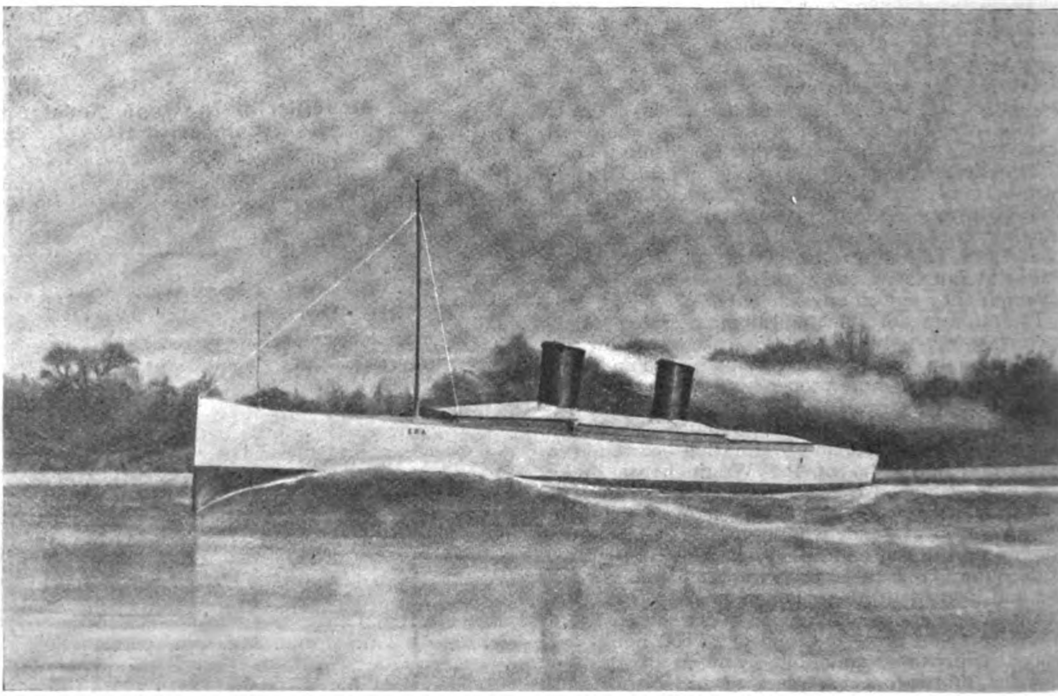
A few alterations have been made in her engines, boiler and propeller since she won the Silver Medal in The Model Engineer Speed Competition of 1903.

The alterations have each tended to increase her speed, the hull however has been left untouched. The engine now in use is constructed in the non-frictional parts of aluminium, and of gun-metal and steel in all working parts. Though made from the same design and patterns as the engine of 1903, the weight has been reduced from 12 lbs. to 6½ lbs.

The propeller shaft has had its *rake* reduced, and it is now more nearly in line with the work required from it, being almost parallel with the L.W.L. The propeller now used is an example of the principle of the "survival of the fittest." More than half a dozen have been tried under similar conditions and after successive experimental tests, this one—cast in aluminium—gives the best results.

The most interesting feature of the tests made in this connection is the very different result obtained by changes in the design of the propeller. The dimensions of the steamer may be interesting:—Length over-all, 8·75 ins.; L.W.L., 8·75 ins.; Mean draught, 3·2 ins. Displacement:—Hull, with fittings, ballast, and lamp, 19 lbs.; Engine, 6½ lbs.; Boiler, 21 lbs. Total, 46½ lbs.

The engine is compound, non-condensing:—H.-P., 1-in. bore, 1-in. stroke; L.-P., 1·75 in. bore, 1-in. stroke. Boiler, 6·25 ins. in diameter, 16 ins. long in water space, two fire tubes with nine cross tubes in each. There are no return tubes and a blast in the combustion chamber rapidly removes all spent gases. The working pressure is 100 lbs. to the sq. in.



THE "ERA" STEAMING AT FULL SPEED.

The propeller has a diameter of 6 ins.; mean pitch, 10·25 ins.; pitch at tip, 11·25 ins.; at boss, 8·25 ins. It is driven at 2,000 revolutions per minute. The lamp works on an air pressure of 5 to 10 lbs. It has two burners, and will raise steam in seven minutes from cold water. It maintains the boiler pressure when the engines are going at full speed.

In conclusion, it may be said that although her record in the Speed Competition of 8·76 miles is high, she can and has attained a public and authentic speed of 10 miles per hour. As our Club have now reduced the measurement limit of their power boats I am willing to part with the *Era*, should I find anyone desirous of purchasing.

The photographs (enclosed) were taken by Mr. A. J. Keay, the hon. treasurer of the W.M.Y.C.—Yours faithfully, W. R. WEAVER.

Annesley Road, Seacombe.

Model Yachting Correspondence

A London Championship.

To the Editor of *The Model Engineer*.

DEAR SIR,—Owing to the increasing popularity of the sport of model yachting, particularly in London, it has occurred to me to ask you to invite the opinions of M.Y. Clubs in and around London *re* the promotion of a race for the championship of London, competitors to be the men their respective Clubs select as their best man. A small entrance fee, say, 2s. 6d., might be charged, and some token of success purchased and presented to the winner. If you will kindly publish the above in your Model Yachting Correspondence you will greatly oblige an old reader.—Yours faithfully,

JOHN K. HALE,
Hon. Sec. F.G.M.Y.C.

The Society of Model Engineers.

London.

A PARTY of the members spent a very interesting afternoon on Tuesday, the 14th inst., in making an inspection of the Royal Arsenal, Woolwich, where they were fortunate in being able to see some very large guns in process of being turned and a number of operations in connection with bullet making, etc.—HERBERT G. RIDDLE (Hon. 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:—

[17,623] **Working Induction Coils from Supply Mains.** W. A. (Cardiff) writes: I should be very deeply obliged for any information you can give me on the following matter. I want to know the most economical way to work a large 12-in. spark high frequency medical coil fitted with motor-driven mercury interrupter —(*a*) with accumulators, (*b*) direct across supply mains D.C. 200 volts, (*c*) small motor generator driven off A.C. supply and generating D.C. The coil takes about 9 amps. According to the text-books for medical purposes a coil must not be put across main supply. Does this mean that you cannot use a series resistance with the primary, and, if so, what is the reason? I should be very glad if you could give me diagrams of any connections practicable, also name of the maker of the Milne Murray switchboard for high frequency coils.

The most economical way would probably be to use a motor generator either from the direct current or alternating current mains. You could have the low voltage side arranged to give you a pressure suitable for charging accumulators as well, if this is any advantage. Induction coils are now being worked direct from supply mains at pressures of 100 and 200 volts or more, high speed mercury interrupters being used. It would be advisable

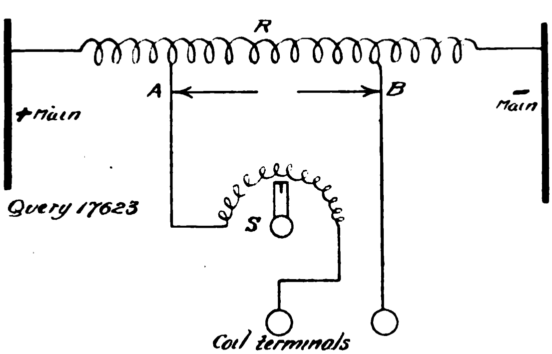


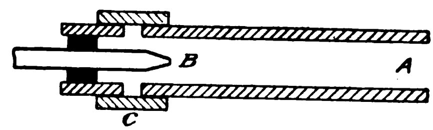
DIAGRAM OF CONNECTIONS FOR INDUCTION COILS AND SUPPLY MAINS.

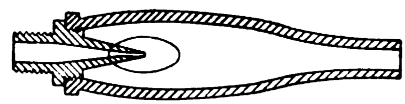
for you to refer to the makers of your coil and interrupter, however, before attempting to do this. There is a way of working direct from mains by the use of a shunt (as sketch). The main resistance R is switched on through a suitable switch and fuse, and takes, in your case, about 20 amps. The coil is connected as a shunt to the main resistance, the current dividing at A; that required by the coil returning to the main resistance at B. A small regulating resistance S is placed in series with the coil. The distance between A and B, where they are connected to the main resistance, is determined by trial, the greater the distance between them the greater the voltage upon the coil. About 100 yds. of No. 10 gauge "Eureka" resistance wire would do for the main resistance made into coils and mounted in a fireproof frame. If an ordinary coil is connected direct to the mains with a resistance in series with it the sparking at the interrupter is excessive. We do not know the makers of the switchboard referred to, but believe that Dr. Milne Murray is to be found at the Edinburgh Royal Infirmary, Scotland. He would, no doubt, give you the name of the maker.

[17,421] **Acetylene Gas Engines.** E. H. (Amsterdam) writes: Reading in handbook No. 16 that acetylene gas could be used in Bunsen burners, I experimented with the tube as Fig. 1. The gas enters at B. When I had the air-holes closed by the tube C, I got a heavily smoking flame at A. When I opened them a little the flame stayed at A and was still lightning but the smoke had disappeared; when I opened the holes further to get the flame blue I heard a bang and the gas began to burn at B. Could you give me a dimensioned drawing of an acetylene gas Bunsen burner which I can make without a lathe? Gas inlet diameter 7-32nds in. inside.

Mr. Turner replies as follows: I cannot say that I have experimented with acetylene Bunsen except so far as regards a vertical

FIG. 1.





Query 17421 FIG. 2.

BUNSEN TUBES.

one, and that not to any practical extent. A vertical Bunsen is a hazy blue smokeless flame, but a horizontal one is intended to have a flame of the blowlamp or blowpipe variety, and to obtain this it is essential to have a good pressure of gas, so that in its forced passage through the Bunsen tube it may act as an injector drawing (by its own impetus) a positive current of air through the holes in the Bunsen tube and mixing therewith form a strong jet at the open end of the Bunsen tube without fear of the jet lighting back. The querist's failure is therefore probably due to a lack of pressure in his gas supply. This can be overcome by weighting the gasometer of his generating apparatus and only using a very minute hole at his jet, and regulating the amount of air intake at the side holes of the Bunsen tube. The Bunsen tube should, in my opinion, be a bellied one (as Fig. 2), forming a roomy mixing chamber before reaching the outlet.

[17,708] **Running Small Lamps in Parallel from Cells.** H. C. W. (Eton College) writes: If you could enlighten me on the following subject, I should be very much obliged. A battery connected as in Fig 1 gives a reading of 5 volts. A 4-volt Osram lamp is now inserted, and the reading falls to 1·5. Now what I want to know is—If the E.M.F. is strong enough to light up two 4-volt 3 c.-p. Osram lamps in parallel? The battery does so, but when both lights are on together the total light is far less than when a single light is on. To light a second lamp, should the meter show 4 volts? (Sketches not reproduced.)

Provided your cells are large enough to supply current to the lamps, any number can be connected in parallel up to such a point as will not overtax the capacity and discharge rate of cells, the voltage of lamps, of course, to correspond with the voltage of supply A reference to Query reply on "Reduction of Voltage," in March 5th, 1903, issue will put you right. The case is analogous.

[17,690] **Partial Failure of Spark Coil.** T. A. W. (Smethwick) writes: Will you kindly answer the following? I use a coi for engine ignition which is worked by an accumulator giving 4½ volts. Thinking that chemical batteries would be less trouble than getting accumulator recharged, I bought two 1-pint and one 1-quart bichromates, and charged with chromic acid and sulphuric acid, as instructions in your "Electric Batteries." These are connected in series giving more than 5 volts, yet I get only 1-16th-in. spark, instead of ¼-in. There seems to be no increase in length of spark by passing through coil. On page 34 of your "Induction Coils" you say, "With two good sized bichromates ¼-in. spark should be got." Again, on page 53 of your "Petrol Motors," I read "Chemical batteries or accumulators can be used with coil so long as 3·6 voltage is obtained." Nothing is said of amperes.

Evidently your coil is taking more current than the cells can supply comfortably, or else some of the conditions under which it is working are not the same as before. The only thing you can do is to try more cells in parallel, or make a careful examination of the whole case to see where the trouble lies. We presume the coil gave ¼-in. spark (in air) with the accumulator previously.

[12,890] **Gearing of Shafting, Pulleys, Etc.** W. P. K. (Northamptonshire) writes: Could you answer the following questions. (1) What is the method used in finding the ratio of the number of revolutions of two-cog wheels? (2) What fraction of the power applied to a cog-wheel would be lost if the speed was changed to 1,000 revolutions from 1 revolution per second? (3) How many cog-wheels would be required to multiply the speed 1,000 times? (4) Where and for what price (approximately) could I get cogs to multiply 1,000 times, if the force applied to the first wheel was (*a*) 10 lbs, (*b*) 40 lbs.?

(1) The speed of cog-wheels is directly proportional to their diameters. For purposes of calculation this diameter is always taken as a circle passing through a point about half-way down the length of the tooth and is known as the diameter of the pitch circle; the teeth are neglected, the calculations being made as if the pitch circles were friction wheels rolling against one another. A wheel having a diameter of 12 ins. would drive one having a diameter of 6 ins. at double the number of revolutions per minute, and so on; the converse would also hold good—the 6-in. diameter wheel would drive the 12-in. diameter wheel at half the number of revolutions per minute. As a matter of fact, the number of teeth on the wheels will follow the same proportion. A wheel with twelve teeth will drive a wheel with twenty-four teeth at half the number of revolutions per minute, and so on. (2) Depends very much upon the accuracy of the gearing and other conditions. You might allow about 10 per cent. loss in friction for each pair of wheels; but is this what you mean? You must remember that if you apply 1 h.-p. to the gearing you cannot get more out of it, but rather less. (3) Depends upon the arrangement of gearing permissible; it is not good practice to use less than twelve teeth in such a case on a cog-wheel, so that taking this as the least number, you could get your speed by three pairs of 10 to 1 ratio wheels; that is 120 wheel driving 12 would speed up ten times; a second 120 wheel would speed up a second 12 wheel to 100 r.p.m. and a third 120 wheel would speed up a third 12 wheel to 1,000 r.p.m., arranged as sketch. (4) Messrs. Cotton & Johnson, Gerrard Street, Soho, London. Only a small fraction of the 10 lbs. or 40 lbs. pressure would appear on the teeth of the last wheel, but it would be working at very high speed.

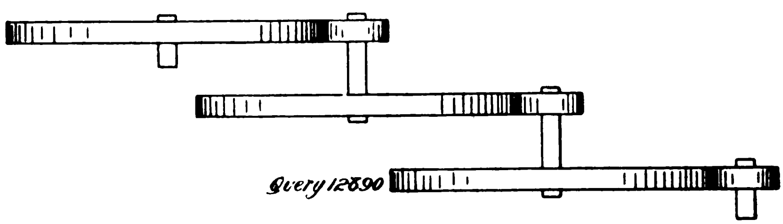


DIAGRAM SHOWING METHOD OF REDUCING THE SPEED OF SHAFTING.

[17,646] **Model Engine Packing.** W. M. (Ryarsh) writes: (1) Please give me the dimensions and method of making a piston for a small model steam engine of ¾-in. bore? (2) Is asbestos or other packing admissible for ensuring a steam-tight fit of cylinder covers? (3) Should soft solder be used for any part of cylinder, steam chest, etc.?

(1) There is a varying opinion as to piston rings for cylinders of ¾-in. and below, but with good workmanship and design no trouble should ensue. Something on this subject will be published shortly. Asbestos makes good packing, but see that the grooves are deep. (2) No, not on a small engine. Employ thin paper for such joints. (3) Yes, it may where the parts are not in the smokebox. All steam pipes should be silver-soldered or else screwed with fine threads and soft soldered.

[17,644] **Model Steamer.** D. B. (Wimbledon) writes: I am going to make a model steamboat, 3 ft. 6 ins. long by 7-in. beam, and 6 ins. depth, which I think of fitting with a single-acting oscillating engine, ⅝-in. bore by 1-in. stroke. I propose fitting a boiler made of solid-drawn copper tube to stand 200 lbs. per sq. in. The boiler is to be 5 ins. diameter by 3 ins. long; the flue tube will be 2 ins. diameter and have about ten solid-drawn copper water tubes. I propose firing the boiler with a petrol blowlamp. (1) What would be the cost of the wood for hull, and which is the best and cheapest place to obtain it from? (2) Will the engine drive the boat at a reasonable speed? (3) Will the copper for boiler be too thick, and is it necessary to braze the water tubes into flue tubes? Are the tubes the right diameter? (4) Is the boiler large enough to drive the engine? If not, what size boiler should I use?

The beam and depth of the proposed boat is very excessive. You will be able to carry everything necessary with a beam of 5½ ins. and a draught of water of, say, 2½ ins. (maximum). Although solid-drawn copper tube is naturally very strong compared to a riveted cylindrical shell, we do not see the necessity for adopting such dimensions and plate thickness as would safely stand a pressure of 200 lbs. per sq. in., or of employing such an elaborate (comparatively) furnace tube and firing arrangements for use with a simple single-acting oscillating cylinder, which will leak like fury if worked at a high pressure. (1) The cost of the wood will vary from 5s. to 10s., according to sort and quality. (2) No; not a boat of the dimensions you suggest. (3) The shell need not be heavier than 3-64ths thick. Use a plain spirit lamp and about three tubes (light stuff) about ½ in. diameter ranged in a longitudinal direction inside the furnace tube inclining upwards towards the mouth of the furnace. (4) The boiler you propose is too heavy and powerful—that is, if fired by a petrol blowlamp.

[17,689] **Materials for Making Small Dynamos.** R. L. (Beverley) writes: I am writing you a little query on my dynamo. I was reading through your handbook (No. 10) last night, and noticed that the field-magnets of No. 11 are to be made of three forgings. I never noticed this until after I had got them cast. I made the pattern, got them cast, and planed them to exact size. I would be very much obliged if you would kindly explain how to meet the little difficulty. Do you think that by having the field-magnets cast the machine will be a failure; if so, would you kindly explain how to meet the difficulty? I would like to stick to the cast ones, as it is a difficult job to get small forgings here. Is there any remedy in altering the gauge of wire? I would like the dynamo to be kept to stated output (50 volts at 5 amps.) if possible. Is there any brass-casting firms you could recommend that cast to customers' patterns? I would like to make the armature shaft ⅞ in., owing to its length. The hole in armature stampings is ½ in. Do you think it will make any difference by making shaft ½ in.?

It would have been better had soft wrought-iron been used, but we should advise you to soften the castings well, as explained in handbook, and to finish machine, and give it a good trial. The output and efficiency of the dynamo may be a little impaired, but no serious difficulty should be met with. Castings can be had from Gilbert & Co., 11–13, Gray Street, Waterloo Road, S.E., to your own patterns. A ⅞-in. shaft is far more than need be; ½-in. or ⅝-in. is enough.

[17,678] **Starting, Regulating, and Control of Motors.** J. T. G. (Pembroke Dock) writes: Would you oblige me with an answer to the following question? (1) What is the Ward and Leonard system of control of motors? (2) Would the question, viz., "Control of Motors," comprise all varieties of ordinary starters and controllers for controlling the speed and direction of motors?

(1) The speed at which an electric motor armature will run depends upon the volts applied to the motor terminals. The torque, that is, the effort to turn which the armature will exert, depends upon the current which is flowing through its windings for a given strength of magnetism produced in the field-magnets. The product of the volts and amperes is the power supplied to the motor. At starting the motor armature requires to exert the necessary amount of turning effort to deal with the particular load, but a small speed only is required. Therefore, the most economical method of starting a motor will be to give the armature as much current as required, but at very low voltage, increasing the voltage as the speed is required to rise until full speed is attained. The Ward-Leonard system does this by supplying the motor with current through a motor generator, the voltage of which can be varied from zero to full voltage. The maxim of the system is—"Vary the voltage as the speed required, vary the amperes as the torque required." There may be variations in the arrangement of the motor generator; its voltage can be arranged to add to the line voltage or oppose it. The general principle is the use of a motor generator interposed between the line and the working motor. It is a continuous current system of control. (2) Yes, taking it in its broadest sense.

[17,704] **Small Dynamo Connections.** A. W. (Bedford) writes: I see that in No. 10 of THE MODEL ENGINEER series of handbooks that you are willing to clear up any problem unsolved. I have made up my mind to make a model "Simplex" dynamo, and the only thing I cannot understand is how to connect the different parts. I should like to know where to connect the exciting coil, whether to the brush rocker or not; if not, I should also like to know how the brush rocker is connected, and whether the brush is made of spring steel, brass, or copper.

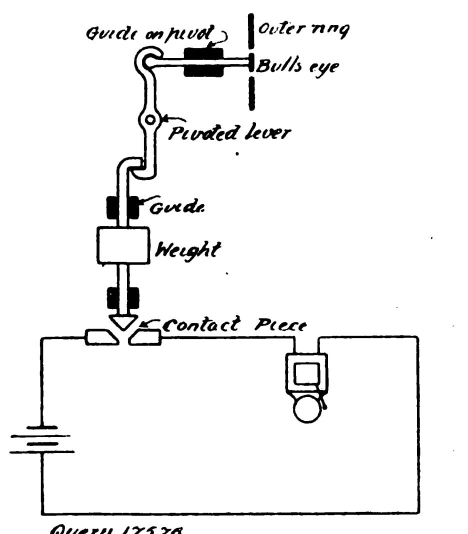
The two ends of the shunt field windings are connected to the two brushes respectively. The brushes of small machines can be of strip copper or brass, and springy; those of larger machines of copper gauze.

[17,654] **Electric Light for Cinematograph.** E. F. W. (Bangor) writes: Having had a great deal of experience in the cinematograph business as operator for a touring company now closed down for the summer vacation, I am writing to ask whether you can help me in any way. My difficulty is this. My light for lantern during the tour was high-pressure gas (oxygen and hydrogen), supplied to us in cylinders by the British Oxygen Company, London. I want to use electric light for projection purposes next tour, so could you advise me what to do, or have you got any publications dealing with setting carbons on a naked arc lamp, amperage required, also cable connections, rheostats and switchboard rigging-up. Other companies generally take from 25 to 45 amps. for lantern lighting. Have you got any books in stock dealing with the above subjects? My weakest points are connecting the right cables on to rheostats, to switchboard, and then to lamp; also carbon filing to make a neat arc. Kindly let me know whether you have any books dealing with carbon lighting, etc.

Your best plan is to obtain from some electrical firm an arc lamp suitable for your purpose, and get them to supply you with a small resistance board which can be used to regulate the supply current between, say, 100 volts and 220 volts, which are the most commonly used pressures for lighting circuits. The connections are quite simple. The positive lead is connected to the positive of rheostat, and the positive of rheostat to positive of arc lamp (it is marked +). The usual fuses are, of course, in series with the rheostat and arc lamp. The return then goes to negative of supply circuit.

[17,576] **Electric Target Signals.** L. S. (New Cross) writes: Would you be so kind as to answer my little query. I am thinking of making an electric target, such as used in rifle ranges. Can you tell me how such a target is constructed so as when shot hits it it rings a bell and also lights a lamp, showing on a dial whether it is a bull, inner or outer, as the case may be? Also, could you show me the connections for same?

The connections are probably as shown below. We believe

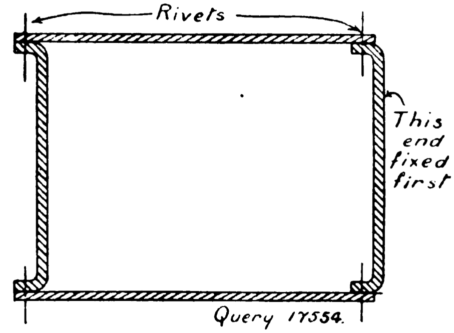


CONNECTIONS FOR AN ELECTRIC BELL-RINGING TARGET.

there is another device in use which is operated electrically. A gun is mounted on a pivot, and according to the position it is in when the trigger is pulled so is a corresponding signal given announcing that a "bull" or otherwise has been scored—or, we should say, *might* have been scored—for there is no actual discharge from the gun.

[17,554] **Making Small Water-tube Boilers.** N. S. (Wanstead) writes: Being a regular reader of your useful paper, I should be much obliged if you would answer the following queries. I wish to make a horizontal boiler out of a piece of seamless brass tube, 12 ins. by 3 ins. I have obtained two cast brass ends with flanges to fit outside the tube, and I do not know quite how to fix them. I do not see how they could be riveted on, as when one end is fixed you could not rivet up the other. I do not wish to fix it with small screws. Could I tie the ends in with a strong stay, say, 3-16ths in. or ¼ in., then thoroughly sweat all round the flange? I want to fix a few water tubes running from end to end, as described in "Model Boiler Making." How should the joints be made between the pipes and boiler shell? Could they be soldered inside and out? What solder should be used—blowpipe or ordinary?

The very best method of fixing the ends would be to silver solder them in (see article in issue of April 23rd, 1903). However, you can readily rivet them if you turn one end with the flange inside the barrel and then rivet up on a stake in the vice. Then fit the other end with the flange outwards as indicated in our sketch herewith. If you must have the flanges both inside the barrel, then fix one flange with ⅛ in. brass screws instead of rivets. If you will refer to "The Model Locomotive," by Greenly, you will find several



RIVETING FLANGED END-PLATES OF MODEL BOILER.

methods described. No stay is required if the ends are silver soldered in. As you are proposing water tubes, then we certainly advise silver soldering the joints as there is no other method of satisfactorily fixing water tubes in a small boiler. You may, of course, fix the ends by attaching them to a strong stay, as shown in the above-mentioned book, and after silver-soldering the tubes into place, spinning the shell over the ends in the lathe, soft soldering the joints with an iron or a blowpipe to ensure steam tightness. Another method is to cut a thread on the ends and screw them into the barrel and finally soldering with tinman's solder.

[17,560] **Link Motions.** B. L. (London, S.E.) writes: I have two small horizontal engines to which I wish to fit a reversing link. Could you please tell me the formula for determining length of link (Stephenson's) and am I right in taking as the radius of link the length of eccentric rod? I have looked up several books on the subject and can gain no information.

The subject is dealt with very fully in "The Model Locomotive," which, by the way, is the only book which deals exhaustively with link motions from the model standpoint. The exact length of the link is not important; what is important is the length of the link between the eccentric rod pins and the maximum travel of the die block. The usual length of link as recommended by the above book is from 1·1 to ·875 times the stroke of the cylinder. The larger proportion is advisable for smaller engines. Therefore, for a 1 × 2 engine you would make the length of the link ·875 × 2 = 1·75 = 1¾ ins. For a ½ × 1 cylinder the link would be 1 × 1·1 = 1·1 = 1 1-10th ins., or, say 1 1-16th ins. The radius of the locomotive type link equals the length of the rod and eccentric strap between centres. The launch engine link is, however, different.

[17,565] **G.N.R. 8-ft. Singles.** G. M. (Glasgow) writes: On looking through some old MODEL ENGINEERS I found a description of a 1-in. scale model of one of Stirling's 8-ft. single locomotive engines, No. 776 (without dome). The maker said he made it from a scale drawing of the actual engine in an English engineering paper. Will you please say where I could get one of these plates, or, if they cannot be had, could you please give me a drawing—an outline will do, or outside elevation to a scale—of that engine?

As far as we remember drawings of the G.N.R. 8-ft. of the 776 class were published in the *Engineer* about 1890. The *Locomotive Magazine*, however, issued a supplement some two or three years ago of the later 1,007 class and possibly you can obtain the drawing now. You have a large library in Glasgow and can readily turn up the back volumes of the *Engineer*. You will find an outline drawing of the 776 class in THE MODEL ENGINEER for November 10th, 1904.

The News of the Trade.

Castings for Small Model Undertype Engine.

We are informed that sets of castings and parts for the small model undertype steam engine designed by Mr. Henry Greenly are now being prepared, and will be supplied by Messrs. Stuart Turner, Ltd., Shiplake, Henley-on-Thames, from whom further particulars and prices may be obtained.

The Editor's Page.

AS the result of suggestions both from private readers and from members of the trade, we have been induced to consider the possibility of organising a Model Engineering Exhibition. It is proposed that the exhibition should be held in a suitable building in London during the latter part of October next, and that in addition to a comprehensive display of models, tools, and scientific apparatus by leading trade firms, there should be on view a thoroughly representative collection of high-class models made by private workers. Inventors' and educational models would also come within the legitimate scope of such an exhibition, and the various model engineering societies, model steamer and yacht clubs, and similar associations might be represented. Such an exhibition on the scale contemplated has never yet been held, but we think that if properly organised it would be welcomed by the many thousands of people interested in this fascinating business and hobby. Model making, both as a business and as a recreation, has developed so tremendously since the first publication of THE MODEL ENGINEER, that it seems quite appropriate that a public demonstration of the present state of the art should be arranged. We are anxious to ascertain the feeling of our readers on this matter, and we should be glad to have the views of all who would like to see such an exhibition arranged. We may say that a number of well-known trade firms have already promised their support, and we hope the suggestion will prove equally popular with the amateur enthusiast. We have on previous occasions been indebted to our reader friends for helpful opinions and suggestions, and we look with confidence to a ready response to our present invitation to them to write and tell us what they think of our proposition.

* * *

Readers will remember the recent article which appeared in these pages describing the 1906 Model Speed Boat Competition. We were unable at the time to illustrate the boat which was the winner of the Silver Medal in Class A—viz., Mr. W. R. Weaver's *Era*. We have since received a batch of excellent photographs of this boat, and have selected two, which are reproduced elsewhere in this issue. Apart from the interesting subject of the pictures, we think the very realistic effect obtained of a model steamer on the water is worthy of special mention.

Answers to Correspondents.

G. W. P. (Bath).—Cotton & Johnson, 14, Gerrard Street, Soho, W.C., would be most likely to supply you.

W. S. N. (Bromley).—We believe the firm you mention is not now in existence. We have not heard anything of them for a long time past, and we do not find their name in the current Post Office Directory.

"MAGNET" (Tooting).—Your request will be dealt with at the earliest possible moment. We may be able to treat the subject in article form.

C. S. (Hackney) and OTHERS.—We will insert drawings of the G.E.R. 1855 Class as soon as the circumstances permit.

B. M.—Yes. See our new book on "Wireless Telegraphy," 2s. 3d. post free.

J. C. R. (Loftus).—If you wish to submit your ideas to the War Office you should write to the Secretary of State for War, War Office, Whitehall London, S.W., and state fully what you have invented, and what it will do. You cannot dictate terms to the Government, but must leave the matter entirely in their hands to deal with as they think fit. You will find full particulars about obtaining a patent in our handbook, "Patents Simply Explained," post free 7d. Messrs. E. & F. N. Spon, Ltd., Haymarket, London, may be able to supply you with books on torpedo and submarine work. Ask them for a list.

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, etc., 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.

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

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Model Engineer
And Electrician.
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EDITED BY PERCIVAL MARSHALL, A.I.Mech.E.

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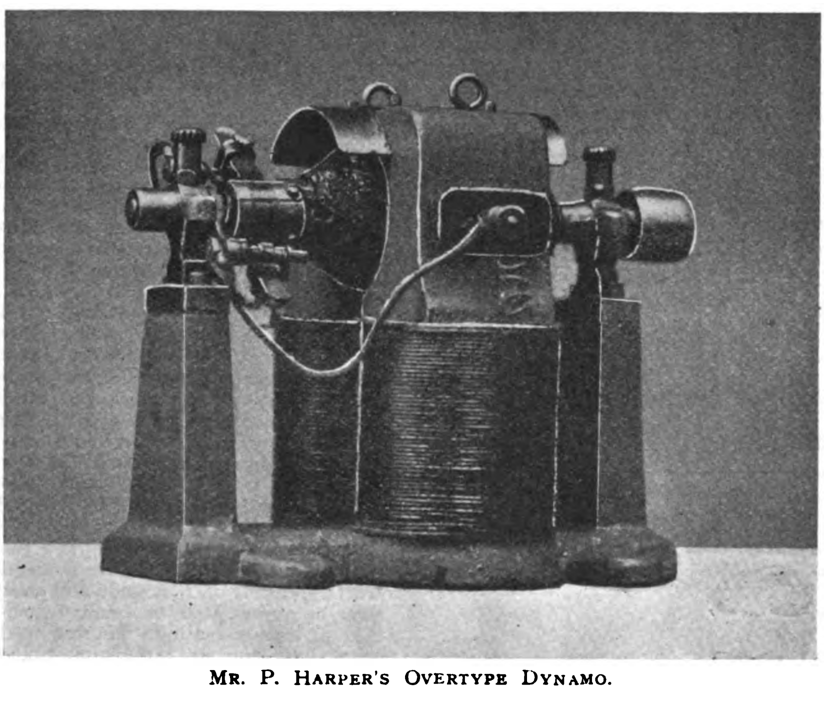
A Small Home-Made Overtype Dynamo.

By P. Harper.



Mr. P. Harper's Overtype Dynamo.

THE illustration given above is of a small dynamo which I have been at work on in my spare time for about three months. I first made the drawings and then the patterns, and castings were made at a local foundry. Each field-magnet is cast separately. The bearings are of iron extra long; they were first bored slightly smaller than the armature shaft, and put in a mandrel and the bosses turned and sides faced; they were then fitted to frame. The armature shaft is an old needle bar from a sewing machine, which, being case-hardened, just suited my purpose. I brazed a collar on it to back stampings up against, and brazed a piece of tube the other end which I screwed for a nut. The stampings are insulated from the shaft by a piece of wood turned down for the stampings, and the stampings are insulated from one another by rubber solution. The shaft was ground in the bearings by fine emery powder. The field-magnets were then brought close to the armature, marked and drilled, to receive a 5-16ths-in. screw, which screws into the magnet from underneath frame. The magnets were then taken apart and ground out by an emery wheel the same size as armature. The oil cups are turned from brass rod, and brush holders made from sheet brass fitted with springs. The brushes are made from copper gauze. The dynamo runs perfect at full load without the least bit of sparking. It gives about 15 volts 5 amps. at 2,500 revolutions.

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 Handy Soldering Furnace.

By J. B.

The following is a description of a very handy double-burner soldering-bit stove. The burner is made out of ¾-in. gas fittings. A T-piece, two elbow-pieces, two caps, a diminished socket, and about 16 ins. plain tube will be required. The construction is, I hope, clear from the drawings (not to scale). The cover is made out of ⅛-in. sheet iron. The top should have some holes drilled in it to let the fumes out. The bottom consists of about six 3-16ths-in. iron rods, put across and tightly held with nuts at each side to keep it firm. There are also two more rods to each soldering-bit to lodge them on, as shown by the drawings.

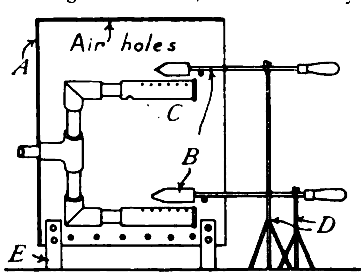


Fig. 1.

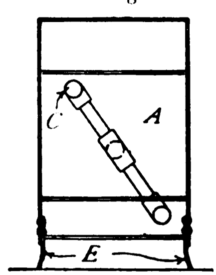


Fig. 3.

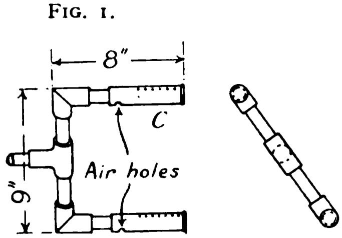


Fig. 2.

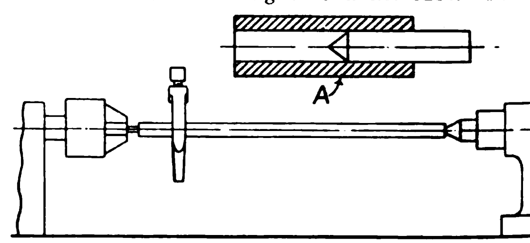
Details of a Handy Soldering Furnace.

The legs consist of four strips of ⅛-in. iron 1 in. wide, fixed to side by three screws. They should be about 2½ ins. long, 1 in. for fixing to cover, and might also be bent out a little. Two suitable rests must be made to support soldering irons. Referring to drawings:—Fig. 1—A, cover; B, soldering irons; C, burner; D, soldering-iron supports; E, legs. Fig. 2 is a detailed view of burners, showing how they must be fixed at an angle, so that the upper does not come directly over the lower one. Fig. 3—front view, showing support bars. I may say in conclusion that this is a very useful soldering-iron stove, as both irons are ready when required, which necessitates very little waiting, if any, for the second iron when the first has become cold.

Centreing Small Rods.

By H. Grinsted.

The following tool will be found very useful for centreing small rods to turn between centres. A separate one is made for each size of rod stocked. A tube A about 1 in. long is bored out parallel to a good fit on the rod. A piece of steel larger than the size of the rod is then put in a chuck and about 1 in. turned down to a tight fit in the tube. The



Centreing Small Rods.

end is then turned to a point while running in the lathe. The turned portion is cut off, hardened and tempered, and is driven into the tube. By inserting the end of the rod to be centred in the open end of the tube and giving a sharp knock on the punch the rod is accurately centred.

After centreing the ends of a rod with the punch it can best be drilled in the lathe. A drill chuck is put on and a small drill put in it allowing only about ¼ in. of the drill to project from the chuck. The rod is then placed between the drill and the back centre, using the punch marks as centres. The rod is kept from revolving by holding it in a pair of pliers or a clamp, and the mandrel is revolved and rod fed on the drill by the back centre adjustment. The rod is then turned about and the other end drilled in the same way.

An Inexpensive Driving Belt.

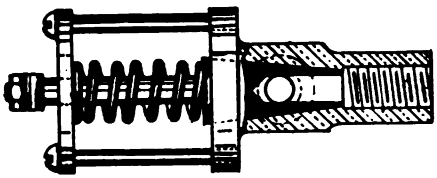
By N. N.

The cost of leather belting is a rather expensive item to the amateur, if there is any length wanted worth speaking of. A good and cheap substitution may be appreciated, especially when it is half the cost of leather belting. Having to drive an overhead shaft from my lathe some time ago, I bought some of the material that file card backs are made of, and found that it answered perfectly. This material can be procured at any card manufacturer's mill, in two or three widths, and any reasonable length, sewn butt joints, made with stout thread, making a good job. The belt is rather stiff until it has run a little while, but this quickly wears off and the belt runs beautifully. I have had a 1¼-in. by 17-ft. belt running for several months, and I have not had the slightest trouble. Powdered resin, or some similar substance, must be used at first to get the belt to give a good grip. This material can be had for 1d. per foot 1¼ ins. wide, whereas ordinary leather belting is about 2½d. per foot of the same width. Wider belting is easily cut to half the width with a sharp knife, no trouble ensuing from unravelling at the edges.

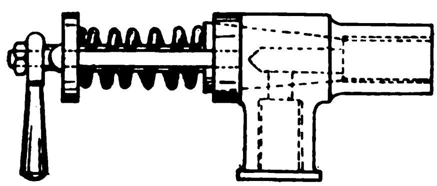
A Safety Stop Valve.

By Barton Mott.

This is a design for a regulator which by its ease of construction may appeal to some of those readers who make their own boiler fittings. A glance at the drawing given here will



Section.



Elevation.

A Safety Stop Valve.

show the simple arrangement. A section is given in order to show the steam passages in the long tapered valve, which in the elevation are depicted by dotted lines. Steam enters at the end of the valve, and when the pressure reaches the limit desired the spring is compressed and it escapes. When by moving the handle the valve is turned till the small passage in the side coincides with the hole in the casting, steam rushes through to the engine. By this means the steam supply is regulated to a nicety. The spring is adjusted by turning the two long screws shown. A gun-metal casting is required for the body, while with the help of a lathe the valve and stem may be turned in one piece from a short length of brass rod. The sceptical reader may like to know that I have constructed a valve to this design and had the pleasure of seeing it fulfil all its promises without leaking or sticking. In my case the steam end passes through the boiler casing and screws on to the superheater. The spring is pressed to 100 lbs., and since I have another safety valve on the boiler, this one would act only in case the other should fail. The one that I have made is for a 5-16ths-in. steam pipe. The valve seating was made by drilling a ¼-in. hole and enlarging it to the required size with a common straight taper bit as used with a hand brace. Then the valve was turned to a tight fit and ground in.

Planing and Shaping for Amateurs.

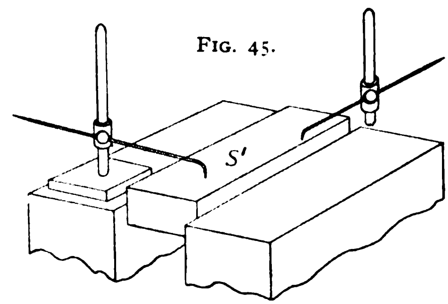
By A. W. M.

III.—Methods of Holding the Work.

(*Continued from page* 512.)

MANY small pieces of work can be clamped in a vice. Though this is a very simple operation, it may involve something more than merely placing the piece between the jaws and

Fig. 45.



tightening up the screw. If the piece is near to finished size, you will require to fix it so that the surface to be planed is parallel to the table of the machine. The tool will then produce a finished surface by removing a minimum amount of metal.

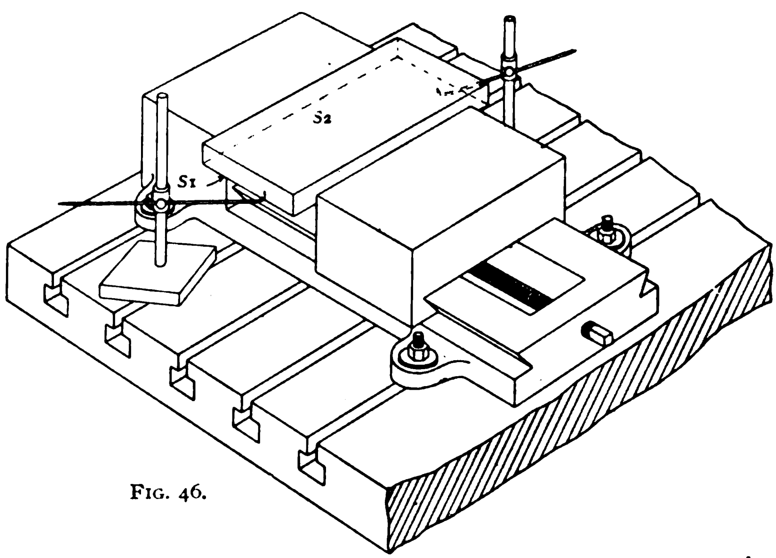


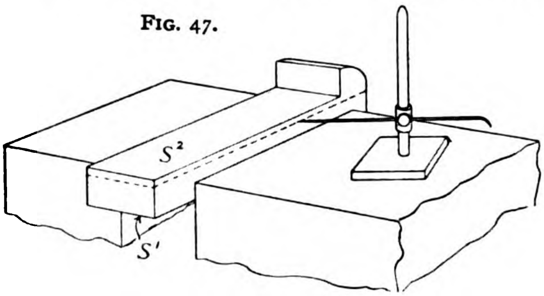
Fig. 46.

Fig. 45 is an example. The piece should be clamped tightly between the vice jaws and a surface gauge set as shown, so that the scriber touches the surface S1. If the point makes contact when tried at an average number of places, the surface will be parallel to that upon which the gauge is moved. Machine vices are usually made with jaws having flat tops which are parallel to the under surface of the vice. The surface gauge can therefore be placed upon them instead of upon the table for the purpose of testing the adjustment of the work to position.

If the point does not touch the surface at an average number of places, it will indicate the part which is low and that which is high, enabling the operator to determine the adjustment of the piece. If the jaws of the vice have not been screwed up too tightly, the piece can usually be adjusted by tapping it with a hammer—at the high place being driven downwards and at the low place in an upward direction.

Should there be a second surface (S2) which is to be planed parallel with the first surface, the piece is reversed in the jaws and adjusted until S1 is parallel with the table of the machine. To test if this is so, apply the point of the scriber rod, as

Fig. 47.



shown in Fig. 46: when it touches the surface, S1, at any point to which it may be moved, this surface will be parallel to the table of the machine. As the movement of the tool is parallel to the table, the surface S2 will be planed parallel to surface S1. An example is given in Fig. 47 of a piece, such as a taper key, which is to be planed to dimension lines marked upon it. The under surface (S1) of the key could be set and planed as Fig. 45. It would then be placed upon a surface-plate, and the dimension lines marked upon it. As the upper

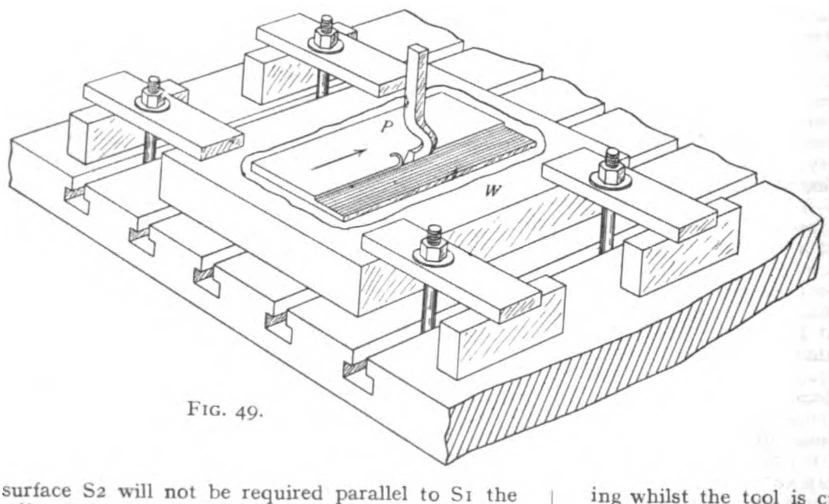


Fig. 49.

surface S2 will not be required parallel to S1 the adjustment cannot be made as in Fig. 46, but as in Fig. 47. The dimension lines having been marked to show the required position of the new surface, it is necessary to set the key so that the tool will follow them in its cut. Apply the scriber point as indicated, and adjust the key until the lines meet the point when the gauge is moved to any position upon the jaws. They will then be parallel to the table, consequently the tool will cut to them when planing S2.

An alternative method of ensuring that the surface S2 would be planed parallel to S1 is to support the piece upon a parallel block, as Fig. 48, surface S1 bearing evenly upon the block.

Very thin pieces which cannot be clamped in the vice, and which have no projecting parts available to which clamping plates can be applied,

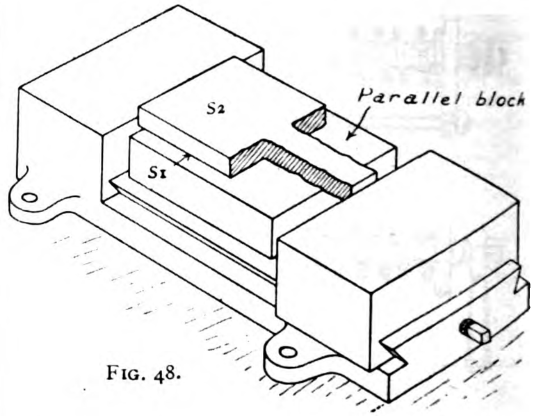


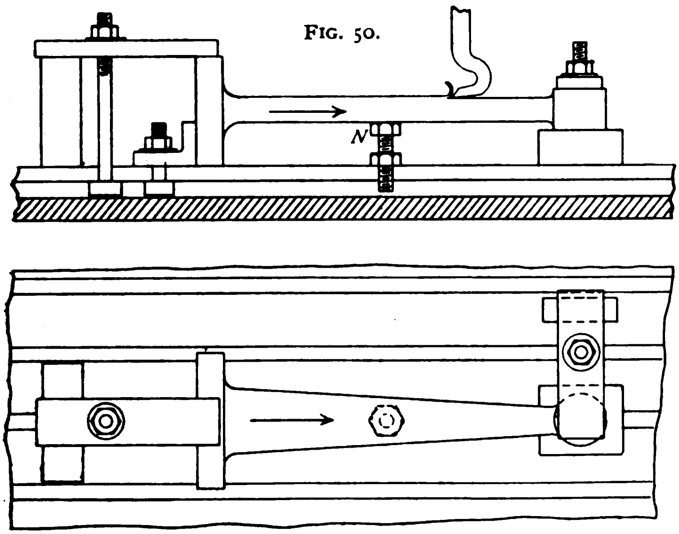
Fig. 48.

may be held by shellac or cement, such as elastic glue, to a block of wood. This is either held in the vice or clamped to the table, and planed so that it has a flat surface either parallel or vertical to the table, according to the shape of the piece to be planed. The shellac or cement should be spread evenly upon the wood block W (Fig. 49), and the plate (P) to be planed is made warm and then pressed down in place, the cut being taken when the cement is cool.

When applying clamping plates to finished surfaces a piece of brown paper placed between the plate and the work will assist in preventing the surface from being bruised and enable the plate to obtain a firmer hold than if it bears direct upon the metal. When a finished surface is underneath, and against the surface of the table, angle-plate or parallel block, a sheet of brown paper interposed between them will assist to preserve the surface and prevent it from sliding whilst the tool is cutting the remaining parts to be planed. If the paper is selected of an even thickness, it will scarcely interfere with the accuracy of position of the surfaces produced.

The amateur can make angle-plates, V-blocks, parallel blocks for himself, and they will provide exercises in planing, but a variety of patterns can be obtained from dealers in small tools. Some of these parallel blocks are adjustable to different heights; useful and special forms of clamping plates, adjustable screw packing-pieces, and other accessories are also supplied. An adjustable packing-piece can be made with an ordinary nut and bolt, the latter being screwed throughout the entire length of its shank. One of these is shown in use at N (Fig. 50) to support a connecting-rod, which is clamped in position to be planed.

FIG. 50.



Circular planing or shaping requires special attachments to be fitted to the machine. Some shaping machines are fitted with a hollow mandrel, which is provided with gearing, so that it can be rotated by a small amount at a time from the feed-movement. This mandrel is placed in the bed of the machine and in line with the stroke of the tool. The piece to be planed—for example, a boss upon a lever—is fixed upon a mandrel which fits at one end into the hollow mandrel in the machine; when the latter is rotated by the feed-movement, the boss will be rotated also. The movement is timed to alternate with each stroke of the tool, which thus makes a succession of cuts over the surface of the boss.

In Fig. 51 A shows a comparatively large boss supported upon a pair of cones carried by the mandrel. The shank E fits into the mandrel, which is in the bed of the machine. The object of the cones is to enable bosses having holes of different size to be clamped upon the same mandrel. Sketch B shows a comparatively small boss clamped upon a cylindrical mandrel, which also has a shank E to fit into the machine mandrel. A headstock similar to that of a lathe could be clamped upon the table of a planing or shaping machine, and used to support cylindrical pieces. Some form of feed-movement would be required.

Hexagon or other shaped nuts can be planed—a number at a time, if desired. They should be slipped upon a plane mandrel, as shown at C (Fig. 52), and clamped between a shoulder and nut. The mandrel is supported by a pair of headstocks, as indicated by the sketch, one end being held in a chuck K. A division-plate D contains the requisite number of holes by which the mandrel is secured, whilst the tool is making its cut over one surface. As each length of surface is planed the tool is stopped and the division-plate rotated by the amount which will bring the next length of surface to the correct angular position. Surfaces 1, 2, and 3, etc., are thus planed in order; surface 1 first, surface 2 next, and so on.

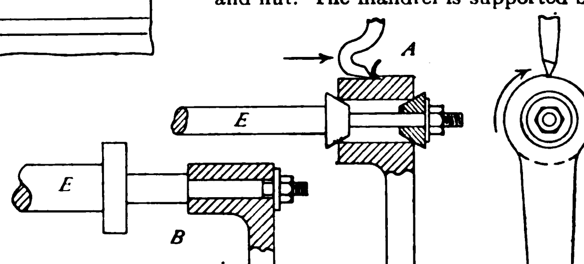
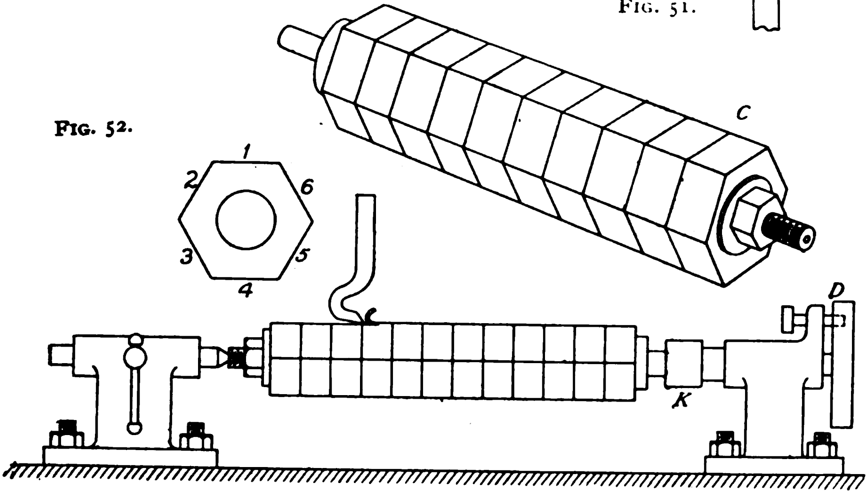


FIG. 51.

FIG. 52.



The amateur will require to exercise his ingenuity in deciding upon the best way to secure a certain piece of work. The examples given are intended to illustrate general methods which form the basis of this branch of the subject.

(*To be continued.*)

How to Make a Wool Winder.

By J. C. Clough.

(Continued from page 491.)

THIS much of the woodwork being completed, the ironwork may be proceeded with. Commence by turning the bobbin spindle J (Fig 6). Cut to given length a piece of ½-in. round iron, centre and clean up the ends, turn ⅞ in. of one end to ⅜, leaving a clean square shoulder, screw ½ in. of this to ⅜ thread and fit a nut to it. Reverse in the lathe putting the carrier on the nut, reduce to the sizes given, using the sliding backstay for the ¼ in. portion, finish the surface with a touch of a fine file. The ⅛ in. collar left full size may have its outer edge just trued up that it may fit neatly in the recess made for it in the base. The centre pins O and Y (Fig. 6) may be also made now, and will be ready when wanted.

In Fig. 7 is shown a very useful tool for sinking in wood such recesses or counter-sinks as that required for the washer and nut on J (Fig. 6). The stock is made of ⅜ round iron, a 3-16ths square hole put diametrically through ⅜ or ½ in. from the end. The cutter is of 3-16ths square steel, made to fit snugly in the square hole; as no set-screw is used, the fit requires to be a good one. The piece of steel cut to the exact length of the diameter of the recess to be made is marked centrally to just within the diameter of the stock, and then filed to a cutting edge as the section shown, from the marks to within 1-16th in. of the end, observing to make the cutting edge on each half in the proper direction. The lips left at the ends are to be filed to a cutting edge, filing on the inside so that the lip may cut across the fibres of the wood a circle the full size of the intended counter-sink. A hole the size of the stock being first bored in the wood ensures the counter-sink being concentric. By having collars to fit the end of the stock, this tool will do for a number of different sized holes.

The cone spindles M and N (Fig. 1) are cut to length from ⅜-in. round iron, the ends centred truly, the centres being drilled deep and well coned to 60° with the cutting centre; straighten them carefully, using a wooden mallet and a block of lead, slide the spindle N to 5-16ths, its centre length. Then, if necessary, reduce one end to fit the pinion V (Fig. 1). Drawfile the other end for 2½ ins. from the end till the mark of the cut is taken out, and just round off the sharp corner; this allows the spindle to be driven into the wood without jambing.

The cone spindle M is first marked for the worm pinion L (Fig. 2), which is to be of the full diameter, ⅜ in. and ½ in. long; the short remaining portion is to be reduced to ¼ in. and about 3-16ths in. at other end of the worm should also be reduced to ¼ in., to clear the screwing tool, using a round nose tool. After just skimming the surface of the worm pinion, the thread must be cut. Put on the necessary wheels for 8 per inch, or whatever the thread is to be, and cut down to about half the depth of the full thread or until the point of the tool touches the bottom of the ¼ in. clearance. Then, for succeeding cuts set the tool up by the top slide towards the left, until the widths of the top of the thread and the bottom are equal, the top the narrowest if anything. Use plenty of lubricant and a sharp tool so as to leave a nice clean surface on the thread. The point of the tool should be well rounded, thus giving a smooth surface at the bottom of the thread.

The remaining portion of the spindle must now be turned to 5-16ths its whole length, and draw-filed for 2½ ins. up from the end, and rounding the corner as before.

The blocks of wood that are intended for the cones H H (Figs. 1 and 2) are trimmed roughly to a cylindrical form, driven into a cup chuck and a true centre made in the end. The drill chuck which fits in the spindle nose will also fit in the loose headstock; a 5-16ths twist drill held in the chuck is passed through the wood.

An alternative method, should there be no cup chuck, is to centre each end of the wood, put on a carrier, and turn up the ends between the centres; then, holding the wood between the centre and the cone plate, with the drill held in the chuck as before, drill up half the length of the wood; reverse in the lathe, and drill the other half. Hold the wood in the vice, and with a mallet drive the draw-filed portion of the spindle through the block of wood; this must be done with care, to avoid bending the spindle; let the end of the spindle just show through. It will be noticed that the base of the cone is at the end of the spindle, so the top slide of the rest must be set to cut in towards the fast headstock.

The diameter of the base is 1½ ins., that of the apex ½ in., so, if the length of the cone, 2½ ins., is set out on a line drawn on a piece of stiff paper and perpendiculars drawn on these points, on which set out the two semi-diameters, a line joining these will be at the correct angle to which to set the rest. Cut the paper on these lines, and, applying one edge to the side of the top slide, look the other edge into coincidence with the edge of the lathe bed.

See that the wood-cutting tool is quite sharp, and with a fine feed make as good and even a surface as possible, and leave it at that; do not use file or sand-paper.

The bobbin J (Fig. 6) should be turned at the ends between the centres, and, using the cone plate as before, drill half its length ¼ in.; reverse, and drill the other half the same, taking care that the drill goes quite through; then, with a 5-16ths drill, open out for ⅜ in. up. This must be turned on its own spindle as a mandrel, but putting the carrier on the wood. First turn up ¾ in. of its length to fit tightly into the centre of the worm wheel, W. This should not be less than ⅝ in. diameter; make a clean, square shoulder, and leave it not less than ⅛ in. larger in diameter. Now reverse in the lathe, and, having obtained as before the angle of the taper, which is in a length of 3½ ins., from ½ in. diameter at the lower end, to ⅜ in. diameter at the top, slide up nice and smooth, and in this case finish the surface to a semi-polish with a fine sharp file and sand-paper.

The bobbin is secured in the wheel by making a couple of cuts with a fine saw from the end to about the middle of the thickness of the wheel at right angles to one another through the centre, and driving in thin wedges of wood, one of the wedges being the full width of the bobbin, the other two wedges a little less than half that width each; put them in with a touch of hot glue; see that the wheel is up to the shoulder and runs perfectly true, then set by to dry. When quite dry clean out the bore with a small gouge and the outside with a fine file after cutting away the superfluous parts of the wedges. When finished, it should go easily on its spindle and turn freely, but not slack or shaky. The place on the base for this balling spindle and bobbin is next to be located by setting up the frame with the worm pinion spindle M (Fig. 1) in its place.

Stand the bobbin on the base, with the teeth of the wheel well in gear with the worm, so that a line drawn through the centre of the wheel square across the base would pass through the centre of the worm pinion. Holding the bobbin firmly in this position, drop a ½-in. bar, which has been turned to a point at one end, down through the bobbin, thus marking the centre on which the hole for the spindle is to be bored in the base. Notice now that this centre must be in the axial line of the tubular spindle B C, as will be seen on the plan (Fig. 2). The hole must be truly upright to the surface of the base and a snug fit to the

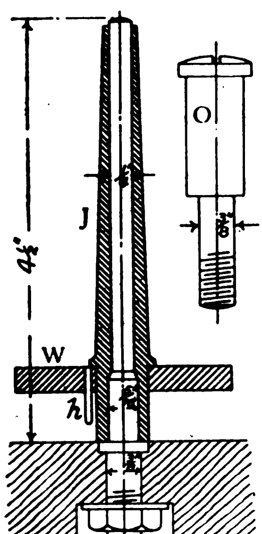


Fig. 6.

screwed portion of the spindle; the recess for the collar, and also that on the underside for the nut, should be cut with the tool shown in Fig. 7, taking care not to go too deep in the top one and to make the under one deep enough to take the nut (a thin one) and a thin washer, so that the nut is well below the surface.

The fitting up of this part is very clearly shown in Fig. 6.

The wheel and pinion X and Y (Fig. 1) are to be now fitted to their place on the base.

This place will be found by placing the wheel on the axial line of B C as nearly central as possible, and with the teeth of the wheel X just clear of the surface of the bobbin beneath the wheel W. With a fine point mark the base through the centre of the wheel X. If, upon lifting away the wheel, the small circle marked is not central on the line, it should be made so, carefully preserving its distance from the bobbin.

On this centre make a truly vertical hole through the base the size of the screwed part of the centre pin Y (Fig. 6). Recess the top of this hole to take a thin iron washer flush with the surface of the wood, and recess the under side to take the nut and washer of this pin in the same manner as for the spindle J.

To cause the wheel X to revolve two teeth for every complete revolution of the wheel W, a steel pin that will go easily between the teeth of the wheel

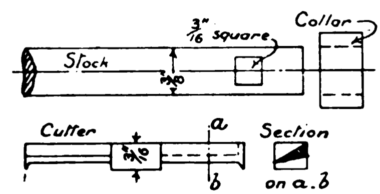


Fig. 7.

