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THE

Model Engineer

AND

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A Journal of Practical Mechanics and Electricity.

Volume XVII.—1907.

[July—December, 1907.]

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INDEX TO VOL. XVII.

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GENERAL INDEX.

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INDEX TO QUERIES AND REPLIES.

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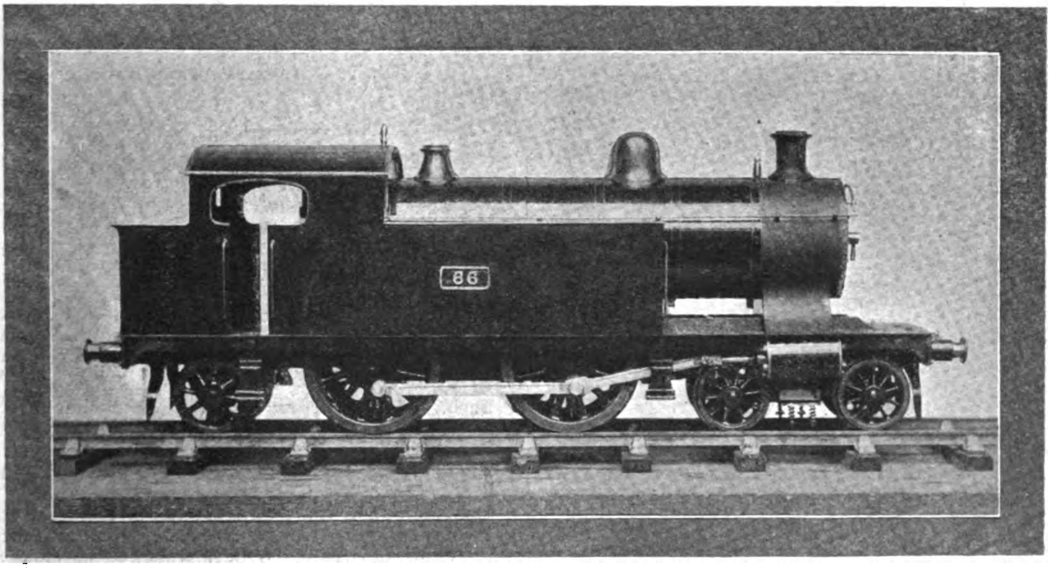
THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 323. JULY 4, 1907. PUBLISHED WEEKLY.

A Fine Model 10-wheeled Tank Locomotive.

By LEWIS BEVAN.



MR. LEWIS BEVAN'S MODEL TANK LOCOMOTIVE.

THE photograph reproduced above is of a ten-wheeled tank locomotive I have built during my spare time, and which has taken me about two years to construct. The leading dimensions are as follows :—Cylinders, ½-in. bore by 1-in. stroke. Wheels: Bogie, 1 9-16ths ins.; trailing, 1 11-16ths ins.; driving, 3 ins. Gauge, 2½ ins.; length over buffers, 19½ ins. I completed the boiler first, which is a Smithies type—inner tube 9½ ins. long, 2 ins. diameter, fitted with an ordinary downcomer and four ¼-in. water tubes silver-soldered in; outer tube 11½ ins. long, 2¾ ins. diameter. The smokebox door is hinged and opens. Slip eccentrics are used. Side tanks and cab are made of 1-32nd-in. hard brass plate edged with 3-32nds-in. half-round wire, and look very smart. Coupled wheels have coiled springs and axle-boxes, as in the "Simple Model Locomotive Design." Bogie truck has compensating beam and axle-boxes in one piece and two small springs between. The radial truck is exactly as in the design given in the issue of this Journal for June 1st, 1902. The firing is with a six-wick methylated spirit lamp. The spirit flows automatically into drum under rear footplate, and works splendidly. I have no track at present, but with the gauge registering 25 lbs., and by the way she fought for her head on a 6-ft. run, I am convinced on a track that she would travel at a very high speed. I might mention that I have had no training in these matters,

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my occupation being that of a hotel servant. Most of the work has been done on the kitchen table, and frequently about a square foot of it has been my allowance. I am greatly indebted to THE MODEL ENGINEER for the many happy hours I have spent during its construction. The dimensions and the ways and means of doing everything have been taken from its pages.

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 Tool for Turning Studs.

By H. S. C.

The following is a description of a tool for turning a quantity of studs suitable for screws, etc. Fig. 1 is the tool-holder made of metal, iron or brass, one end turned to fit loose headstock of lathe. The

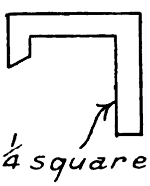

FIG. 1.

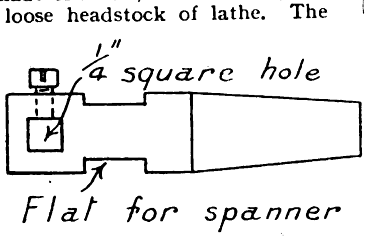

FIG. 2.

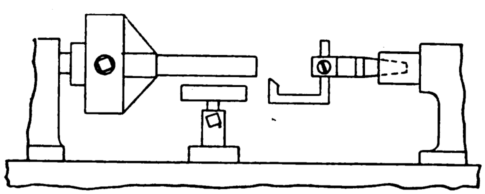

FIG. 3.

TURNING STUDS.

other end has a ¼-in. hole drilled through, and then filed square to hold the cutter. A hole is now drilled and tapped ¼-in. Whitworth, and screw inserted for fastening the cutting tool. This is shown in Fig. 2, and is made of ¼-in. steel. The tool is now complete and can be put in the headstock, as shown at Fig. 2, the cutter adjusted to give the required size, the cut being applied by screwing the wheel of headstock. I find this method better than using slide-rest, as I can keep T-rest in position for cutting off the studs, or can cut them off with tool fastened in slide-rest.

A Grindstone and Emery Wheel Attachment for the Lathe.

By T. C. BAYLIS and F. W. BENNETT.

Readers who have a hollow mandrel lathe will have no difficulty in fixing up this attachment. We successfully carried this out on a Britannia 4½-in. centre back-geared screw-cutting lathe. In this case we proceeded as follows:—We turned up a mild steel spindle to the measurements shown in Fig. 1. The hollow lathe mandrel (ball thrust end) was tapped ½-in. Whitworth. An iron bracket was made from 1¼-in. by ¼-in. flat iron as shown in Fig. 2, with a ⅝-in. hole drilled for a spindle. This hole could be fitted with a gunmetal or steel

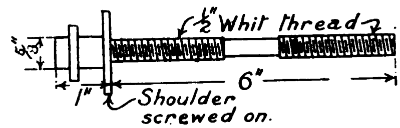

FIG. 1.—SPINDLE.

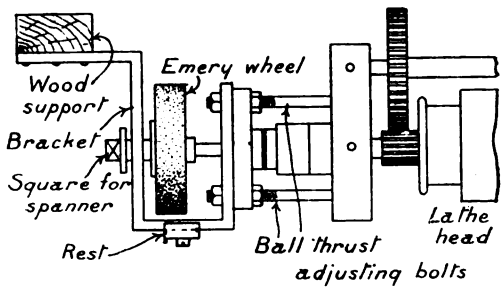

FIG. 2.—GENERAL ARRANGEMENT.

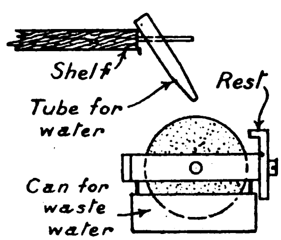

FIG. 3.—WATERING DEVICE.

bush. The grindstone or emery wheel should have a ½-in. bore, and could be bushed with wood to get this. The wheels are pushed up against the shoulder and held there by a nut. An adjustable rest was made by bending a piece of flat iron at right angles, with a 3-16ths-in. slot cut in longest part for adjusting. A simple watering device was fixed up with a piece of old cycle tube. One end was flattened to allow just sufficient water to drip on the stone. This was fixed in a slanting position from a shelf just over the lathe, by a nail, minus its head (see Fig. 3). A shallow tin was suspended from the iron bracket by two cycle spokes, to catch the surplus water. Obviously this device could be fitted to lathes that have a solid mandrel. It does away with the objections of using an emery wheel or grindstone between centres, as by this attachment no emery or grinding matter can get into the bearings or slides of the lathe. It is also a convenience to have the emery wheel or grindstone so handy for grinding the lathe tools. We find that when the 6-in. by 2-in. grindstone is mounted, we get easier and more even running of the lathe. The lathe treadle can easily be lengthened if required (as in our case) to bring it directly under the attachment.

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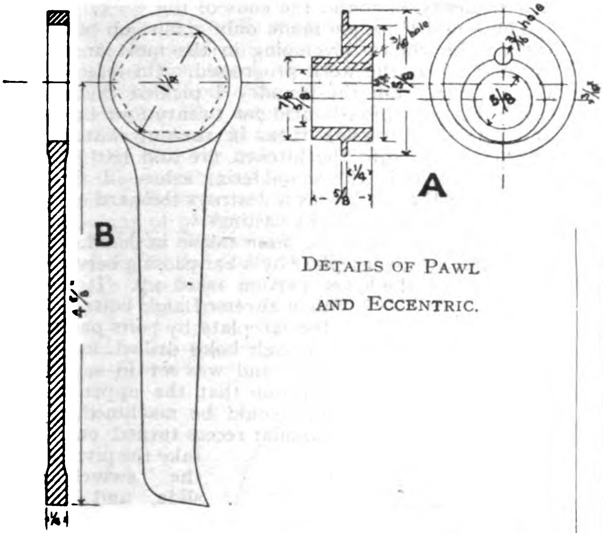
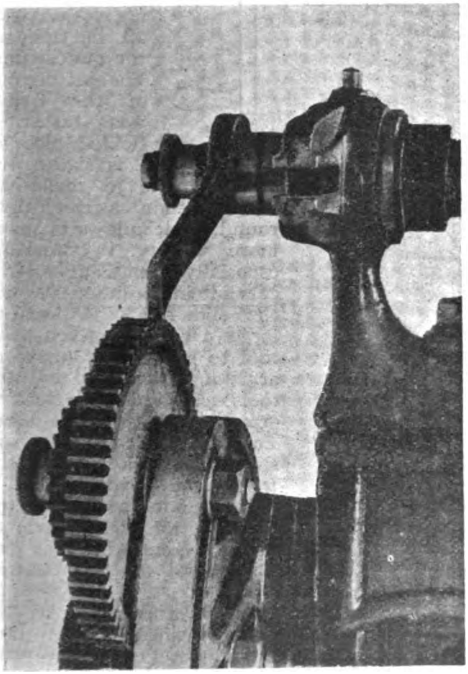
A Slow Feed for a Self-Acting Lathe.

By Thos. Goldsworthy-Crump.

Requiring a very slow feed for a certain job, and knowing such could not be obtained with the change wheels in the usual way, the following



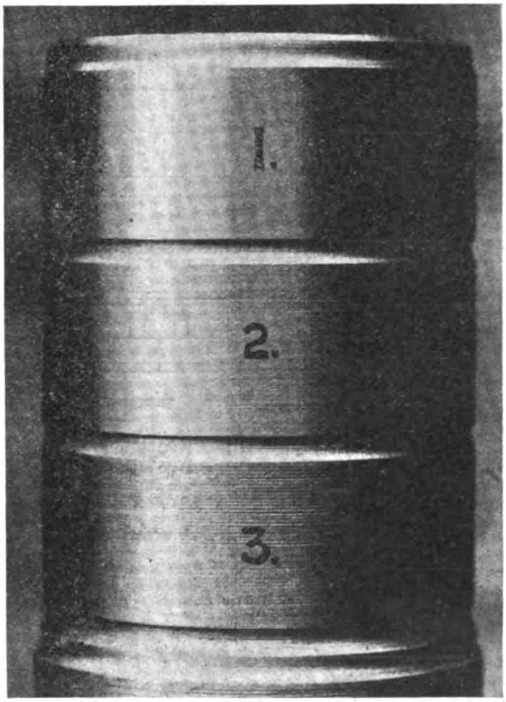
Details of Pawl and Eccentric.



Slow Feed for Self-acting Lathe.

solution of the problem turned out most satisfactorily. First of all an old spanner (B) was found. This was chucked and bored out 1¼ ins. diameter, faced, and filed up to shape and dimensions shown. A piece of brass rod was then chucked and turned to the dimensions shown in A, making a good running fit on the 1¼-in. part to carry B. A was then set out eccentric 3-16ths in. and bored ⅝ in. diameter, to fit end of lathe mandrel. A 3-16ths in. hole was drilled 15-32nds in. from centre to engage with pin as provided on Drummond's 3½-in. lathe in connection with the change wheels.

The eccentric A, with pawl B in position, was placed on mandrel instead of first change wheel. The change wheels were then arranged as required, and the quadrant adjusted so that the pawl engaged with the teeth of the first driven wheel, as shown in photograph, the result being that each revolution of the mandrel advanced this wheel one tooth and the remaining wheels and lead screw *pro rata*. It is necessary to put a leather washer against the first wheel so that it may revolve stiffly. With this



No. 1.	Slow feed	1,000 per inch.
No. 2.	,, ,, ...	480 ,,
No. 3.	Self-acting.. ..	110 ,,

Surfaces produced by Slow Speed.

(*Enlarged from ¾ in. bar, same tool and speed.*)

arrangement it is possible to obtain a feed of 1,400 per inch.

A simple feed of 480 per inch can be obtained by fixing 60-tooth wheel on lead screw and letting pawl engage direct. Reversing the pawl will give feed in opposite direction. The finish of work produced with a slow feed and properly found and adjusted tool does not seem to be fully appreciated. The surface is perfectly even, smooth, and highly polished, and any further treatment is absolutely unnecessary—in, fact, harmful.

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Compound Slide-rest for a Barnes 5½-in. Screw-cutting Lathe.

By S. E. Anderson (S. Africa).

Some time ago I purchased a second-hand 5½-in. Barnes screw-cutting lathe, which was only fitted with a plain cross-slide, the parallel traverse by hand being by means of the rack. I was not at all satisfied with this arrangement, as the hand traverse by rack gave a very irregular and coarse feed, and I therefore decided to convert the existing slide into a compound slide of a similar pattern to that used on English-made lathes, the ordinary compound slide fitted by the makers of the Barnes lathe being, in my opinion, too light.

My first step was to get out drawings of the proposed new slide, as illustrated, from which to make patterns of the three slides, the sizes given being the finished dimensions, so that in preparing the patterns allowance must be made for machining.

The cross-saddle of a Barnes lathe is very narrow, mine being only 3 1-16th ins. wide, and in order to make the new slide as substantial as possible, I decided to make the bottom slide 4 ins. wide, thus overlapping the saddle by ½ in. on one side and 7-16ths in. on the other. As I did not possess a planing machine, I took the precaution when making the patterns to extend the V-portion of the slides about 1 in. each end, so as to form lugs to facilitate the bolting of the slides to the faceplate for machining. This saved me a lot of trouble in setting the slides up for facing, and also proved useful when I came to file out the V's, as, unless one is extremely careful in filing, there is a tendency to round the ends of the work.

The foundry people made only a fair job of the casting, blowholes developing in the most annoying manner as the work progressed. On receiving the castings from the foundry I pickled them in a solution of sulphuric acid for twenty-four hours, and after well rinsing them in running water, I dropped them into the kitchen fire and left them there all night in the smouldering ashes. I think this repays the trouble, as it destroys the hard outer scale and also anneals the castings.

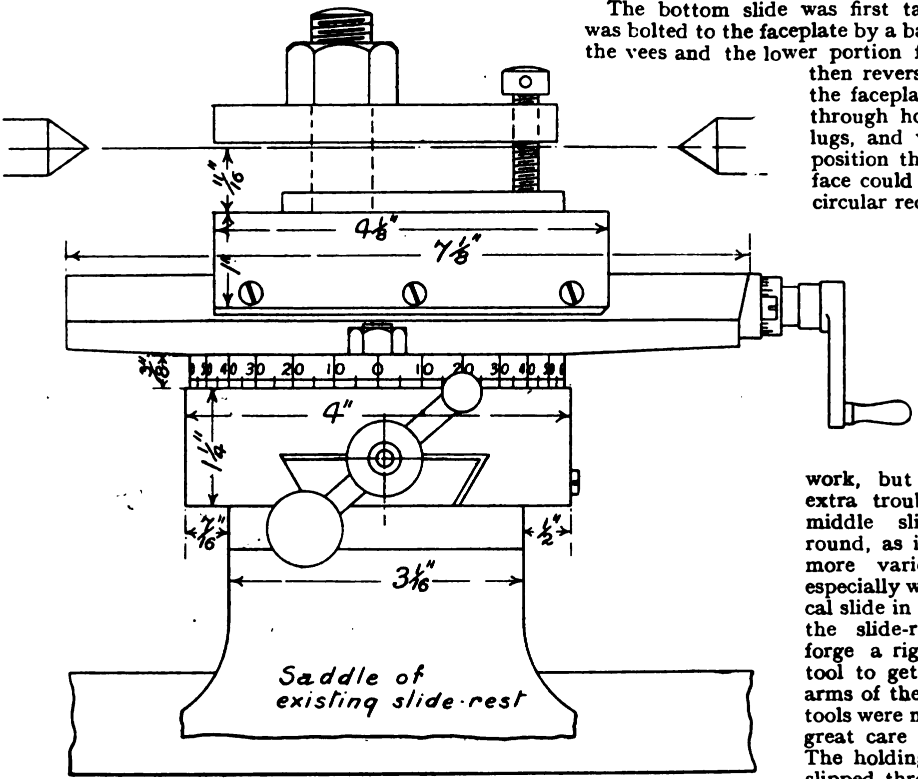

Fig. 3.—General Arrangement of Slide-rest.

The bottom slide was first taken in hand. It was bolted to the faceplate by a bar passing between the vees and the lower portion faced up. It was then reversed and bolted to the faceplate by bolts passed through holes drilled in the lugs, and was set in such a position that the upper surface could be machined, the circular recess turned out to take the pivot of the swivelling slide, and the circular T-slots for the swivelling motion could all be done at the one setting. The cutting out of the T-slots was rather a ticklish piece of work, but it is worth the extra trouble to make the middle slide swivel right round, as it allows of much more variety in working, especially when using a vertical slide in conjunction with the slide-rest. I had to forge a right- and left-hand tool to get out the undercut arms of the tee, and as these tools were necessarily slender, great care had to be used. The holding-down bolts are slipped through a recess cut to the full width of the T in the under portion of the slide. This enables me to set the middle slide at *any* angle, which cannot be done when the slot is cut in the upper surface and the bolts passed through from the top.

The swivelling slide was then mounted on the faceplate and the top surface turned, then reversed and the circular swivelling plate turned up, and the pin which was cast on the plate also turned to fit the recessed hole in the bottom slide, care being taken to make the pin a good fit without trace of shake. The ends of the middle slide were also faced up by bolting the work on to an angle-plate and taking light cuts, this being necessary owing to the overhang.

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The top slide was then mounted and machined in a similar manner to the bottom slide.

The next thing to be done was to fit the bottom slide to the saddle of the lathe and the top slide to the middle slide. This was rather tedious work, as it all had to be done by filing and scraping. However, after much exercise of patience, I succeeded in making all the slides a good fit, the final fit being made by well working the slides together with finely powdered oilstone and oil.

Jibs of cast steel made from two worn-out parallel files were filed and scraped to fit, and the holes for the adjusting screws drilled in the two slides. As I did not possess a drilling machine, I had to drill the holes in the lathe, and I found that the easiest way to do this was to rig up a wooden platform on the existing slide-rest and, by means of packing strips, to set the slide to the exact height required for the holes and then screw the slides to the platform by ordinary wood screws through the holes in the lugs, taking care to set the slide exactly at right angles to the lathe bed,

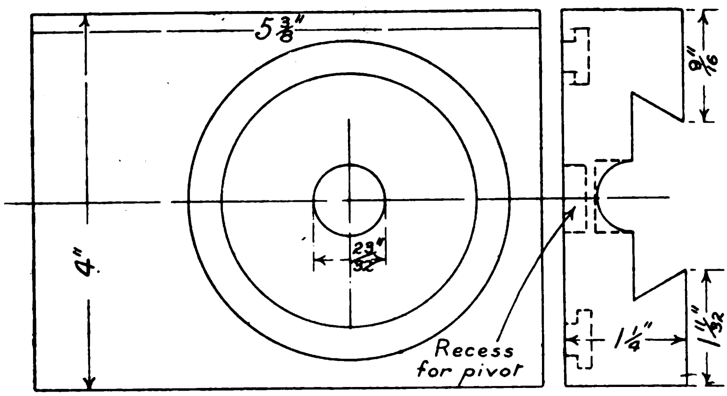
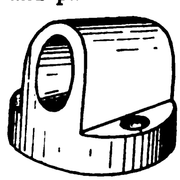


Fig. 1.—Bottom Slide.

this being easily done by putting the large faceplate on the mandrel nose and setting the slide to be drilled flush up against it. The three holes in each slide were drilled at one setting, and were bound to be on the same line and parallel to each other

Fig. 5. Finished Nut.



as the platform was traversed by means of the cross-slide screw. Cheeseheaded screws should be used and the heads countersunk.

I next fitted the nut to the bottom slide, and a few words as to the best way of doing this may save others a lot of trouble. First a pattern was made of the nut (*vide* Fig. 4), the portion A B being cast on the nut to form lugs by which to bolt the work to the faceplate, and a casting in gun-metal was obtained. After marking off the position of the nut on the bottom slide, the latter was mounted on the faceplate by the lugs in such a position that the centre of the place where the nut was to go was exactly opposite the dead-centre point, and a recess turned out to the bottom of

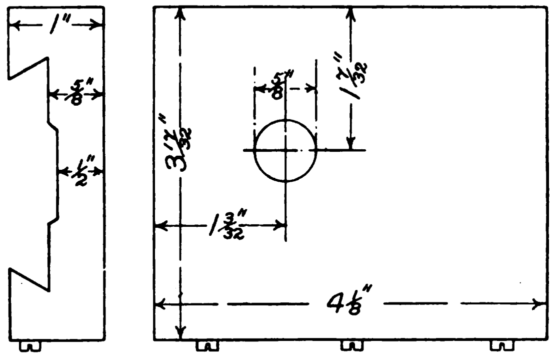


Fig. 2.—Top Slide.

the semicircular groove in the slide (*vide* Fig. 1), care being taken to get the bottom and sides of the recess at right angles. The diameter of this recess will vary according to the lathe, but it should be made as large as possible to allow room for the holding-down screws. The casting of the nut was mounted by the lugs on the face plate and the circular portion turned down to fit tightly in this recess. The nut was then filed to the shape shown in Fig. 5, so as to slide without touching in the semicircular groove in the saddle peculiar to Barnes lathes, and was secured to the bottom slide by two 3-16ths-in. screws.

The screw was now removed from the cross-slide of the saddle, and the bottom slide, with the

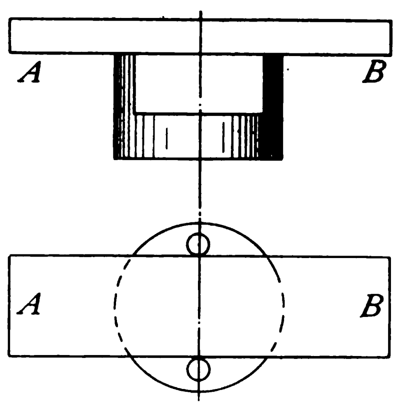
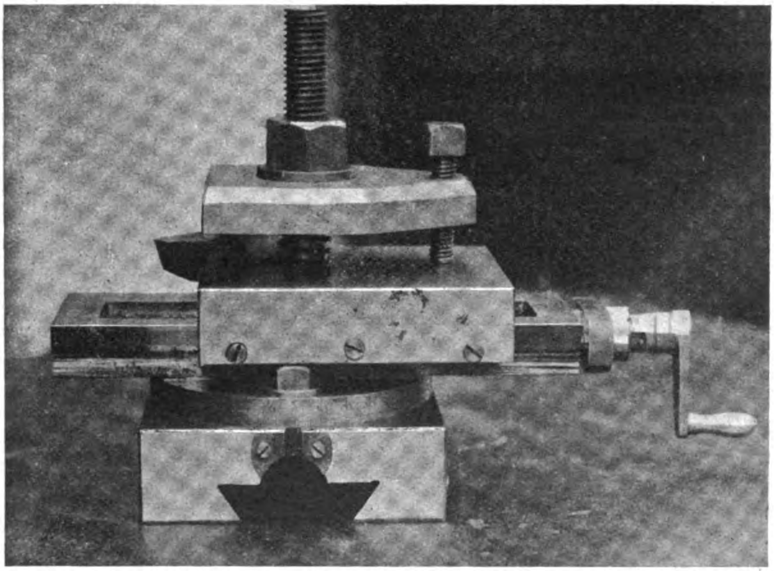


Fig. 4.—Plan and Elevation of Pattern for Nut.

nut in position and the jib adjusted, was slid on to the saddle and brought close up to the bearing in which the cross-screw works. A circle was then scribed on the front end of the nut, using the inside of the bearing as a guide. The exact centre of this circle was then centre-punched, the nut mounted on an angle-plate in the lathe, the hole bored out to the tapping size, and a screw cut to the same pitch as the cross-screw, using the scribed circle on the nut as a guide to ensure its being mounted centrally. This method proved very successful, as, when I replaced the screw and tried it with the new slide in position on the saddle, it engaged the nuts and traversed the slide without binding at any portion of its traverse.

The nut for the top slide was made in a similar manner, and where this method is possible, I think it is a good one to adopt, as the screws simply hold the nut in position, the strain being taken by the recessed portion of the slide.



Mr. S. E. Anderson's Compound Slide-rest.

The fitting of a leading screw to the middle slide was then taken in hand, the screw decided upon being ½ in. in diameter. The holes at each end of the slide were first marked off. This was done by setting the slide on its edge on the surface-plate, which in my case consists of a piece of thick plate-glass against an angle-plate, and the centres at each end marked with a surface scribing gauge and centre-punched, circles being scribed from these centres to form a guide in drilling and boring out the holes for the screw. An angle-plate was bolted on to the old cross-slide, and the middle slide attached thereto so that the centre-punched holes at each end were exactly on the line of centres of the lathe, and a 5-16ths-in. hole was drilled to take the tail of the screw. The slide was then mounted on an angle-plate on the faceplate, care being taken to see that it was mounted centrally, and a 9-16ths-in. hole turned out at the right-hand end of the slide to form the bearing for the screw, and a recess 13-16ths in. in diameter and ⅛ in. deep to take the shoulder of the screw.

The screw was cut from a piece of mild steel rod. A lot of work may be saved if a collar is welded on to the rod for the shoulder instead of turning down a ⅞-in. rod. I cut the tail of the screw flush with the end of the slide, but I am sorry now that I did not allow it to project about ½ in., so as to admit of the handle being used at either end of the slide, as it is often a great convenience to be able to traverse the top slide from either end. The thrust of the screw is taken by a mild steel plate with a shallow recess turned out to take the shoulder on the screw, and the plate is held in position and adjusted by two ¼-in. cheese-headed screws.

A micrometer was turned up from a piece of brass rod and made a good fit against the thrust plate; it was divided into thirty divisions, and gives a feed of 1-360th in.

The toolholder is of the Willis type, a coil spring being slipped over the tool post between the two plates to prevent the top plate dropping when the tool is changed. The tool post is ⅝ in. diameter.

The swivelling slide is divided up to 90 degs. on either side of the zero mark.

The photograph herewith shows the slide before it was quite finished. The flaws in the casting show very plainly and rather spoil the appearance of the rest, but model engineers in this Colony have not the opportunity of getting the beautiful castings which home manufacturers turn out.

Readers who possess a Barnes lathe will, I feel sure, be well repaid by adding a rest of this description to it, and I shall be pleased to give further particulars, if required.

The Summer Meeting of the Junior Institution of Engineers is being held this week in the Clyde District, and the following works are being visited: Messrs. Barr & Stroud's Works, Caxton Street, near Anniesland; Messrs. Sir William Arrol and Co., Ltd.; Corporation Sewage Works; Messrs. Stewart and Lloyds' Tube Works, Rutherglen; Farme Colliery, and inspect Newcomen engine; North British Locomotive Company, Ltd.; Elevating Ferry at Stobcross; Cattle Lairage, Merklands Quay; Rothesay Dock Works, Electric Station, and Coal Hoists; Clyde Trust Works, Renfrew Wharf; Naval Construction Works of Messrs. Wm. Beardmore & Co., Ltd.; Corporation Sewage Works at Dalmuir; Dock and Ore Handling Plant and Pumping Station at Queen's Dock; Fairfield Shipbuilding and Engineering Co.; Messrs. Babcock and Wilcox's Works; Engineering Laboratory, Edinburgh University; Forth Bridge; Sewing Machine Works of Messrs. Singers; Messrs. John Brown & Co., Ltd.; Lanarkshire Steel Works; Messrs. Yarrow & Co. On Monday last the members were entertained at luncheon by the Lord Provost and Magistrates of Glasgow. The Summer Dinner is to be held at the Windsor Hotel to-morrow, July 5th.

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Locomotive Notes.

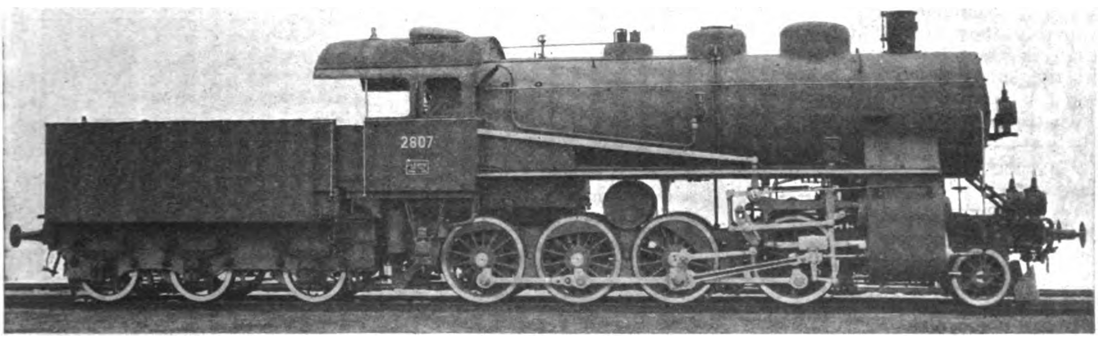
By Chas. S. Lake, A.M.I.Mech.E.

New "Consolidation" Locomotives: St. Gothard Railway.

Messrs. J. A. Maffei, of Munich, Bavaria, have recently delivered to the St. Gothard Railway eight very large "Consolidation" type compound locomotives, one of which is illustrated herewith. The four cylinders are arranged in line below the smokebox with the high-pressure inside of the frames and the low-pressure outside. The second coupled wheels are the drivers.

Automatic valves are fitted, by means of which steam from the boiler is admitted to the receiver when the cut-off exceeds 75 per cent. of the piston stroke, but there is no mechanism by which the driver can, at will, turn boiler steam into the low-pressure cylinders. The boiler is of large size, and contains a Schmidt system superheater. The slide valves are of the piston type, and the valve gear Heusinger's pattern. The principal dimensions are as follows:—

- Cylinders: H.-P., 15½ ins. diameter; L.-P., 23⅝ ins. diameter.
- Piston stroke, 24 ins.
- Bogie wheels, 2 ft. 10¼ ins. diameter.
- Coupled wheels, 4 ft. 5 ins.
- Wheelbase: Rigid, 15 ft. 9 ins.; total, 24 ft. 9 ins.
- Total heating surface, 2,734·6 sq. ft.
- Grate area, 43·8 sq. ft.
- Steam pressure, 220 lbs.
- Weight on coupled wheels, 62 tons.
- Weight of engine in working order, 76·4 tons.



New "Consolidation" Type Compound Locomotive: St. Gothard Railway.

New 0—6—4 Tank Locomotives, M.R.

The writer is indebted to the courtesy of Mr. R. M. Deeley, M.Inst.C.E., locomotive superintendent of the Midland Railway, for the accompanying photograph and particulars of the first of a new series of tank locomotives recently built at the Derby Works of that Company.