X is driven into a hole drilled for it on the under side of the wheel W close to the wood of the bobbin. This hole is to be drilled by hand after the bobbin is fitted in the wheel, either with a wire-size twist drill or an ordinary drill made to the size of the wire used for the pin, and rather bare so as to ensure a good fit of the wire; the hole may be broached with a taper-broach and the wire touched with a fine file to fit.

As the wheel X moves only two teeth at a time, it must be held stationary during the remainder of the revolution of W. For this purpose a steel spring or detent, *a* (Fig. 1), is made of thin sheet steel, screwed to the front of the standard E, and with its extremity bearing on the teeth of X, with just sufficient force to cause its bent point

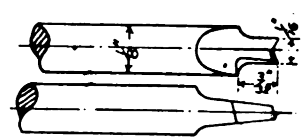


Fig. 8.

to drop between the teeth, this point being so formed that whilst it allows the teeth to pass under it quite freely in one direction, will not allow any movement of the wheel in the opposite direction except the spring be lifted out of the teeth, for which purpose a small hook is riveted to the spring as shown. For the purpose of adjustment of the wheel X, so that its teeth shall not jamb with the pin in W, two or three small pieces of thin tinplate are made to the size and shape of the foot of the spring, with holes in them to correspond with those in the spring, which is held in its place by one button-head screw and a steady pin. If necessary, one or more of these packing pieces can be inserted between the foot of the spring and the surface of E. If a pinion of sixteen teeth of the size of Y can be obtained (the number of teeth and size of the pinion are not arbitrary—anything near the given dimensions will answer the purpose—which is to move the slide carrying the friction roller at a much slower rate than the periphery of the wheel X; in the drawing the proportionate speeds are two to one) the boss of X must be turned, and the pinion bored to fit accurately together, and a pin driven tight into a hole drilled through both will secure their relative positions.

In the event of a pinion not being procurable, the boss of X will have to be cut for one. Fig. 8 shows a form of drill that, run in the drilling frame on the slide-rest, will answer the purpose; a clearance of 3-32nds at least, but not more than ⅛, must first be turned to the intended depth of the teeth close up to the under side of the wheel; this is for the purpose of clearing the cutting drill upon getting through, but is not absolutely necessary where great care is taken at the second cut not to force the drill too far at the risk of breaking it. The first cut should be taken with a straight drill, a trifle less in diameter than the finishing drill, which should be turned to the shape of the space between the teeth, obtained by making as accurate a drawing as possible of the tooth and space of the pinion and working to a template made from that.

The wheel is put on a true mandrel between the centres, and the centre of the drill must be exactly centre high. The counting wheels for dividing to 16 are 100 on the spindle, gearing into a 25 on the intermediate sleeve; an 80 on the same sleeve-gearing into a 20 on the lead screw, on which is also fixed the catchplate and the spring catch on the banjo. One revolution of the catchplate for each tooth. Make the slide-rest carriage fast by its clamping screw, and see that the closing nut is kept open.

(*To be continued.*)

Re THE MODEL STEAMER "ERA."—The length over all and low water line dimensions of this boat given in last week's issue were obviously incorrect. They should both have read 83·75 ins.

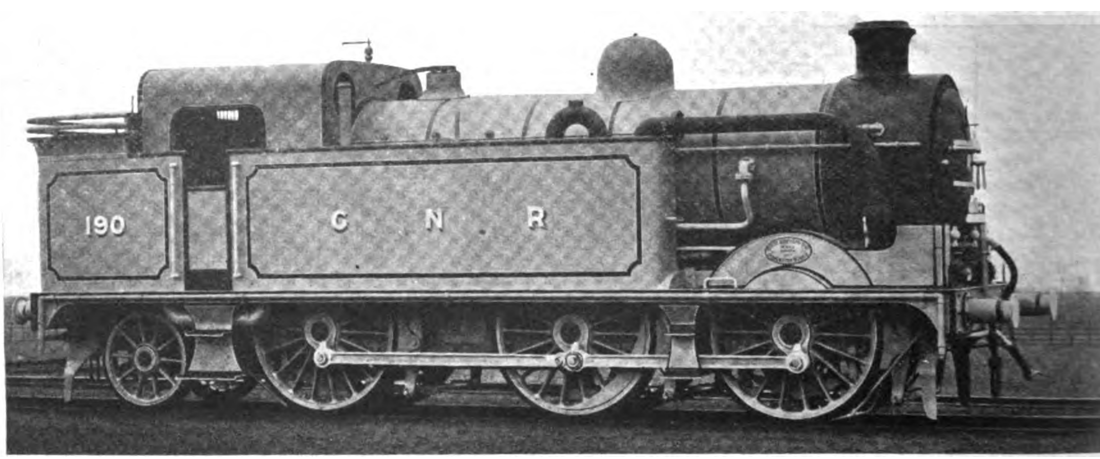
Locomotive Notes.

By CHAS. S. LAKE, A.M.I.Mech.E.

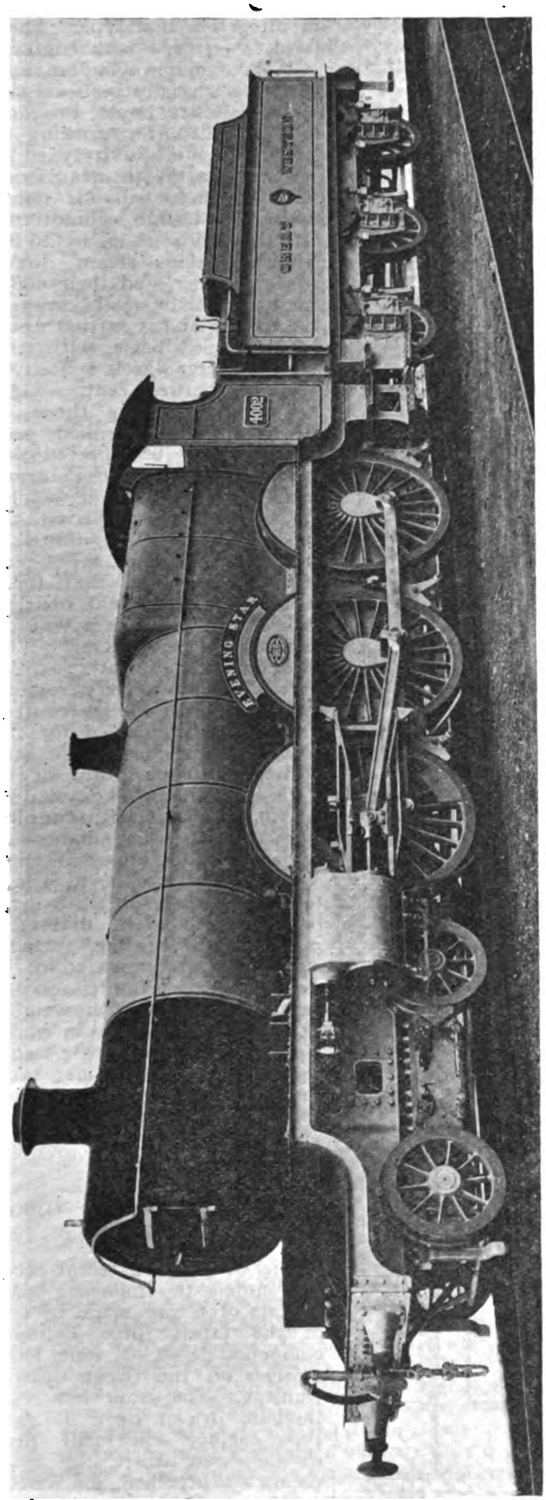
NEW LOCOMOTIVES FOR ENGLISH RAILWAYS.

Upon three of the principal railways of England new locomotives of a type hitherto untried on their respective lines have recently been, or will very shortly be, introduced. The railways concerned are the Great Northern, Great Western, and Great Central. On the first named Mr. H. A. Ivatt has put in service a 0—6—2 type tank locomotive, designed for heavy suburban passenger traffic. This engine is numbered 190, and is now regularly working between King's Cross and the various outlying suburban districts served by the G.N.R. The design is admirably proportioned, with the result that a substantial collective appearance is combined with that neatness which is still the pride of British locomotive engineers. The six-coupled wheels of moderate diameter, in conjunction with a large boiler capacity and ample cylinder area, will render the design particularly applicable to the special requirements of Great Northern suburban traffic, and the engine will have an all-round efficiency which will make it suitable for dealing with varying conditions of working and different classes of traffic. The boiler is carried somewhat higher than usual above the level of the rails, and contains ample heating surface area and steam space. The coal and water-carrying capacities of the bunker and tanks respectively are such as to enable the engine to run considerable distances (as things go) without replenishing either commodity. Altogether, the design may be regarded as marking an advance in locomotive standards for its particular type and purpose. The leading dimensions are—

Cylinders, 18 ins. diameter; stroke, 26 ins.
Coupled wheels, 5 ft. 8 ins. diameter.
Radial wheels, 3 ft. 8 ins. diameter.



THE NEW SIX-COUPLED RADIAL TANK ENGINE: G.N.R.



NEW 4—6—0 TYPE EXPRESS LOCOMOTIVE WITH FOUR SIMPLE CYLINDERS: G.W.R.

Coupled wheelbase, 16 ft. 3 ins.; total wheelbase, 23 ft. 7 ins.
Boiler: Diameter (outside), 4 ft. 8 ins.; length of barrel, 10 ft. 7 ins.
Total heating surface, 1,250 sq. ft.
Grate area, 20·8 sq. ft.
Working steam pressure, 170 lbs.
Height of centre of boiler above rail, 8 ft. 0¾ in.
Water capacity of tanks, 1,400 gallons.
Coal capacity of bunker, 4 tons.

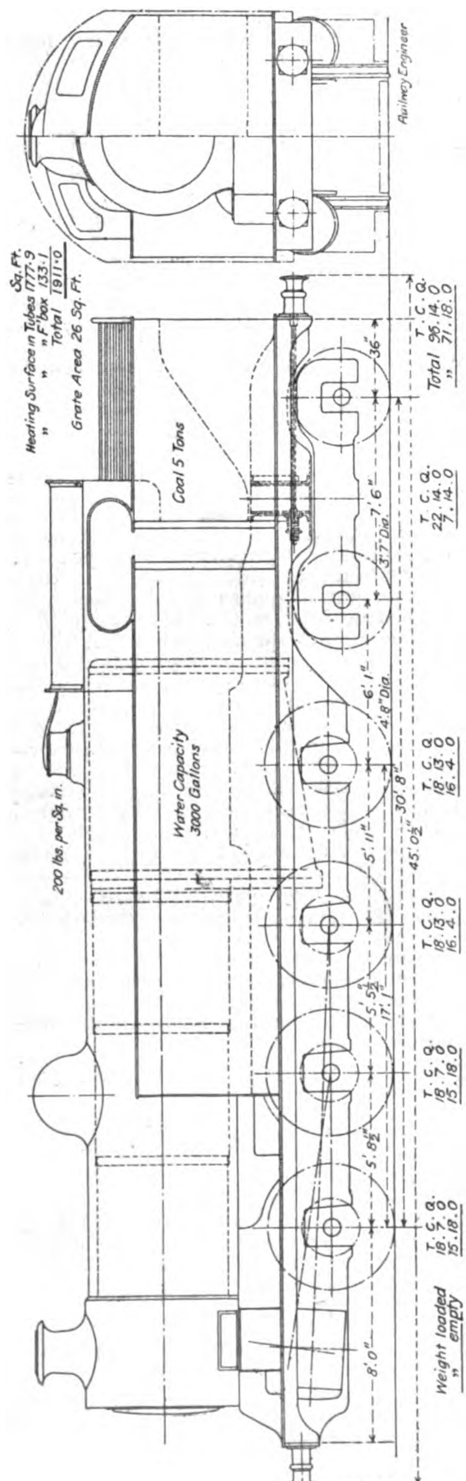
The engine is fitted with steam sanding gear and other G.N.R. standard equipment.

The new Great Western locomotives are of the 4—6—0 type. They are four-cylinder simple engines, designed for the fastest and heaviest express train haulage. The two inside cylinders are in advance of the bogie centre, whilst those outside are at the rear of the same, the inside cylinders driving the crank axle of the leading coupled wheels and the outside ones the middle pair. Only two sets of Walschaerts' valve gear are employed for actuating the four steam distributing valves, which latter are of the piston type throughout (8 ins. in diameter). The two valve spindles on each side of the engine—one inside and the other outside the frames—are connected together by a cross-lever with two arms, this lever being fulcrumed at about the centre on the main engine frames. The gear is applied to the valves of the inside cylinders, and motion is transmitted to those outside through the double-armed lever before mentioned. The four cranks are arranged so that there is a crank-pin on every quarter—that is to say, the inside crank and outside crank on each side are 180 degs. apart and at 90 degs. in relation to those on the opposite side, this arrangement being adopted in practically all four-cylinder locomotives in modern practice, whether simple or compound. The boiler, in common with all others built at Swindon, is coned throughout the length of its barrel; an extended smokebox is fitted, and the firebox is of the Belpaire type. These locomotives rank among the most powerful express engines in use on British railways; their tractive force is considerable, and it is understood that they are to be regarded as the standard for the heaviest Great Western express passenger services, several more of the engines being at present under construction at Swindon works. Below are the principal dimensions:—

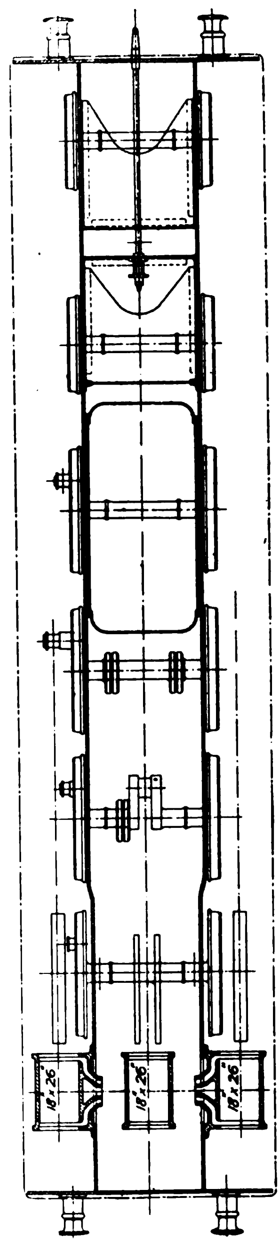
Cylinders (four), 14¼ ins. diameter; piston stroke, 26 ins.
Bogie wheels diameter, 3 ft 2 ins.
Coupled wheels, 6 ft. 8½ ins.
Bogie wheelbase, 7 ft.
Coupled wheelbase, 14 ft. 9 ins.
Total wheelbase, 27 ft. 3 ins.
Boiler: Diameter (front end), 4 ft. 10¾ ins; diameter (rear end), 5 ft. 6 ins.; height of centre from rail, 8 ft. 6 ins.
Heating surface (total), 2142·91 sq. ft.
Grate area, 27·07 sq. ft.
Working pressure, 225 lbs.
Weight in working order, 76 tons 14 cwts.
Adhesion weight, 58 tons 16 cwts.

The tender weighs 40 tons when full, viz., with 6 tons of coal and 3,500 gallons of water. The tractive force of the engine is 26,560 lbs.

The latest locomotives designed by Mr. J. G. Robinson for the Great Central Railway are of



0—8—4 Type Three-cylinder Tank Engines: Great Central Railway.



an altogether new type. They are 0—8—4 type tank engines, with three simple cylinders, and are being specially built at the works of Messrs. Beyer, Peacock and Co., Ltd., for working in the "hump" or gravity yard of the G.C.R. at Wath, near Doncaster. These will be enormously powerful locomotives, with their three 18-in. by 26-in. cylinders taking steam direct from the boiler, and their eight coupled wheels of small diameter. The trailing end is carried upon a four-wheeled bogie, with 3 ft. 7 ins. diameter wheels spaced at 7 ft. 6 ins. between centres. All the wheels, including those of the bogie, will be braked, and reversing will be effected by means of a steam and cataract gear. The boiler fitted will be the same as those carried by the well-known "Atlantic" type locomotives of the Great Central Railway, so that, for a tank engine, the total heating surface and grate area will be something quite unusual. The three cranks are set at 120 degs. apart, so that a very regular turning moment will be secured. The writer is indebted for the accompanying illustration and particulars to the Editor of the *Railway Engineer.* The cylinders are 18 ins. by 26 ins; coupled wheels, 4 ft. 8 ins. diameter; bogie wheels, 3 ft. 7 ins. diameter; coupled wheelbase, 17 ft. 1 in.; total wheelbase, 30 ft. 8 ins.; boiler—length, 15 ft., diameter, 5 ft.; total heating surface, 1,931 sq. ft.; grate area, 26 sq. ft.; working steam pressure, 200 lbs. per sq. in.; adhesion weight, 74 tons; total weight in working order, 96 tons 14 cwts.; coal capacity of bunker, 5 tons; tank capacity, 3,000 gallons. Altogether, a remarkable engine.

Performance of a Great Central Compound.

The writer on a recent occasion noted the following particulars of a run made by one of the latest three-cylinder compound 4—4—2 type locomotives on the Great Central Railway. The train left Nottingham drawn by a 4—4—0 type engine, and made time to Leicester, where the compound was attached, and started for London with a scheduled allowance of 118 minutes for

104 miles, with stops at Woodford and Aylesbury.

The train consisted of five eight-wheeled corridor coaches and a dining-car, and with this load the engine made very fast running to Woodford, arriving there one minute ahead of time. The same occurred on the journey from Woodford to Aylesbury, and, finally, Marylebone was reached nearly four minutes early after a very easy run from Harrow, where the train came almost to a standstill in deference to an adverse signal.

Chats on Model Locomotives.

By Henry Greenly.

(*Continued from page* 516.)

SUPPLEMENTING the notes on the application and principles of the new gear illustrated in the last article, I submit in Fig. 10 views of a reversing shaft, which, I think, will prove most serviceable under the average conditions of working. This drawing is, like Fig. 5, arranged to suit the "Experiment" type of L.N.W.Rly. model. The slide blocks are 3-16ths in. diameter and are placed ⅜ in. apart. This reduces the total lateral space occupied by the slides, and altogether makes a neater and more symmetrical job of the gear. As the reversing shaft comes very close to the boiler, the slide block pin is not placed centrally, but in the "Experiment" and the ten-wheeled tank engine already referred to, the blocks may be turned from ¼-in. steel and parted in ⅜ in.

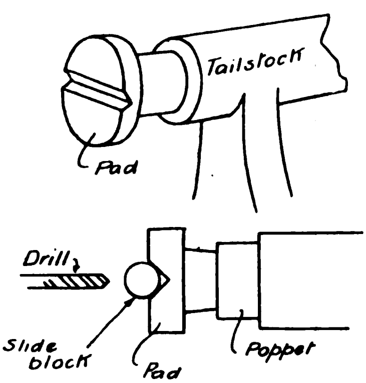


Fig. 11.—Drilling the Slide-blocks.

lengths, the hole being drilled 5-32nds in. from the top edge. To drill these slide blocks a vee-grooved pad should be used to hold them in place on the tailstock of the lathe during the operation. If a drilling machine is employed a vee block placed on the table will, of course, act in a similar way and tend to ensure accurate results. The slides of the reversing shaft may also be made to extend farther in downward direction than above the centre line of the trunnions, so that the maximum amount of bearing surface may be obtained without the danger of either slides fouling the bottom of the boiler barrel. The drawing (Fig. 10) shows the slide equally spaced, but no doubt a file would have to be applied to the upper surface to make them clear the boiler at all points of the reversing lever.

It will be noted that there is a projection, which may be likened to a continuous bar on the back of reversing shaft at the top. This is necessary to connect the slides together clear of the vibrating links and slides. To keep this clear of the boiler when the shaft is tilted into the forward direction, the top of the shaft should be chamfered off as indicated in the cross section of the shaft in Fig. 5 of last week's article. In addition, a chamfering

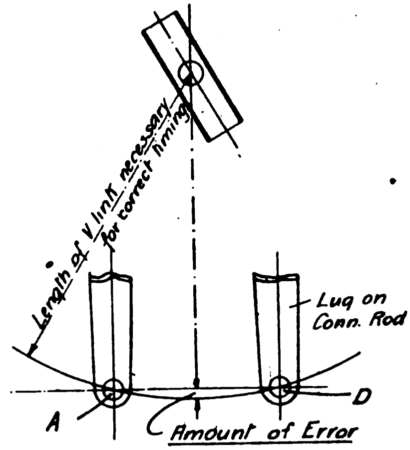


Fig. 12.—Showing Error due to Angularity of Link.

off is necessary on the lower edge, so that the vibrating link will not touch the reversing shaft when the bottom end is on point D and the reversing lever is in back-gear (that is, when the shaft is at the opposite angle to which it is shown in Fig. 5).

Those who may elect to set out the gear for themselves will find that owing to disturbing influences in the various rods employed mostly due to angularities, the gear has several vagaries peculiar to itself, some of which are to be avoided and others which may be utilised to advantage. I spent quite two whole days studying these points until my drawing-board was a mass of lines, points, arcs, etc., showing the alterations in steam distribution consequent on variations in the points and lengths chosen for the many different examples dealt with. The conclusions I arrived at may be enumerated as follows:—

(1) That the longest possible connecting-rod should be employed so that the lug does not tilt to an excessive angle and cause the oval path of the bottom joint (see point path diagram, Fig. 6 in last issue) to be tilted out of the horizontal to an appreciable extent. The variation in the valve movement due to this tilting of the elliptical path of the bottom joint may be studied by making a diagram similar to Fig. 6, the arcs struck from the various points in the ellipse showing at a glance the difference in the extent and speed of the port opening in forward and reverse gears simultaneously.

(2) That the stroke of the piston should be as short as possible, as the effects of angularity are

considerably reduced where a short stroke is adopted. For 7-16ths in. scale engines $\frac{1}{2} \times \frac{3}{4}$-in. cylinders are therefore advised instead of 7-16ths × $\frac{7}{8}$ in.

(3) The port openings are equalised to a greater extent if the reversing shaft is placed a little nearer (say, 1-32nd in. in a 2-in. gauge model) to the crank-axle than the theoretical distance. The normal horizontal distance between the reversing shaft, trunnions, and the crank-axle should equal the horizontal distance between the big end of the connecting-rod and the centre of the lug which projects downward and connects with the vibrating link. In the case of the "Precursor" and "Experiment" models (see Figs. 5 and 6) the horizontal distance between the centre of the big-end and the centre of the lug is 1$\frac{7}{8}$ ins., but the reversing shaft is therefore set only 1 27-32nds ins. (that is, 1-32nd in. less) forward of the crank-axle. Where the cylinders are inclined, all "horizontal" measurements are, of course, made parallel to the centre line of the cylinders. The above alteration in the position helps to equalise the distribution of the steam in fore gear more particularly, and although it is not obligatory in any engine, may be adopted in the case of engines which are intended to do their best in forward gear. The same applies where the centre line of the valve spindle is placed slightly above the centre line of the reversing shaft, and owing to the use of straight instead of curved slides, the arrangement then conduces to a more equal port opening when the engine is running in fore gear.

(4) The valve rod should be as long as possible to reduce the effects of the straight slides on the movement of the valve. Against this, however, it will be noticed that if a smaller vertical movement is given to the slide blocks by placing the lug nearer to the little end, and to obtain the required port opening the angle to which the reversing shaft is tilted is increased, a better movement of the valve is obtained. But this is only another case of losing on the swings and gaining on the roundabouts.

(5) The maximum length of vibrating link should be obtained.

(6) The port bar should be wide with ports 1-16th in. in width, adopting 3-32nds in. port bars. The larger valve necessary is no practical detriment to the working of the engine. Several of the above recommendations are only worth troubling about when the cylinders are already made, and where the port bars are very small.

(7) Do not add the whole error due to angularity to the length of the vibrating link. If in swinging from point A to point D (Fig. 12) the versed sine of the arc (which is the amount of the error) works out at 3-64ths in., then knock off the odd 1-64th in. and only add 1-32nd in. to the theoretical length of the vibrating link. The valve opens and closes so quickly so that the alteration in timing is unnoticed, whilst the effect on the port openings is considerable.

With this I conclude the notes on the new gear, but on some future occasion I may submit a design for a complete model to which the gear will be applied. The next article will deal with making small simple engines.

(*To be continued.*)

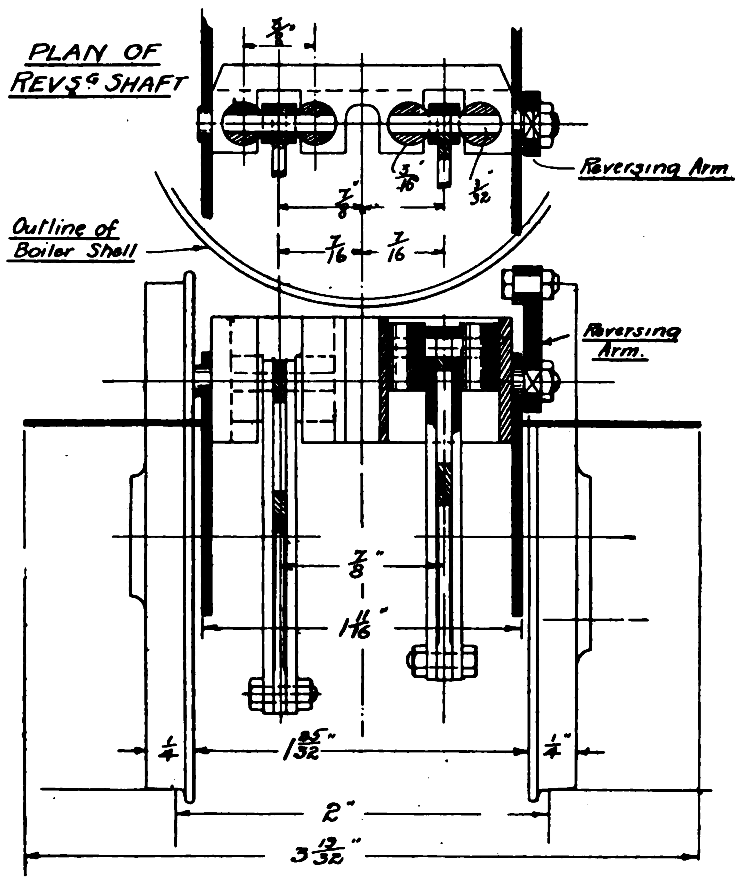


Fig. 10.—Details of New Valve Gear, as applied to a 7-16ths in. Scale Model L.N.W.R. Locomotive, "Experiment" Class.

Arc lamp carbons are made of lampblack, gas retort carbon, petroleum, coke, tar, water glass, molasses, &c. The best carbons are made of lampblack and tar, the latter serving as a flux. Cheaper forms are made of gas retort carbon, petroleum, coke, etc., with different binders, depending on the manufacturer.

Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page* 468.)

THE student is now asked to draw as an exercise the big end of a marine type of connecting-rod as shown in Fig. 40. If the preceding geometrical examples have been mastered this will not present much difficulty.

Begin by setting off the centre lines *x y*, *w o*, *s u*, and *t o*, making firm, clear lines with a sharp H H pencil (a half sheet of double elephant paper will be suitable, and if the line *x y* be 7 ins. from the top, and *s u* 12 ins. from the left, the views will be fairly central on the paper); where these lines cross will be the centre of the circle representing the crank-pin bearing, 4½ ins. diameter. Draw the outline only of the view to the dimensions given—it will not yet be possible to complete the view; now draw the end view on *t o*, making the centre of the rod to coincide with *x y*. The top half may show the view as seen from the direction of *x*, and the lower half as seen from the direction of *y*. We may now return to the front view and determine the line *d*1, *a*3, *b*5, which indicates the edge where the turned and planed surfaces meet.

From any point at *a* draw the horizontal line, cutting *t o* in *a*1, draw the arc *a*1 *a*2, project *a*2 *a*3 to meet the vertical line *a a*3 drawn through *a*, *a*3 will be a point in the intersection of the turned and flat surfaces. By taking a number of points along the outline we may determine the curve required. At *b* we have to consider the recess cut away to clear the nut of the cap bolt. A study of the projection of the point *b* will show how this is to be done, several points being determining and a fair curve drawn through them. The broken line shows the surface before the bolt hole is taken out. To find the point *d*1 we may draw the plan which can be projected from the other views. From *o* where the centre lines cross, set off a line at an angle of 45 degs.; we can then project all the principal lines from the end view. The most intricate will be the trace of the recesses for the bolt head and nut; the method of finding these will be understood by following the projection of the point *b*6. Notice that the radius *r* is drawn from the same vertical line as the 2½ ins. radius in the front view, and that the point *d*, where the arc touches the line *d f*1, may be projected, giving the correct position of the point *d*1.

The views should be completed by the addition of the second bolt; the head and nut should be shown in the end view, also the setscrews for holding (or locking) the large nuts; part of the plan may be shown in section. The provision for oiling should be shown before the drawing would be complete.

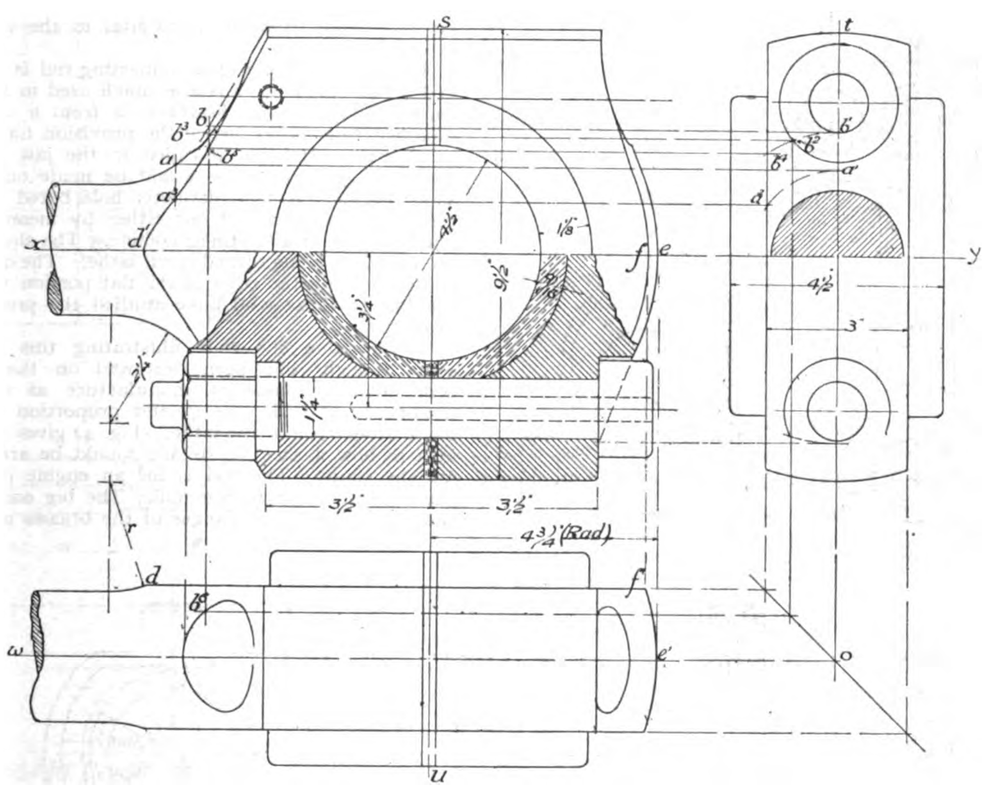


FIG. 40.

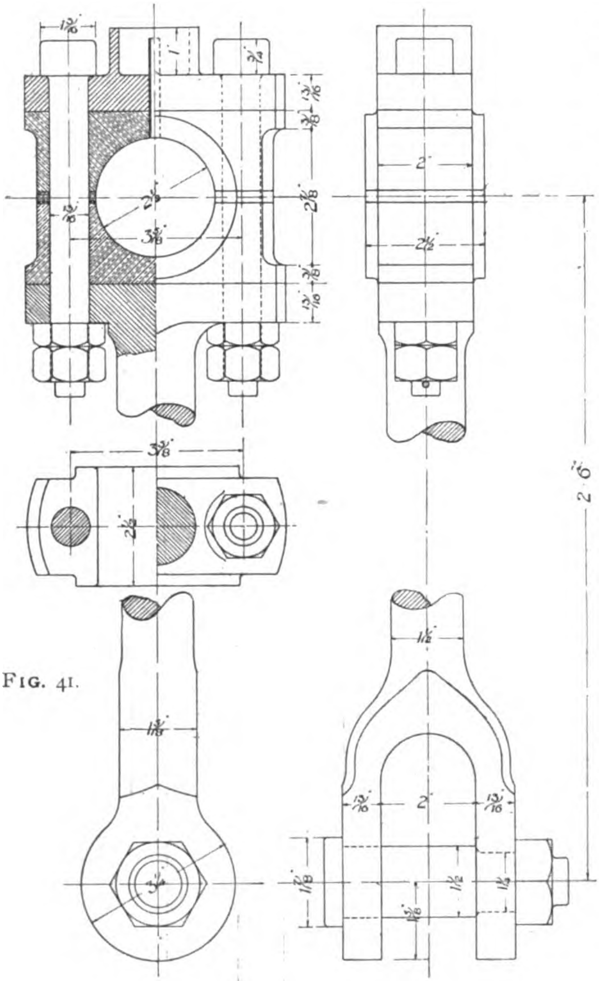


FIG. 41.

After having drawn every part carefully in pencil, the lines may be inked over, except the construction and projection lines, as *a a*1, *b b*1, etc., which will be rubbed out after the inking is finished. It is very desirable, however, to ink all centre lines. These are sometimes done in red or brown and the dimension lines in blue, but the writer's practice is to make all lines black. Where alterations are afterwards necessary, these are conveniently shown in red.

The importance of arranging the various views in a proper order has already been mentioned. The example serves to illustrate this as well as the utility of the tee square and drawing-board for rapidly projecting the various lines. The method of using the angular line passing through *o* is, perhaps, not usually adopted, but the writer from a long experience, gives it, for many reasons, the preference to the method of using the compasses for projecting from the horizontal to the vertical or *vice versa*.

A further example of a connecting-rod is shown in Fig. 41. This type is also much used in marine work. The example, however, is from a vertical double-acting pump, hence the provision for oiling as shown. Attention is called to the jaw at the crosshead end; this jaw would be made out of a solid forging. A 2-in. diameter hole bored at the crutch and a piece cut out either by means of a band-saw, or of a slotting machine. The shoulders are spherical, being turned in the lathe. The method of determining the edge of the flat portion will be familiar to those who have studied the preceding examples.

In designing the rods illustrating this paper, some thought has been bestowed on the most economical methods of manufacture as well as uniformity of style, the greater proportion of the work being done in the lathe. Fig. 42 gives a good idea of how a sheet of details should be arranged for the shops. The rod is for an engine driving the rolls in a bar rolling mill. The big end is of the solid type. The flanges of the brasses are cut

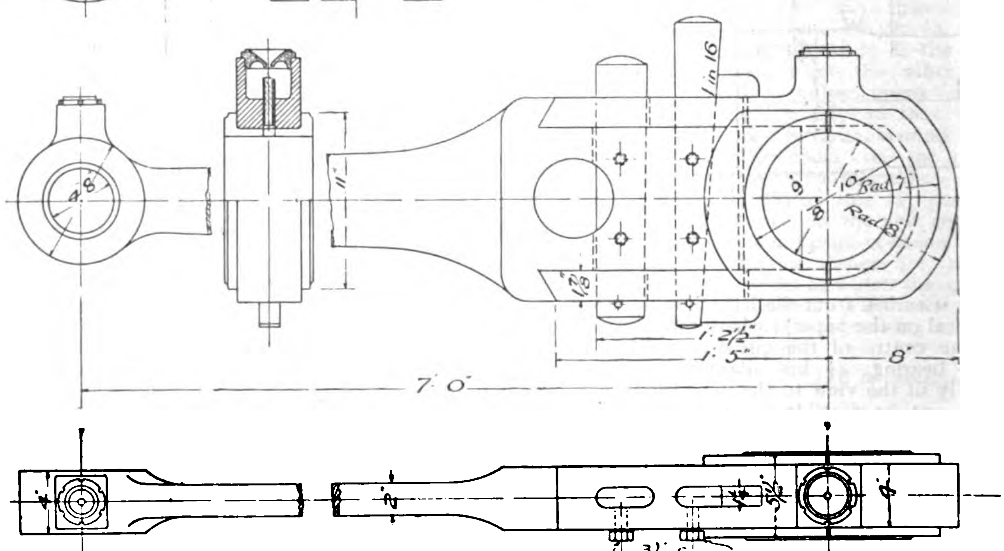


FIG. 43.

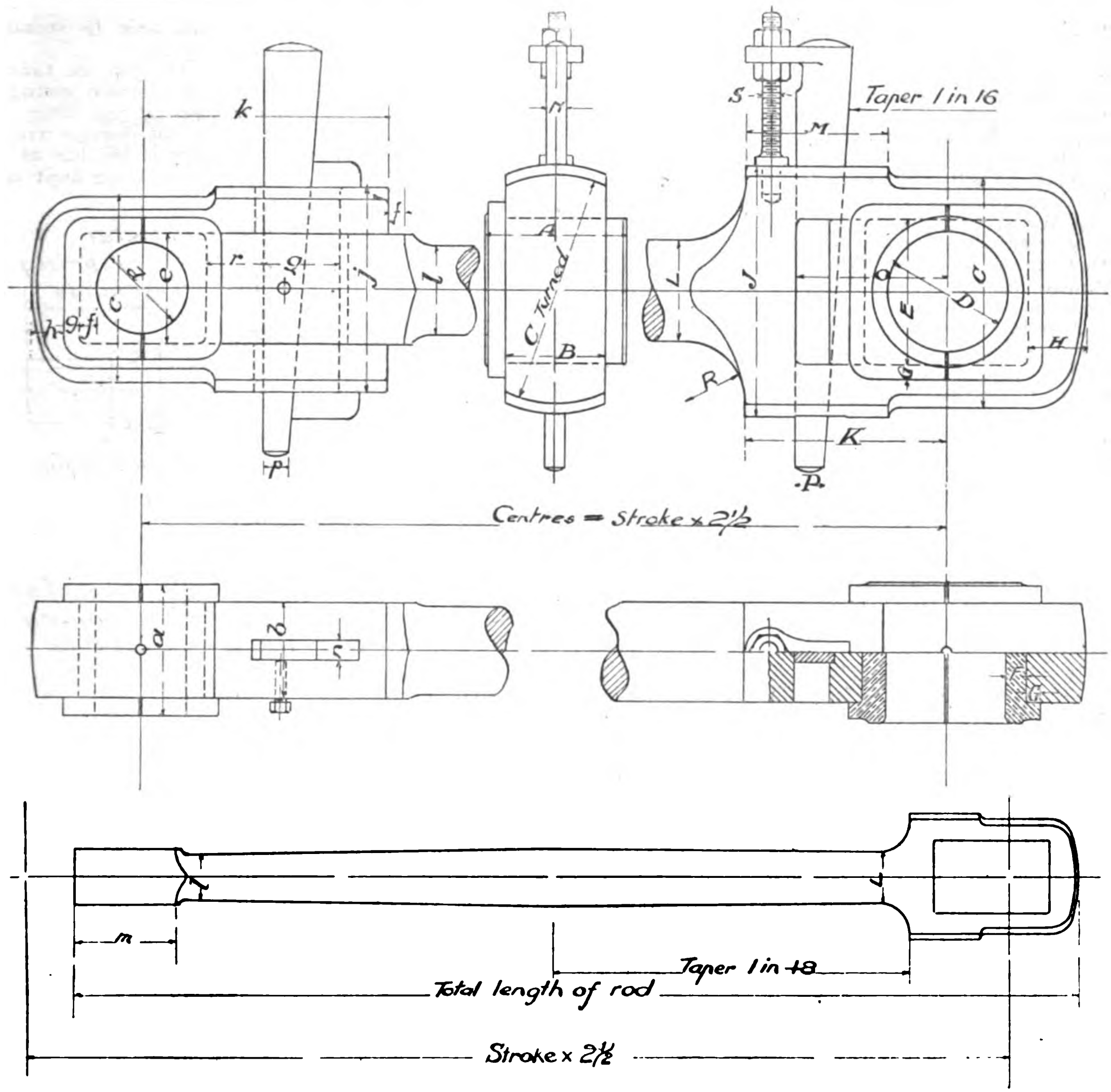


Fig. 42.

Table of Dimensions for Connecting-rod Ends Rolling Mill Engines—100 lbs. Steam Pressure.

Big End.

Engine.		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
15″ diam. × 20″ stroke	..	5	3½	8	4	4¾	¾	⅝	2	8¾	—	3¾	4½	⅞	5⅛	1	⅝	2
18″ „ × 30″ „	..	6	4½	9¾	5	6	⅞	⅝	2½	10¼	7¾	4¼	5½	⅞	6⅜	1⅛	¾	2½
24″ „ × 36″ „	..	7½	5	11½	6	7½	⅞	¾	3	12½	10	5	7	1	7¾	1¼	⅞	3
33″ „ × 45″ „	..	9½	6¾	15¼	8	9½	1	⅞	4	16	12	7	9¼	1⅛	10½	1½	1	4

Crosshead End.

Engine.		*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*j*	*k*	*l*	*m*	*n*	*o*	*p*	*q*	*r*
15″ diam. × 20″ stroke	..	4	3	5¾	3	3¾	¾	⅜	1¼	6¼	8½	2¾	6	¾	—	1	3	1½
18″ „ × 30″ „	..	4¾	3½	6¼	3¾	5¼	¾	⅜	1½	7	11¼	3	7¾	⅞	—	1⅛	3½	1¾
24″ „ × 36″ „	..	6	4¾	9⅛	4½	5½	⅞	½	2	10	13	4½	10	1⅛	—	1½	4¼	3
33″ „ × 45″ „	..	8	6	11¼	5½	7½	1	¾	2¾	12¼	16	6	13¼	1¼	—	1¾	5	3½

$$A \times B = \frac{\text{Max. load on piston,}}{1{,}000} \text{ as a minimum.}$$

to allow them to pass through the opening. Provision must be made for separating the brasses sufficiently far to enable the rod to be got over the collar of the crank-pin. It is worth while to notice that the amount taken up for wear when adjusting the brasses will at the one end tend to lengthen the rod, while at the other end a similar adjustment will tend to shorten it, and if the wear be equal at each end the centres of the bearings will always be the same distance. There is, however, considerably more wear on the big end, so that the rod may get slightly longer after use. The dimensions are to accompanying list, the drawing being made to suit a 24-in. diameter cylinder engine.

A style of connecting-rod where no turned work occurs is shown in Fig. 43, which is for an inside cylinder locomotive. The brasses are held by means of a strap which is attached to the butt end of the rod by a cotter *c*; this cotter drives the strap against a dovetailed shoulder in such a manner that the ends of the strap are prevented from flying open. The gib also prevents any spreading in the middle of the strap. The cotter *c* will take all the strain due to the pull on the rod, and must be sufficiently substantial to allow for this.

The drawing of this rod is a much easier matter than any of the previous examples, and any of the views may be completed without reference to any other view. They will, however, as a matter of convenience, be put in their proper relative positions. The student is requested to draw this to a scale of 3 ins. to 1 ft. as an exercise in drawing, and to familiarise himself with the details of the work. It is by frequently setting out work to good examples and cultivating a habit of observing the proportions of the various parts that one is enabled to judge approximately at sight the correct proportions when designing any similar work; this intuition is sometimes very useful, especially where suitable data is not obtainable and one is obliged to work more or less to "rule of thumb."

(*To be continued.*)

A Simple High-speed Governor.

By Hilton Bradshaw, A.M.I.Mech.E.

THE reproduced photographs show the general arrangement and parts of a very simple and effective governor suitable for any high-speed engine. The whole of this governor was

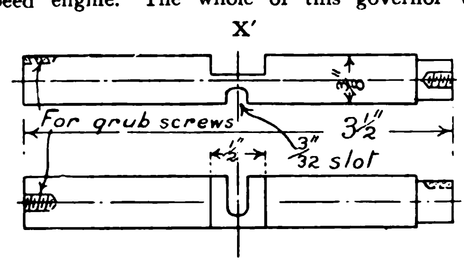


Fig. 2.—Ring Axle.

made out of scrap. The various parts are as follows:—

Steel: Main axle with trunnions (Fig. 1), ring axle (Fig. 2), slide-rod, bracket (Fig. 3).

Iron: Trunnion head of main axle (¼ steam T-piece) (Fig. 1), pulley, C.I. (Fig. 4).

Gun-metal: Ring (3⅞ in. diameter, ½ in. on face, ⅜ in. thick), locknuts, and guide for tension spring.

The action is as follows:—When at rest, ring is as shown in photograph, and in this position ring axle flat X′ is in a horizontal position and has end of slide-rod X bearing on same, this being kept in

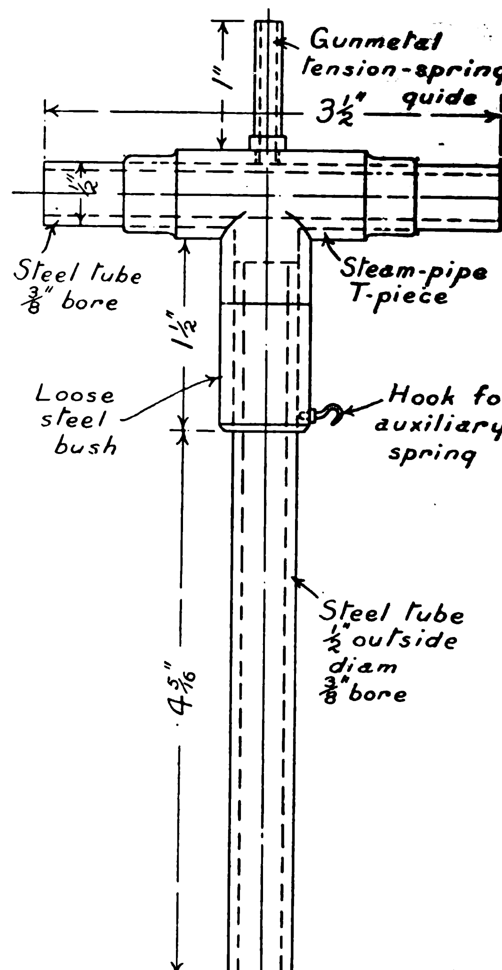
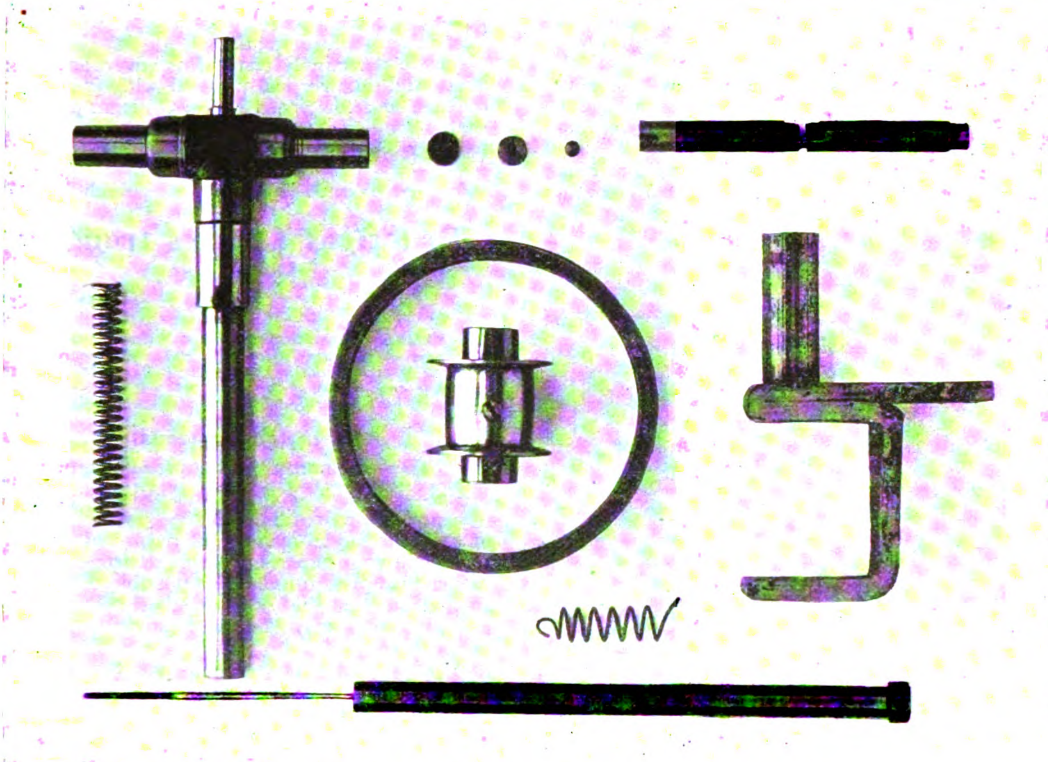


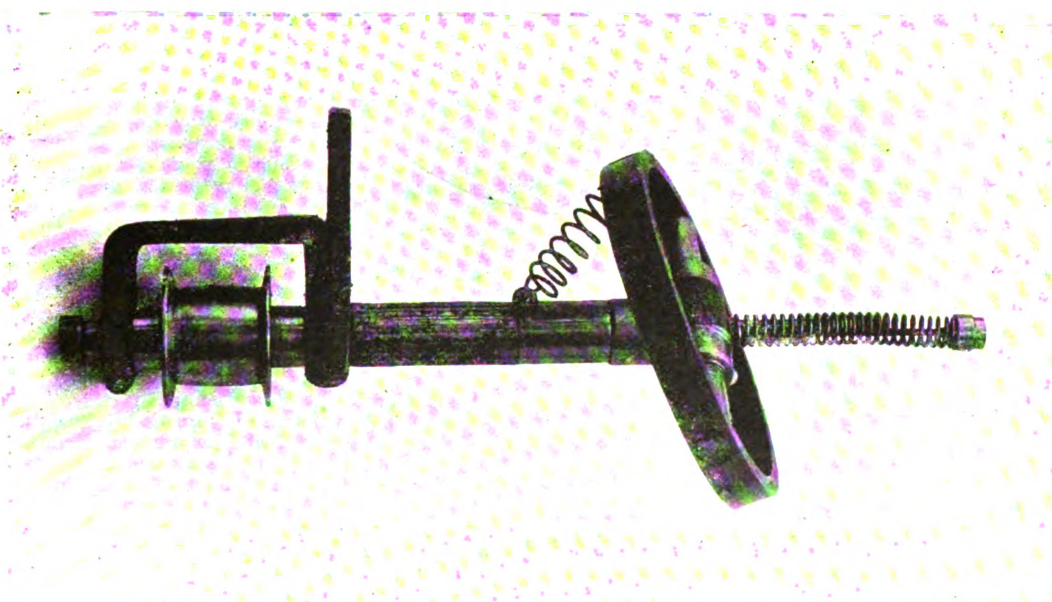
Fig. 1.—Trunnion Head.

position by tension spring (Fig. 6). When the governor is rotated the ring tends to revolve in a horizontal plane, and in order to do this it must rotate its axle partially, which in turn presses down the slide-rod by means of the flat previously mentioned. The movement of the slide-rod is carried to the engine mechanism in the usual way. The auxiliary spring is only necessary when the governor has to run at a very high speed. The necessary regulating is made by means of adjusting the tension spring.

In the photograph the governor is fitted at the end of the slide-rod with a steel (cast) bush; this bush engaged with a similar bush fitted on the



THE PARTS READY FOR ASSEMBLING.



GENERAL ARRANGEMENT OF SIMPLE HIGH-SPEED GOVERNOR.

exhaust valve tappet and governed by means of intercepting between this tappet, thus preventing the valve from closing (viz., "hit-and-miss" Gardener principle), it being in this case easy to mount the governor directly over the exhaust valve tappet, hence a very positive form of governing was obtained.

The chief feature of this governor—and for which I claim originality—is the ring, used in lieu of balls, or similar devices, and which I have found to be more sensitive and far easier in construction.

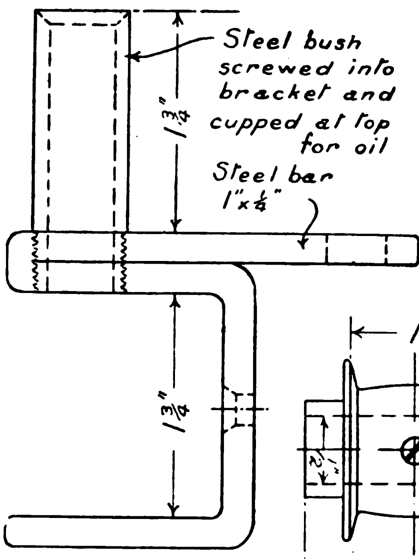


FIG. 3.—BRACKET.

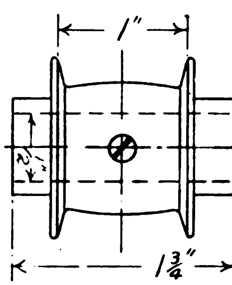


FIG. 4.—PULLEY.

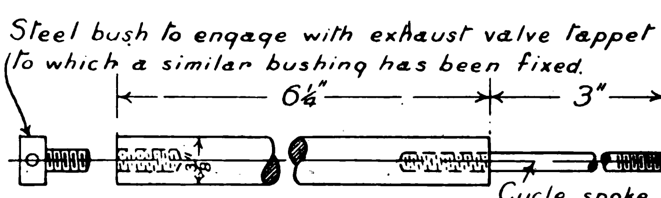


FIG. 5.—SLIDE-ROD.

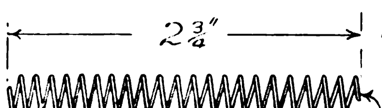


FIG. 6. TENSION SPRING.

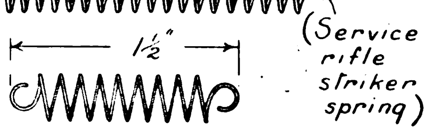


FIG. 7.—AUXILIARY SPRING.

DETAILS OF SIMPLE HIGH-SPEED GOVERNOR.

I think that the two photographs will clearly describe the method of construction and the working, and with this object the same has been photographed before being finished or painted externally. It will be noticed that many of the parts are constructed of steam pipe (iron) and are bushed with white metal.

I have thoroughly tested this governor both in a horizontal and vertical position with great success on high and low speed engines—steam and oil. I shall be pleased to supply any further particulars to anyone wishing to make one similar.

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 intended for publication.]*

A Note from Queensland.

TO THE EDITOR OF *The Model Engineer.*

SIR,—Having derived a considerable amount of pleasure from reading the various experiences of amateur model-makers, as published from time to time in your paper, and being desirous of reciprocating that pleasure as far as possible, I send a few items, and trust that others similarly circumstanced as ourselves may be interested and perhaps encouraged.

A glance at the map will show you that we live 300 miles inland from the coast, and being so far away from any firms who deal in model-makers' material, we are seriously handicapped in that respect (the nearest firm being considerably over 1,000 miles off). It was only by reading the advertisement in THE MODEL ENGINEER that we discovered that Mr. L. A. Vail, of Melbourne (over 1,700 miles away), stocked the very class of goods we required. We had previously sent to England on two occasions, and did not get satisfaction. One firm did not reply to a registered letter (which contained cash) until enquiries were instituted by the postal authorities in England. In the other case, a portion of the material was missing. There is little wonder that Colonial readers write you complaining of their treatment by some of the home firms—that is, if their experiences are in any way similar to ours in that respect.

I send you under separate cover photographs of a twin-cylinder launch engine built by Mr. A. A. Dyer (one of our group), whose portrait is also sent with that of the engine.

I may state that this engine is built up from Stuart Turner's castings, supplied by Mr. L. A. Vail, of Melbourne, and is *supposed* to be ¼ h.-p.

It has been tested with steam from 30 to 60 lbs., and at 30 lbs. pressure (wet steam) gives 1,400 r.p.m. (tested by speed indicator). The castings were all that could be desired, and no parts were missing. The engine throughout is made exactly to scale, is 1-in. bore by ⅞-in. stroke, stands 5½ ins. high, and weighs about 4 lbs. Mr. Dyer intends to use the engine for driving a model boat as soon as the boiler and the necessary fittings are completed.—Yours truly,

"ONE OF THE GROUP."

Barcaldine, Queensland.

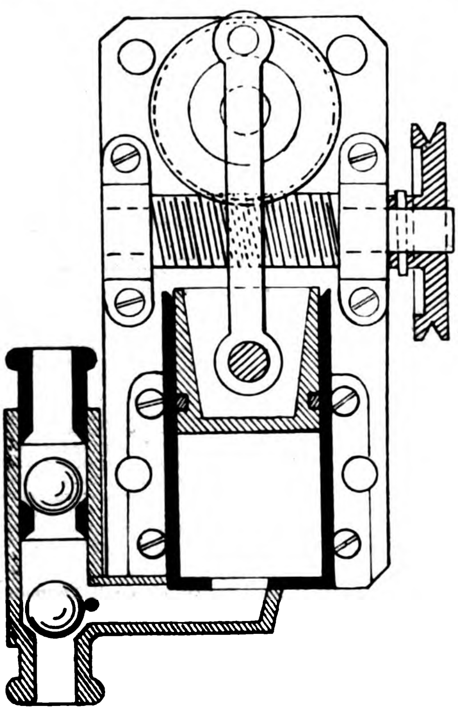
An Ingenious Model Force Pump.

To the Editor of *The Model Engineer*.

Dear Sir,—I thought an account of a model force pump which I have made, and a few details of its construction, would be of interest to some of your readers. I use it for pumping the circulating water for a model petrol motor boat, though it would do equally well for filling a boiler. Owing to the high speed of my engine it is very much geared down, there being about 60 teeth on the worm-wheel; but this, of course, could be varied to suit different cases by altering the size of worm-wheel and ratio of pulleys.

As is shown in the sketch, the drive is taken by a pulley at the side through a worm gear to the plunger. The screw is a standard $\frac{3}{8}$-in. screw with the ends turned down to $\frac{1}{4}$ in. The worm-wheel was made by turning down a piece of brass to 1 in. diameter and then placing it in a bearing held by the tool-rest so that it could revolve in a horizontal plane and then pressing it against a tap revolving in the lathe. The teeth on the wheel are cut very well by this method, although it is only able to determine approximately the number of teeth beforehand.

The barrel of the pump is made of $\frac{3}{4}$-in. solid-drawn brass tube 1-16th in. thick. The valve-box was turned down from solid and a $\frac{1}{4}$-in. hole bored right through, and a $\frac{3}{8}$-in. to within 5-16ths in. of the bottom. Another hole was also drilled at the side for the tube connecting it to bottom of pump. Two 5-16ths balls were then dropped in, with a tightly fitting tube let in between them to form the valve seat of the second ball, and another piece on top of the second ball. The bottoms of the pieces have saw cuts in them to prevent the balls making a seat on them.

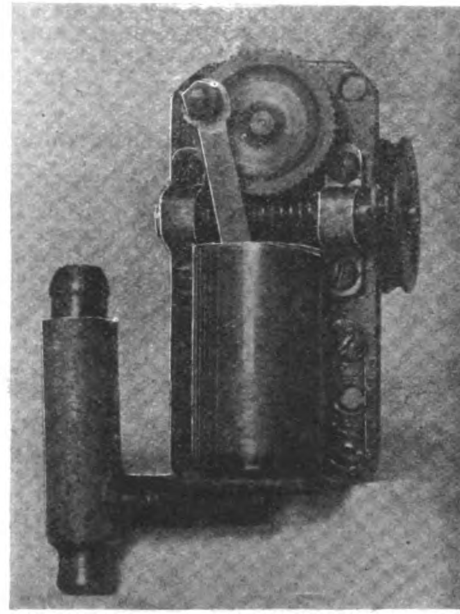


Full-size Section through Model Force Pump.

The plunger was turned from the solid and has a groove round it for string packing.

The parts are made of brass, with the exception of the balls, screw, and backplate, which are mild steel; and except for the bearing of the worm-wheel, which is brazed into the backplate, the joints are soldered. I enclose photograph and sketch which shows clearly what I mean.—Yours truly,

L. J. Cadbury.



Mr. L. J. Cadbury's Model Force Pump.

Six-Coupled Locomotives.

To the Editor of *The Model Engineer*.

Dear Sir,—The letter signed "Compound Model Locomotive" appearing in The Model Engineer of May 23rd will no doubt interest many of your readers. I take a keen interest in the development of the modern locomotive, and am rather inclined, possibly with other readers, to resent the somewhat condescending tone of your correspondent's letter and his references to private information. Persons in possession of such information should say nothing about it. The figures relating to heating surface of C.R. six-coupled engines (published for the first time) are not new. They are four years old. The *Engineer* gave them in 1903, and *Engineering* has, during the last two or three years, given tabulated dimensions and heating surfaces of C.R. six-coupled engines, finishing up with working drawings of No. 903 in issue of February 1st last. Despite your correspondent's remarks *re* those 21-in. cylinders, there will still be many who are not assured on this point. The *Engineer* of April 3rd, 1903, page 331, gave a full account, by Mr. C. R. Marten, of engine No. 49, and the cylinders are given as 21 ins. Mr. Marten has a reputation for accuracy, and he expressly states his obligation to Mr. McIntosh for the information. This is curious in the face of "C.M.L.'s" version. The same dimension was also given by other engineering journals, presumably with some official origin.

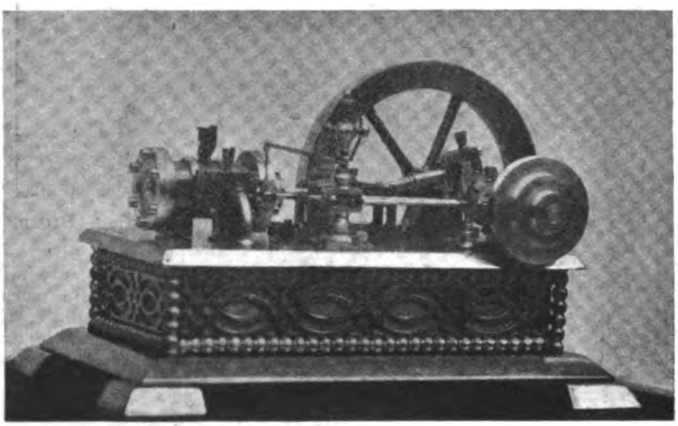
The paragraph concerning N.B.R. engine is sweetly vague, and if this is not also private information, perhaps "C.M.L." will favour us a little more fully in this direction.—Yours faithfully,

London, W. W. G. ROBLIN.

A Diminutive Model High-Speed Governor Steam Engine.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I am sending you a photograph of the smallest horizontal high-speed governor engine in the world. The dimensions are as follows:—Bore of cylinder, ¼ in.; stroke, ⅜ in.; diameter of piston-rod, 1-16th in.; crosshead-pin, 1-16th in.; diameter of crankshaft, 3-16ths in., reduced at bearings to ⅛ in.: diameter of crank-pin, ⅛ in. The flywheel is 1¾ ins. diameter by ¼ in. broad; pulley



MR. FRED. WILKINSON'S SMALL MODEL HIGH-SPEED GOVERNOR ENGINE.

(*Illustration shows model actual size.*)

wheel, ¾ in. diameter, down to ⅜ in.; diameter of connecting-rod, 3-64ths in. The valve rod is 1-32nd in. diameter, reduced to 1-64th in. where it comes through gland at back of steam chest. The governor balls are 1-16th in. diameter; governor shaft, 1-32nd in. diameter. Diameter of bevel wheels inside governor standard, 3-32nds in., driven by a pinion 3-32nds in. diameter, from a crown wheel on crankshaft 5-16ths in. Speed, 4 to 1. Wing throttle valve, size of ordinary pin-head. There are nine oil cups from ⅛ in. down to 1-16th in.; two lubricators with cocks, one on cylinder ⅛ in. diameter, one on steam chest 1-16th in. Engine runs at 400 r.p.m. governed, 2,000 with throttle valve out. All working parts are made of steel. There are 176 pieces in all. The engine is beautifully got up in oxidized silver and gilt, and has taken me two years to make.—Yours faithfully,

FRED. WILKINSON.

60, Carlisle Road, Manningham.

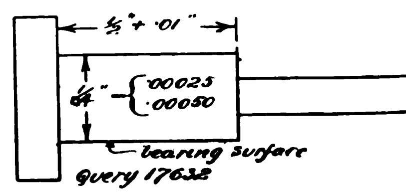
Queries and Replies.

[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:—

[17,632] **Limit Gauge Work in a Small Lathe.** J. M. R. (Ipswich) writes: I desire to make a small number of pins (as shown in sketch herewith). The limit of error in diameter is—high, ·249·00050 in.; low, ·249·00025 in. Material is machine steel (¼-in. bright-drawn rod). Tools, 3½ Drummond lathe, Browne and Sharpe micrometers, high-speed steel tools. All corners to be dead square, if possible. I find that by reducing the steel to ·260 in., and working the bearing surface up with a dead smooth file and emery cloth, the resulting pin is neither truly round nor truly parallel thoughout its short length, this latter being especially the case when the bearing surface is only ⅜ in. or ¼ in. long. What is the proper way to turn these pins so as to get them round, parallel, and within the above limits? Is



it worth rigging up a slide-rest grinder with a very narrow emery wheel driven from an overhead motion? Many people tell me that such an appliance would not be rigid enough.

The method you have tried is hardly suitable to the circumstances of the case, and we think that the use of the slide-rest grinder is the only good solution to the difficulty. As the pressure of the grinding operation will not be very great to finish the work to the exact size required within the limits stipulated, the lathe should not spring if the slides are nicely adjusted. We have not had exactly a similar experience with a Drummond lathe, but perhaps some other reader may have been confronted with a task of the nature you describe, and may elect to help you through our R ers' Replies column.

[17,638] **Flash Boiler; Power of Small Twin-cylinder Single-acting Engine.** B. H. B. (Slinfold) writes: Please will you answer the following questions for me? (1) Where can I get wood for planking a model yacht? (2) I am making a model engine with two cylinders, 1½-in. by 3-ins. trunk pistons, single-action, slide-valve. What speed should same run at, and what power would it develop at that speed? (3) How much tubing should I want to make a flash boiler to drive the engine? (4) Where can I get it? (5) How much will it cost? (6) Please give rough sketch of boiler.

(1) You can obtain the wood from B. C. Young, 1-5, Virginia Road, Bethnal Green, London, N. (2) We beg to refer you to article in THE MODEL ENGINEER for March 23rd and 30th, 1905. The engine will, at 50 lbs. and 500 r.p.m., develop about 7-16ths i.h.-p. Other powers in proportion to steam pressure and speed. (3, 4, and 5) You can obtain all material from Bolsover Bros., Ltd., Eaglescliffe, R.S.O., co. Durham. (6) See also THE MODEL ENGINEER for August 27th, 1903, for details of a flash boiler

[17,733] **Size of Spark Plugs; Rubber Rings for "Model Engineer" Gas Engine.** W. H. C. (Bedford) writes: I shall be much obliged if you will answer following questions:—(1) Is there any standard size and thread for ignition plugs, and, if so, what are they? (2) Where can I get copper and asbestos ring, and indiarubber ring for *M.E.* gas engine cylinder?

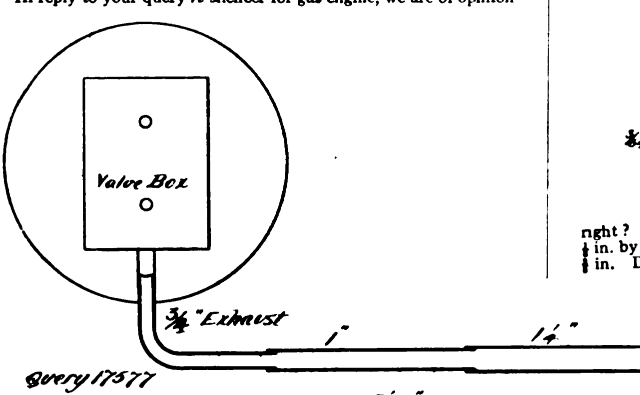
Replying to your query *re* ignition plug threads. The standard is the metric one, as used by the De Dion Company in the first place and is now almost universal. There are 16½ threads to the in., *i.e.*, practically seventeen to the inch. Tapping size is 41-64ths in., and allow 3-64ths in. to the diameter for depth of thread. This brings the total to 44-64ths in. or 11-16ths in. Try Messrs. Capel & Co., 168, Dalston Lane, London, N.E., for rubber rings and asbestos.

[17,710] **Plante Cells.** W. B. (Barrow-n-Furness) writes: Please state if the Plante type of cell requires plates of very large size and area compared with ordinary pasted plates? Has the thickness of the plates any effect on the capacity? Providing you have the area required for a given output, does it really matter whether the plate is as thin as paper, or ¼ in. in thickness? Where can sheet lead or Plante type of cell be obtained?

When thoroughly formed this type of plate has as good, if not a better, capacity than the paste plates. The thickness has a certain effect on the capacity, but is not such a governing factor as the area. It must be thick enough to give rigidity to the cell. See above. Any of our electrical advertisers would supply you.

[17,577] **Silencers for Gas Engines.** A. E. (Brighton) writes: Thanks for your reply to my query *re* "Silencer for Gas Engine," and I beg to enclose particulars, as requested. The engine is a 3-in. by 4-in. horizontal one that I have made up from castings, etc., purchased from a firm that advertise from time to time in THE MODEL ENGINEER. As originally arranged, I could not get it to work satisfactorily, but by making a new cylinder head, fitted with larger valves, larger gas, air, and exhaust ports, I have succeeded in getting it to work excellently, doing up to 500 r.p.m. without a single miss-fire; but the bang of exhaust was terrific; this was direct from engine. I then ran pipe away from exhaust, as per rough sketch, with attachments at end which converted the bang into a noisy, heavy thud, neither method being worthy of the name "silencer." Feeling sure that there must be a cure for this annoyance, and that you could help me in the matter, prompted me to write. At the end of exhaust pipe I have tried two methods, one being to turn it down with a bend into a pail filled with small coke and beach stones; the other method being one cylinder of tin, 6 ins. diameter, 12 ins. length, perforated with small holes, enclosed in an outer cylinder about 1-in. larger every way, perforated at one end only, both being fitted with drainhole at bottom for condensation.

In reply to your query *re* silencer for gas engine, we are of opinion



SILENCER FOR GAS ENGINE.

that the main fault lies in the fact that your silencing chamber is in each case somewhat small. We would suggest using a good sized box—an old galvanised dustbin is a suitable vessel—say about 2 ft. high by 16 or 18 ins. diameter, with holes in bottom for drainage, etc., filled with broken coke, and the whole lot sunk in a pit in the ground. This method is usually quite satisfactory if properly caried out, and we do not think you will have further trouble. If you do, write us again, and we will be pleased to go into the matter more fully.

[17,720] **Connections and Windings for Small Motor.** E. B. (Swansea) writes: I am making a small motor from direction in No. 14 handbook, Fig. 1, and am making it with armature 1¾ ins. by 1½ ins. diameter, but am not quite clear about the winding of the coils for field-magnets. From the description in No. 10 (Fig. 1B) I see the wire carries over from the right core to the left. Does the wire shown in the above figure continue from the one core to the other, as shown in sketch; or, are they wound separately and connected under the base board; or, are they left separate and connected to the battery and brushes? I want to wind them

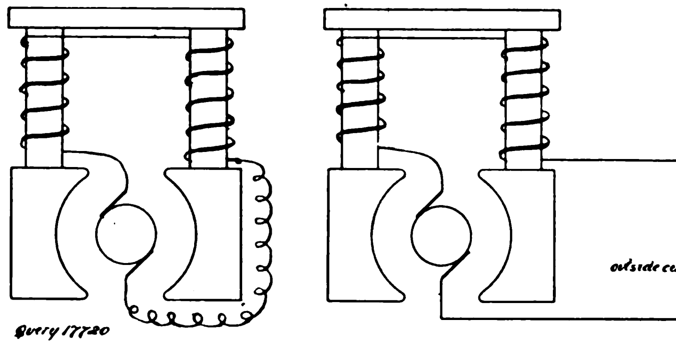


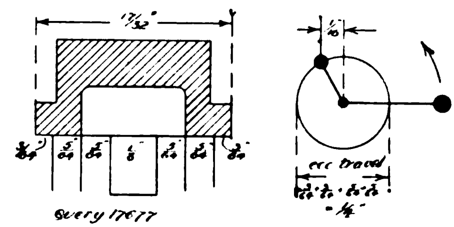
FIG. 1. FIG. 2.

WINDINGS FOR SMALL ELECTRO-MOTOR.

in series. (2) Please say what thickness of paper should be used on the field-magnet cores for insulation. (3) I am using a tri-polar armature of the above size, the field-magnets being 1¾ ins. by ⅝ in. by 2 9-16ths ins. Please say what will be the right size of wire and how much should be used in each case. (4) Also, which would be best to use for power—bichromate batteries or Empire batteries, and how many of either sort will be required, and what would be about the probable power the motor will work to?

(1) The connections are as Fig. 1 for a shunt winding, and for series as Fig. 2. (2) Good medium thickness brown paper, with a coat of shellac varnish, answers well. (3) Wind armature with about 2 ozs. No. 23 and fields with 6½ ozs. No. 25 for shunt winding. If series-wound, use same weight of No. 20 for fields. (4) We should advise bichromate cells. Try three good large ones in series. Motor will take about 1½ or 2 amps. at 6 volts.

[17,677] **Engine Proportions.** R. F. P. J. (Normanton) writes: I should be very much obliged if you would answer the following questions for me. I am going to build a horizontal engine 1-in. bore by ⅞-in. stroke. Will these slide-valve proportions be



right? Steam ports, 1-16th in. by 5-16ths in.; exhaust port ⅛ in. by 5-16ths in.; bars, 1-16th in. by 5-16ths in.; length of valve, ⅝ in. Do you recommend piston rings in cylinders as small as 1-in. bore? What size boiler do you suggest? I would like a pressure of 40 lbs. What horse-power would this engine develop at the above pressure of steam, if well made?

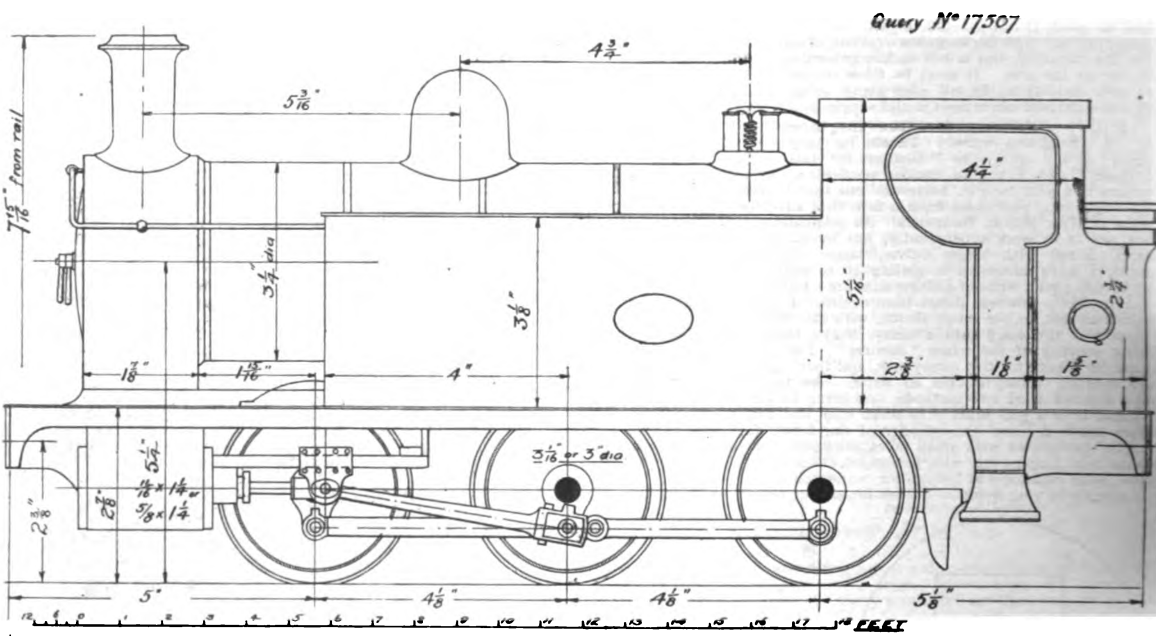
As we presume you will not bother about a reversing gear, except it be a slip eccentric (which is always worth fitting), as such does not lessen the efficiency of the gear by increasing the number of joints), we recommend that you set the valves with 1-64th-in. lead and 3-64ths-in. lap. The steam ports may be 5-64ths in. by ⅜ in. port bars 5-64ths in., and exhaust ports ⅛ in. by ⅜ in. The length of the valve will be 17-32nds of an inch, as shown. Piston rings may be used in a piston 1-in. diameter with advantage. Good workmanship, however, is essential. Use two rings at least. The best boiler would be a small vertical boiler with steel shell 7 ins. diameter by 12 ins. high, with twelve or fifteen tubes (¼ in. or 7-16ths in. diameter), fired by a "Primus" stove or gas-ring. Such a boiler should work the engine at 50 lbs. pressure and 500 r.p.m. without forcing it in any way. This means about 3-48ths—1-16th i.h.-p., or about 10 watts output if a dynamo is coupled to the engine.

[17,587] **Leclanches for Charging.** F. W. (Newbury) writes: I have a 4-volt 20-amp. accumulator. Can I charge it from six Leclanché batteries (pint size). If so, how many hours would it take? Should I need a voltmeter?

Yes, at a slow rate. See that voltage of cells is always a bit higher than voltage of accumulators being charged. Yes, a voltmeter is desirable. It will take many hours, as the charging rate will be extremely slow. Probably they may be kept connected up continually, except when accumulators are being used, of course. We should advise something larger than pint-size cells. Make them as large as possible.

[17,507] **Model Shunting Locomotive, L.Y.R.** J. H. A. (Coventry) writes: I have a great wish to make a ¾-in. scale model six-coupled tank locomotive, but I cannot start same as I do not know what size to make the different parts, so I think I had better get some drawings. Will you please let me know if you have a set of detail drawings of a 0—6—0 type coupled outside cylinder tank locomotive with short rigid wheelbase which I could buy?

You should possess a copy of "The Model Locomotive," which will give you all the information you require as to details of construction. We would advise you to go in for a 3½-in. gauge model as then you can use stock pattern cylinders and a water-tube boiler. The design herewith is based on the L.Y.R. 0—6—0 shunting tanks No. 1,353 class, and except that the boiler is a little higher than scale represents the engine very well. The valve chests may, with advantage, be placed inside the frames instead of on top of the cylinders. The drawing is figured for a 11-16ths-in. scale model and is reproduced to a scale of half full size for a 2-in. gauge model. If you wish for a maximum power for the size, we recommend you to fit a 3¼ or 3½-in. boiler, placing the same 5¼ ins. above rail level. The chimney and dome would not, of course, be so tall.



OUTLINE SKETCH OF L.Y.R. TYPE SHUNTING ENGINE.

Dimensions for 11-16ths-in. scale model: Scale of drawing, 7-32nds in. to foot, or half-size for 2-in. gauge model.

[17,647] **Small Armature Winding.** G. O. E. (Hampstead) writes: I enclose sketch of winding for a small motor. The armature has twelve slots and six commutator segments. Referring to Handbook No. 10, you give a 24-slot armature wound in twelve sections, and I have wound my armature to suit the enclosed sketch, but find it will not go. Will you please let me know if the winding is right, and if so, what other mistake am I likely to have made?

Your winding is not correct. If you carefully compare with the diagram, Fig. 47, in handbook you will see that one end of each of your coils end at the wrong commutator segment. A 12-slot six segment winding is precisely similar to a 24-slot twelve segment one. If you remedy this you will find machine generates current properly.

[17,613] **Model Steam Turbines.** F. C. W. (Newcastle-on-Tyne) writes: I am constructing a model De Laval turbo-generator with direct drive on to the dynamo. I should be very pleased for your opinion on one or two points. I am using a turbine wheel 3 ins. diameter over all with twenty-four blades ⅛ in. wide by ⅜ in. deep, two steam nozzles drilled ·04 in. tapering 1-16th in. full, and I want this turbine to run at 30,000 r.p.m. I propose using a fire tube boiler (vertical) 9 ins. diameter by 16 ins. high, with flat bottom and with five ⅜-in. tubes by 16 ins. long heated with "Primus" burner. I also propose feeding this boiler from hot-well heated by exhaust from turbine. What I want to know is:—(1) What b.h.-p. ought I to get out of this turbine under best conditions? (2) Do you consider this boiler the right size for turbine, or could I use a smaller boiler and get best results? (3) What pressure would you advise? I have got the sizes of turbine from "Model Steam Turbines," and also have "Model Boiler Making."

Your boiler will evaporate about 2 cubic ins. per minute, and the pressure to use depends upon the size of nozzles adopted. See Table IV, page 30, "Model Steam Turbines." We should advise 80 lbs. pressure so that the nozzle diameter becomes 0·0264 in. You might get 1,000 ft.-lbs. per minute out of the turbine, but the wheel will have to run at 75,000 revolutions, and you must gear down to get the speed suitable to the dynamo. You will find the design of a suitable dynamo above a speed of 2,000 revolutions a rather difficult matter, unless you intend using a Faraday disc type of machine.

[17,713] **On Making Small Accumulators.** E. T. (Norwich) writes: I have made an accumulator, as described in your handbook No. 1 on page 12. (1) Can you tell me how many 8 c.-p. lamps I should want for charging it off a 220-volt main? (2) Is there a way of pasting negative plates with litharge; is it applied to the grids in the same way as the positive? If the negative plates are made this way, do they need further forming? (3) Can you give me the address of any firm who would supply me with pure sheet lead in small quantities for accumulator grids, as I have a difficulty in obtaining pure lead, and the price per lb.? (4) Would this lead (of which I enclose a sample) do for accumulator grids? (5) I have a 10-watt motor, which is shunt-wound. It works well off a 4-volt battery, but when I connected it to the main (220-volt), using an 8 c.-p. (220-volt) lamp as resistance, it refused to work at all. Can you tell me the reason for this?

(1) Use four negative 8 c.-p. lamps in parallel. (2) Yes. Paste in the same manner as the positives, and then form by repeated charges and discharges. (3) Whitney's, or Thompson. See advertisements in this Journal. (4) Yes. It appears to be good

enough. (5) Try the effect of a few 8 c.-p. lamps in parallel, so as to give it more current.

[17,612] **Horizontal Engine and Boiler.** E. J. F. G. (Cambridge) writes: (1) Of what dimensions ought a boiler to be in order to get the highest power from an horizontal engine of which the internal measurement of cylinder is 2 ins. by 4 ins.? (2) What horse-power would this engine develop?

The power obtainable from the engine will vary directly, as the speed. At 50 lbs. pressure (boiler pressure) and 500 r.p.m. the indicated horse-power will be about 1 i.-h.p.—that is, presuming the stroke is 4 ins. If it is 3 ins., then the indicated horse-power will be three-quarters of the amount, viz., ¾ i.h.-p. The boiler, if of the multitubular type, coal fired, should have at least 2,000 sq. ins. of heating surface. A vertical boiler having this heating surface will measure 30 ins. diameter by 30 ins. high; with twenty tubes 1¼ ins. diameter, or twenty-five tubes 1¼ ins. diameter.

[17,612A] **Air-cooled Petrol Engine.** E. J. F. G. (Cambridge) writes: Is it possible to put an air-cooled petrol engine, 2 h.-p., into a boat, and cool the engine by means of a rotary fan?

Yes, this is commonly done; but, of course, a water-cooled engine has some advantages in spite of the simplicity of the air-cooled arrangement.

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 the asterisk have been based on actual Editorial Inspection of the goods noticed.*

*Model Steamer Hulls.

Quite a novel process for the production of model steamer hulls is being used by the Machine-Carved Model Company, 11, Balmoral Road, Watford. They have installed an automatic machine-carving plant which, while it is also utilised for other purposes, has for one of its objects the manufacture of hulls for model steamers and sailing boats in quantities from specially designed original models. The first design which this Company is placing on the market is that of a fast model torpedo-boat destroyer of an over-all length of 1 metre (3 ft. 3⅜ ins.) Fig. 1 shows the general appearance of the finished model, Fig. 2 shows the hull as it leaves the carving machine, and Fig. 3 shows the finished hull ready for the purchaser to fit up. We have inspected one of these hulls and have been very pleased, not only with the design, but also with the modelling and finish. We have no doubt that there are many readers who will be glad to be able to purchase ready-made hulls of this kind, especially as the machinery employed in their production enables them to be put on the market at very reasonable prices. We understand that designs for other types of vessels are to be introduced in due course. Full particulars may be had on application to the Company at the above address.

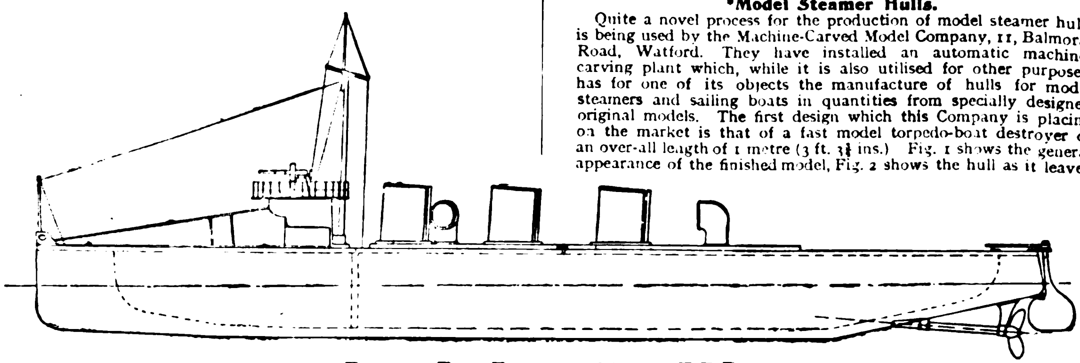


FIG. 1.—THE FINISHED MODEL T.B.D.

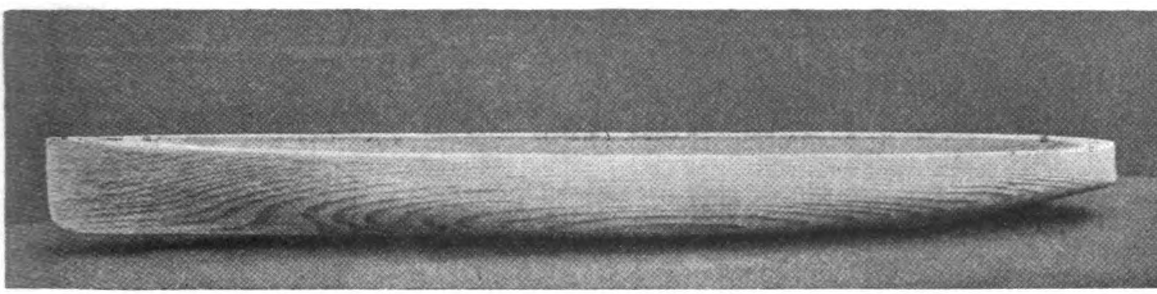


FIG. 2.—THE HULL AS IT LEAVES THE CARVING MACHINE.

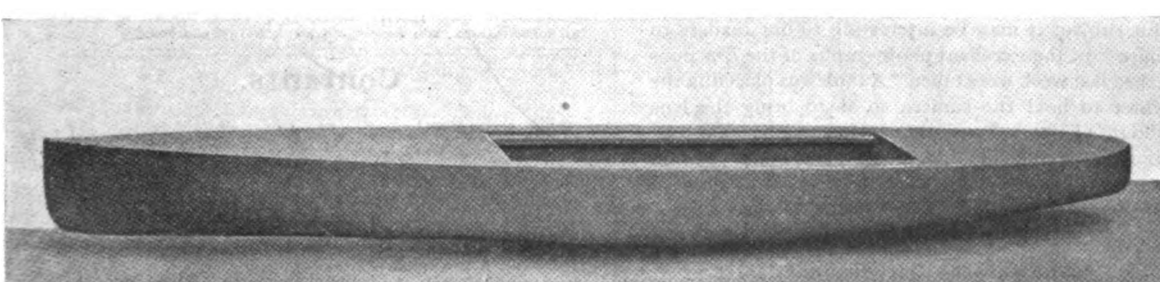


FIG. 3.—HULL READY FOR FITTING UP.

The Editor's Page.

We have recently received a number of queries from readers asking us to publish working drawings of various types of engines, mostly locomotives. It will be readily understood that replies to requests of this kind involve a good deal of work in their preparation, and it is not possible for us to deal with them as rapidly as with queries requiring a written reply only. In some cases details and other information have to be looked out, or inquiries in other quarters have to be made, before we are in a position to furnish the exact thing asked for. While we are willing to use our best endeavours in all cases where the general interest of the query warrants the preparation of a special drawing, we must ask our correspondents to make the necessary time allowance for the appearance of the reply. The requirements of the following querists will receive attention as soon as circumstances permit:—A. C. H. (Edmonton), J. H. A. (Coventry), C. S. (Hackney), E. G. C. (London), C. W. H. (Brentwood), N. R. (Shrewsbury), L. S. (Ilkeston), W. S. (Devizes), W. B. (London), T. G. G. B. (Penzance).

* * *

We understand that the Wirral M.Y.C. have decided to reduce the overall measurement limit of their power boats from 7 ft. to 5 ft. 6 ins. There is no doubt that the smaller size is a handier boat from point of convenience and portability, and it is easier and cheaper to build. For this reason we think the new class is likely to have a beneficial influence on the popularity of model steamer racing and will justify its adoption. As this alteration on the part of the Wirral M.Y.C. may affect the regulations for future MODEL ENGINEER Speed Competitions, we should be interested to have the views of other clubs or individual speed boat owners on this subject in particular and on our next speed competition in general. *Apropos* of this subject it may be interesting to our readers to know how the excellent photographs of the *Era* published last week were taken. A tank was placed in the water to hold the camera so as to bring the lens about 1½ ins. above the surface. The point of view of the model is thus brought down to a position corresponding to that of the observer of a full-sized steamer, and a very realistic result is obtained.

Answers to Correspondents.

K. A. (Hong Kong).—Many thanks for your interesting post-card safely received. You give no address, so we cannot reciprocate.

A. L. S. (Nuneaton).—Thanks for your poetry. We are afraid, however, it would not appeal to a sufficient number of our readers.

L. S. J. (Burnopfield).—If you turn up the commutator and get it into good condition again the sparking should cease, unless there is a broken connection in one of the armature coils. In that case the faulty one must be found and the damage put right. We should not advise you to attempt to reverse rotation.

H. S. (Horwich).—As you do not give full details we should say motor would run if wound with No. 28 S.W.G. on armature and No. 30 for fields, the same weight as is on at present. Use a few yards of fine German silver wire (No. 28 S.W.G.), as a starting resistance.

G. M. (Sydney).—We are in receipt of your Workshop Note, for which we thank you. The device you illustrate is, however, too well known to enable us to give space to it. Shall be pleased to hear again from you if you have any really new wrinkles.

L. W. C. (Leichardt, N.S.W.).—A small steam or petrol engine would be the best for your car. We can supply you with a book "How to build a Petrol Motor," post free 7d., or you can find suitable drawings of steam engines in back numbers of THE MODEL ENGINEER. We cannot suggest a special design from the brief particulars of your car which you give us.

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, etc., 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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[The asterisk (*) denotes that this subject is illustrated.]

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THE

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And Electrician.

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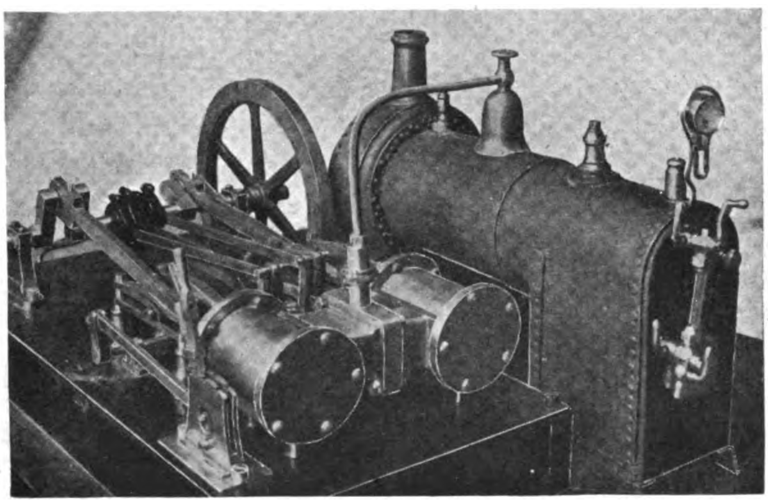
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XVI. No. 320. JUNE 13, 1907. PUBLISHED WEEKLY

A Model Steam Plant.

By THOS. PAGE.



MR. THOS. PAGE'S MODEL ENGINE AND BOILER.

AT the time I built the engine and boiler illustrated herewith my occupation was that of a mason's labourer, and I lived in a lonely part of the Yorkshire Moor, the nearest railway station being some seven miles away. Considering these circumstances, a brief description of the work may be encouraging to some, at least, of my fellow readers.

Previous to building the engine I gathered any bits of scrap metal I could find that might be of service for the work. The cylinders (1-in. bore by 3-in. stroke) were first taken in hand. They are constructed of an inside barrel, being a piece of 1-in. iron tube (ordinary water pipe) bored out with an old file, and tinned with solder on the outside, and a piece of 2-in. brass tube tinned on the inside and then placed over the 1-in. tube; the space between being filled up with white metal made a good space for port-poles. The cylinder ends were next sweated on. A piece of brass ¼ in. thick and 3 ins. long was grooved to fit cylinder and to serve as a valve face. A piece of round tube made square to fit the piece of brass which made half of steam chest, and the top edges were turned over to form flanges, which were sweated to cylinders. Between the steam chest is a piece of ⅜-in. brass for stiffening, hollowed out, into which the steam pipe is attached.

Four old water tap tops were utilised for glands to cylinders. Two 5-in. wire nails were made to act as piston-rods. For the pistons, six discs—four large and two small—were used, the small ones placed between the larger allowing a groove for packing. The connecting-rod is 6 ins. long. For this engine, I may say, I have succeeded in winning a few prizes.

Regarding the boiler, the first I made was not a success, so discarded it and set about making the locomotive boiler as shown in the photograph. As there seen, it is without lagging and unpolished. It has been tested to 160 lbs. pressure from a large boiler. The shell is in two pieces. The boiler is 16 ins. long, 4¾ ins. diameter, 7 ins. high. Fire-box, 4 ins. by 3¾ ins. The only parts that were purchased for this engine are the steam gauge and flywheel casting, the remainder being home-made.

Some Wrinkles in Model Making.

A Special Report of Mr. L. M. Ferreira's Recent Paper before the London Society of Model Engineers.

SINCE the founding of the London Society of Model Engineers in 1898 we have had many papers of absorbing interest to model-makers: but, with all respect to other lecturers,

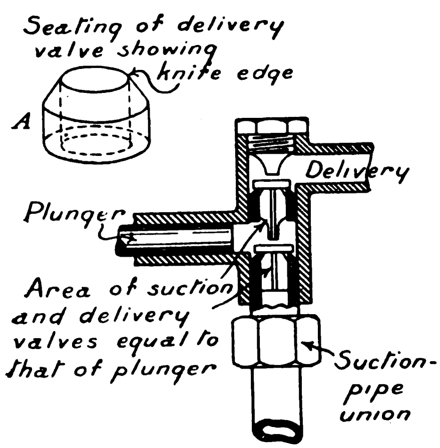


Fig. 1.—Model Force Pump.

the discourse by Mr. L. M. Ferreira the members had the pleasure of listening to at the April meeting stands out as one of the most valuable to workers in the art.

The subjects treated were for the most part unconnected with one another. They were, so to speak, loose leaves from Mr. Ferreira's note book of model-making experiences. They were delivered in a conversational style, further enlivened by neat blackboard sketches. Each of the subjects raised a small discussion, which added considerable interest to the meeting.

Mr. Ferreira started off with model pumps. He said that many model engineers considered it an axiom that a force-pump could not be expected to work at high speeds. While this might be true in the case of pumps constructed on ordinary lines, speeds up to 800 or 1,000 r.p.m. are possible with very satisfactory results in the working of the pump if the apparatus is properly designed.

The two conditions which must be observed in a high-speed model force-pump are:—

(1) The valve seatings should have an area equal to that of the pump plunger; or, which is the same thing, the diameter of the valve seating must be the same as that of the plunger.

(2) The lift of the valve must be restricted to, say, about 1-6th of the diameter of the valve.

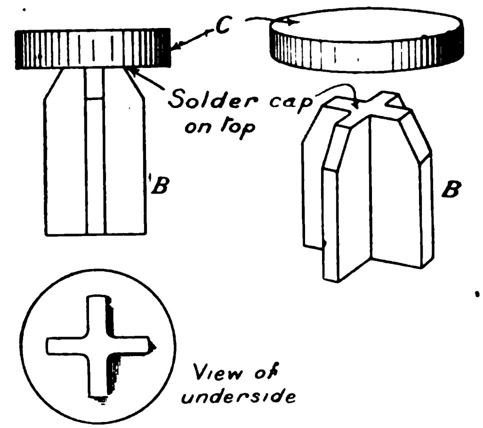


Fig. 2.—Valves for Pumps and Check Valves.

In addition to these features, to ensure success the valves may be provided with knife-edge seat ings, as indicated in the accompanying sketch (Fig. 1), which diagram also shows in a more or less diagrammatical form the construction of a pump fulfilling the above-named conditions. The lift, it will be noticed, is limited by a projection from the top cap or plug of the valve-box in the case of the delivery valve, the suction valve being prevented from rising too high by the wing of the delivery

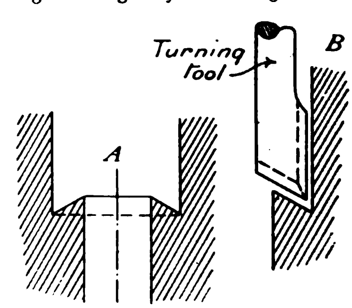


Fig. 3.—Solid Pump Valve Seatings.

valve. The seatings in this pump are separate from the body. To make the valve-boxes a piece of rod brass is obtained, of either square, hexagon, or round section, as desired, and is drilled right through to a diameter equal to the inside diameter of the finished valve-box, *i.e.*, a little larger than the pump plunger. The delivery and suction valve seatings are made from smaller sticks of rod brass turned to fit the valve-box and drilled the same size as the pump plunger. These seatings are finished with a knife-edge seat, as shown in the perspective sketch (A, Fig. 1), and are sweated or screwed in place in the valve-box.

In conjunction with flat valves Mr. Ferreira finds that such seatings give no trouble whatever, and remain tight and in good condition for indefinite periods. Dirt in the water is not so apt to cause the valves to be lifted off their seats and leak back, which is a common trouble in the case of ordinary valves and seatings with chamfered seatings.

The valves used by Mr. Ferreira are shown in Fig. 2. They are made in two parts—B and C.

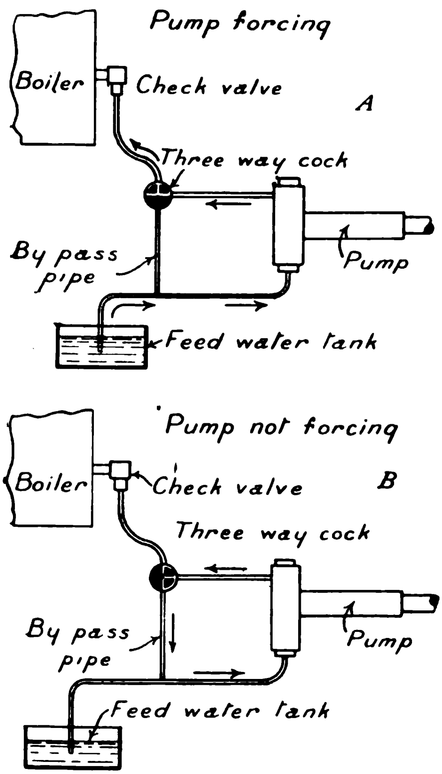


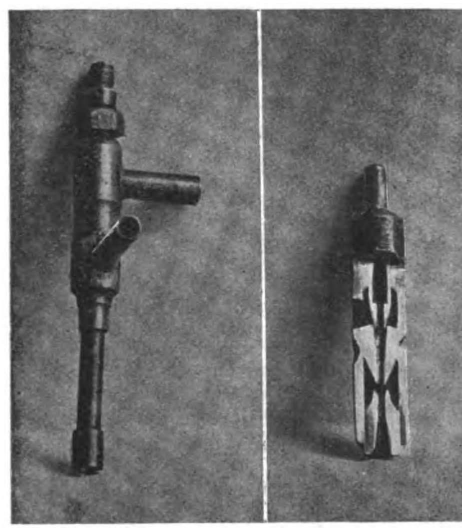
Fig. 4.—Showing Method of Regulating Boiler Feed Pump.

The cap is a slice turned off a piece of rod. To make the stalk B chuck a piece of rod of smaller diameter than that used for the cap, and turn down to fit the orifice of the valve seating. Then file up, as shown in the sketch (B, Fig. 2), or should the appliances be to hand, mill the rod to form the four feathers. After filing, skim up the stalk to an easy fit in the seating hole and face and chamfer the end. Part the stalk from the rod, and solder the chamfered and faced end on to the cap C, as indicated on the plan and elevation drawings (Fig. 2).

Where the pump is made from a solid casting, the seatings would, of course, be made like A (Fig. 3). To do this the pump casting would require to be chucked or set up on an angle-plate and a turning tool of the shape shown in sketch B (Fig. 3) employed.

There are many methods of regulating feed-pumps, some of which—viz., regulating by a pet-cock on the delivery pipe, or by a cock which throttles the suction—Mr. Ferreira mentioned. The device he has used with great success is shown in the two sketches (Fig. 4). The arrangement is a very simple one, the delivery pipe being arranged with a three-way cock on it, the branch pipe being connected to the suction pipe in the manner shown in the drawings.

The action is as follows: When the three-way cock is placed as shown in the first drawing, the delivery of the pump goes direct into the boiler, *via*, of course, the usual check valve. In the other position of the three-way cock, the delivery is diverted back again to the suction, and the water is simply driven round and round the circuit of pipes with practically no effort on the part of the pump. The pump always remains full of water and will readily restart when the three-way cock is put back into the first position.



A Model Injector. Sectional Model.
(*Shown exact size.*)

Intermediate positions of the three-way cock would give a partial return of the feed-water to the suction side, thus altering the amount of water supplied to the boiler and providing an easy means of adjustment. A groove should be filed half round the plug on the same side as the branch hole.

Some discussion on this device was evoked, and to render it impossible for the feed to be entirely shut off with the handle of the three-way cock in mid-position, and for burst delivery pipes to result, one member suggested that the size of the ports on the cock should be so arranged that the cock could never become blind to the delivery water. It would either all go to the boiler or all back to the suction, or some would go both ways. The handle could also be restricted in its movements to further prevent the delivery becoming choked.

Mr. Ferreira mentioned that on one occasion he burst the delivery pipe of a model force-pump by shutting the cock entirely, and said that, independent of the cause of the trouble, it spoke well for the tightness of the delivery valve used in the pump.

So much for pumps. The lecturer next turned his attention to injectors. He had made one or two model injectors with success, and showed a finished injector—which, by the way, was all made out of tube and rod material—and also a similar injector, cut into two longitudinally. The capacity of these injectors was found on test to be 1 qrt. of water in 55 seconds, which, reduced to terms

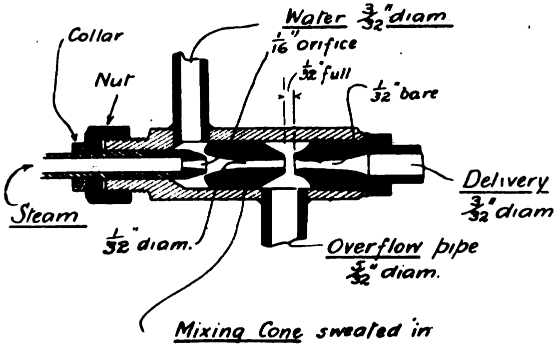


FIG. 5.—SECTION OF MODEL INJECTOR.

(*Full size.*)

familiar to model engineers, is 75 cub. ins. per minute. The injector would therefore be suitable for quite a large boiler. The steam pressure was 20 lbs. per sq. in.

To make the injector, procure a piece of stick brass ⅜ in. diameter, and bore it ¼ in. diameter for a depth of about 1 in., and bottoming with a 5-32nds-in. hole, as shown in the drawing. Thread the lower end and part what is now the injector body from the rod. The steam cone can then be prepared and fitted. For this a piece of 5-32nds-in. tube may be used, the working end being plugged,

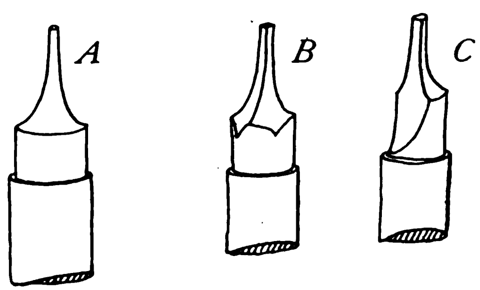


FIG. 6.—REAMERS FOR MAKING INJECTOR CONES.

as shown, and drilled and broached out with an ordinary "English broach" to form a conical hole, the orifice of which should be 1-16th in. The other end of the tube may have a union nut fixed to it so that the steam cone is carried down with it, and a method of adjustment in this way provided. The mixing cone is made from a piece of rod, and is fitted permanently into the body of the injector by soft solder. The throat diameter is 1-32nd in., and the general outline in the case of Mr. Ferreira's injector cone was copied from a published diagram of the sections of a large injector, and is substantially as shown in the sketch herewith.

To make these cones Mr. Ferreira used home-made reamers. A piece of silver steel is chucked in the lathe and turned down to the proposed curved outline of the cone, as indicated in the sketch (Fig. 6) herewith. When this is done, four flats are filed in the rod so that the corners formed coincide with the outline of the portion originally turned, or only one flat may be formed, like in a D-bit. The delivery cone may then be made in a simlar manner, but this cone, Mr. Ferreira suggested, may be screwed into the body, so that with the movement of the steam cone already provided for all necessary adjustments are obtained. The water supply pipe should be large.

The injector shown in the photograph, if started at the pressure it was adjusted for (20 lbs. per sq. in.), would continue to force water till the pressure dropped to 5 lbs.

(*To be continued.*)

Planing and Shaping for Amateurs.

By A. W. M.

(*Continued from page* 533.)

IV.—WORKING THE MACHINE.

THE surfaces of castings are frequently found to be more or less coated with sand from the foundry mould. This will dull the edge of the cutting tool and should be removed as much as possible before the casting is clamped upon the machine table. When taking a roughing cut, adjust the depth so that the point of the tool is well below the lowest portion of the surface; that is, provided there are no lumps which would cause the cut to be so deep in places that the tool will not stand the strain. The machine and the particular piece of work in hand also require to be considered. If the work is slender a very light cut may be imperative to avoid risk of breaking or bending the piece, and the higher parts of the surface will of necessity have to be planed off by degrees.

In many kinds of material some thickness of the outer surface is very hard by comparison with the under surface. Cast iron, for example, may be so hard upon the rough surface of the casting that the tool will scarcely cut it, but underneath the skin the metal may be comparatively soft. Rolled steel and brass have a comparatively hard skin; gun-metal castings may also be hard upon the surface, and so on. If the roughing tool is adjusted to cut the higher parts of the surface only, it will rub upon the hard skin in places and its edge will soon become blunt. By having the depth of cuts adjusted so that the point is well below the surface, at every place it cut into comparatively soft material and retains a keen edge for a greater length of time. The hard skin is broken up and carried away by the curling action of the shaving. Therefore, always take a deep roughing cut if circumstances permit, and get the point of the tool well under the crust of the work.

The hard skin referred to exerts a straining effect upon the mass of metal forming the bar, forging, or casting. When it is removed the softer part of the metal, being no longer held by the hard skin, tends to relapse into a condition of rest. If, on account of this tendency, it changes its shape, the surfaces which have been planed will not remain true and flat. Lathe beds, surface plates, slides for machine tools, and similar castings which are required to have very accurate surfaces, should, therefore, not be finished immediately after the roughing cut is completed. Some makers would allow such a casting to remain for weeks in stock with the surfaces rough planed nearly to size so that it could settle into a permanent shape before the finishing cut was taken over it. The amateur is not likely to require such accuracy as a rule, but a bar or casting may distort to an appreciable extent when the rough skin is removed. If the piece of work is, therefore, of a light or thin character and likely to spring, the clamping bolts should be slackened when the roughing process is concluded, and the surface tested by means of a straight-edge. Should the surface prove to be hollow or rounded it will be evidence of an alteration (assuming the machine is accurate) in the set of the material. Examine the piece to ascertain if any of the portions upon which it should be resting are away from the table, and if so, introduce packing strips. When you are satisfied that a firm bearing is attained, tighten the clamping bolts and take a finishing cut

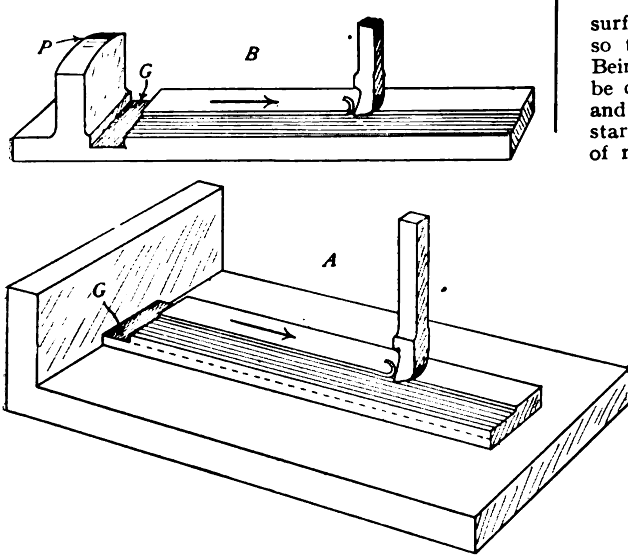


FIG. 53.

over the roughed surface. Some hard rolled metals, such as brass, will spring so much when released after the skin has been roughed off that it is necessary to hammer the piece straight before it can be finished.

A final finishing cut should not be stopped and re-started again whilst in progress, if a very accurate surface is required. For example, if you have a final cut in operation—say it has planed one half of the surface and you stop the machine, re-starting it after an hour or upon the following day—when you put the machine in motion the tool may not cut it exactly the same depth as it previously had done, and you will find the remainder of the surface planed to a different level. This discrepancy may not be much, but quite sufficient to render the surface useless for a very accurate purpose.

The stroke of the tool should be adjusted so that it has a fair margin of length over that of the surface which is being planed. It is sufficient if the point merely passes the edge of the surface at the end of the stroke, but the commencement should take place at from half-an-inch to several inches before the place at which the tool commences to cut the metal, depending upon the kind of machine and size of the

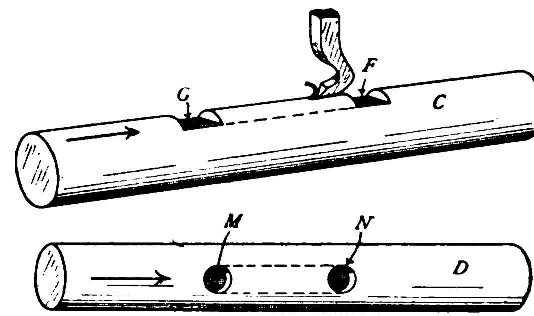


FIG. 54.

surface. A shaping machine is usually arranged so that the tool is moved by a connecting rod. Being thus positively driven the stroke will always be constant to the length to which it is adjusted, and you can depend upon the point leaving and starting its cut to a definite dimension. The tables of many very small planing machines are driven by a similar method, and may be regarded as shaping machines in this respect. Medium and large size planers, however, are usually arranged with a rack or screw drive for the table, the reversal of the pinion or screw being effected by the driving belt, which is shifted across a set of pulleys. The belt shifter is moved by tappets fixed to the table of the machine, which strike against a rocking lever connected to the belt shifter. As the time at which the reversal of stroke will take place is dependent upon the momentum of the table and its load, you cannot be certain that the length of stroke will remain constant. The belt also interferes by slipping more or less at each reversal. If you adjust the stroke so that its length is too near to that of the surface to be planed, you may find the point occasionally stop short of its full stroke when cutting and the feed take place before the end of the return stroke is complete. In the first instance the surface is not completely planed. In the second instance the tool is forced against the higher part of the surface which is being planed and may be damaged or its adjustment disturbed. The feed should take place after the tool has cleared the surface when on its return stroke. The mechanism requires an interval of time to perform its function, during which the tool should be away from the work. To ensure that these conditions are fulfilled planers adjust the travel of the table so that the tool overruns the surface by half-an-inch or so at the end of each stroke, and clears it by a greater distance at the commencement.

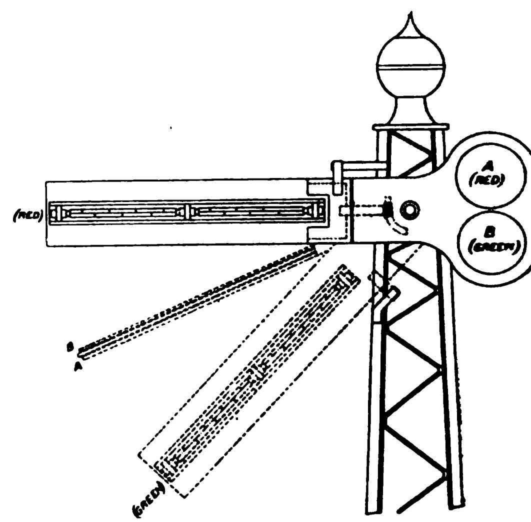
This irregularity in the stroke introduces a difficulty if the surface has to be planed to some exact limit at the end, as when cutting up to a shoulder. In such a case it is usual, if possible, to cut a channel into which the point of the tool can enter at the end of its stroke. Fig. 53 shows examples. A is a bracket having a strip to be planed up to the angle of the foot. The tool would be liable to breakage of its point if the cut is allowed to run dead up to the angle or even to stop whilst embedded in the metal at a short distance away. A groove G is chipped and filed to the level which the planed surface will have. The point of the tool can therefore run clear at every stroke. Fig. 53 is a strip of considerable length having a projection P up to which the surface is to be planed. A groove G is cut as in A, serving the same purpose. Fig. 54 shows a shaft which is to have a keyway planed in it. Grooves F, G are cut at each end to allow the point of the tool to clear at each end of its stroke. A second shaft D requires a sunk keyway for a feather key to be cut in it. Holes M, N are drilled with a flat ended drill, and the keyway planed from one to the other, as indicated by the dotted lines. The holes give a clearance for the tool point at each end of the stroke. The grooves and holes may require to be cut as near to the line of finished surface as possible, or they may be cut below it according to circumstances. When required to form a part of the surface they would in practice be left slightly high so that the finishing tool just scraped into them. They would be finally adjusted to the planed surface by file and scraper. Even if the work is done by a shaping machine these grooves should be cut to relieve the tool. Of course, work of this kind can be done by a transverse cut, and the grooves would not be necessary; it is a matter of time, convenience, and circumstances. Difficulties like these occur when you are cutting work out of solid blocks of metal or forgings rather than with castings.

(To be continued.)

The Latest in Engineering.

The World's Biggest Locomotive.—The American Locomotive Company has just completed at its Allegheny plant the largest locomotive in the world for the Pennsylvania Railroad Company. When first run out of the shops with the intention of taking it to Altoona, it was found that the whistle on the boiler was so high that the engine could not get under the bridges. It was taken back to have the whistle lowered. The giant will be used to haul the eighteen-hour special between New York and Chicago, and will work on the mountain run between Altoona and Pittsburg. Together with its tender the new locomotive weighs 204 tons. It has three drivers on each side, the drivers being 80 ins. in diameter. While no test has been made of its fleetness, it is thought that the engine will be able to cover more ground in a shorter time than any now in existence.

An Illuminated Semaphore Arm.—With the object of rendering signals more distinct, particularly at night, Mr. J. A. Panton, of the Liverpool Overhead Railway, has recently patented an arrangement by which the semaphore arms are illuminated by a line of electric light, which may show any desired colour. The signals are intended for electrically operated railways, though they may obviously be used wherever a supply of electricity is available. The drawing shows that the spectacle casting is in two portions—one portion carrying the spectacles, whilst the other portion carries the wooden arm, and can revolve upon a trunnion, which is mounted in a bearing in the spectacle casting. Fixed on this trunnion is a pinion wheel which gears with a rack fixed upon the post, consequently, as the arm is raised or lowered, this pinion causes the outer wooden portion of the arm to make half a revolution. Two separate and insulated contact-pieces connected to the lamps on the arm engage with two electrically connected contacts on the post, whereby the lamps are lighted, only one colour being lighted at a time, and that only when the arm is in its correct raised



PANTON'S ILLUMINATED SEMAPHORE ARM.

or lowered position. It will therefore be observed that the line of light on the arm is provided in addition to the present coloured spectacles, and also that the reversal of the face of the arm causes the red (or white) side to be presented to the driver when the signal is "off." The arrangement would also appear to be a very suitable one for indicating conspicuously the difference between "home" and "distant" signals. It will also be noticed that extreme simplicity is a distinctive feature of the invention, of which the principal advantages may be briefly summarised as follows:—(1) The greatly increased conspicuousness of the visual signal; (2) the change in the position of the coloured lights in addition to the change of colours; (3) in daylight the reversing-arm presents its white or green face when lowered; (4) saves life and also fog-signalling expenses; (5) the warmth of the lamps and the reversing prevents the signal from becoming obscured by snow.—*Railway Engineer.*

A Bookbinder's Plough.

By J. R. Brown.

In order to add to "Orlando's" interesting articles on "Bookbinding," which appeared in the issues of March 28th and April 4th, by the kind permission of the Editor, I herewith submit a description of a bookbinder's plough, which I made and have used since The Model Engineer commenced its successful career.

Living in the country at the time, and being a long distance from any professional bookbinder, and also finding the knife business of cutting the edges a very unsatisfactory and blister-raising job, I bought some well-seasoned beech wood, and made the following plough and a suitable press for the same. The village blacksmith did the ironwork, and although the threads are not up to the standard finish, they serve their purpose. Ironwork and wood cost about 10s.

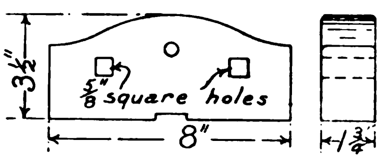
Plough.—For the plough, plane up carefully two pieces 8 ins. by $3\frac{1}{2}$ ins. by $1\frac{3}{4}$ ins., with two pieces 10 ins. by $\frac{5}{8}$ in. by $\frac{5}{8}$ in., and be sure the edges are square and the surface smooth. The next thing is to truly gauge and mortise four $\frac{5}{8}$-in. holes in A and B, Fig. 5, the positions being shown in Fig. 1—those in A to be a true and tight fit for the stems, Fig. 2, whilst those in B must be a true but sliding fit for the same. Having obtained the $\frac{1}{2}$-in. square threaded screw, Fig. 3, with nut and washer, 9-16ths-in. holes must be bored in A B, and the nut fixed in position in B. The holes are 1-16th in. larger than the screw for ease in working and closing the plough at the finish. Now all superfluous wood may be cut away above the stems, as shown in Fig. 1, the edges except the soles to be rounded off.

The next step is to cut the soles for bedding the 3-16ths in. knife, Fig. 4, which must be flush with the face of soles. The steel knife with the bevelled edge towards the stems is fixed to A by two wood screws, the holes in the knife being countersunk for heads of screws. As the knife will require sharpening for at least each volume, the screws must be a good fit. Unless the knife is kept sharp the work will be laborious, and the edges of the book jagged. The stems should be glued and wedged in A before fixing the knife.

Press.—I should recommend two presses—one the size mentioned by "Orlando," and one larger and heavier, of hard wood for plough work, 2 ft. 6 ins. long × 4 ins. × 4 ins., with two $\frac{3}{4}$-in. runners for guiding the plough, Fig. 5, using two $\frac{3}{4}$-in. square threaded wrought-iron joiner's bench screws, 16 ins. long. This may seem expensive, but, with two extra nuts, the screws may be used in bench for other work.

Finishing.—Give the woodwork a coat of raw linseed oil, and allow to stand for a day or two, and then polish with dry cloth. The oil is not essential, but the wood has a nicer appearance, and the plough slides along easily.

Using.—A thin cutting board will be required, as shown in Fig. 5, a little longer than the edge to be cut, and to project a little above the press. Having placed the press on an empty soap box without lid, and fixed your book with cutting board in position, grasp the plough with both hands, as shown in Fig. 5, and with a little downward pressure slide the plough along the press, turning the screw slightly with the right hand when the plough is coming towards the body, but do not be too rash or the book may be damaged. If the press is a fixture, the cutting may be done during both backward and forward movements.



Figs. 1 and 2. Plough Frame.

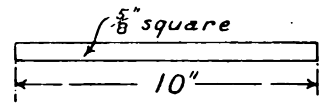


Fig. 2.—Stems.

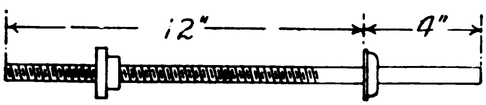


Fig. 3.—Plough Screw.

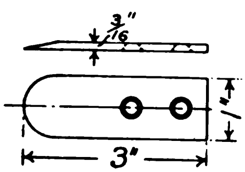


Fig. 4.—Knife.

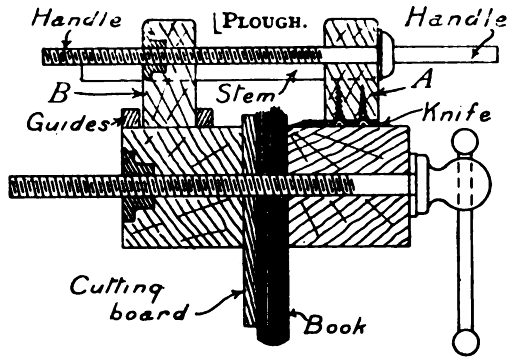


Fig. 5.—General Arrangement of Plough.

DETAILS OF BOOKBINDER'S PLOUGH.

(*Scale: One-sixth full size.*)

A Design for a Small Model Undertype Engine.

By Henry Greenly.

(*Continued from page 521.*)

VI.—Eccentrics and Eccentric Rods.