The wheel arrangement—viz., 0—6—4—is somewhat unusual, having only been employed on one other English railway, *i.e.*, the Wirral, prior to the present instance, and there are also one or two features in the construction which differ from usual practice.

The cylinders are placed inside the frames, at an inclination of 1 in 8½ ins., and the crank-axle of the middle pair of coupled wheels is driven through connecting-rods 6 ft. 3¼ ins. in length. These rods are provided at their small ends with a ball-and socket arrangement which permits of the rods adapting themselves freely to the side play of the driving axle; and, in addition to this, ball-and-socket bushes are fitted in the pin-joint connection of the side rods ahead of the driving wheel crank-pin.

The leading axle is provided with a modification of the "Cartazzi" type axle-box, the spring gear of which is placed below the journal. This axle is free to move laterally to the extent of 1¼ ins., or ⅝ in. on each side, whilst the four-wheeled bogie at the opposite end of the locomotive has a total side-play of 5½ ins., so that the engine is well adapted, by these combined means, for negotiating curves of four chains' radius with ease.

The balanced slide-valves work between the cylinders through the medium of Stephenson link-motion; the angle of the eccentrics is 105½ deg., and the eccentric-rods are 4 ft. 3⅞ ins. in length. The engine main frames are of steel plate 1 in. thick. Each frame is made in two lengths. Jointed at the rear of the trailing coupled wheels, the two plates overlapping for upwards of 3 ft., and having a packing piece between them ½ in. in thickness. Springs of the laminated plate type are employed for all except the leading axle, which has spiral springs.

The boiler is made in two telescopic rings, of 9-16ths in. steel plate. It is similar to that of the standard Midland Railway goods engines, and contains 242 copper tubes, having an external diameter of 1¾ ins., expanded at the smokebox end to 1⅞ ins. The firebox is of the semicircular pattern with girder roof stays, the interior box being of copper.

Three safety valves are mounted over the firebox—viz., two Ramsbottom valves of 3½ ins. diameter, and one supplementary valve, at their rear, with a diameter of 2¼ ins. The working pressure carried by the boiler is 175 lbs. per sq. in.

The engine has a large tank capacity, and also carries an ample supply of coal without heaping.

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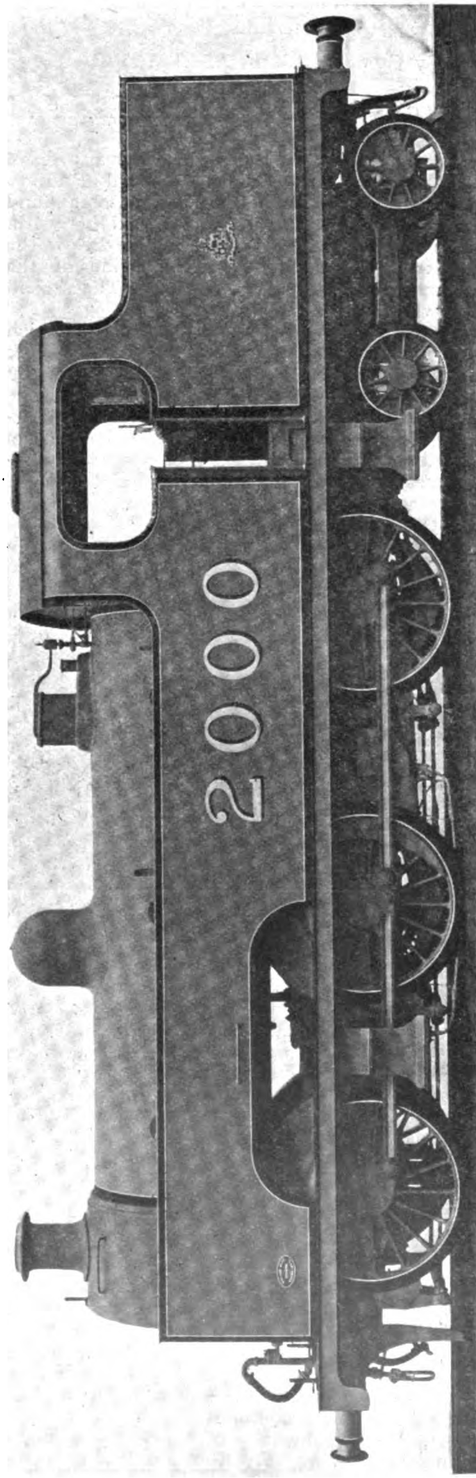
Water pick-up apparatus is fitted, and two scoops are provided, these being let down, by hand gear, between the rear of the firebox and the bogie so that water may be taken up from the track troughs in whichever direction the engine may be travelling. A flap valve is employed for closing the mouth of the scoop not in use. The water is delivered to the rear tank by a Y pipe, and it passes forward through pipes having equilibrium connection to the side tanks, which latter, as seen in the illustration, are extended forward the whole length of the boiler and smokebox, a clearance being made for giving access to the valve-motion and running gear inside the frames for oiling and general accessibility. The engine is fitted with vacuum automatic brake, steam sanding and carriage heating appliances. The axle boxes are provided with sight-feed lubricators, and the cylinders with special suction lubricators, whilst the slide valves are lubricated by sight-feed displacement oilers.

These new locomotives represent a considerable advance in the practice of the Midland Railway, whereupon large tank engines have hitherto not been the rule. With their large cylinder and boiler capacities, ample adhesion weight and general flexibility of wheelbase, they will be capable of dealing efficiently with heavy and frequently stopping passenger and goods train traffic. Presumably they are intended for working in other than the London district (probably Birmingham), as the suburban traffic of the Midland Railway around the Metropolis is not heavy when compared with that of some of the other lines, and, further, there are at present no water troughs on the London side of Bedford, although, of course, that would not prevent the engines being employed in turn with others on the ordinary services. The following are the leading dimensions :—

- Cylinders, 18½ ins. diameter.
- Piston stroke, 26 ins.
- Coupled wheels, diameter, 5 ft. 7 ins.
- Bogie wheels diameter, 3 ft. 1 in.
- Wheelbase : Rigid, 16 ft. 6 ins. ; bogie, 6 ft. ; total, 29 ft.
- Boiler : Height of centre from rail, 8 ft. ; length between tube plates, 10 ft. 10⅝ ins. ; diameter, outside (maximum), 4 ft. 9⅛ ins. ; number of tubes, 242 ; outside diameter of tubes, 1¾ ins.
- Firebox : Length outside, 7 ft. ; width outside, 4 ft. 0½ in. ; depth below centre of boiler at front, 5 ft. 6 ins.
- Heating surface : Tubes, 1,206 sq. ft. ; firebox, 125 sq. ft. : total, 1,331 sq. ft.
- Grate area, 21·1 sq. ft.
- Working pressure, 175 lbs.
- Tractive power per lb. of steam pressure, ·0593 ton.
- Weight on coupled wheels, 52 tons 13 cwt. 1 qr.
- Weight of engine in working order, 72½ tons.
- Tank capacity, 2,250 gallons.
- Coal capacity, 3½ tons.
- Total length over buffers, 40 ft. 4½ ins.
- Width over all, 8 ft. 7¾ ins.
- Distance between centres of cylinders, 2 ft. 4 ins.

The First de Glehn Compound.

The first locomotive built on the de Glehn system of compounding was a six-wheeled engine



New Six-coupled Bogie Tank Locomotive : Midland Railway.

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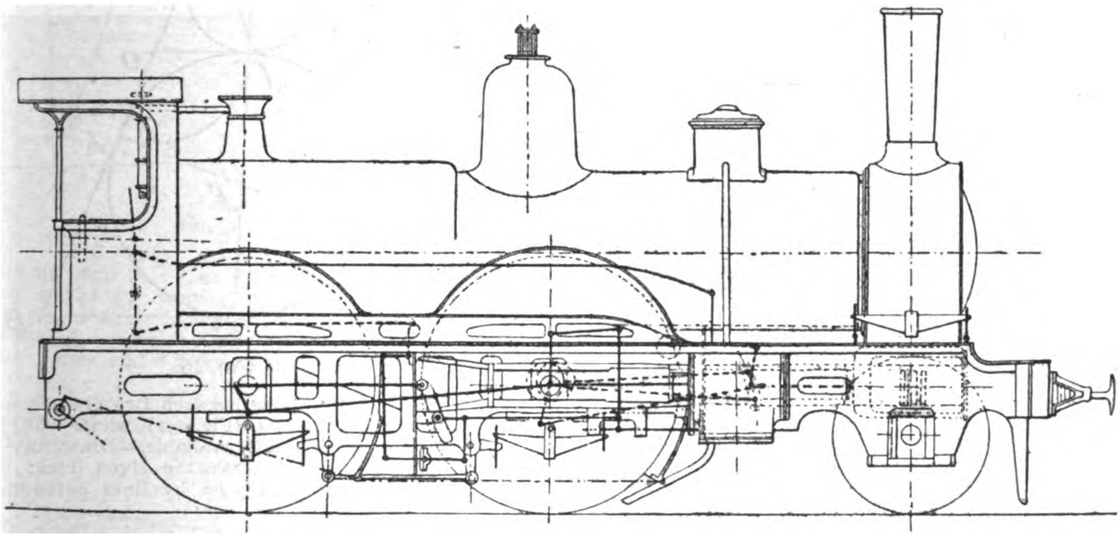
with uncoupled driving wheels, resembling in that respect the earlier Webb compounds in this country and being contemporary thereto. The engine was built for the Northern Railway of France in 1886, and bore the number 701. It had a single pair of leading wheels, 4 ft. 3⅜ ins. diameter, and two pairs of independent driving wheels, 6 ft. 10⅝ ins. diameter. The high-pressure cylinders were placed inside the frames and actuated the crank-axle of the leading drivers, whilst the low-pressure cylinders outside the frames drove the trailing wheels from the position shown in the accompanying drawing, for which the writer is indebted to Mons. du Bosquet, locomotive superintendent of the Northern Railway. The inside (high-pressure) cylinders had a diameter of 13¼ ins., and the low-pressure cylinders were 18½ ins. diameter, the piston stroke being common at 24⅜ ins. The wheelbase of the engine was 18 ft. 1½ ins.; the total heating surface, 1,182 sq. ft.; and steam pressure, 180 lbs. In 1889, or three years after being built, engine No. 701 was rebuilt with a leading four-wheeled bogie.



THE FIRST DE GLEHN COMPOUND LOCOMOTIVE IN FRANCE; DRIVING WHEELS UNCOUPLED.

A NEW coal-loading contrivance has recently been invented by Cavs. L. Calcagno and C. Orengo, of Genoa. It consists of a cylindrical tube containing a specially designed screw worked by a 10 h.-p. electric motor. The tube at one end has an inverted funnel, into which the coal is emptied, and the action of the screw transfers the coal to the top end. On reaching this point it falls through a funnel into the holds or bunkers of vessels, etc. It is stated that coal can be loaded by this means at the rate of 30 tons per hour. One of the above-named gentlemen has also invented an automatic intercepter of lubricating matter, which is claimed to effect great economy in the use of lubricating oils, and prevents the oil penetrating into the boilers.

Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page 544, Vol. XVI.*)

IN machine drawing, problems are frequently met where a knowledge of geometry is of great utility. We are to join line to line, find circles to touch certain lines and to pass certain points or touch other circles, find lines and circles to fulfil a variety of conditions. If we possess the requisite knowledge, a few lines will often enable us to find the means of working to the conditions without unnecessary labour or delay. If we lack the knowledge, we are compelled to adopt some system of trial and error, gradually arriving at a more or less approximate solution, involving a waste of time, sometimes to the detriment of the drawing.

The following problems are given as likely to occur in every-day work, and the student is urged to draw each one carefully, not only to familiarise himself with the solution, but also as a means of acquiring accuracy in drawing. It should be recognised that the principles on which the solutions are based are always true, and absolutely true, not merely approximations, that any error in result is due to imperfections in the draughtsmanship or the appliances, and no result should be considered satisfactory that does not exactly fulfil the conditions.

To find a circle that will pass through two points *a* and *b* (Fig. 44) and also touch a given line *x y*.—Draw a line through the given points, cutting the line *x y* at *o* and extending to *d*. Make *o d* equal to *o b*, bisect the line *a d*, and from the centre-point describe the semicircle *a f d*; from *o* draw *o f* perpendicular to *a d*, cutting the semicircle at *f*; set off *o e*=*o f*; from *e* draw *e c* perpendicular to the given line *x y*; bisect *a b* in *g*, and from *g* erect a line perpendicular to *a b*, cutting *e c* at *c*; then *c* is the centre and *c e* the radius of a circle to fulfil the conditions. If the line *x y* be extended beyond *x* and a perpendicular erected from a point E1 at a distance from *o* = *o e*, the line *c g* (extended to meet this perpendicular) will intersect it at C1, the centre

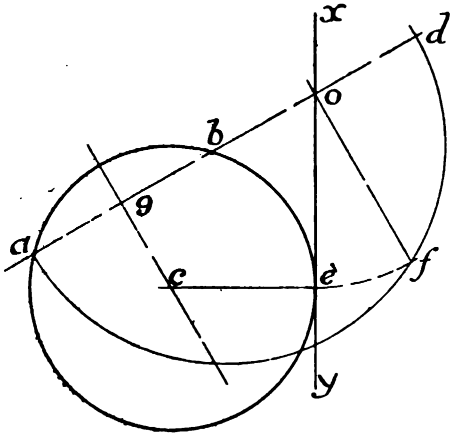


FIG. 44.

of a circle of radius C1 E1 passing through the points *a* and *b*.

On a given line *a b* (Fig. 45) to find the centre of a circle which shall touch a given line *x y* and pass through a given point.—Extend *a b* to meet *x y* at the point *o*, where they intersect draw a line passing through the point *p*; take any convenient point, as *e* in *x y*, erect the

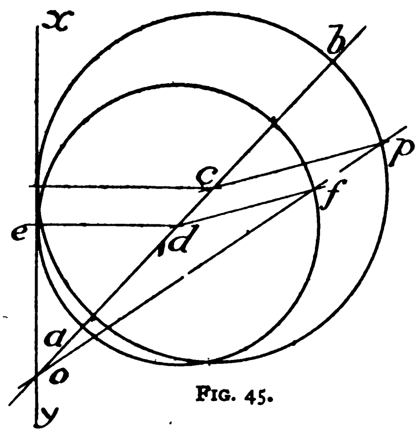


FIG. 45.

perpendicular *e d*. With *d* as centre, and radius *d e*, describe a circle cutting *o p* in *f*; join *d f*. Through *p* draw *p c* parallel to *f d*. *c* is the centre and *c p* the radius of the circle required.

To draw a series of circles touching each other and two converging lines, as A B, A D (Fig. 46).—Bisect the angle B A D by a line A *k*, the centres of all circles fulfilling the condition will be on A *k*; let one circle have its centre *c*; draw *c e* perpendicular to A B; describe the circle *e f* (centre *c*, radius *c e*), cutting A *k* in *f*; draw *f g* perpendicular to A *k*. With *g* as centre, and radius *e g*, draw the semicircle *e f h*. From *h* erect *h j* perpendicular to A B, cutting A *k* at *j*; *j* is the centre of a circle (radius *f j*) touching the first circle and the lines A B and A D. In a similar manner smaller or greater circles may be drawn as desired.

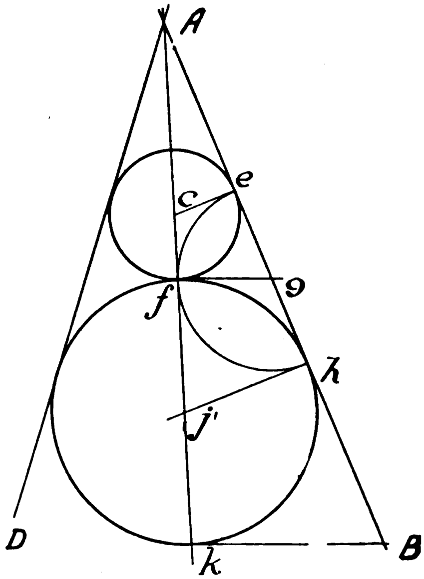


FIG. 46.

To bisect the angle between two given converging lines *a b* and *c d* (Fig. 47) where the point of intersection is not available.—Draw any convenient line, as *e f*, across the given lines; bisect the angles *a e f* and *c f e* by lines extending to

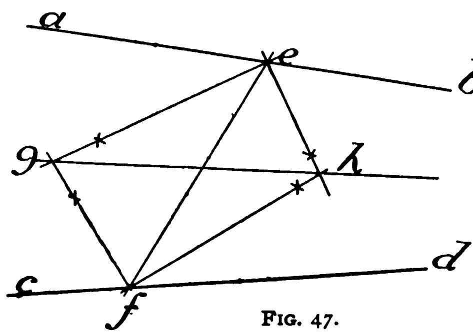


FIG. 47.

meet at *g*; likewise bisect the angles *b e f* and *d f e* by lines extending to meet at *h*; a line passing through the points *g* and *h* will bisect the angle between the given lines.

To draw through a given point *p* (Fig. 48) a line towards the point where two given converging lines (if extended) would meet.—From *p* draw (at random) *p e* and *p f*, meeting the given lines at *e* and *f*; join *e* and *f*; draw at a convenient distance *h j* parallel to *e f*. From *h* draw *h k* parallel to *e p*, and from *j* draw *j k* parallel to *f p*, cutting *h k* in *k*; draw through *p* and *k*

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the required line. A similar construction holds good when the point *p* is outside the lines *a b* and *c d*.

To describe a circle that shall pass through a given point *p* (Fig. 49) and touch two given converging lines *a b* and *c d*.—Draw a line *e f* bisecting the angle between *a b* and *c d*; from *p* draw a line *p k* towards the point where *a b* and *c d*, if continued, would meet; from any

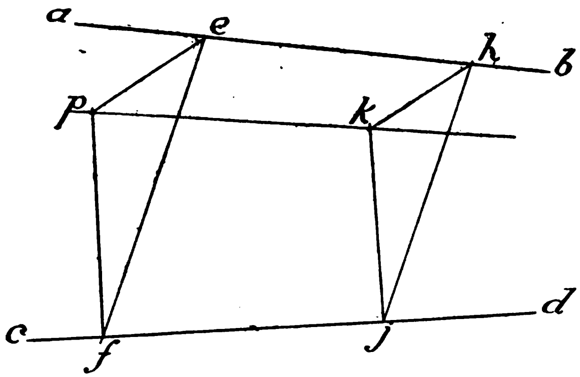

Fig. 48.

convenient point in *c d*, as *h*, erect a perpendicular cutting *e f* at *g*; from *g* as centre, and with radius *g h*, describe a circle cutting *p k* in *j*; join *j* and *g*. From *p* draw *p o* parallel to *j g*; *o* is the centre and *o p* the radius of the required circle.

On a given line A B (Fig. 50) to find the centre of a circle that shall touch a given circle F H and pass through a given point P.—On the given line

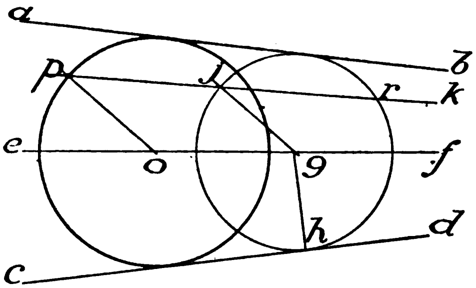

Fig. 49.

take any convenient point G, with radius P G, that will cut the given circle in two points, as H and J; draw a line through H and J, and extend to E. On A B erect a perpendicular passing through P and extending to cut E H in E; from E draw E F a tangent to the given circle. From the centre C of the given circle draw C F perpendicular to E F, extending to cut A B at O. One circle fulfilling the conditions will have its centre at O and a radius equal to O F. The centre of a circle which will include the given circle may be found as follows: From the point E draw the tangent E *F′*; set off *F′ O′* perpendicular to E *F′* and cutting A B in *O′*. The centre of the circle touching and enclosing the given circle, and passing through the given point, will be *O′*.

To find the centre of a circle that shall pass through two points P and *P′* (Fig. 51) and touch a given circle J H.—Join the given points P *F′*, bisect the line, and draw the perpendicular through the middle point. The centre required will be on

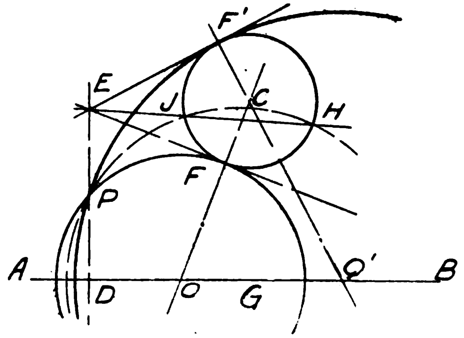

Fig. 50.

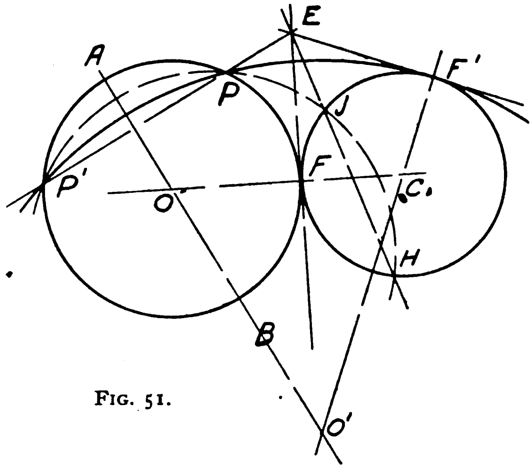

Fig. 51.

the line A B, and may be found by the previous problem, either for a circle excluding or a circle including the given circle.

(*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 Telegraphists' and Telephonists' Note Book, 1907. London: S. Rentell & Co., Ltd. Price 1s. net; postage 1d.

This is a useful book to employees in the telegraph, telephone, and railway serivces, giving in a concise manner much useful information for immediate reference, together with a diary and leaves for note-taking. The book is a very handy size for the pocket.

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Chats on Model Locomotives.

By Henry Greenly.

Modelling Shunting Engines.

(*Continued from page* 611, *Vol. XVI.*)

THE method of reversing the engine is very simple, and the only additional fitment is a plate with a projecting handle, which is placed between the cylinder and the steam distribution block.

The cylinder itself is of quite ordinary construction, and may be made out of a piece of stout solid-drawn brass tube. When a suitable piece has been obtained, the ends should be trued up and the outer (lower) end bell-mouthed, so that there is no difficulty in placing the piston into position after it has been packed. The cylinder should be lapped out—not with emery, but grindstone dust—so that it is quite smooth, and the cap fitted. The top cap may be permanently soldered on, together with a block 3-16ths in. thick, drilled and tapped for the pivot-pin. A 1-16th-in. diameter hole should be drilled through to the interior of the cylinder, and the block should be recessed, so that only the port face and the strip below the pivot-pin make contact with the reversing-plate.

To show up the parts which should make contact I have shaded all the rubbing portions. Other parts of the blocks and plates should be recessed. This is very important, as, if not attended to, it will not be found possible to get the surfaces steam-tight. Of course, if the steam block on the cylinder and the fixed steam distributing block are well recessed in the manner indicated, the reversing-plate may be quite parallel; but a little recessing will do no harm.

The bottom cap of the cylinder may be made to fit tightly, or may be secured by a touch of solder. It should be provided with two or three vent holes. The piston shown is a long one, and has two grooves. It is screwed to a $\frac{1}{8}$-in. diameter piston-rod, and if a lathe is available, the piston may be trued up after the piston-rod is fixed in. The crank-pin end is of simple construction, and as a single working stroke (in a downward direction) is employed, a bottom brass is not absolutely necessary.

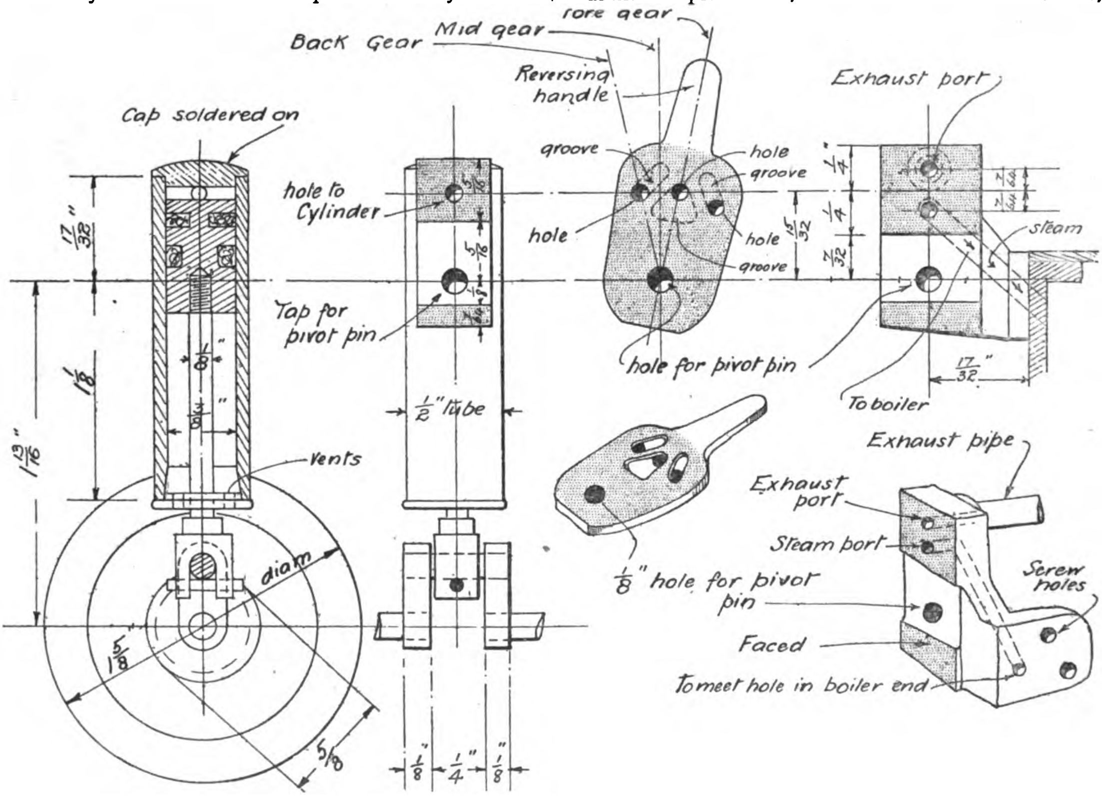

Fig. 9.—Details of Reversing Oscillating Cylinder. (*Scale: Full size.*)

Before making the reversing-plate the pattern for the steam distributing block should be prepared, or, if a casting is not easily obtained, the block may be made out of the solid or built up from rectangular brass rod. The block is very simple, and can be made (as indicated) without a steam pipe. A hole is drilled in the boiler end, and to meet this another hole is drilled diagonally in the steam block connecting with the lower port. The steam block is screwed and sweated on to the boiler end.

The port holes in the steam block, it will be noticed, are placed above and below the port in

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the cylinder, the exhaust being on top and the steam inlet below. The reversing-plate should be made of steel, if possible, but brass would, of course, do very well. The plate may be at least ⅛ in. thick. At the same radius as that of the cylinder

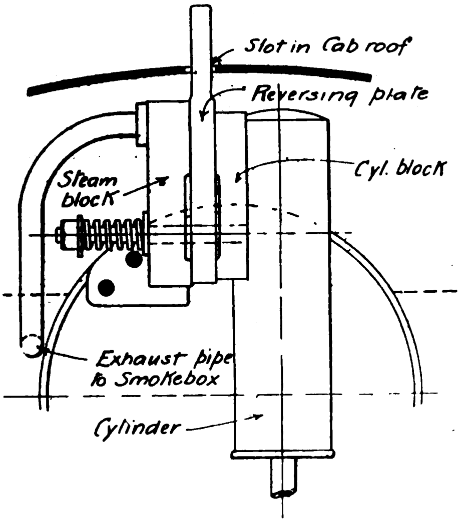

Fig. 10.—View of Reversing Oscillating Cylinder assembled.

port (15-32nds in. from the pivot-pin) three holes should be drilled at a sufficient distance apart to leave solid metal 1½ times as wide as the ports (say, 3-32nds in.). On the side of the plate which faces

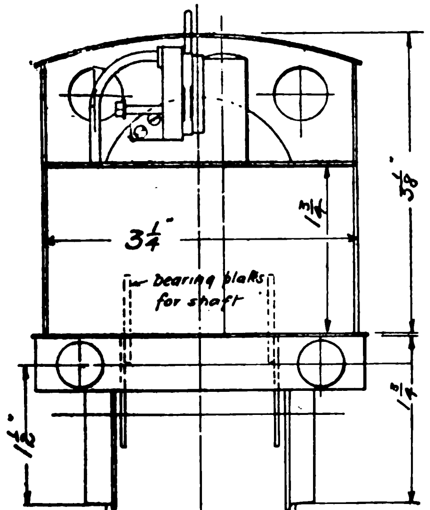

Fig. 11.—Rear End View of Model Locomotive showing Oscillating Cylinder in Cab.

the steam distributing block the grooves indicated in the drawings may be drilled and chipped out. The depth of these grooves should be half the thickness of the reversing-plate, viz., 1-16th in.

If a rough tracing is made of the reversing-plate and laid over the drawing of the steam distributing block, the holes for the pivot-pin coinciding, it will be found that when the plate is rotated about the pin that the steam inlet port alternately occupies right and left-hand positions, and thus effect a change in the direction of the engine. The exhaust ports are also changed over in a similar way. In mid-position all the passages are blind. To prevent leakages, due to an excessive travel being given to the handle, the movement of the reversing-plate may be restricted in any convenient manner; either by the slot for the handle in the roof of the cab, or by projecting pins on the reversing-plate or the steam block.

The contact surfaces should be faced with grindstone dust (or grindstone mud, according to its state of moistness) and finished with any finer powder, say rottenstone or pumice.

The exhaust pipe can be carried alongside the boiler through the side "tanks," turning in at the smokebox, as indicated in the sketch.

The crankshaft may be built up out of ⅛-in. steel wire and thick brass plate in the approved style by first preparing two pieces of wire—one just over ½ in. long and the other just a little longer than the finished length of the shaft. Centre the ends of the main portion if a lathe is to be used. For the crank webs prepare two pieces of ⅛-in. by ¼-in. strip brass, 9-16ths in. long, and, sweating them together, drill two ⅛-in. holes (driving-fit holes) for the shaft and pin respectively. Unsweat and drive on the main shaft, and then drive in the crank-pin, and, placing all in position, sweat

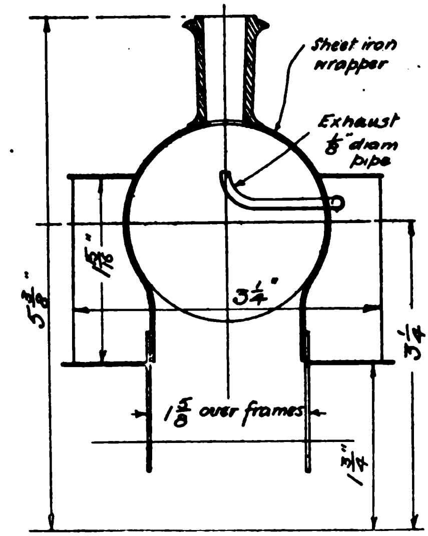

Fig. 12.—Section through Smokebox of Friction-driven Model Loco, showing Smokebox Wrapper and Exhaust.

all together, taking care not to let the solder run on to the working portion of the crank-pin any more than can be helped. Previously to driving on, burr the shaft and pin with a chisel, as shown in issue of April 4th last, page 334. Do not remove the piece of shaft between the crank web until everything is complete and the flywheels and the friction pulleys of fibre are in position and trued up.

(To be continued.)