ALTHOUGH for the purposes which such a model as the one now under consideration would usually be employed reversing motion would not be required, there is no reason why the shifting eccentric type of gear should not be fitted. Nothing will be lost in the matter of efficiency, as the slip eccentric contains no feature which is likely to go wrong or cause trouble. Therefore, the drawings show this well-known device. The form of slip eccentric adopted is the best that has come within the writer's experience, as it not only is easily made, but has the merit of being readily adjusted. The eccentric sheave may, however, be fixed, and then would be cast with a projecting boss, placed next the crank web, as shown in Fig. 30. The patterns may provide for either method of construction.

The eccentric strap and rod is intended to be cast in one piece—gun-metal or phosphor-bronze. The pattern should allow for the sawing off of the back half of the strap. When sawn in two, the facings should be filed up and the joint sweated with soft-solder in the usual manner. The strap and rod may then be mounted on the faceplate, with the flat side touching the faceplate, and the strap bored and faced. To enable the tool to make a clear bore, parallel packing pieces—sheet metal of a given gauge, say about 3-32nds in. thick would do—should be placed behind the casting to lift it off the faceplate to the required amount, which, by the way, will depend on the proportions of the tool used. The other side of the strap may be faced by either turning the strap the other way round on the faceplate or by gripping the strap on a ⅜-in. mandrel by means of the bolts, at the same time providing lateral support by butting the strap and rod up against the faceplate. In this way a considerable proportion of the rod may be accurately machined—more than could be done at one operation if the strap and rod were simply clamped on to the faceplate.

It will be noted that the sheave has a central flange, and to machine the strap a specially shaped hook tool will be required. In any case, the chase in the strap should be slightly deeper than the flange, so that as the strap is taken up the flange does not bear on the top edge.

The forked end of the eccentric rod should fit the intermediate spindle without appreciable side shake, and as it is always better to fix the pin or bolt in the forked portion, one fork of the joint should be tapped and the other drilled with a clearing hole. The bolt should be tapped only at the end with a plain portion, 5-32nds in long, and if a locknut is screwed on the projecting portion of the bolt no trouble should ensue. It is a very bad (although common) practice to simply put a screw which is threaded all the way down in such a joint, with the result that the amount of lost motion due to slackness soon becomes considerable.

The eccentric sheave should be made of cast iron, or, at least, some material different to that of the strap. Wrought iron or steel would, of course, make a very good wearing combination with the bronze strap. The sheave for the lip

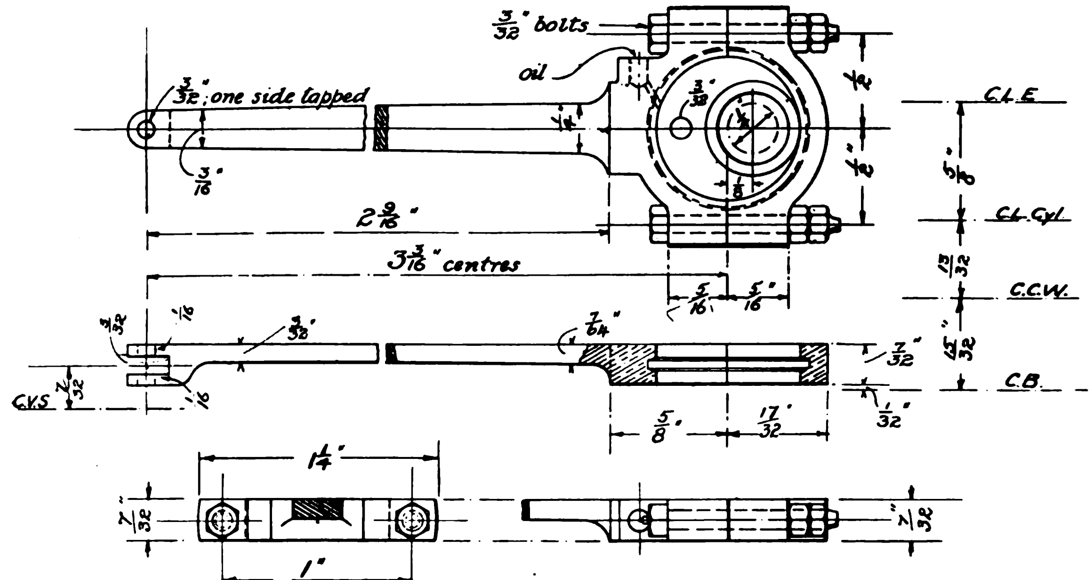


Fig. 26.—Eccentric Strap and Rod for Small Model Undertype Engine.

(*Scale: Full size.*)

Note.—*C.L.E. = Centre line of engine; C.L.Cyl. = Centre line of cylinder; C.C.W. = Cheek of crank web; C.B. = Cheek of bearing; C.V.S. = Centre of valve spindle.*

eccentric gear is quite plain, and has a rubbing face on each side $\frac{1}{2}$ in. diameter and projecting 1-32nd in. The bore should be a running fit on the crankshaft. To provide for reversing, a pin should be screwed into the outside face of the sheave. This should fit tightly and may be riveted over at the back to prevent any possibility of its coming loose. The exact position of the pin in relation to the throw is immaterial, but that shown on the drawing (Fig. 27) is the most suitable. The diameter of the pin may be 3-32nds in.

The stop collar is shown in Fig. 28. This is a plain flanged collar made as shown at A, Fig. 29. It should be a reasonably tight fit on the crankshaft and when turned up to the required circular shape the face of the large flange should be scribed with a centre line, as at XY, in view B, Fig. 29. The flange should then be filed off, as at B, to within 1-32nd in. of this line at first and the gear tried. It will, no doubt, be found that after the movement of the valves over the surface of the steam ports has been equalised by means of the adjustment nuts provided at the intermediate valve spindle, the H.-P. valve has a little too much "lead," and the L.-P. valve (which has less lap)

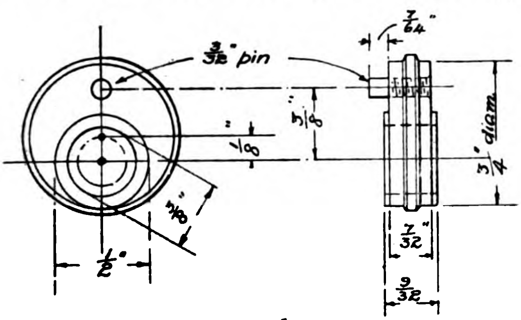


FIG. 27.—ECCENTRIC SHEAVE.

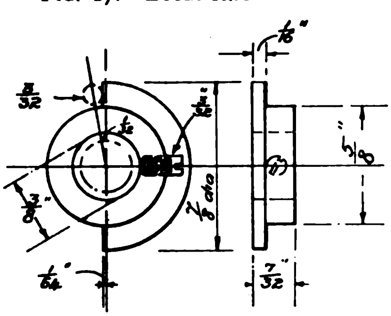


FIG. 28.—STOP COLLAR FOR REVERSING.

has much too great an amount of this same commodity. The stop collar may then be filed down to something less than 1-64th in. (the normal dimension as shown in Fig. 28) in the case of the L.-P. valve, and to full 1-64th in. on the high-pressure side. With the pin placed in the position shown in the drawings, the XY line of the stop collar will stand in a truly vertical direction when the crank-pin is on either dead centre, or, which comes to the same thing, with the crank webs vertical the XY line of the stop collar will be in the horizontal plane. Should any difference in the size and disposition of the steam and exhaust ports have been made during the process of cutting them, the valves should then be arranged to suit such accidental or intentional alterations and be either lengthened or cut down according to requirements. If this is done, the eccentric gear may be made exactly as shown on the drawings without any further modification.

In Fig. 26, the letters C.L.E., C.L.Cyl., C.C.W., etc.,

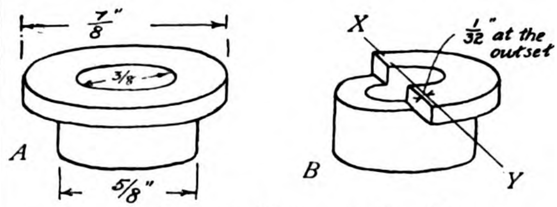


FIG. 29.—HOW TO MAKE THE STOP COLLAR.

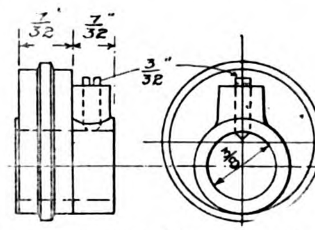


FIG. 30.—ORDINARY ECCENTRIC FOR NON-REVERSING ENGINE.

are intended to indicate the relative positions of the other portions of the engine in respect to the eccentric strap as viewed in plan.

The dimension, 1$\frac{1}{32}$ ins., in Fig. 24 (slide bars), of the last instalment, should read 1$\frac{3}{32}$ ins. The difference is luckily unimportant, but we might as well be correct.

(*To be continued.*)

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 TEXT-BOOK OF PRACTICAL PHYSICS. By Wm. Watson. London: Messrs. Longmans, Green and Co. Price 9s.; postage 5d.

This book is intended as a manual for advanced students of physics, and is an extension of the author's well-known "Elementary Practical Physics." Beginning with a discussion of the methods used in the reduction of experimental results, the various classes of work undertaken in a modern well-equipped physics laboratory are carefully described, and instructions given for carrying out the various measurements. An extremely valuable series of tables is given in an appendix, and the book forms a very valuable source of reference, even to those who are not daily engaged in the laboratory. We can thoroughly recommend this work to the teacher or student, the only criticism we can offer being that we think the mathematical introduction, particularly that referring to the theory of errors, might with advantage have been extended.

The "New" Steam and its Application to Models.

By W. L. Blaney.

NOW that the flash and semi-flash systems of steam generation have proved so superior for certain classes of work commercially, it is time for model engineers to consider the advisability of adopting the new principles for models in order to get better results.

The present article cannot claim to be anything more ambitious than a guide to indicate the path to be followed; but it is in the hope that others may be induced to give serious attention to the subject that the writer has set himself the pleasant task of clearing up one or two mechanical difficulties that present themselves. The "new" steam, if I may be allowed to so call it, does not appeal to model locomotive builders very much, because its adoption would mean such radical changes in the design that the chief charm of a model locomotive—*i.e.*, its semblance to the original—would be lost. There is a field for its use in the modelling of motor-cars and motor-coaches such as are now in use on branch lines of several railways, but it is the model marine engineer that the question most concerns. There are practically no bounds to the design of hulls, which may range from a "tub" to a hydroplane, and, as to the motive power—well, anything from a Serpollet installation to a pair of reins and a mermaid!

It may perhaps be interesting to first examine the reasons why the flash generator shows itself so superior in steam raising qualities. The first point that impresses one is the large amount of "effective" heating surface that can be got into a small space. The second, and in the writer's opinion the most important, is that there is no circulation in the sense that obtains in other types of boilers. Once the bubbles of steam are formed, they are not allowed to cool down again by threading their way through water of a necessarily lower temperature in order to rise to the steam space. This comparison shows in, brief, the difference between saturated and super-heated steam.

Most modellers are aware of the great improvement in an ordinary boiler when the steam is re-heated by carrying it through a tube in contact with the flame, and thence to the engine. In the flash boiler this double treatment of the steam with its heat wastage is dispensed with. The advantage may be described as—the elimination of heat radiation from the contents of the generator. Indeed, the history of the progress of steam is made up of successive endeavours to prevent the loss of heat energy. James Watt was confronted with the wasteful system of cooling and reheating the engine cylinder at every stroke, and this led him to devise the separate condenser. Since then many inventors have been at work producing various compounds and devices for preventing the leakage of heat from the surface of parts containing steam; but it was early discovered that the best lagging was the furnace gases.

This, together with the fact that the greater the proportion of heating surface to the total amount of water it has to maintain at a steam raising temperature increases the *efficacy* of the heating surface, led to the inception of the water-tube boiler in its many forms. The above principle makes itself apparent in another way, for the lesser total amount of water in any given boiler increases the efficacy of the heating surface.

An amusing incident that occurred some time ago very prettily illustrated this principle to the writer. A 4-ft. 6-in. boat, belonging to one of the members of the V.M.S.C. was steaming down the lake at its average speed when it suddenly accelerated its gait, a plume of white burst from its pop valve in a manner that clearly indicated that it was insufficient to relieve the excess of pressure, and away she went down the lake with a 20-degree list to starboard and an ever-increasing speed. It was a sight to gladden the heart of anyone who did not know what was the matter; but alas! she as suddenly slowed up and stopped. A hasty examination solved the mystery. The furnace tube with its water tubes was intact, being silver soldered together, but the shell and end plates, although well riveted, had been caulked with soft solder. The said "soft tommy" in the heat of the moment had yielded to the pressure of circumstances, and handsomely "electro-plated" the engine-room and stoke-hold. Moral: Watch the water level.

The superheater and feed-water heater still further improved matters in the conservation of heat energy until some genius—presumably M. Serpollet—discovered that, by joining up the feed heater with the superheater and cutting out the boiler, he reduced the afore-mentioned heat-dissipating property of water in bulk to a minimum.

There is some difficulty in discovering who was the first to experiment with the continuous pipe boiler; but the writer, in his endeavours to penetrate these clouds, has come across one curiosity that is of interest. This is a well-executed engraving of a steam fire engine, horse drawn—the engine, not the engraving. It is a matter of regret that no letterpress accompanies this design, which appears in an old portfolio of American machinery lent to the writer by Mr. Thomas Dysart. The only particulars available are that the inventor and patentee was one Abel Shawk, of Cincinnati, Ohio, the date of the patent being 1853, the scale of the drawing 1½ ins. to the foot.

The boiler is a continuous tube made up of several elements, gradually increasing in diameter from the water inlet to the steam container, and coupled together by cast bends. Not the least interesting feature of this engine is that, with the exception of the road wheels, there are no rotating parts.

Turning our attention now to models, there does not seem to be much difficulty in designing a model semi-flash boiler, providing one bears a few points well in mind. Steel tube is now obtainable in small sizes suitable for the purpose. The only real difficulty is the regulation of its working. It has been found necessary to make existing plants as nearly automatic as possible in their various functions, and this self-regulation must, of course, be the first consideration in a model, where there is no helmsman to put things right. The first problem is the water feed. It is the usual practice in flash steam installation to keep the pumps almost constantly at work delivering more water than is needed and relieving the excess of water through a spring-loaded valve. This is a wastage of power that does not count much in a 20-h.p. set,

DESIGN FOR A MODEL MARINE FLASH STEAM GENERATOR.

(*Scale: About half full size.*)

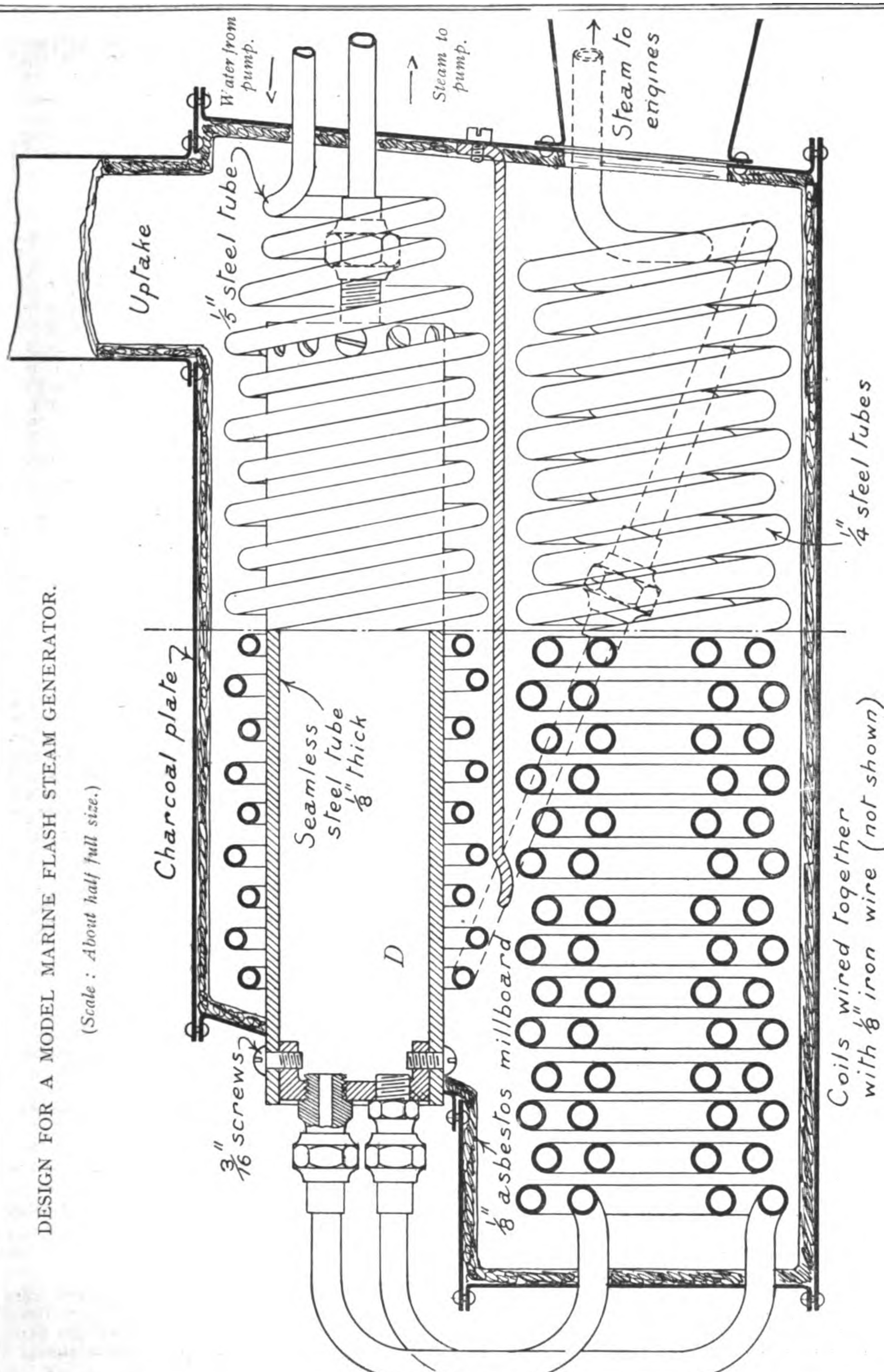


FIG. 3.—PART LONGITUDINAL SECTIONS THROUGH BOILER.

but we do not need even to waste this fractional amount in our model.

Figs. 1 and 2 show an independent steam pump and a simple device for controlling it by the steam pressure. The drawing is a slight modification of a pump made by Mr. James C. Crebbin, who very kindly lent it to the writer to experiment

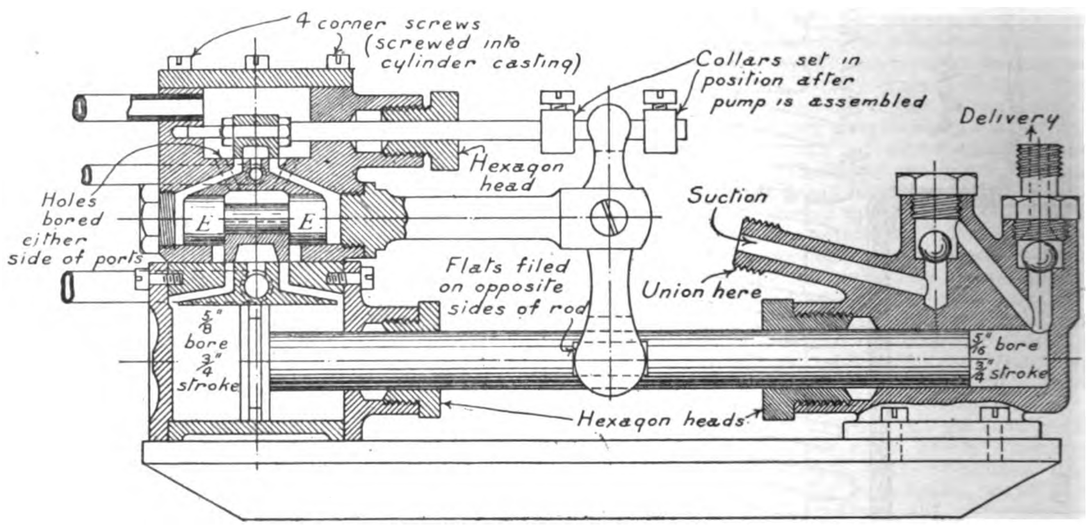


FIG. 1.—LONGITUDINAL SECTION THROUGH STEAM PUMP.

with. It seems particularly suitable for this purpose, as it will work dead slow or up to any speed required, and will always start up when steam is turned on. The system of steam distribution in the cylinder is very similar to that used in the Westinghouse pump. An examination of the controlling gear shows a spring loaded piston working in a cylinder

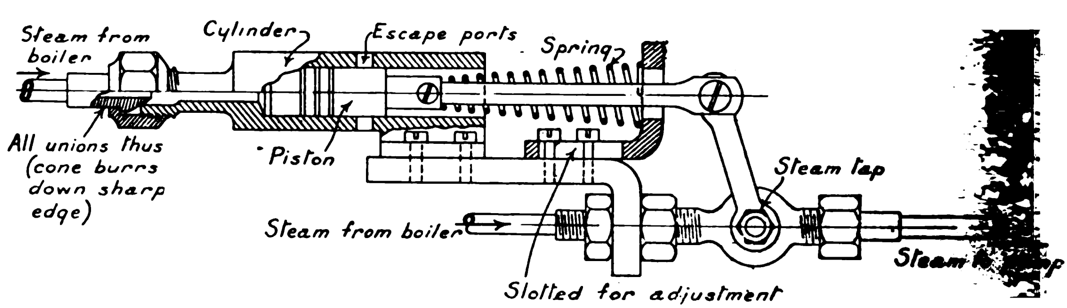


FIG. 2.—SECTION THROUGH CONTROLLING DEVICE FOR PUMP.

and having a rod attached to it prolonged to engage a steam cock. The action then is this: when the pressure in the boiler arises above a certain limi , predetermined by regulating the spring, it forces out the piston, and closes the steam cock, thus shutting off the pump. No water enters the boiler then until the pressure falls. The piston returns and the pump goes to work again. In practice it is probable that the pump would automatically adjust itself to a constant speed. The steam leading to the pump should be taken from a point about half-way up on the drum (D, Fig. 3), and not from the end of the tube where the main engines are fed. The object of this is twofold: cooler steam is necessary for the proper working of the slide valves, and, should the boiler "flood" through any reason, the water will flow into the steam chests and be ejected through the exhaust pipes in larger quantities than the pump ram delivers, which is a desirable result. It is important that there should be no inside or outside lap on the slide valves for the pump to work satisfactorily under these special conditions. There are escape holes drilled through the walls of the cylinder. When the pressure of steam rises above the safety limit, the piston uncovers these ports and allows the excess to escape. So we have a safety valve and a regulator in one.

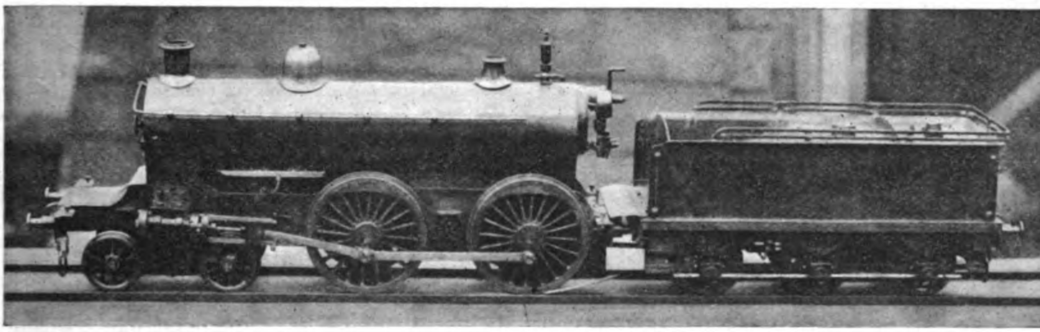
(To be continued.)

It is stated that if the whole of the power from Niagara was utilised, it would only give three times the horse-power that is thrown away by the blast furnaces of the United States of America alone.

Building a Model N.E. Express Locomotive.

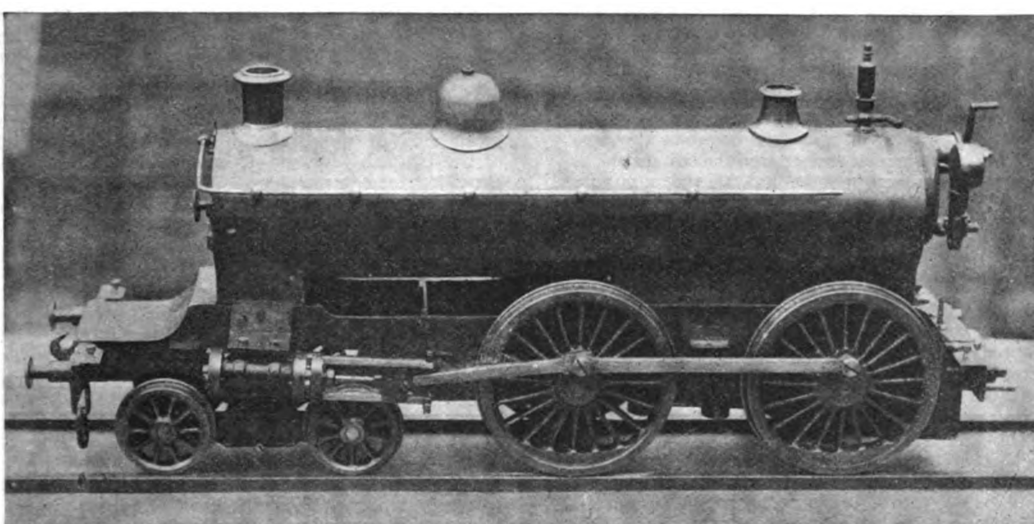
By J. Baird.

THE photographs reproduced herewith represent a ½-in. scale model N.E. express locomotive and tender, 2½-in. gauge, in course of construction during my spare time. It is followed from drawings in "The Model Locomotive." The frames are cut to shape from 1-16th in. hard brass, and riveted to the buffer beams with angle brass. The buffers and draw-hooks are all fitted with springs. The bogie frame and equalising bars are made up from sheet brass, fitted with gun-metal wheels and axle-boxes with steel axles. The driving and coupled wheels and axle-boxes are gun-metal, fitted with springs. The cylinders are 7-16ths in. bore, 1-in. stroke, fitted with steel slide-bars and fixed to frames as in drawings. The connecting and coupling-rods are of German silver. The eccentrics are fitted with slip reversing motion. The boiler is of the water-tube type; the inner barrel is 1-16th in. solid-drawn copper, 2 ins. diameter, and is fitted with gun-metal ends, and downcomer with three copper tubes, ¼ in. diameter, and the whole is silver soldered together. The steam is taken from the dome, which is not shown in the drawings. It is fitted with regulator, steam gauge, check valve, and safety valve which blows off at 50 lbs. by the gauge.



View of Locomotive and Tender, without Cab.

The outer shell is of brass tube, 2¾ ins. diameter, cut and opened to form firebox. I had to put a piece on each side to make it deeper; it is 5 ins long by 1¾ ins. wide. I have the side footplates, splashers, and cab to make yet. The lamp has six burners; it is made of brass and silver soldered and gives a splendid heat. I may mention the tender was built first, like putting the cart before the horse; it is all made from hard sheet brass. The frames are 1-16th in. thick, cut and filed to shape and fixed in the usual way. There are six cast



View of Mr. J. Baird's Model N.E.R. Express Locomotive during Construction.

dummy springs riveted to side frames—three on each side, and a spiral spring fitted between them and the axle-boxes. The wheels are gun-metal fitted on steel axles, and it runs very smoothly along. The soleplate is in one piece, with a division-plate between the two tanks—one for water the other for spirits, fitted with a tap to regulate supply to lamp. On the top of water tank there is the usual slope for coals with hole in front plate and a guard rail. I made a force pump some time ago, which I intend to use for feeding the boiler from a tank on the side of the track. The principal dimensions are: Bogie wheels, 1 7-16ths ins. diameter on tread; driving and coupled, 3⅜ ins.; tender wheels, 1⅞ ins.; length of engine over buffers, 17 ins.; length of tender over buffers, 11¼ ins.: total length, 28¼ ins.

How It Works.

X.—Slip Couplings for Railway Carriages.

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

THE practice in vogue on the railways of this country whereby carriages are "slipped" or released from express passenger trains whilst the latter are in motion has, so far as the writer is aware, no counterpart in the railway methods of other countries. It, nevertheless, forms a very convenient and useful means of improving the train service without increasing the number of trains, and as, with ordinary care, no danger whatever is involved in the employment of the contrivance, it is somewhat difficult to understand why the adoption of such an effective plan should be restricted to British railways, the working conditions of which have much in common with those obtaining elsewhere.

An express train, we will say, leaves London bound for an important centre 150 or 200 miles away. The traffic is highly competitive between the two points, and it is necessary to reduce as much as possible the time occupied in making the complete journey. *En route* several important towns or busy junctions have to be passed, and to stop at even one or two of these would spoil the character of the run for those desirous of travelling through to the ultimate destination of the train. The specially fast schedule is only possible by eliminating all station stops, and yet the demand for rapid transit between the Metropolis and points intermediate between it and the furthermost centres must be observed, and that whilst economising train mileage. Of course, it is not necessary to carry the "non-stop" principle to extremes, but where there is great competition the provision of special through fast expresses, making no halts on the way, does undoubtedly attract patronage to the line; and if, as an additional attraction, a slip carriage is attached for the accommodation of those who wish to take advantage of the fast timing (although travelling over a shorter distance), the result is to benefit not only the passengers who are so desirous, but also the company which runs the trains.

A case in point is the well-known and highly popular afternoon express between London and Sheffield on the Great Central Railway. This train, which leaves Marylebone at 3.25 p.m., is timed to cover the complete distance of 164¾ miles in three hours without stopping. A carriage is slipped at Leicester (104 miles) and this is at once attached to a train which is standing in readiness to start for Nottingham, so that by means of the one special and one short auxiliary train three important places are served, and the time on the journey between London and each of them very considerably reduced.

The slip-carriage method is resorted to on several among the most important railways in England. The London & North-Western has made extensive use of it for many years, and on the Midland also it is a much favoured practice. The apparatus employed varies only in matters of detail, the principle upon which its working is based being the same in all cases. The accompanying illustration, kindly provided by Messrs. Gresham and Craven, Ltd., of Manchester, shows the general arrangement of the device as fitted to railway rolling-stock upon which the vacuum automatic brake is used. The guard in the slip carriage controls the gear by means of two handles. To one of these a thick cord or rope is attached which at the opposite end is secured to the lever which actuates the main coupling-pin, whilst the other handle operates the finer cord which releases the brake pipe couplings. By the use of these couplings the continuous brake on the slip portion of the train is under the control of both driver and guards until the slip is made, and it is the duty of the slip guard to see that the couplings are properly connected between the hose pipes and that the gauge in his van indicates the correct amount of vacuum.

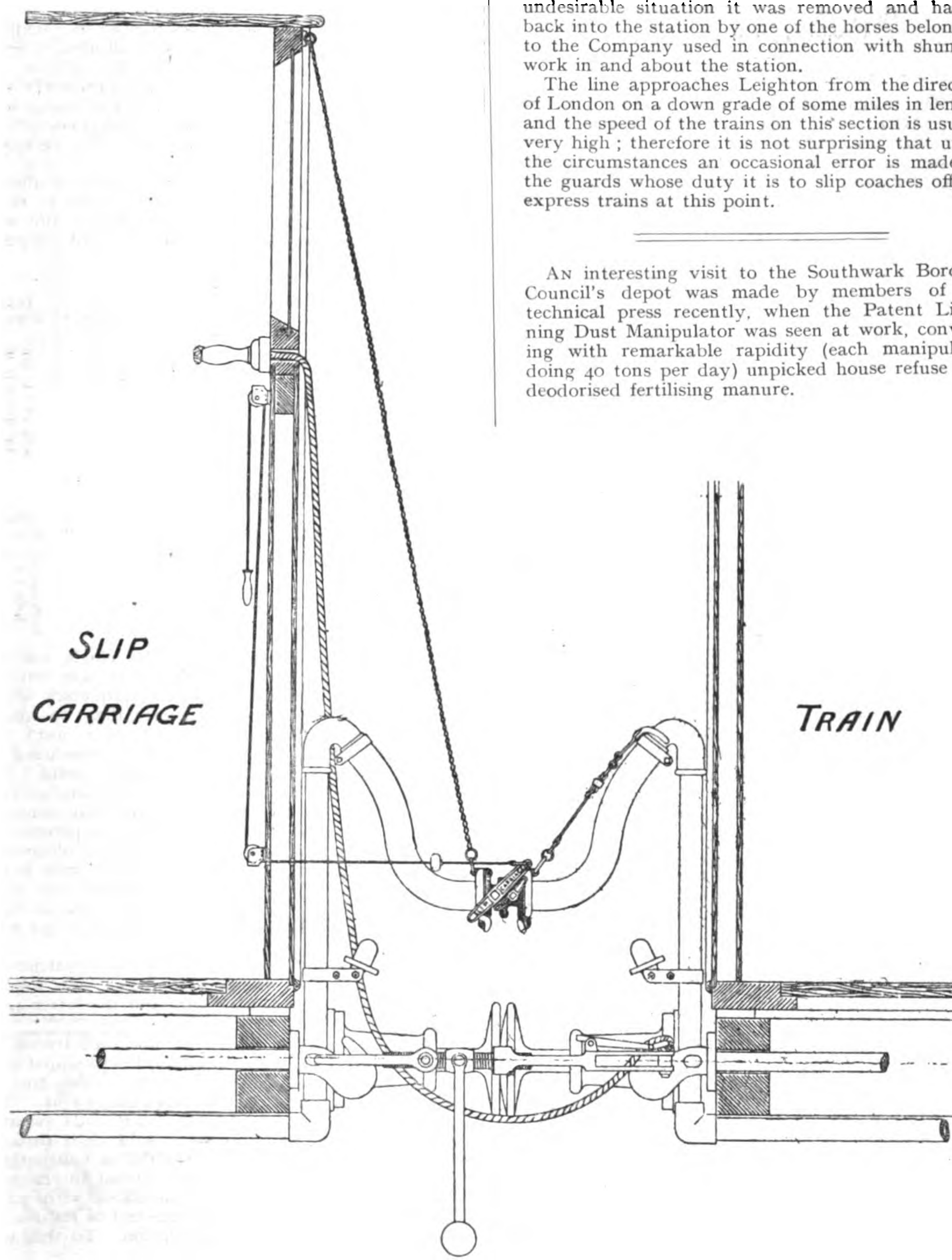
The couplings are made to fit in between the couplings of the train brake hose. One is marked "Slip carriage," and must be affixed to the hose coupling of that vehicle. The other is marked "Train," and must be fixed on to the hose coupling of the train. The "slip" portion is attached to a chain which is fixed at the end of the slip van, and the "train" portion of the coupling to the swan-neck of the brake pipe, on the last vehicle of the train, by means of the special clip and strap provided for the purpose. When the slip couplings are connected together, the strap is buckled up so as to take all the weight of the couplings, and the levers must always point towards the front of the train.

When making the slip the cord connecting the levers of the slip couplings is pulled steadily until the brake pipes separate, and this function must be performed before the coach is slipped. The hand-brake is used for stopping the slipped portion, the continuous brake being left for use in case of emergency. Great care is taken that there is not less than 2 ft. of slack in the cord connecting the slip couplings, and that it is perfectly free to run out should the slip coach break away from the train.

The drawing shows so clearly the manner in which the device is arranged and operated that further explanation is unnecessary. It is, so the writer is informed, only very rarely indeed that any hitch occurs in the manipulation of the gear, and even then no serious results are likely. Lack of judgment on the part of the slip guard might, of course, be the means of causing inconvenience to the passengers, and the writer well remembers one occasion when such a thing happened. The train which leaves Euston at 2.45 p.m. for Birmingham, slips a carriage at Leighton, 40 miles down the L. & N.W. main line. About a quarter of a mile beyond the station there is a short tunnel, and on the day to which reference is made the guard, partly by an error of judgment in leaving the slipping operation too late and partly owing to defective working of the brake, was unable to stop alongside the platform, the coach running on until it reached the middle of the tunnel from which undesirable situation it was removed and hauled back into the station by one of the horses belonging to the Company used in connection with shunting work in and about the station.

The line approaches Leighton from the direction of London on a down grade of some miles in length, and the speed of the trains on this section is usually very high; therefore it is not surprising that under the circumstances an occasional error is made by the guards whose duty it is to slip coaches off the express trains at this point.

An interesting visit to the Southwark Borough Council's depot was made by members of the technical press recently, when the Patent Lightning Dust Manipulator was seen at work, converting with remarkable rapidity (each manipulator doing 40 tons per day) unpicked house refuse into deodorised fertilising manure.



Slip Coupling in Conjunction with Automatic Vacuum Brake.

Some Accurate Electrical Measuring Instruments.

By V. W. Delves-Broughton.

(*Continued from page* 230.)

Volt- and Ampere-meters.

THE instruments described in the previous articles have been for use in the laboratory, but are not suitable for every-day use, as they are not direct reading. The instruments most generally required for the workshop are volt- and ampere-metres, and as both these can be constructed on the same general lines I propose describing them together.

These instruments, roughly speaking, consist of special forms of galvanometers which are controlled by gravity, springs, or magnets, as the directive influence of the earth's magnetism cannot be depended upon and is not practical in instruments which are fixed to a switchboard or carried about for testing purposes.

There are a vast number of designs for these instruments, and patents are being continually taken out for variations in their construction. The systems on which they work are generally due to the following reactions :—

(1) If two pieces of soft iron—one fixed and the other free to move—are surrounded by a coil of wire, the movable piece of iron will be repelled by the fixed piece of iron to a greater or less extent, according to the intensity of the magnetic field generated by the current flowing through the wire forming the coil—commonly called "Repulsion Instruments."

(2) A piece of soft iron is sucked into a "solenoid," or coil of insulated wire, to a greater or less extent, according to the magnetic field generated in the solenoid—commonly called "Solenoid Instruments."

(3) A piece of iron surrounded by a coil of insulated wire becomes more or less magnetised, according to the intensity of the current flowing through the coil, and tends to attract a piece of soft iron exterior to the coil in a greater or less degree, according to the magnetising effect of the current —commonly called "Attraction Instruments"

(4) A coil hung in such a manner that it is free to move in a strong magnetic field produced by a permanent magnet or an electro-magnet (wound in such a manner that it is saturated at all loads) will be deflected proportionately to the current flowing through the coil—commonly called "Moving Coil Instruments."

(5) Two coils through which currents are flowing tend to attract or repel one another, according to the sense in which the current flows in the two coils, to a greater or less extent, according to the intensity of the magnetic field generated by the current—commonly called "Double-coil Instruments."

(6) Instruments which depend on the heating effect of the current on a wire through which it flows, which causes the wire to expand to a greater or less extent, according to the intensity of the current flowing—commonly called "Hot-wire Instruments."

For this article I shall confine myself to the first two systems, *i.e.*, "Repulsion Instruments" and "Solenoid Instruments," as the others are of little use for amateurs or for general purposes. Repulsion instruments fulfil all requirements. In No. 24 of The Model Engineer series of handbooks, pages 21 to 27, a brief description of these instruments is given, and as far as it goes, is excellent except in one item—viz., the wire nail used to repel the soft iron wire attached to the action. It seems to me to be a bit risky to use a wire nail (which are sometimes made of steel capable of being hardened) for this purpose, as if it became permanently magnetised it would entirely upset the accuracy of the instrument.

Before starting to make an instrument it should be decided how many volts or amperes it is to carry. I therefore subjoin two tables for the wire to be used for different sized volt- and amperemeters.

Amperemeters.

	Capacity.	Wire.		Tube.		Diam.
	Amperes.	S.W.G.	Ozs.	Diam.	Length.*	Flanges.
A	1	20	2	½"	¾"	Sufficient to hold the quantity of wire.
B	3	16	2	½"	¾"	
C	5	14	2	½"	¾"	
D	8	12	2	½"	¾"	
E	10	11	2½	½"	1"	
F	16	9	3	⅝"	1"	
G	20	8	3	⅝"	1"	

Voltmeters.

		Wire.		Tube.		Diam.
	Volts.	S.W.G.	Ozs.	Diam.	Length.*	Flanges.
A	5	36	1½	½"	¾"	Sufficient to hold the quantity of wire.
B	10	38	1½	½"	¾"	
C	20	40	2	½"	1"	
D	30	40	2½	⅝"	1"	
E	60	42	3	⅝"	1"	

Note.—No. 20 wire should be single cotton-covered, the thicker wires being double cotton-covered, and all the wire for the voltmeters single silk-covered. For larger currents than 20 amps. a shunt (non-inductive) resistance is used for amperemeters and a non-inductive resistance is used in series for voltmeters above 60 volts. For really accurate instruments for use on switchboards, etc.—that are always left in circuit—slightly thicker wire should be used for the amperemeters and a greater quantity of wire used for voltmeters.

In the class of instruments that are now being described—*i.e.*, Repulsion instruments—the construction is exactly similar, whether they are used for measuring amperes or volts, except in the wire for winding the coils.

I therefore propose describing the construction of a 10-amp. or 20-volt instrument, the former being wound with No. 11 wire and the latter with No. 40.

The instrument described and illustrated is for standard and testing work, and is provided with a number of refinements which would not be necessary for every-day approximations. The bobbin is formed of two cast-brass ends sweated to a brass tube and the whole split right through one side with a slitting saw. For a voltmeter a short piece of No. 20 wire is soldered to the tube and the whole of the inside insulated with paper discs and tape, allowing only the end of the No. 20 wire to pass through the insulation. To this wire

* Length between flanges.

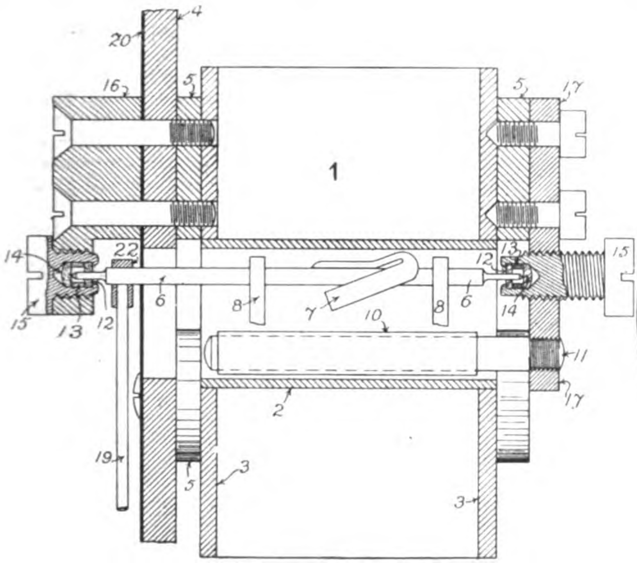


FIG. 1.—SECTION THROUGH COIL.

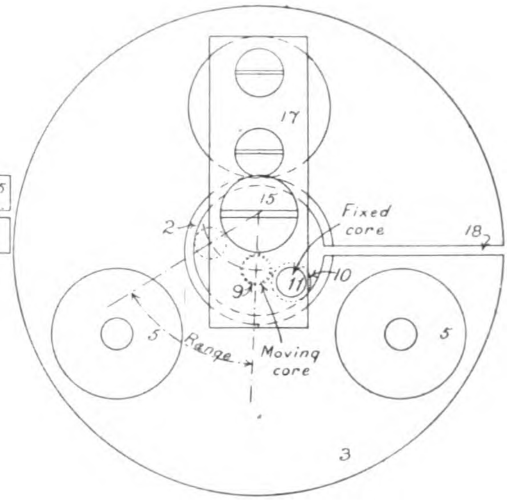


FIG. 2.—BACK VIEW.

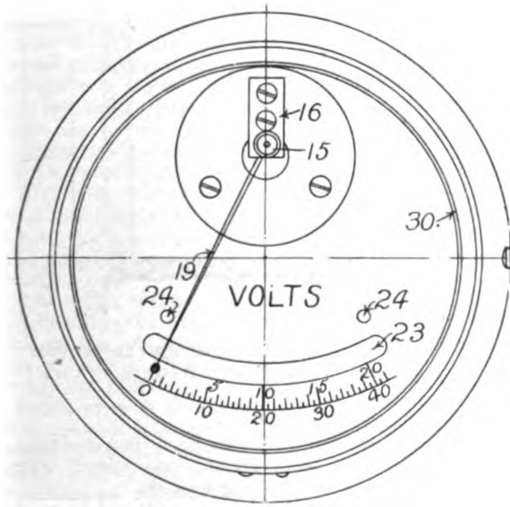


FIG. 3.—FRONT VIEW OF INSTRUMENT.

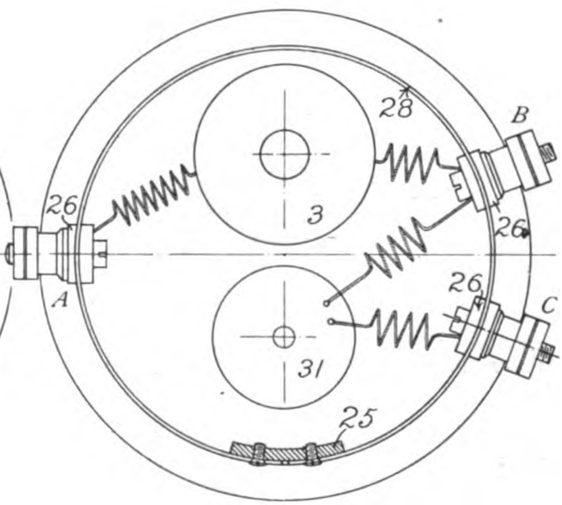


FIG. 4.—FRONT VIEW: DIAL REMOVED, SHOWING CONNECTION OF RESISTANCE COIL.

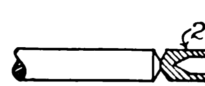


FIG. 7.—HARDENED STEEL CENTRES.

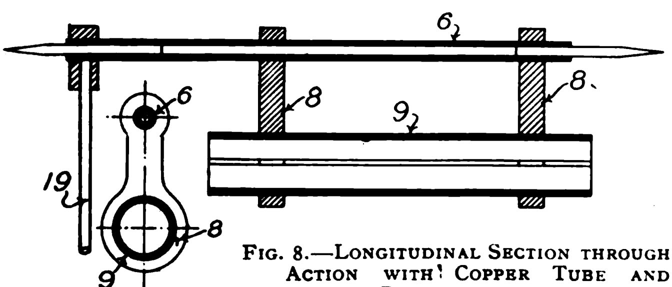


FIG. 8.—LONGITUDINAL SECTION THROUGH ACTION WITH COPPER TUBE AND NEEDLE POINTS.

FIG. 9.—END VIEW.

(*Copper wire balance weights not shown.*)

DETAILS AND GENERAL ARRANGEMENT OF VOLTMETER.

the end of the fine wire is soldered (using resin only as a flux), and the requisite quantity of wire is wound on the bobbin, the last layer being of No. 20 wire D.S.C., again soldered, as explained above.

For an amperemeter the wire is flattened on its end and soldered direct to the tube. The insulation is then put on and the wire wound on, leaving a short length for connections.

The dial is next taken in hand. This consists of a piece of "patent plate" glass, ⅛ in. thick, through which five holes are drilled—four to fit the screws that hold the front bracket to the bobbin, and one sufficiently large to admit the action. Subsequently, this glass is silvered to serve as a mirror to indicate the fact that the index is viewed in a truly perpendicular plane with the divisions; this is shown by the index point exactly covering its reflection whilst reading the scale. The silvering is all removed except a narrow strip corresponding with the slot cut in the paper dial, as shown in the front view of the finished instrument. The holes can be easily and quickly drilled by taking a knitting needle or similar piece of steel, heating a bright red, and plunging into oil. The end is then broken off, leaving a jagged edge, which, used as a drill, will soon penetrate the glass, turps and camphor being used as a lubricant. A sheet-brass jig, with the holes corresponding to the holes required, should be cemented to the glass to act as a guide to steady the drill. When the drill leaves off cutting, a small piece should be pinched off with a pair of pliers to make a fresh cutting edge.

The large hole can be cut out with a piece of soft copper or aluminium tube, supplied with turps and fairly coarse emery powder; or, a small hole can first be drilled, as described above, and then enlarged with a rat's-tail file, using plenty of turps and camphor.

The action is formed of a piece of steel wire, No. 16 gauge, which is turned down to fit the jewels, as shown in the drawings.

At the front end of this spindle a small block of aluminium is fitted, driven on to a slight taper formed on the thicker part of the spindle. In this block a small hole is drilled which carries the index point, which may consist of a seed stem of grass or a bit of fine aluminium wire.

Two celluloid bridles are also made to fit the spindle, with holes 3-16ths in. in diameter, at the other extremity, which carry a cylinder formed out of soft iron bent round to form a nearly complete tube. The gauge of this iron should be about No. 30, and should be the softest obtainable and thoroughly annealed before being cemented in place.

It is sometimes difficult to obtain iron sufficiently thin for this purpose, but thicker sheet can be reduced by dipping in a mixture of strong nitric acid and a small quantity of water. The water should be dropped in a little at a time till the action of the acid becomes energetic, at the same time keeping the iron moving about to prevent the action being more rapid on one part than another. The length of this tube should correspond with the length between the bobbin flanges.

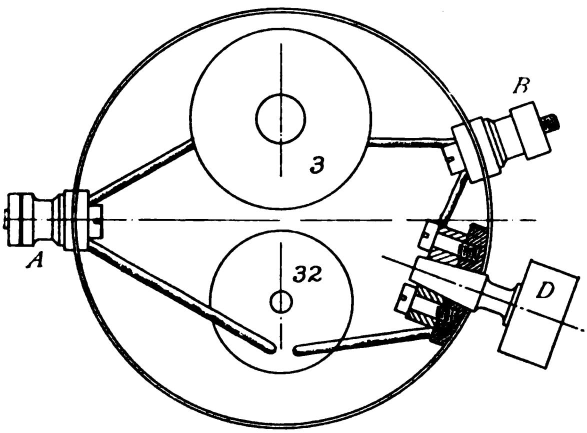


FIG. 5.—FRONT VIEW OF AMPEREMETER WITH DIAL REMOVED SHOWING CONNECTION OF RESISTANCE COIL.

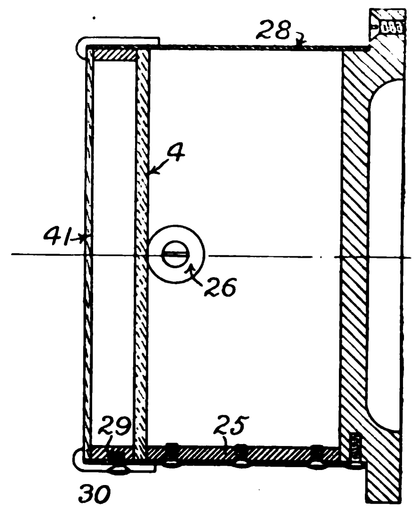


FIG. 6.—SECTION THROUGH AMPEREMETER CASE, SHOWING FIBRE BRIDGE PIECE.

The tube and spindle having been slipped through the celluloid bridles, the whole is cemented in position with a little celluloid dissolved in acetone.

Before doing this, however, a small piece of thick copper wire should be soldered to the top side of the spindle to act as a balance-weight, a portion of this wire being filed away thin, as shown in the drawing, and the whole thoroughly annealed by heating red hot and plunging into water, to enable it to be bent easily, as required, to effect the balance.

The jewels in the screws are fitted as shown in the drawing, a hole being first drilled so that the jewels just fit tightly. Then the end jewel is pushed down with a flat-ended wooden drift, then a small brass distance-piece, and, finally, the holed jewel. To secure the jewels in position the end of the screw is burnished over to form a bead, as shown in the drawings.

The fixed iron core consists of another cylinder of soft iron, similar to the moving core already described, and is carried by a piece of ivory, which is screwed into the back bracket. The whole being now mounted in position, the front is dropped into the case, which may be formed of wood or a brass tube which has been screwed to a piece of fibre and split with a slitting saw (see Fig. 2).

The object of using a wooden case or a split brass case is that the instrument, if constructed on these lines, can be used equally well for continuous or alternating currents, as no eddy currents can be set up in the metal. For a similar reason the greater portion of the silvering is removed from the glass. If, however, the instrument is only to be used for continuous currents, these precautions are unnecessary.

The instrument is provided with a pair of spirit levels or a single circular level (similar to that used for photographic cameras) and the three-legged levelling appliance, as already described for other instruments.

The instrument is next set level, and the divisions marked off on the dial with a fine-pointed pencil, using either another standard volt or ampere meter, as the case may be, or the tangent galvanometer placed in parallel (for volts) or series (for amperes), as a guide to calibrate the instrument (as described in Chapter V in handbook No. 24) finally inking in and numbering the scale. The above describes the construction of a standard instrument with all the possible refinements, but for most practical purposes sundry modifications can be made which will greatly simplify the construction, while at the same time the accuracy will be to all intents and purposes sufficiently great.

First, the dial can be constructed of sheet metal with a slit sawn from the top to the centre hole to cut out eddy currents, bridges of some non-conducting material being used to stiffen the metal where divided.

Then the action can be considerably simplified by forming the spindle out of two needle points (about No. 8 needles) soldered into a piece of No. 16 S.W.G. brass wire drilled out at the ends to fit the needles. This can be done by forming a D-bit out of a needle taken from the same packet. Or a piece of solid-drawn copper tube can be drawn down through a wire plate till it is about No. 16 gauge with a piece of steel wire inside the same thickness as the needles used.

Instead of jewelled centres, hardened steel pieces driven into the adjusting screws can be substituted. These are turned out of silver steel wire, bored and finished inside with a hardened steel burnisher shaped much like a centre-punch, but with a longer point. A nick is cut nearly through at the required length, and the whole is hardened, during which process a little whitening should be well rammed into the hole to prevent oxidisation of the interior. The wire is again chucked, and the hole lapped out with fine emery, etc., finishing off with rouge, and finally removing all traces of the grinding material with dogwood pins. These steel centres, which should be left dead hard, are nearly as efficient as jewelled centres, only the needle points are liable to get damaged.

On most cheap instruments simple brass centres are used, and if properly made, give very good results, although they can scarcely be called theoretically perfect.

If it is determined to make an instrument with jewelled centres, the spindle will have to be turned down on a watchmaker's "hand-turn," being much too fine to turn in any ordinary lathe, and if such an instrument is not available, a working watchmaker will undertake this part for a very moderate sum.

(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.]*

Evaporative Capacity of Model Boilers.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—With reference to Mr. Steele's letter in your issue of April 18th last, I should like to have further particulars on two heads: (1) How the heating surface was measured; (2) how the water was measured, and what precautions were taken to ensure that the water passed out of the boiler in the form of steam. Any priming would, of course, make the rate of evaporation appear high.

I quite agree that the water-tube boiler as applied to model locomotives is generally far more efficient than a fire-tube boiler, but as has already been pointed out in your columns, the whole boiler is slung in the heated gases, and what is and what is not "heating surface" is difficult to determine.
—Yours faithfully, "MODEL LOCO."

London.

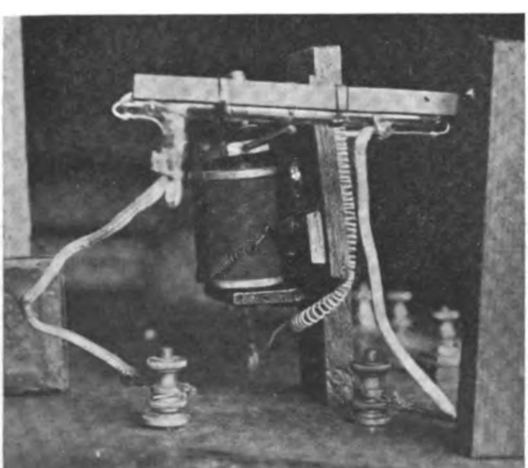
An Amateur's Wireless Telegraphy Work.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I enclose a photograph of a small wireless receiver I have made, which may possibly be of interest to you. The chief difficulty I had was with the suspension of the relay armature. I tried several methods to get a delicate suspension, and finally fixed on the following:—

Getting a ½-in. wire nail with a flattened oval section, I filed the top of it to a knife edge as sharp as possible. To the top of the armature (part of an old electric bell) I soldered two pieces of brass, through which I bored two round holes about ¼ in. diameter. Passing the nail through these, with the knife edge uppermost, I got a fairly delicate suspension. The relay is of the "gravity" type, and works well through 800 or 900 ohms. I first tried to decohere by making the hammer of the bell strike the coherer, but after spending much time over it I could not get it to succeed. I then added a separate tapper (made from an old bell), which succeeds admirably. This I mounted (to get a universal movement) as follows:—Mounting the magnets on a flat piece of wood, I passed a bolt and nut through the latter. Then, cutting a long vertical slit in another piece of wood (shown in the photograph), I passed the bolt through this, clamping the two pieces of wood together with the nut. This allows every scope for adjustment, as the tapper can be put to any height, or inclined at any angle. Of course, the spark at contact point is shunted the same as that of the relay or bell. The six terminals are used thus: from left to right; the first pair for the local battery; the two middle ones are joined to the coherer and are used for connections to earth and aerial; the last two for the coherer cell. I always keep the latter on the baseboard of the instrument ready connected to the terminals in series with coherer and relay. The switch in the middle puts the bell in or out of circuit. The bell and tapper are in parallel, resistance being inserted in the circuit for the latter to make both paths for the current of equal resistance. Two terminals at the back serve to connect it to any other instrument, such as Morse printer, etc. The model works well at several hundred yards with a coil or Wimshurst, and has amply repaid the time and care spent on its construction.

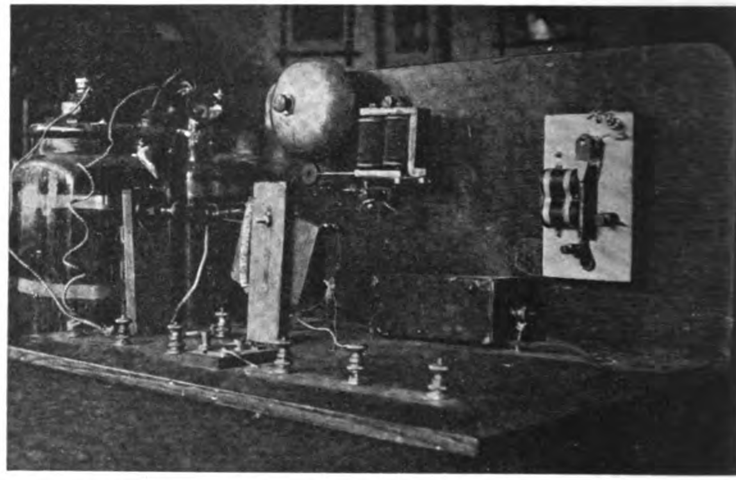
I also send a photograph showing the position of the tapper to the coherer. A glass-covered case fits on to the relay (I have taken it off for the photograph to show the movement of the relay). This prevents the wind, when the instrument is used out of doors, from blowing over the armature and thus closing the circuit. I may add that the first relay I tried



View showing Position of Tapper to the Coherer.

was rather a novel one, consisting of an old Post Office galvanometer. A piece of platinum rod was soldered to the top of the needle the latter was balanced, and the platinum was made to strike against an independent platinum stop. Contact was made with the needle through the pivot passing through the galvanometer coils. This "relay" was fairly sensitive, but had to be discarded, as the needle did not strike the contact "dead," but kept on vibrating backwards and forwards while the filings cohered.—Faithfully yours,

Neath, S. Wales. Lewis Thomas.



Showing Mr. Lewis Thomas's Wireless Telegraphy Receiving Apparatus.

A Forthcoming Model Yacht Race.

A MATCH open to models of 12 mètre (39·4 ft.) rating to European Yacht Racing Union Rule, scale 1 in. = 1 ft., will be sailed on the Round Pond, Kensington Gardens, on Saturday, November 16th, at 11 a.m., under the auspices and rules of the London Model Yacht Club. First, second, and third prizes are given by the Club. Entries, which close on November 2nd, are to be made to the hon. secretary, L.M.Y.C., Kensington Gardens, Kensington, W.

Steamer Speed Experiments.—Interesting experiments are being made, says the *Mechanical World*, by the Belgian Government on the old mail steamer *La Belgique*. Mr. Cannon, an engineer in the service of the State, has invented a system for increasing a vessel's speed, and to test it the steamer was put into dry dock and fitted with a series of pipes having their outlet near the bows. When under steam a part of the vessel's motive power was used to operate air-pumps, which forced compressed air into the pipes. The air escaped under water, rising to the surface alongside the vessel, which was enveloped in a sort of foam, which, being less dense than water, diminished the resistance of the vessel and increased the speed. It was stated that the speed was increased by 7 per cent. under bad conditions. Other experiments are to be made.

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.]*

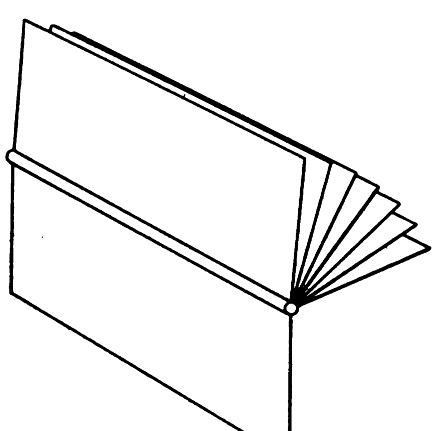
The following are selected from the Queries which have been replied to recently:—

[17,681] **The Smee Cell.** C. D. W. (Croydon) writes: What solution and the proportions are required for Smee's battery for electrotyping; also what acid bath for battery?

The constituents of the Smee cell are: A zinc for the positive in dilute sulphuric acid, and for the negative a platinum plate. The strength of the sulphuric should be (by weight), strong acid 1 part, water 12 parts. A platinised silver or copper plate may be used instead of a platinum plate, but if so, then it should be varnished at its edges. The surface of this plate should preferably be roughened by depositing the platinum on the thin silver plate. This is done by placing the latter in a solution of platinic chloride and passing a current through the solution, using the silver plate as the cathode, when the platinum will be deposited in the form of a fine black powder.

[17,436] **Station Indicators for Trains.** H. A. (Scarborough) writes: Could you inform me as to whether there are any indicators for trains so that when travelling one can see what the next station is going to be? I have an idea for one, but should not like to get it finished and then find I am infringing another's patent, so I thought before I started I would consult your valuable paper?

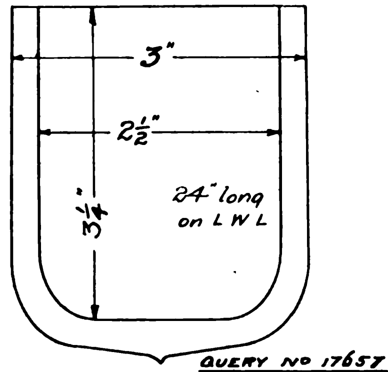
In reply to your query, an apparatus of the kind was in use on the



RAILWAY CARRIAGE STATION INDICATOR.

District Railway some years ago. The thing was mechanically fairly successful, but each train had to be kept to its own particular route, and therefore it interfered with the efficient management of the railway. The thing was placed in the roof, and a projection actuated it on leaving each station. The names were placed on cards slung on a roller. The name of the next station always hung down, as shown. We are speaking from memory, and therefore advise you to turn up the patent records to get definite and fuller information.

[17,657] **Model Steamer Machinery.** H. S. (Birmingham) writes: Will you kindly answer me the following queries. I have made a model yacht, like the enclosed sketch, and I wish to fit an engine and boiler. The steamer requires a ballast of 2½ lbs. to float at the correct water-line. Will the engine, boiler, blowlamp, etc., come to this weight? What size boiler shall I use? I want to drive the boat with a ½-in. by ½-in. slide crank engine to keep the centre of gravity low. Will this engine be large enough? Also what diameter propeller?



SECTION THROUGH MODEL STEAMER HULLS.

You will find it very difficult, if not impossible, to design and build an engine, boiler, and blowlamp of the style you suggest to suit the boat. A load limit of 2½ lbs. will necessitate quite a simple steam engine, say, a light 1½-in. diameter boiler, outside fired (by a small spirit lamp), and a small oscillating engine. A blowlamp is out of the question. Propeller, 1¼-or 1½ ins. diameter. The hull is not of good design and is hardly worth the trouble of converting it to a steamer. If you decide to go on with the work of fitting the hull with an engine, buy a 10s. model steamer with a tin hull and use the machinery from this or else make an engine and boiler on the same lines. The weight of a ½-in. by ½-in. slide crank engine is, roughly, 1 lb. Some makes weigh 21 ozs. The blowlamp would weigh about 1½ lbs. in working order. This totals 2½ lbs. without reckoning the boiler.

[17,513A] **Model Steamer Machinery.** "READER" writes (1) Why do you say in No. 3: "The single-acting engines would use more steam proportionately"? (1) Single-acting engines can be arranged with much shorter steam ports than double-acting engines, therefore less steam will be lost in the steam passages. (2) The pistons (trunks) being much longer than pistons in double-acting engines, they offer a better chance of checking the escape of steam past the pistons. (3) Any defect in the matter of steam leaking past the piston can be easily detected. (4) This type of engine essentially offers facilities for better steam distribution than double-acting engines. Why should not tappet valves, somewhat like petrol motors, be used cutting off at, say, quarter stroke? I am afraid "F. H." will lose much power by using four propellers. One propeller is much more efficient than two, and two are only used on high-speed boats, as a powerful engine working on a single screw tends to give the boat a list.

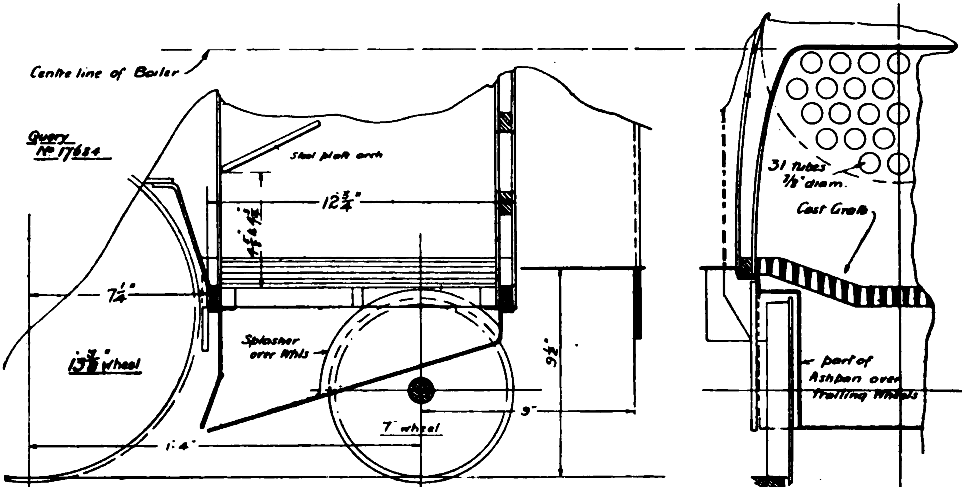
(1) The reason why two model cylinders of equal capacity to a single cylinder will use more steam is because the radiation surfaces are increased in the twin-cylinder engine in proportion to the heat of the steam passing through the engine, and therefore cylinder condensation is greater. See the diagram in "The Model Locomotive" on this subject. This fact explains why small engines are more wasteful than large engines. (2) This is true. The question is—Which is the greater evil? (3) Yes; but it is no good simply detecting it; it is incumbent on the builder of the model to stop the leakage. (4) Yes, this has already been done, with success, and for certain purposes we strongly recommend single-acting engines. We are not in favour of the four propellers except in special circumstances, where the speed of the shaft must be very high and the diameter of propeller small. To get sufficient blade surface, the propeller may then be duplicated. The tendency of a large single screw to give the boat a list is well-known. We have heard it said that on one occasion the engine was so powerful and the single screw so large that instead of the propeller turning the boat revolved round the propeller shaft.

[17,769] **Smoke or Vapour for Clockwork Model Locomotives.** A. G. writes: Can you suggest something that would smoulder and give off an inoffensive visible vapour that could be burnt inside smokebox of clockwork locomotive? I should like to fit a pump worked off cranked axle to make the locomotive puff and thus be more realistic, but am at a loss as to what to use to make the vapour.

Hydrochloric acid (strong) would give off a white inoffensive solid in the form of a smoke when mixed with NH_4OH (ammonia and water or ammonium hydrate).

[17,684] **Model Locomotive Making.** V. H. (Canonbury) writes: I am going to make a model locomotive, and should be very glad if you would answer the following questions. (1) Would it be all right to follow out measurements of G.N.R. "Atlantic" locomotive, three-quarter scale plates V, VI, IX of the "Model Locomotive," by Mr. Henry Greenly, and apply it to 2-in. scale? Should alter firebox for coal fuel, and should not use superheater tubes. (2) In using 5-16ths-in. steel rivets for boiler would it be necessary to make them red hot? Would 3-16ths-in. manganese steel be all right to use for boiler for working pressure of 100 lbs.?

(1) The wide firebox is to be desired as regards the shape of the inner firebox and the very favourable arrangement of tubes which is possible with this style of boiler. For a given amount of heating surface the tubes may be large and the crown of the firebox comparatively low. The deep firebox, however, gives a better fire, and it is debatable whether the wide firebox would give any practical advantages, the two types being considered as a whole. (2) Is the engine intended more as a model, or do you propose to subject it to hard, constant work? In the latter case use 3-16ths-in. plate (best open hearth mild steel boiler plate). Otherwise, 5-32nds in. plate may be used, and to prevent serious corrosion the inside of the boiler may be galvanised. Use ⅜-in. rivets for 3-16ths in. plate, and 5-16ths in. for 5-32nds-in. plate. Where the thinner plate is used the boiler should have longitudinal seams double-riveted. You can drive rivets cold. You will require to re-design the engine. To get the best results with a wide firebox boiler, the cross-section of the box may be as shown in the diagram. The grate, it will be seen, is made basket fashion so that the depth of



ARRANGEMENT OF FIREBOX AND GRATE FOR A 2-IN. SCALE MODEL, G.N.R. "ATLANTIC" LOCOMOTIVE, NO. 251 CLASS.

(*Scale: ⅛th full size for model.*)

the fire is greater in the middle. The arch or deflector-plate may be curved to the same radius as the boiler barrel, if desired. To prevent the dust and ashes falling into the axle-boxes of the trailing wheels the ashpan is shaped like a wheel splasher at this point. The wheels shown are of scale size, but no great difference in the appearance of the engine would be observed if the wheels were made 6½ ins. or 6¾ ins. diameter instead of 7 ins., and firebox and fire would benefit by lowering this splasher. Note the shape of the throat-plate. Thirty-one tubes (⅞ in. diameter) are possible, which will give considerably over 2,000 sq. ins. of heating surface, with the crown only just above the level of the boiler centre.

[17,699] **Starting and Regulating Resistances for Small Motors, Etc.** A. S. C. (Wolverhampton) writes: (1) I have a motor which I have made to drive a phonograph, Simplex type field-magnet, and ring armature 2¼ ins. diameter by ⅞ in. wide, and wound in ten sections with 30 S.W.G. wire, 12 ft. in each section, and magnet wound with 20 S.W.G. (too thick, I think), and made of wrought iron. Armature is also a section of wrought-iron tube. This motor is perfectly successful, and, when tested with volt and ammeters, takes 1-2 amps. at 10 volts, although at 2 amps. it gets rather warm. I wish to run this motor from a lighting circuit, 220 volts continuous, and should be glad if you will inform me what size and quantity of German silver wire would pass the above-mentioned current to it, under the following conditions: (2) Using bare G.S. wire, wound in a spiral on porcelain or slate bar, so that slight overheating would not greatly matter. (3) Cotton-covered wire, wound on a bobbin, to go inside phonograph case. If I should use lamps for resistance, I take it that two 220-volt × 32 c.-p. lamps in parallel will pass about 1 amp. Is this correct? I want to use G.S. or other resistance wire in preference to lamps if in any way possible. I also want to put part of the resistance in with a speed regulating switch, and I suppose I shall have to find quantity of this out by experiment? (4) I want to make a resistance frame to cut down the 220-volt current, to fix on wall, after the style of sketch, using iron wire in loose spirals, to be used for testing, small motors, etc., and to cut down current from, say, ½ or ¼ amp. up to about 4 or 6 amps., which, I should say, is about as much as the wiring of the house (1/18) will safely stand. Please let me know quantity and gauge of iron wire for this purpose.

(1 and 2) Use ½ lb. No. 26 G.S. wire. This will give you approximately 240 ohms and a current of nearly 1 amp., and by arranging this in lengths, connected to the several studs as shown on your sketch (not reproduced) you can cut out as much as you choose, until current is brought up to about 2 amps., *i.e.*, the maximum motor should have. (3) Yes. (4) A similar resistance to the above can be used for this. No. 20 S.W.G. G.S. wire will carry 5 amps. comfortably and has a resistance of 31 ohms per lb. Hence to cut the current down to ¼ amp. a maximum of 880 ohms is needed. But you could arrange to use a finer gauge wire in several stages or sections so that a smaller quantity of wire could be made to answer the purpose. Say make one-third of the total resistance required of No. 28 S.W.G., another third of No. 24 S.W.G., and the last section of No. 22 and 20 S.W.G. (half of each). From a table of resistances given in "Small Electric Motors" you will get the respective resistances of the various wires, from which you can easily figure out the exact quantities required from the formula—

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance.}}$$

[17,635] **About Accumulator Charging, Etc.** J. A. L. (Settle) writes: I shall be pleased if you will give me some information respecting my accumulators. (1) Can I charge an accumulator or accumulators from a 150-amp. 110-volt dynamo which is only running about three hours a day during the present season? It is looked after by a night watchman who knows nothing about dynamos, etc., beyond keeping the voltage at 110 volts, everything having been left straight for him during the daytime by the engineers. One of the accumulators is 12 amp.-hours, rate of charging 1·2 amps.; the other 20 amp.-hours, rate of charging 2 amps. (2) Can an accumulator be charged with a dynamo running only a short time daily as above, and, if so, will it take longer to charge than by continuous running? (3) Shall I do any better by charging in the daytime with the following stoppages: run 6 to 8, stop half hour; 8.30 to 12.30, stop one hour; and 1.30 to 5.30? (4) What volts and amps. should I get charging from the two main switches with, I think, 3/22 wire (wire usually used for five 16 c.-p. 110-volt lamps) as per sketch? Will you please send me a rough sketch for wiring for charging in the least time it is safe to charge the accumulators? Will thicker wire be better? (5) As soon as a 4-volt lamp shines brightly, is the accumulator fully charged, or does it require an hour or two longer? (6) In charging at night

does it matter if the accumulator is overcharged a couple of hours, the night watchman not understanding them? (7) Should the accumulator be cut off from the dynamo when it is standing? Will the charge run back into the dynamo if left connected while it is standing? (8) On pulling one of the accumulators to pieces, I found two of the positive plates badly broken, crumbled away, and in the other cell one positive plate disconnected from the other at the top. Do you think this has been done with the vibration of the motor cycle, as I had not packed it in the case, or through being left connected to the dynamo when it was stopped, thereby causing short circuiting? (9) After charging ten hours on the principle of No. 4 query, and not disconnected during the short stoppages, I can only get 10 or 15 miles of a run before it runs out, and on testing I only get a dim light and the faintest spark. Do you think it is the fault of charging or is my coil at fault (Bassé-Michel non-trembler)? (10) Is ordinary solder suitable for soldering the plates at the top? (11) Does it make any difference as to the amount of current passing whether 110-volt or 105-volt lamps are used? (12) In using the induction coil for ignition in motor cycles are there any means of ascertaining what amperes it is using? I am using a 20-amp. accumulator and it runs down in about 30 miles instead of lasting 600 miles. I have rewired all the machine, still this makes no difference to the accumulator running down quickly. I think it is the induction (plain Bassé-Michel) coil that is at fault. (13) If 150 amps. 110 volts machine be reduced to 4 or 6 volts either by reduction of speed or by resistance board, what amperes will it give?

(1) Yes. Charge through two or three 100-volt lamps in parallel, but the one accumulator will require a longer time than the other. (2) Yes; two or three separate charges will not harm them at all. (3) It is merely a question of time. Charge whenever you have an opportunity. (4) A 16 c.-p. 110-volt lamp takes about ·5 or ·6 amp. (5) Yes, but that is only a rough test. (6) There is no harm in overcharging a little. Yes. (7) As soon as the voltage of charging supply falls below that of the cells being charged, the latter begin to discharge unless they are cut out of circuit. (8) Quite possibly. If the paste falls out, the cell, of course, will probably be short-circuited owing to the paste connecting up the negative and positive plates. (9) You *must* disconnect—*i.e.*, switch off—during the stoppages unless you use an automatic switch or cut-out, otherwise all this time it is discharging. (10) No. Burn the lugs together with pure lead. (11) Yes, a slight difference. See "Small Accumulators," 7d. post free, and study it carefully. See also "Secondary Batteries," by an Engineer, price 4s. 9d. post free. Also "The Management of Accumulators," by Salomons, price 6s. 3d. post free. (12) Compare with another coil or another accumulator. (13) Amperes depend on resistance of circuit and the voltage of supply. You should study Ohm's Law as explained in all text-books on electricity, for example, S. P. Thompson's "Elementary Lessons in Electricity and Magnetism," 4s. 9d. post free.

[17,715] **Model Coil Boiler.** F. H. (West Kilburn) writes: Will you kindly give me advice on the following queries? I have a Stuart 1-in. by 1-in. high-speed engine. I wish to construct a flash generator for same. What bore and length tube would do? I do not want too high a pressure. Could you kindly sketch me the easiest way of building the generator up with as few joints as possible? What bore should the pump be, the pump being driven direct from crankshaft? Shall I want a hand-pump for starting? Lastly, what method of firing do you advise?

You will require not less than 10 ft. of ¼-in. thick tubing. The tube should be of steel if an oil burner is used, as copper or brass tube would be absolutely unreliable for anything but a methylated spirit fire or a gas-ring. Possibly such an arrangement as that described in our issues of July 20th and 27th, 1905, would prove suitable to the work you require. We advise this because you specially mention that you do not require a large amount of work from the engine. The pump should be ¼-in. by ⅜-in. stroke, and be provided with some means of adjusting the feed-supply. You should not require a hand-pump, as a few turns of the flywheel should suffice to start the boiler and provide steam to continue the engine working. Increase the length of boiler tube to get more power and use a larger burner.

[17,610] **Steam Port Proportions.** J. H. (Whiteabbey) writes: Will you please give me the size of ports and exhaust in a slide-valve cylinder, 1⅛-in. by ⅞-in. bore; also the length of lap in the valve?

Steam ports for medium speeded engine, ⅜ in. by 3-32nds in.; exhaust ports, ⅜ in. by 3-16ths in.; port bar, 3-32nds in. wide; lap of valve, 3-64ths in.; length of valve, 21-32nds in.

[17,662] **Broken Drill; Engine and Boiler for Dynamo.** "Electric" (Newcastle) writes: (1) I am making a horizontal high-pressure steam engine, 1⅛ ins. by 2¼ ins. When drilling out the holes for the steam ports at the end of the cylinder I broke about ⅜ in. off the drill about ¼ in. below the surface. The drill is a 1-16th dia. Archimedean drill. How can I get the broken part out? Could I soften the drill by heating up with a blowlamp and then drill it out? And, if so, could I get it hot enough without damaging the cylinder, which is already bored, etc.? I have not room to makes the holes much larger on account of breaking through the brass. (2) What power shall I be able to get out of the above engine, and what is a suitable pressure? (3) What size vertical multitubular boiler will be required to drive the above at full power for three or four hours at a time? What will be the best material to make the same? (4) What size dynamo will the engine drive, and what kind do you recommend?

(1) We recommend heating up the cylinder and drilling the broken piece out; the difficulty, however, will be that the hole will tend to run out owing to the difference in hardness of the broken drill and the brass cylinder. Therefore, endeavour to keep on the right side of the present hole. (2) At 50 lbs. boiler pressure and 500 r.p.m. you will get

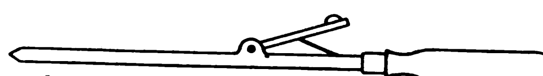
$$A \times L - \text{I.H.-P.}$$

Where A is the area of the piston and L is the length of stroke in feet—

$$A \times L - \frac{9 \times 9}{10 \times 4 \times 12} - \tfrac{1}{6}\ \text{I.H.-P.}$$

(3) To obtain a run of three or four hours with the least possible attention we advise a paraffin burner or a gas-ring. You cannot do better than go in for a vertical multitubular boiler or else a water-tube boiler of the specially large type described in "The Model Locomotive." At the speed and pressure above mentioned, the engine will consume about 5 cub. ins. of water per minute, and for a vertical boiler at least 450 to 500 sq. ins. of heating surface will be required. A well-designed water-tube boiler with superheater need only have about 350 to 400 sq. ins. of heating surface. The vertical boiler should be about 9 ins. diameter by 16 ins. high (without furnace, none being used), and be fitted with eighteen to twenty tubes ⅝ (or 9-16ths) in. diameter. The water-tube generator shown in "The Model Locomotive" should do well as it stands, but may be reduced slightly if you wish to cut the cost of material down to the lowest point. (4) The engine and boiler should manage a 40-watt dynamo very well.

[17,680] **Piston Ring Pliers.** T. P. (Camberwell) writes. I should be much obliged to you if you would kindly let me know to what use the instrument (see enclosed drawing), which I came across some time ago, is put, and would consider it a great kindness, if the drawing should not be complete, if you would put in a few lines and return finished drawing, for which I enclose two sketches



Query 17680

—one for you to keep and one to return to me with reply. Could you tell me where to get it in case it would come useful to me?

From your sketch the tool appears to be a pair of glove stretchers, but if you refer the matter to any fair friend perhaps you will get more reliable information on the subject. No doubt it could be easily converted and employed usefully as a pair of small piston ring pliers.

[17,761] **Power for Chaff Cutter and Circular Saw.** C. E. T. (Stratford-on-Avon) writes: I should feel very grateful if you could answer the following questions. (1) What would be the horse-power required to work an ordinary hand chaff-cutting machine and a 2-ft. circular saw? Also horse-power to drive each one separately? (2) What would be the best power to drive these machines? The electric main wires are half mile away, but gas is used close by. (3) What size accumulator would I require for lighting two 16-volt lamps, with relative candle power?

The power required depends to a great extent upon the rate at which you require to cut chaff and saw your wood. In the ordinary way, a small chaff cutter takes about 1 b.h.-p. to run at, say, 150 r.p.m. The speed is, of course, reduced by 1 to 4 or 1 to 3, the engine running at about 400 revs. A 2-ft. diameter saw would need another 3 b.h.-p. at the least to do ordinary work; the horse-power absorbed would depend on the rate of feeding, and also on the kind of material being cut. We should advise a small gas or oil engine (preferably gas) of about 5 b.h.-p. We recommend you to get a quotation from some of our advertisers. *Re* accumulator: nine or ten cells each, say 15 amp.-hours capacity, and coupled in series.

Further Replies from Readers.

[17,555] **Jointing Material.** I have used the lead foil (sample enclosed) with success for three engines, and I find it is much easier to apply than paper. I simply lay the foil on top of the studs, then press the cover on. If the holes in the cover are a good fit on the studs, small circles will be pushed up through; if the holes are oval, the piece will be found sticking up the side of the stud, being held by one side. The enclosed sample is a capsule used for whisky bottles. If the painted side is put next the cylinder, the cover can be taken off several times without disturbing the packing.—L. A. Turnbull.

The Editor's Page.

IN the very practical articles on "How to Bind THE MODEL ENGINEER," contributed by "Orlando," in our issues for March 28th and April 4th last, the writer wisely advised readers attempting to bind their own volumes to leave the task of cutting or trimming the edges to a bookbinder. Following the appearance of these articles, one of our readers, Mr. J. R. Brown, informs us that he had already bound every volume of THE MODEL ENGINEER, and had successfully trimmed the edges himself by means of the apparatus which he describes elsewhere in this issue. Many of our readers who propose becoming their own bookbinders will be glad to have the particulars of this accessory so that they may complete the work without any outside aid.

* * *

A number of the successful competitors in the last "Gauge" competition seem to be somewhat impatient—judging from some letters we have received—for the appearance of their contributions in our pages, some venturing to suggest that we have mislaid the manuscript, or to express fears that we do not intend to insert them. The fact is that with so large a number some considerable time must necessarily elapse before space can be found for each one. We shall endeavour to publish all of them in time, as space will permit, and our friends must please exercise a little of that virtue which the model engineer in his practical work cannot well dispense with.

* * *

Our Publishing Department informs us that the stock of locomotive engravings is not quite exhausted. We think there are still many enthusiasts among our readers who have not yet taken advantage of this unique opportunity, and we advise such to send without delay, stamp for list of the prints that are still obtainable.

Answers to Correspondents.

"SOUTHEND-ON-SEA."—We should say you require to run machine at a higher speed, and also to have a fair resistance in the main circuit when starting, otherwise machine will not excite, owing to the small amount of current flowing round the field coils. Your windings are correct.

T. J. B. (New York).—Some of the subjects you suggest have been dealt with in our columns in the "How It Works" series, the others will appear in due course.

W. L. A. (Beeston, Leeds).—We are much obliged to you for the information contained in your letter.

W. J. (Quebec).—The contents of your letter were included in the correspondence recently published before we received yours. We thank you, however.

H. M. (Oldham).—(1) Torrance & Sons, Ltd., of Bitton, Bristol, would send you particulars of their crushing mills and machinery. (2) Fine sand is blown at a high velocity against such parts of the glass as are not covered by a mask, with the result that the name or design is apparent, due to the rough surface so produced.

G. H. C. (Worksop).—The material usually employed is fine silk, and this is coated with elastic varnish, the exact composition of which we do not know.

J. H. A. (Coventry).—We are publishing notes on simple locomotives in the next few "Chats on Model Locomotives" articles.

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, etc., 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.

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

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THE

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And Electrician.

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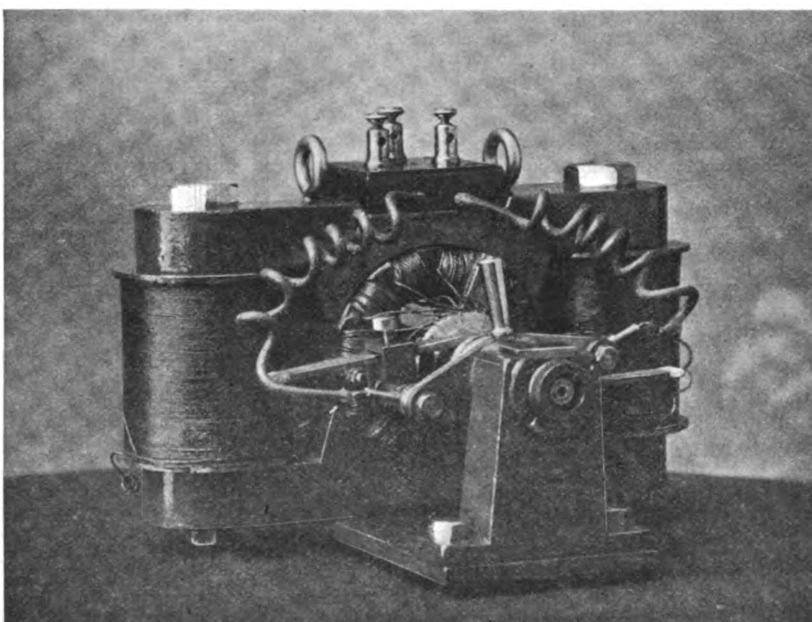
A 150-watt Manchester Type Dynamo.

By G. N. CARLETON-STIFF.



MR. G. N. CARLETON-STIFF'S MANCHESTER TYPE DYNAMO.

THE accompanying photograph is of a 150-watt Manchester type dynamo, the principal dimensions for the fields and armature being taken from Fig. 13, page 20, of THE MODEL ENGINEER handbook, "Small Dynamos and Motors." There are, however, two departures from the drawing given in that book, the ring armature having only twelve sections instead of twenty-four, and the field-magnet cores are bolted to the yokes instead of being carried right through.

After the full-sized drawings were made, the patterns were started in wood. It will be seen from the photograph that the oil catchers for the bearings are separate castings from the bearings themselves, the reason for this being that when I began the patterns I had only a 3½-in. lathe, and should not have been able to bolt the bearings to the faceplate in order to bore out the interior of the oil catchers if the latter had been cast in one piece with the bearings.

The commutator has twelve bars, each bar being a separate casting. The pattern for these bars was made by turning a hollow wooden cylinder from a piece of hard wood to the size and shape of the finished commutator. This wooden cylinder was then carefully divided into twelve equal sections by pencil lines, and one of the sections sawn out with a hacksaw having fine teeth; all the brass bars were cast from this one pattern. Any rough projections found on the sides of these cast bars were smoothed off with a file; they were then arranged in a circle on the bench, and a piece of wet asbestos millboard about 1-16th in. thick placed between each. They were then all squeezed up together in a special clamping ring, the whole being chucked in the lathe by this ring while the centre of the commutator was bored out, and a rabbet turned at each end for the clamping rings. The commutator was then mounted on a brass bush in the usual manner, asbestos washers being used at the ends in place of the mica or fibre usually recommended. The outside of the commutator was finally turned up when the latter was mounted on the armature-shaft and the armature wires soldered in the slots prepared for them. The object of wetting the asbestos before using it is that it can be compressed to a much greater extent, and takes the form of the clamping rings, etc., much more readily. Before testing the insulation between the commutator bars, it is necessary to dry out all the moisture by placing the commutator in an oven for an hour or so.

Soon after the dynamo was begun I became the possessor of a 4-in. screw cutting lathe, which enabled the armature tunnel to be bored without much difficulty. In order to make a boring bar an old broken cast-iron pulley was obtained. This pulley had four spokes, and a hacksaw was passed through each spoke at a distance of about 2¼ ins. from the centre of the hub. The hub with the four spokes sticking out from it was then mounted on a mild steel bar between the lathe centres, and the ends of the spokes turned down until the diameter was about 4¼ ins. A ¼-in. hole was then drilled in the end of each spoke, and a cutter made from ¼-in. round tool steel, inserted in each hole, the cutters being held tight by clamping screws in the sides of the spokes. This arrangement made a most satisfactory boring bar, the field-magnets being mounted on the slide-rest saddle, which was traversed by the lead screw. It was found necessary to pack the head and tail stocks up about an inch, oak strips being used for the purpose. The armature shaft is turned from mild steel, the part which carries the armature spiders being ⅝-in. diameter, and the part on which commutator is mounted is 23-32nds in. diameter; the diameter in the bearings is ½ in. The bearings are bushed with brass, the bushes being secured in place by small grub screws.

It will be noticed that no provision is made for drawing off old and dirty oil from the oil wells; it was, however, intended that small brass taps should be fitted in the sides of the bearings for this purpose. The dynamo has (at the time of writing) been in use for ten months, and the oil appears as clean as on the day it was first put in. The wire on the armature and fields is slightly in excess of the quantity given in The Model Engineer hand-book, the armature being wound with about 2 lbs. of No. 20, and the field-magnets with about 6½ lbs. of No. 22.

I am not able to say very much about the working of the dynamos, as my engine (a 2½-in. by 4-in. gas engine) is not sufficiently powerful to drive it up to its full output, which is 50 volts 3 amps. I, however, use it regularly for charging three accumulators, which it does very satisfactorily, a resistance being placed in the field magnet circuit so as to reduce the voltage. One cell of an accumulator is sufficient to run it slowly, as a motor, and three cells will run it at a good speed, but it would of course take 25 cells to enable it to develop its full power as a motor.

Some Wrinkles in Model Making.

(*Continued from page* 556.)

FROM injectors Mr. Ferreira went on to discuss the question of making successful water gauges of small size. He said that he had experienced no trouble with gauge glasses as small as 1-16th in. bore, but to obtain accurate readings of the water level the gauge fittings should have a clear way through them of not less than the inside diameter of the glass. The other necessary precaution is to get rid of the air. It is this air-lock which prevents the gauge giving a correct level, and although he did not advise the usual cocks, the bottom blow-off cock is absolutely necessary. When steam is up, open blow-off cock, and allow the air bubbles to be blown out, and on returning the cock to the normal shut-off position (with the handle down), the gauge should indicate the proper level of the water. To prevent differential pressures occurring afterwards, the gland nuts must be quite

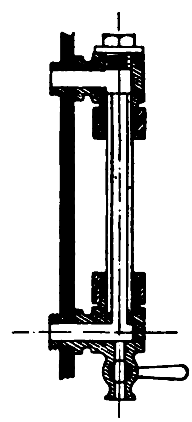


Fig. 7.
Section of Small Water Gauge.

steam- and water-tight, and the form of packing Mr. Ferreira has found most satisfactory is a thin slice off a piece of indiarubber tube of suitable size.

The construction of a small water gauge recommended by Mr. Ferreira is shown in the accompanying sectional drawing (Fig. 7). The bottom fitting, it will be seen, is not drilled down the size of the glass right through to the horizontal passage to the boiler, but is arranged to form a shoulder upon which the glass rests. Otherwise, the glass would fall through and block up the passages. The gland nuts and the holes in the fittings for the glass should be quite an easy fit, so that there is no tendency to bind on the glass and cause the latter to fracture when the packing is being tightened up. The nuts should screw on to the outside of the gauge fittings, as shown in the sketch. The cap is, of course, necessary to put the glass into position.

With regard to glasses, the lecturer mentioned that he made some model water gauges with a 1-16th-in. glass, and as he had no suitable glass for the job, he "drew down" a ¼-in. gauge glass for the purpose. The method adopted was very simple. About 1 in. of the tube was slowly heated over a Bunsen gas burner, and when it attained a dull red heat and the heated portion began to sag, it was stretched out with a sudden pull. ("Just like you would toffee," interpolated a member in the front row.) It was found that a length could be cut from the drawn-out portion which was exactly suitable in all dimensions to the model gauge being made, and perfectly clear and regular in the bore. Moreover, the red streak in the original glass was reproduced in correct proportions.

The construction of small water gauges led on to the making of plug cocks. Mr. Ferreira mentioned that he made all his own cocks and also the

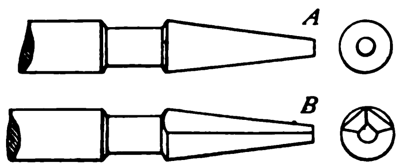


Fig. 9.—Reamers used for Making Small Plug Cocks.

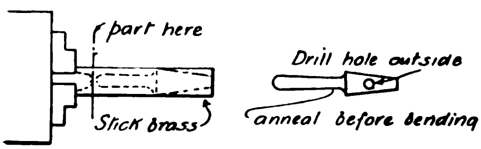


Fig. 10.—Turning the Plugs.

necessary reamers used in their production. Some time ago he was commissioned to make a two ⅛th-in. scale models of one of Dewrance's water gauges with packed plugs. It was, of course, out of the question to copy the internal arrangements of these patent plug cocks, but by making plain plugs with a hexagonal head and nut (see Fig. 11), Mr. Ferreira was able to accurately represent the exterior features of the actual water gauges. The reamers used by the lecturer are shown in Fig. 9 herewith. A piece of steel is turned up, as shown at A, and then two flats are filed on the conical part, as indicated in sketch B, and the reamer hardened.

Fig. 12.—Firing Model Boiler with Coal Fuel.

The slide-rest is marked or kept set to the same angle, and the plugs turned up out of rod brass, as shown in Fig. 10. The hole is drilled in the plug outside, and not whilst in place in the body of the cock, and the handle is annealed by making the plug red hot and bending the handle when it is cold in the usual way.

Talking about the running and firing of steam models, Mr. Ferreira said that he had been quite successful in working a boiler with a grate 3¼ ins. square with a coal fire. To start the fire charcoal is used. In the case of Mr. Ferreira's own engine the fire-door is fairly large and low down, and the fuel is ignited by blowing on the charcoal with the flame of a blowlamp, as shown in Fig. 12. The fuel is

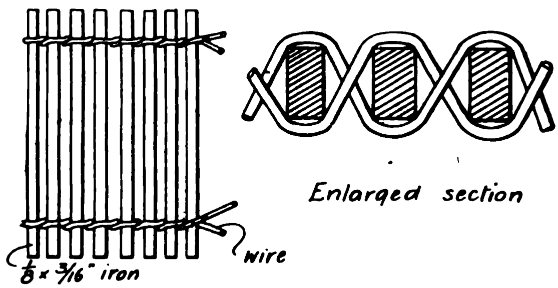


Fig. 13.—A Simple Model Fire Grate.

heaped up at the back as indicated. Any blowlamp may be used, quite an old-fashioned style of methylated spirit-vaporising lamp being employed by M. Ferreira.

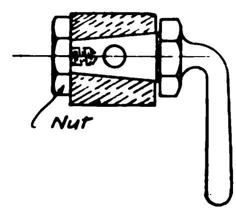


Fig. 11.—Plug Cock.

The task of making fire grates is rendered very easy by the method shown. A couple of 1½d. household gridirons are obtained—gridirons formed of ⅛ in. by 3-16ths in. square iron rod bent to the usual gridiron shape, the ends being twisted up to form the handle—and the material is cut up to form a series of bars of the given length. These strips are then bound up with iron wire of about 20 S.W.G., as shown in the sketch, the number of twists in the wire between the bars regulating the size of the air-spaces.

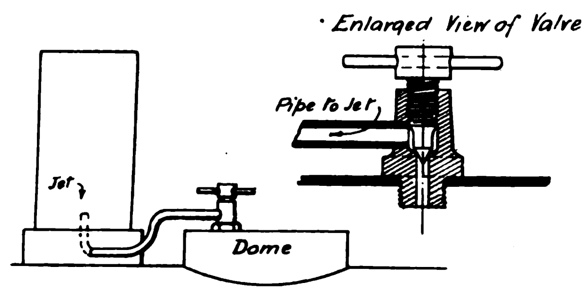


Fig. 14.—A Simple Blower Valve.

For inducing a draught after steam is once obtained, a steam-blower, of course, should be used. The type of valve recommended by the lecturer for this and other purposes is shown in Fig. 14, and resembles in its construction the release valve used on Primus stoves and blowlamps for allowing the air-pressure on the top of the oil to escape. The exit hole is, however, connected to the blower jet by a pipe, and the head of the screw-down pin-valve provided with a handle more in keeping with model practice.

As there is some little difficulty in making such a valve absolutely steam-tight—the valve cannot be ground in, and if the metals are hard, a steam-tight seating cannot very well be made by forcing the pin valve down into the orifice—Mr. Ferreira tips the end of the valve with a small blob of solder, and when the pin valve is screwed down this solder is squeezed

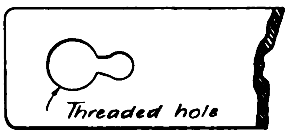


Fig. 15.—Special Die for Fine Threads.

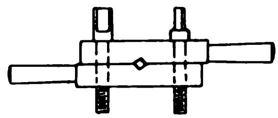


Fig. 16.—A Neat Tap Wrench. (*Half size.*)

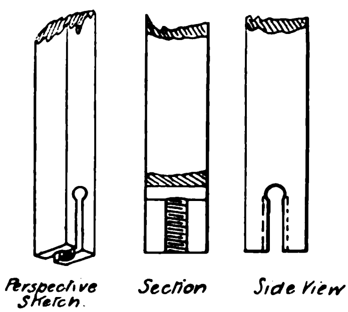


Fig. 17.—Special Die for Screwing in Awkward Corners.

into shape, and beds properly on the seating of the valve. It may also be easily re-seated at any future time should occasion so require, but once properly seated, such a valve seldom, if ever, leaks like a plug cock would do if constantly used.

In making all boiler fittings Mr. Ferreira adopts sixty threads per inch, as a standard for all sizes. He finds that a fine thread improves the design of fittings and at the same time is easy to chase. He has a standard chaser, and from this makes any special taps or dies required. For the latter he advises only one clearing hole and cutting edge, as shown in the drawing herewith (Fig. 15).

Fig. 17 shows a special die made for screwing a stud in an awkward corner where the ordinary screwplate could not be used. The construction is clearly shown by the three views, and further description is unnecessary.

Fig. 18 shows a method of making temporary thumb-screws for work fitted to wood bases or blocks. The device is very simple and easily made, consisting of an ordinary washer soldered into the slot of a wood screw. The washer should fit the wood screw tightly, and should measure about ¾ in. diameter for a 1¼-in. or 1½-in. wood screw.

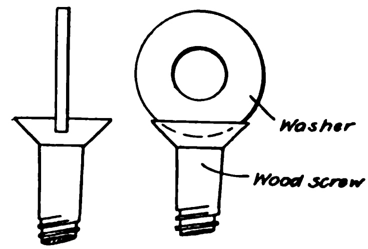


Fig. 18.—An Easy Method of Making Temporary Thumb-screws.

To obtain success with stationary and marine engines, where comparatively long runs of steam pipes are necessary, Mr. Ferreira strongly recommended lagging the pipes. He uses cotton string —the white string about 3-32nds in. diameter. This gives an excellent finish if it is wound on tightly—(" It hides the bad steam pipe bends,"

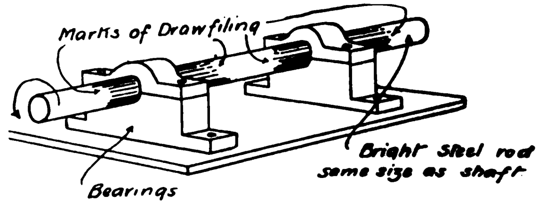
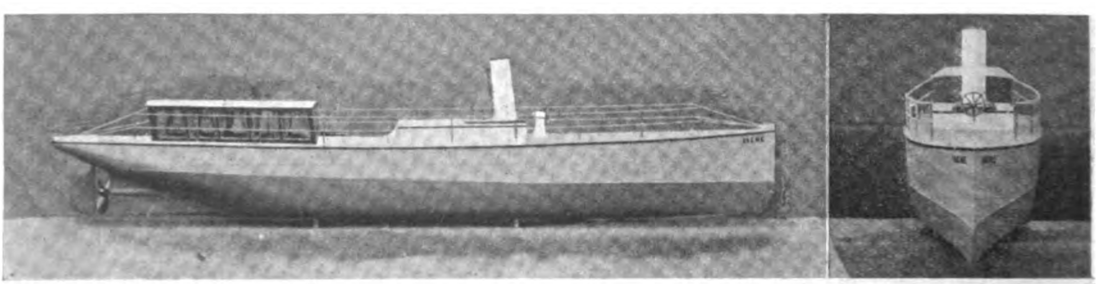


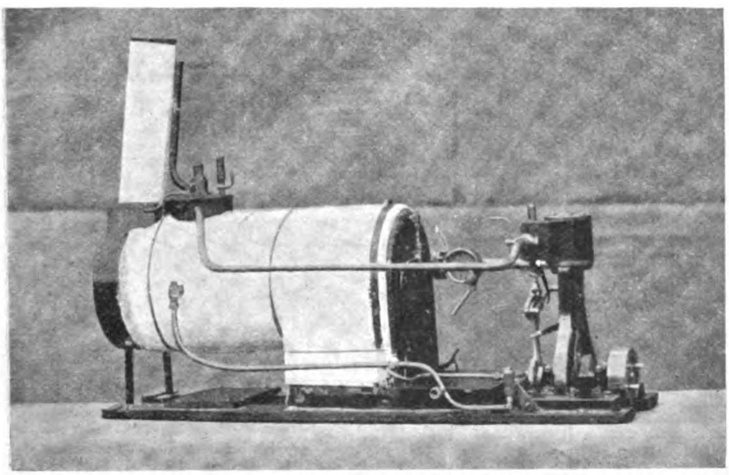
Fig. 19.—Showing Method of Reamering Engine Bearings.

said the front row member again)—and also acts in a very efficient manner as a heat-protective covering. Very little heat is conducted through the covering, owing, it would appear, to the large amount of air-spaces present in the material and to the method in which the pipes are covered (*i.e.*, by coiling), so much so that the hand can be borne on pipes through which live steam is passing without the slightest discomfort. To prevent the covering unwinding the end of the string should be passed under the last two or three turns and pulled taut.



Two Views of Mr. Ferreira's Model Steam Launch.

During the paper Mr. Ferreira referred to his own model, and by his permission we are able to reproduce a photograph of this well-made engine and boiler, and also two views of the boat in which the machinery is fitted. The model was made about twelve years ago, and although the construction involved most of the "dodges" described above, there is one point which has not been dealt with. It is very important that engine bearing should be truly in line, and to ensure this being the case in the engine illustrated in the photograph, Mr. Ferreira devised the simple reamer shown in Fig. 19. As indicated, this reamer consisted of a plain piece bright steel rod, which, as we all know, is generally hard enough, however mild it may be, to cut brass. This rod is of the same size as the finished crankshaft and is placed in the vice and draw-filed with a coarse file. Draw filing, we may say for the benefit of those beginners who are not familiar with the term, is done by holding the file by two hands across the work and drawing it backwards and forwards *along* the rod, in a direction parallel to the length. In the present case, it provided a series of longitudinal deep scratches in the rod which, when the rod was placed in the bearings and rotated—the bearing caps being screwed down as the operation proceeded—resulted in a pair of well-finished bearings in absolute alignment. The cost was practically insignificant, as the rod was used up afterwards for a more "legitimate," shall we say, purpose.



ENGINE AND BOILER OF MODEL STEAM LAUNCH.

TO LIVERPOOL READERS.—It is proposed to start an Electrical Society with a view to having regular meetings for lectures, discussion, and social intercourse, and anyone interested in electricity is invited to join. If interested readers will send a stamped addressed envelope to Mr. S. Frith, 77, St. John's Road, Bootle, Liverpool, he will be pleased to advise them of a preliminary meeting. The Society will be controlled by a Committee elected by the members, and it is expected the subscriptions will be low.

Planing and Shaping for Amateurs.

By A. W. M.

IV.—WORKING THE MACHINE.

(Continued from page 558.)

AN example of planing out a link from a rough solid block of metal is given in Fig. 55, and the part to be cut out is indicated by dotted lines. As a preliminary process the block should be rough-planed all over. The dimension lines to which it is to be planed are then to be marked on, and clearance spaces C, D must be cut at each end to allow the tool to commence and finish its cut as previously explained. These spaces can be cut by drilling several small holes as at C, and cutting between them with a saw, or by drilling a large hole as at D; the corners and sides being finally cut out square to finished size. The block is then clamped to the machine table and the centre piece V cut out by planing two grooves S and T with a parting tool (Fig. 56). You need not carry the cut completely through, but leave a very thin piece at the bottom of each groove to be cut away by chisel. This will avoid risk of cutting into the table. The parting tool should have tapering sides as indicated at A, Fig. 56, so that it will not bind in the grooves. To ensure that it is set with this clearance upright, use a small try-square as indicated at A, placed first at one side and then at the other. Such a small try-square is very useful to a planer, and enables him to set his tools and test his work more conveniently than with a square of usual size.

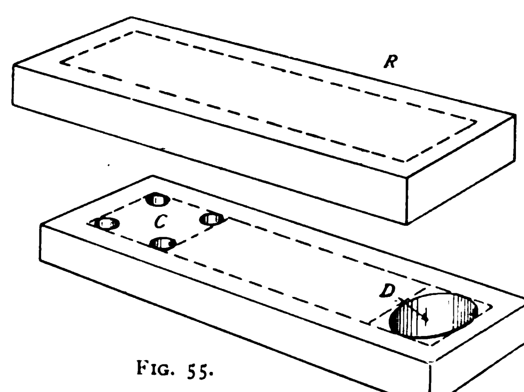


FIG. 55.

If the stock be about ¾ in. and blade about 1 in. in length, it will be quite large enough.

The parting grooves should not be cut upon the dimension lines, but about 1-16th in. or so away, so that a margin is left for finishing, as F F, Fig. 57, which represents the link with centre piece removed, but still in a roughed condition. The margin F F is finally planed away, and the surface finished to size by tools such as Figs. 7, 8, 15, and 16, according to the metal of which the link is made. When the inside surfaces are finished the outer parts are planed with finishing cuts, each surface in turn.

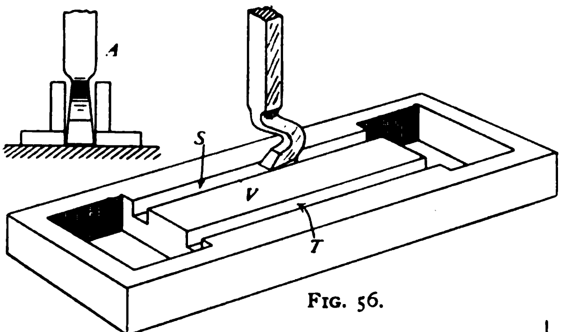


FIG. 56.

Though the cross-slide of a planing machine is supposed to be accurately parallel with the surface of the table it may not actually be so, owing to the necessity for raising and lowering it to different heights, according to the size of the work. The movement is usually made by vertical screws, one

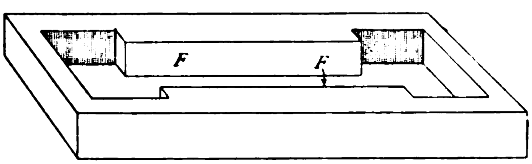


FIG. 57.

in each standard, geared together by bevel gearing, so that they rotate in unison, working through nuts placed in the ends of the cross-slide. If the screws are exact to pitch and all the connecting parts accurately made and adjusted, the cross-slide may be

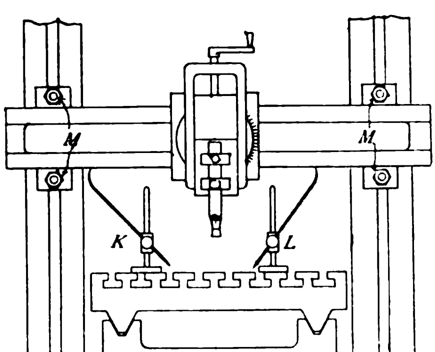


FIG. 58.

perfectly parallel to the table at any height. In practice some small inaccuracy is likely to be present, due perhaps to wear, and the slide may be at a slight angle to the table, differing according to its particular position. As this will interfere with the accuracy of the finished work, you should try the position of the cross-slide by means of a surface gauge, Fig. 58. Adjust the scriber point so that it just touches the machined surface of the slide ; if a V-slide, the scriber point should be applied to the lowest corner of the V. Try the gauge at both ends of the slide K and L, the clamping bolts having been tightened up. If it is not parallel to the table the point will not make equal contact at each end, and you will see which way it should be set to be parallel. Slacken the clamping bolts until the slide is held lightly against the standards, and rotate the screws by a very small amount one way or the other until you can feel

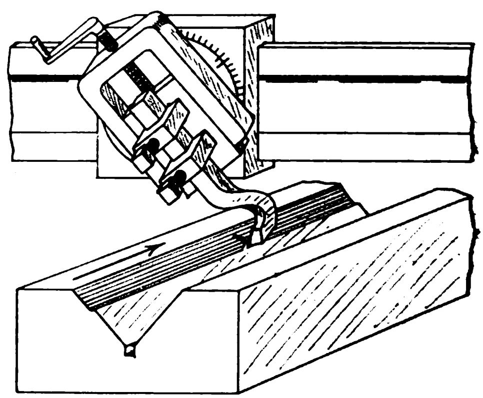


FIG. 59.

that they do not strain against the nuts; then shift the ends of the slide up or down by tapping them with a block of wood and hammer until the surface gauge shows that the slide is accurately parallel to the table; finally tighten up the slide

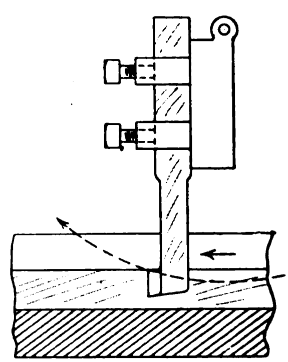


FIG. 62.

clamping bolts. This adjustment will only serve for that particular setting of the slide. When it has been moved up or down to a new position, the test should be made again and adjustment effected, if found necessary.

Surfaces at an angle less than a right-angle to the table can be planed if the vertical slide is provided with a swivel movement by which it can be set to slant in either direction from the vertical. A graduated index is usually added, so that the degree of angle can be determined. Two examples of angle planing are given in Figs. 59 and 60; the cut should be fed in a downward direction. Certain kinds of planing will present difficulties peculiar to the particular instance and require a tool to be made to suit the job. Planing a T-slot as Fig. 61 is an example. A pair of tools will be required to cut

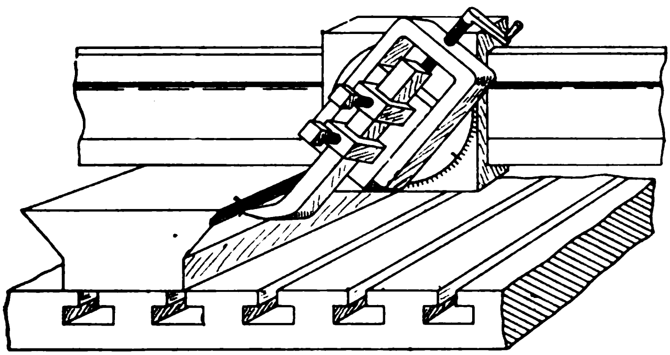


FIG. 60.

each side of the slot, as at A and B. They can be so shaped that tool A will cut surfaces 1, 2 and part of 3. Tool B will cut surfaces 4, 5 and also a part of surface 3. The central part of surface 3 is to be planed first, and can be reached by means of ordinary straight tools. The other surfaces of the slot and remainder of 3 are then planed; with care the cuts upon 3 can be made to meet evenly. It is

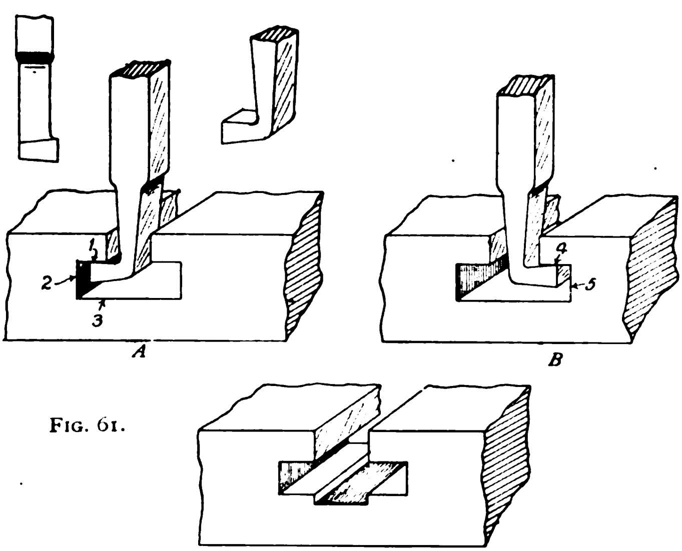


FIG. 61.

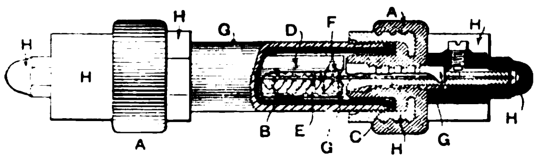
necessary to fasten the hinge of the tool box so that it cannot open when using tools A and B. If the tool is allowed to swing upon the return stroke it will dig into the work. As shown in Fig. 60 it moves in the arc of a circle, as indicated by the dotted lines, and its point therefore will move upwards and catch the work unless the tool box is made fast.

(To be continued.)

The Latest in Engineering.

An Electrical Theatre Equipment.—The electrical equipment of the new Stuyvesant Theatre, in New York, will embody several novel and interesting points. According to the *Electrical World*, no chandeliers nor brackets will be visible in the auditorium. Instead, the clusters of electric lamps will be enclosed in the space between the fireproof roof of the building and a ground-glass ceiling. The ceiling will be supported by ribs, and thus present a panelled appearance. The lamps beneath the balconies are to be similarly contrived. Behind the scenes—for stage effects—there are to be no less than 4,000 lamps, with a number of new contrivances for obtaining all degrees of brilliancy. The distance from the floor of the stage to the roof above is 92 ft. Above the stage are to be two large fly galleries on both sides. All the "drops," as well as the curtain, are to be raised and lowered by electric motors. The centre of the stage is occupied by the platform of a large electric lift, and below the stage are two separate floors. The purpose of this arrangement is to change the stage settings between acts more rapidly. One stage setting need merely be pushed on the lift and lowered to either of the floors below, where it can be stowed away.

A Non-explodable Enclosed Fuse. — A new form of steel-cased tubular fuse, which is claimed to be absolutely non-explodable, and which should prove useful where enclosed fuses are essential, has been placed on the market by Messrs. Verity's, Ltd. The fuse was designed by Mr. Peard, whose switchboard fuses are well known, and is shown partly in section in the accompanying figure. The parts of which the apparatus is composed consist of an outer steel case, steel end caps, a permanent insulating lining, asbestos packing rings, end insulators and brushes, a terminal stem steel ferrule, fuse terminal stem locknut caps securing fuse, renewable iron guard washers, the tinned copper fuse wire, a set of renewable filling discs, a renewable line, and the external brass contacts. As the fusible conductor is entirely enclosed in a steel casing, no molten metal is scattered and no flame emitted. The construction of the fuse ensures a low thermal capacity, resulting in a small time element, and the arrangement of the filing material results in the volatilisation of only a very small quantity of metal, and instantly suppresses any arcing. The permanent parts of the holder are undamaged by the fuse blowing, and may be kept in constant use. The internal insulation is protected from metallic deposits or films by the secondary mica tube, while the terminal ends are similarly protected from deposition of molten metal by replaceable iron washers. Exhaustive short-circuit tests have been made, and even under



A Non-explodable Enclosed Fuse.

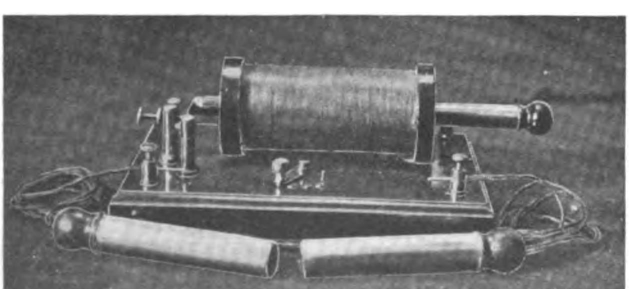
A, Moulded Insulators; B, Renewable Filling Discs; C, Asbestos Packing; D, Renewable Liner; E, Copper Fuse Wire; F, Mica; G, Steel or Wrought Iron; H, Brass.

these conditions the circuit has been instantly severed with entire absence of noise, metallic vapours, or flame. The fuse should be specially useful in connection with the sectionalising of distributing mains, and it is particularly suitable for use underground. Two sizes are made, which can be fused for current up to 50 and 200 amperes respectively.—*Electrical Engineering.*

A Shocking Coil.

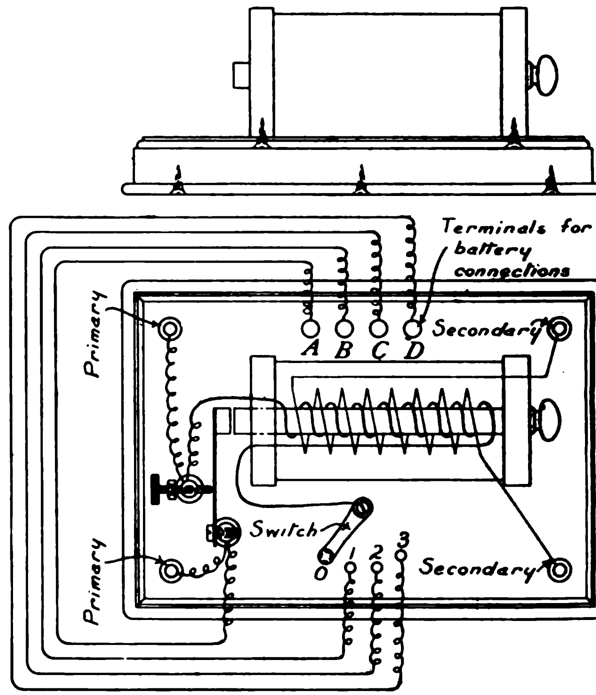
By J. G.

THE following is a brief description of a shocking coil I have made. The base is worked up from a piece of baywood, and is nicely polished. The bobbin ends are made of beech, which I turned up in the lathe. To make the core I packed the regulating tube with lengths of No. 23 soft iron wire. I then drew the core from the tube for a distance of ¾ in. and twisted a piece of wire round it, and as the core was drawn from the tube,



General View of Shocking Coil.

pieces of wire were twisted round at intervals of 1 in. to keep the core the right shape. I then dipped each end of the core in a tinning tank, which made a good job of it. The paper tube on which the primary winding is wound is made on the same principle as explained in The Model Engineer Handbook No. 11, "Induction Coils," page 22, which I consider a very good method. The bobbin ends were then fixed on the tube and shellac varnished, where the primary is wound on. A 1-16th in. hole was drilled through one of the



Views of Coil showing Connections.

bobbin ends close to the tube, and the primary wire (No. 20 s.c.c.) was threaded through from the inside, leaving about 12 ins. for connecting up. I wound on four layers and then drilled another 1-16th in. hole through the bobbin end, and threaded the finishing end of primary winding through, leaving a short length for connecting. I put up a sheet of paraffin waxed paper between the second and third layers of primary winding. I insulated the primary from the secondary with paraffin waxed paper, and then wound the secondary winding on ten layers of No. 36 d.c.c., putting sheets of paraffin waxed paper between each layer, and brought the starting and finishing ends through holes drilled in the opposite bobbin end to that which was drilled for the primary. I may say I purchased the contact-breaker. Three batteries can be connected up to the terminals *A, B, C, D* on coil, and operated by the switch as required. It is a very powerful coil. A very decent shock is obtained from the primary terminals and the secondary is more than several persons can stand. All the connections given in sketch are enclosed under the coil, the bottom being screwed on. The bobbin ends are painted black and then varnished. The top layer of secondary winding is covered with a dummy winding as a protection and then painted dull black, and the handles are made from an old bicycle pump.

Some Accurate Electrical Measuring Instruments.

By V. W. Delves-Broughton.

Volt- and Ampere-meters.

(*Continued from page* 571.)

If the instruments described in the last article are required to have a larger range than can be obtained conveniently by direct reading, the range of the instrument can be increased by placing a resistance in series for volt- and in shunt for ampere-meters.

First, considering voltmeters. If the resistance is made equal to that of the coil and the ends be connected to three terminals, so that one end of the voltmeter coil is connected to A and the other end to B, and one end of the resistance to B and the other to C, a double-scaled instrument will be formed, so that, supposing the simple coil registered 20 volts, the combined coil and resistance would register up to 40 volts, and each division on the scale would show exactly double the voltage.