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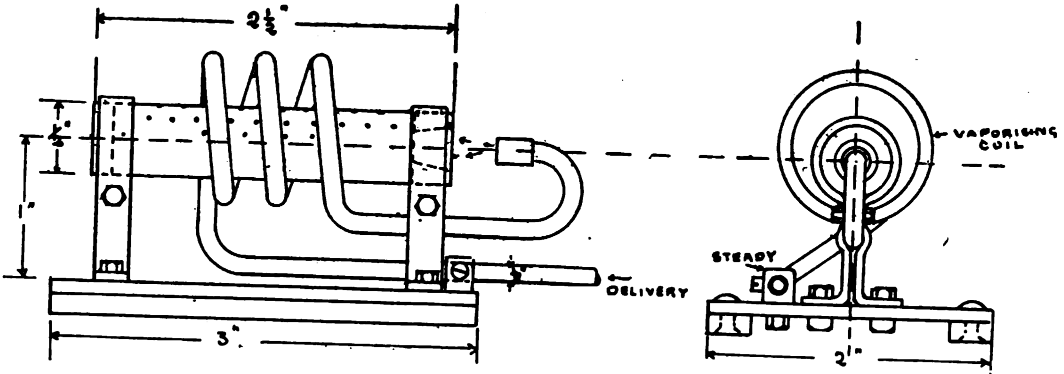
A Model Locomotive Type Boiler and Burner.

By A. R. Griggs.

HEREWITH are given some particulars and photographs of a locomotive type boiler which I have constructed in my spare time during the past twelve months.

It is built of copper throughout, 1-16th in. thick. The length over-all is 14 ins., and the diameter of barrel 3½ ins. The firebox is a Belpaire type—116 sq. ins. With the exception of a ¼-in. wheel valve, I made all the fittings myself. They were turned up on my 4½-in. centre lathe, which appeared in these pages some time back, and include one water gauge with 5-32nds in. diameter glass fitted with blow-through cock, also a spring safety valve and a check valve (to which I shall connect a pump). The two bushes which can be seen at the back end of the firebox (up in the corners) are for a pressure gauge and a steam blower, which I intend fitting to the boiler. The working pressure is 45 lbs. per square inch.

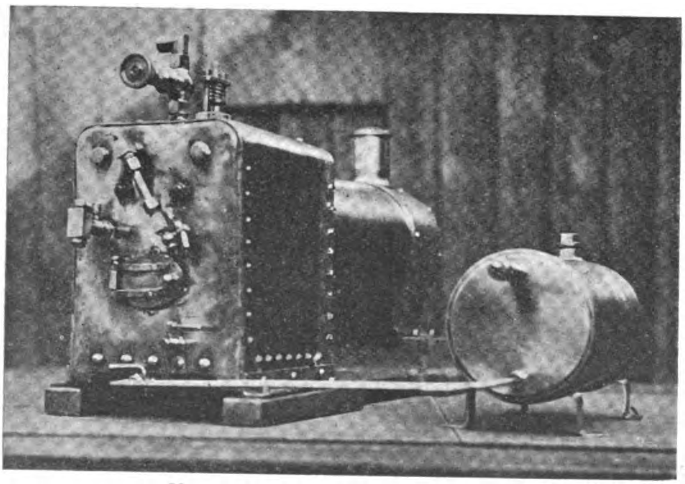
On the right of the boiler will be seen the oil tank



Side View. End View.

Burner for Model Locomotive Type Boiler.

4½ ins. long by 4 ins. wide on the outside; the inside dimensions are—4 ins. long by 3½ ins. wide by 3¾ ins. deep. There are five tubes of solid-drawn brass ½ in. diameter and 7 ins. long. All the flat sides of the firebox are stayed in the usual way, and there



View of Boiler and Oil Tank.

are two stays of hard-drawn brass wire 5-32nds diameter running the length of the boiler, the tubes acting as stays also, as they are flanged over each end. The total heating surface of the boiler is which supplies paraffin to the burner. The tank is made of a piece of brass tube 3 ins. diameter and 6 ins. long, and is fitted with a filling plug and a bicycle valve, the latter being used to maintain an air pressure to force the paraffin to the burner.

The burner, which is entirely my own idea, is constructed as follows (reference being made to the drawing shown above):—A piece of brass tube ½ in. diameter and 2½ ins. long was plugged up at both ends, one end being drilled and rimered out 5-16ths in. (this was found by experiment). It was then fitted to sheet-steel base by means of clips, as shown on drawing. A piece of copper pipe ⅛ in. diameter was then coiled round the tube to about ½-in. radius, this forming the vaporising coil. One end was brought round opposite the hole in the brass tube and finished off about 5-16ths in. from it. A brass nipple was then made, a ⅛-in. hole being drilled half-way through and the rest drilled out 1-64th in.; the ⅛-in. hole was then tapped and screwed on to the copper pipe. The other end is connected with the oil supply. The ½-in. tube has three rows of holes drilled in it—1-16th in. diameter and 3-16ths-in. pitch. One row is drilled on the top and another either side of it—about 45 degs. from the vertical.

For about two months I was experimenting with this burner before I could get a perfectly non-

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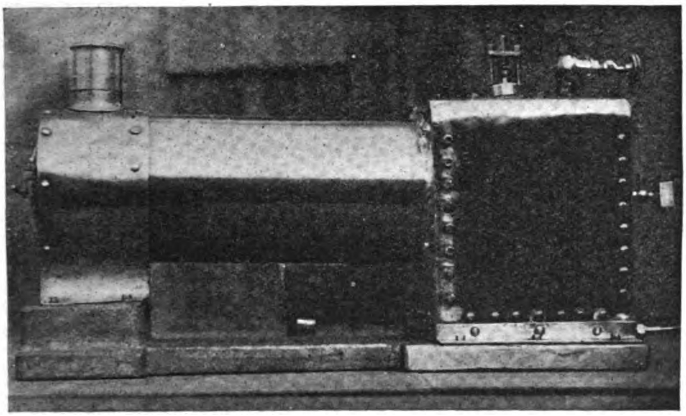
luminous flame, free from soot, which at first used to accumulate on the coil and thus prevent it from getting properly heated. All this depended



Side View of Model Locomotive type Boiler.

on the air supply, so I had to keep rimering out the hole in the ⅛-in. tube until I got sufficient air drawn in by the jet of vapour. I tried also having the coil a larger diameter, but I nearly melted it, as it passed through the hottest part of the flame, which is at the end. But by bending the coil to a smaller radius, I made it pass through the middle of the flame, which just gave enough heat to keep the coil red-hot.

In conclusion, I may say that this is my first attempt at model boiler making.

Some Accurate Electrical Measuring Instruments

By V. W. Delves-Broughton.

(*Continued from page* 588, *Vol. XVI.*)

A Sensitive Polarised Relay.

In using an ordinary coherer of the "filings" type, it is most important to use the very smallest current possible. Therefore, a very sensitive relay is necessary. The polarised relay about to be described should be most suitable for this purpose, as it will work freely with ½ milliamp., and can be adjusted for much less current. The principal dimensions are given in millimetres, and the rest can be scaled off the drawing.

The permanent magnet M consists of five laminations of special magnet steel, 15 mm. wide and 5 mm. thick. The cores of the coils L are formed of soft iron laminations, 15 mm. wide and about 30 S.W.G., insulated from one another by a thin coat of varnish. The bobbin ends are made of sheet brass split down one side, as shown in Fig. 2. This allows the laminations to be slipped in one at a time till the holes in the flanges are wedged full, and also serves to prevent eddy currents flowing round the brass bobbins. The cores are then well wrapped round with thin waxed paper. The yoke part of the cores are divided at X*, as shown by the dotted line in Fig. 1, and pivoted at P, the post P being securely fixed to the base as shown in Fig. 3, and the pivot passing through the two outer laminations of the permanent magnet, which are made longer than the three interior laminations for this purpose. Three of the laminations in each core are provided with projections which are tenoned into saw-cuts in the blocks U, and secured by pins (Figs. 1 and 3). The laminations L of the magnets M are clamped together by the bolts H and the pillars F, which also serve to attach the instrument to the base B. It will be seen from the drawing that the core and bobbin furthest from the magnet are capable of being turned through a small arc, thus allowing the distance between the poles to be adjusted. To effect this adjustment three capstan-headed screws N are provided—the pair tending to pull the poles apart, and the single screw tending to push them together. The pole-pieces are reduced as shown in Fig. 4. The details of the tongue T are clearly shown in Fig. 5. The three central laminations of the magnet have a recess filed out and the central one has a slight notch cut as shown, in which the projecting knife-edge on the tongue fits and is held in position by the attraction of the magnet. As a safeguard the pin S is passed through the two outer laminations and two distance pieces and through a hole in the tongue, which should be amply large enough to allow free play. On one side of the tongue a slip of copper foil is soldered to prevent absolute contact with the pole-piece, and on the other side a platinum stud is secured.

A spiral formed of a few strands of tinsel drawn from a piece of tinsel braid is soldered to the copper and the other end to a small post, which in turn is connected to the terminal V, the corresponding terminal being connected to the contact pillar K, which in turn is provided with a platinum pointed adjusting screw G and a capstan-headed clamping screw. The bobbins A are wound with No. 42 S.W.G. s.s.c. copper wire, about 10 ozs. being required. About 15,000 turns should be got on to each bobbin, and the resistance should be about 5,000 ohms for the two bobbins.

In winding the bobbins, which must first be finished complete with the cores in position (which should have previously been annealed), a short length of stouter wire (say No. 30) should be soldered to the bobbins, then the inside of the bobbin thoroughly insulated with waxed paper. The end of the thick wire being brought up through the insulation, the fine wire should be soldered to this end and the winding proceeded with, keeping the layers as even as possible. All joints in the wire should be soldered and insulated with a strip of waxed paper. It is rather difficult to keep the layers even on a square core with such fine wire, and

* No provision need be made for the movement at this point by making a clearance; in fact, it is better to make the ends of the laminations butt up as close as possible. The deflection at this point is so slight that the unavoidable slackness is sufficient to allow of the necessary adjustment.

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after a few layers have been put on it may be found advisable to put on a strip of waxed paper to enable a fresh start to be made. Do not let the winding get too bad before using the paper, but at the same time do not use more paper than necessary. Fairly stout tissue paper will be found as good as anything.

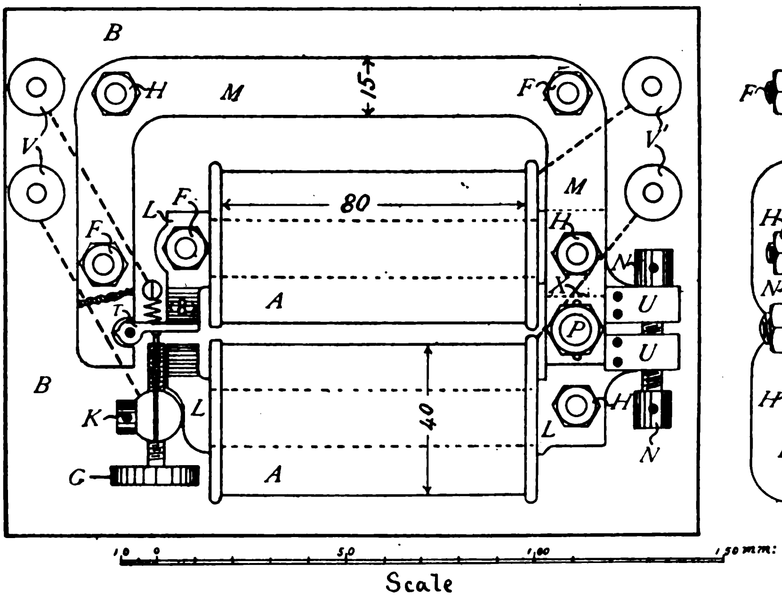


FIG. 1.

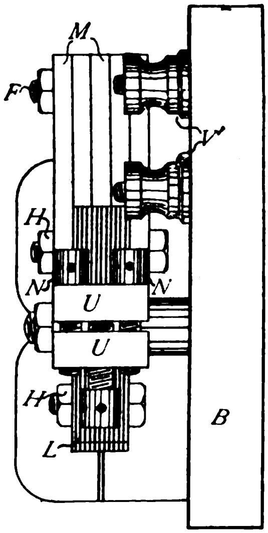


FIG. 2.

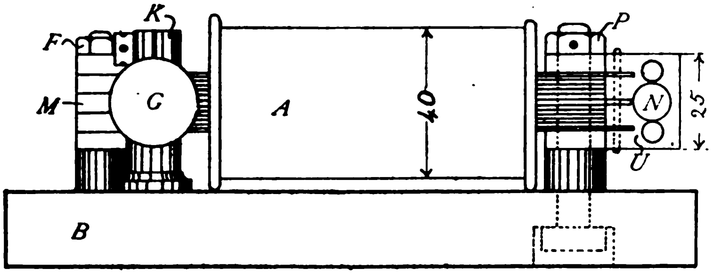


FIG. 3.

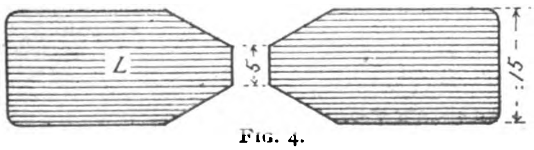


FIG. 4.

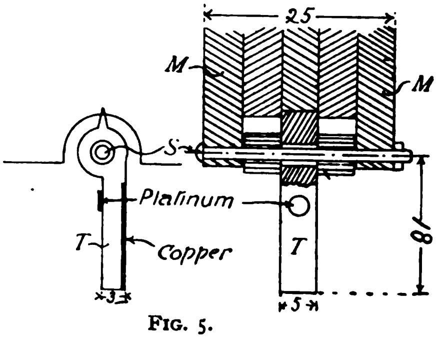


FIG. 5.

DETAILS OF GENERAL ARRANGEMENT OF SENSITIVE POLARISED RELAY.

When the bobbin is practically full, wrap a stouter piece of paper round and wind the last layer with No. 30 D.S.C. copper wire to form a protection and a neat finish. The winding having been completed, the bobbins should be boiled at about 300° F., till all bubbles cease to rise, in a mixture of equal parts of best clear resin and paraffin wax. When thoroughly boiled, allow to cool down in the wax mixture and reheat just sufficiently to remove the bobbins, any superfluous wax being melted off with a hot iron and wiped clean with a rag.

The base B should be of slate or ebonite, but slate is much the best, as there is absolutely no fear of it twisting, and the weight is an advantage. The magnets M should be of special steel, and after being fitted should be hardened and magnetised as already described when discussing magnetised needles, only of course much more powerful magnetising currents will be required. The base should be secured to a larger wooden base, and a glass case fitted to keep out dust, etc. (not shown in drawings). A small piece of thick wire should be screwed at each end of the bobbins (not shown in drawings) to ensure a perfect electrical connection between the bobbins. The connections between the terminals should be made in slots under the base, V′ being the terminals connected to the recorder and V to the coherer.

The manner in which the instrument works is as follows :—The permanent magnet induces magnetism in the tongue T (let us suppose this to be the north pole); similarly the magnet induces magnetism of the other sign, *i.e.*, south pole, in the two pole-pieces adjoining the tongue. This causes the tongue to attach itself to the nearest pole-piece, or that opposed to the contact, this magnetic attraction acting as an imponderable spring.

On a current being sent through the coils (in the right direction) the pole-piece to which the tongue is normally attracted becomes converted from S. to N., thus repelling the tongue instead of attracting it. At the same time the other opposing pole-piece has its south polarity increased. These two effects combined cause the tongue-piece to leave its normal position and try to move to the other pole, but is stopped by the contact-piece making contact for the local circuit *via* the terminals V.

By adjusting the pole-piece on the contact side close to the tongue, it will be seen that a very small reversal of the normal conditions (hence a very small current flowing through the coils) will be sufficient to cause the movement of the tongue. If however this is adjusted too fine, the return of the tongue will not be sufficiently sharp; and, if set still finer, the tongue will be attracted by the wrong pole.

In making all telegraph and similar instruments, metal (brass) bobbins are preferable to all others, for several reasons, amongst others the following :—These instruments often require to be taken to pieces, and if great care is not observed in this operation the inner end of the wire is liable to be broken; but with a metal bobbin and the wire securely soldered inside, this cannot occur. Again, brass makes a much more substantial job and lasts longer in a respectable condition if properly lacquered; it is absolutely impervious to moisture, and is easy to construct. Brass bobbins where an intermittent or alternating current is used must be split to obviate the eddy currents induced, otherwise a large portion of the magnetic force would be lost. This can readily be understood on observing the effect of the sliding tube used to regulate the power of ordinary medical coils.

As telegraphic instruments are sometimes required to be used in all sorts of climates and atmospheres, it is necessary to boil out all the moisture and fill in all the interstices with a mixture of wax and resin. Silk is of a very hygroscopic nature and absorbs water very easily, and "shorts" are liable to be set up and the wire corroded if not protected in the above manner.

The magnets required for the above instrument are the most difficult part of the construction, and if any difficulty is found in obtaining them or suitable steel for their construction, they can be obtained from Mr. J. A. Cole, of Chapel Road, West Norwood, S.E. I understand that he will supply the magnets soft and, when fitted, harden and magnetise them for a very reasonable sum. He can also supply slate bases, terminals, etc., at short notice.

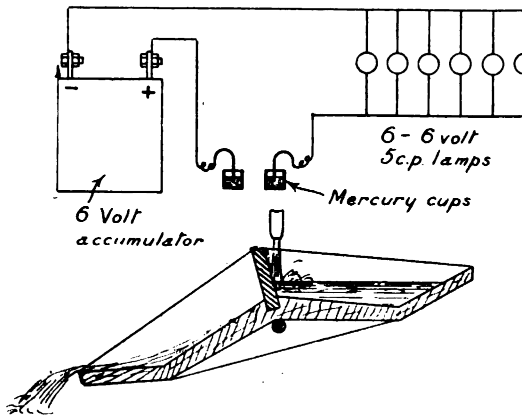
I should have mentioned earlier that it is advisable to make the holes for the pivot P, pillars F, and bolts H plenty large enough to clear easily, as with the utmost care it is impossible to prevent the magnets warping to a slight extent during the process of hardening. The laminated iron cores will probably have to be cut out of sheet by hand unless a number of readers determine to construct the relay, in which case Mr. Cole would obtain stampings specially for the purpose.

(*To be continued.*)

An Automatic Intermittent Switching Device.

By G. L. Atkinson.

HAVING decorated a Christmas tree with six 6-volt 5 c.-p. lamps, and the accumulators not being of large capacity, the idea of an automatic time switch occurred to me so that the battery would only be in use for one-half the time it would have been if the lamps were lit continuously, and being so short of current an electrically operated one was out of the question, so I hit upon the following device.



Connections and Section of Automatic Switch.

The rocking beam A has wood cross-pieces with sheet tin sides nailed on, shaft put through and soldered to sides, and then the whole enamelled. The beam is 14½ ins. long, and the bottom or cross-pieces are so shaped that, in position shown on next page, end B of beam is filling with water from pipe D and end C of beam is completely empty; then when the weight of water in end B is sufficient to move it, which in my case was a little less than 1 dram, the beam rocks over and end B empties, then end C is being filled, which drops, empties, and so on.

E and F are each mercury cups, and wires G and H are connected to same and to circuit. Attached to the shaft of rocker is a lever carrying a U-shaped dipper which completes the circuit from cup to cup every time the end B of beam comes down. The illustration shows it in the open circuit position. The end C of beam is weighted to counter-balance the dipper so that when the shaft of rocker was placed on two true and sharp knife edges fixed quite level it would settle down into a horizontal position.

The shaft of rocker works in bearings on box K, which are made from sheet brass with a U-shaped slot in each, of same width as the diameter of shaft,

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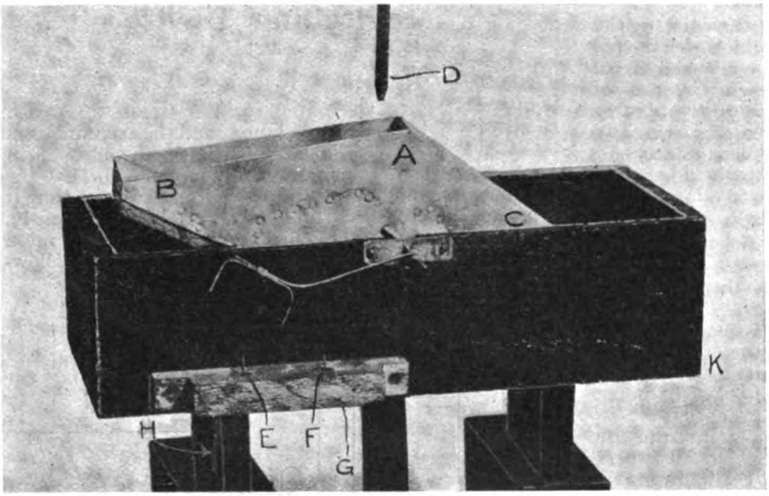
so that the rocker can be lifted out if required. There are rubber buffers to limit the travel of rocker, and the box is watertight. In the bottom is a pipe to carry away waste water.

This arrangement can be used for many purposes, and takes a very small quantity of water to work



AUTOMATIC INTERMITTENT SWITCHING DEVICE FOR ELECTRIC LAMPS.

it, the one described worked very well indeed every 45 seconds for several hours a day.

The Rating of Model Yachts.

By C. T. POLLIT.

THE (NEW) INTERNATIONAL RULE FOR THE RATING OF YACHTS.

ALTHOUGH the new rule for the rating of yachts was decided upon in June of last year, and does not come into force until January 1st, 1908, a considerable number of model yachts have already been built to conform to it. Particulars of some will be found in THE MODEL ENGINEER for April 4th and 11th last.

The rule is $\frac{L + B + \frac{1}{2}G + 3d + \frac{1}{3}\sqrt{S} - F}{2}$ = rating in linear units, *i.e.*, feet or metres.

L = Length on the water line, with the addition of (*a*) the difference between the girth at the bow ending of the L.W.L. and twice the freeboard at that point, and (*b*) one-fifth of the difference between the girth and twice the freeboard at the stern ending of the L.W.L.

B = breadth of beam at the broadest place including wales, doubling planks, and mouldings of any kind.

G = chain girth measured from upper side of covering board, round the keel to upper side of covering board again, at that part of the yacht at which the measurement is greatest, less twice the freeboard at the same station. This station to be indicated by letter G on covering board.

If the chain girth be the same at several stations, that nearest to the greatest beam shall be adopted for subsequent measurements. But if the keel underside line abaft the girth station is straight except for a reasonable round at the extreme after end, the station for the girth measurement may be fixed by the designer anywhere abaft of ·55 of L.W.L. length from its forward end, provided that the maximum chain girth (covering board to covering board) does not exceed that at the station so fixed anywhere forward of that station or by more than 3 per cent. anywhere abaft of that station.

Should there be any hollow in the fore and aft underwater profile, the girth and difference measurements shall be taken under an imaginary line excluding such hollow.

d = girth difference = the difference between the chain girth measured as above described, and the skin girth measured along the actual outline of the cross section at same station.

S = sail area = to be measured as stated in Y.R.A. rules.

F = freeboard = once the freeboard at the bow ending of the L.W.L., added to once the freeboard at the stern ending of the L.W.L., added to twice the freeboard at the girth station, the sum divided by 4.

All measurements are in linear units, except the sail area, which is in square units.

The international classes are :—A, above 23 metres, 23, 19, 15, 12, 10, 9, 8, 7, 6, 5 metres, corresponding to 75·4, 62·3, 49·2, 39·4, 32·8, 29·5, 26·2, 23, 19·7, 16·4 English feet.

It will be observed that the (New) International Rule produces a somewhat larger boat. The 39·4 rater being larger than the old 42 rater, because the G tax is reduced from ¾ to ½; the 4*d* is reduced to 3*d*, and $\frac{1}{2}\sqrt{SA}$ is reduced to $\frac{1}{3}\sqrt{S}$; the mean freeboard is also deducted, while the only addition is the tax at the bow and the stern, and this is not much more, and may be even less, than the mean freeboard; the sum is divided by 2 instead of 2·1. There is an inducement to increase the freeboard because it is a minus quantity, but it would not be wise to have too much freeboard as that would raise the centre of gravity, and so decrease the stability. Nothing is said about displacement, but it will be readily understood that displacement would tax itself, because the more the displacement the greater would be the immersed surface, and of course the greater the resistance to speed. It would therefore appear as if it would be an advantage to have the displacement as small as possible. This in the models so far built appears to be about 26 lbs.

The new rule is to be in force ten years. Full

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sized yachts are to be measured in sea water and without crew. The 39·4 rater model yacht is equivalent to 1 metre, and is a 1-in. scale model of a full-sized yacht of 12-metre, or 39·4-ft. class. This 39·4 ins., or other units, does not indicate the length of L.W.L., although it so nearly coincides with it.

It is to be hoped that all or most of the model yacht clubs will adopt the New International Rule, so that any two clubs can compete against each other with boats of the same class, and possibly competitions on a much larger scale may be arranged in the near future.

Practical Letters from our Readers.

[*The Editor invites readers to make use of this column for the ful 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.*]

Re Six-Coupled Locos.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I am sorry if any of your readers considered my letter as given in a patronising manner. Such was far from my thoughts when penning the communication.

As regards the information concerning the 4—6—2 locomotives, now building, Mr. Roblin will find I stated that the *details* of these engines were private, not the fact that they were being constructed, and it is quite possible that these machines will be seen in London next year.

With regard to the paragraph on page 547, where Mr. Roblin says " The figures relating to six-coupled engines (published for the first time) are not new, they are four years old," turning back to page 499, he will find stated that " the heating surface of the Cardean class, etc," *not the six-coupled class*, as there are several types of six-coupled engines. I certainly cannot trace anywhere in THE MODEL ENGINEER information concerning the details of the heating surface of the Cardean class, so consider my remark about it being the first time published to be correct, as I am not considering the whole Press. As to the figures being four years old, I may say that I have a letter from Mr. M'Intosh stating that the Cardean class was built in 1906, and also that the cylinders of Nos. 49 and 50 *are* 20-in. bore, in spite of all statements to the contrary, and I trust Mr. Roblin will be satisfied with the official origin.

Concerning the North British Railway Company's Atlantic locomotive being fitted with the " New Century Engines Patent," I fail to see how the invention of Mr. Field (the inventor of the Field Tube) is " sweetly vague." It was fitted to one of Mr. Holmes' early six-coupled goods locomotives some few years back, and is common knowledge. Yet, to satisfy Mr. Roblin, I will endeavour to explain the patent. Fitted inside the smokebox are a number of tubes which resemble a super-heater. Through these tubes air is pumped, by means of two air pumps, into the steam pipe, the junction being just above the steam chests. What action takes place I do not profess to know, but certainly some remarkable results have been obtained. The first trials of the North British Atlantic so fitted take place on Wednesday, June 19th, 1907. Trusting that this will sufficiently explain my previous letter, I remain, yours faithfully,

" MODEL COMPOUND LOCOMOTIVE."

Cleaning Soiled Hands.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—A few weeks back I read in your paper an inquiry from J. Bee *re* the best method of cleaning greasy hands, and was very interested in the different ways suggested by some of your correspondents, particularly one who recommended the use of fat without soap, then soap without water, and then that precious liquid must only be used sparingly at first and in the ordinary manner. Well Sir, if it means all this mess and trouble, the only thing I can say is—save me from greasy hands. Recently I had an occasion to try a soap called " Lasso " ; it is used chiefly by motorists and cyclists, but I can strongly recommend it to anyone whose profession or recreation causes them to have greasy hands. No matter what condition your hands are in, it is my experience that this soap will not only make them absolutely clean, but will leave them quite soft, and will not cause any irritation to the skin whatever.

I should like your correspondent, J. Bee, to try it, as I feel sure it is the very article he requires. I believe it can be obtained from any oilman or chemist, or I dare say the makers, Edward Cook and Co., Ltd., of Bow, E., would be pleased to send a sample.—Yours truly,

Forest Gate. C. S. CATT.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—If J. Bee and other readers will use a little " Ethol," manufactured by Messrs. Parke, Davis & Co., manufacturing chemists, 111, Queen Victoria Street, London, E.C., they will have no difficulty in keeping the hands soft and clean, no matter how greasy or dirty they are. I have tried this marvellous preparation, and have been astonished at the excellent results obtained without trouble or injury to the hands.—Yours truly,

Leith. J. WOOD.

WE hear that a patent has been granted in London to an inventor in Victoria, N.S.W., for an aquatic roundabout, which consists of submergible torpedo-shaped boats, with transparent sides, which are to revolve in a tank of water, ascending and descending as they revolve. The sides of the tank are to be transparent, too, affording entertainment for the spectator as well as the participator.

HOME INDUSTRY.—Mr. A. T. Hutchinson, secretary of the Edinburgh and Midlothian Home-workers' Industrial Exhibition, has been invited by the Yorkshire Union of Institutes, Leeds, which embraces 71,000 members, and which is under the patronage of Her Majesty the Queen, to give an address on home industry at their annual meeting and conference in July, and to give an outline of how he works the above Exhibition, which he has made such a prominent success in Edinburgh.

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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:—

[17,753] **Oscillating Engine.** A. R. A. (Belfast) writes: I have sent you drawing and dimensions of cylinder. By your reply you seem to have taken my question up wrongly, or I have not correctly stated it. The overall length of cylinder is 3¼ ins., and what I want to know is—how to arrange cylinder, which is 1½-in. bore, for a 2½-in. stroke. I have not got steam-distributing block. What thickness should I make it, as the thickness of stuffing-box is hardly ½ in. from body of cylinder? What size should I make steam and exhaust ports and steam and exhaust pipes? What size of boiler will it take to drive same?

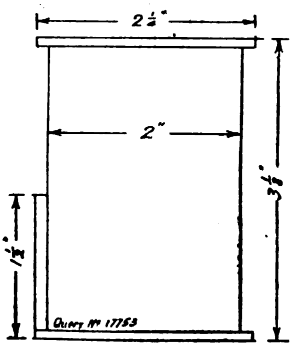

FIG. 1.

In further reply to query your sketch clears up the difficulty and we submit drawings—to half size—of one method of arranging the cylinder. It would appear from your sketch that there is no provision for making it double-acting. The walls of the cylinder seem very thick; a more normal thickness would be something like that we show on the right-hand side of our sectional view of the cylinder. Lag the cylinder with a sheet-iron casing filled with slag wool, or cotton steeped in an alum solution and dried. With regard to the port proportions, the first things to settle are the position of the pivot pin and the distance from this pin to the crankshaft. Then draw two lines showing the maximum angularity of the cylinders, and mark out three ports, allowing a small space between the centre port—the one in the cylinder, and the two in the steamblock. This is shown in Figs. 3 and 4. This "lap" prevents the steam port in the cylinder bridging the steam and exhaust ports in the distributing block and causing a direct loss of live steam to exhaust as the cylinder passes the dead point of its stroke. Drill only one port in the cylinder (in the centre) and chip to the shape shown, chamfering the edge of the bore of the cylinder and drilling a 5-32nds-in. hole to meet the port. Of course, the three ports may be "marked out" on the faces of both

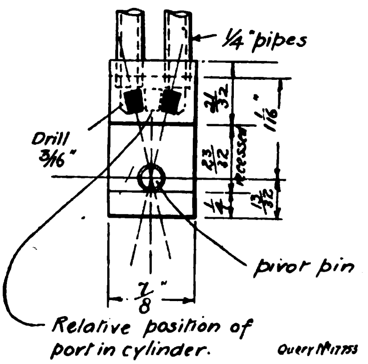

FIG. 4.

steam block and cylinder as a guide. For the steam block (Fig. 4) first drill two vertical holes for the steam pipes and tap for a suitable pipe thread. Then drill to meet these two holes, as shown in block in Fig. 4, chipping the ports to shape. Round ports may be used, but the port openings are not so rapid as where square ports are used. The steam block should be recessed, as indicated on the drawings, so that the cylinder only takes bearing at the ports and below the spring pin. If this is not done, steam tightness cannot be assured. To allow the blocks to take proper bearings, the hole for the spring pin in the steam-distributing block may be broached out slightly taper, as shown in an exaggerated manner in the drawings. Vent holes, say three ⅛ in. diameter, are required in the bottom cover of a single-acting engine. Pack the piston with asbestos yarn or cotton. Work the engine at about 20 lbs. pressure. Any boiler having 100 to 200 sq. ins. of heating surface

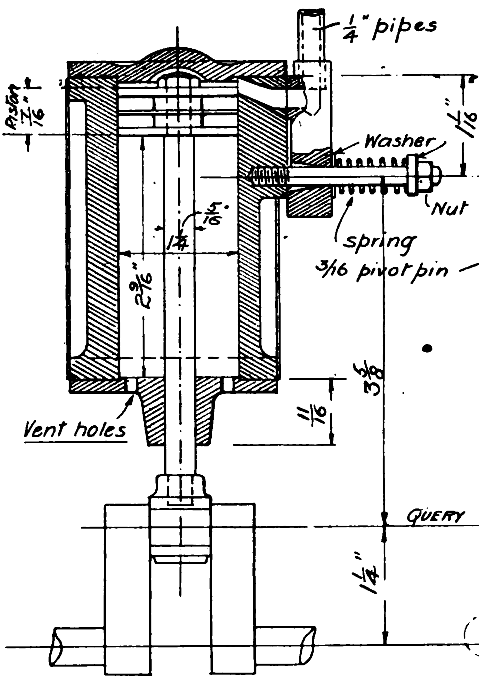

FIG. 2.