In this manner, by simply calibrating for the coil without the resistance, the scale for the higher voltage with the resistance in series can be marked off. In a similar manner other resistances can be put in series. Thus, if a resistance twice as great as the resistance of the coil be put in series, the reading will be increased three times, and a resistance equal to three times the resistance of the coil will increase the reading to four times, and so on.

For amperemeters the reading can be increased by putting a resistance in shunt. If this resistance be equal to the coil, the reading will be doubled; if one half, the reading will be three times as great; and if one third, four times as great; and so on.

In both these instruments non-inductive resistances must be used, *i.e.*, the wire must be wound with a double bight, as explained in reference to resistance-boxes. For voltmeters it is most convenient to use high-resistance wire of about the same gauge as that used for winding the main coil. For amperemeters the same wire as that for winding the main coil can be used for the resistance, using the same length in each coil, and if a greater reduction of resistance is desired, two or more wires are put in parallel, as required.

For a number of purposes it is convenient to have a voltmeter which will have a very open scale, but only a limited range. For instance, a volt-

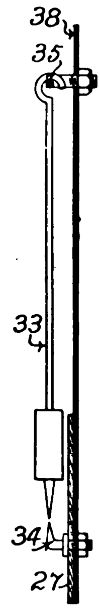


Fig. 12. Section through Dial.

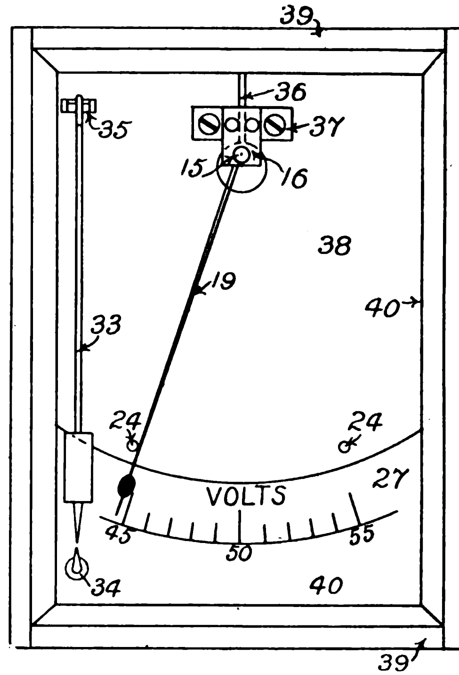


Fig. 11.—Voltmeter with Stopped Action and Independent Zero Pointer, in Wooden Case.

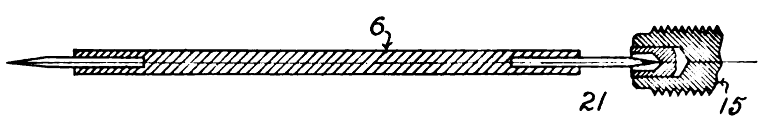


Fig. 10.—Spindle formed of Brass wire, showing how Needle Point rests in Steel Centre.

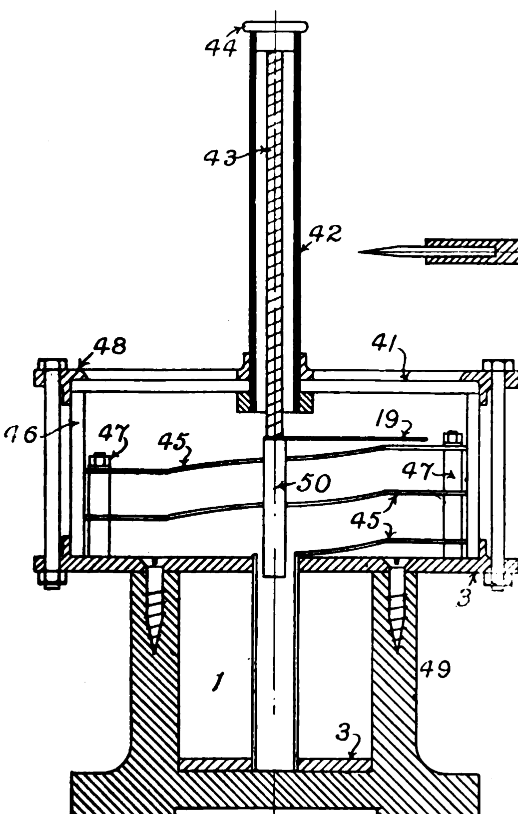


Fig. 14.—Section through Solenoid Instrument.

meter may be required for a dynamo working at 50 volts. If any pretence is made to keep the dynamo running steady, the variation on each side of 50 volts will be slight. It is, therefore, unnecessary to show on the scale more than 5 volts on each side of the normal, so that the whole space available can be used to show a scale of 10 volts from 45 to 55, and thus a very open scale can be obtained which will be visible from a distance and obviate the necessity of walking up to the switchboard every time an observation has to be made.

Such an instrument can be made by balancing the action in such a manner that the index will rest hard up against a stop till the voltage rises sufficiently to cause the deflection of the pointer. Instruments of this class must be permanently and securely fixed before being calibrated, or an independent pointer working by gravity on the principle of a plumb-bob must be provided (see Fig. 11).

A Solenoid Volt- or Ampere- meter.

Another type of instrument suitable for an amateur to construct, and entirely free from pivot friction, is that which was first described by Messrs. Ayrton and Perry many years ago, but seems to have dropped out of use entirely.

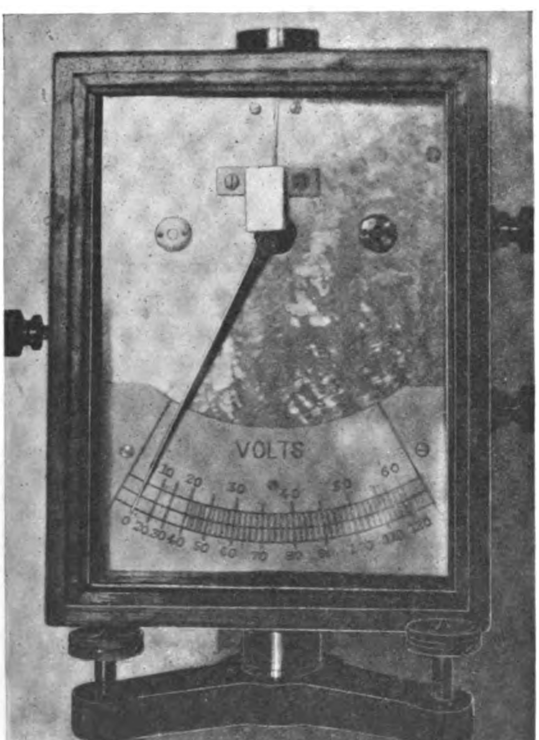


Fig. 13.—Showing Standard Voltmeter with Level and Tripod.

The principle on which this instrument works depends upon the fact that a spiral, consisting of a metallic ribbon of considerable width as compared to its thickness, fixed in such a manner that one end is free to move when put under tension, produces both a longitudinal and turning movement.

The spring, or spiral, is made of a piece of hard-rolled phosphor bronze, about No. 40 S.W.G., by $\frac{1}{8}$ in. wide. A strip of this is rolled round a piece of $\frac{1}{8}$-in. silver steel wire in such a manner that it forms a close coil. Both ends are then fixed with a touch of solder, and the coil is rubbed down with a polished steel burnisher to make it as hard as possible.

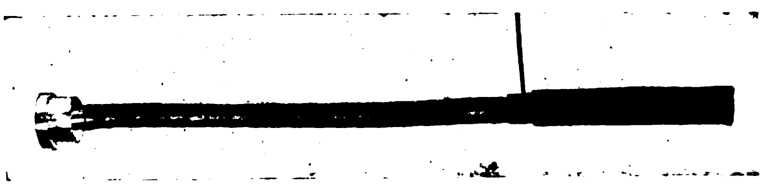


Fig. 15.—Showing Spring and Core for Ayrton-Perry Solenoid Instrument.

To the end of this a piece of ferrotype iron in the form of a cylinder ($\frac{1}{4}$ in. diameter by $1\frac{1}{2}$ ins. long) is attached by means of a small wooden plug cemented with shellac. This wooden plug also carries a pointer.

The solenoid is formed on a brass tube ($\frac{3}{8}$-in. bore and 2 ins. long), wound with the same quantity of wire as given for the repulsion instruments, and with the same precautions as to splitting the tube and flanges, etc., and the whole is mounted, as shown in the drawing, Fig. 14.

The scale is formed of card, which is cut out in circles and joined up to form a helix corresponding with the movement of the index, the helical form being kept by a series of screwed studs and distance-pieces arranged round the outer edge of the scale. The advantage of this type is the length of the scale, as the pointer can be made to make several complete revolutions.

The case consists of a cylindrical box, preferably constructed of ebonite or other non-conductor, which contains the coil surmounted by a glass cylinder, which in turn is covered with a glass disc pierced in the centre and carrying an upright tube, which contains the spring.

On the top of the tube a plug is fitted to which the upper end of the spring is soldered in such a manner that the index can be turned to zero, and, when once in adjustment, securely fixed. In making these instruments the spring should be completed first with the iron cylinder, etc., attached, and hung up for some time before the instrument is calibrated, as the spring is liable to spontaneously change its form during the early periods of its life, which would be fatal to the accuracy of the instrument if continued after the final adjustments had been made. Further description of these instruments is unnecessary.

If found to give too small a travel, the iron core can be made heavier; if the scale is too open, the amount of iron in the core can be reduced, or a resistance put in series for voltmeters or shunt for amperemeters.

Increased range can be provided by resistances, and the calibration effected as already explained for repulsion instruments.

General Precautions to be observed in the Construction of Volt- and Ampere-meters.

(1) All iron entering into their construction must be of the very softest quality obtainable, and after being finished, should be packed into iron tubes surrounded with powdered whitening and heated to a dull red heat for a number of hours, and allowed to cool down slowly. Any scale formed in this process may be removed by pickling in dilute sulphuric acid, followed by copious washings.

(2) After the above annealing process the iron must not be bent, hammered, or touched with any tool, or even polished with emery cloth.

(3) That all magnetic continuity between the steel spindle (or needle points) and the moving core be avoided.

(4) That all wires used on the coils are of the best high-conductivity copper, thoroughly well insulated, without an undue amount of cotton or silk covering. N.B.—Cheap wire has the covering sometimes so irregular that it is nearly impossible to wind an even coil, and the insulation is so thick that it is not possible to wind a sufficient number of turns on to the bobbins.

(5) That all joints in the wires should be soldered, using only *resin* as a flux, and neatly insulated with tissue paper or sarsenet ribbon.

(6) That all coils be thoroughly boiled in paraffin wax or paraffin wax and resin, to expel all moisture and prevent the insulating material again absorbing moisture.

(7) That in instruments which may be used for alternating currents precautions should be taken that no part of the metal in the case or other part of the instrument forms a complete metallic circuit, as eddy currents would be formed which would upset the accuracy of the readings.

(8) That the action is hung in such a manner that friction is reduced to a minimum. Any oil used should be the finest watch oil obtainable, and in very small quantities.

(9) That when once the instrument is calibrated no alteration of the adjustment is made. The instrument should be permanently put together before calibration, and not touched after; simply removing and replacing the action is sufficient to upset the accuracy of an instrument. Similarly, bending or moving the wires of the resistance coils is sufficient to upset the reading.

The following is a key to the figured parts of the instruments that have been described in this article :—

(1) Coil; (2) tube; (3) flanges; (4) dial plate (glass); (5) bosses cast on flanges; (6) spindle; (7) copper wire balance-weight; (8) celluloid bridles; (9) moving core; (10) fixed core; (11) ivory stud carrying fixed core; (12) holed jewels; (13) brass distance-piece; (14) end jewels; (15) adjusting screws; (16) front bracket; (17) back bracket; (18) saw-cut through tube and flanges; (19) pointer or index; (20) paper dial; (21) steel centre; (22) block carrying pointer; (23) slot in paper dial showing mirror; (24) stops for pointer; (25) fibre bridge-piece; (26) ebonite washers; (27) celluloid scale; (28) brass tube forming case; (29) celluloid strip sprung in to form rebate for glass; (30) brass ring to hold glass in position, split and screwed to 28, the two side slits being brought to correspond; (31) non-inductive resistance in series with voltmeter coil; (32) non-inductive resistance in parallel with amperemeter coil; (33) zero pointer; (34) fixed pointer; (35) Universal suspension for zero pointer; (36) split cut through metallic dial; (37) ivory bridge piece; (38) metallic dial; (39) wooden case; (40) fillet to hold glass; (41) glass cover; (42) brass tube carrying helical ribbon; (43) helical ribbon; (44) plug; (45) helical card scale; (46) glass cylinder; (47) studs and distance-pieces holding helical card scale; (48) brass ring holding glass cover and glass cylinder on to top flange; (49) wooden base; (50) soft iron core. A, B and C terminals; D, plug to connect or cut out shunt resistance.

Note.—Since writing the above article I have found that by a slight modification of the action an increased range and a more equal scale can be obtained. The improvement consists of forming

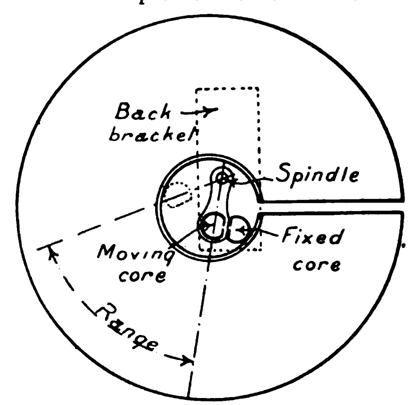


FIG. 2*a*.—BACK VIEW, SHOWING IMPROVED ACTION.

both the fixed and moving cores with the opposing sides flattened and setting over the point of suspension towards the fixed core. The improved action is clearly shown in the accompanying drawing.

I have also found that celluloid is not a perfect material to use for the bridles, as it is liable to shrink after being cemented. The acetone used in cementing the celluloid seems to have a softening and expanding effect on the bulk of the material, which takes a long time to work off. Light brass (or other non-magnetic) wire might be used and fixed with a touch of solder. It is a great pity that celluloid cannot be used, it being the most convenient substance for the purpose, as it enables the movable core to be fixed temporarily to the spindle simply by forcing the bridles over the spindle, and when the best position with reference to the balance weight on the spindle has been found the whole can be fixed by a touch of cement. If sufficient time can be given between the approximate adjustment and the final division of the scale for the celluloid to thoroughly season it might still be used. The error mentioned was discovered in an instrument which was finished in a great hurry. Other instruments which have been constructed in spare moments with plenty of rests between have proved to remain practically constant, but having found a cause for error I shall certainly refrain from using celluloid for this purpose in future.—V. W. D.-B.

(To be continued.)

Locomotive Notes.

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

Fast Running on the Great Western.

The writer, returning on a recent occasion from Birmingham to London by the Great Western Railway, noted a good performance by one of the 4—4—0 type locomotives of similar design and proportions to those of the "City" class, with cylinders 18 ins. by 26 ins., coupled wheels 6 ft. 8½ ins. diameter, and a total heating surface of 1818·12 sq. ft. The train was the one which leaves Birmingham (Snow Hill) every week-day at 4 p.m., stopping at Leamington and running thence through to Paddington, with a conditional stop at Ealing Broadway, in 2 hours 20 minutes, the distance being 129½ miles. The engine on the occasion noted was "Mauritius," and the train consisted of seven 8-wheeled corridor coaches, or a load, say, of from 170 to 180 tons at least.

The Birmingham-Leamington section was covered at what appeared to be a very easy rate of progress, but subsequently some high velocities were reached and maintained. Through Banbury station and for about a mile on either side of it the speed reached 65 miles per hour, and later the Oxford-Didcot run was performed at a high rate of speed. Clear of the junction of the north and west main lines at Didcot the engine had before it a 53 miles run and 59 minutes in which to cover it. A rather heavy permanent way slack at West Drayton and a stop of two minutes at Ealing Broadway Station spoilt the continuity of the running, but, of course, added to the merit of the performance. The train came to a stand at No. 8 platform, Paddington, precisely at 6.20 p.m., the run up from passing Didcot Junction to the terminus, excluding the Ealing stop having occupied 57 mins., the speed thus averaging 55·7 miles per hour.

A Geared Compound Locomotive.

It is not often that—even among the large variety of locomotive types to be found now-a-days—one comes across a geared compound. The writer, however, was, on a recent occasion, afforded the interesting experience of riding upon such an engine in the yards of the Metropolitan Amalgamated Railway Carriage and Wagon Works at Saltley, near Birmingham. The locomotive is, by the courtesy of Messrs. Aveling & Porter, Ltd., the well-known firm of engineers of Rochester, who built it, illustrated herewith. It runs upon four wheels, and is practically one of the firm's ordinary type compound road locomotives mounted upon special wheels for rails and fitted with buffers and a buffer beam at each end. The cylinders, one high-pressure and one low-pressure, are carried on top of the boiler, immediately behind the chimney, and the motion imparted to the crankshaft is transmitted through suitable gearing to the running wheels, the coupling-bar of which remains stationary, although at first glance it might well be taken for an ordinary coupling-rod rotating with the wheels. The entire working parts of the engine are on the top of the boiler within view of the driver, and the bearings of the driving axle, crank, and countershafts, are all carried by the sideplate brackets, the gearing itself, together with the working parts of the locomotive, resembling as much as possible those of an ordinary road locomotive. The wheels are fitted with steel tyres, and are under the control of a powerful brake acting on all four wheels. The crankshaft carries a flywheel for driving fixed machinery, enabling the locomotive to be used as a powerful semi-fixed engine.

The engines of this type are made in varying sizes; they will ascend inclines of 1 in 20, and can be made to work on tramways of 3 ft. 6 ins. gauge and upwards, as well as round curves of from 35 ft. radius.

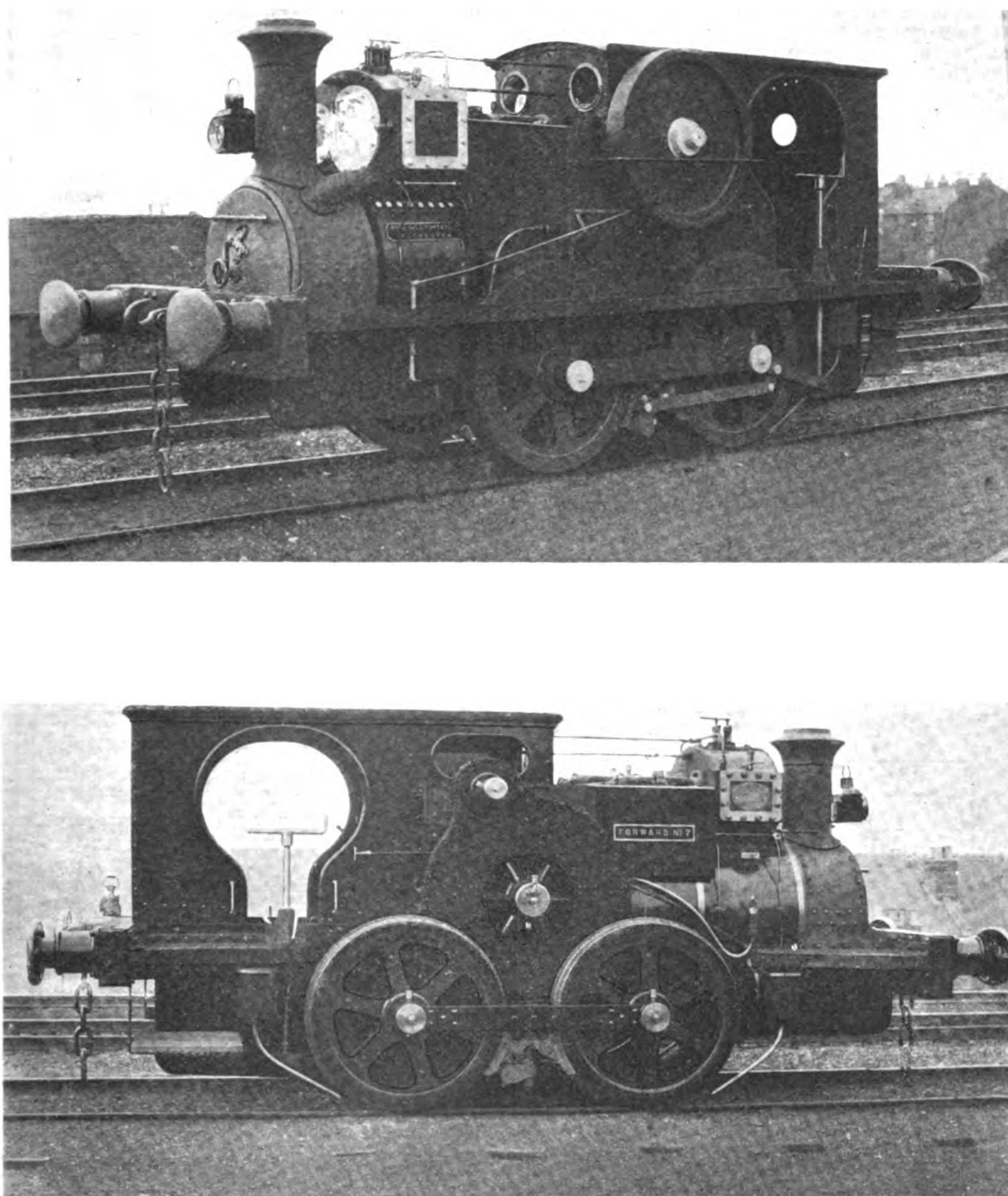
The makers state that in service the engines, many of which have been built for service in various parts of the country, have proved in all cases successful. They are capable of hauling a much greater load than ordinary direct-acting tramway engines with half their consumption in fuel. The locomotives are made both compound and non-compound, and with or without cab, as may be desired by the purchasers.

Another Locomotive Feed-water Heater.

Letters patent have recently been granted to Mr. George Hughes, chief mechanical engineer of the Lancashire and Yorkshire Railway, for an invention which provides means for condensing the exhaust steam from the cylinders of locomotives and utilising the condensed steam for heating the boiler feed-water, and also provides mechanism for inducing draught for the fire. At either side of the boiler of the engine, or in any other convenient position, a surface condenser or a jet condenser is placed, through which the exhaust steam from the cylinders is passed. The condenser is preferably tubular, with steam chambers at top and bottom and steam tubes connecting them. Steam pipes connect the cylinders with the condenser and conduct the steam to the top chamber, whence it flows through the tubes to the bottom chamber. From the latter the steam and water of condensation flow into an auxiliary tank or chamber, to which also is connected the feed-water supply from the tender or main tanks by pipes controlled by a float valve. The surplus uncondensed vapour passes by way of another pipe to a chamber carried in the tender or main tanks. In place of a blast pipe to create the desired draught a fan is employed, this being preferably mounted on the inside of the smoke-box door.

"Pacific" Locomotives for a French Railway.

The letter of a correspondent signing himself "Compound Model Locomotive," which appeared on page 499 of The Model Engineer of May 23rd, will no doubt have caused amusement to many readers of the Journal. If we are to accept "C. M. L." at his own valuation, which is evidently a high one, we must first be brought to believe that he had access to sources of information from which other and less fortunate persons are debarred. There are, however, among us, perhaps, a few who are permitted occasionally inside a locomotive works, and who then hear many things which at the time it would be impolitic to publish. However, there need be no secrecy about the dimensions of the French "Pacific" locomotives.



TWO VIEWS OF A GEARED COMPOUND LOCOMOTIVE.

(Built by Messrs. Aveling & Porter, Limited, Rochester.)

These dimensions were given to the present writer during the summer of last year by the Société Alsacienne, at Belfort. They were subsequently published in the *Railway Gazette*, and are as follows: Cylinders—H.-P. (two) 15⅜ ins., L.-P. (two) 25½ ins.; stroke, 26 ins.; coupled wheels, 6 ft. 2 ins. diameter; boiler pressure, 228 lbs. per sq. in.; total heating surface, 2,630 sq. ft.; grate area, 46 sq. ft.; adhesion weight, 54 tons; weight of engine, only 90 tons. These were the dimensions decided upon when the drawings were being got out. Of course, some modifications may have been introduced since. The present writer can also claim the "distinction" of having published, in THE MODEL ENGINEER and elsewhere, the figures relating to the heating surface of the Caledonian Railway "Cardean" class engines shortly after the first engine of this series appeared. "C. M. L." has not secured a monopoly of first-hand information yet. He did well to write over a *nom-de-plume*. Publication of his name would probably have defeated the object he had in view when writing the letter.

The "New" Steam and its Application to Models.

By W. L. BLANEY.

(*Continued from page* 564.)

A SIMPLE device for a boiler feed suggested to the writer by Mr. David J. Smith is shown in Fig. 8. The container C is partly filled with water and air pumped in through a cycle valve until the desired working pressure is shown on the gauge. When the boiler coil is sufficiently hot for starting, the water tap is turned on. The water is forced into the hot coils by the air pressure, and converted into steam. As the steam pressure rises above the air pressure in the container, it blows the excess of water back. The connecting pipe between the container and the boiler would have to be cooled in some way, or it is probable that the water in the container would get hot and raise the air pressure by expansion. In the case of a boat this could easily be effected by carrying the pipe outside the hull for a short distance. It will be seen that the conditions in this arrangement are very similar to those in an ordinary air-pressure blowlamp. Many lose sight of the fact that these blowlamps are really small self-regulating semi-flash generators. A further refinement could be added by arranging a feed pump

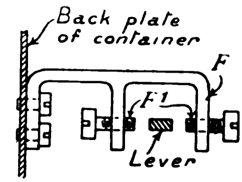
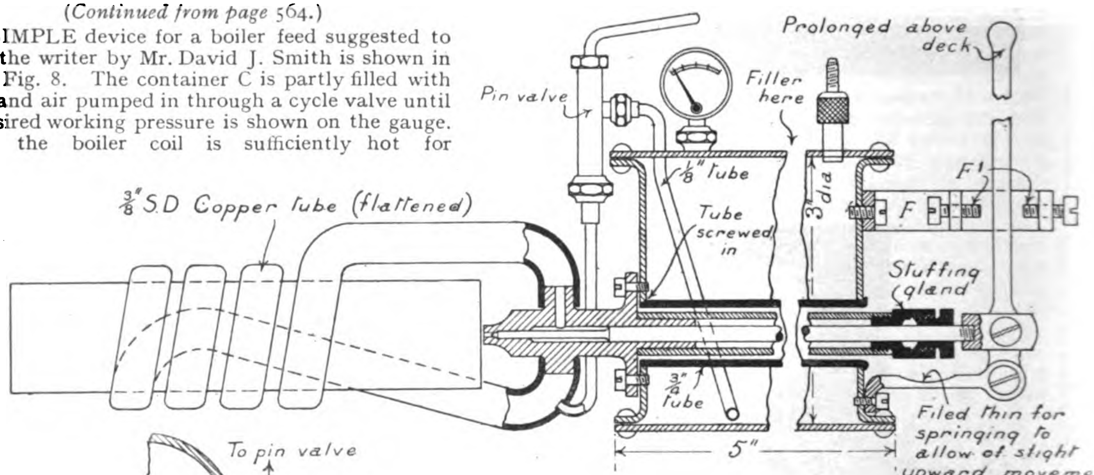
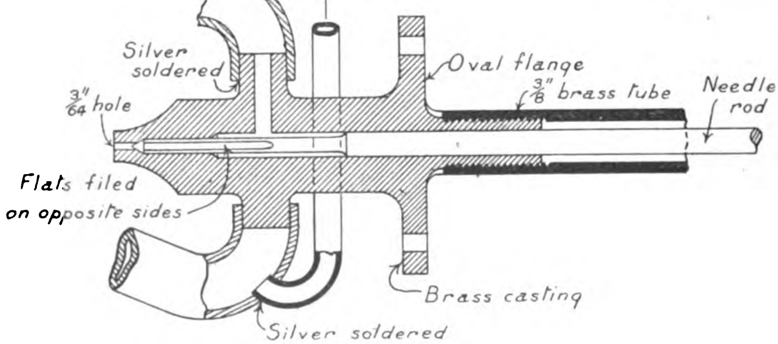


FIG. 6.
PLAN OF
BRACKET F.

FIG. 4.—SECTION THROUGH LAMP.





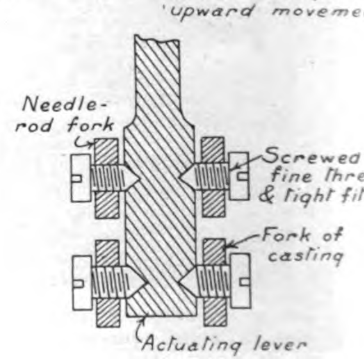


FIG. 7.—ENLARGED VIEW OF NIPPLE CASTING. FIG. 5.—ENLARGED VIEW OF LEVER FULCRUM.

GENERAL ARRANGEMENT AND DETAILS OF BENZOLINE LAMP.

working from the engines to deliver into the container, thus making it constant working.

The above system is open to the serious objection that should the flame of the lamp be diverted from

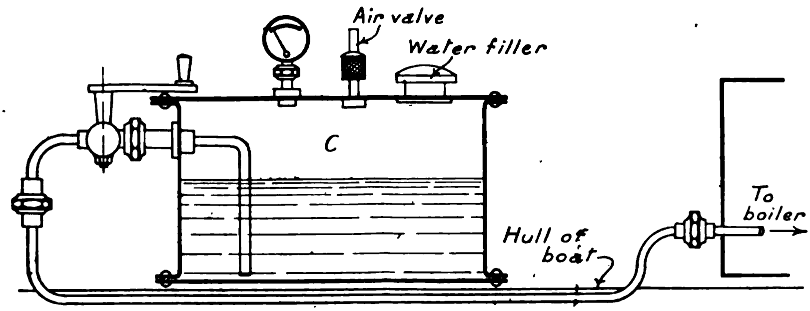


Fig. 8.—Simple Device for Boiler Feed.

the coils for a few seconds by a down draught, the boiler will flood right through and cause trouble. This question of flooding is a very important one. The writer has been confronted with this difficulty in his own practical experiments. Any fluctuations in the flame of the lamp is almost instantly reproduced in the temperature of the steam at the stop valve.

The lamp shown in Fig. 4 has been designed to give a fairly constant flame under all conditions, and with the exception of the nipple regulating device is a copy of the one already in use, and giving good results. As the range of movement in the needle is so slight, there must be no slackness in the pivots of the actuating lever. The best way to

minimum flame when the lever approaches the one or the other. The deck striker (Fig. 9) can be fitted on the nose of a boat and provides a good method of stopping a fast boat without jar. It will be noticed that this striker communicates with the actuating lever of the lamp and also with the main steam valve which is brought to a convenient position in the fore part of the boat.

The mere act of stopping the boat will thus shut off steam from the engines and cut down the flame of the lamp. By reducing the flame when the engines are at rest and letting out when they start again, we prolong the life of the boiler and incidentally provide a means of keeping the nipple clear. A much greater movement is needed in the striker than suffices for shutting off the control levers, and this inequality is taken up by the springs M M. These springs also serve to hold the respective levers well up to their positions when running and at rest. A clip at E falls into place when the striker is forced home in stopping the boat, and prevents the striker shooting out again when it is released. This clip is disengaged by a cord carried to the stern. When the boat is ready to make another voyage, all that is necessary is to pull the cord.

Provision must of course be made to allow the lamp to be removed for the initial starting up, therefore it is advisable to make the striker easily

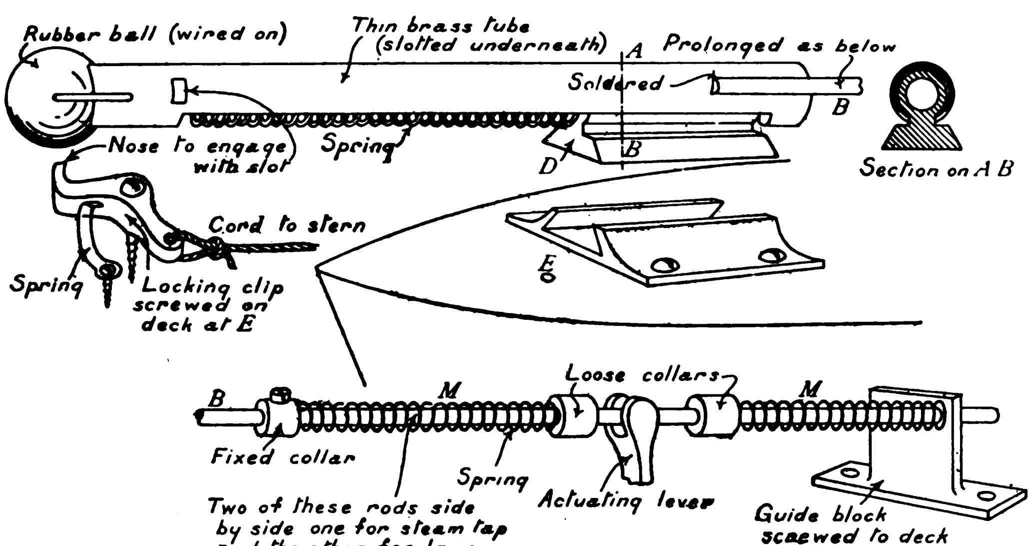


Fig. 9.—Showing Arrangement of Deck Striker. (*Scale: About half size.*)

avoid this will be to mount the fulcrum on cone-screws pointed screws as shown in Fig. 5. The two F' (Figs. 4 and 6) limit the amount of movement of the lever. These can be set by actual trial while the lamp is working to give the maximum and

removable. A good way to do this is shown at D (Fig. 9.) A wedge-shaped piece fixed on the striker barrel slips into a clip shaped to fit, fixed to the deck. This will enable the striker to be firmly held or disengaged instantly.

The design of boiler shown in Fig. 3 is really a compromise between the continuous pipe boiler and the ordinary type fitted with superheater and feed-heater; but it is probable that the type shown would best fill the requirements of a model, as the drum D serves the purpose of a pocket in which the rapidly moving mixture of water and steam approximates to a settlement and so gives the pump a better chance of fulfilling its duties.

The writer regrets that he cannot place any exact data before his readers for computing the evaporate capacity of model flash generators. So many factors tend to vary the results, that it becomes largely a matter for individual experiment. Consultation with two or three experts in the "new" steam has failed to elicit any decided opinions on the subject owing to the absence of all data for model work. It is probable that an even higher efficiency can be obtained from models, owing to the better thermal conductivity of the smaller tube used. As a broad guide for calculating

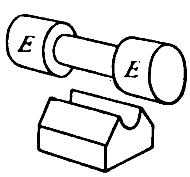


Fig. 1*a*.—Main Slide Valve and Actuating Piston.

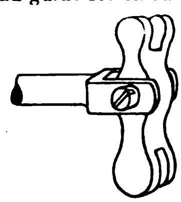


Fig. 1*b*. Rocker.

Pump Details. (*See page* 564.)

the heating surface necessary to serve a certain sized engine, it is fair to assume the added efficacy of this type of generator in model sizes, as 2 to 1 in comparison with a good type of ordinary boiler using saturated steam. Thus—a suitable size of engine for the above design would be a three-cylinder single-acting one of 1 in. bore by 1 in. stroke, cutting off at ·35. It would require a particularly efficient type of boiler of the same amount of heating surface to feed this with 100 lbs. of steam per square inch at 1,500 revolutions per minute, but the 30 odd feet of tube in the design given will probably suffice to get double that pressure on the engine, possibly more. In any case, however, if the coils, or elements as they are called, are fitted together with unions as shown, it is an easy matter to add more length of tube or take away, and so, by careful observation of the results arrive at the most suitable length for the particular work it is required to do.

It is well to bear in mind that there must be no slide valves, stuffing glands, or unbalanced parts in the engine, if the best results are expected. Neither is it advisable to have any rubbing surfaces in contact with the steam or other metals than iron or steel.

With the Editor's permission I may perhaps at some future date be allowed to submit a design of engine to suit these requirements.

Last February the first electric railroad was opened for traffic in Damascus. At present it is 3½ miles long, and connects the city with two suburbs. The power station is water driven, and is situate about 25 miles west of Damascus; it also supplies current for about 1,000 lamps.

Chats on Model Locomotives.

By H. Greenly.

(*Continued from page* 540.)

Modelling Shunting Engines.

We cannot all build models of express engines. Reasons of space forbid—to say nothing of the expense. Therefore, thoughts turn towards models of shunting engines and similar small types of locomotives. We are not enticed by ingenious methods of arranging the bogie so that the maximum amount of lateral play may be obtained. The curves of the model railway contemplated are too sharp to be negotiated with safety by a model express passenger engine with the best of these devices. Then again, if we wait until we can afford a complete set of castings for a big engine we shall never get a model locomotive at all.

In some such strain I have known many of my model-making friends to soliloquise, and therefore

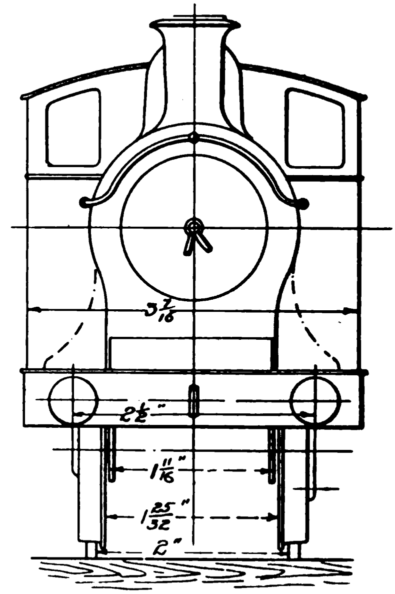


Fig. 2.—End View of Model Shunting Engine.

the advisability of including in this column some notes on the subject of small simply-made engines has suggested itself to me, more particularly as a recent correspondent asked for opinions on the cylinder arrangement for a model of the same general design as that which I submitted to Model Engineer readers in 1902.

Readers who subscribed to the journal at that time will remember that for this "Simple Model Locomotive" two types of cylinders were recommended, and that all the motion was confined to the space in front of the leading wheel. The cylinders were :—

(1) A double-acting *oscillating* cylinder, with spring contact, the reversing being effected by means of a four-way cock.

(2) A double-acting *slide-valve* cylinder with a slide crank instead of a connecting-rod.

Presuming good workmanship and fitting, I think it will be found that the oscillating cylinder will give excellent results in working. The steam distribution is direct and certain. Lost motion due to slackness of parts has very little effect on the timing of the gear.

That the reversing gear can be made successfully by an amateur is proved by an article in an issue by Mr. Percy Briggs. If the cylinder itself is thought to be a difficulty, then no doubt any of the firms supplying such fittings would allow a stock

With regard to the slide-crank cylinder, I cannot say very much from actual experience of their use in model locomotives, but under the given circumstances there does not seem to be any reason why a slide crank should not work equally well on a locomotive as in a marine model. At the moment I cannot think of any other satisfactory device which would be applicable where the whole of the motion has to be got into the space provided, and where a double-acting slide-valve cylinder is employed. By making the cylinders single-acting, however, and by employing two instead of one, the connecting-rod difficulty is overcome. Ordinarily, this would mean two valves and eccentrics, but by the device shown in the accompanying drawings only one valve, and that not in a steam chest, and one eccentric are needed. Packed glands and slide bars are also dispensed with, but against these advantages a simple reversing gear from the cab

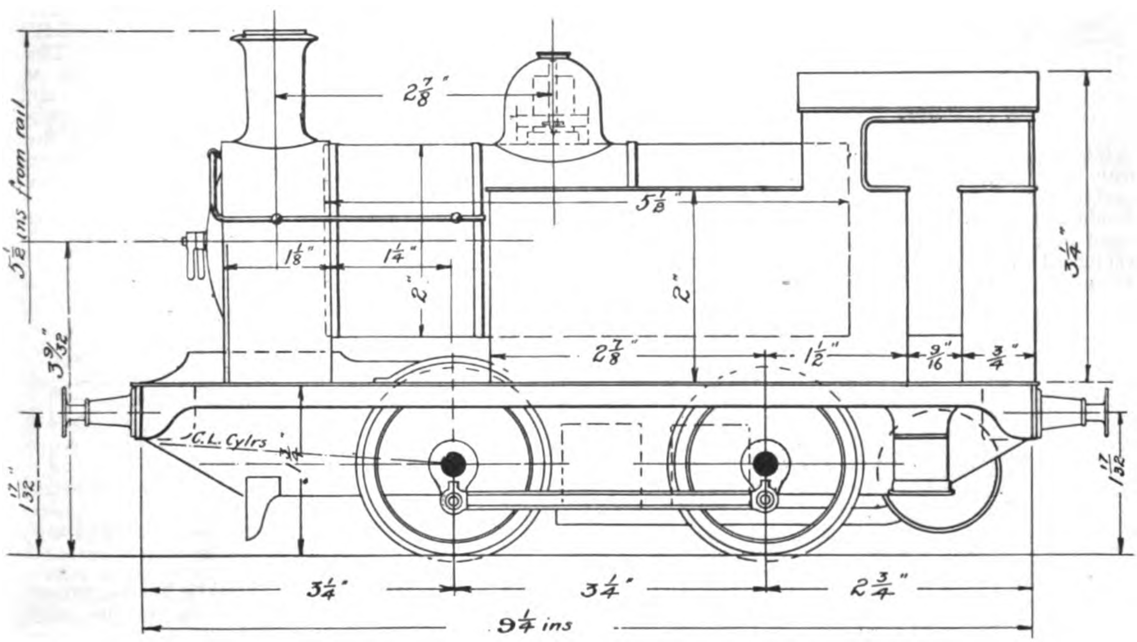


FIG. 1.—ELEVATION OF SIMPLE MODEL LOCOMOTIVE, 7-16THS IN. SCALE, 2 INS. GAUGE.

pattern oscillating cylinder only to be purchased without the steam distributing block and the pivot bearing. The antiquated and absurd system of making contact commonly used on stock pattern oscillating cylinders may then be altered to the no less old, but satisfactory, spring contact arrangement. A new distributing block with reversing plug will, of course, be necessary.

Apart from these considerations, the use of an oscillating cylinder for a simple model locomotive indirectly allows a very desirable feature to be added to the engine, viz., a reversing lever in the cab. At moderate pressures perfect working is also assured, once the distributing block is fixed in position. The steam distributing faces being always kept in close contact, by virtue of the spring, the model is not likely to fail to work after having been laid aside for a considerable time.

does not seem possible, and the slip eccentric has to be resorted to.

The cylinders, however, do not call for great skill in workmanship. The barrel of the cylinders may be made out of a piece of thick brass tube, which, if of the right quality, will not require any boring. The cylinder barrels, however, should be lapped out and the mouth belled as shown. The end fitted into the cover may also with advantage be placed on a mandrel or chucked in a self-centreing chuck and turned down to a shoulder for a distance of about 1-16th of an inch.

The cover and the steam distributing block (as already mentioned, no steam chest is provided), may be cast in one piece from a simple wooden pattern. When the casting is received from the foundry, file out the side flanges which form a fixing for the cylinders to the main frames. Then chuck the casting so that the sinkings for the cylinders may be turned so as to tightly fit the shouldered down portion of the latter, which may then be securely soldered in place and squareness and parallelism ensured. Before finally fixing, however, file up the

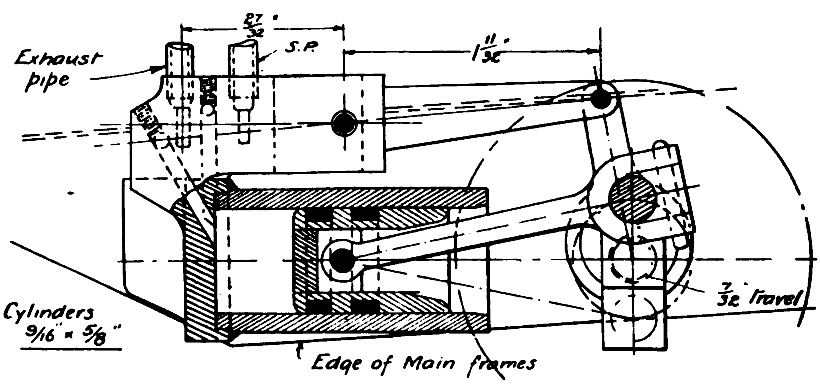


FIG. 3.—SECTION OF CYLINDER.

valve faces and drill the ports. As will be noted from the drawings, the latter are various and peculiar. But they are not so mysterious as they would appear to be from the sketches. The left-hand port (the rectangular one) in the perspective sketch (Fig. 5) is connected directly with the steam pipe, the port allowing live steam to pass

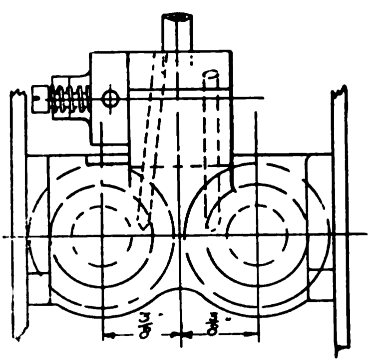


FIG. 4.—END VIEW OF CYLINDERS.

into the hollow valve when the latter is in any position in its travel.

The next port is a round hole which communicates with left-hand cylinder. Between this and the other circular port is the rectangular exhaust port, which simply forms a passage to the exhaust pipe.

The valve is made from plain strip of brass, and to simplify the link connections to the eccentric it vibrates on a pin in a vertical plane. It takes steam into the cavity or passage drilled in it longitudinally before distributing it, and exhausts by means of chases or grooves in the working surface.

The piston is intended to be made up of a plug of brass slotted and drilled for the little end of the connecting-rod and a piece of thick tube. This tube is grooved for the packing, and is bell-mouthed to clear the connecting-rod, and the plug is soldered in with the gudgeon pin and connecting-rod in place.

The drawings of the cylinder and gear are, I think, quite clear in every detail, but should any further explanatiion prove necessary I shall be pleased to give it.

With regard to the boiler, the correspondent referred to gave the dimensions of a boiler he had already made, viz., 5½ ins. long by 2 ins. diameter, and the design is built up round this boiler. The generator should have two water tubes suspended from it. The regulator may be a plain cock in the cab, with the handle projecting through the cab roof preferably, the steam pipe passing down to footplate level and through the flame to the cylinders.

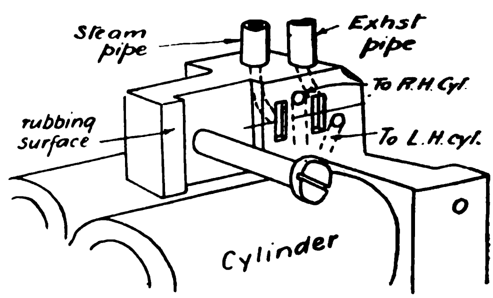


FIG. 5.—PERSPECTIVE SKETCH OF DISTRIBUTING BLOCK.

As I have so often mentioned—having myself committed the error of boxing in the fire of a methylated spirit lamp, with the attendant disappointing results—the flame must be well ventilated. Therefore, it is recommended that the

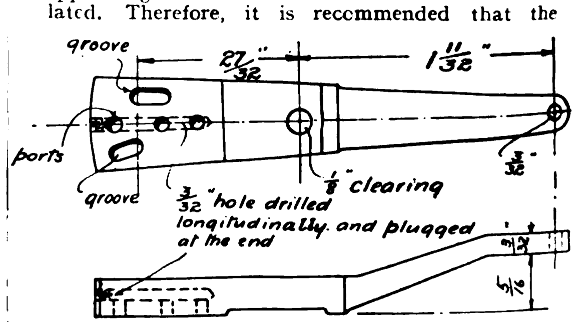


FIG. 6.—SLIDE VALVE.

side tanks should be made without top plates and the heat generated allowed to escape in this way instead of being confined to a flue connected to the funnel. The inside of the side plates may be lined with asbestos or, better still, a roughly made tin lining may be provided, this lining acting like two uptakes, one on each side of the boiler, and saving any burning of the paint on the side tanks. A deep throatplate should be fitted just behind the crank axle, its purpose not only being to protect the machinery from the flame of the lamp, but the flame from being blown about by any steam which may escape past the pistons when the packing wears. Some such precaution as this is found absolutely necessary where single-acting oscillating cylinders are used inside the frames where the boiler is "outside fired." The back bunker may contain a supply of spirit and feed the cylindrical tank attached to the lamp below footplate level. For a 2½-in. gauge all the dimensions may be increased slightly, and the cylinder made ⅜-in. bore × ⅜-in. stroke, and it is questionable whether it would not pay to increase the outside diameter of the boiler to 2½ ins. and fit an inner barrel (say, 2 ins. diameter) in the approved manner.

(To be continued.)

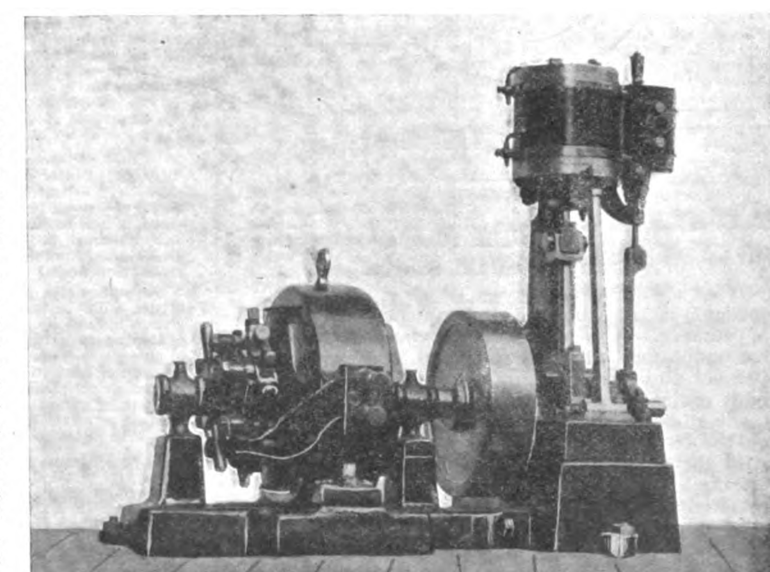
Practical Letters from our Readers.

[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.]*

A Reader's Work.

To the Editor of *The Model Engineer*.

Dear Sir,—The accompanying photograph is of a model I have completed a short time ago. Cylinder of engine is 2-in. bore; stroke of piston, 1½ ins.; speed, 1,200 r.p.m.; with 35 lbs. steam pressure it drives the dynamo easily. Castings for the engine I bought from an advertiser in The Model Engineer. Dynamo castings were cast at a local foundry in this city; the field-magnet casting is annealed steel. I commenced fitting up dynamo by bolting magnet casting to the bed, then fixing them on the lathe saddle; bored out the tunnel for armature with a boring bar, at the same time facing up the seats of bearings. The bearings were next bored out ½ in. for spindle, then mounted on a mandrel and turned up on the face so that they were central to the tunnel when bolted down on their rests. Armature is of the six-pole type; each pole is wound with 122 turns of No. 24 D.C.C. wire. Magnet bobbins were made of vulcanised fibre 1-16th in. thick; each bobbin wound with 135 turns of No. 22 wire, then slipped on the poles of the magnet and connected up so that each pole of magnet is alternately north and south. Commutator and brushes were fitted up to dimensions and drawings given in The Model Engineer, December 15th, 1902. When finished, the dynamo gave off easily 20 volts 4 amps. without any sparking at the brushes. At an exhibition here last November the model gained the first prize, also the *Work* Medal in the class open to the United Kingdom.—Yours truly, H. W. Davey.



Mr. H. W. Davey's Model High-speed Engine and Multipolar Dynamo.

Windmill Design.

To the Editor of *The Model Engineer*.

Dear Sir,—In reply to Mr. Sydney Russell and "Wind-power," I wish to say that my new sails, or sweeps, are of the spring type. They will be four in number, and are all finished except fitting the springs; but, as I have to raise the lower 2 ft. to get room for them to swing, and put in some new shafting and gears and make other alterations, I expect it will be the latter end of the summer before I get them running, and so I cannot say anything further at present. I quite expect a difficulty in getting the springs of the right strength, as there are some points to be considered which can only be found out by actual working, and if I hit the mark at the first venture I shall be agreeably surprised. I do not by any means admit that my mill is a failure. She has done all my work for five years, and is in first-class going order, but she is such a lot of trouble in stormy weather.

I got the two numbers of *Traction and Transmission* mentioned by Mr. Sidney Russell, and I was very much interested.

I obtained all my information with respect to making my sails from a millwright at Wickham Market, Suffolk, who was for many years with Whitmore & Binyon, a once flourishing firm of engineers (now, unhappily, defunct). They under-took all kinds of mill-work—steam, wind, or water, but my friend's work was chiefly among windmills, and his particular line was sail-making. He told me he had made sails 32 ft. long and 11 ft. wide; but he does not believe in them: a long, narrow sail is his idea for power, as they cut clean through the wind, whereas the wide sails drag in the wind.

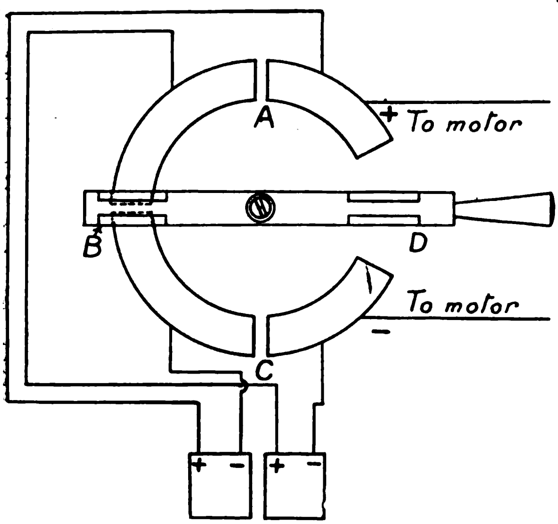
There are still a number of wind cornmills in use in Norfolk and Suffolk. I am personally acquainted with at least fifty in good going order, besides several wrecks. All the mills I know there are of the four-sail type, but I know several six-sailers in Cambridgeshire.—Yours respectfully,

Burton-on-Trent. THOS. A. WOODTHORPE.

A Series Parallel Switch.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The enclosed sketch of a series parallel switch suitable for electrically-driven boats of 2 or 4 volts pressure, may appeal to some of the younger readers of THE MODEL ENGINEER on



A SERIES PARALLEL SWITCH.

account of its simplicity, usefulness, and neat appearance. A 4-volt boat will "cruise" slowly for about four times as long with the switch on parallel position with the same batteries as used with ordinary switch, and a 2-volt boat may be made to "race" for short periods with the switch on the series position, no current being wasted as with the use of resistances. The arm is made of ebonite, hardwood, or other suitable insulating material, and the contacts on same are sheet brass clipped on. The segment contacts are of sheet brass, and the spaces A, B, and C are smaller than, and the space D larger than, the contacts on the arm.—Yours truly, "TUX."

Re Modified Daniell Battery.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I should like to draw "Amateur's" attention to the fact that he has apparently quite overlooked the point in my description of above. It was not the use of any particular excitant, but simply to dispense with the sulphate of copper depolariser which he used.—Yours truly,

Leyton. A. GREEN.

Six-Coupled Locomotives.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I am much indebted to Mr. Roblin for his kindly advice and criticism on my letter concerning six-coupled locomotives, present and future. I shall always endeavour, in the future, to carry out his wishes, but he must remember that I am only an outsider where his authority is concerned. Therefore, as it is for the master to command and the servant to obey, I trust in the course of a few days to send you the official information Mr. Roblin requires.—Yours faithfully,

"MODEL COMPOUND LOCOMOTIVE."

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:—

[17,667] **Boiler and Lubrication Questions.** W. H. P. (Salisbury) writes: Would you kindly supply me with a rough sketch of a steam generator for a small steam car, and also a rough sketch of how to lubricate the small end of the piston-rod. I have looked through about 205 back numbers of your valued paper, THE MODEL ENGINEER, of which I am a constant reader, but I cannot find what I have stated above.

We cannot give you a drawing of a steam car boiler. It is a matter quite beyond the scope of a query. Furthermore, you give no indication of the system you propose to adopt. See issues of March 23rd and 30th, 1905, for a design for a "Flash" generator to give 3 h.-p. For what kind of engine do you wish us to suggest a system of lubrication? Is it enclosed? For diagram of a forced system of lubrication, as applied to a model, we can refer you to the articles in the issues of December 1st and 15th, 1902. We presume you want to lubricate the "little end" of the connecting-rod. The piston-rod has no "little end," strictly speaking.

[17,730] **Steam Dynamo Plant.** R. E. Y. (North Walsham) writes: (1) Could the boiler in the coloured plate design for the compound undertype engine for 1904 be used as a stationary boiler without the Field tubes? (2) Also, could the firebox be lengthened, say an inch or two, to increase its evaporative powers? (3) What is the largest size engine (vertical, direct-coupled to a dynamo) it would drive at 75 lbs. boiler pressure? (4) What sizes of ports would be correct for this engine? (5) What is the largest size dynamo above engine would drive (*a*) as single one-cylinder, (*b*) suitably compounded? What size would the L.-P. cylinder be for best results?

(1 and 2) Yes, you may omit the "Field tubes" and lengthen the firebox, doing which will lessen the amount of firing required. (3) A $1\frac{1}{2} \times 1\frac{1}{2}$ high-speed engine. You can get a set of castings for an engine of this size from Stuart Turner, Ltd., Shiplake-on-Thames. (4) Steam ports, $\frac{1}{8} \times \frac{3}{8}$-in.; port bar, $\frac{1}{8}$ in.; exhaust ports, $\frac{1}{4}$-in. × 7-32nds in. (5) The difficulty is the speed required

by the dynamo; however, you ought to be able to obtain about 20 watts. (6) You will not get very much extra from the compounding except you fit a jet condenser working from the house supply. However, you may couple the boiler to a compound engine with cylinders 1¼-in. by 1⅞-in. for non-condensing, or 1¼-in. and 2-in. for condensing; stroke, 1¼ ins. Special arrangements will be required for the draught if you make the engine condensing. We do not recommend such a small boiler for the plant. You will do much better if with the same engine you instal a much larger steel boiler. The cost would be about the same as the smaller copper boiler, but the attention the plant will require would be reduced considerably. A small boiler working up to its power by induced draught, although it may be sufficiently powerful, requires constant attention. We are of opinion that for an electric light plant you would do well to consider a boiler of the type illustrated in "The Model Locomotive," page 192, Fig. 247. This design has about the same heating surface and could be fired by oil burners instead of coal.

[17,727] **Model Steamer Machinery.** T. G. B. G. (Harrow) writes: (1) I have made a small boiler similar to that of Mr. Scott's which gained first prize in Competition 42. I have not got a pump for it yet. The drum is 7 ins. by 2½ ins. What I want to know is how to regulate the pump and feed, so that sufficient, but not too much water, enters the boiler? What size pump do you recommend? The boiler is intended for a boat. (2) What weight of machinery will a 4-ft. 6-in.×7×5 deep boat carry? It is of wood about ¾ in. thick. (3) Would it be worth my while to condense and have an air pump? (4) What relation is there between the volumes of water and steam generated from that water—*i.e.*, how many cubic inches of steam are generated by 1 cub. in. of water at 100 lbs.? (5) What oil is most suitable in a cylinder with high temperature steam which has been superheated? I have heard that hydro-carbon oils are the only ones which do not flash with these high temperatures. (6) Can you tell me the dimensions and pitch of a screw suitable for the above boat? I intend having two on the same shaft—one loose and one fixed, geared to run in opposite directions, as described in THE MODEL ENGINEER for January.

(1) The best way to regulate the pump would be to provide a by-pass valve on the delivery pipe, which either turns the water back overboard or into the suction pipe. You give no particulars of the engine or the approximate speed, but no doubt a 9-32nds-in. bore pump, having a stroke of ⅜ in., would do very well. At 200 r.p.m. about 4 cub. ins. of water should, not reckoning losses, be delivered by the pump. Therefore you should be on the safe side with a 9-32nds×⅜-in. plunger. (2) ¾ in. thickness of hull will give much too heavy a boat. About ¼ to 5-16ths in. is a more reasonable thickness. The boat will weigh, if ¼ in. thick, about 4 lbs. with deck, and would probably carry 6 to 8 lbs. of machinery, irrespective of the top hamper. (3) Not in such a small boat, unless you are aiming solely at the completeness of the machinery. (4) You will find a table in our issue of May 3rd, 1906 (see article on "Model Steam Engines"). At 100 lbs. gauge pressure (that is, 115 lbs. pressure absolute), the number of cubic inches of steam obtained from 1 cub. in. of water will be 235. (5) Yes, you require to use a cylinder oil. The same oil as used for petrol motor cylinders will do very well. (6) 2½ ins. diameter, 4 ins. pitch for ordinary speeds.

[17,649] **On Compound Models; The Minimum Boiler Pressure.** J. A. B. (Seven Kings, Essex) writes: I have recently completed a vertical compound (1½ by 2¼ by 1½-in.) link-motion reversing gear, and on Saturday last got up steam in anticipation of a good run, but the only movement I could get was that supplied by my hand. I enclose you a tracing of the eccentrics and settings and particulars herewith of the valves and port faces, and shall

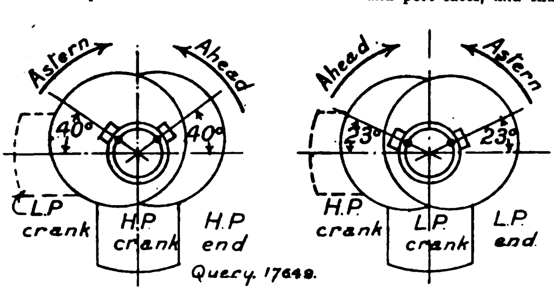


FIG. 1.—ECCENTRIC SETTINGS FOR COMPOUND ENGINE.

feel obliged if you will let me know if they appear to be thoroughly in order. The ports are: H.-P., 5-32nds by 5-16ths by ⅞-in.; L.-P., 3-16ths by ⅞ by 1¼ ins. The H.-P. valve is 1¼ ins. long, and the L.-P. valve 1 9-32nds ins. long. I have a steel boiler (9 by 18 ins. centre flue) tested to 80 lbs., working pressure 40 lbs., made of ⅛-in. steel plate, riveted. Can you suggest a method of adding a superheater to same? It is such a nuisance having to take an engine to pieces after running to get rid of the condensed steam. What size hand pump and check valve would suit?