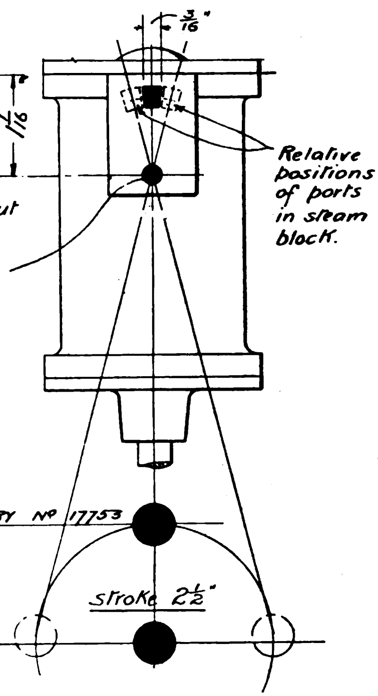

FIG. 3.

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would be suitable. Before we can advise as to type of boiler we should require to know how you propose to fire it. See our handbook, "Model Boiler Making," price 6d., 7½d. post free. The direction of rotation will depend on which pipe you couple to the boiler.

[17,799] **Alteration of Small Dynamo to give Lower Voltage and Greater Current.** C. M. (Ton Pentre) writes: Will you kindly give your advice on the following. Two years ago I made a small dynamo (No. 8), about 30 watts size, which was wound for 20 watts. The wire ordered was No. 22 gauge, but owing to the kindness of the firm they sent No. 24 gauge (which was not found out for some time afterwards). The machine seemed to give all volts and will easily light two 10-volt lamps (H.F.), but does not charge my accumulators, which are 4 volts 20 amp.-hours. The dimensions are: Armature (eight slots), ½ in. by ½ in., 1½ ins. diameter by 2 ins. long; field-magnets (cast iron), 4½ ins. high by 2½ ins., same width as armature. Can I rewind armature with heavier wire or rewind the whole lot again? The machine is well made and will run for ten hours at a time. I do not mind if it will only charge one accumulator at a time.

If your machine gives 20 volts you should have no difficulty in charging your accumulators with it, provided it gives at least 1 amp., as it should do. Find out (by the size or candle-power of the lamps) what it is giving (or by inserting a small ammeter in circuit). If you give it long enough, it should charge cell all right. To rewind for lower voltage and more amperes, use No. 22 S.W.G. on armature, and try it with the present winding on fields before altering that. You do not say whether the machine lights the two 10-volt lamps in series or in parallel. We presume the former.

[17,805] **Steam Pumps.** L. K. A. (Bristol) writes: (1) What is the simplest and most effective motion to work the slide-valve of a small donkey feed pump? (2) With 50 lbs. boiler pressure, what diameter should the pump plunger be if the cylinder to work it is ·7 in. by 1 in.? (3) Would this cylinder be big enough to feed a boiler 12 ins. in diameter and 22 ins. high with three flues 2 ins. in diameter? If not, what size ought it to be?

(1) The ordinary eccentric actuating the valve from a crankshaft, which, by the way, must have a flywheel of sufficient power to drive the eccentric over the dead point of the stroke of the cylinder and to reverse the direction of the motion, is the simplest method you can adopt. It is, however, not self-starting and a flywheel and crankshaft are not always desirable. Therefore you may employ one of the many forms of steam actuated "relay" valves. A very good example of this type of pump is shown in the article in the issue of The Model Engineer for June 13th. For stationary engine work we advise a crankshaft and flywheel. (2) The area of the pump plunger is usually made about one-fourth that of the piston, or, which is the same thing, half the diameter of the piston. In your case the plunger may measure ·35 in. (11-32nds) in diameter. (3) Allowing 50 per cent. efficiency at 150 strokes per minute, the pump should force about 7 cub. ins. of water per minute, and is. therefore, of sufficient capacity for the boiler mentioned.

[17,807] **Output of Small Gas Engine and Electrical Plant.** W. S. (Penge, S.E.) writes: (1) I have a small "Butler" gas engine which, by making certain alterations, I have improved so that it develops 1-5th b.h.-p. It drives a "Crypto" 60-watt dynamo, and when developing 80 watts appears to be working at full load. Now, if I made a larger dynamo, say 120 or 150 watts, should I get a bigger electrical output from the same engine? (2) What is the highest electrical output I could get from this engine and a suitable dynamo? What will be the dimensions of an armature to drive off a ½ b.h.-p. petrol engine, speed 1,800–2,000 r.p.m., direct-coupled? Am I correct in supposing a toothed ring is best form? How many slots should it have? What electrical output might I expect in watts? What should be the winding for 30 volts?

(1) *Re* gas engine and dynamo. Whatever dynamo you use the brake horse-power of engine will remain the same, and as the efficiencies of the two dynamos mentioned will not differ greatly, you may take it that you are getting the maximum electrical output with existing plant. (2) A 250-watt machine is the most ½ b.h.-p. would cope with at maximum load. The armature of a Manchester machine this size would be 3½ ins. diameter by 3½ ins. long. We should prefer a cogged drum, after the drawings given in "Small Dynamos and Motors," 7d. post free.

[17,804] **400-watt Manchester Dynamo Windings.** W. M. (New Pitsligo) writes: Would you kindly help me in the following. I have a set of Manchester dynamo castings, 400 watts. The tunnel is 4 ins. broad, and the armature stampings are plain ring, 4 ins. in diameter, which I want to wind in twelve sections. What size should the tunnel be bored out? Is it necessary to put pegs in between the sections of the armature? What gauge and quantity of wire to use for 50 volts 8 amps.? I have a quantity of 20 gauge D.C.C. which I want to use. I have Handbook No. 10.

Bore out tunnel to 4½ ins. diameter: that is allowing 5-16ths in. for depth of windings. Yes, pegs are necessary to ensure the coils not moving. The matter is explained in our one shilling manual, "Practical Dynamo and Motor Construction," 1s. 2d. post free. Wind with No. 18 S.W.G. for armature—about 1 lb. 14 ozs.—and for field-magnets use 11½ lbs. No. 22, connected in shunt.

[17,802] **Size of Valves, etc., for Small Petrol Motor.** F. H. (Jarrow-on-Tyne) writes: Will you please inform me of the size of the oil and exhaust valves for a petrol motor, 1½-in. bore, 1½-in. stroke. What size should the oil pipe be which conveys the oil to the cylinder, and what size exhaust pipe? How much lift should exhaust valve have? Could I run this same engine with electric ignition, using a ½-in. spark coil?

The oil pipe may be any convenient size, but from the carburettor to the inlet the diameter of the pipe should be about 3-16ths in. Make valves not less than half diameter of piston, and the lift of exhaust valve should be quarter its diameter. Yes, spark ignition can be fitted, and is, in fact, necessary on so small an engine.

[17,800] **Estimating Power Required for Driving New Plant.** E. W. W. (Dunstable) writes: Please can you give me any information as to how I can find out the power required to drive any single machine or group of machines, such as lathes, drills, etc., when the main drive is a 30 b.h.-p. suction gas engine? There is a lot of power to spare, but I do not know just how much, so I am unable to tell how much more machinery it will drive.

The best way to arrive at this is to use your judgment, and estimate the power your new plant will take by basing your calculations on the figures given by the manufacturers of the various new machines. By observing the way engine cuts out (if it is governed on the "hit-and-miss" principle) you can estimate what proportion of its maximum power is already being used when the existing machines are running, and from this you can judge how many more similar machines the engine could cope with.

[17,729] **Motor for Submarine.** E. R. (Glasgow) writes: I have just finished making the hull of a model submarine. It is 2½ ft. long by 5 ins. in diameter. A reply to the following will much oblige. The hull is of yellow pine. Would clockwork or an electric motor be best for it? If a motor, what gearing would you suggest between motor and propeller shaft? Would the boat motor sold by the Clyde Model Dockyard, Glasgow, at 8s. 6d., with propeller and flexible shafting, or even their "Ajax" at 6s. 9d., do for the submarine to drive it at a good speed? Would twin screws be an improvement, or submerging tanks? Please explain the action of the side rudders? Could I use bichromate batteries for this boat?

Either could be used. It is really a matter of choice. A 10-watt motor would be large enough, but you must experiment to see exactly what weight and size of battery or accumulator your boat will carry. Try a single screw. We should recommend an accumulator, so that no harm would occur if it was upset. Geo. Adams would supply suitable clockwork motor, which we advise for your first experiments. The action of side rudders is the same as stern rudders, only being in a variable horizontal plane the boat's course is altered towards a vertical direction when they are moved in any given manner.

[17,676] **Oil Fuel for 2 hr.-p. Boiler.** C. W. R. (Hurstmonceux) writes: I have a 2 h.-p. vertical tubular boiler (riveted), 5 ft. by 2 ft. At present I use coke as fuel but this requires being fired every half hour or so. As the plant charges accumulators I want to get it to work for four or five hours without attention. Could you tell me if it would be possible to use a burner for paraffin or petrol? The inside of the firebox is about 22 ins. diameter. Where could I get such a thing? I have doubts whether I could get one sufficient to heat the boiler (sixteen tubes). What would the fuel cost per day of eight hours?

We do not like the idea of a 2 h.-p. steam engine and boiler being left for several hours without attention. With regard to firing arrangements, possibly you could obtain a "Clarkson" or other oil burner to run for the required time without adjustment, but what would happen if the pump became inoperative or the engine seized? Of course you may fit some form of automatic cut-out gear to open and shut off the oil with the fluctuations of pressure (as used on motor-cars), and also employ a high and low water alarm or other regulating device. The boiler is certainly not suitable for a petrol fire. Burners using paraffin are made to all powers, but you will find that it will cost about two to three times as much to run the engine with paraffin as it at present does with coke or coal. For prices and particulars of burners, write to D. J. Smith, 58, Compton Street, Goswell Road, London, E.C.

[17,640] **Model Steamer Machinery.** L. F. (Berkeley) writes: I am at present building a model torpedo-boat destroyer to Mr. Kidd's designs in November, 1900. Would you please tell me (1) If instead of the two single cylinder engines of ½-in. bore and ½-in. stroke, a compound engine would do having the H.-P. cylinder ½-in. bore and the L.-P. cylinder ¾-in. by ½-in. stroke? (2) Would the above engine be powerful enough to drive the boat at a reasonable speed with 75 lbs. pressure geared to two propellers?

(1) There ought to be something in favour of the compound engine. It is a significant fact that the fastest model steamer (as officially recorded) has a compound engine fitted to it. Read the notes in the opening article describing the recent design for the model undertype engine. Cylinders for compound engine ½ by 15-16ths by ½-in., not ½ by ¾-in. (2) The above mentioned engine will suit the boat very well. Work at not less than 70 to 80 lbs. per sq. in. pressure.

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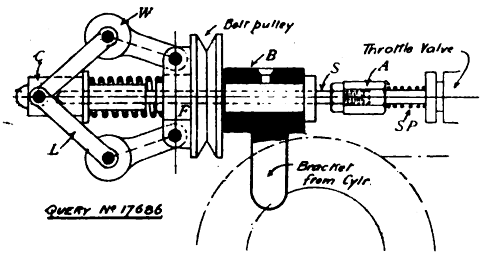
[17,790] **Small Motor Failure.** C. P. H. (Richmond) writes: Would you kindly let me know what is wrong with an "Ajax" motor I bought in parts? The armature is wound with the wire supplied, and I had the field wound with the thicker wire, but I re-wound the field with the wire (as enclosed), and now it will not work with 8 volts generated by an "Empire" dynamo. The field has 3½ ozs. of wire on it. Both kinds of wire are single cotton-covered. I want the motor to work a locomotive No. 1 gauge. Please let me know if I ought to re-wind armature; if so, with what gauge and how much?

Your inquiry is not very clearly put. Did your motor *ever* work? That is, did it run when wound with thicker wire on fields, and were fields connected in series or shunt? We suspect that the windings are too thick a gauge, and consequently take more current than your dynamo can supply. Try re-winding the armature with No. 26 S.W.G. and fields with No. 24 in series, and make sure the dynamo *is* giving its supposed voltage. Get on as much wire as you can in the space. Enclosed sample of wire you sent was barely No. 20 S.W.G.

[17,686] **Governor for Model Steam Engine.** "Expansion" (East London) writes: I am making a slide-valve horizontal engine (¾-in. bore by 1½-in. stroke), and wish to add a governor to complete. Would you kindly furnish me with design and details of a suitable one? I want it as near "real" as possible—to add to the appearance of model.

A working governor which must be very "real" for a ¾-in. by 1½-in. engine is in the nature of a tall order. To obtain perfect realism the governor would have to be very small, and it would then have little power. Moreover, the ordinary type of governor—with vertical shaft and bevel gears—you would find much too complicated to make to scale. The Pickering governor would perhaps be the best type to adopt, if you do not care for the simplified form of flyball governor shown herewith. In this governor the necessity for bevel wheels is dispensed with. The governor spindle may be placed parallel to the crankshaft and run in a bracket bearing (B) fixed to the cylinder. The spindle should extend right across to the throttle valve on the steam chest. The parts of the governor may be built up. The pulley and journal



Horizontal Governor for Small Horizontal Engine.

may be turned up in one piece, with a 1-16th-in. hole through it for the spindle. The weights (W) may be cylindrical (instead of spherical) in form, and be made solid with the arms. The fork-piece (F) may be made out of rod or strip brass and soldered on to the face of the belt pulley. The cap (C) may be turned out of drawn brass rod, and should be drilled with a blind hole the same diameter as the spindle. Connecting the weight links L (two to each weight) should be pivoted to the cap, so that as the weights or flyballs spread with the centrifugal force as the speed rises, the cap is drawn toward the pulley and the spindle of the throttle valve moved inwards. This movement should of course cut off or throttle the supply of steam. The main spring should be adjusted to requirement and the size found by experiment. An adjustment in the length of the spindle is provided at A. The block A is soldered to the throttle spindle, and the governor spindle (S) is tapped into it and provided with a locknut. A light spring should be provided at S P to return the throttle valve after any movement inward has taken place and to keep the end of the governor spindle in contact with the cap C.

[17,781] **Silver-soldering.** A. W. (Hampton) writes: I have recently made my first attempts at silver-soldering, the work being brass boiler fittings. I find the heat burns the threads and dissolves the surface of the fittings. Is there any way of preventing this? I used a paraffin blowlamp (and in one case a gas blow-pipe), making the work just hot enough to melt the silver-solder when touched on the work, and then kept the flame on to sweat the solder well into the joints.

If you take care not to blow on the threads any more than you can help, you should have no trouble such as you mention. There is no way of preventing discolouration of the polished fittings, but if you dip them in a solution of sulphuric acid and water (1 to 10) while still hot (not red hot), you will obtain a cleaner job. All the brass will be removed and the fittings will readily repolish. Silver-soldering is a matter of skill, and you will have to keep on trying. Always blow on the larger object of the two being soldered. Do not continue blowing the flame on the work one second after the solder has run it. The "slicker" the job is done, the better will be the result.

[17,791] **Reduction of Voltage and Flow of Current in a Circuit.** O. B. (North Shields) writes: I would be greatly obliged to you if you could help me in the following. I have a dynamo running at 20 volts which I would like to use for accumulator charging. What wire and gauge should I use to reduce the 20 volts to the following—8 volts, 4 amps.; 4 volts, 2 amps.; 6 volts, 4 amps.; and so on; also, the material for filling the plates in the accumulators?

Your question is difficult to reply to in few words, as it is evident you do not quite understand the subject touched upon. By inserting a resistance in the 20-volt circuit you obtain a certain flow of current which is uniform throughout the entire circuit. But the voltage between any two points in the circuit depends on the resistance of the conductor between those points. We advise you to study some elementary text-book on the subject of Ohm's Law, which gives that—

$$\text{Current flowing} = \frac{\text{Voltage}}{\text{Resistance}}$$

See also recent query replies on the subject and our handbook, "Small Accumulators," 7d. post free; also, Maycock's "First Book of Electricity and Magnetism," 2s. 9d. post free. All of these will assist you. See Query reply, "Reduction of Voltage," on page 237, March 5th, 1903, issue of this Journal.

[17,784] **Lamps for Lighting Small Model.** J. J. W. (Campden) writes: I have a model which I wish to light up with about half-a-dozen pea lamps for four or five hours at a time. What would be the best kind of battery to use? The Economic Electric Company in their catalogue advertise a "Defiance" bichromate battery lighting set. I was thinking of getting six of these batteries (which each give 2 volts) and connecting each pair in series to give 4 volts, and the lot in parallel to supply all the lamps at once. Will these batteries do, and is this the right way of connecting up? Will the lamps have to be connected in parallel or in series with each other? Would it do to use a 2 h.-p. air-cooled motor cycle engine to drive a wood-turning lathe, if I run a fan to cool it? If so, can you tell me some arrangement by which I can fix cycle down, so that it can easily be removed to use as a motor cycle?

You must find out what voltage your lamps take, and then arrange the wiring accordingly. Assuming them to take 2 volts, and, say ¼ amp. each, then connect cells up in parallel and run lamps in parallel, too. You will need very large cells if lamps are taking ¼ amp. each, but perhaps they may take less. Or you could connect the cells in series parallel, two in series and the three sets in parallel, and then run the lamps in sets of two in series. You do not mention the size of the cells you propose getting. The makers would tell you what their maximum discharge rate should be. *Re motor.* Much depends upon the situation as to how you could best fix the cycle for stationary work. We should say it could be fixed with the bolts clipping the top bar back and front, and should be supported by a substantial packing under the main frame near bottom bracket. You might try the effect of clamping it down on the tyres, and see if it reduced vibration and noise. A fan would do for cooling.

[17,589] **Screw Threads.** T. W. A (St. Leonards) writes I have Morse twist drills from 1-16th to ¼ in.; also B.A. taps and screwplates 0 to 11. Will you kindly tell me the nearest size drill to use for each tap 0 to 11? I do not understand the tables in your Handbook No. 27, and I have only the drills 1-16th, etc., upwards, and none as numbered 1 to 60. Also what fractional size rod to use to make screws 0 to 11?

We cannot understand your remark that the tables are not clear. Please say by what fraction of an inch the set of drills progress. Are they 1-16th to ¼ by 1-64th? We are afraid that you will have to get a few drills to wire gauge sizes (0 to 60) to enable you to cut all B.A. threads from 0 to 11. For sizes of rods, see our Table of Screws and Wire Gauges. On referring to the book mentioned we find that in no case can a fractional inch drill be used for tapping holes for B.A. sizes, but in some instances these drills may be used for clearing holes.

[17,743] **Expansion Valve Mechanism.** R. G. G. (Leeds) writes: I am building a twin-cylinder marine engine, 1¼-in. by 1¼-in. cylinders. I should like to fit a simple expansion gear to this engine, but as it is not intended for reversing, there is not room for two eccentrics for each valve spindle. Could you give me a small sketch of an expansion gear which would suit this type of engine, but with one eccentric?

The simplest and best method would be to make the engine a compound and use a by-pass valve to vary the receiver pressure. However, we suppose this is out of the question. A double motion is required to give a varying cut-off with a constant lead, unless you use some form of shifting eccentric, which would not seem to be possible in the present case, as you say you have none too much room on the crankshaft. You could fit a radial gear

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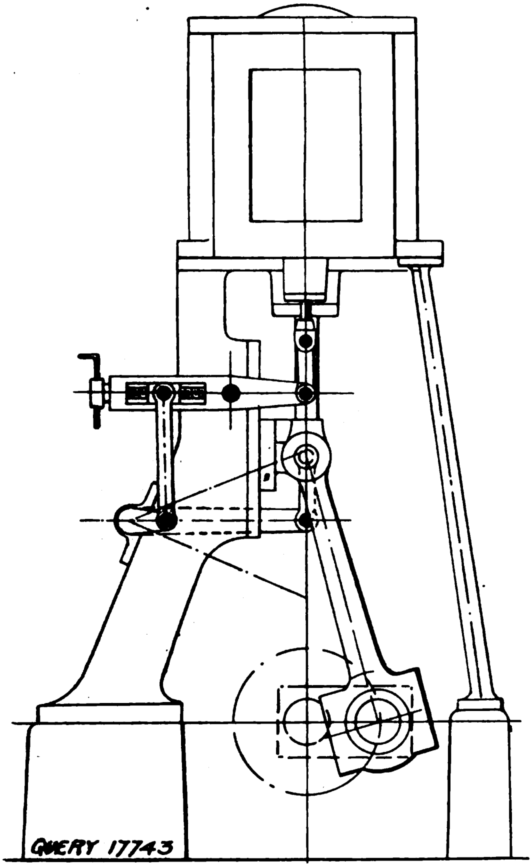
like Walschaerts', and in this way provide for reversing at the same time. If, however, this is not desired, you may use the movement of the crosshead to work the expansion valve. The timing of the motion thus derived is exactly what is wanted under ordinary circumstances. We show how this idea may be worked out. We have arranged slide travel of the expansion valve to be varied by a slide-link. This slide-link should really be a curved one, but as the travel of the die block will not be very great, and the connecting-link may be even longer than shown, the error in the cut-off point when the link is on either side of the normal position will be negligible. The connections are as follows: A lever is connected to a short shaft running in a bracket on the back column, and the end is connected by a short link to the little end pin in exactly the same way as a marine engine pump is connected. The short shaft extends as far along the engine as required to bring the short arm



A Mechanism for Operating Expansion Valve from the Crosshead in place of the Usual Expansion Valve Eccentric.

and slide-link in line with the expansion valve spindle. The travel is in this way reduced from 1½ ins. (the length of the piston stroke) to about ½ in., the required travel for the expansion valve. The connecting link from the short arm of the pivot shaft should be as long as possible, therefore vibrating lever should be placed low down and the slide-link as near the cylinder as is practicable. The die block in the expansion link should have two projecting pins turned out of the solid, and the connecting links should be in duplicate. Any suitable type of expansion valve (with fixed blocks, of course) may be used; for designs see the issues of November 30th and December 14th (1905). A plain expansion block with a main valve, like in the Meyer arrangement, would do admirably.

[17,806] **Steam Ports.** D. S. (Leith, N.B.) writes: What size shall I make the ports and valve, and lap and lead of same, also throw of eccentric, for an engine ⅞-in. bore, 1½-in. stroke, to run about 500 or 600 r.p.m. at a pressure of 20 lbs.?

Steam ports, not less than ⅜ by 3-32nds in.; exhaust, not less than ⅜ by 5-32nds in.; port bars, 3-32nds in. wide; lap of valve, 3-64ths in.; lead, 1-64th; inside lap, 1-64ths in. Dry the steam thoroughly, otherwise waste will be considerable. See that all pipes are covered also.

[17,808] **Boiler Proportions.** G. A. R. (Plumstead) writes: Will you oblige with advice as to the size of cylinder suitable for a boiler of the following dimensions: Pressure about 60 lbs. to the sq. in. (horizontal engine, driving dynamo); shell, 9 ins. diameter by 6½ ins. high; eighteen field tubes from 2½ ins. to 6 ins. long by 1 in. diameter; steam drum, 1⅞ ins. by 7½ ins. long; tubes, ¼ in. thick; shell, 3-16ths in. thick; heating surface, 561 sq. ins (including tubes, shell, and drum)?

You will not get much more than 4½ cub. ins. of steam per minute and at 60 lbs. pressure the engine should have a cylinder 1¼ by 1½-in. stroke; speed, 500 r.p.m. Do not adopt a slow speed type of engine.

[17,831] **Choice of Engine for Small Dynamo.** E. G. (Carshalton) writes: Would you favour me by answering the following questions. I have a small 6-volt dynamo for which I want an engine; a speed of 3,500 r.p.m. is necessary. Would you advise me to have oil, steam or gas? What would be about the price of this engine, second-hand? Is it best to buy or make your own? If the latter, what book would you advise on the subject?

It is quite impossible to reply definitely to any of your questions, for in the first place it is partly a matter of choice, and partly governed by prevailing conditions, whether you use gas, oil or steam power. You do not mention the output of dynamo, but only say 6 volts. So we presume it is about a 10-watt dynamo, and would need about 1-20th h.-p. to drive it. Gas engines of just this size are not made, but you could get a useful sized one for a few pounds. We cannot recommend cheap gas or oil engines, for nasty ones are dear at any price. The question of making one depends on what you have done in this line before. If nothing much, then do not *begin* on a comparatively big job like this. No one book will teach you all about everything in the making of any engine. You must pick up knowledge by degrees and by actual practice—*i.e.*, practical work yourself. We can recommend "Gas and Oil Engines," by Runciman, 7d. post free, if you wish for a good and clear idea of what is involved in a small or large gas engine of good design. See also the coloured plate (supplement) in the January 4th, 1906 issue, and the articles on "Otto Cycle Gas Engines." As regards cost of a second-hand engine, this all depends on condition, etc., it is in, and no fixed price can be named.

The News of the Trade.

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

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

*A New Soap for Engineers.

A particularly good soap now being placed on the market will be found to be Cleaver's "Antioyl" soap, which has been specially prepared for the use of engineers, motorists, and in fact everyone who in one way or another gets their hands into such a grimy state that something possessed of exceptional cleansing properties is required to remove the grease and dirt. In addition to these qualities, we find that "Antioyl" soap effectually softens hard water and is consequently very beneficial to the skin. We have used some of this soap ourselves recently, and our opinion is that it meets every requirement and fulfils the makers claims to the letter.

New Catalogues and Lists.

Messrs. C. A. Vandervell & Co., of Warple Way, Acton Vale, London, W., have sent us their new list of ignition accumulators and coils, electric lamps, and accessories, which we can recommend to the notice of our readers who require something substantial and lasting in the lines this firm supplies. Messrs. Vandervell impress upon us the fact that their accumulators, which have held such a high reputation in the past, are this year better than ever. This opinion is also fully endorsed by many of the leading motor manufacturers and other private users, who have had a long experience with this firm's productions.

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The Editor's Page.

WE publish elsewhere the details of a prize competition we have arranged in connection with the forthcoming MODEL ENGINEER Exhibition. It will be noted from the announcement referred to that the underlying idea of the competition is to produce a display of models, apparatus, and tools made from instructions given in this Journal, and we are quite sure from what we know of the excellent way in which many of our readers have carried out one or more of the numerous designs we have published, that quite a first-class show of work can be made if the idea is properly supported. The competing exhibits need not, of course, be made specially for the Exhibition; they may have been made at any time since the particular design in question first appeared in our pages. The exhibition of a representative collection of this kind will not only be a matter of considerable attraction for the general public visiting the Royal Horticultural Hall, but it will doubtless indicate to many of our readers who may see the models the wide scope for their talents and the vast amount of useful information which is to be found in the various volumes of THE MODEL ENGINEER. Last, but not least, it will be a source of personal gratification to ourselves to receive a really good entry for this competition, for it will enable us to see the way in which the matter we have provided during the past nine years has been turned to useful account. We hope, therefore, for all these reasons that those who have made models from our paper will give them another rub with the polishing cloth and send them along in accordance with the rules. Every competitor cannot, of course, win a prize, but he can at least gain some satisfaction from the honour of being represented at such a fine display of models as this Exhibition will in every way provide.

* * *

The trade exhibits at this Exhibition will make a very fine show, as practically all the leading firms in the model line will be there, and each will bring its best. But, apart from the trade exhibits, we are arranging to show a number of high-class examples of engineering and electrical model-making, which have been kindly offered by various private owners. There are doubtless many others among our readers who have well-made models which they would be willing to lend to add to the completeness of the Exhibition, but until our space arrangements are a little more advanced, we do not quite know how much room there will be to spare for loan exhibits. We should be glad, however, if all those who would be willing to lend any models or other interesting exhibit of a scientific character would kindly write to us stating exactly the nature of the proposed exhibit and the probable space it would occupy. We will file all these offers together until we see exactly what space is available, and we will then communicate with all who have thus offered their kindly help. It may be that we shall be unable to find room for all the exhibits that are offered, but each and every offer will be carefully considered and, whether accepted or not, will be greatly appreciated. We may perhaps suggest, without any desire to give offence, that the standard we are setting for our exhibits is a somewhat high one, and only really good examples of design and workmanship should be offered. Everyone whose offer of a loan exhibit is accepted will, of course, receive a complimentary ticket admitting during the entire duration of the Exhibition.

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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Contents.

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

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THE

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And Electrician.

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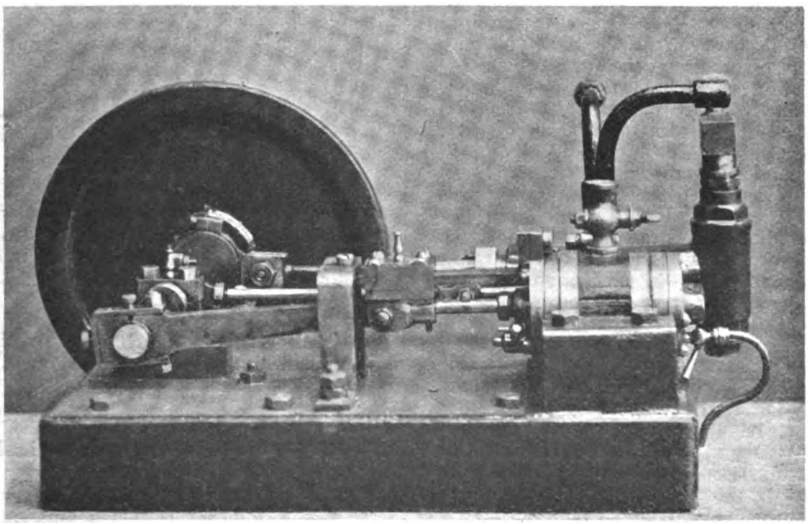
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XVII. No. 324. JULY 11, 1907. PUBLISHED WEEKLY

A Model Horizontal Engine with Single Slide Bar.

By W. SAWYER.



MR. W. SAWYER'S MODEL STEAM ENGINE.

THE model herewith illustrated is of my own design, and has taken about two years of my spare time to construct. All the parts I have made myself, with the exception of the cylinder, which is of cast iron 1 9-16ths in. diameter, 2½ ins. stroke. The steam and exhaust ports were cast in, being 3-16ths in. and 5-16ths in. respectively. The cylinder I fitted with drain cocks and lubricator. The steam chest is separate, and is coupled up by four studs to the port face, so securing chest and cover together. The piston, which has one ring, is 9-32nds in. diameter, and is connected to the cross-head (locomotive pattern), which is built up of steel and is adjustable for wear by liners. I forged the connecting-rod, which is also of steel, and filed it up and fitted cotters and strap. The brasses were turned up of ⅝ths-in. gun-metal. The crank-pin is 9-32nds in. and the shaft ⅜ths in. diameter. The plummer blocks I built up of steel to avoid broken caps. The slide-rod was made of 3-16ths in. steel, and eccentric-rod was forged up at the slide end and filed to suit valve spindle, which is screwed up far enough to take lock-nut for adjustment. The eccentrics are built up with a disc ¼ in. thick, ¾ in. diameter, having two flanges sweated to it, 1 in. by ⅛ in., drilled and pinned together. The straps were cut out and filed up to fit. I made two for this model, the other being a larger one for the pump, which is built of 1-in. tubing and brazed up. The valves are wing pattern. The flywheel is cast solid, and weighs 10 lbs., and is grooved for driving. By the way, the pump plunger is ½ in. diameter,

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1¼ in. stroke, and fitted with an internal tube inside and cut short so that the packing ring should seat on the lugs, which are brazed on to take the three gland studs. I lagged the cylinders and banded them, which add to the effect. The engine, which is a fairly powerful one, weighs 36 lbs. in all, and has been tested with 100 lbs. of steam.

Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page* 11.)

TO describe a circle that shall pass through a given point P (Fig. 52) and touch two given circles J H and J1 H1.—Join the centres of the given circles by a line C C1, cutting the circles in H and H1; describe a circle P F (Fig. 52) (centre G) passing through the three points H H1 and P; draw the tangent T N to the two given circles; through P draw a line P E converging to meet at the same point as the lines C C1 and T N; through G draw A B perpendicular to P E. The required circle will have its centre on the line A B, and may be found by the aid of the preceding problem.

If it be required to include the given circles, as in Fig. 53, find A B by means of the method shown in Fig. 52 and the centre O, as in Fig. 51. A circle having O as centre, and radius F O, will touch (and include) both the given circles.

To describe a circle to touch three given circles C, C1, and C2 (Fig. 54).—If the given circles be all of the same diameter, draw lines joining the centres of any two pairs of circles C C1 and C1 C2; bisect C C1 at A and erect the perpendicular A O; bisect C1 C2, at B and erect the perpendicular, cutting A O at O. A circle with centre at O—that will touch any given circle—will touch all given circles.

If the given circles be of different diameters, as in Fig. 55.—Draw the lines C C1 and C1 C2, assuming that C be the centre of the smallest circle; set off B D and E G both equal to A C. With C1 as centre, describe the circle D, and with C2 as centre describe the circle G. Find by problem (Fig. 52) the centre O of a circle to pass through a given point C and touch two given circles D and G; join O and C; with radius O F, and centre O, describe the circle required.

If the given circles have to be included (Fig. 56), find the centre O of a circle that will include the circles D and G.—Draw a line from O passing through C to the opposite side of the circle F1; then, with O as centre, and radius O F1, describe the required circle.

To describe a circle that will touch a given circle E G (Fig. 57) and a given line A B in a given point P.—From the centre C of the given circle drop a line perpendicular to A B, extending to E; draw a line E P from E to the given point, cutting the given circle at F; erect P O1 perpendicular to A B; from C draw a line through F, cutting P O1 at O. With O as centre and radius O P, describe the required circle.

Note.—A line joining G and H will pass through F. The angles E F G and H F P are right angles.

There are two solutions to the above. A second circle may be drawn to fufil the conditions and include the given circle as follows:—Draw a line from P passing through G and extending to cut the given circle at F1; from F1 draw a line through C and extending to meet P O at O. A circle, with centre O, and radius O F1, will pass through the point P.

To describe a circle that will touch a given line A B (Fig. 58) and a given circle in a given point P.—From the centre C of the given circle drop a line perpendicular to the given line extending to cut the circle at E; from E draw the line passing through P to meet the given line A B at G; erect the perpendicular G O; draw C P, and extend to

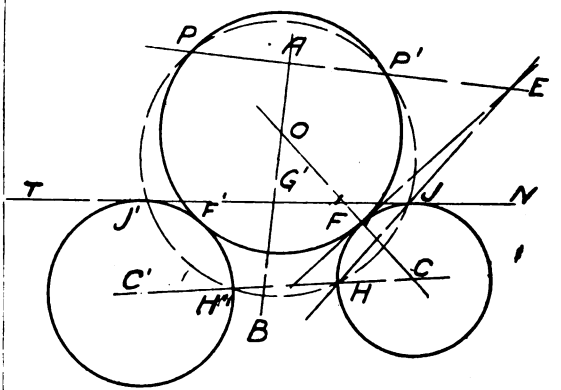

FIG. 52.

cut G O at O. A circle with O as centre, and radius O G, will fufil the conditions. A circle to include the given circle may be determined as follows: Through the points P and F draw a line extending to cut A B at G1; erect the perpendicular G1 O1 through P and C; draw a line meeting G1 O1 at O1. The required circle will have its centre in O1, radius O1 P.

(*To be continued.*)

Liverpool and District Electrical Association.

THE first meeting of this Society will be held at the Common Hall, Hackins Hey, Dale Street, at 8 p.m. on Tuesday, July 16th. It is intended the Association will meet fortnightly, and that papers will be read, followed by general discussions; occasionally social evenings will be arranged. A series of Saturday afternoon visits to places of interest will also be promoted. The subscription is 10s. 6d. per annum, payable on entry; or in a first instalment of 3s., followed by three further payments of 2s. 6d. The committee extend a most cordial invitation to all engaged in electrical work, or other interested persons, to attend the above meeting.—S. FRITH, Promoter and Hon. Secretary, 77, St. John's Road, Bootle.

A RECENT report states that tests on the New York, New Haven, and Hartford Railroad have been made of the new electric single-phase trains at a speed of 100 miles an hour, which show that passenger trains can be run at this speed with perfect safety.

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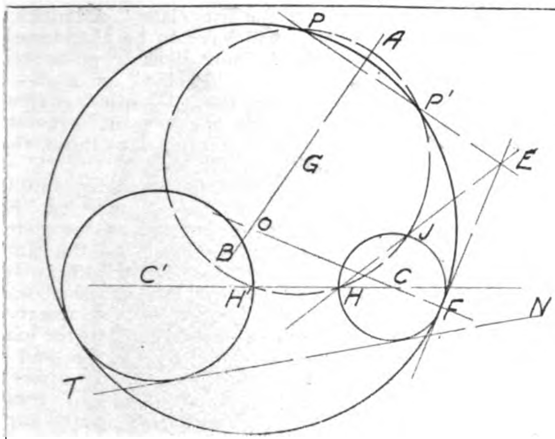

FIG. 53.

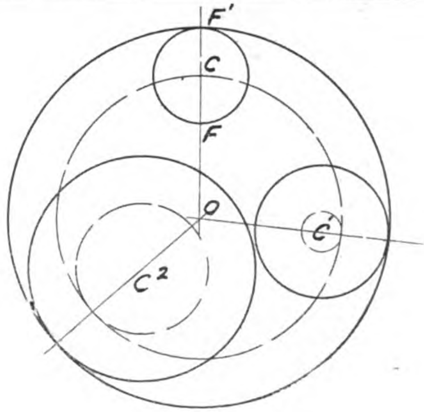

FIG. 56.

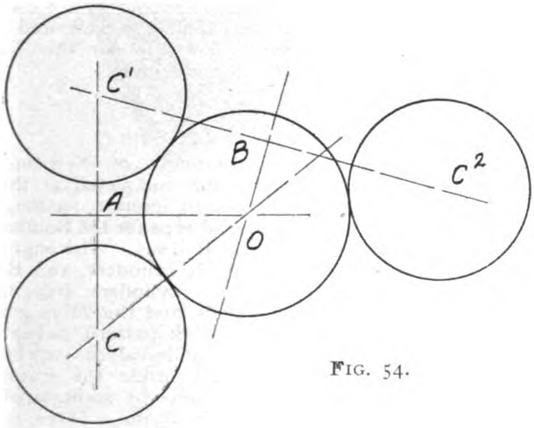

FIG. 54.

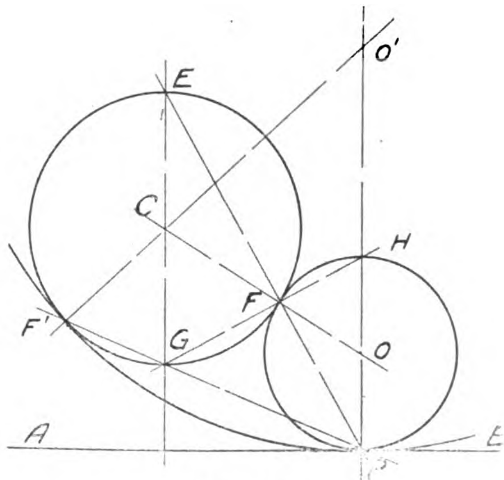

FIG. 57.

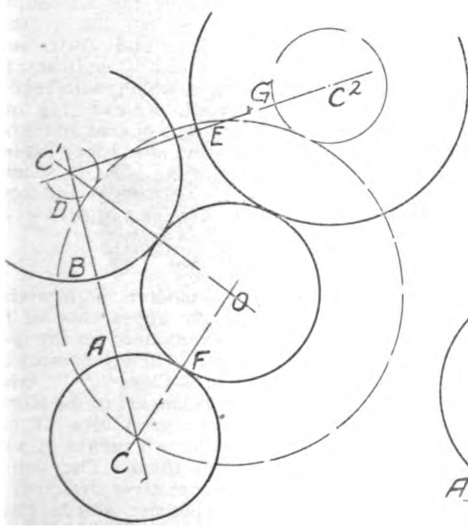

FIG. 55.

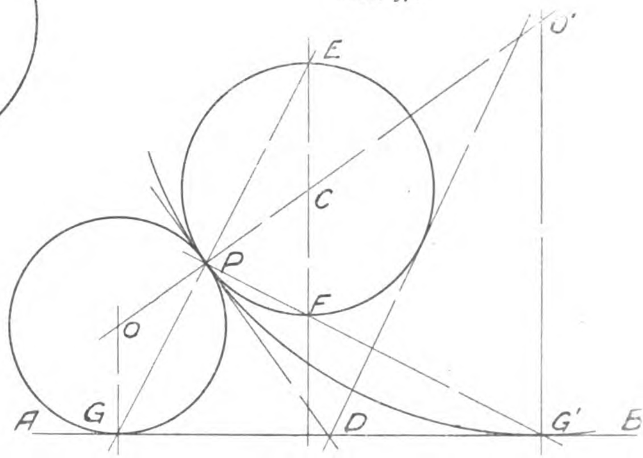

FIG. 58.

ENGINEERING DRAWING FOR BEGINNERS.

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Locomotive Notes.

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

New Locomotives for Portugal.

The Société Alsacienne de Constructions Mécaniques have delivered from their Grafenstaden Works five large four-cylinder de Glehn system compound locomotives, which have been built there for service on the Compagnie Royale des Chemins de Fer Portugais. The engines have six wheels coupled and a leading four-wheeled bogie, thus being of the 4—6—0 type, and the usual cylinder and valve gear arrangements employed in de Glehn compounds have been adhered to in this case. The design approximates to that of the engines of the same type running on the Paris-Orleans Railway, and the dimensions are in most respects similar. There are, however, one or two differences, and the Portuguese locomotives, which run upon the 5-ft. 6-in. gauge, are slightly more powerful than those of the P.O. Company. In a later issue, No. 305 of the new series will be illustrated and a list of its chief dimensions given.

Some very neat-looking little tank engines have recently been built at the works of the Glasgow and South-Western Railway at Kilmarnock. They are 0—4—4 type, with inside cylinders (16 ins. diameter by 22-in. stroke) and coupled wheels (4 ft. 6 ins. diameter). They are intended for hauling light suburban and branch line traffic and also for working on harbours where sharp curves are frequently met with. The bogie has outside framing, and its springs are connected by equalising levers. The general appearance of the engines conforms to G. & S.W.R. standards.

A few days ago one of the large "Atlantic" type express locomotives of the Great Northern Railway, No. 1,401, took a load reckoned as 365 tons behind the tender out of King's Cross, and hauled it up the 13 odd miles of bank to Potter's Bar in eighteen minutes, subsequently passing Hitchin in forty minutes from starting and Peterborough in one hour twenty-four minutes. Possibly, better performances have been recorded in favour of these engines, but the writer, who was present on the occasion referred to above, considered it a highly meritorious performance for an 18¾-in. by 24-in. engine on a night when weather conditions were certainly not in favour of getting the best results in speed and traction. So many people question the advisability of employing such small cylinders as those fitted by Mr. Ivatt to his latest express engines, but they seem to overlook the fact that with only just 18 tons on each of two coupled axles, or 36 tons in all for adhesion, out of an engine (total weight in working order of 65½ tons) larger cylinders represent no advantage. To utilise their greater capacity means nothing more than to slip the wheels frequently, for, where, the adhesion weight is limited, a high tractive power serves no useful purpose, and until such time as it may become necessary to employ six-coupled express locomotives on the Great Northern Railway, there can be no gain in fitting cylinders materially larger than those now used. If ever the 4—6—0 type engine makes its appearance on the G.N.R., one of the best features of the 201 class "Atlantics," viz., the wide firebox, will have to be abandoned, unless, of course, the designer likes to go a step further and introduce the "Pacific" or 4—6—2 type. For the time being, the "Atlantic" engines sufficiently meet the needs of even the heaviest traffic, and that is saying a great deal, as those who understand the conditions will agree.

It is said that the new four-cylinder simple express locomotives of the 4—6—0 type on the Great Western Railway are proving as successful as No. 40 of the 4—4—2 type, which had the same cylinder and valve arrangements proved otherwise. Here is another case wherein the adhesion was insufficient to give the balance to the tractive effort of large cylinders, for in the aggregate the four cylinders (each having a diameter of 14 ins. and a piston stroke of 26 ins.) are equal to a pair of very large cylinders indeed, and although the four-coupled wheels of No. 40 "Atlantic" engine supported 39 tons 12 cwts., there is no gainsaying the fact that this was insufficient under the circumstances. The "Star" class have 55 tons 8 cwts. distributed over their six-coupled wheels, and to this fact may be ascribed the reason for the very successful results which they are giving.

New Locomotives for India.

The Vulcan Foundry Company, of Newton-le-Willows, Lancs., have recently completed at their works the first of a series of express passenger locomotives of a very powerful type for the Bombay, Baroda, and Central Indian Railway. The engines are 4—6—0 type, with outside cylinders, and Belpaire boilers are fitted. The cylinders drive the middle pair of coupled wheels, and the valve gear, which is of the Stephenson link pattern, actuates the balanced Richardson slide-valves working at the side of the cylinders inside the frames. The cylinders are 20 ins. diameter by 26-in. stroke, and the coupled wheels 6 ft. 2 ins. There is a load of 50 tons distributed over the six-coupled wheels. The boiler pressure is 180 lbs.; total heating surface, 2,037 sq. ft.; and grate area, 32 sq. ft. These dimensions clearly indicate the power of these new locomotives, which, with tender, and in full working order, turn the scale at 113¾ tons. The tender accommodates 7½ tons of coal and 4,000 gallons of water, and weighs 46½ tons loaded. The fixed wheelbase of the engine is 14 ft. 3 ins.; total (engine) wheelbase, 27 ft. 3 ins.; and total wheelbase (engine and tender combined), 51 ft. 7 ins.

The influence which the modern high-pitched boiler brings to bear upon the appearance of the modern locomotive is well exemplified in the illustrations on the opposite page. These represent the front end and cab interior of a Class "V" Atlantic type express locomotive belonging to the North-Eastern Railway, and a very good idea of how these engines appear from the two points of view referred to is obtained from them. The cab of these, as well as of other locomotives designed by Mr. Wilson Worsdell is of ample size, and is, moreover, exceedingly well arranged, all the fittings, etc., being within convenient reach of the enginemen, and the arrangements generally of the most complete description.

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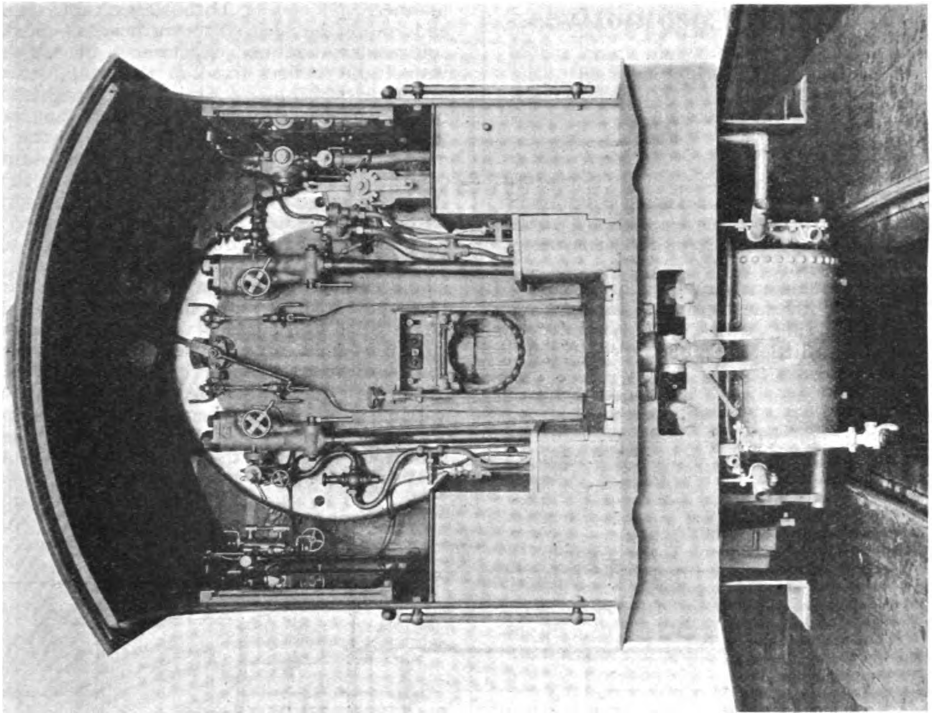
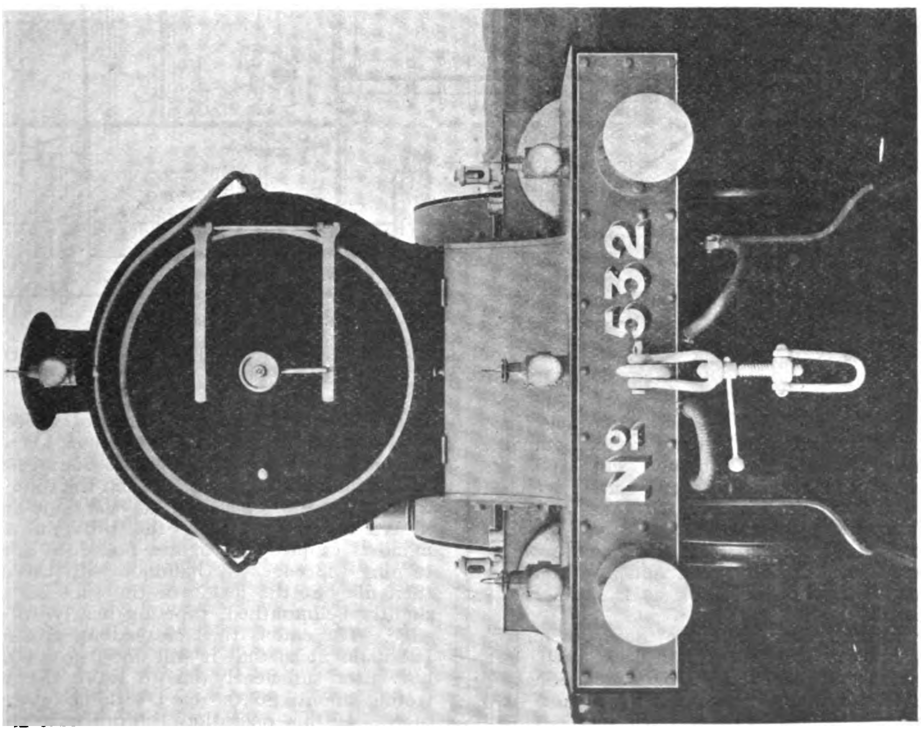


INTERIOR OF CAB.



FRONT END VIEW.

CLASS "V" ATLANTIC TYPE EXPRESS LOCOMOTIVE: N.E.R.

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Chats on Model Locomotives.

By Henry Greenly.

Modelling Shunting Engines.

(*Continued from page* 13.)

With reference to the construction of a model locomotive boiler, the usual injunction given to the prospective builder is "that the boiler shall be brazed throughout." It is very easy to say do this, and no less easy to write it, but the actual performance is quite another matter. There is no disguising the fact that the brazing of a boiler (or silver-soldering, which is only another form of "brazing," a little less difficult to accomplish) requires a considerable degree of skill, especially in the larger sizes. Therefore, whilst the writer would at all times prefer to make a silver-soldered joint in, say, a piece of 3-16ths copper or brass pipe than use ordinary tinman's manner. Of course, both water tubes and boiler ends might be secured, or rather "caulked," with soft solder, but my experiences of tubes of the water-tube boilers fixed in this way, when these boilers first became recognised by model locomotive builders, were always sad. Sooner or later the joints became leaky; therefore, in the present design, unless means can be obtained to properly braze or silver-solder at least the water tubes, I suggest the latter should be dispensed with altogether.

A plain boiler, if the flame is well ventilated—as the one shown in the drawings—should, with a single cylinder, supply all the steam required. If it should not, the efficiency of the boiler may be augmented by a device which is well known and which, in a measure, is used in the "Serve" tube. The addition of the wires or spikes shown in the drawings does not necessitate silver-soldering appliances being used, and if the fixing is properly and carefully done, no leakage troubles should result, even where the boiler is accidentally run

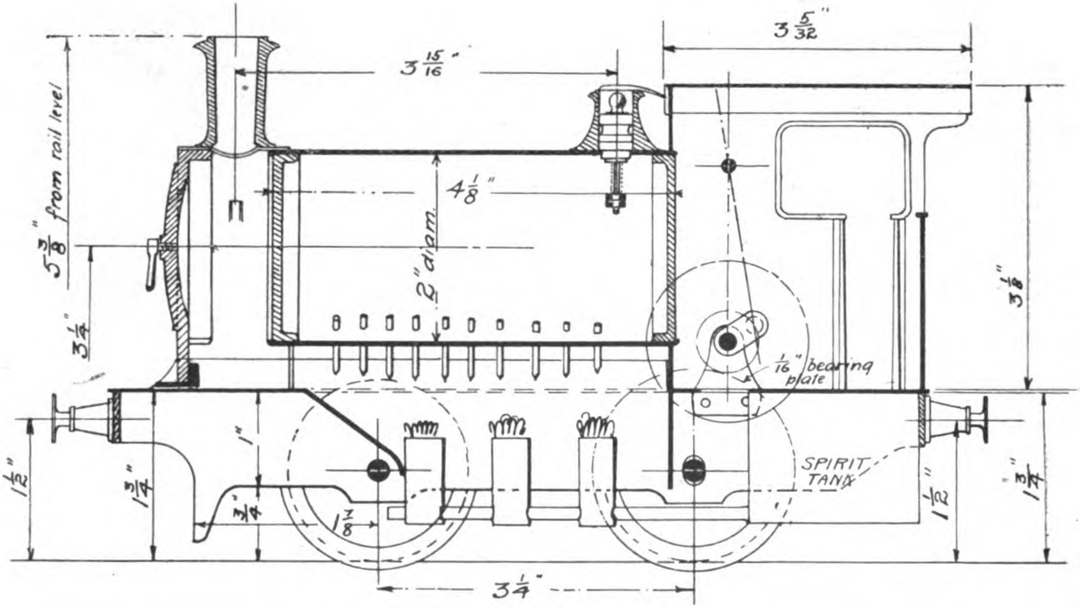

Fig. 13.—Sectional View of Simple Model Locomotive, with Friction Drive, showing Details of Boiler, Smokebox, and Lamp.

solder (*i.e.*, soft solder) for the same purpose, in silver-soldering a complete boiler great care must be exercised in handling the flame. This applies more in the case of the pointed flame which emanates from a lamp of the "Ætna" type, otherwise the work will not be heated equally all over, and instead of the solder running into the joint with a neat fillet, the job, when finished—should nothing worse happen—will look as if "the rats had been at it."

Bearing in mind that the present design is for a simple locomotive, to be constructed with a minimum number of tools and a limited experience in practical technics, I do not think I should be justified in specifying a brazed (or silver-soldered) boiler fitted with water tubes in the orthodox dry. The boiler should be made of a piece of light solid-drawn tube, brass or copper, it does not matter. The ends may be brass castings or, better still, spun flanged plates. When the tube has been trued up, which operation may be done on a lathe, if available, by placing the tube on a wooden mandrel (a piece of curtain pole does admirably), turning the edges by hand or with the slide-rest, then file out the inside of the tube so that it is slightly bellmouthed, tapering nearly to a feather edge. The end is then cleaned up and driven in. It should fit so that it will not "go all the way," but enter sufficiently far to leave the tube projecting about 3-64ths or 1-16th in. over the end plate. If this operation is not successful in the manner described, then "tin" the flange with

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solder and sweat in place. If it is still very loose, two or three brass screws may be used to secure the ends; indeed, these may be employed in any case as an additional fixing. Centre the boiler ends for the lathe, and with a burnisher or other suitable smooth tool spin the edges of boiler tube over the ends. Where a lathe is not available, a light hammer may be used instead. When finally sweated with solder, such a boiler barrel should be quite strong enough for all practical purposes and for all pressures likely to be obtained in such an engine as the one now under consideration.

The spikes which are shown bristling from the lower part of the barrel may be made from ⅛-in. brass wire. Holes should be drilled and tapped with not too full a thread in the boiler barrel and about thirty pieces of wire screwed nearly half way down, the thread tapering, if possible, so that the pieces of wire become tighter as they reach the end of the thread. The wires may be treated with a little soldering paste as they are driven in, and when all are once sweated to the barrel with soft solder wiped all over the bottom of the barrel with a brush, no trouble should occur even if the water runs short at any subsequent time during the manipulation of the model.

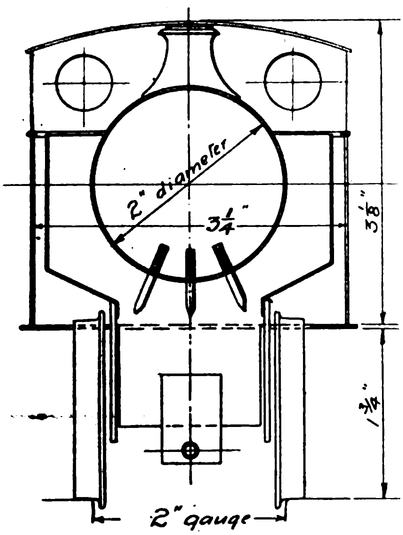

Fig. 14.—Cross-section through Boiler of Simple Model Locomotive.

The smokebox is formed by wrapping a piece of sheet iron or steel over the boiler, the wrapper passing between the frames, as indicated in Fig. 12 published with last week's article. For the smokebox front I find, on rummaging through my collection of odd castings, that a smokebox front in iron with flange may be obtained to suit the engine. This is shown in the sectional sketch herewith with a piece of angle brass inside placed to secure the smokebox front to the footplate.

The weatherboard of the cab should be in one piece, with a hole in it 2 ins. diameter, to receive the end of the boiler barrel. The lower portion should be cut to fit between the main frames and form a flame guard protecting the back axle and machinery from the heat of the lamp.

The footplates may be made out of a single sheet of tinplate. Piercings will be required for the end of the crank-pin, the lamp space, the spirit tank filler, the tops of the wheels, and the flywheels on the crankshaft. The front portion of the footplates between the frames should not be cut away entirely, but may be bent down to guard the flames from the rush of air as the locomotive is travelling. The cross section shows the internal lining of tinplate which may be inserted to form an extra uptake and at the same time preserve the paint on the side plates of the tanks from blistering. The wicks may be oval, formed of ¼-in. tube, squeezed up in the vice. The pipe connecting the

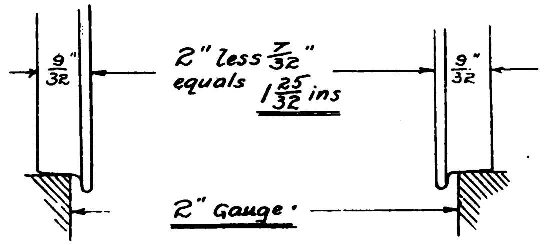

Fig. 15.—The 7-16ths-in. Scale Standard Gauge.

wick tubes with the spirit tank may be 3-16ths in. in diameter. Larger spirit conducting tubes are not advised, as besides blocking up air spaces they lead to flooding.

The safety valve is a stock pattern, such as may be obtained with a bushing for about fourpence or fivepence. It will be found a little large in diameter, but it may be turned or filed down so that a casing of the standard N.E. Railway pattern may be made to fit over it, as indicated in the drawing.

As before mentioned, all running gear should be very free and any unnecessary weight dispensed with. In addition, care should be exercised in

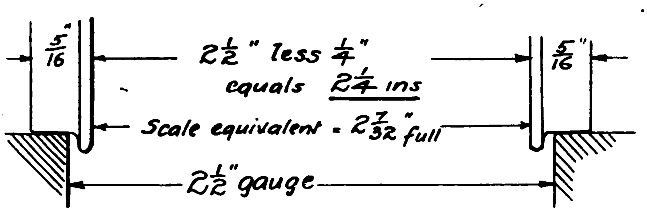

Fig. 16.—The ½-in. Scale Standard Gauge.

making both the boiler and the cylinder, so that a steamtight job is obtained. When an engine does not steam, always look for the leak. Many a very pretty theory of a failure has been propounded when the actual cause was simply an almost imperceptible leakage of steam from the generator, in some cases perhaps acting in conjunction with a similar waste of the precious fluid from the cylinder and its connections.

Scales and Gauges: "Atlantic" Type Models.

Before dealing with some correspondence which has arisen out of the articles in this column on valve gears, there are one or two letters which I would like to acknowledge.

A reader, R. H. G. (Seaham), asks if it is not a

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fact that the standard gauge for ½-in. scale locomotives should be 2⅜ ins., and not 2½ ins. He also says that the former is nearer the scale equivalent of the English standard gauge of 4 ft. 8½ ins., and affords ample boiler space now that the "Atlantic" locomotive has come to stay. Yes, this is quite true, but like the "Atlantic" type locomotive, the 2½-in. gauge is here and is also likely to stay. For this reason I do not think it wise to suggest any alterations in the gauge at this date. The gauge has remained a standard for close on ten years; indeed, ever since the German toymakers remodelled the gauges on lines more nearly approaching scale equivalents than those adopted by the makers of the "Ajax" and "Conqueror" models of the writer's schooldays, which had gauges of 3 to 3½ ins. for engines which, if they could be scaled at all, were not larger than our present 7-16ths-in. scale engines. The recognised gauges are now 1¼ ins., 1¾ ins., 2 ins., 2½ ins., 3¼ ins., 3½ ins., 4¾ ins.; the scale of locomotive usually adopted being ¼ in., ⅜ in., 7-16ths in., ½ in., 11-16ths in., ⅝ in., ¾ in., and 1 in. to the foot respectively. These gauges should, I think, remain immutable. It is easy to trim your sails to the wind as regards the scale, rather than altering the gauge to suit the scale, and any stickler for accuracy may build his 2½-in. gauge locomotive to, say, 17-32nds in. to the foot. But I would remind him that when a locomotive is to be essentially a working model he will only be correct in this one point. The distance between tyres is just as important a dimension, as upon this depends the width over frames. Supposing our correspondent's idea of using a 2⅜-in. gauge for ½-in. scale models were adopted. As in small models the distance between tyres generally measures 7-32nds to ¼ in. less than the gauge, this distance in a ½-in. scale engine would be, say, 2 5-32nds in. Now, 4 ft. 2 ins. is a common dimension for the distance between frame plates. This means that in a model the width over frames would be at least 2⅛ ins. Now, 1-32nd in. is not enough clearance between wheels and frames, and if the more usual figure of 1-16th in. each side is allowed, the frames must be placed closer together than scale, which may have a rather bad effect on the design of the smokebox, especially in the case of a L.N.W.-Rly. engine. Where the gauge is slightly under scale—as in 7-16ths in. scale, 2-in. gauge models—the reduction in the width of frames is very noticeable. Having in view the fact that the 2½-in. gauge has such wide popularity, I do not think it would be at all wise to make any change at this date.