We are much interested in your queries, but the exact nature of the trouble is not clear. Your diagnosis is not sufficiently complete. The engine should go round. If you will forgive us for saying so, your query may be likened to a man going to his doctor stating that he has a pain and wants it cured, without indicating whether the said pain is in his head or his toe. But we are obliged by your sketches, which are useful in determining one important point, viz., the minimum pressure at which it is advisable to work the engine to get any benefit from the L.-P. cylinder at all when working the engine non-condensing, and also to compare the amount of work done by the two cylinders. As we want to find the minimum boiler pressure which should be used—otherwise if the pressure is too low, as we suspect it is from your second query (which states that the working pressure of your boiler is 40 lbs.) the L.-P. cylinder will be doing negative work—it is best to commence with a stated terminal pressure in the L.-P. cylinder. For experiment sake, we have chosen a 5-lb. terminal pressure, which means that after the steam has done its work in the L.-P. cylinder it is exhausted at a pressure of 5 lbs. per sq. in., which pressure may be needed to work the blast. From this we have to find the initial pressure in the L.-P. cylinder, then the terminal pressure and finally the initia pressure in the H.-P. cylinder. Having done this, we can allow for a small drop in pressure from boiler to engine, and say what should be the minimum pressure at which the engine should be worked. Furthermore, we can produce indicator diagrams and estimate the work done in each of the cylinders. The first thing to do is to examine the setting of the valves. We are presuming that the eccentric travel is ½ in. The valve of the H.-P. cylinder has, according to your sketches (Fig. 1), 5-32nds in. lap. The eccentric is provided with 40 degs. advance, and by making the diagrams reproduced herewith, we find that it has no lead; the L.-P. valve has about 1-64th lead, the lap being 5-64ths in. The cut-off of the H.-P. valve occurs at 60 per cent. of the stroke, and the L.-P. at 87 per cent. With these data we can prepare the expansion clearances in the lower part of Fig. 2. The base lines of the expansion diagrams are equal to the stroke, and are drawn under the crank diagrams. Then pressure scales are set up on the right-hand side as shown. It will be noted that the pressures are from the absolute zero, so that the atmospheric pressure of, roughly, 15 lbs., has to be added to the gauge pressures; this is necessary to obtain accuracy in the expansion diagrams. As already mentioned, we fixed on 5 lbs. as the terminal pressure of steam in the L.-P. cylinder. This will, of course, be 15+5 = 20 lbs. to the sq. in., absolute. This being so, draw a horizontal line through the diagram at the 20 lbs. level, projecting down from the crank diagrams above the cut-off position of the crank-pin of the L.-P. cylinder. From the lower right-hand corner of the diagram, draw a line AB, cutting the point at which the 20-lb. pressure level intersects the cut-off line (CP on diagram). The level at which this line cuts the left-hand vertical line of diagram is the level of the admission pressure on the vertical scale. It will be seen from the diagram that with a cut-off of 87 per cent. the initial or admission pressure will be 23 lbs. where the terminal pressure is 20 lbs. Now, we can turn our attention to the H.-P. cylinder. The L.-P. admission pressure being 23 lbs. to the sq. in., it is evident that the L.-P. cylinder must have received from the H.-P. cylinder a certain definite quantity of steam, and for convenience this "quantity" may be represented as the product of the pressure × the volume. As the steam was only received by the L.-P. cylinder up to the moment of cut-off, the volume is something less than a complete cylinder full. It is found in the present case by multiplying the length of stroke traversed up to the point of cut-off by the area of the piston. The cut-off occurring at 87 per cent. of the stroke, the capacity is—

L.-P. piston area × 87 per cent. of 1½ ins. = 3·976 × 1·3 ins. = 5·17 cub. ins.

The pressure is, as we have shown, 23 lbs., therefore the "quantity is represented under Boyle's law as—

$$P \times V = \text{constant quantity},$$

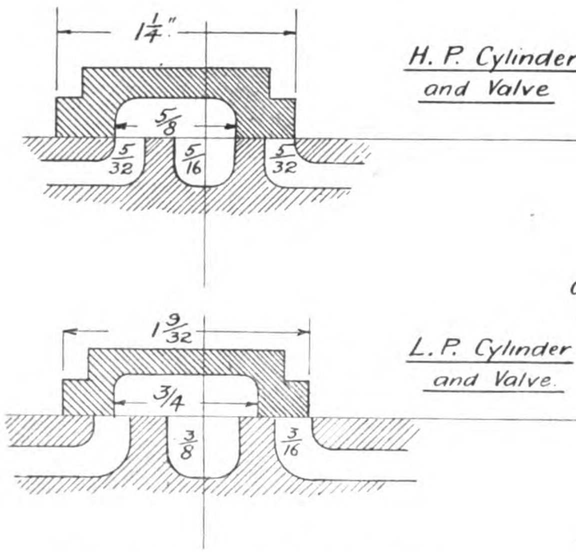
which, in this example, is—

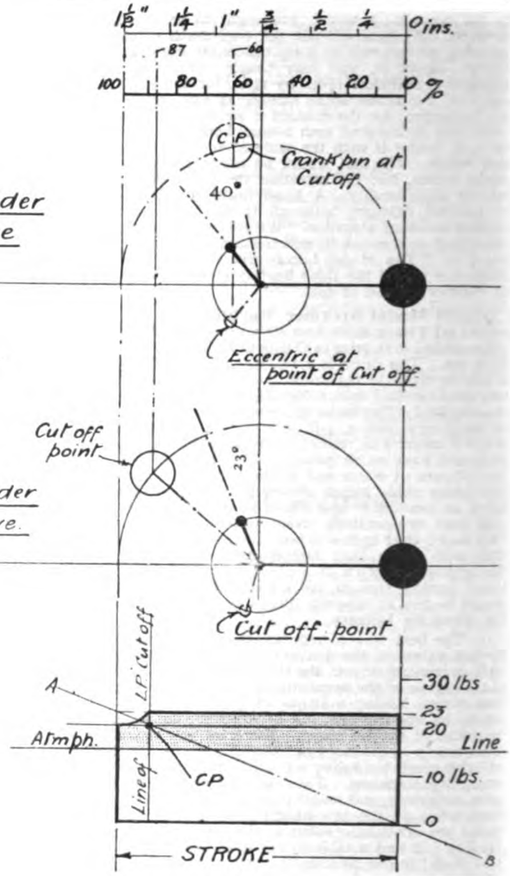
$$23 \times 5{\cdot}17 = 118{\cdot}91.$$

Now, this steam, although the same in amount, occupied less space in the H.-P. cylinder owing to the latter's smaller capacity. The total capacity of the H.-P. is equal to its area × the stroke = 1·767 × 1½ ins. = 2·65 cub. ins. As P × V = constant quantity, and we know the new (or perhaps we should say the original) volume, and the constant quantity, we can easily find the pressure in the H.-P. cylinder before the steam was transferred to the L.-P. cylinder. The equation may be stated as follows:—

$$\text{Pressure} \times \text{H.-P. C. volume} = 118{\cdot}91$$
$$\text{Pressure} \times 2{\cdot}65 = 118{\cdot}91$$
$$\text{Pressure} = \frac{118{\cdot}91}{2{\cdot}65} = 44{\cdot}9 \text{ lbs.}$$

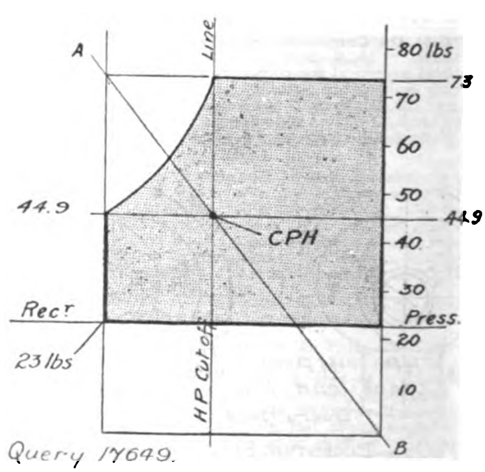
The steam, therefore, left the H.-P. cylinder at 44·9, or, practically 45 lbs. per sq. in. But the crank and valve diagrams show that it was already expanded, and to find the pressure at which it entered the H.-P. cylinder we must make another expansion diagram. On the second base line we erect another scale of pressures up to at least 80 lbs. The pressures are again absolute pressures. We draw a horizontal line at the 44·9 lbs. level and drop from the H.-P. crank diagram the point of cut-off, marking the intersections by a dot, C P H. From the right-hand lower corner of the diagram we draw another diagonal line A B, passing through the dot C P H, and onward through the left-hand vertical line of the diagram. The level at which it cuts this line is the pressure at the point of cut-off in the H.-P. cylinder, and therefore the admission pressure





Low-pressure Diagram.

FIG. 2.—DIAGRAMS SHOWING CUT-OFFS AND EXPANSION OF STEAM IN A "STUART" $1\frac{1}{2}$ AND $2\frac{1}{4} \times 1\frac{1}{2}$ COMPOUND ENGINE.



High-pressure Diagram.

of the steam. This, it will be seen, is 73 lbs. per sq. in. To get the gauge pressure, deduct the atmospheric pressure of 15 lbs. Thus we come to the conclusion that to obtain a terminal pressure of 5 lbs. in the L.-P. cylinder, we must maintain a pressure of 73–15 — 58 lbs. per sq. in. in the H.-P. steam chest. This would mean at least 60 lbs. per sq. in. in the boiler. Considering next the work done in each of the two cylinders, we shade the working portions of the diagrams. For simplicity's sake, the rounding off of the diagrams, due to wiredrawing, compression, clearance, and transmission losses, and also receiver fluctuations, are left out of the question altogether. Such refinements are soon mastered once the elementary facts are clear. It is only a question of elaboration of details and full particulars are given in a very able manner by Mr. W. J. Tennant in his book, "The Compound Engine," price 2s. 6d., post free 2s. 9d. The shaded portion of the H.-P. pressure diagram represents the work done by this cylinder, and, as will be seen, the pressure is 73 lbs. for 60 per cent. the stroke, and then drops to 44·9 lbs. at the end. The average pressure is therefore something between the two, and may be found by taking a number of equidistant points in the stroke and finding the mean pressure by averaging the pressures at each of these points. We will not show how this is obtained in detail, but may say that the mean pressure in the H.-P. cylinder throughout the stroke is 68 lbs. There is, of course, the back pressure to be considered, which we may take as being exactly equal to L.-P. admission pressure, or, in other words, the receiver pressure. This is 23 lbs., therefore the effective pressure in H.-P. cylinder is 68 – 23 — 45 lbs. The foot-pounds of work done per stroke are, of course, equal to the piston area × average forward or effective pressure × stroke in feet. This works out as follows :—

$$1{\cdot}767 \times 45 \times \tfrac{1}{8} = 9{\cdot}9 \text{ ft. pounds.}$$

The low-pressure cylinder has a forward pressure of between 23 and 20 lbs., say, 22 lbs. Presuming that the exhaust is quite free, the back pressure is equal to that of the atmosphere; therefore, the mean forward or effective pressure acting on the low-pressure piston is—

$$22 \text{ lbs.} - 15 \text{ lbs.} = 7 \text{ lbs.}$$

and the foot-pounds of work done are—

Piston area × average effective pressure × stroke in feet —

$$3{\cdot}976 \times 7 \times \tfrac{1}{8} = 3{\cdot}48 \text{ ft. pounds.}$$

The ratio of the work done in the two cylinders is—H.-P. to L.-P. as 9·9 is to 3·48—which means that the H.-P. cylinder is doing nearly three times as much work as the L.-P. cylinder, which, to say the least of it, is not good practice. If the L.-P. exhaust is restricted by a blast nozzle, then the case is worse still. To give the L.-P. cylinder a greater share of work, either of the following courses may be adopted :—(1) Increasing the boiler pressure. As will be seen, to make use of the compound principle at all with the present valve setting, the boiler pressure should not be anything less than 60 lbs. To equalise the work of the two cylinders, about 100 lbs.

pressure should be adopted. The only question is: Will the boiler you are using maintain a pressure of 100 lbs. at the required engine speed? If not, arrange for a reduction of speed. (2) The H.-P. valve may have the lap reduced so that it normally cuts off at, say, 80 per cent. of the stroke, and if the engine drains the boiler of steam under such circumstances, the speed may be reduced or the engine may be linked up slightly, which would virtually result in the cut off in the H.-P. being brought back to approximately its original point, but the L.-P. cut off would occur earlier than before (87 per cent.). You may say that the same thing would be accomplished by simply altering L.-P. valve so as to make it cut off earlier. Quite so; the effect of providing an earlier cut off on the L.-P. side is to throw more work on the L.-P. cylinder, which at the moment is desired; but permanently increasing the lap of the L.-P. valve might not prove convenient, therefore we suggest the other alternative. (3) Providing a condenser. Where you reside you no doubt have a continuous house supply, and it would be very little trouble to make and fit a jet condenser, which would increase the L.-P. average effective pressure (by destroying the atmospheric pressure) possibly from 7 to 17 lbs. With only an average effective pressure of 15 lbs. the work done in the L.-P. cylinder would be increased to about 7½ ft. pounds instead of 3½. If instead of exhausting at the atmospheric line you exhaust below this pressure, the shaded area of the L.-P. diagram, and consequently the work of the cylinder, is increased. By using a jet condenser off the house supply no extra friction is thrown on the engine. The question is, however: Does your boiler depend on the exhaust for its draught? With regard to the boiler, the only way to fit a superheater is to take a pipe and coil it to fit the centre flue. It may start from the crown of the firebox and come out at the uptake at the top of the boiler, or else may be taken from the top of the boiler into the centre flue and out again after having made a dozen or so turns. A ½-in. lever hand pump will do very well. Use ¼ or 5-16ths pipes and a check valve to suit.

[17,720] **Firing Steam Boiler.** O. G. W. (Sydenham) writes: I have a small boiler, the same as described on pages 30, 31, etc., of your Handbook No. 6, with the exception that it has only seven 1-in. tubes. I can maintain a steam pressure of 55 lbs. with a coal fire (forced draught) working a Stuart No. 3 compound, which drives a 20-volt 4-amp. dynamo. (1) As a coal fire requires constant attention, I should be glad if you would advise me, if it would be satisfactory, to use a cluster of Primus burners. (2) Would it be necessary to alter the firebox, or would the insertion of water tubes answer? (3) How many burners would be necessary—diameter of firebox 8 ins. tapering to 7 ins. and 8 ins. high.

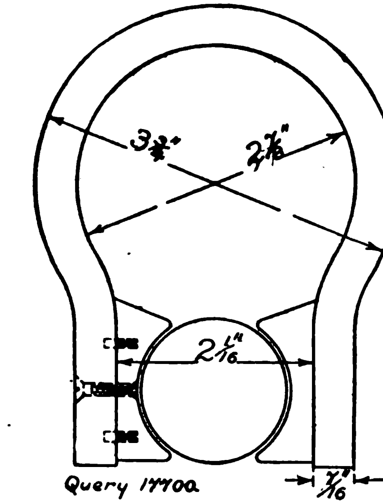
(1) You are not likely to obtain any satisfaction with a coal-fired boiler in the matter of attention required, unless you provide either a big vertical centre flue boiler, say, 22×48, or a multi-tubular boiler the same size or slightly smaller. Natural draught, of course, would be used, and the rate of firing considerably reduced. Furthermore, 55 lbs. pressure is of little use in the engine you name, unless it is a condensing engine. We cannot recommend fitting burners to this boiler. It is on the one hand rather small, and, on the other, the firebox and tubes are not quite suitable for the purpose. A water space firebox has no merit where Primus or similar burners are employed. (2) Yes, you would need to provide it with water tubes. Probably "Field" tubes screwed into the crown to miss the flue tubes would be the simplest way of fixing them. (3) A battery of four burners. Do not use the Primus burner. The "Hekla" burner, which works on the same principle, will be found to be more serviceable. We do not, however, recommend the experiment of altering the boiler for oil fuel. Complete satisfaction would not be obtained.

[17,611] **The "M.E." Steam Locomotive.** E. F. (Queen's Park) writes: I have been engaged on a model locomotive for some six months, the design for which appeared in a periodical some five or six years ago. Happening, however, to see the coloured plate of the *M.E.* 1904 tank locomotive just recently, I have become very dissatisfied with the design I am working to, which is very much out of date, compared to Mr. Greenly's design. I have, therefore, decided to commence this design. There are one or two points I am in doubt about, and I should be very glad of a hint or two. (1) The side elevation of framing shows all holes—*i.e.*, for cylinders, corner brackets, motion plate, etc. Are all these holes to be drilled through both plates before separating? (2) Would the cylinder holes be sufficient to bring cylinder at the proper angle within frames when cylinder has been tapped for screws? (3) What material do you advise for the wheels? I see Stuart Turner & Co., of Shiplake, supply complete sets in cast iron. Would this do as well as brass or gun-metal? If in cast iron, would it be possible, in the case of driving wheels, to make a driving fit on axles without fear of damage? Of course, I should screw all the other wheels on.

(1) Yes, they may be drilled with advantage with the two plates together, and any tapped holes may be drilled and tapped at the one operation. (2) Yes, but it would be considered still better to drill a couple of small holes on each side after the cylinders are fixed and fit steady pins, but this refinement may be omitted where the screws fit the clearing holes in the frames in a reasonable manner. (3) Cast iron. The material for the wheels to be obtained from the firm mentioned is very soft, and is to be preferred to brass for several reasons. You should have no trouble in fitting the wheels to the axles. You may drive all the wheels on, and if you make a mistake and obtain a slack fit of any one wheel, solder it on to the axle and turn it up between centres.

[17,700] **Winding an Old Permanent Magnet for Small Motor Field Magnet.** W. W. (Glasgow) writes: I enclose a sketch of a permanent magnet. Is it possible, by fitting it with pole-pieces and winding on one coil, to use it as the field-magnet for a small dynamo or motor; if so, what is the best size for pole-pieces? Best type of armature and what size? Gauge of wire for field-magnet and for armature.

You could use a tripolar armature for your little motor, 1¼ ins. diameter and same width as the field-magnet. Fit on pole-pieces, as per sketch enclosed, and use a couple of steady pins and one screw riveted over, as shown, for fixing. Wind field-magnet with about



USING A PERMANENT MAGNET AS CORE OF FIELD-MAGNET OF SMALL MOTOR.

4 ozs. No. 26 S.W.G. and armature with No. 28 S.W.G. Get on as much as you can in the space—about 1½ ozs. will be needed. Connect field in series with armature, and run from a few bichromate cells or accumulators. The machine is not of good design, but will run well enough as a motor. Make sure that the winding on field-magnet does not oppose the permanent magnet's polarity. For further particulars of windings, etc., and better designs for small machines, see "Small Dynamos and Motors," 7d. post free.

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.*]

An Interesting Competition.

An attractive competition for model makers, in which some useful and valuable prizes are offered, has just been arranged by Messrs. Stuart Turner, Ltd., of Shiplake, Henley-on-Thames. Altogether some £30 worth of prizes are offered, in eight different classes, for the best models built from the well-known high-class castings and materials supplied by this firm, and purchased by the competitor after June 20th. There is also an extra prize of a gold medal to be given to the model judged to be the best of all the entries submitted. The conditions are quite fair and not at all onerous, and the competition is open to everybody who is not a professional model-maker. It is proposed to exhibit the prizes at "The Model Engineer" Exhibition in October next, and to close the competition in January next, when the competing models will be publicly shown at some convenient place. The models will be judged by the Editor of THE MODEL ENGINEER, in conjunction with Mr. A. W. Marshall, M.I.Mech.E., A.M.I.E.E., and Mr. L. M. G. Ferreira. Full particulars of the competition may be obtained from Messrs. Stuart Turner, Ltd., at the above address. We hope their enterprise will be rewarded by a large number of entries.

The Editor's Page.

As will have been noticed from the announcement in our last issue, The Model Engineer Exhibition will be held at the Royal Horticultural Hall, Westminster, London, S.W., in October next, from the 22nd to the 26th inclusive. The proposal to hold this Exhibition has received a very cordial welcome both from our readers and the trade, and it is our intention to make it one of the most interesting and attractive scientific exhibitions ever held. We have received a number of most enthusiastic letters on the subject from readers of this Journal, and we desire to thank those who have written us for their very encouraging response and for the various suggestions they have made. We regret that we are unable to acknowledge these letters individually on account of their number, but it is evident that the idea of the Exhibition has "caught on." Although the printed prospectus has only been issued to the trade for a few hours previous to the writing of these notes, applications for space have already reached us by telegraph, by telephone, by personal call, and by letter, and there is every indication that the trade will be thoroughly well represented. Naturally, the early applicants are securing the best of the positions, and if there are any intending exhibitors who have not yet applied for space, we would strongly advise them not to delay. The exhibition will be so important a factor in deciding the flow of next season's business that every firm of any standing in the model engineering and allied trades should make a point of having a stand. Arrangements for a large number of attractions in the way of scientific lectures and demonstrations, working models, and other interesting adjuncts to such an exhibition are in preparation, particulars of which will be announced in due course.

* * *

Mr. W. H. Blaney sends us the following interesting letter on the subject of Model Steam Boats :—"*A propos* of the next Model Engineer Speed Competition, may I be allowed to make another appeal on behalf of the 'metre' boat? I have before advocated in your pages the adoption of this measurement for model steamers, and am gratified to find that several clubs, including the Wirral M.Y.C., have recognised the advantages of the size for small boats and have started building 'metres.' May I hope that The Model Engineer will assist to make the metre a standard size for small model power boats by recognising the measurement in the prize-list of the next competition? The advantages of the size may be briefly summarised as follows :—(1) Less first cost and upkeep, (2) easier to handle and transport, (3) easier manual labour to construct, (4) a call for higher skill in construction and design, (5) greater honour when a high speed is obtained. Add to this that the metre is a measurement that practically every nation understands, and we have all the elements of a promising contest in the future, when the sport of model steamer racing becomes more widely spread, a contest in which the humble mechanic may (with reasonable hope of success) pit his skill against the world's best. This is no idle 'chimera,' but is a reasonable view of the future providing the metre measurement is adopted and taken up with enthusiasm. Model engineering is becoming increasingly popular, and it is fairly safe to prophesy that in the pro-scientific age now coming it will be a universal recreation. This being recognised, it will be readily conceded that such a tendency will be greatly helped by adopting standard sizes for contests between models, and I submit the 'metre' as the most suitable universal measurement for model power boats. There are dissenters who dislike the measurement, and their principal arguments against it are that—(1) It is too small, (2) too much of a toy, (3) 6 miles an hour impossible, (4) can't get the power in the length. The last two objections may be answered with: It is quite possible, and you cannot do anything if you don't try. The first two are objections that no really enthusiastic model marine engineer would advance. I must apologise for using so much of your space, and trust the importance of the subject justifies it."

Notices.

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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THE

Model Engineer

And Electrician.

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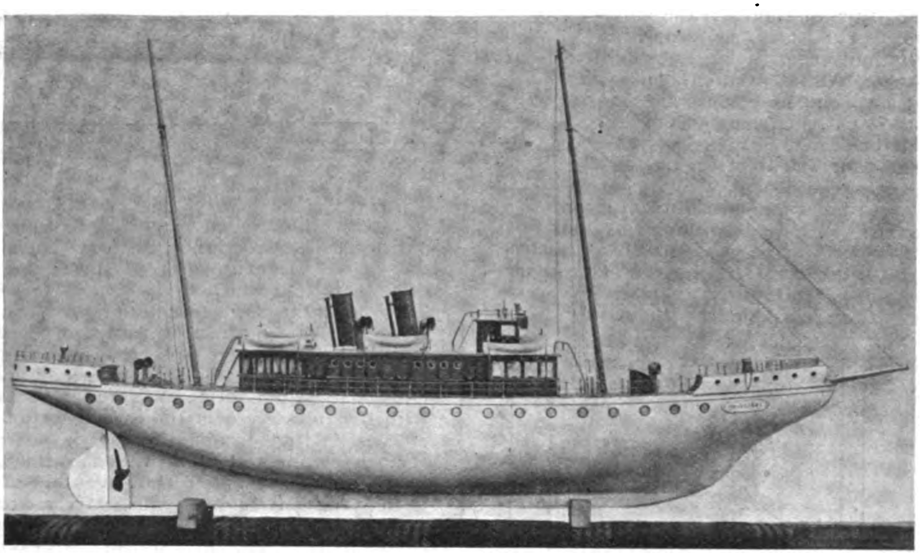
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XVI. No. 322. JUNE 27 1907. PUBLISHED WEEKLY

An Electrically-driven Model Yacht.

By E. G. MASON.



MR. E. G. MASON'S ELECTRICALLY-DRIVEN MODEL YACHT.

THE model electrically-driven yacht, *Brilliant*, which is shown in the illustration herewith, is the first attempt at model boat building, and therefore may be of interest to young readers of THE MODEL ENGINEER. The boat is carvel-built and dimensions are as follows:—Length over all, 5 ft. 11 ins.; beam, 10½ ins.; depth, 9 ins.; forecastle deck, 10 ins. long; poop deck, 8 ins. long; The cabins are of mahogany panelled, 2 ft. 1½ ins. long, whitewood deck marked as planks. The interior of cabins are decorated with white enamel and pale green, with a red and gold dado, and fitted with the electric light. The furniture consists of brass chairs with cushions, table, carpet, and lace curtains to windows, and curtains to doors. The port and starboard and headlight and chart house are lit by the electric light. All stanchions are of brass turned on hand lathe. The davits are of ⅛-in. brass. The ventilators are of brass, and the cowls are spun and fitted on revolving tubes. The companion ladders are made of tin and perforated steps with brass treads, and brass hand-rails; brass hand-rails are also fitted round the cabins and chart house. The funnels are made of tin and coloured buff, two binnacles, six lifeboats, 5 ins. long, 1⅜-in. beam, 1-in. deep. The capstan works with two pawls. The riggings are of brass picture wire and fitted with screw tension eyes. The railings through stanchions are of picture wire also. The beading around poop deck and forecastle is cut out to represent rope and gilded. The hull is painted white, and brass portholes and steering-wheel. Driven by 8-volt motor by accumulators.

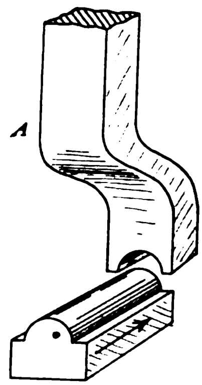
Planing and Shaping for Amateurs.

By A. W. M.

IV.—Working the Machine.

(Concluded from page 583.)

THE feed of the tool, that is the amount by which it is moved across the surface of the work at each stroke of the machine, should be determined by the depth of cut and character of surface desired. An adjustment is provided by which the feed can be regulated in amount. The screw which moves the slide is usually rotated by a ratchet wheel and pawl. The latter is vibrated from some lever which receives its movement from a cam or tappets. An examination of this gear will show that the movement of the pawl can be altered so that it will vibrate over one tooth or several teeth at each stroke of the machine. If the movement of the pawl is small, the feed will be fine; if the movement is large, the feed will be coarse. With a deep cut, such as a roughing cut, the feed must be fine. With a shallow cut, such as a finishing cut, the feed can be coarse. This means that you can take your weight of shaving as a thin deep cut or as a wide shallow cut, and remove a similar amount of metal in each instance. A coarse finishing cut will not, however, produce such a good quality of surface as a fine feed, taking a shaving the same depth in each instance. It is usual to plane cast iron and brasses of various kinds without lubricating



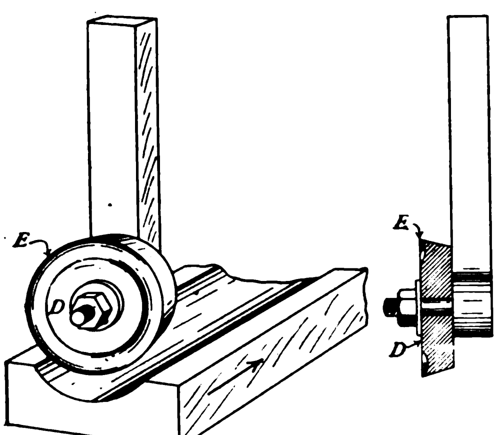


Fig. 63.

the cutting edge of the tool, for both roughing and finishing cuts. Wrought iron and steel may be planed dry for roughing cuts, but to produce a polished surface it is necessary to lubricate a finishing cut on these metals. A soap and water composition as follows will be a good lubricant: water, 12 pints; soft soap, 14 ozs.; oil of any kind used for lubrication, 1 pint. The water should be made hot before the soap and oil is added to it; stir up thoroughly. Ordinary paraffin oil answers very well as a lubricant for steel, perhaps better than the soap and water; for very hard steel, try turpentine if you have difficulty in getting the tool to cut.

Though not necessary, lubrication is beneficial when rough-cutting wrought iron and mild steel; crucible cast steel, however, may be cut easier if dry; when a lubricant is used, the tool is liable to slide over the surface instead of cutting. Lubrication is, however, required to obtain a polish with a finishing cut. Curved or moulded surfaces can be planed by a tool which has its cutting edge shaped

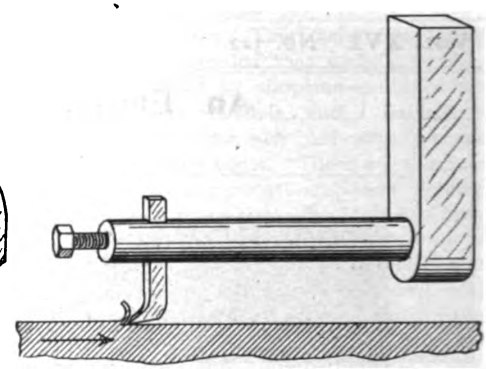


Fig. 64.

to produce the desired curve. A tool for cutting a circular groove is shown in Fig. 63. It consists of a disc of tool steel turned in a lathe to the diameter of the circle to which the groove is to be shaped. The edge of the disc is turned to taper away from the front edge, and a groove is turned in the front face so that a cutting edge E is produced. The turning should be done so that the proper clearance and cutting angles are formed to agree as far as possible with the rules given in the earlier portion of these articles. After turning to shape, harden and temper the disc and mount it as shown upon a steel bar to form the shank. The advantage of this tool is that the cutting edge will be truly circular and that by rotating it into different positions a new cutting edge is brought into use. An example of a shaped tool is given in Fig. 64A. The work should be roughed to size as nearly as possible by ordinary point tools and finally finished with the shaped tool, using very light cuts indeed. Another instance is cutting wheel teeth, which can be done by a planing or shaping machine. The wheel blank must be mounted upon a dividing mandrel clamped to the table. Cut the bulk of the metal from between the teeth by means of a parting tool as C, Fig. 65, as a first operation; then plane them to form by means of a shaped tool, made to the shape of the spaces *between the teeth*, as D, Fig. 65.

Cutter bars or tool-holders should, if possible, conform to the principles given in the section relating to tools. The writer does not know if any patterns of small size tool-holders are made specially for planing and shaping machines. Some of the patterns made primarily for use in lathes will also serve for planing and shaping work. The ingenious amateur will probably design and make some tool-holders to suit his particular class of work, if he cannot find something on the market. Figs. 66 and 67 show some patterns which he could make.

Design A can be made to take either round or square-section steel. The sketch is that of a front tool, but side-cutting tools for left and right hand

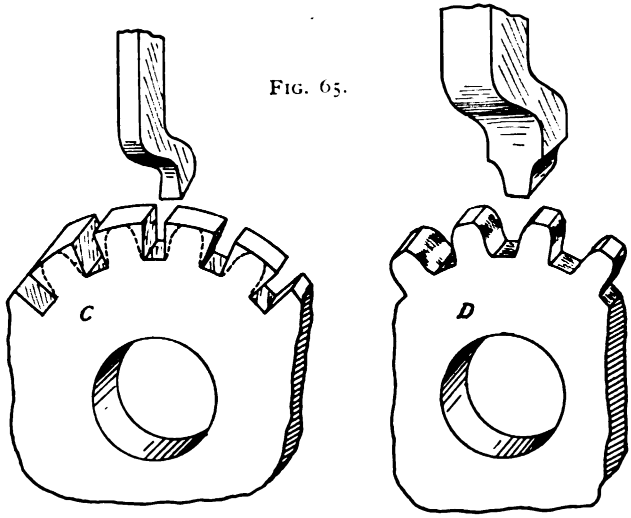


Fig. 65.

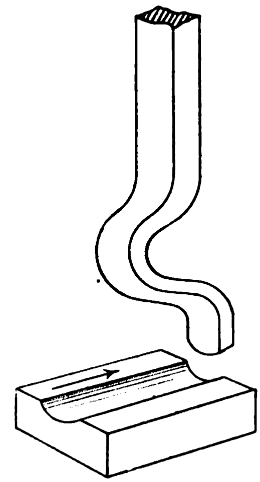


Fig. 68.

can be made by setting the lower part of the bar to one side or the other.

Design B has a swivel, and can be used for both

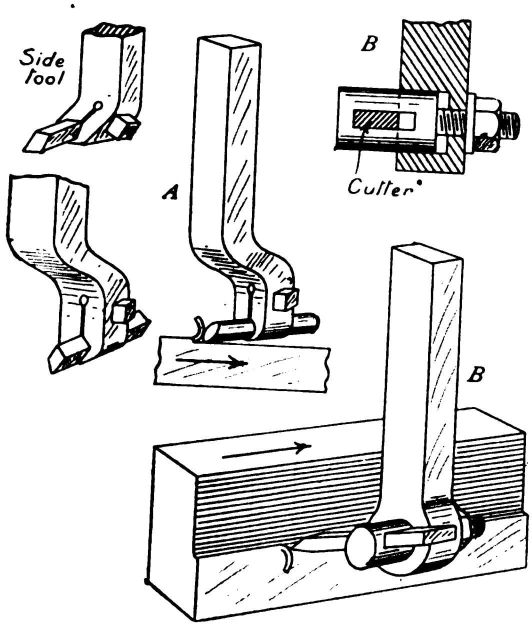


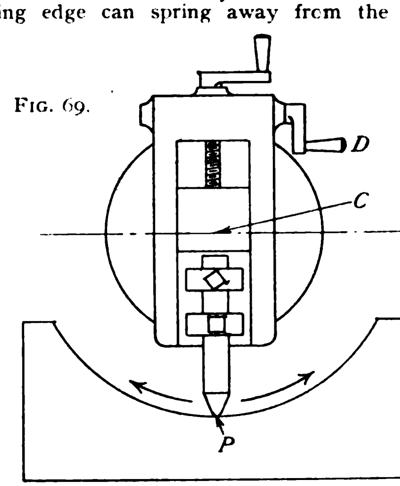
Fig. 66.

front and side cutting. It is necessary to shape the cutting angle of the tool to suit the material upon which it is used.

Design C can be also made for side-cutting by setting the holder portion to one side or the other. Another way to make the bars A and C so that they can be used for either front or side cutting is to fit the holder portion to the shank by a hinge joint, as D, so that it can be straight or inclined. The difficulty with cutter bars is to make them so that the cutter is held sufficiently firm. In design C the cutter is supported at its back by a setscrew, which is screwed up to the cutter as the latter is moved forward to replace wear due to sharpening.

Sometimes the surface to be planed lies under a projecting part of a casting and cannot be reached by an ordinary tool. The cutter bar shown in Fig. 64 is designed to reach such places—for example, to cut a keyway in the boss of a wheel. Spring tools, such as Fig. 68, are used to produce very smooth surfaces. As they are made so that the cutting edge can spring away from the surface

Fig. 69.



of the work, the cut is not likely to be so true and straight as that produced by a stiff tool. Their proper use is to cut curved shapes used for ornamentation, where accuracy of surface is not required, but a smooth appearance is to be produced. The cutting edge should be in line with the under side of the shank, and only very light cuts be taken at a time; these tools are to be regarded as scraping the surface to a finish rather than cutting away much metal. It is a good plan to finally finish the cutting edges of all tools with an oilstone. Finishing tools, such as Figs. 13 or 68, should certainly be treated in this way if they are to produce good surfaces, but even roughing tools cut better if their cutting edges are rubbed with an oilstone after having been ground.

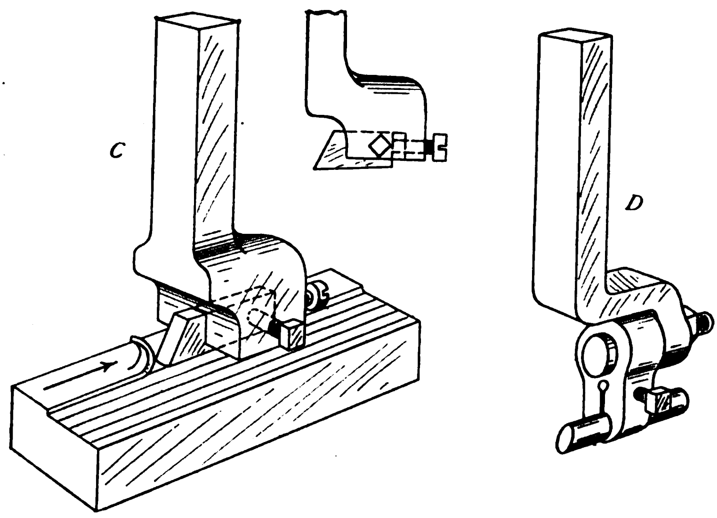


FIG. 67.

Many shaping machines are fitted with a circular movement to the tool-holder. This is for the purpose of producing hollow circular surfaces, but its application is somewhat limited. The vertical slide is made to rotate upon a pin fixed in the head of the ram, the motion being effected by means of a quadrant rack and worm. The curve produced by the tool will depend upon the distance of the point P from the centre C (Fig. 69) upon which the slide turns. The handle D is the one which rotates the quadrant, thus giving a circular feed to the tool.

The cross-slides of the machine should be fitted with a clamp, so that the slide can be locked in postion. Usually a small pinching screw is arranged to force a strip against the slide, and this screw can be noticed projecting near the adjusting screws, which are provided to compensate for wear. If, for example, you are planing a vertical surface, the cross-slide of the machine is liable to move slightly, or you may accidentally knock against the feed-handle. To prevent the surface being affected, the slide is clamped tight as soon as the cut has been adjusted, and remains locked until a new cut is commenced. Remember, however, to see that this pinching screw is slack before you put the cross-slide feed motion again into gear.

Cutting Small Gearwheels Without a Lathe.

By W. D. D.

MANY amateurs are handicapped in the construction of models by the necessity of having sundry small gearwheels, racks, etc., cut for them, or adapting corresponding parts of a superannuated clock to take their place. With no other tools, however, than hack-saw, files, compass, etc., and with the exercise of a little patience and moderate skill, very respectable teeth may be cut on blank wheels, and even if they are not perfect cycloids, etc., so long as the pitch is correct and the teeth are uniform they will work well.

First take the case of a small gearwheel, say 1 in. outside diameter and 1-16th in. thick, with twenty-four teeth. Draw a circle on paper, the same diameter as the wheel. Divide the circumference into the number of parts desired, by drawing diameters (Fig. 1). The distance A B will be approximately the pitch. Now describe a smaller circle for the base of the teeth (half-way between these circles may be taken as the pitch circle).

Now scribe a circle (diameter of outside of teeth) on a piece of 1-16th in. sheet metal, and having cut it out and filed it up, fasten the marked-out paper circle accurately over it with Seccotine or glue. Saw-cuts can now be made down the diameters to the smaller circle with the aid of a saw guide (Fig. 2) made from 1-16th-in. mild steel or iron. This guide should have a bevelled edge

FIG 2.

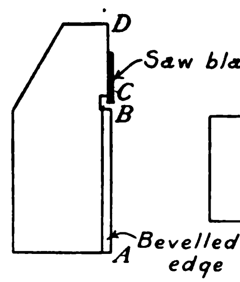
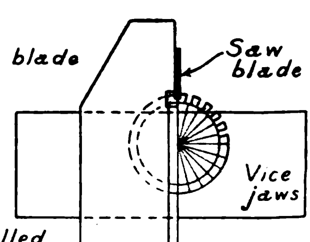


FIG. 3.



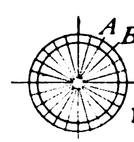


FIG. 1.

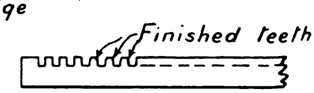


FIG. 4.

CUTTING SMALL GEAR WHEELS.

(A B) to lay along the line on which the saw-cut is to be made. The straight-edge C D should be set back one-half the thickness of the saw-blade, so that the centre of the blade, when flat against it, will be over the line A B. A small clearance space (B C) must be made to allow the teeth of the saw to pass.

The guide should then be placed along one of the diameters and held in position until gripped in the vice (Fig. 3). The first tooth may now be cut, care being taken to keep the blade of the saw flat up to the guiding edge. If this is done, and the saw-guide well made, the cut will be central on the line, and if the marking out is correct the teeth will be quite uniform all the way round. A small ward file will be needed to finish off the teeth to their proper shape and thickness.

In making a worm wheel the cuts must be taken in a sloping direction, the slope and pitch depending on the slope and pitch of the worm thread (which, though more difficult, may also be cut with a hacksaw and file).

A bevel wheel should be cut in the same manner as the spur wheel, but the cut should be deeper on the side which has the larger diameter. To cut a rack the pitch should be marked along the side, and the guide and saw used as before (Fig. 4).

"We never know what we can do till we try," and the good work which can be turned out, even at a first attempt, will come as a surprise to many.

A Design for a Small Model Undertype Engine.

By Henry Greenly.

(*Continued from page* 561.)

VII.—Crankshaft and Flywheel.

Some readers may have noticed that in the article in May 30th issue, in referring to the machinery and fitting of the connecting-rod the writer said that the splitting of the big end brasses would be done *after* boring for the crank-pin, and in the later article (No. VI) the method suggested for making the eccentric straps is to cut them in half in the rough, face and sweat the pieces together, and then to bore for the sheaves. In case anyone should ask which is correct, it may be said that either course might be adopted; but where the big end and eccentric straps are sawn through after boring a very fine saw should be used, otherwise the gap will be rather large. With a fine saw the gap formed may be filled with a piece of lead foil. When eccentric strap wears, this may be removed, and the strap or big end closed up on the sheave or crank-pin, as the case may be. To ensure that the cut shall be quite square, the ingenious little device used by Mr. J. C. Taylor (see issue of November 2nd, 1905) may be employed. Less care may be taken where the bearing is split before boring. A coarser saw may be employed, but at the same time faces should be filed up quite square and true before the two parts are joined with solder for the machining.

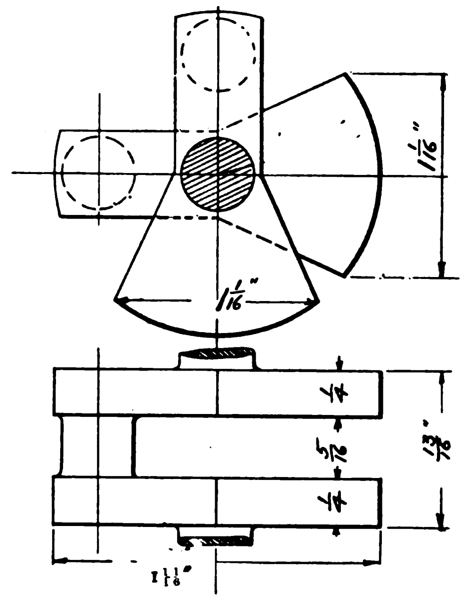
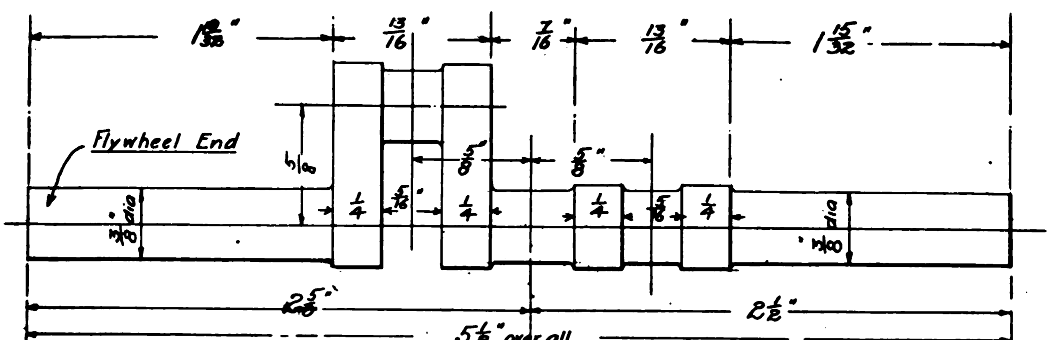


Fig. 32.—Crankshaft with Counterweight solid with the Webs.



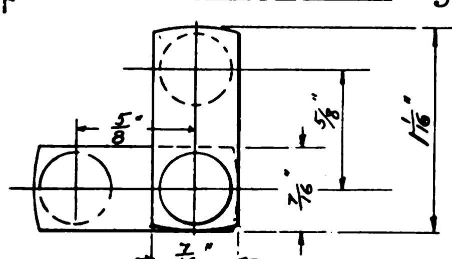


Fig. 31.—Crankshaft with Plain Square Webs. (*Full size.*)

While talking about the machining of the connecting-rod, attention may be called to the virtues of the pin drill for facing the sides of both little and big ends. In such cases where the lathe will not swing the rod a very good finish may be obtained in this way. The pin drill used for the big end would, of course, require a broad face edge, which

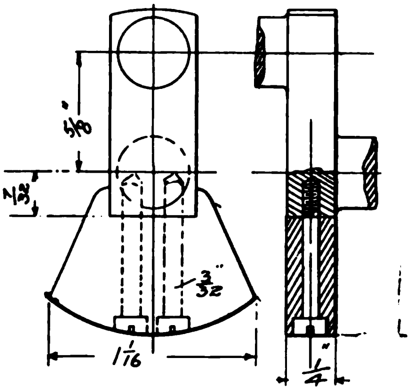


Fig. 33.—Crankshaft with Separate Counterweights.

would also have to be recessed to form the projecting collar.

The next parts described are the crankshaft and flywheel. A reference to the general arrangement drawing which accompanied the first article will drilled and sawn away, and the crank webs twisted at right angles, whilst the middle part (the centre journal) is red hot. End plates centred in the usual manner (see "Practical Lessons in Metal-Turning," by P. Marshall), will, of course, be required for machining the crank-pins.

The balance weights, if used, may be solid with crank webs, as shown in Fig. 32. The only drawback to this is the fact that a very long tool must be used to turn the crank-pins, projecting nearly 2 ins. from the tool-rest, and therefore the writer also shows (Fig. 33) the balance weights made separately from the crankshaft and attached by means of screws to the webs. This method is commonly used in model work, but, as in the present instance the dimensions of the shaft are necessarily small, the counterweights should fit the crankwebs tightly and may be secured by sweating, as well as screwing, to the webs. When fixed the sides and edges of the weights may be turned up in the lathe. When the bearings are fixed down they may very well be turned up in the manner adopted by Mr. Ferreira and described in the recent report of his paper before the Society (see Fig. 19, page 580, issue of 20th inst.), the rod used being the same as the crankshaft, viz., ⅜ in. diameter.

The flywheel is detailed to full size in Fig. 34. Only half of the wheel is shown. The number of spokes may be six to eight, but six will be found quite enough in such a small wheel. Should, however, any reader require an eight-spoke wheel he can easily arrange the pattern with this number without altering any of the other dimensions of the flywheel. Soft cast iron should be used. The wheel should

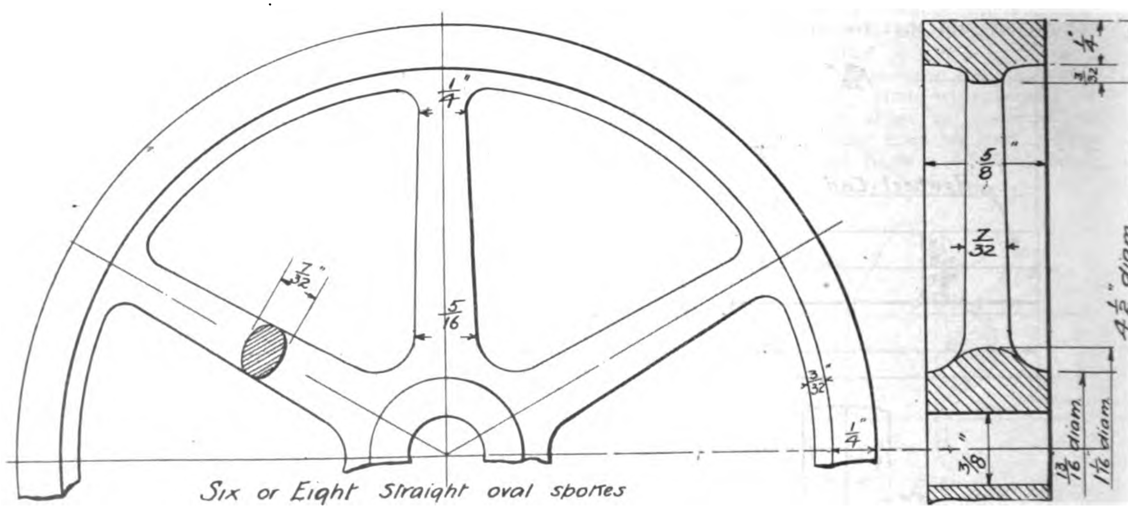


Fig. 34.—Flywheel for Undertype Engine.

show that balanced cranks were considered; but while these are desirable features in any engine which has no balance weights in the flywheels, and where the pistons and other reciprocating parts are not balanced in themselves, they are in the present case by no means essential to success. This being so, the writer shows in Fig. 31 a crankshaft with ordinary square webbed cranks. This may be made from a steel casting or from a piece of ½-in. by 1¼-in. steel plate, the superfluous parts being

be bored a driving fit for the axle, and the edges and face of the rim turned up with the wheel on a short ⅜-in. mandrel placed between centres, the driver being placed through the spokes of the wheel. The writer thanks Mr. T. C. Howard (Manchester) for pointing out that the dimension given to the bore of the L.-P. cylinders in the plan view (Fig. 5, May 2nd issue) should read, as in all other views, 1 in. instead of 1¼ ins.

(*To be continued.*)

How It Is Done.

Turning Long Shafts.

By Alfred Parr.

THE evolution of the shaft-turning lathe would form a most interesting subject for research, and one which would well repay for the trouble it would incur. It is, however, scarcely within the scope of the present article to go backward further than the introduction of the self-acting slide lathe; at the same time it is only right, I think, to state that shafts were turned previously by means of a slide-rest, and before that even, when hand tools alone could be used. Shafting lathes were of two principal forms, viz., ungeared and geared. Lathes of the ungeared type were all belt-driven, the driving cones were of very large dimensions, and abnormally wide driving belts were used. The main desire was to obviate all possibility of chatter, by substituting the cast gearing for a powerful and direct drive by belt. It is not here intended to decry toothed gearing, but simply to state that an ungeared lathe engaged in turning long shafts and operating three tools on 3-in., 3¼-in., and 3½-in. shafts respectively, did excellent work for a considerable number of years. Link belting was used and no alteration was needed to the belt after four years wear, although the lathe was in daily use. Lathes of the geared type were, of course, of very much less proportions; there were few draughtsmen with shop experience in those days, the result being that symmetry of design and neatness of arrangement were quite as important as utility.

Machine tools generally were too light for the work they were designed to execute, the result being too often found when heavy cuts were taken. In the lathe feeding arrangement two small step cones were employed—one being keyed to the back shaft, and the other fitted with a gear wheel which was in communication with the pinion on the spindle end. This small belt drive was quite satisfactory for small machine tools, but altogether inadequate for powerful lathes. A practice in operation in some shops was for owners to alter short lathes on their own premises, and machine builders would show you—with quite a satisfied air—sliding lathes which they had converted into shaft-turning lathes by just adding 10 or 15 ft. to their length, as the case required. Fortunately, this practice is dying out, because the enormous cost of these additions would go far towards the purchase of an up-to-date shafting lathe which would, if supplied with sufficient work, soon pay for its introduction. Therefore, there was no real economy in making the alteration referred to. Again, in all machine tool construction there is not one which is put to the test more constantly than a shafting lathe which is daily producing finished shafts 20 to 30 ft. long accurately to the gauge. The design has been gradually changing during recent years; for instance, it is not long since 3½ ins. would be considered ample for a 10-in. centre lathe spindle journal bearing. To-day we have in its place a 5-in. journal, and, in addition to this, the area of all surfaces in contact—*i.e.*, the saddle, the transverse, and the tool-rest slides, have all been proportionately increased and in other ways strengthened.

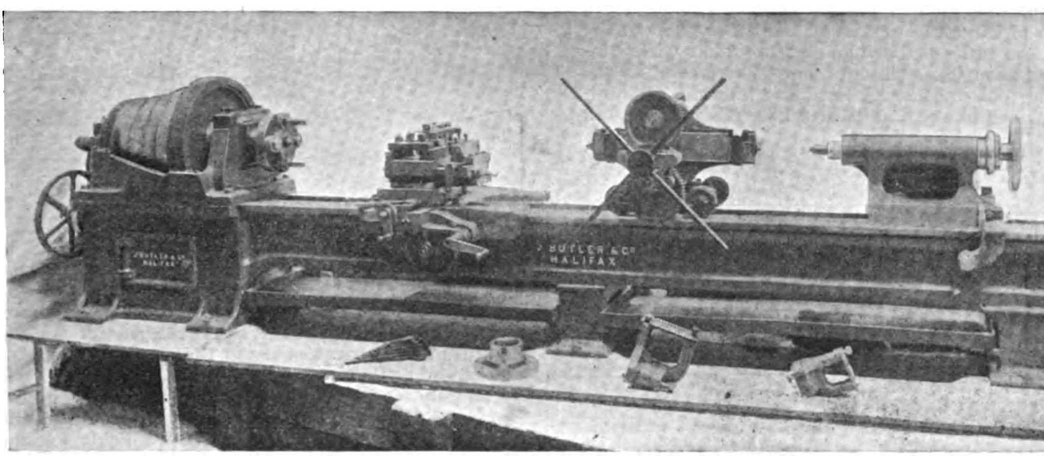


Fig. 1.—High-speed Shafting Lathe.

The bed has also undergone considerable changes. A stout box has been introduced at one end instead of a leg, whilst the whole of the fast headstock and more is carried in a solid form down to the floor. Stiffly made bridging strips are placed between the shears at close intervals to strengthen the bed still further, whilst the depth has also been increased. From the foregoing it will be gathered that too much cannot be said for the proper design and construction and the adequate equipment of a shaft-turning lathe. The illustration (Fig. 1) is of a fully rigged lathe kindly supplied by J. Butler & Co., of Halifax. The specification below bears out what has already been stated without further comment.

This lathe is specially designed for turning shafting at maximum speeds with high-speed steel. The headstock is of specially strong design and is arranged with exceptionally large cones and with double gearing carefully calculated to give exact cutting speeds on shafting from 3 ins. to 6 ins. diameter. The spindle is of ·4 carbon forged steel of large diameter and runs in phosphor-bronze parallel bearings. The headstock frame is of massive design and is secured to the bed by turned bolts. The sliding is done by a screw under the front shear of the bed which gives a direct and powerful pull on the saddle without intermediate torsional strains, and the handle for controlling the nut box for sliding is placed conveniently on the front of the saddle. A backshaft is also provided for the surfacing motion. The saddle is of specially heavy type with large bearing surfaces on the bed and has quick hand traverse motion on the bed. It carries a strong slide-rest with two tool posts with swivel base and also a special two-tool shafting rest with steady rest and polishing die combined, and means provided for adjusting each tool independently. The loose headstock is fitted solidly between the shears of the bed and secured by two bolts. It is fitted with handle shaft and pinion into rack for traversing it along the bed. The lathe is fitted with wheel pump driven from the countershaft and fitted to a tank or reservoir placed below ground behind the bed at the driving headstock, and suitable gutters are provided throughout the length of the lathe to convey the water back to the tank, the lathe bed being also provided with conducting troughs. The lubricant is conveyed to the cutting tools by flexible hose and jet from a standpipe placed in the middle of the length at the back.

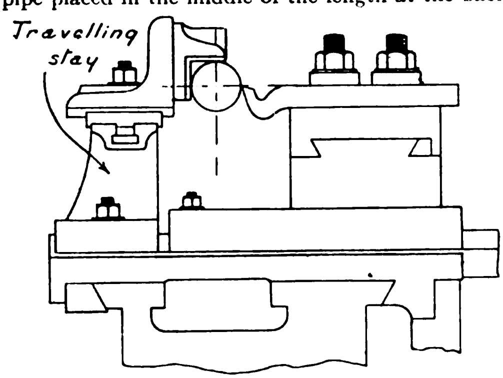


FIG. 2.—TRAVELLING STAY.

The following are the dimensions:—Height of centres, 12 ins.: bed, 37 ft. 3 ins. long by 19½ ins. wide on face by 13 ins. deep, admitting 30 ft. between centres; front bearing of spindle, 6½ ins. diameter by 8 ins. long; cone (four speeds), 18 ins., 20 ins., 23 ins., and 24 ins. diameter by 4¼ ins. wide; gear power, 4·4 to 1; main countershaft pulleys, 24 ins. diameter by 5 ins. wide; speeds, 225 and 107 r.p.m., with improved self-oiling cast-iron swivel bearings; approximate weight, 10 tons.

When a very short but thick shaft is turned in the lathe, no support is necessary, but slender shafts, and certainly all line shafts, have to be controlled by suitable stays. Illustrations of back or travelling stays are shown at the base of the lathe in the photograph, and another form of stay for the same purpose is given in Fig. 2, which is an end elevation of the stay mounted on the saddle to its work. These stays are very important and have to be fixed firmly, and at the same time be accurate in adjustment with the line of centre; they are further helped in their control of the shaft by a steady rest or movable stay (Fig. 3). The latter type has a twofold purpose—first, by one being placed in advance of the tool it gives support to the rough shaft, and a second one serves as a support to the finished shaft by just placing it behind the saddle. It would, therefore, follow that

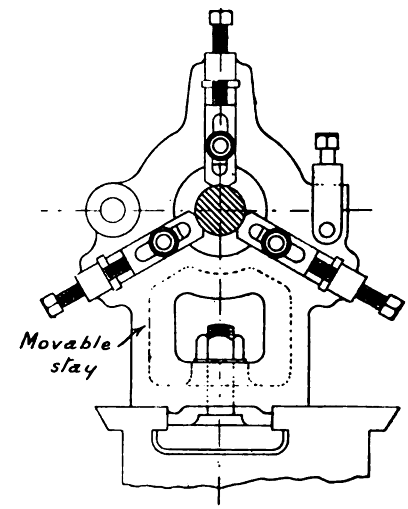


FIG. 3.—ADJUSTABLE STAY.

in the lathe illustrated, where a 30-ft. shaft can be conveniently turned between the centres, that several movable stays would be constantly employed. The principal aim should be to so manipulate these movable stays on each side of the cut as to prevent any sagging of the shaft. If sagging be allowed, the probability is that the shaft will gradually worm out of centre and affect the smooth running of the shaft in its bearing in the stay, and so set up undue friction, which will quickly expand the diameter of the shaft, thereby causing the tool to remove more metal than it should, and so spoil the work. Mild steel (being stronger than wrought iron) is almost universally used for line shafts.

In practice, where shafting and fittings are manufactured as a speciality, straightening machines of one form or other are used, and usually unskilled workmen are employed to set the shafts true for the lathemen. They also restraighten and polish the shafts after they have been turned; by this arrangement the turners are using their lathes to the best possible advantage—*i.e.*, the lathes are always cutting, being stopped only to take out finished shafts and put in rough ones.

There are various driving devices in use to facilitate the output, and each has advantages peculiar to itself. In the first place, it must be understood that a lathe carrier fixed on the shaft and made to rotate by one fixed driver, is calculated to act somewhat as a crank, and is for this reason unsuitable. A double driver is therefore necessary, and an arrangement which is very popular to-day is seen in Fig. 4. The carrier is driven by two opposite studs, one being placed on each side of the lathe centre, and since these drivers are secured to an oscillating plate they give an equal pressure to the carrier as it rotates. For the above purpose "clamp carriers" have been introduced, and are the best for this form of drive, since each driving arm is alike parallel and of the same diameter throughout. After the shaft has been turned to within a short distance of the carrier, it is reversed between the centres, and the untooled portion is tooled and finished.

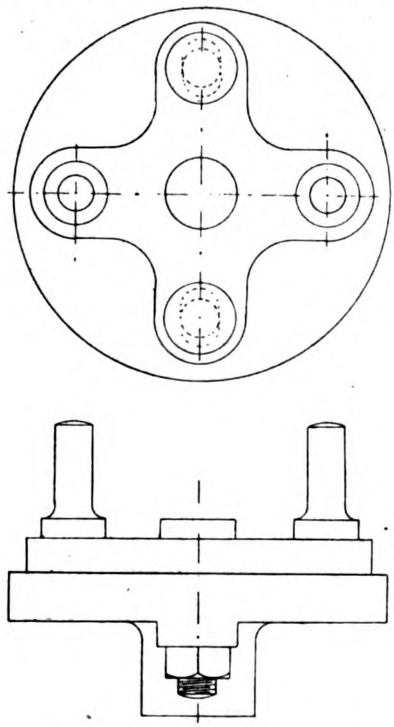


FIG. 4.—DOUBLE DRIVER FOR LATHE CARRIER.