Continuing, R. H. G. says: "I also venture to say that the 4-coupled 'Atlantic' engine, if well cut away as far as the bogie and trailing wheels are concerned, affords ample opportunity for getting over the curve difficulty better than the 4—4—0 or 4—6—0 types, and a smarter looking engine is the result." With this I agree, and will deal with it at a later date. For the moment, I may say that it was this fact that made me decide on a 4—4—2 type locomotive for the railway at Blackpool. A 4—4—0 type showed many disadvantages on the sharp curves this railway necessitated, and these disadvantages were entirely overcome by the "Atlantic" design. The "Little Giant" traverses a 100-ft. radius with ease, the safe speed being eight miles per hour with a super-elevation of about 2 ins.

With reference to "Compound Model Locomotive's" interesting letter, as it does not deal with the effects of actual locomotive practice on model work in a detailed manner, I do not feel justified in taking up very much of the space available in this column for a reply to his criticisms. With regard to footplate level, however, my remarks remain correct. Mr. D. Drummond did use the "4 ft." footplate level when he was on the Caledonian, and still adheres to its use now he is engineer on the L. and S.W.R.; furthermore, Mr. McIntosh has not made any change in this particular, therefore, as Mr. McIntosh came into power after Mr. Drummond, it remains, as I said, "a relic of Mr. Drummond's superintendency." As once upon a time a junior member of the locomotive staff of an English railway, I know with what seriousness "outside experts" who tell their tales in the Press are regarded. Much amusement is occasioned when one of these gentlemen gets past the hall porter and proceeds to instruct the "super" on what he ought to do!

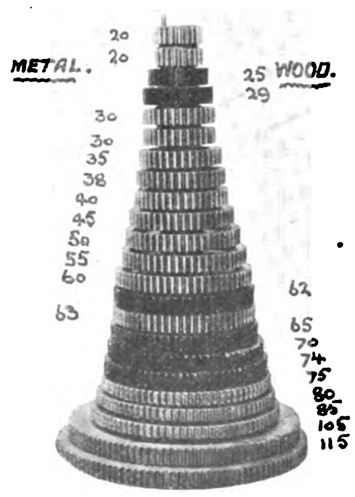
(To be continued.)

Workshop Notes and Notions.

Home Made Change Wheels.

By T. Goldsworthy-Crump.

Having occasion to require some screws of an odd pitch, and not possessing the necessary change-wheels amongst the set supplied with the lathe, it



A Group of Change Wheels.

was decided to make them of *wood*. The resulting wheels proving so satisfactory, it was further decided to make the set complete in accordance with the list given in the "Model Engineer Screw-Cutting Indicator"—by the bye, a most useful table. The wheels supplied with the lathe were 20, 20, 30, 30, 35, 38, 40, 45, 50, 55, 60, 63, and are of 14 pitch, and the wheels that have been added are 25, 29, 62, 65, 70, 74, 75, 80, 85, 105, 115.

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The 25 and 29 wheels were cut from coco-wood; the 62, 65, 70, 74 from lignum; the 75, 80, 85 from three thicknesses of 3-ply fretwood glued together; and the 105 and 115 from apple.

The first thing was to make a fly cutter exactly to fill the space between the teeth, Fig. 1. For

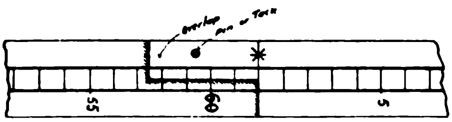


Fig 2.

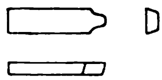
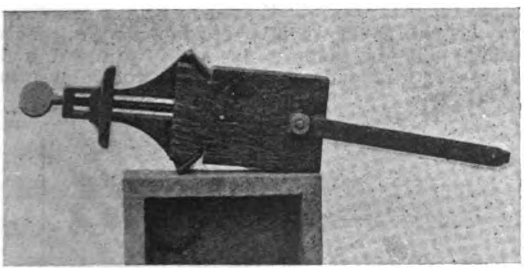


Fig 1.

this purpose a piece of tool steel, 1 in. by ¼ in. by ⅛ in., was taken and carefully filed to shape, backed off, hardened, ground, etc. Too much care cannot be taken to have this absolutely right in every way, as a satisfactory result depends almost entirely on this little tool.

The blanks were now taken in hand, each one being attached to the faceplate, and the central hole bored out ⅝ in. to fit end of mandrel, studs and lead



METHOD OF HOLDING INDEX FINGER TO LATHE TOOL TRAY.

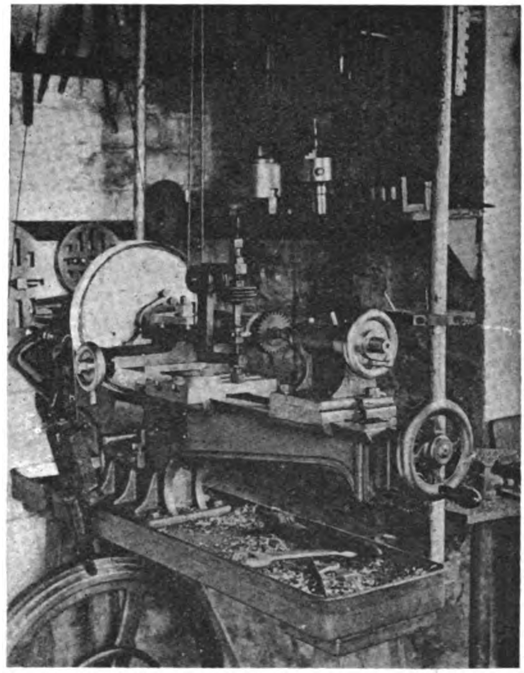
screw. The holes for pin-fitting as adopted on the "Drummond" lathe were drilled, using a metal change wheel as template, the 3-16ths pins being fitted afterwards.

A wood mandrel about 12 ins. in length and 2½ ins. diameter, with metal centres inserted, was now turned down at one end to ⅝-in. diameter, leaving a square shoulder. Each blank was mounted, turned, and cut on this mandrel.

The manner of dividing was somewhat similar to that adopted for the division plate (described in THE MODEL ENGINEER, April 18th, 1907), save that in this case it was somewhat simplified, the punched tin being replaced by paper.

A strip of stout drawing paper, 30 ins. by 1 in., was carefully divided into ¼ inches, as shown in Fig. 2, and used as described later.

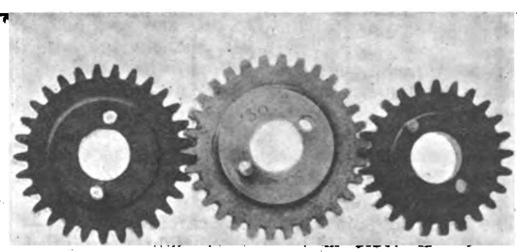
The index finger was secured to the lathe tool tray as shown in photograph, which allowed of its being adjusted to the varying diameters of dividing disc. The index point was also made chisel shape to more exactly cut into the paper. The vertical cutter, of course, was properly adjusted to lathe centres.



GENERAL VIEW OF APPARATUS FOR CUTTING WHEELS.

As a preliminary the 25 wheel was cut first. The blank was turned 1 59-64ths ins. diameter, and the 50-tooth change wheel used for dividing, every second space being used. The vertical cutter was carefully adjusted for depth of tooth and the space cut out with one traverse, the tool running about 2,000 r.p.m. Result, a perfectly clean cut with no chatter. The next dealt with was the 29 wheel. How to divide a circle into 29 parts does not seem easy at first sight. However, 4 times 29 = 116, and the strip of paper is now brought into use.

Wood. *Metal.* *Wood.*



SHOWING FINISHED CHANGE WHEELS.

A blank piece of wood 9⅜ ins. diameter and about 1 in. thick was screwed to the faceplate and turned to 9¼ ins. diameter, and a 3-in. hole bored out of

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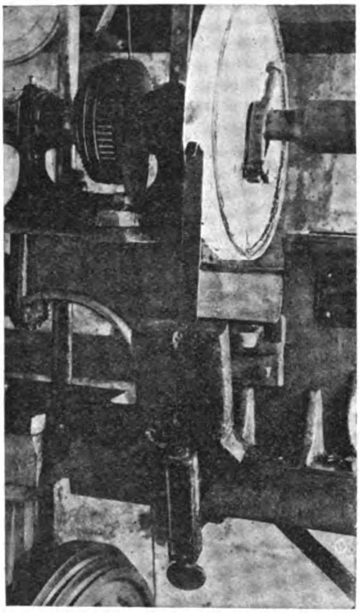
the centre to allow the wooden mandrel to centre within. The lathe carrier must be securely fastened to the faceplate. The paper strip was now carefully adjusted so that the 116 divisions made a complete circle, no more nor less. The index pointer was put into position, and every fourth division used, giving the twenty-nine teeth required.



WOOD DISC IN POSITION FOR MARKING-OFF PROCESS.

The paper strip was now removed and the disc fastened to the *back* of the faceplate and reduced to 9 5-32nds diameter. The paper strip was adjusted to 115 divisions, and the blank on the mandrel (which for this and the 105 wheel has to be reversed to enable them to swing into the gap) was refixed and cut. The process for the remaining wheels is the same, and the divisions, blank diameters, and disc diameters to the nearest 64th in., are as under :—

Teeth Required. (14 pitch.)	Blank Diameter.	Dividing Disc Diameter.	
25	1 59-64	(50 change wheel).	
29	2 15-64	9¼ — (1-in. divisions).	
115	8 23-64	9 5-32	¼-in. divisions.
105	7 41-64	8 11-32	
85	6 13-64	6¾	
80	5 55-64	6 7-16	
75	5½	5 31-32	
74	5 22-64	5⅞	
70	5 9-64	5 9-16	
65	4 50-64	5 3-16	
62	4 26-64	4 15-16	

The following points should be carefully noted :— The paper strip should be strained tight and pinned or tacked. Any slackness may be taken up by putting paper underneath. When using fly cutter, have back centre screwed up tight, and. if necessary, keep one hand on index finger. There must not be any shake. Run cutter as fast as possible and keep *sharp*.

Faceplate Holder.

By T. GOLDSWORTHY-CRUMP.

In fixing and adjusting work on a faceplate or independent chuck it is often a convenience to do so with the plate in a horizontal position. It is, however, necessary that the plate may be firmly fixed and at the same time capable of being easily revolved.

These conditions are obtained by the use of a plug screw as shown in photograph Fig. 1. This may be made of metal or hard wood. The screwed portion is to be of the same pitch and dimensions as the mandrel nose. The shoulder and flats may be of any reasonable size. In use the plug is screwed into the faceplate or chuck and then held

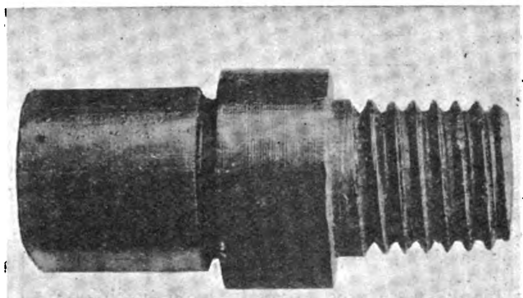
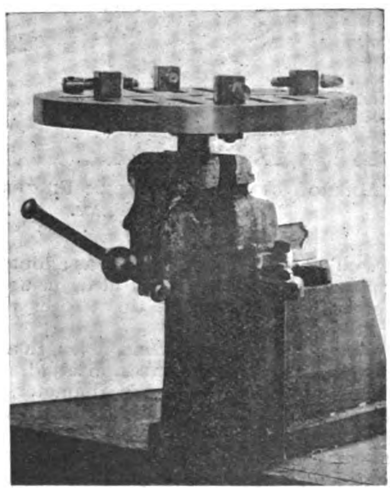


FIG. 1.

in the vice as shown in photograph Fig. 2. This allows nuts or bolts to be easily adjusted and tightened from underneath, and the work placed in

FIG. 2.



position without fear of slipping. If it is desired to centre work this can be done by unscrewing the plate two or three turns and then running back, at the same time chalking or otherwise marking the work and adjusting until true. Further, with a large faceplate attached it forms a convenient erecting table. It is a little home-made fitment, and fulfils its purpose in every way.

Design for a Simple Model Electric Locomotive.

By S. M. Thompson.

THE accompanying drawings and following description will illustrate a 2-in. gauge electric engine, which I have just completed, and which will pull a very heavy train satisfactorily, taking a current of about 2 amps. at 10 volts.

The engine, which is composed largely of sheet zinc, is meant to represent one of the engines used on the District Railway. The principal dimensions are as follows :—

Length of engine: Over buffer beams, 12 ins.; over buffers, 13 ins. Width of engine, 3½ ins. Height (rails to roof), 6½ ins. Wheels (8): Diameter on tread, 1¼ ins. Gearing: Pinion of motor, ⅜ in.; spur wheel, 3⅛ ins.

The bogie trucks were each cut out of a single piece of sheet zinc No. 20 S.W.G. thick, the two sides or hornplates, with the grooves for the axle blocks, being bent over at right angles. The axle blocks were made of 3-16ths in. sheet brass, with saw cuts on the vertical opposite ends which slide up and down the above-mentioned grooves; and all blocks, except those of the driving wheel axles, have springs fitted above them. The wheels I bought, and they are of cast iron, 1¼ ins. diameter on the tread. They are all loose on their spindles, and are kept at the proper gauge by distance tubes, except in the case of the driving wheels, which are a tight fit and sweated on to their spindle. The driving is done by means of two bevel wheels, as shown, and a pinion and spur wheel, which latter were taken from an old medical electric machine.

The floor of the engine I made of 5-16ths-in. teak. The bearings for the spindle of the spur wheel forms the trunnion for one bogie, and the other is simply a screw put in from underneath.

The sides and ends of the engine casing were cut out of sheet zinc in one piece, the joint being at one end of the car. There are two windows at each end, and a sliding door and two windows at each side. The roof was also cut out in one piece and bent at the dotted lines (see Fig. 5).

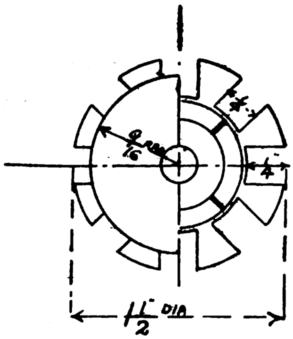


Fig. 6.

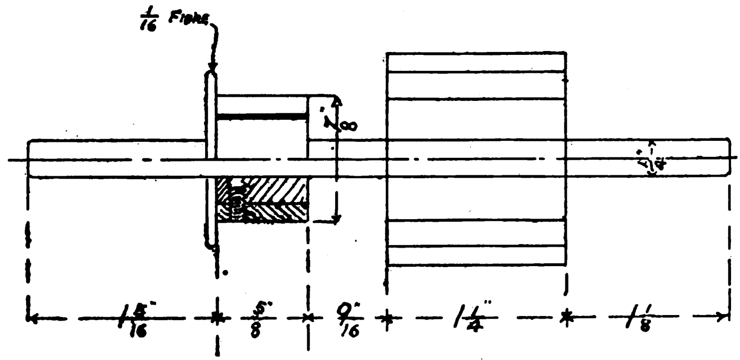


Fig. 7.

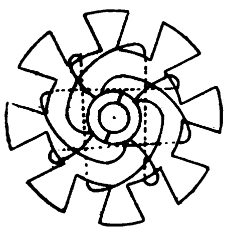


Fig. 8.

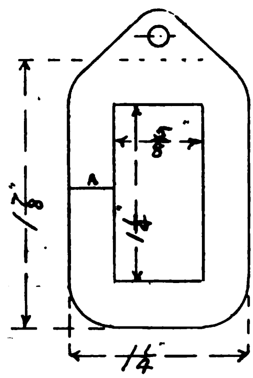


Fig. 9.

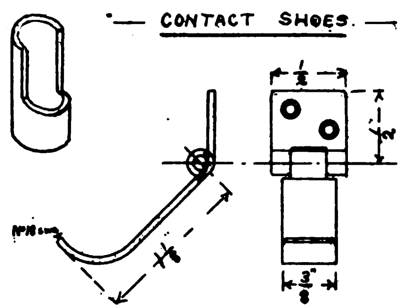


Fig. 10.

Details of Motor for Simple Model Electric Locomotive.

The motor is series wound, the magnets being made of thin Swedish iron stampings bolted up between two outside stampings ⅛ in. thick, and the tunnel bored out to 1⅝ ins. diameter. Vulcanised fibre flanges were made and cut across at A (see Fig. 9) to enable them to be slipped on to the magnet limbs before winding was begun, the spaces between these flanges being insulated with tape and varnished with shellac varnish. The magnet winding consists of 26 yds. of No. 18 S.W.G. D.C.C. copper wire, which was wound on by hand and well coated with shellac varnish. It is best to test this winding for leakage before varnishing.

The armature was also made of thin iron stampings assembled on the shaft, with a coat of shellac

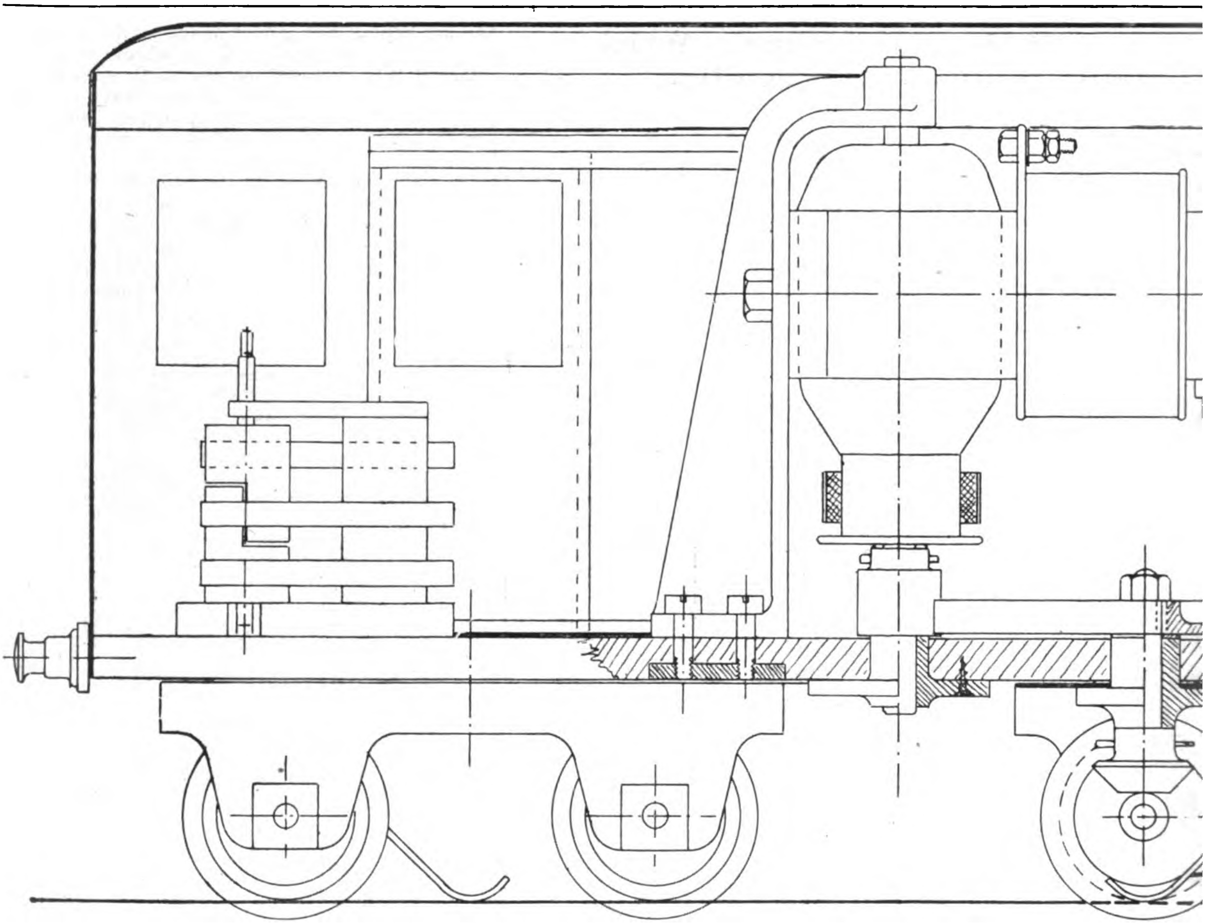


Fig. 1.—Part Longitudinal Section.

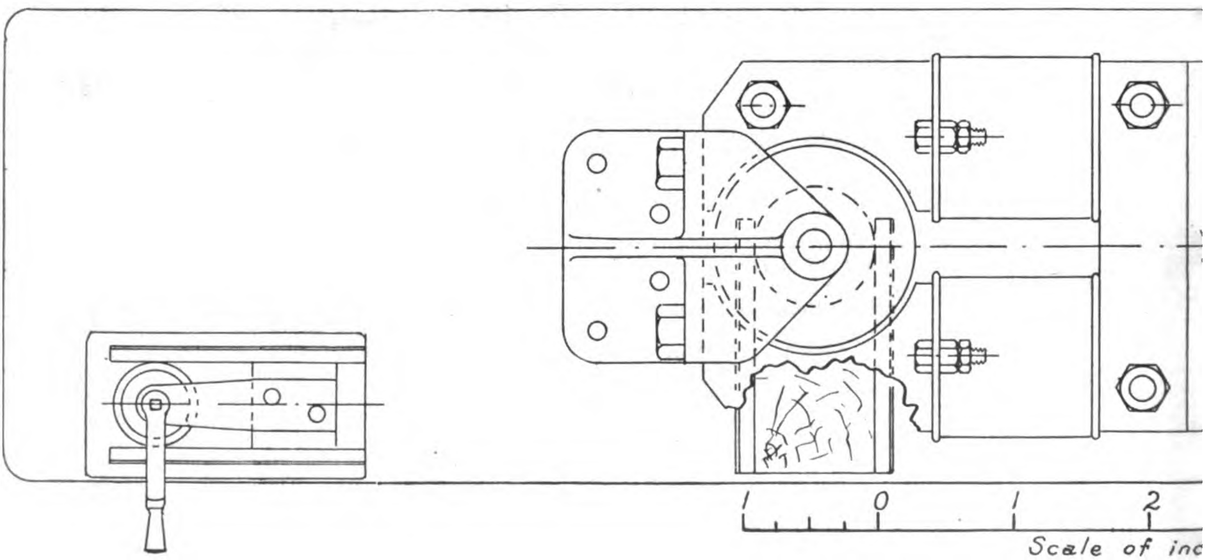


Fig. 3.—Plan showing Arrangement of Motor and Reversi

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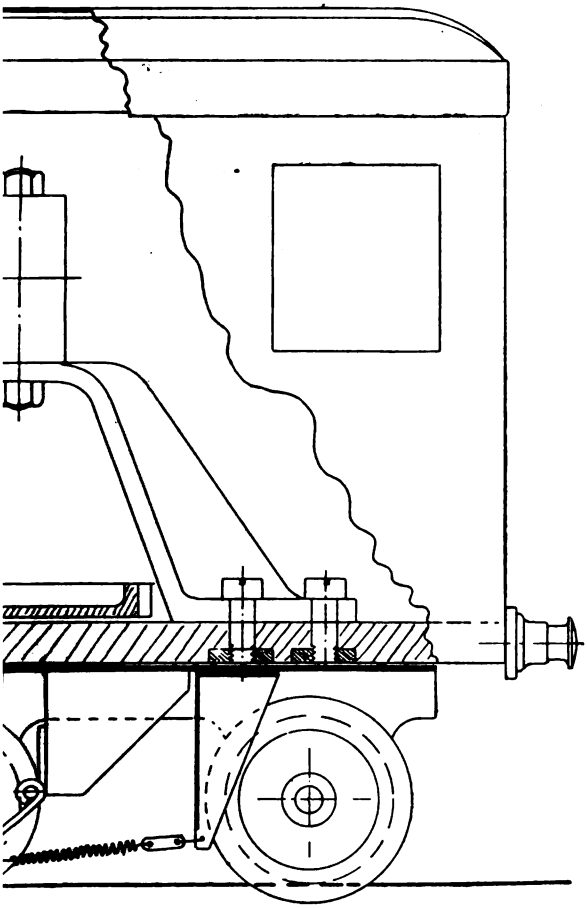


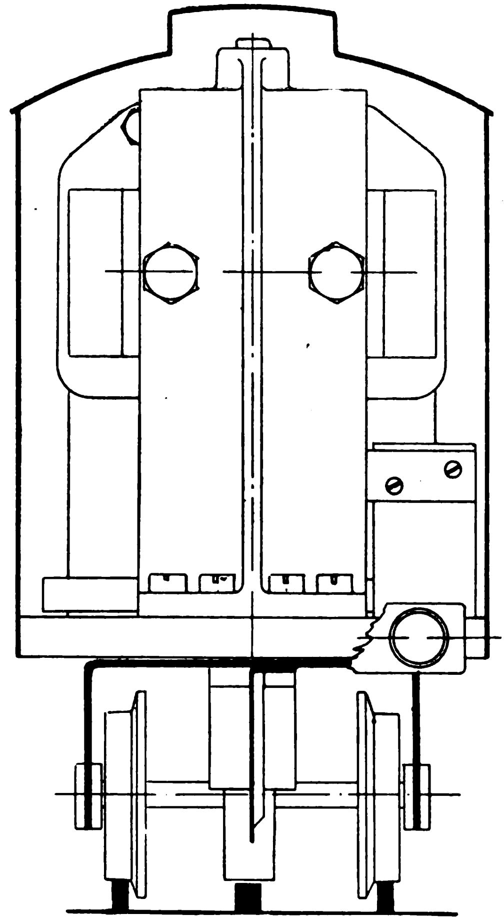
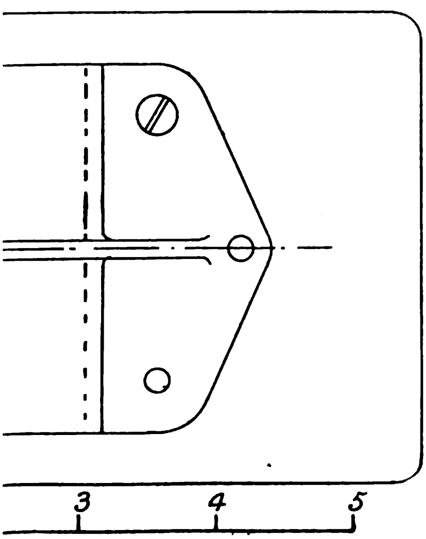


FIG. 2.—CROSS-SECTION.



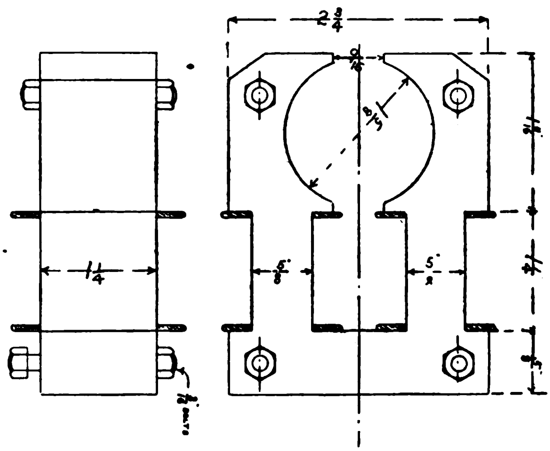


FIG. 4.—DETAILS OF ELECTROMOTOR.

DESIGN FOR A MODEL ELECTRIC LOCOMOTIVE.

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R.

For description] [*see pages* 35—38.

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varnish between each stamping. It is 1½ ins. diameter by 1½ ins. long, with eight slots. The stampings I clamped tight together whilst the varnish was wet, and put a taper pin through the spindle at each end to hold them in this position.

The commutator was made of brass tube ⅞ in. outside diameter by ⅝ in. long by ⅛ in. thick, which was fitted tight on to a turned fibre bush and scribed off, for division with four segments, each division being fastened to the fibre with two ⅛-in. screws. When all these screws were fixed the tube was sawn through at the four lines, thus making four segments. These four saw cuts I filled with mica strips driven in with shellac varnish, and when ready the commutator was keyed to the shaft,

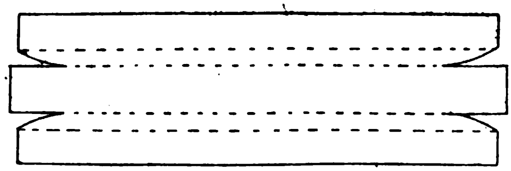

FIG. 5.—ROOF TEMPLATE.

turned up, and faced at ends. Four small holes were drilled in the segments at the end, near the armature, to receive the ends of its winding. The armature was then carefully insulated with silk and shellac, and wound with No. 24 S.W.G. D.C.C. wire until the slots were filled (see Fig. 8). The reversing switch was placed in the engine so that the handle projects through one of the windows, and was made as follows: Two pieces of brass tube were cut (see Fig. 3), and driven on to a turned piece of fibre, and which can be rotated by the handle above mentioned. Four copper gauze brushes with flat springs behind them press on this tube—one each side at the centre of its length, one at the top on the left, and one at the bottom on the right. The connecting wires are simply soldered

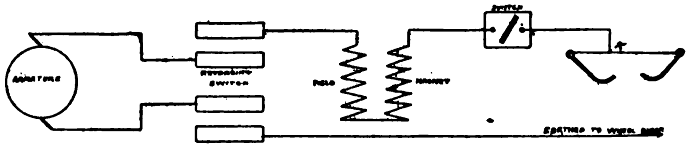

FIG. 11.—DIAGRAM OF CONNECTIONS.

to the ends of these brushes. The contact shoes for collecting the current from the middle rail are made of sheet copper hinged and bent as shown on the drawing, two of them being provided, to enable the engine to run over points and crossings without shutting off the current, as would happen if only one contact shoe were fitted. These shoes are drawn down to the live rail by coiled brass springs, and are connected together electrically. The motor brushes are made of folded copper gauze with flat springs on the outside, screwed to a block of hard wood of the same width as the diameter of the commutator. This block of wood was screwed to the engine base from underneath.

A main switch was also provided in the engine, so that the current can be cut out of the engine when other engines are being run. The starting resistance was not placed in the engine, as it is more convenient to start the engine without going near it, but was put in the supply circuit, viz., between the accumulator and the live rail.

The engine was painted red, and provided with buffers, couplings, and head lights, which latter are worked by a small accumulator carried in the train. The electrical connections of the engine were made as shown in Fig. 11.

Steam Traps for Model Engines.

By JOHN A. DICKINSON.

IN model engines the trouble and annoyance caused by violent priming is far more in evidence than in large engines, owing to the very small bore of the pipe system and the difficulty in obtaining dry steam from the ordinary design of model boiler. Apart from the trouble caused by a lot of undue condensation in the cylinders, the loss of efficiency in the engine is very considerable, as the drainage water in the cylinders of small engines cannot be collected as easily as that of large cylinders.

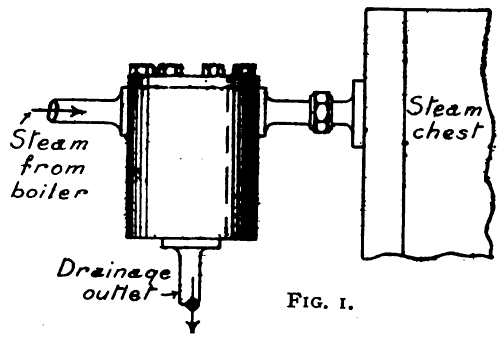

FIG. 1.

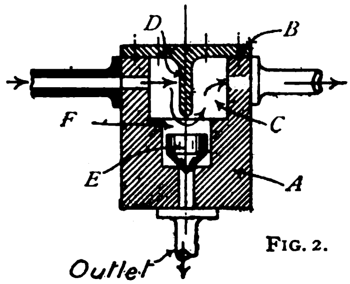

FIG. 2.

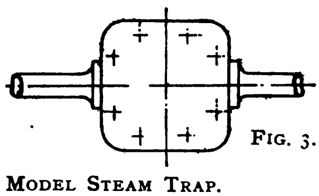

FIG. 3.

A MODEL STEAM TRAP.

The object of the apparatus herein described is to arrest the water in the steam before it enters the cylinders, so that nothing but dry steam can be used behind the piston. There are many types of apparatus on the market for effecting this purpose in connection with large engines, but the designs are far too complicated to apply to model engines. The trap described in this article is very simple in design and exceedingly easy to make, and will

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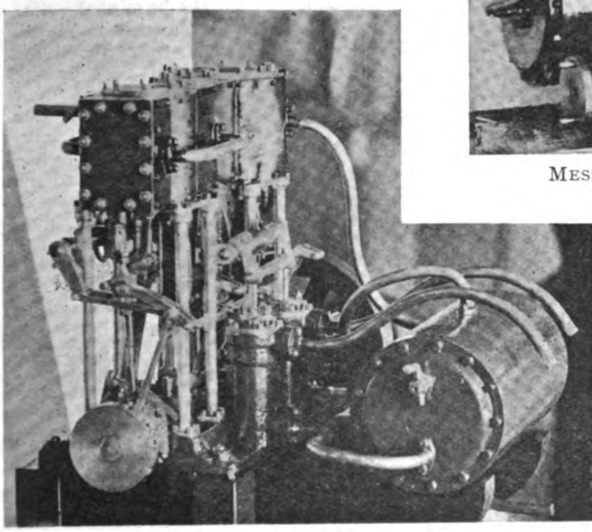
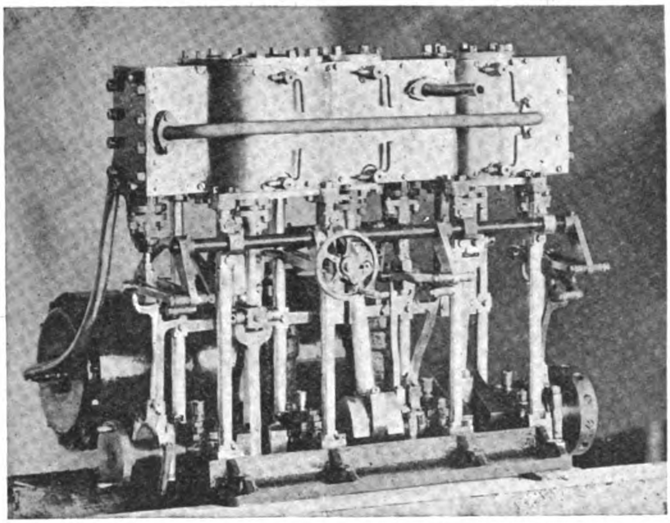
soon repay in efficiency and economy the small amount of trouble expended upon it.

Fig. 1 shows an external elevation, Fig. 2 a sectional elevation, and Fig. 3 a plan of the cover. It consists essentially of a solid brass casting A, with a square section, but having very large fillets in the mould. It is 1 in. square by 1¼ ins. deep, bored out at one end to ⅝ in. diameter for a depth of ½ in., as shown at C. It is then bored ⅜ in. diameter for a depth of about ⅞ in., as at F, and the remaining ¼ in. of metal is drilled right through with a ⅛-in. hole to form the drainage water outlet. The cover B is a small brass casting cast to the shape shown in plan (Fig. 3), with a small baffle-plate D cast on the under side. This baffle-plate is about 7-16ths in. deep (measured from under side of cover) by ⅛ in. thick by ⅝ in. wide. The whole of the cover is neatly turned and machined, as also is the whole of the body A. The cover is drilled to receive eight 1-16th-in. studs, as shown in plan (Fig. 3), and the main body is also drilled on two opposite faces of the casting, about ¼ in. from the top, with two ⅛ in. diameter holes to receive the inlet and outlet pipes. The inlet, outlet, and drainage outlet flanges are all brazed on to the main body, as shown on the drawings.



Acting in the well F is a small tin float, which can be simply made from a strip of tin with a flat piece soldered on the top side, and on the bottom side a cone-shaped cover is tinkered on. This float acts as a valve to regulate the discharge of the drainage water, and is guided when in motion by the walls of the well F.

The action of the apparatus is as follows: Steam enters from the boiler by the inlet pipe, as shown by the arrows, and impinges against the baffle-plate D, under which the steam passes to the outlet pipe on its way to the cylinder. Any water passing over with the steam is directed by the baffle-plate into the well F below, and will also be partially condensed by its contact with the baffle-plate and walls of the trap, so that the drainage water accumulates in the well F, whilst the pure dry steam passes out to the cylinder. As the water is collected in the well the float E begins to rise, thus opening the passage to the drainage outlet and allowing the water to escape. As soon as the water has been removed, the float E falls on to its seat again, where it is held by steam pressure, allowing no steam to pass through the drainage outlet. It is automatic in its action, and the same motion occurs whenever the boiler commences to prime. The drainage water can be led overboard, if used for small steamers, or to a waste tank, if used with a stationary engine. If used in connection with a condensing engine, drainage water could be led to the condenser, so that the vacuum acting on the under side of the float would make the trap more certain in its action. After it has been in operation for some time the baffle-plate and walls of trap will become very hot, so that it will have the beneficial effect of drying the steam still more before passing into the engine. The trap is very accessible, as the whole apparatus is opened up by simply removing the cover, and there are no working parts which are likely to give trouble. The dimensions here given are, of course, not binding, and any modification or enlargement may be made to suit individual taste.



MESSRS. J. CARSON'S MODEL MARINE ENGINE.

A Model Triple Expansion Marine Engine.

WE have recently had the opportunity of inspecting an excellent scale model marine engine built to a private order by Messrs. Jas. Carson & Co., Ltd., of Birmingham. This model is shown in the accompanying photographs, which, however, hardly do justice to the finish and appearance of the real article. The engine is of the triple-expansion type, and has three cylinders

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of $\frac{3}{4}$-in., $1\frac{1}{4}$-in., and $2\frac{1}{4}$-in. bore respectively, and $1\frac{1}{2}$-in. stroke. It is a model of the engines of Dr. Nansen's arctic exploration ship, the *Fram*, and is built to a scale of 1 in. to the ft.

How to Make a Wool Winder.

By J. C. Clough.

(Concluded from page 616, *Vol. XVI.)*

WHEN the rings are in place, set up the reel as a whole to run on its pin, and make it true by the centre and laterally

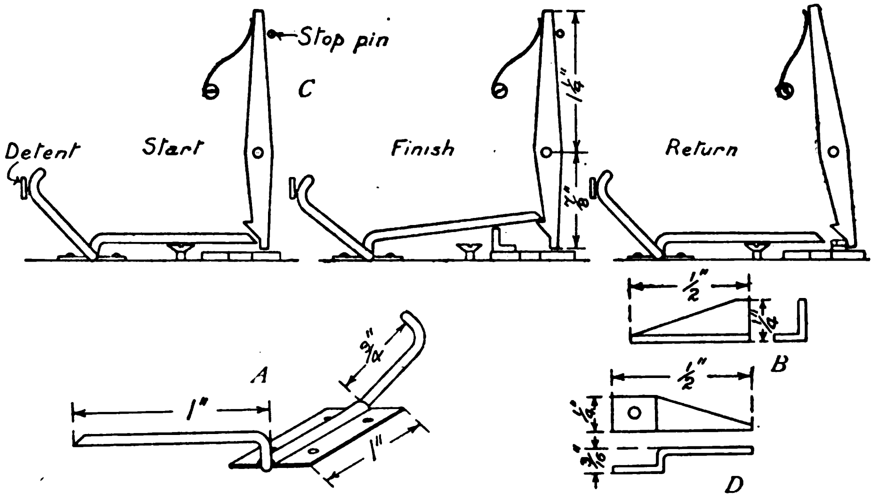

Fig. 12.

and with a blow-pipe soft solder each spoke to the ring, leaving the joint till last when, the lashing having been taken off, the joint held in a pair of pliers can be soldered. When all are done, wash off all traces of soldering fluid with clean water, dry and clean up, and with a scraper and fine file remove all superfluous solder. Clean all grease off the wire with turpentine and go over the reels—wood and wire—with a coat of hard varnish. The reels when mounted on the standard should look like Fig. 10 (p. 615), and as will be seen can be adjusted to any required distance apart, within the length of the standard.

Now to make use of the combination: the reels having been adjusted to the length of the skein of yarn (the standard having been clamped in some convenient situation), the end of the yarn is taken to the balling machine (also fixed to the table by a clamp). The wire hook is passed up the tube and the end of the yarn drawn through, and then passed in succession through the loops and eye on the fly and then taken a couple of turns round the middle of the bobbin in the direction in which it turns.

The handle of the machine turned in the direction indicated by the arrow causes the fly to rapidly revolve round the bobbin, winding on the yarn; at the same time the cone on spindle N through the friction roller *e* drives the cone on spindle M, causing by the worm pinion, the wheel W and bobbin to revolve, and thus forming a ball on the bobbin. To accommodate the increasing size of the ball to the rate at which the yarn is delivered by the reels, the combination W, X, Y causes the slide carrying the friction roller to move along between the cones, the varying diameters of which give a rate of speed to W varying in the proportion of 9 to 1.

The machine is finished, and the writer hopes these slight efforts to alleviate the monotony and add to the comforts of the lives of his impecunious brethren of the lathe and bench, may act as the cones in the machine, cumulatively, until the proportions may reach, not 9 to 1, but 90.

Addenda.—As a preventive of over-running the slide C an automatic arrangement, that lifts the detent A clear of the wheel X and holds it clear until the slide has been returned to its position at starting, is shown in Fig. 12. A piece of steel wire, 14 B.W.G., is bent to the shape shown at A. A piece of thin sheet brass as shown forms a bearing for the wire on the base of the machine; it is placed so that the horizontal part of the wire extends over the slide a little more than half way, parallel to the face of the standard E, and nearly touching it, and parallel to the surface of the slide and 1-16th in. above it. The other end of the wire, bent as shown, stands inside the detent just touching it and just clear of the wheel X. To prevent the horizontal part of the wire from falling to the surface of the slide a small wood screw is put in under it and can be adjusted to a nicety. The end of this part is filed to a level of about 45 degs. A wedge cam formed as B is riveted to the surface of the slide at such place, that when the slide has reached the extent of its movement towards the main wheel the high part of the wedge will be under the horizontal wire, having by this means caused the wire to lift the detent out of the teeth of the wheel X. A lever C is pivoted on the

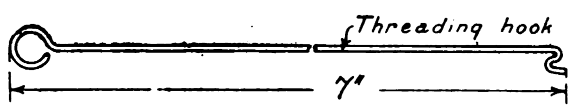

Fig. 13.

face of the standard E, so that its lower end, formed with a catch and a short incline corresponding with the bevelled end of the wire, will upon an upward pressure of the wire, act as a catch and retain the end of the wire in the raised position; this retention being assured by the pressure of the fine brass wire spring shown, acting upon the upper extension of the lever. When the detent is clear

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of the wheel, the coil spring tends to draw back the slide, which upon continuing the turning of the handle in the same direction it will rapidly do, and the machine is then ready for another ball. At the moment of the slide reaching this place, a wedge-cam as D, Fig. 12, which is riveted to the proper part of the slide, acts upon the lower end of the lever C, so as to release the end of the wire and so also the detent.

When the ball is finished place the fly horizontally, then lift the bobbin and ball together off the pin. After removing the ball when replacing the bobbin, see that the steel pin *h*, Fig. 6, is just clear of the teeth of the wheel X in the direction of the motion of the wheel W.

Do not force the slide back without running the machine, as the friction will destroy the even surface of the leather-friction roller *e*. Should it be necessary to return the slide *c* before the wedge D, Fig. 12, comes into action, the detent must be lifted by its hook and held clear of the wheel X, whilst turning the machine to run the slide *c* down.

A Novel Electric Advertising Device.

By H. Oxenham (South Africa).

The photographs and drawings reproduced herewith will, I trust, be of interest to the readers of The Model Engineer. The idea is original, and, with the exception of the main shaft and cabinet, is my own work. Not having a lathe, I had to get the shaft turned up, and, after finishing the top part, I decided to put it on a cabinet, with the result as seen in the picture. I only made it for amusement, but it forms a very effective shop window attraction and advertising medium. The wheel is made of a 24-in. bicycle rim, and the faceplate is of sheet aluminium bolted to same. These bolts, together with those running through the face, and the turned brass plate at the back, which is threaded and made fast with two set-screws on to main shaft, keep it firm and true. The holes to take the miniature lamp holders were cut with a ⅜-in. bit,

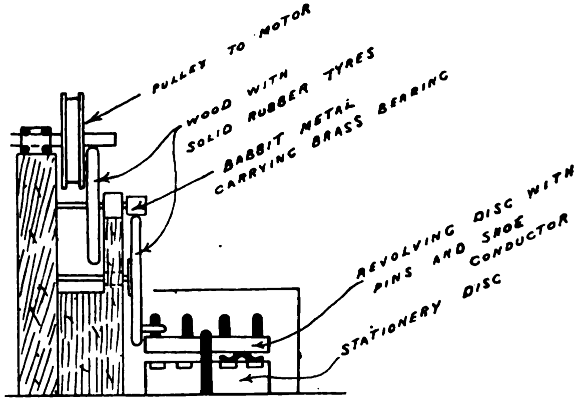

Fig. 2.—Diagram of Gearing.

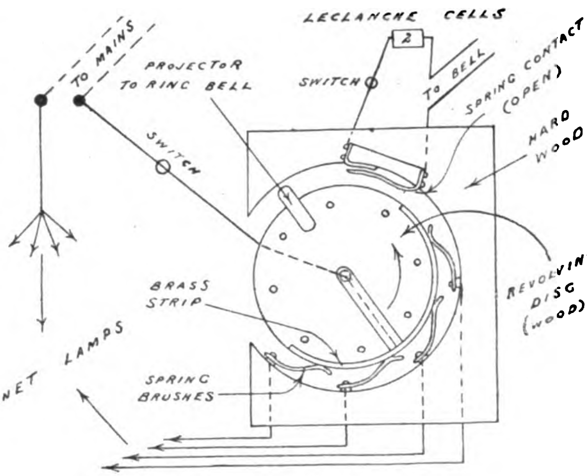

Fig. 3.—Diagram of Connections.

Note.—The Stationary Disc is placed on edge for the purpose of showing wire connections.

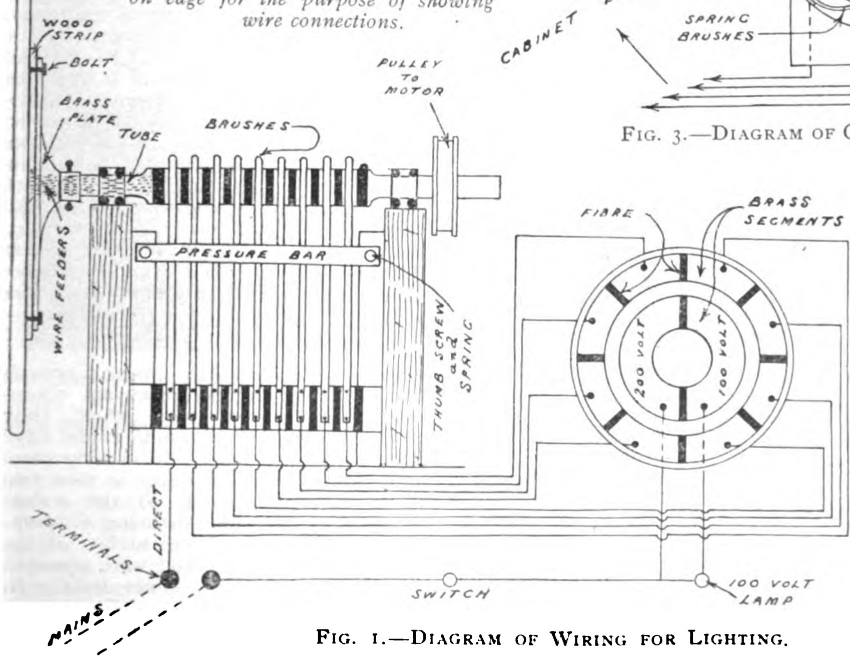

Fig. 1.—Diagram of Wiring for Lighting.

and they are screwed on to the plate with the shade carriers and wired in series of 10. These lamps are all of 10 volts and running through the 100-volt lamp shown on Fig. 1 form the four changes of small lights. There are three other changes made with twisted candle lamps and one with long window lights; these are all of 100 volts and run through in series of two from the main (Fig. 1). The centre light, which is 200 volts, comes on with the long lights and these combined form a glow on the entire surface of plate.

The main shaft is of ¾-in. steel tube and runs on ball-bearings. It is fitted with screw shoulders at each end of distributing rings; these are of copper tubing ⅛-in. by ½-in. wide, and insulated between shaft and rings with fibre, the rings being ¼ in. apart. To each of these rings is connected a wire running through to lamps on face and completes circuit through the brushes and revolving disc (Fig. 3) which also switches on and off the lights in cabinet. The brushes are cut from sheet copper, and owing to their length are springy. The pressure bar is wood stripped, where making contact, with vulcanite, the ends of bar running in tubes fitted with spiral springs and thumbscrews. The uprights are of teak, but all the other parts I have made of a very hard Colonial wood, and they are first-class for the purpose.

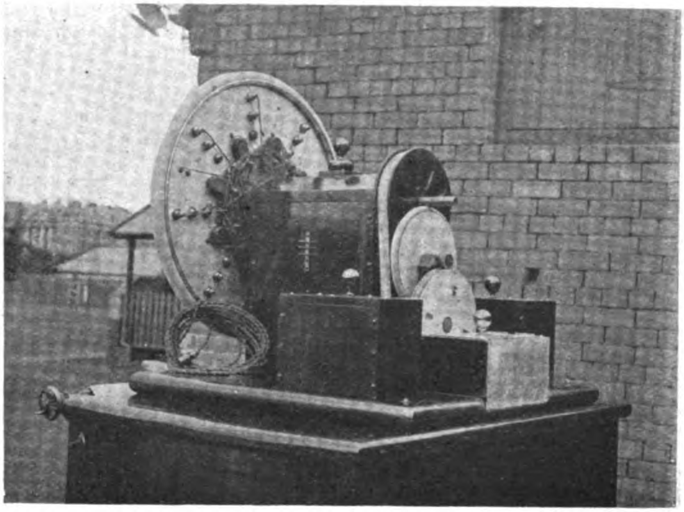

FIG. 4.—REAR VIEW OF ROTATOR.

The motor (⅛ h.-p.) runs behind the plate in cabinet, with band connecting to main shaft pulley through slots cut in top of cabinet. The main shaft is driven at a speed of between 350 and 400 r.p.m., at which speed the lights form a perfect circle. Although shown at different places on drawings, there are only two terminals on the machine; these are connected to rotator, cabinet, and motor, each having a separate switch, all of which are placed close together and covered in by a hinged box. This box shows on the right-hand side of rotator. the box on the left covers the resistance lamp so that the light from same will not detract from the smaller lights on the face. At the top of the switch-box inside is screwed the bell which rings when all the lights come on and helps to draw attention when the machine is put to the purpose of advertising. When shown first I had it running in the interest of a friend of mine, who was standing as a candidate at one of the elections here. The bell rang and his colours came on in the cabinet the same time as they appeared on the rotator, and thus drew attention to the notice displayed. The machine works at about a cost of 6d. to 9d. per hour, and is connected by an adaptor to the ordinary lighting main, and I have found it a very reliable worker. It runs for hours with little or no attention. Altogether there are 114 bulbs on the affair, and these seldom perish, as I regulate the glow by the lamp put in as a resistance. I do not think it necessary to explain further as the photographs and drawings will do that, but I may say that if any readers would like further particulars on anything I may not have made clear, I shall be pleased to furnish same.

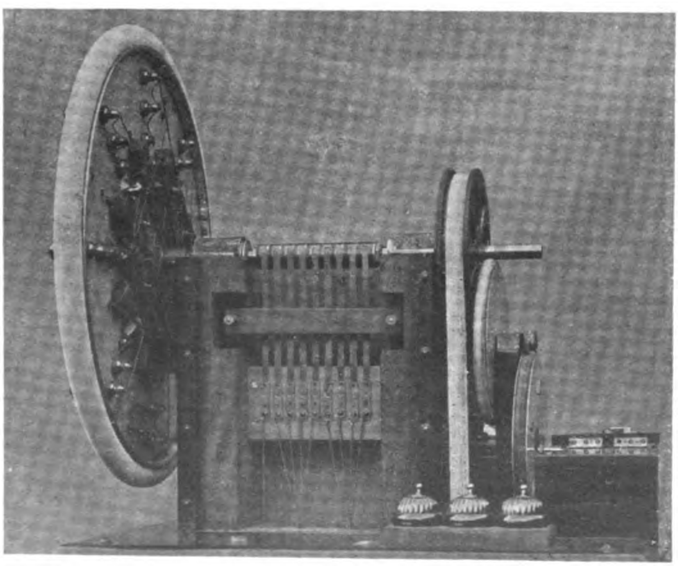

FIG. 5.—SHOWING ROTATOR MECHANISM.

FOR a considerable time proposals for utilising electric tramway equipments during the hours when they would be otherwise standing idle have been brought forward, and in some cases adopted. With this object in view two large brushes belonging to the streets department of the Aberdeen Corporation were recently fitted to one of the Corporation tramcars, and were arranged so that any width of street from 7 ft. to 14 ft. might be swept. The experiment is reported to have proved very satisfactory.

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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.*]

Large Electric Clocks.

To the Editor of *The Model Engineer.*

Dear Sir,—Since reading Mr. F. P. Farrow's letter giving a very interesting description of a large electric clock, at Cowbit, I have met with a large four-faced clock which is driven electrically, and which is fixed in the tower of the palatial works of the Argyll Motor Company, Alexandra, near Glasgow. This clock appeared to be constructed on better principles than that at Cowbit, as, for instance, instead of taking energy from the battery every swing of the pendulum, it draws energy only at half-minute intervals, and then for a very short period of time. The mechanism moves the hands forward at each half minute. The dials are 9 ft. in diameter and are four in number.

An interesting feature of the mechanism is an automatic boosting arrangement which boosts up the current when the battery gets weak, and also gives notice of the fact by ringing a bell.

This clock is subservient to a master clock within the building, which also drives a number of smaller clocks. The clock movement bears the inscription "Gent & Co., Ltd., Makers, Leicester, B.P. Patent System." Taking in consideration the number of the dials as well as their diameter, it is probably the largest electrically driven clock in the country. Possibly our readers could give us particulars of any other large electric clocks with which they have met.—Yours truly,

A. E. Lilley.

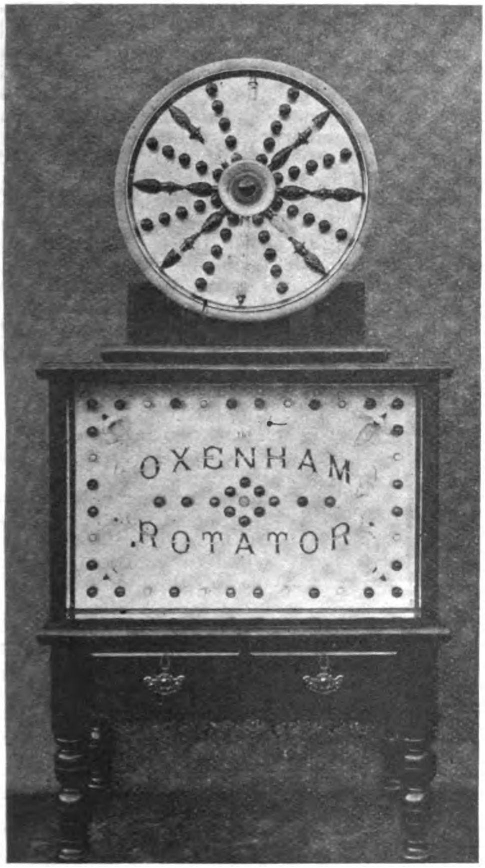

Fig. 6.—Mr. H. Oxenham's Novel Electric Advertising Device.

For description] [*see pages* 41 *and* 42.

Re Six-Coupled Locos.

To the Editor of The Model Engineer.

Dear Sir,—I have always understood that he who writes letters to a public journal must be prepared for criticism, but this would not appear to be always the case, judging from the result of my remarks on C. M. L.'s letter. "Lathe," apparently disappointed at the somewhat sulky rejoinder of his friend C. M. L., has taken the matter up himself. I am not a bit disturbed to see his letter; on the contrary, I welcome it, as it may possibly lead to C. M. L. disclosing his precise standing as a locomotive authority. I stated that I objected to the condescending tone of the original letter. It flavoured too much of the journalistic "exclusive information" style, and was obviously worded to create an impression. The dangling of private information in a public journal is far more likely to close the sources of authentic information than the cause which "Lathe" fears.

The particulars of C.R. six-coupled engines were given in much fuller form in The Model Engineer some two years ago than that supplied by C. M. L., and "Lathe" must surely have seen them as he never misses The Model Engineer. If C. M. L. should still think his figures are published for the first time, then I am more than ever convinced that he who reads the engineering press and the "Locomotive Notes" in The Model Engineer is much better served, in spite of an "unique acquaintance with the greatest locomotive engineers." "Lathe" objects to sarcasm, therefore his remarks concerning the man who spent two days on a valve gear is a sneer, and not nice at that. Possibly it may be the jealousy which he charges me with.—Yours truly

W. G. Roblin.

[We think it advisable, and certainly more conducive to a determination of the facts of the case, that any further correspondence on this subject should bear directly on the technical points in question.—Ed., *M.E. & E.*]

Brushes for Small Electro-Motors.

To the Editor of *The Model Engineer.*

Dear Sir,—The brushes for small electro-motors are generally made of hard copper or brass strip unnecessarily wide considering the amount of current they have to conduct, and are sprung to bear well on the commutator. More especially is this the case when the commutator is not quite true, which causes the brushes to jump and spark

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unless they are made to bear very hard on commutator. Thus they act as a brake and absorb from 25 per cent. upwards of the power.

I will advise readers to make them of about half-a-dozen (more or even less, according to size of motor) of the No. 36 wires from a piece of flexible electric light lead. It will be impossible to put pressure on these sufficient to absorb any power, and at the same time they have sufficient spring to make good contact.—Yours truly,

Leyton. A. GREEN.

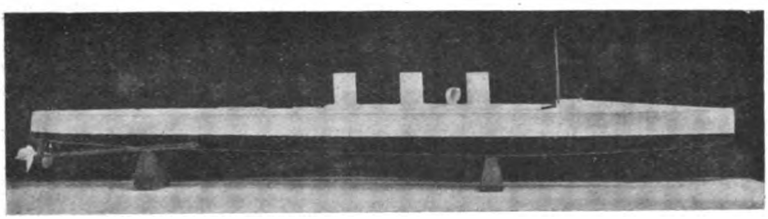
A Light Weight Model Speed Boat.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I was rather surprised to see in THE MODEL ENGINEER that the decision of the Wirral M.Y.C. to reduce the size of their racing boats is likely to affect the conditions of future MODEL ENGINEER speed competitions, and, as an advocate of the larger size, I give my views. No doubt a boat 7 ft. long and weighing 46 lbs. is an extremely unhandy boat and very difficult to carry about, but I would point out that there is no reason for building them heavy and bulky, and it is the builder's fault if they are such.

It is generally recognised that the best form of hull for high speed is on the lines of a T.B.D., and I give some particulars and a photograph of one which was built two years ago, and is made of aluminium in one sheet, the only seam being a small bit at stem and stern. The boat is 6 ft. 6 ins. over all, 7 ins. beam, and 4¾ ins. deep, the machinery for which was described recently in THE MODEL ENGINEER, and can be carried under the arm with very little effort, as it weighs only about 20 lbs. I have been for some time fitting a petrol motor into it, and when complete it is expected to weigh about 17 lbs., so that on the score of portability there is very little inconvenience. Further, a boat built of metal 6 ft. 6 ins. to 7 ft. long can be built as easy, if not easier than one of 5 ft. 6 ins., because it allows of easier lines, and there would not be much difference in the cost.—Yours truly,

D. SCOTT.



MR. D. SCOTT'S LIGHT MODEL T.B.D.

The Victoria Model Steamboat Club.

AT the floral fête and bazaar held at, and in aid of, the Children's Orphanage, Victoria Park, on June 18th, 19th, and 20th, one of the features which attracted many visitors was the exhibition of working models arranged by the Victoria Model Steamboat Club. Prizes were offered for the best working model, and some keen competition resulted. The first prize, a Climax micrometer, went to Mr. S. Parker's fine model steam yacht *Corsair*; the second, a Columbus gauge, went to Mr. T. Bowman Duff's "metre" boat, *Ena*. Among a long list of "highly commendeds" came first a return tube boiler and pump by Mr. F. W. Bainbridge and Mr. J. C. Crebbin's model locomotive "Boorman." Mr. A. Darby, instructor of engineering at the East London Technical Institute, kindly officiated as judge, and the thanks of the club are tendered to him for his skilful treatment of a delicate task. The trade were well represented. Messrs. Whitney, City Road, exhibited a case of their latest novelties, prominent among these being some particularly neat small compound engines suitable for driving "metre" hulls. Messrs. H. Williams & Son, Cambridge Heath, E., exhibited a wide range of special lathe tools in various stages of manufacture, and Messrs. Smith & Co., Lower Clapton Road, N.E., lent a large assortment of steam and clockwork models, much amusement being caused by running the locomotives on special tracks laid down for the purpose. Messrs. the Machine Carved Model Company exhibited some specimens of their productions, and these caused much interest. The lines of these hulls are very neat, and should prove very popular with those who prefer to have the most difficult part of model boat-building done for them. Among the many interesting boats on show we noticed a 5-ft. 3-in. model sea launch by Mr. C. Rose, and a handsome model of an up-river motor launch electrically driven, this being shown floating in a tank suitably draped and "moored" in correct fashion. These two boats have many novelties in their construction and design, and we hope to give a fuller description of them shortly. We can heartily recommend other clubs to emulate the example of the Victoria Model Steamboat Club by exhibiting whenever practicable, and thus by bringing the pastime well before the public establish it on a higher status.—Hon. Secretary, W. POOLE, 40, Sewardstone Road, Victoria Park.

PROPOSED MODEL RAILWAY TRACK FOR WALTHAMSTOW.—An application has been made to the Walthamstow Council for permission to erect a ¾-in. scale model railway track in Lloyd's Park. Interested readers living in that district are invited to communicate with Mr. James Presswell, 56, Winn Terrace, Forest Road, Walthamstow.

MR. ERNEST JARDINE, an engineer of Nottingham, who has recently purchased the historic ruins of Glastonbury Abbey, is the possessor also of the largest bar planer in existence. It is especially built to plane four lace machine bars at one time, speed 100 ft. per minute; length of table, 45 ft.; length of bed, 84 ft.; weight, 26 tons, and is driven by a 30 h.-p. electric motor.

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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:—

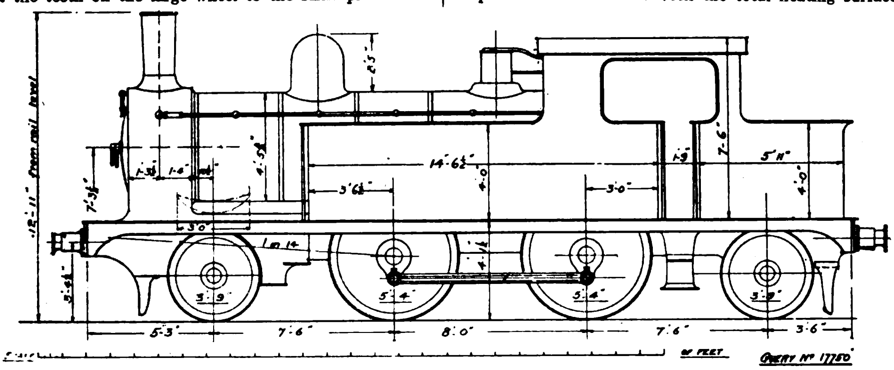
[17,685] **Setting Out and Cutting Gearwheels.** A. H. H. (Devon) writes: Will you kindly give me some information on the subject of cutting gearwheels. My difficulty is as follows:—A wheel of, say, 1 in. diameter, with eighteen teeth, is required to gear into one of, say, 10 ins. diameter. Given a suitable cutter, etc., how can I find the requisite spacing on the divided lathe head which will cut the teeth on the large wheel to the same pitch as the small in order that they may gear together; also, when a wheel of a certain number of teeth is required, how do you find the diameter?