The strain on the shaft being more or less severe, t will sometimes be found when the shaft has been reversed, that the turned portion near the loose headstock is not running quite truly, and will need the centre hole drawing with a hand scraper or possibly square centreing to get it back to truth. To obviate this, some prefer to have the shaft made a few inches too long, so that by placing one end in a stout jaw chuck, or a bell chuck, the shaft can be turned, straightened, and cut off, without reversing it. There is, of course, a short piece wasted on each shaft, but it is contended that the value of the material is less than the value of the time which the turner occupies in turning the shaft "end about" and tooling the unturned portion.

The shafts are generally forged 1-16th in. over size, and are tolerably straight and true, but all the same, each shaft has to be set true either by some form of straightening machine (see machine mounted on wheels on lathe bed, Fig. 1), or by the aid of a cramp and links, or both, as the case may be. The final setting is very particular, as the errors left in a shaft are not altogether removed by tooling. This will be better understood when we remember the first principle of true cutting—*i.e.*, rough out with one cut and finish with a smoothening cut afterwards. But in the above case the tool or tools are continuously cutting, and therefore the more uniformly the shafts rotate before tooling the less the error afterwards, and the final setting will be at a minimum, and consequently the greater the accuracy of the finished work as a result. There are three or four different ways in which the tools may be arranged to do the above work.

(1) The first is to place the tool in the slide-rest in front of the travelling stay and to use it in such a way as to cause it to act both as a roughing out and a finishing tool. Necessarily this tool must have a penetrating angle of about 60 degs. with an ample side rake, and a decided sloping away from the cutting edge towards the right. The nose of the tool must be rounded to lead properly and somewhat flat on the centre, dying into a gradual curve to prevent the traverse leaving any ridges on the work. The shaft is further smoothened by the use of a hard steel plate which is kept close in contact with the revolving shaft. This plate acts as the front die in the travelling stay.

(2) In this case two tools are used on the same rest, the leading tool doing the brunt of the work, whilst the following tool acts simply as a "sizer" by just taking off a scraping cut.

(3) Another method of using two tools is to employ two rests—one tool fixed in the ordinary manner at the front of the shaft, and the other acting independently at the back of the shaft; but in this case the cutting tool is inverted, meeting the work as it revolves upwards.

(4) A fourth plan is to use a special head on the lathe saddle, in which case the ordinary transverse slide and the top rest are dispensed with.

The cutting tools are set at 120 degs., and each works in a small independent slide. The three tools are set so as to divide the amount of cutting required between them.

The shafts are turned for several inches to exactly the size of the gauge, and on to this finished part the travelling stay is secured. The fit should be smooth and uniform throughout, so that the movement of the saddle on the surface of the bed (carrying as it does the cutting tools and the stay) is axially straight from beginning to end of traverse.

To ensure the above movement, the best thing to do is to bore out the dies in their places by means of a bar and cutter carried between the lathe centres. When this is not done very great care has to be exercised in doing the work at another machine, whilst the parts concerned are more or less detached. Originally "coarse traverses and low speeds" were the order of the day. Now, however, the reverse is the fashion. "High speeds and fine feeds" obtains. The somewhat recent introduction of air hardening steel is largely the cause of the increase of speed obtainable. By looking again at the special shaft turning lathe in Fig. 1, it will be quite clear that with such a powerful machine, using tools whose edges it is difficult to dull, that the output will be considerably increased, and in this case especially, as there are four tools at work. Lubricating the cutting tools is also a speciality in the above lathe, and plays an important part in the successful working of the tools. The more uniformly the temperature can be maintained the less will be the friction on the poppet centre, and obviously the less will be the attention requisite. On the other hand, if the shafts get unduly heated, their length gradually increases and much trouble will be found with every part of the lathe concerned.

Chats on Model Locomotives.

By Henry Greenly.

Modelling Shunting Engines.

(*Continued from page* 540.)

CONTINUING the branch of the subject opened up in the last article, I submit another design for a simple engine in which the four wheels and plain boiler are retained. Instead of driving direct on to axle of one or other of the two pair of wheels, a system of transmission gear which has been used with success on small engines is employed. The design should appeal to the "latheless ones" more particularly, as the amount of work for which this "King of Tools" is is not required, and also to form a flame guard completely shutting the lamp from view, the tanks being intended to form additional up-takes as already described. These necessary alterations in external design should not, however, prevent the builder, if he so desires, from painting N.E.R. on the side tanks, and considering it a more or less accurate model of this pretty little shunting engine.

As will be seen by the drawing, Fig. 7, a single-acting cylinder (one) is intended, and this is virtually geared to the driving wheels in a ratio of approximately 1 to 3¼. A cylinder ⅜ in. by ⅝ in. stroke may therefore be adopted without fear of the boiler running short of steam. Toothed gear is not intended, although the same may be used. The drive is obtained by friction, and to give a sufficiently powerful grip between the flange of the coupled wheel and the pulley on the engine shaft it is

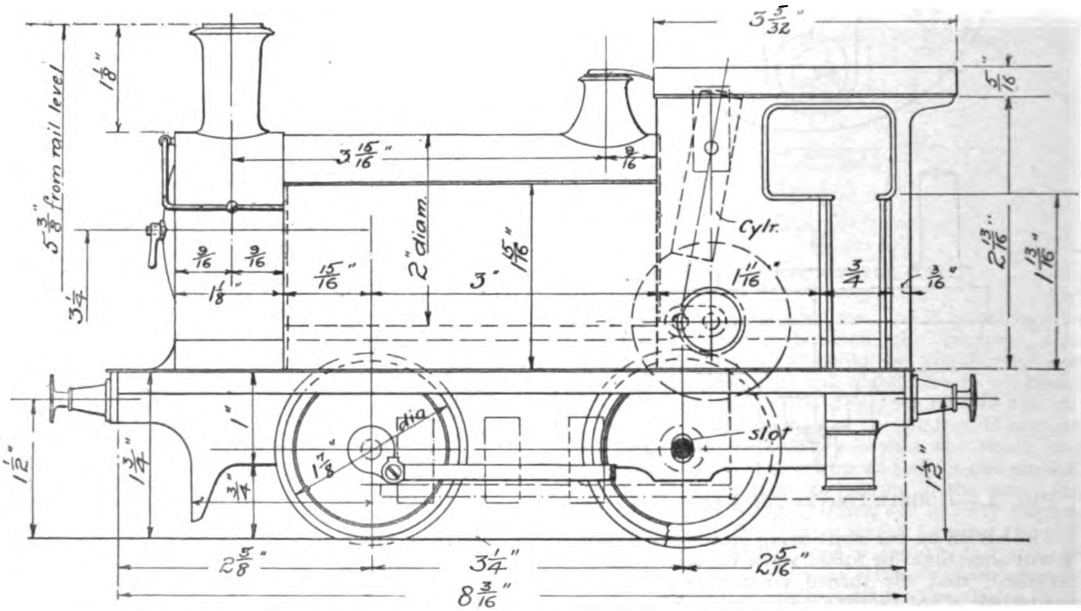


Fig. 7.—Side Elevation.

MODEL SHUNTING LOCOMOTIVE USING OSCILLATING CYLINDER IN CAB, AND FRICTION DRIVE.

required is reduced to the minimum, and the cost of obtaining finished wheels, cylinder, boiler ends, and fittings is, by reason of the simplicity of the model, I think, as low as it can be got down to.

With regard to the external design, some readers may be inclined to remark, "Yes, the engine looks all right, but there is nothing like it in use in this country." If, however, reference is made to THE MODEL ENGINEER for September 1st, 1904, on page 205 of that issue will be found an excellent picture of a small North Eastern Railway engine of similar design; indeed, I have endeavoured to make the external proportions of the model as nearly as possible like this locomotive. The differences are slight; the cab is a trifle bigger, also the coupled wheels, but this is inevitable with the style of driving mechanism suggested. The tanks are also extended so that a leading wheel splasher intended that the whole of the weight of the rear half of the engine should be utilised for this purpose. The trailing wheels should be fitted in slotted holes in the main frames, and instead of the weight of the locomotive being borne on the axle of these wheels it will be transferred (when the engine is on the rails) to the journal of the crankshaft, *via* the rolling surfaces of the wheel flange and the friction pulley. In this way an adhesive force almost equal to that between rail and wheel is obtained.

The friction wheel may very well be grooved for the flanges of the driving wheels, and, instead of being made of metal, boxwood, or, better still, red vulcanite fibre may be employed. Either of these materials will be found to provide a very good grip. The edge of the trailing wheel flange may also be knurled or otherwise roughened to enhance the effect.

Reversing gear is intended, as, however small a locomotive is, it never seems to give satisfaction unless means of making it travel backwards and forwards are provided. In this model the reversing gear may take the form of an extra movable port plate placed between the cylinder and the faces of the steam-distributing block in a manner which will be described. The handle may be made to project through the roof of the cab, and be marked with three positions—"forward," "mid or shut off," and "backward" gears. This plate will dispense with the necessity of a regulator. Two flywheels are shown fixed on the crankshaft. Preferably these may be made of lead or type metal, and may project below the frame edging sufficiently far to

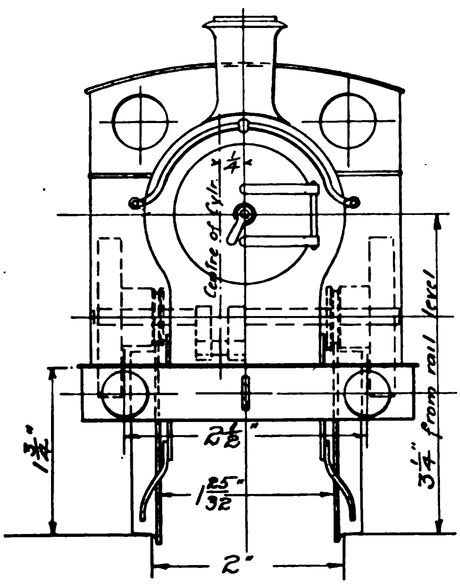


FIG. 8.—FRONT VIEW.

enable the finger to be used to give the engine a helping hand over the head portions of the stroke.

The chief point to be observed in building an engine of this kind is to make it as light as possible. Furthermore, all the working parts should run freely. As in the locomotive which formed the prototype for this little engine, the back of the cab may with advantage be left open. If this is done it will be possible to get at the cylinder to oil and adjust any parts much more readily than if it were completely boxed in.

(To be continued.)

AN ELECTRIC FILTER.—This is the invention of a Hungarian engineer and is about to be exhibited in St. Petersburg. The filter is in two parts. One part is connected with an electric circuit which sends a powerful current through the drinking water and thereby kills any micro-organisms in it. The second part is an ordinary filter of an improved type.

The Construction of the Hull of a Model Atlantic Liner.

By R. H. COLLET.

AS a rule in articles about model vessels the construction of the hull is very shortly explained, almost all the explanation being given to the contents of the ship. Although this is perhaps the more important, the speed of a boat very largely depends on the shape of its hull, which—to design

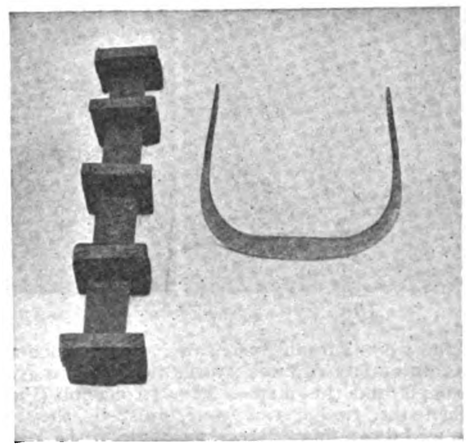


FIG. 6. FIG. 1.

and build properly—is by no means a small factor in the making of a ship.

As many readers seem to have had difficulty with the hull—which some have had made for them—perhaps it will interest them to know how I built my boat. The boat, which is 50 ins. long, 8½ ins. beam, and 7 ins. deep, is, with the exception of the stern piece, completely made out of basswood, which is very nice and easy to work. I first bought a piece of basswood 48 by 7 by ⅞ ins. and cut out of it a piece which was ultimately to be shaped down to a combined keelson, stem-post, and sternpost. This piece of wood was, approximately, a longitudinal vertical section through the centre line of the ship. All the inside part was cut out, leaving a bar of wood connecting

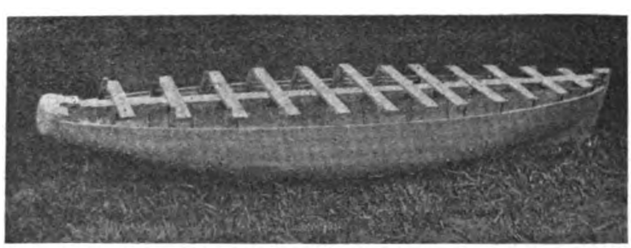


FIG. 2.

the tops of stern- and stem-posts, the object of this being to afford a substantial centrepiece for fixing the ribs in their correct position.

Templates having been made of the ribs in white cardboard, the shapes of which were obtained from the design (*quae a patre meo facta est*), the ribs were easily marked out and then cut out of a sheet of basswood ⅜ in. thick. Then, from the same cardboard templates, I cut out similar ribs in tin. These were to strengthen the lower part of the wooden ribs where they were weakest, the grain

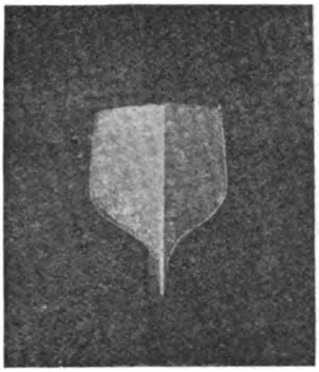


FIG. 3.

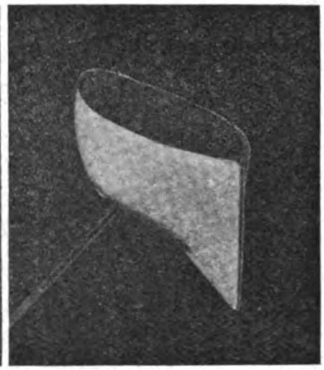


FIG. 4.

of the wood running vertically. Each wooden rib was ultimately fished between two tin ribs riveted through, and this made a very strong job (Fig. 1). When the twelve ribs were finished, they were screwed down in small recesses made in the keelson, in their correct positions, and the tops of each rib were accurately fastened together by a piece of wood, which was itself screwed down to the abovementioned longitudinal bar of wood, great care being taken that the ribs were in true alignment (Fig. 2).

When the frame of the vessel was set up, most of the tedious work was over. Too much trouble cannot be taken with this part of the construction, which amply repays all care expended on it. Still, the most laborious work was yet to come.

The next job was laying on the planking, which I decided to make out of ⅛-in. basswood, the planks averaging about 1¼ ins. in width amidships. This was comparatively plain sailing, except at the bilges, where the curvature of the ribs was very sharp. At the expense of much wasted wood and labour I eventually discovered how to obtain the sharp bends required in the planking. I first made a dozen clamps, five of which are shown holding a piece of planking in Fig. 6. It is advisable to make these strong, as I first made the clamps out of common wood (without any strengthening pieces), but to my disgust found that when they were screwed down in the steaming-box, instead of bending the plank into the proper shape, the plank bent and split them up. I then cut a plank out roughly, and having made as many longitudinal slits as possible about half-way through the plank with my penknife, I placed the plank in between the clamps with slitted side upwards, placing the clamps about 4 ins. apart, as shown in Fig. 6, and tightened up all the slack in the clamps. The prepared plank having been placed in a steaming-box about 60 by 6 by 6 ins., with a hole in one end to receive the spout of a kettle, the plank was allowed to steam for about twenty minutes, at the end of which time the lid was unscrewed and all the clamps tightened up as fast as possible with the brace and bit before the plank had time to harden, on opening the steaming-box. The amount of the tightening up had to be guessed, as each plank varied in its shape at different parts of the boat, but this could be very fairly guessed. The plank was then allowed to cool with the clamps on it, and when these were removed the plank was found to retain its shape very well. I then nailed the plank on the ribs with 1-in. brass nails, the ends of which were burred over in the inside. By this method I obtained a very satisfactory result, and any inaccuracy in the bending of a plank was put straight by the inner planking, which was placed over the joints of the outer planking with a mixture of red and white lead in between, the inner and outer planking being riveted together with ¼-in. brass gimp pins. The inner planking only consisted of short pieces placed between the ribs. The stern piece was carved out of a solid block of oak 1½ ins. thick.

I have mentioned before that I wasted much time and labour before I discovered the best way to mould the planks. In my first efforts I tried to steam the planks into shape without slitting the inner surface, with the result that they refused to bend, and split up. After scarifying them, however, with a penknife, they not only bent where the clamps were applied, but also in between the clamps. The ends of the planks were filleted into the stem and stern pieces, the stem being afterwards shaped up into its correct shape. When the planking was complete, the temporary crosspieces which held the tops of the ribs to the centre bar were removed, and the centre bar was cut out, leaving an open undecked hull. The total thickness of

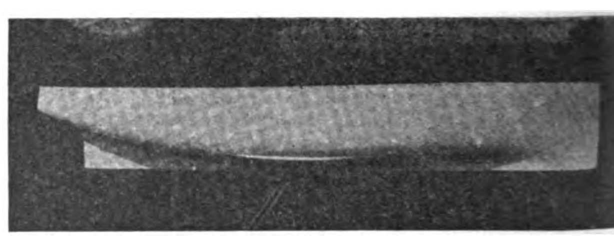


FIG. 5.

the double skin is ⅜ in. The boat (empty) weighs about 12 lbs., which is distinctly heavy; but, on the other hand, her strength is such that she can be lifted up amidships by the *top of one* side, retaining her vertical position, with at least 30 lbs. in her—for I have not tried any more to be on the safe side—without uttering any suspicious sounds or even, I might say, showing any signs of distortion. This is a pretty severe test for a wooden hull without any stanchions or bracings of any kind. It will take 20 lbs. to load her down to her proper water line; I hope this weight will cover that of the engines. I have calculated her total displacement to be about 6 galls., *i.e.*, 60 lbs. I am designing a boiler of 150 sq. ins. heating surface to stand a pressure of 200 lbs. per sq. in., and hope to be able to keep up 50 lbs. per sq. in. with a paraffin blowlamp. This boat was not designed for speed, but to be a good weatherly, roomy boat (as will be seen in Figs. 3, 4, and 5). I have not smoothed her down yet nor given her a well-laid-on coat of paint, for this will be done when I have engined her. Figs. 7 and 8 show the bottom and interior views of the completed hull.

AN OPEN RACE FOR SEAGOING MODEL BOATS.—Under the auspices of the Clacton Model Yacht Club, an open race for model yachts and steamboats in the sea will take place in the first week of September next. Members of any model yacht club will be heartily welcome to compete. Further particulars may be obtained of the Hon. Secretary, J. W. GOLDSMITH, Southwood, St. Osyth Road, Clacton-on-Sea.

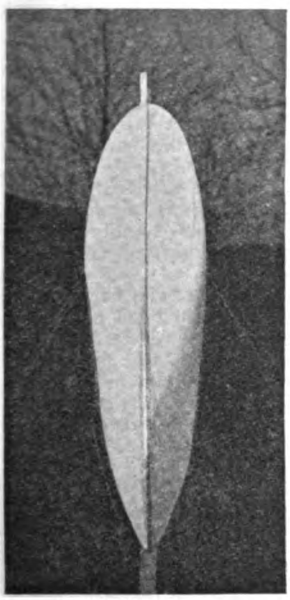


FIG. 7.

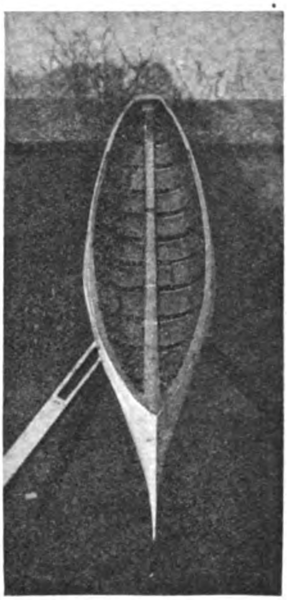


FIG. 8.

HULL FOR MODEL ATLANTIC LINER.

AN AMERICAN SAFETY-LAMP TEST.—A mine inspector, of Pennsylvania, has arranged a practical demonstration by which miners making application for certificates will have a chance to display their knowledge of gas. Suspended from a rope in the ceiling of a room provided for the purpose, the inspector has a large glass globe, into which he turns a jet of natural gas until it is filled. The windows are then completely darkened, and the interior of the room is identical with that of a gaseous mine, so far as light and atmospheric conditions are concerned. Each candidate for a certificate is given a safety lamp and required to work it in pure air, mixed air, and gas. In this way it can soon be determined whether or not the men know the utility of the safety lamp, and are efficient in its use. This test is, of course, supplementary to the oral examination required.

How to Make a Wool Winder.

By J. C. CLOUGH.

(*Continued from page* 536.)

REFERRING now to Fig. 9, the spindle *f*, which carries the friction roller *e*, is seen to be, in plan, parallel with the side of either wood cone, H, and in elevation parallel with and at the same height as the cone spindles. It is made of 3-16ths round bright steel rod; ¼ in. of each end is screwed to take a small nut outside each standard; these nuts are not shown in Fig. 9, it being only a diagram to show the position and action of the friction roller *e* and the slide *c* operating it.

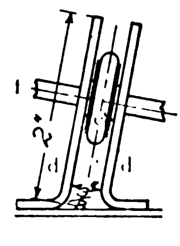


FIG. 10.—STANDARDS TO CARRY FRICTION ROLLER.

To form the friction roller *e*, make two circular plates of 1-16th-in. wrought iron plate, ¾ in. diameter, and with a 3-16ths in. hole in the centre of each that will pass easily but not slack along the spindle *f*. When setting out these plates, at 15-64ths in. from the centre scribe a circle on each, and on it centre punch for drilling three holes at equal distances apart to take stout brass pins for riveting; after drilling these holes countersink them on one side of each plate.

Cut a piece of butt leather, ¼ in. thick, roughly circular, 1¼ ins. diameter; place one of the plates centrally on this and prick through the three rivet holes, drive the brass pins though these holes, and place the other plate on the pins and rivet all

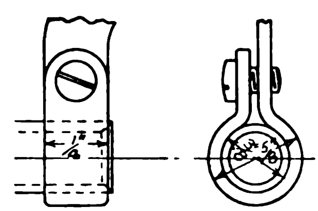


FIG. 11.—CLAMP FOR EYE *b*, FIG. 1.

together, making the plates close and firm on the leather, but not too tight. File the heads of the rivets flush with the surface, and see that the combination will go easily between the standards *d*. Pass the 3-16ths-in. drill through the leather, mount on a true mandrel, and turn the edge of the leather with a very sharp tool to 11-32nds in. diameter, leaving the edge quite flat.

The spindle *f* must be quite straight; if not so, roll it on a clean surface plate, and notice where the light comes under. A light blow of a hardwood mallet on the high place, the spindle resting on a block of lead, will, after a few trials, make it straight.

To carry the roller *e* along the spindle, two standards or forks *d* (Fig. 10) are made of a strip of wrought iron ¾ in. wide and ⅛ in. thick, bent to the angles shown; cut down the centre from the top to just clear the spindle *f*, the feet also forked as shown to clear well the button-head screws *g*. These forks are riveted on the slide *c*, so that they will take the roller *e* between them, allowing it to slide freely up and down between them, but no slack or lost motion.

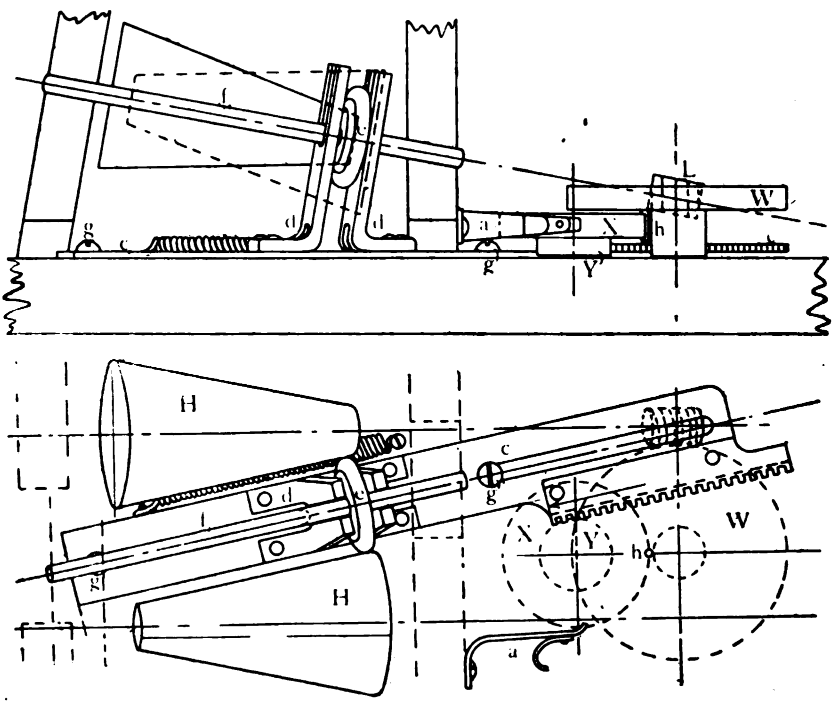


Fig. 9.—Diagrams showing Position and Action of the Friction Roller.

The slide *c* (Fig. 9) is made of stout hoop iron of 1 in. width, cut to the given length and filed to shape, being reduced to ¾ in. wide for the greater part of its length.

Two truly parallel slots of equal length, and in the same straight line, are made to fit nicely the necks of the button-head wood screws *g*, which are adjusted to allow the slide to move quite freely, but not to lift from the surface of the bed.

The rack on C is made of a piece of the same iron, and the teeth can be cut with a ward file with sufficient accuracy; but if our amateur is of the true species he will be satisfied only with teeth properly machine cut. This can be easily done by mounting a revolving cutter of the required pitch between the centres, clamping the piece of iron to be cut on the top slide between two pieces of hard wood, exactly centre high, and parallel to the lathe bed. The pitch of the teeth in our case is eight to the inch, to cut which, if the lead screw is of ¼-in. pitch, put an 80 wheel on the lead screw, and a 40, and the counting disc on the sleeve in one slot of the banjo, and mount the spring catch in the other slot. See that the rest is in gear with the screw, and one revolution of the 40 will move the rest ⅛ in. Should the lead screw be of ½-in. pitch, a 20 on the sleeve will be required. For any other pitch of lead screw, a little simple calculation will give the required combination.

An even depth of cut will be secured by fixing a stop on the transverse slide, or by means of the micrometer, if the lathe is fitted with one.

The length of the rack is equal to the side of the cone, as also the length of the slots.

The coil spring, which returns the slide to its starting place, is made of the finest steel piano wire; wind it on a straight ⅜ mandrel, keeping the coils as close together as possible.

The spring when closed should be about equal to the rack in length, and when in its place should have only sufficient tension to bring the slide quite back.

The screws P, Q, R, S (Fig. 1), are made of 3-16ths round steel, turned at one end to a point of 60 degs., polished and hardened, the other end notched for screwdriver; their lengths are governed by the places they go in, allowing about ⅛ in. give and take for adjustment.

For the fly *b* (Fig. 1) a piece of stout brass wire will be required; about 2 ins. of one end is to be flattened to about ⅛ in. thick or a little under. The thickness of the wire being about 5-32nds, with care it will flatten out to ¼ in. in width. It must be first annealed by making nearly red hot and dipping in cold water. Hammer very lightly and evenly so as to avoid cracking the brass, and keep it straight and parallel. After hammering make it soft again, and bend the flattened part round a ⅜ mandrel held in the vice, and form as Fig. 11 by pinching in a hand vice, inserting a bit of sheet iron to prevent the end being pressed quite close. As shown in Fig. 11, a small pinching screw is fitted in. The remaining portion of the wire is now cut to length, the end filed up and then flattened for about ¼ in., and a 1-16th or 3-32nds hole drilled through; the edge of this hole must be made round and quite smooth with a burnisher. The flat of this end must be in the same plane as that of the other end.

As will be seen in Fig. 1, the fly is to be bent into such a curve that it will well clear the top of the balling spindle J, and will carry the thread to be wound so far clear of the bobbin that when being wound it will be at right angles to the axis of the tubular spindle, B C. On the side of the fly *b* next the worm pinion, when in the position shown in Fig. 1, two small loops or rings of brass wire are to be hard soldered on, and a third one on the under side just above the pinching screw. These are to be so placed that they will lead the yarn from the end of the tubular spindle to the hole in the extreme end of the fly, and at the same time keep it clear from fouling the balling spindle.

The tubular spindle B C (Fig. 1) is made of brass tube ⅜ in. diameter, cut to the length required, the ends cleaned up true and smooth and the inside edges rounded and polished. On the end B is to be fitted and secured with a set-screw the pinion Z. The whole length of the tube should be polished quite smooth, and it should turn in its bearings quite freely, but without lateral shake.

The hand or driving wheel T must now be fitted to its place, its centre pin *o* having been previously fitted to it. Having the cone spindle N with the pinion V on it set up in position, and also the tube B C, with its pinion, place the wheel T on the surface of standard D in gear with both pinions, and holding it firmly in position, scribe through the centre a circle on D. Carefully find the centre of this circle, and on it drill a ⅜-in. hole, upright to the surface of D. Previous to drilling, it will be as well to draw a line through the centre parallel with the base, and continue it round the edge of D, and square with it, for a short distance across the centrepiece. On this line and equally on each side of it, set out a mortise to take a ⅜-in. square nut, just inside the standard D. Now drill the hole 1¼ deep and then neatly cut in the mortise. A thin flat washer must be let in flush with the surface of D to take the shoulder of the centre pin O.

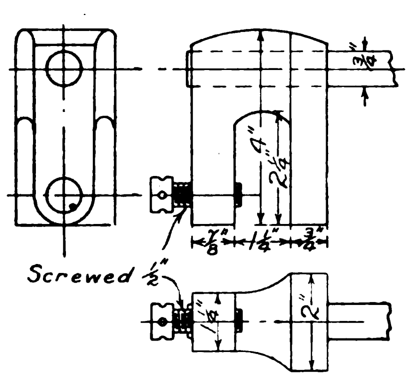


FIG. 9.

The handle K may be made of a piece of ¼-in. thick bar iron 1¼ ins. wide, filed and bent to the shape shown and riveted on to a boss that is bored to fit the centre boss of the wheel T.

The turned handle may be bought for a trifle, with its screwed centre pin, at the same place and time as the wheels; or if preferred can be made by chucking a piece of hard wood, boring for the centre pin, recessing for the head, and then turning and cutting off just a shade less in length than the pin to the shoulder; the screw on the pin being a trifle less in diameter than the body of the pin.

The various parts of the machine being now finished should be carefully cleaned up, the metal portion being freed from grease with spirits of turpentine on all parts that are not polished bright and, given a coat of black Japan or Brunswick black; the wood portion other than the cones and bobbin, clean sand-papered and given two coats of brown oak varnish.

When everything is quite dry the machine is to be set up by first setting up the wheels X and

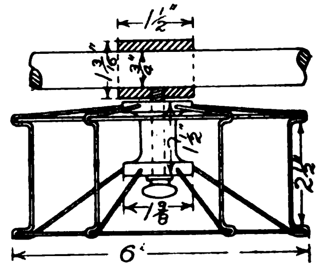


FIG. 10.

W with the balling spindle J and bobbin, then the slide *c*, carefully adjusting it to gear well with the pinion Y, and to work freely and with the least possible amount of shake, and so that it is brought back by the coil spring without any sticking. The screws P, Q, R, S, being in their places, lay the cones and spindles on the base and place the frame over them, putting in the screws to keep them in place until the cone spindles are put on the points of their screws, when the screws in the base may be put home and the centre screws adjusted for free running of the cones, but no end play.

The brass tube put through its bearings and the fly fixed on allowing just a trifle of end play. The hand wheel next put in its place, the handle already fitted. A guide to keep the yarn opposite the centre of the tube is made of a short piece of bright iron or steel wire, turned at one end into a short spiral, something like a corkscrew, the remainder of its length bent so as to clear the pinion Z, and with an eye turned on the end, enabling it to be held in its place by a button head screw in the bearing of the brass tube as shown in Fig. 1.

Before putting the hand wheel in place, the steel spindle is to be pushed through the hole made for it in standard D. The friction roller then put between the forks on the slide, pressed down between the cones till the spindle will pass through its centre, the spindle pushed on through the hole in E, and the nuts put on at each end and screwed up firm.

A tool for threading up the machine is made of steel or iron wire that will go through the eye on the end of the fly; it must be long enough to go well through the brass tubular spindle and beyond the yarn guide, its one end is made like a crochet hook, the other turned into a ring for convenient holding.

A drop of sewing machine oil on all rubbing surfaces, and the complete machine is ready for its work.

A necessary supplement to the balling machine is a reel stand for holding the skein of yarn to be wound. Fig. 9 gives three views of a clamp made of tough hard wood, the side view showing in dotted lines the lower end of the standard, which may be a 3-ft. length of brass tube fitting tightly into the wooden clamp or held by a set screw as shown. This clamps to the edge of the table, the standard upright; or it may be clamped to the edge of a door at a convenient height, the standard horizontal. Two short pieces of iron tube that will slide freely along the standard are cut and their ends turned up; centrally between the ends is drilled in each a 1/4-in. tapping hole, these tapped to take the screwed ends of 1/4-in. pins as shown in Fig. 10. These pins have flattened thumb-screw heads and are of such length under the shoulders as to allow the hard wood reels to revolve freely on them when they are screwed in the holes in the sides of the short pieces of tube and are acting as set-screws to hold in place on any part of the standard.

The spools, after being turned, are put on a true mandrel between the lathe centres, and with the drilling frame and overhead, drill six holes at equal distances apart, using the front gear on the lathe spindle and a scribing gauge to do the dividing. The holes must be just large enough to take the wire of which the reels are made and 1/8 in. deep.

On a flat board make a drawing as Fig. 11, and in each angle and at the places shown, drive a 1 1/2-in. wire nail. Cut the nails off at 1/4 in. from the surface of the board. Now take the wire, and commencing at *b*, pass it round the pins, making the different angles and bends as shown, and keeping the wire as straight as possible between, and cut off at *c*. Twelve of these will be required, and as there is a considerable amount of spring in the wire (bright iron), when they are taken off the pins they do not retain their form, so have to be gone over separately with a pair of pliers, setting them up to the shape of the drawing on the board, and making them

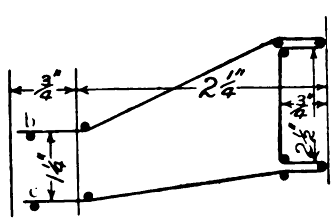


FIG. 11.

quite flat and out of winding. When all are done, push the ends of each wire spoke into a corresponding pair of holes in the spools. Next, of the same wire, make a couple of rings as truly circular and out of winding as possible, and of 6 ins. diameter, letting the ends overlap 1/2 in. Work these rings up into the bends at the outer ends of the spokes, pushing them well up into the bends; let the overlap come into one of the bends and lash it temporarily with a thin string. The overlap of one ring must be diametrically opposite to that of the other in each reel.

(To be continued.)

THE voyage from Tilbury to Sydney and back of a P. & O. 10,000 ton mail boat costs £30,000 before any profit goes to the owners, and the steamer generally makes three voyages a year.

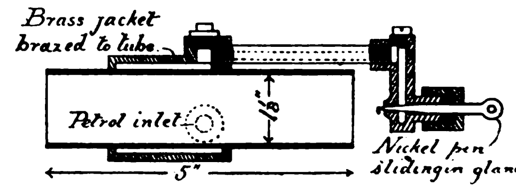
Practical Letters from Our Readers.

[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.]*

Blow Lamps.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Can you or any of your readers tell me the petrol consumption per hour of the lamp described in handbook No. 13, page 27? I wish



SECTION OF BLOWLAMP.

for particulars of a lamp that will burn about 2 1/2 lbs. per hour. Do you think the lamp as per enclosed sketch would be suitable.—Yours truly,

V. W. B. D.

Re Six-Coupled Locomotives.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Although I am well aware that your pages are dedicated to things mechanical, and not to the venting of sarcasm, may I crave a little space, if only because I am an old late rampant member of the S.M.E. I noted C. M. L.'s letter in yours of May 23rd, and in spite of the *nom-de-plume*, I recognised the phrasing. Yours of the 6th inst. contained a reply, but I was surprised to see Mr. Roblin's name at the end. I quite expected it would be that of the man that spent two whole days at his drawing board, studying the vagaries and angularities of a certain valve gear. I thought it was a battle of the giants, and I could not resist a chip in. W. G. R. resents C. M. L.'s condescending tone. I cannot see it. I protest against W. G. R.'s sarcastic criticism of a polite and interesting letter. Personally I am indebted to C. M. L. for giving me news of what is to be in the locomotive world. I take it from C. M. L.'s letter that the *details* are private and not the *fact* that certain engines are building, and if C. M. L. is in the know I see no harm in him informing others who are not. Mr. Roblin might take into consideration that the work of everyday life prevents thousands of MODEL ENGINEER readers gaining knowledge of what is going on in the engineering world except through its pages, and C. M. L.'s rather unique acquaintance with some of our greatest locomotive engineers enables him to give us these welcome notes. We cannot all be as wise as Mr. Roblin. It is jealous criticism such as his that prevents much information being published. Sound information is always acceptable, but the sarcastic critic frightens a lot off in much the same manner as the experimental amateur keeps his mouth shut in case his professional brothers apply the cold douche. Touching the Caledonian locomotives, I should be inclined to take C. M. L.'s version of the cylinder sizes, coming as it did straight from Mr. McIntosh. Even if the particulars were given in the great engineering journals mentioned by Mr. Roblin, they may not have been strictly adhered to in the shops.

I have never missed a number of THE MODEL ENGINEER, and the manner in which its pages are open to all to give interesting information is one of its great points. In conclusion I would say that in everything knowledge is power, and the few condensed notes of C. M. L. are very helpful, and I think Mr. Roblin's letter a little uncalled for. I like criticism, but it must not be caustic.

LATHE.

Queries and Replies.

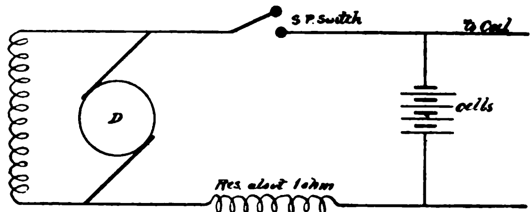
*[**Attention is especially directed to the first condition given below and no notice will be taken of Queries not complying with the directions therein stated.** Letters containing Queries **must be** marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating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

[17,770] **Apprenticeship; Driving Dynamo from Cycle Tyre.** A. R. W. (Manchester, S.) writes: I beg to acknowledge the receipt of your letter, and thank you for your valuable advice. I inform you that I started at the British Westinghouse Electrical and Manufacturing Company, Trafford Park, Manchester, 3½ weeks ago, as apprentice for three years. Wages—10s., 13s., 16s. Half-year, machining shop; half-year, dynamo winding shop; and two years in the erecting shop. (1) Do you think that I have done the right thing? (2) Will I be able to obtain a fifth, fourth, or third engineer's berth, as the case may be, after I have received my indentures? (3) Should I join the Union (A.S.E.)? (4) Is it possible for me to join that Society in which I would be able to get the A.M.I.E.E. (5) If not, how would I be able to obtain that? (6) I have a motor bicycle, 2½ h.-p. Noble engine (M.O.V.). The ignition is the ordinary system; accumulators, 4 volts 10 amps, and coil, De Dion fall contact-breaker. What I wish to do is this: I wish to fit a compound dynamo on the front of the cycle and drive it off the tyre (28-in. by 2-in.). What I want to obtain is the following. Assume that the accumulator is charged; then I start my motor from the accumulator in the ordinary way. As soon as I get enough speed up, so as to get 4-volt pressure from my dynamo, then I want to switch accumulator out and dynamo direct to coil and circuit-breaker by means of a two-way switch, and so save my accumulator. As soon as I slow down, then switch on to accumulator again. What sort of an armature must dynamo have? Would the dynamo of 4 watts be sufficient and efficient for working the coil?

(1) Yes, we consider you have made a very good start, but you should study theory in your spare time; not to overdo it, as too much work may impair your health. (2) Difficult to say; depends very much if you can exercise any influence or what opportunity may turn up. You may have to work as a mechanic for some years; in fact, we are inclined to advise you to do so, obtaining further skill and experience. (3) This must depend very much upon your own views on the subject; you will sacrifice your independence by doing so. If you do intend to join a Union, why not the Electrical Trades Union? (4 and 5) The letters A.M.I.E.E. mean Associate Member of the Institution of Electrical Engineers; you can obtain full particulars from the Secretary, 92, Victoria Street, Westminster, London, S.W. We doubt if you would be admitted at present, except in the student class of membership. There is no examination, but admittance depends upon the attainments and record of the applicant. (6) We doubt if you will find driving a dynamo from the tyre a satisfactory method. Your first sketches seem to be correct, as far as we can understand them. We think you will find the following a better method. Use a shunt-wound dynamo; start up on the accumulator, and when dynamo is up to speed, switch it on to the cells, leaving matters thus. The effect will be that the dynamo will keep the cells fully charged as well as working the coil as long as the speed is high, but when the speed falls



Query 17770

below normal, the cells take up the work. When you go very slow or stop, you cut-out the dynamo by means of a single-pole switch. In order to prevent the cells from discharging freely into the dynamo when speed falls, a small resistance is interposed in the dynamo circuit. The result of this system is that your cells are always practically fully charged, while if anything goes wrong with the dynamo, you have enough charge in the cells to take you home. See sketch. The dynamo should give ample volts, say eight or ten, and a current output of, say, 2 or 3 amps., according to the size of the cells. With regard to your second sketches, in one you have the dynamo in parallel with the cells, which should not be done with a compound dynamo; in the other, you have them in series, which is not a good arrangement, as you will continuously discharge the cells. The dynamo should have a drum armature, with a fair number of coils, say eight.

[17,788] **Marine Engineering as a Profession.** H. G. H. E. (Castle Douglas, N.B.) writes: I desire to be a marine engineer, am 14 years old, and attend a high school. Would you be kind enough to answer me the following, being a constant reader of your valuable paper? (1) What kind of school ought I to attend? (2) What special subjects ought I to go in for, and what special training is necessary before leaving school? (3) After leaving school, where is the best place to go to learn the profession, and is there a premium to be paid? (4) Could you also tell me what salary the first, second, and third engineers get and an idea of their duties? (5) Would you be good enough also to express your views as to it being a good profession or not, and make any remarks you can on the subject which will be a guide to me in deciding the matter?

We think your best course would be to read "Marine Engineers: Their Qualifications and Duties," by Constantine, post free 5s. 4d. The matter has also been dealt with in these columns before. Also obtain from Eyre & Spottiswoode, East Harding Street, E.C., 7d. post free, "Regulations relating to the Examinations of Engineers in the Mercantile Marine." The profession is a good one, if you like it; but, like every other trade, it has its black as well as its bright side.

[17,797] **Converting Gas to Oil Engine.** W. J. K. (Hungerford) writes: Can a Crossley gas engine (tube and slide ignition) be converted into a paraffin engine with paraffin carburettor and using electric ignition, as there is a hole on top of cylinder which, with a screwnut on top, makes connection with inside of cylinder through water-jacket, as that is what I want to do. The engine is 4½ h.-p. (nominal); what is meant by nominal horse-power? I believe it is not the effective or brake, is it, as I have seen one mentioned as 4 h.-p. (nominal) and giving as much as 10 h.-p.? The cylinder dimensions are 6½ ins. by 12-in. stroke.

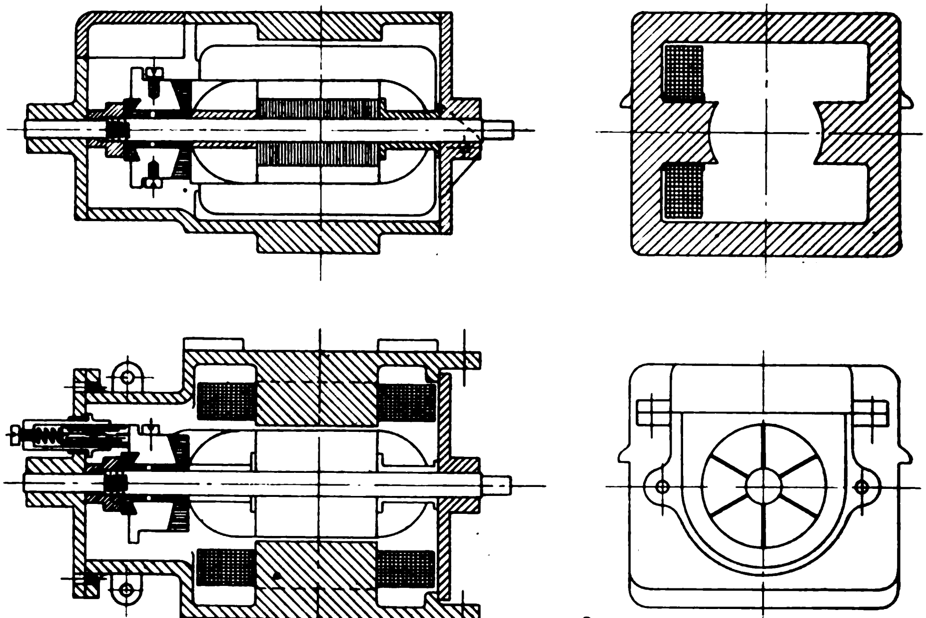
In reply to your inquiry *re* gas engine, we can only say that some types can be converted to oil and fitted with electric ignition. Your best plan is to send the number of engine to the makers, and make enquiries from them as to what can be done in the matter. The term, "nominal horse-power," is now out of use, and effective or brake horse-power is always adopted in the rating of engines. It is a question whether it would be worth the expense of converting to oil. The makers would probably exchange your old engine and part cash for a modern oil engine.

[17,793] **Weight of Copper Tubing.** W. D. (Ebbw Vale) writes: Kindly oblige me with the weight per foot of copper tubing (1 in. diameter, 19 gauge) and copper tubing (16 gauge).

Copper tube 1 in. internal diameter, No. 19 S.W.G., is 51 lbs. per foot run. The same, only No. 16 S.W.G., is 83 lbs. per foot run.

[17,648] **Small Ironclad Dynamo Windings.** A. B. C. (Outwood) writes: I have designed a small motor to enclosed drawing, and should like to ask if you consider same in proportion for best results. I have made a similar motor with a 1½-in. armature, metal on field being only ¼ in. thick, as shown on sketch No. 2 (not reproduced). This was a failure, although it "attempted" to run first clockwise, then counter-clockwise, with 20 volts and a few amps. Everything with regard to connections—earth, polarity, etc.—was in order, but the brushes were not movable, so perhaps this accounted for its failure. As I want to keep over-all sizes, as sketch, will you say if winding on field will be suitable—about No. 28 S.W.G.? You will notice the bearing may be turned round to ascertain correct position of brushes. Armature proposed to use, 1½ ins. diameter by six slots; magnet, 5-16ths in. thick, in soft grey cast iron. Kindly say if I am using correct size of armature to suit proportion of machine, so that it may run from a few bichromate cells.

On armature use No. 26 S.W.G. (about 1½ ozs. will be needed), and on fields use No. 28 S.W.G., and get on as much as space will allow, viz., about 6½ ozs. to 7½ ozs. It would be advisable to have brushes capable of adjustment, especially if motor is to be used for various loads. But if the work to be done is to be fairly constant, then brushes can be adjusted to the most suitable position for that particular load before fixing them finally. We should also advise extending the pole-tips somewhat.



A SMALL IRONCLAD DYNAMO. (*Scale: Half full size.*)

[17,757] **Curves for Model Railway.** C. H. W. (Hammersmith) writes: I have a locomotive 2—4 type (no bogie); the fixed wheelbase is 16½ ins.; gauge, 4½ ins. Would you kindly tell me if this would go round a circle 24 ft. in diameter, and also would you kindly tell me the best and cheapest way of making a permanent way for same; the weight of engine and tender is about 50 lbs.? I also take this opportunity of thanking you for the valuable information you gave me a short time back *re* firing 1-in. scale locomotive. After following your instructions I found I was able to burn any kind of solid fuel in same.

In reply to your enquiry, your engine should traverse a 24-ft. diameter curve at moderate speeds if the rails are laid 1-16th in. wide in gauge, or ⅛ in. total side-play is allowed in the leading wheel. We are presuming not less than 3-32nds-in. total clearance (3-64ths in. each side) between wheel flange and rail. See the issue for October 29th, 1903, for a cheap track; price 3d. post free from our publishing department.

[17,751] **Steam Engine for Dynamo Driving.** P. F. (Brighouse) writes: I have a vertical boiler (10½ ins. diameter by 24 ins. high) with centre flue 2½ ins. diameter; internal firebox, with water space all round. Would this boiler drive a 2-in. bore by 4-in. stroke horizontal engine continually at 60 lbs. pressure? (I can get a pressure of 70-80 lbs. easily without fear of a burst, as the plates are about ¼-in. thick and strongly riveted) If so, what power would it give, and would it drive a 20-volt "Edison" dynamo to give the full output?

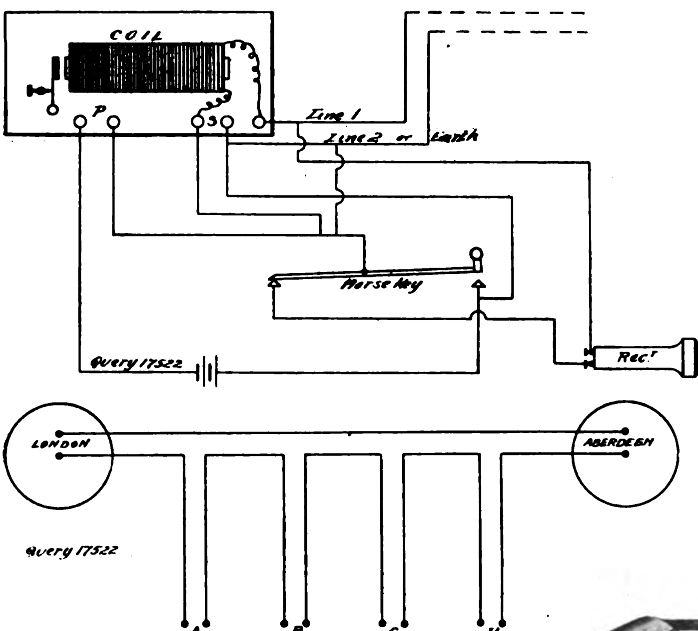
No, the boiler only has about 300 sq. ins. of heating surface, which will evaporate certainly not more than 3 to 3½ cub. ins. water per minute. A 2-in. by 4-in. engine at only 125 r.p.m. would consume at 60 lbs. (the pressure mentioned in yours) about 7 cub. ins. per minute. With very dry steam, obtained by coiling the steam pipe (steel pipe must be used) in the fire, and a fierce draught you might expect to run the engine at 15 to 20 lbs. pressure and 150 r.p.m. You might, with advantage, arrange the boiler to work at 60 lbs., throttling the steam by only having a very small hole in the regulator valve. The power of the engine would be about ¼ i.h.-p., but the greater portion of this would be dissipated in driving the engine. Possibly the engine would manage a 15- to 20-watt dynamo, but what with the attention required in firing and supplying feed-water, and the fluctuations likely to occur in the working pressure, you would have "lots of trouble." We strongly advise a larger boiler or else a smaller engine. On the latter point we can give no opinion, as you only state the voltage of the dynamo. To estimate the power required, it is necessary to know the amount of current delivered, viz., the amperage. The output of a dynamo is expressed in watts. Watts—amperes × volts: 746 watts is the electrical equivalent of 1 h.-p.

[17,780] **Electric Motor for Model T.B.D.** R. G. S. (Colchester) writes: I have made a model T.B.D., which I intend to have driven by electricity. Will you please give me your advice on the undermentioned questions? The dimensions of the model are—length, 3 ft. 9 ins.; beam amidships, 6 ins.; depth, 6 ins.; the weight of hull, with deck and fittings, being 8½ lbs., but the total weight (when ballasted to give the proper stability) is 14½ lbs., which allows 6 lbs. for motor, accumulator, and additional ballast, if required. As I have made this model for the use of my son, I do not want the speed to exceed 3 to 4 miles per hour. (1) Please advise the best kind and size of motor to use, also size of propeller. (2) The size of accumulator to suit motor. (3) Should I find instructions to make a suitable motor in either of the following books—"Small Dynamos and Motors," *M.E.* series No. 10, or to Marshall's practical manual No 5, "Practical Dynamo and Motor Construction"? (4) Should I be able to construct a suitable motor without a lathe?

(1) We should say a 20-watt motor, supplied with plenty of battery power, would meet your requirements. Use the motor described and illustrated in Fig. 9, "Small Dynamos and Motors." Propeller to be 1½ ins. or 1¾ ins. diameter. Try various pitches until you gain the best effect. (2) Accumulators to be as large as space and weight will permit. Thompson or Avery would supply you with suitable ones of, say, 10 or 12 amp.-hour capacity. (3) See above. The speed attainable is a matter for trial, and cannot be exactly pre-determined. (4) A lathe would be a great advantage,

although you could always put out the parts requiring to be turned.

[17,522] **Telephone Systems.** E. C. G. (Edinburgh) writes: I received your letter, for which I thank you. I enclose you a sketch showing the full connections of the transmitting and receiving circuits. Of course, I have not yet got any plan of mounting up the apparatus; the sketch only shows the connections. Are you sure they use induction coils for the telegraph? Are you not thinking of the telephone? In case you have not taken up the idea, I will explain it further, viz.: The secondary current passing through the telephone receiver, gives a trumpet-like sound, which is repeated in the same way as in the ordinary sounder, according to the working of the key. The secondary current is only used to transmit the message to the receiver. Of course, it will be understood that immediately the key is depressed, current is produced in the secondary circuit, and it is this high voltage power that is used to transmit the message along the line, whether it be a dot or dash. With my coil—which only has the power to give a ¼-in. spark, using two dry cells—I have worked the secondary circuit through a resistance equal to 100 miles (No. 18 wire), and the message is quite distinct in the receiver (18 ins. away from the ear). It was also observed that the sounder is constant in the receiver as long as the key is pressed; this would not be so with the ordinary sounder. The message would go direct to the receiver at distant station, without having to go through any relays,



Querist's Telephone Connections.

repeating coils, etc., *en route*; also that the voltage in the secondary or transmitting circuit being so great, the resistance of the cable on line would be overtaken much quicker, and messages could be sent with greater speed; and in my opinion this would be found with the working of underground cables, as these offer such a high resistance to weak battery currents. Taking from the experiments I have made, a spark coil, with the power to give a ¼-in. spark, will send messages direct 100 miles at the very least, using two dry cells in the primary circuit; and a coil giving about a 1-in. spark would send messages from London to Aberdeen direct to the receiver (without using any relay, etc.); and, as I have said before, a coil giving a 6-in. spark could transmit messages to New York with the same speed as in a short distance. As the receiver only equals 60 ohms resistance, and taking, say, the same distance from London to Aberdeen, and by using a coil of a 2-in. spark, you could add in other four stations in series, so that the same message could be sent through each station, all receiving the message at the same time; or, of course, by using a code signal for each station they could be used separately, and more stations could be added by increasing the strength of coil.

We regret to advise you that the arrangement you suggest has been patented as far back as 1881, and is in limited use at the present day for military purposes. Signalling long distances is not altogether a question of applying high electro-motive forces to the line, and experiments carried out on conditions equivalent in resistance to certain lengths of line are not conclusive. For example, a conductor having a resistance equivalent to an Atlantic cable would enable signalling to be carried out at a high rate of speed, while, owing to its capacity, the cable working speed is a matter of twenty to thirty words per minute only.

[17,747] **Book on Railway Signalling.** W. W. (Llandudno) writes: Could you inform me whether there are any books published on railway signalling, either the "Block" system, "Elec" (as L. & N.W. at Euston, etc.), or "track" signalling? We recommend you "Mechanical Railway Signalling," by Rayner Wilson (of the L.Y.R.), price 18s. net, 18s. 6d. post free from this office. The second volume on power signalling is not yet ready. The articles published last year in *Engineering* on the automatic signalling on the Metropolitan District Railway are also worth obtaining. Write *Engineering*, Bedford Street, Strand.

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 Handy Combination Tool.

We have received from Messrs. Avery and Roberts, Limited, a specimen of the new Auto Nut Pliers they are manufacturing, and which we illustrate herewith. The advantages of this tool should appeal to many of our readers. It is specially adapted for use with all nuts up to ½ in., such as on coils, batteries, commutators, and all small nuts, can be used either vertically or horizontally, and has jaws cut to an angle of 120 degrees, and fits perfectly without damage to nuts. With these pliers nuts can be screwed on or off in all sorts of awkward places where it would be impossible to work with ordinary spanners and wrenches. The tool is also a combination of nut pliers, wire cutters and nippers, burner hole, and ordinary pliers. The action is instant adjustment. It is small and convenient for the pocket, and sufficient power can be obtained by the hand for screwing nuts tight enough for all ordinary purposes. The tool is well finished, and we can recommend it to our readers. We understand that these pliers are made also with insulated handles for the use of electricians. Further particulars may be obtained of Messrs. Avery & Roberts, Limited, 64, Stanley Street, Liverpool.

Messrs. Avery & Roberts' Auto Nut Pliers.

New Catalogues and Lists.

Jos. H. Pownall & Co, King Edward Street, Macclesfield.—We have received a catalogue of small power gas engines, gas-driven electric lighting and charging plants, dynamos for small lighting installations, and electro-motors. Prices are also given for complete sets of castings and parts, with full working instructions for ½ or ¼ h.-p. gas engines and for dynamos up to 2,000 watts output.

Archibald J. Wright, Ltd., Leyton Green Road, London, N.E.—The list issued by this firm of automobile accessories and electrical instruments gives prices and particulars of ignition accumulators and accessories, sparking plugs, test and inspection lamps, ignition coils, pocket voltmeters, and ammeters, etc., and will be sent post free to readers of this Journal upon application.

The Editor's Page.

WE have received the following correspondence on the subject of our Speed Boat Competition. "A Member of the Clapham Steam and Sailing Club" writes: "As you invite correspondence on the subject of model boat dimensions and your 'Speed Boat Competition' also, I should like to express my disappointment should the measurements be much reduced, as I have completed—after many months' work—a model petrol boat 6½ ft. long, fitted with a double-cylindered horizontal engine of my own make throughout, with the intention of competing this year for the *M.E.* medal. I have built two steamers previously with the same intention, but on trials they never realised my expectations. The results last year seemed to be very satisfactory, and I don't see that the arrangements can be much improved on. I shall be pleased to send shortly particulars of my new boat and engine, and also some photographs of same, in the hope that it may be published and be of some benefit to others who read THE MODEL ENGINEER."

* * *

The Machine Carved Model Company write: "We note with interest your remarks on the subject of sizes of speed boats in your issue of 6th inst. and the resolution of the Wirral Model Yacht Club to reduce their size limit from 7 ft. to 5 ft. 6 ins. As we have settled on a metre boat, owing in a large extent to the success of the Victoria Park steamers of this size, we suggest that the maximum length for the two classes should be 5 ft. 6 ins. and the Victoria Park standard of one metre. Referring to the rules of your last competition, we find the two limits were 7 ft. and 4 ft. 6 ins., and, naturally, there was a great disparity between the powers of a boat of just over 4 ft. 6 ins. and one with a length on water-line of 7 ft. We feel sure that the Victoria Park Model Yacht Club will agree with this division of the classes."

Answers to Correspondents.

E. D. (Quinton).—Full information on this subject will be found in our handbook, "Induction Coils," post free 7d.

B. W. (Stalybridge).—Your note to hand. We much regret we have no other information concerning these drawing-boards but what is already given in October 6th (1904) issue.

H. T. R. (Ravenscourt Gardens).—There is no 6d. or other cheap publication on the subject, and no tables of lifting powers that we can refer you to. The matter is gone into fully by Underhill in his "Electro-Magnets," price 6s. 6d. Beyond this, we advise you to experiment.

M. S. (Chelmsford).—We have not lost sight of your contribution, and will insert the same as space permits.

B. G. B. (Shorncliffe).—Provided the heat is not sufficient to soften the case or the filling at top of cells, no harm will be done.

J. E. (Dowlais).—You will find a full explanation of the technical terms used in the "Handy Electrical Dictionary," 1s. 2d. post free, to which please refer.

"READER."—If you had complied with our rules, and also given your name and address, you would have had a reply some time ago. However, the information you seek will be published in an early issue.

J. S. (Manchester).—Please refer to the Editor's Page of April 11th.

ROBT. T. W. (no address).—We do not appear to have any inquiry of yours in hand. *Re* blast for use on bench and with small tools, we should recommend an Ætna blowlamp, to be had from any of the engineering firms advertising in this Journal.

W. A. (Rutherglen).—Working drawings would have to be specially prepared to order, but we should be pleased to assist you over any particular difficulty you met with in making your own drawings, free of charge.

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, etc., 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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