If you will refer to May 28th (1903) issue, you will find particulars relating to the matter you write about.

[17,770] **Winding and Construction of Large Induction Coil.** D. S. (Riouw) writes: At present I am constructing a 10-in. spark coil, after the splendid method of Mr. John Pike. At first I possessed accumulators to give easily 10 amps. at 15 volts, and therefore built a core (15-in. by 1½-in.) from soft iron wire (No. 22), wound with No. 14 D.C.C. wire. At present on board ship, however, I only have direct current mains, carrying at most 4 amps. at 80 volts. This cable cannot possibly be altered, and there is no room left for accumulators or batteries. (1) Is it possible to work the coil with 4 amps.? (2) How is the core to be built; if possible, to use 4 amps. only? (3) Will strips of mica do for increasing the insulation at ends of secondary; I mean, to thicken the ebonite tube where Mr. Pike provides two short ebonite tubes? I intend to wind a long, narrow strip all around the ebonite tube, one layer overlapping the other and cemented thereto by shellac varnish, the layers increasing in thickness towards the ends. (4) Could you give me design for a simple mercury turbine break, and would an 80-watt motor at 2,000 r.p.m. be of use for driving it?

(1) With a break of the "Vril" type, nicely adjusted, the coil will give almost full spark with 4 amps., but with the "Vril" (or other hammer break), 6 to 16 volts would be ample. (2) Core 18 ins. by 1½ ins., wound with four layers of No. 16 or six layers No. 18, would do for a high-voltage current. With a high voltage the primary current and magnetisation reach their greatest capacity quicker than with, say, 12 volts. The smaller gauge wire carries less current and the resistance of the primary would be higher, but this would be overcome by the greater pressure. With the 80-volt current and a mercury jet break sparks of the fullest capacity should be obtained. (3) Mica is a good insulator, and may be used wherever available; it is, in my experience, of not much *practical* value, being costly and not easily worked. The ebonite tube should be fully ¼ in. or even ⅜ in. thick from end to end. Any increased thickness at the ends should be designed as *solidly* as possible, and I have no great opinion as to the efficiency of layers of thin ebonite—at the ends, anyway. A thick sleeve of ebonite introduced well under the end sections and brought out quite to the ends of the long tube give strength and safety. I should certainly go in for a resistance if I had the chance of working from such a supply as mentioned. A shunt resistance, by which we can vary the number of volts, and a small sliding rheostat to vary the number of amps., could be put in without much cost. It must not be forgotten that a condenser of the fullest capacity should be provided, made in parts, so that less or more can be used, if found requisite. Cox, of Rosebery Avenue, E.C., would supply you with a suitable mercury break.

[17,750] **Model G.E.R. Tank Locomotive.** E. W. (Ilford) writes: As I am about to build a 1½-in. scale model of Great Eastern Railway tank locomotive 663, *as rebuilt*, which I wish to be complete in every detail and an exact copy of the original—as far as it does not interfere with her working capacity—I should be much obliged if you would answer the following questions:—(1) Could you give a front and longitudinal elevation of 663, indicating the position of frames, cylinders, etc.? (2) Would it be possible to haul about 180 lbs. with this engine? (3) How much vertical and lateral play should be allowed to the axles? (4) Would ⅜ in. be too deep for wheel flanges, as I would rather exceed scale size in this particular, to prevent derailment? (5) Must the cylinders be 1½ ins. by 3 ins., or could they be bigger? (6) What is the highest steam pressure I could use with seams riveted and soldered, boiler being iron ⅛ in. thick, with cast brass ends? (7) What proportion must exist between the total heating surface of a model locomotive type boiler and the cubical contents of the cylinders? (8) Is it possible to buy sheet iron suitable for frames in strips, say ⅛ in. by 4 ins., and where? (9) How much per pound ought to be paid for locomotive wheel castings in iron from own patterns, and where? (10) Would aluminium wear as well as brass for water gauges, taps, and other small fittings? (11) Would a 1½-in. scale model of "663" run round easily in a space, say, 30 ft. by 70 ft.?



OUTLINE DRAWING OF A G.E.R. TANK LOCOMOTIVE.

(1) We are able to obtain the outline drawing shown herewith. The width between frame plates is 4 ft.; width of footplates, 8 ft. 4 ins.; cylinder centres (for Joy's gear engines), 2 ft.; width over tanks, 7 ft. 9 ins. The drawing shows the engine as originally designed by Mr. Worsdell. (2) Yes, if well made, this load should be hauled by the engine on the level quite easily. (3) The driving and coupled wheels will do with ⅛ in. clearance above and below the axle-boxes. The lateral play of the radial axles will vary with distance at which the frames are placed apart. (4) 3-16ths in. or 7-32nds-in. flanges will be found quite deep enough for ordinary purposes. (5) Cylinders should not be larger than 1¼ ins. by 3 ins., as the boiler is small. (6 and 7) See "The Model Locomotive," by H. Greenly, price 6s. net, 6s. 5d. post free from this office. The questions will be fully answered by a reference to this book. (8) Sheet steel may be obtained at Pfeil's, St. John Street, E.C., Clerkenwell. (9) Write to Stuart Turner, Ltd., Shiplake-on-Thames. (10) There is no advantage in its use and many disadvantages. (11) No. Unless the speed is very low and abnormal alterations from the exact scale model you speak of are made. You would do better to make a 1¼-in. scale model.

[17,851] **Chemical Action in Accumulators.** H. K. (Oakham) writes: I should be greatly obliged if you would tell me the chemical action of an accumulator when charging and discharging.

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The plates of an accumulator (when pasted in the usual way) are made of lead, and the positive plate coated or filled in with red lead (Pb_3O_4) and sulphuric acid, and the negative plate with litharge (PbO). On passing a current through them, using the red lead plate as the anode, and the litharge plate as the cathode, we convert the red lead into peroxide of lead (PbO_2) and the litharge into spongy (metallic) lead. The action during the forming of the positive plate is—

$$PbO_2+4H_2O+2SO_4+2PbSO_4-3PbO_2+4H_2SO_4,$$

and at the negative plate we get—

$$3PbSO_4+3H_2-3Pb+3H_2SO_4.$$

It will be noticed that during this part of the process, viz., charging, that sulphuric acid is formed, which accounts for the fact of the specific gravity of the electrolyte rising during charging. When discharging the cell we start with lead peroxide (PbO_2) on the positive plate and get lead sulphate at the finish ($PbSO_4$), and on the negative we start with lead pure (Pb) and also get $PbSO_4$ at the finish.

[17,720] **Model Railway Construction.** O. G. W. (Sydenham) writes: I have just completed a ¾-in. scale locomotive, and am thinking of making a portable track for same in about 12-ft. lengths; total length, about 400 ft., in the shape of an oval, with flat sides. I should be glad if you would give me a sketch of a suitable device for quickly locking the lengths of double rail firmly together. The rail itself will be made of iron strip (¼-in. by ¼-in.), fixed into longitudinal 1 in. square hardwood (as in Fig. 1). the two lengths of wood fixed the correct distance apart by sleepers placed at intervals of about 6 ins.

With this kind of rail you will always have difficulty with the joints. At least, this is the experience of the Society of Model Engineers in using this sort of permanent way. What you require is some method of jointing the ends of the rails truly in line. This can best be done with proper bull-headed rails and fishplates. In any case the system of timbering must be reversed. The longitudinal members should be placed underneath and the rails fixed to the cross-sleepers. If, however, you cannot see your way clear to adopt the scale permanent way, with chains, clip, fishplate, keys, etc., you might make the railway as indicated in the accompanying sketches. Fig. 2 shows the under frames, which should be well tarred with Stockholm tar before being laid. The sections may measure from 4 to 5 ft. in length. The sleepers should be of hardwood, 1 in. by 1 ft. 6 ins. long, slotted for the rails, which, by the way, would be better if ⅜ in. by 3-16ths in. instead of ¼ in. by ¼ in. The sleepers should be at least 4 ins. apart. The method of fixing the rails you propose is not good. Wood always moves across the grain with changes of weather, and, metaphorically speaking, the rails would not stay in five minutes; therefore, we

FIG. 1.—SECTION OF PROPOSED TRACK.

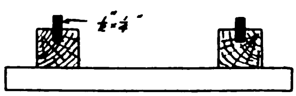
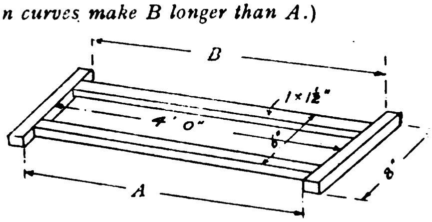


FIG. 2.—SKETCH OF UNDER FRAMES.
(*On curves make B longer than A.*)



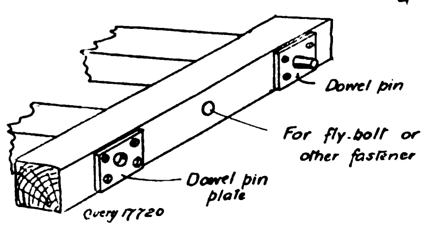


FIG. 4.—ENDS OF UNDER FRAMES.

show cross-sleepers in place of longitudinals. You may key the rails in place with stout cut carpenter's brads, as indicated. The under frames should be made with splayed ends for the curved portions, dimension A (Fig. 2) being longer than B. The end pieces of the frames should butt against each other, and to ensure alignment, they should be provided with iron dowels and dowel-plates. These are commercial articles. Flybolts or screw window-fasteners may be used to couple the sections together. This sort of fastening will not, however, bring the rails always into perfect alignment, and therefore you will require to devise some fishplate arrangement. You might make a jig, as shown in Fig. 5, and drill all the ends, fitting fishplates of cast iron in long lengths, the slots being machined to size and the fishplates then drilled for the bolts. The cross-section of the fishplates may be the same as that of the

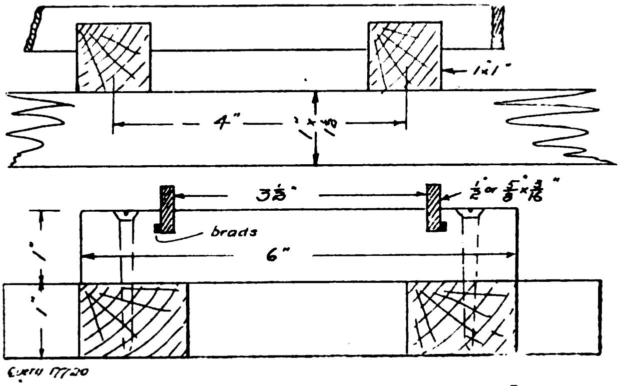


FIG. 3.—LONGITUDINAL AND CROSS-SECTION OF LINES

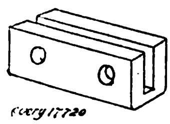


FIG. 5.—JIG FOR DRILLING RAILS FOR FISHPLATE BOLTS.

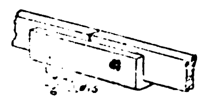


FIG. 6.—COMPLETE FISH JOINT.

jig in Fig. 5. Fig. 6 shows a complete joint. Whether a railway built on this plan will prove less costly than the purchase of the ¾-in. scale permanent way, with brass rail and proper chairs, keys, fishplates, and sleepers, is a matter for your personal consideration.

[17,620] **Model Steamer Machinery.** E. J. H. (Folkestone) writes: I am thinking of making a boat 4 ft. 6 ins. long by 6½ ins. or 7-in. beam, and should be obliged if you would give me some information. (1) Which is preferable—wood planking (like model sailing yachts) or sheet tin; if the latter, what gauge? I can work either. (2) Engine: Is a twin-cylinder or single preferable? I know of a very fine model, two cylinders, ⅝-in. by 1 in., and another ¾-in. by 1½ ins., two cylinders; perhaps this would be too large? I have a good one, single cylinder, ¾-in. by 1¼-in. What would you recommend? (3) As to boiler, I thought the "pinnace" type would do, as Fig. 14 in your boiler book, but with water tubes, as on page 261, THE MODEL ENGINEER. I should like to know the size suitable for the specified engine. To be fired with petrol or paraffin blowlamp burner.

(1) We prefer wood for model steamer hulls, unless you can get the tin up to a good smooth surface. (2) The ⅝-in. by 1-in. engine is quite large enough. The 1¼-in. stroke cylinder is likely to prove too high for the boat. (3) No, do not adopt the pinnace type. See page 46 of the new edition. The sizes given in Figs. 15 *b* and 15 *c* would suit the engine in question.

[17,858] **Pasting Small Accumulator Grids.** F. S. (Leominster) writes: Should be glad of your advice on the following matter. I am making small accumulator, as given in THE MODEL ENGINEER Handbook (No. 1). I have made positive plates all right, as per instructions, but am using litharge paste for negatives, mixed with 1 part sulphuric acid and 1 part water. I have pasted grids and dried them all right, but each time I have put acid into cell (1 part acid and 4 of water) the negative plates begin to fizz and paste all drops out of grid in a fine powder. The positive remain all right. What is cause, please, and could I use red lead in all the grids, as for positives? and also please state what useful technical book there is on making and repairing accumulators.

If thoroughly well pasted and well dried, the paste should not fall out. It should be well pressed into the grids, to make it as nearly solid as possible. When placing in acid after they are quite dry, do so slowly and carefully. Red lead could be used for the negative plates, but this would take a much longer time to form the plates, and is not recommended. A reply on this subject is to be

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found on page 46, which will enlighten you on the matter. Salomon's "Accumulator Management" is a good book, but refers more to large installations. Your best plan is to look through a few back numbers of this Journal—the Query Columns—where some useful information will be found.

[17,658*] **Six-pole Motor Connections.** W. P. (Middlesbrough) writes: I have just finished constructing an electromotor, a six-pole machine, with thirty slots in armature, and on connecting up, both in series and in shunt, through a resistance on a 120-volt circuit I cannot get it to run, so as a regular reader of THE MODEL ENGINEER from the first issue, I write to ask you if you can tell me what is the trouble. The armature I have formerwound with thirty coils of No. 26 s.s.c., covered the pitch into Nos. 1 and 5 slots all through, and the end of one coil connected to the beginning of the next, lap winding, and then taken to commutator sections. The armature tests all right for continuity, also for insulation from coil to coil and to frame. Diameter of armature, 4 ins.; thirty slots, 3-16ths in. deep by ¼ in. wide and 1¼ ins. long, composed of thin stampings, with a coating of shellac between each. The yoke carrying field-magnet coils, of which there are six, is round, 7 ins. diameter inside and 9 ins. outside, fitted with six wrought-iron pole pieces by means of a tap-bolt through the centre of each, and containing a brass bobbin on each insulated with presspahn, and all wound in the same direction, and the end of one coil connected to the beginning of the next and so on, leaving the end and beginning of the whole series to be connected to armature. They test all right for continuity and insulation, and I get a good pull on the

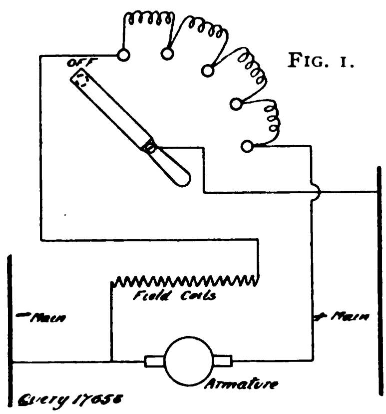
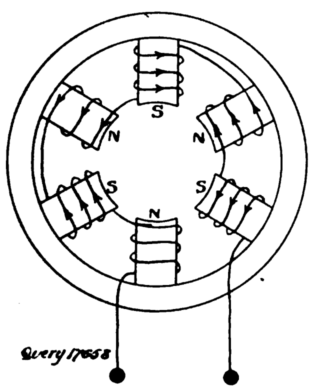


FIG. 1.

FIG. 2.

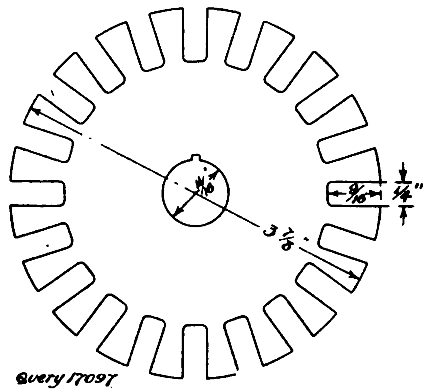


SIX-POLE MOTOR CONNECTIONS.

pole-pieces; these are also wound with No. 26 s.s.c. The length of the pole-pieces is 2¼ ins. and ¼ in. thick, with a face semicircular (1¼ ins. square). Brass bobbins, 2 ins. diameter by 1 in. long. Commutator built up of thirty V-pieces and insulated by mica, which tests all right from section to section and to shaft. Length of commutator sections, 1 in. and 3-16ths in. wide at top of V.

As far as we can understand your explanation and sketch, the fault appears to be that the field-coils are not correctly connected. They must be so joined that the current will produce alternate N and S poles. Herewith is a sketch showing the correct way to connect the coils; perhaps it will enable you to find out if this is the mistake. The brushes must be in the correct position, and should be tried at various adjustments of the rocker until best effect is produced. When starting a shunt-wound motor it is generally necessary to arrange the starting switch so that current is switched to the field-circuit before it is switched to the armature; or, if switched to both at the same time, a resistance is in series with the armature, this resistance being cut-out by degrees as the armature runs up to speed.

[17,097*] **400-watt Ring Armature Machine.** G. H. M. (Rugby) writes: I have a generator, and I wish to wind it suitably for lighting purposes. I have enclosed sketches, from which you will see the armature is built of laminated punchings, having twenty-four slots, and commutator having forty-two sections.



ARMATURE STAMPING FOR 350-WATT MACHINE.

I have enclosed sample wire, of which I have about 10 lbs., which might be suitable for armature. Could you send me a sketch of windings for armature showing connections to commutator, also the weight of wire required for both armature and fields, also the output of the same? I want to light as many 16 c.-p. lamps as possible.

You give no details of machine, and do not say what it is wound with already. The field-magnet cores seem rather heavy. However, approximate windings to give 50 volts would be—armature, 1¾ lbs. No. 18 S.W.G., and field-magnets about 12 lbs. No. 21 S.W.G. in shunt. Output, about 350 or 400 watts. The sample you sent is too heavy a gauge for this voltage. It is No. 13. Methods of winding are given in "Small Dynamos and Motors," 7d. post free.

[17,745] **Dynamo Management.** J. F. P. (Glasgow) writes: I am at present making a dynamo of the "Kapp" type. The output is expected to be 4 amps. 25 volts. I understand very little about the care required when running a dynamo and the lamps which may be connected with it. I have Nos. 1, 5, 10, 22, 24 of THE MODEL ENGINEER Series, and also "The A, B. C. of Dynamo Design," from which I have learned a great deal; but there are some points on which I have been unable to get the information I wish, so I shall be very grateful if you will give me some information on the following points. (1) Why should the brushes be lifted off the commutator when starting, and again lifted off when slowing down? (2) What risks do the armature and field-magnets run, through ignorance of attendant, when the dynamo is running? I understand some of the wires may be burnt out. How may I prevent this? (3) I know very little about resistance coils. Would you please tell me how to make one suitable for above dynamo? (4) Can you tell me where I can get a cheap and reliable instrument for measuring the voltage and amperage of my dynamo? (switchboard type)? Would you advise me to get an instrument for volts and another for amperes, or a combined instrument? What would be the cost? (5) Can the wires of my dynamo, etc., be tested quite as well with a galvanometer and wet battery (Leclanché cell or other) as with a dry battery?

(1) In case the armature should be moved in the wrong direction —*i.e.*, against the brushes. This would possibly cause injury to the latter, and might even, if they caught fast on the commutator, break some of the brush gear. Brushes should be raised from commutator when armature has *nearly* ceased to rotate. If taken off too soon, the shunt circuit is broken, and a high voltage current flows momentarily in the coils, tending to break down the insulation. In addition to this, you would very probably get a nasty shock if you were handling the bare brushes, or such part of the brush gear as is in connection with them. (2) This is rather too indefinite to reply to in a concise manner. You should look up some books on the subject. See "Dynamo Attendants and Their Dynamos," 1s. 8d. post free, by Frank Broadbent. (3) See replies on this subject in recent back numbers. (4) Any of our advertisers would supply you. Use separate instruments preferably. (5) Yes. The results would be accurate up to a certain point.

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The Editor's Page.

In view of the various correspondence on the subject of our Model Speed Boat Competition, it would seem that to discontinue altogether the 7-ft. class would be to inflict an injustice on more than one intending competitor who has been aiming at beating record with a boat approaching this length. This, of course, we have no desire to do; but as in certain quarters a reaction in favour of a 5-ft. 6-in. limit is taking place, we feel that some alteration in our previous arrangements is necessary. The real difficulty seems to be that the gap between the Class A boats of 7 ft. and the Class B boats of 4 ft. 6 ins. is too great, and we think that a slight rearrangement of the limits and the introduction of a new class is required. What we propose is to keep the "A" class at its present limit of 7 ft., to establish a new "B" class having a limit of 5 ft. 6 ins., and to reduce the limit of the smallest, or "C," class to 3 ft. 4 ins., which approximates to the metre class now becoming a favourite. We think this will meet the views of all concerned, and those who are building, or who are contemplating doing so, may go ahead on this basis. The general conditions of the competition will be practically the same as last year, and the closing date for entries will be December 31st next.

Answers to Correspondents.

A. M. B. (Twickenham).—Thanks for your interesting letter.

"Interested Reader."—We are obliged by your letter, and submit the following list of books and back issues, giving information on the subject of oscillating cylinder and single eccentric reversing devices:—"Model Steam Engines," price 6d. net, 7d post free; "The Model Locomotive," price 6s. net, 6s. 5d. post free; Model Engineers for July 15th, September 15th, and April 1st, 1901, May 12th, March 3rd, and September 15th, 1904, and the recent articles on "Model Locomotives."

H. T. (Peckham).—The matter is one for personal investigation and examination, and we can only suggest that you follow the instructions carefully which are given in handbook, and try to understand the diagrams. There is no publication dealing exclusively with hot-air engines that we can recommend.

F. G. (Kimberley).—We can only suggest that you either buy or make a simple book rest. They are a form of small easel, with a ledge along the front to prevent the pages from turning over. The back is either a solid piece of wood or can be a framework like an artist's small easel.

A. E. G. (Manchester).—Your inquiry is having attention.

A. B. J. (Coventry).—As the speed of proposed dynamo is limited to 500 r.p.m., it puts any small dynamo quite out of the field. And in any case accumulators would have to be used also, else there would be no light when car stopped or slowed down. We advise you to adhere to the use of accumulators. If, however, you wish to experiment, you could follow one of the designs in "Small Dynamos and Motors," 7d. post free, say Fig. 8 or 9, and any size you choose.

C. W. H. (Ibstock).—Yes. Charge through one or two lamps, as explained in recent query replies on this subject. You can use as small a current as you choose—slow and prolonged charging does cells good. *Re* speed of pulleys, etc., please also refer to the query colums in recent issues.

B. D. (Salford).—Please refer to reply No. 10,390, page 286, March 24th (1904) issue. A diagram showing connections for combined primary and secondary shocks is there given.

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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Contents.

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

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THE

Model Engineer

And Electrician.

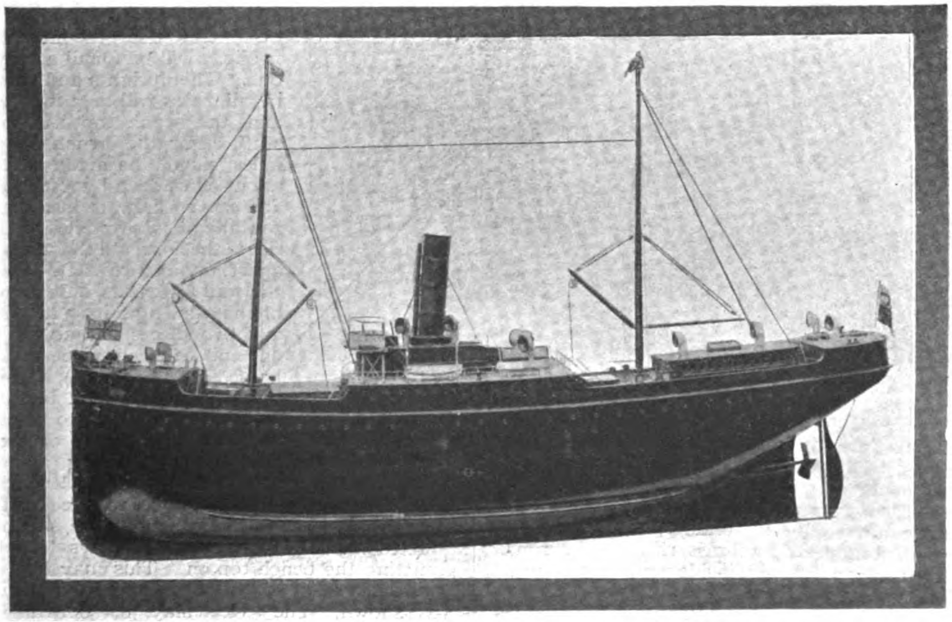
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 325. JULY 18, 1907. PUBLISHED WEEKLY.

A Model Steam Cargo Boat.

By W. F. ROBERTS.



MR. W. F. ROBERTS' MODEL STEAM CARGO BOAT.

THE photographs reproduced show my model steam cargo boat which I have built in my spare time. The hull was cut from a block of yellow pine, 5 ft. 1 in. long and 1 ft. square. I had no drawings nor templates to work to, and the few tools I had were home-made, consequently I found it a very tedious job, more so over the stern, but with patience and perseverance I got over my difficulty, and with plenty of glasspaper I succeeded in getting the hull to a nice fine surface.

The stern tube has a stuffing-box fitted on the inside; the outside is bushed and bored to the size of the shaft, which is a ¼ in. diameter. The propeller is 3½ ins. diameter and has three blades. The engine is a single-cylindered, 1-in. bore by 1⅛-in. stroke; it is not fitted with reversing gear. I have also fitted a vertical pump on to the cross-head, and during the time the engine is at work she is always pumping water and throws it overboard as if she were fitted with condensing engines, and by means of a small cock I can put the water into the boiler, which is fitted with a clack. I have also another pump in the boat to feed the boiler when standing. The exhaust steam goes

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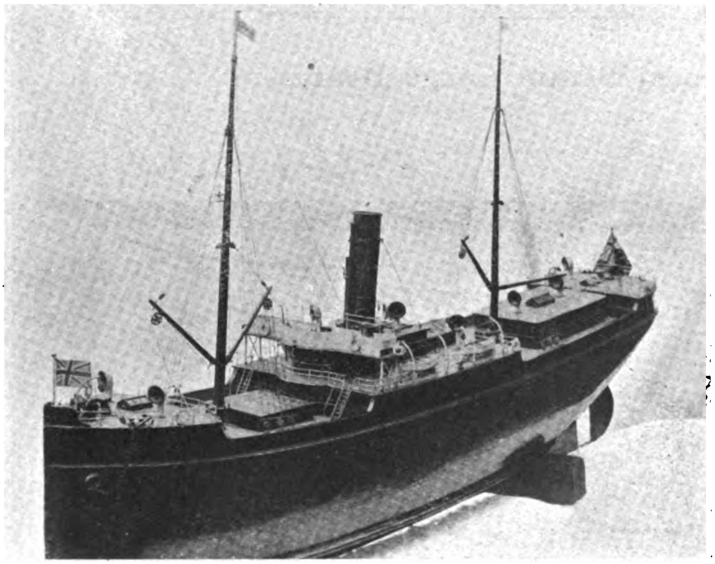
into a tank from which the condensed steam goes overboard, and the dry steam goes up the pipe in front of the funnel.

The boiler is vertical, 8 ins. high and 5 ins. diameter, and ⅛ in. steel riveted all over. I have been firing it with charcoal, but I find that it does not maintain the steam pressure of 20 lbs. as I should like. The following are the fittings:—Safety valve, three-cock water gauge, steam pressure gauge, steam valve, clack, whistle, blow-off cock, and also a plug for fitting the boiler. The decks are all marked off to imitate planks ¼ in. apart, first cut in, and then pencilled and afterwards varnished. On the fore deck is fitted a winch for the anchor, which has about 4 ft. of chain, and a davit for hoisting the same on board. The capstan is worked by clock mechanism. The ventilators,



ANOTHER VIEW OF MODEL CARGO BOAT.

ladders, decks, and other fittings are shown in the photographs. The lifebuoys, of which there are eight, are made of ⅜-in. iron washers. The ventilators are cut from ordinary wooden tobacco pipes; these are twelve in number, they are first cut down, bell-mouthed, a brass ring at the rim, and painted the usual red inside and white out, and the brass ring polished. Stanchions are of fine split pins, 1 in. long; a second hole is made in them, and copper trimming wire passed through in the usual way. When painted white the effect is realistic. Boot eyelets are punched into the sides of the boat and well represent port-holes. The outside case of the funnel is made in several pieces, centre popped from inside to imitate riveting. The boat is painted red below the water-line and black above, with chocolate lining, red funnel with black top. Portions of the deck are movable to allow of access to the machinery for oiling, firing, and repairing. The boat has been tested in a pit 40 ft. long, and I had to be sharp to catch her by the time she reached the other side. To raise steam from cold water takes about 20 minutes.

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 Vice Bench.

By W. F. MANLEY.

The chief requirement of a vice bench is stiffness and freedom from vibration. The details of construction depend somewhat on the circumstances attending each individual worker, as the height of the user must be taken into consideration, so as to obtain the best results with the least amount of labour. The top of the vice should be about level with the elbow when standing ready for work. This height will be found to vary between 40 ins. and 44 ins. from the floor, so the writer is taking 42 ins. as an average, allowing 4 ins. for the height of the vice itself; the top of the bench proper may be 38 ins. from the floor.

If there is no difficulty in knocking a couple of holes in the workshop wall, and if there is a brick or concrete floor, the method shown in Fig. 1 will be found a very strong one. The uprights and cross-pieces in all cases will be 3 ins. by 2 ins., and the bench top 1-in. or 1¼-in. stuff. For the bench shown two holes should be made in the wall about 6 ins. deep by 4 ins. by 6 ins., and centres 1 ft. 10 ins. apart horizontally, also two holes of the same size in the floor, and the same distance apart, and centres 1 ft. 4½ ins. from the wall outwards Cut two pieces of the 3-in. by 2-in. 3 ft. 5 ins. long and two pieces 1 ft. 10 ins. long, at one end of each piece making the halved joint (Fig. 6), and bolt up with a couple of ¼-in. bolts in each. In the ends that are to be cemented into the wall and floor put in five or six strong cut nails, with their heads projecting about 1 in. Stand the supports in position, and level them up, and carefully fill up the holes with cement with a few small pieces of stone about the size of a nut mixed in. Leave a couple of days to set before putting the bench top on. This may be two 9-in. widths bolted to the crosspieces by ⅜-in. bolts, as shown. The vice may be bolted wherever desirable.

The toolboard at back is made of ½-in. matchboard 6 ins. wide, screwed to three pieces of 2-in. by 1 in. by 18 ins. long. The latter are first attached to the wall by cut nails and carefully lined up level. The rack for files is to be made of 1-in. stuff and any convenient width and length. The straight slots are cut wide enough for the tangs of the files only to pass through, and the circular parts slightly larger than the ferrules. The rack is secured to the toolboard by iron brackets.

Where the above method cannot be followed, the uprights can be fixed by strong iron brackets, as shown in Fig. 3, or made after the style of a

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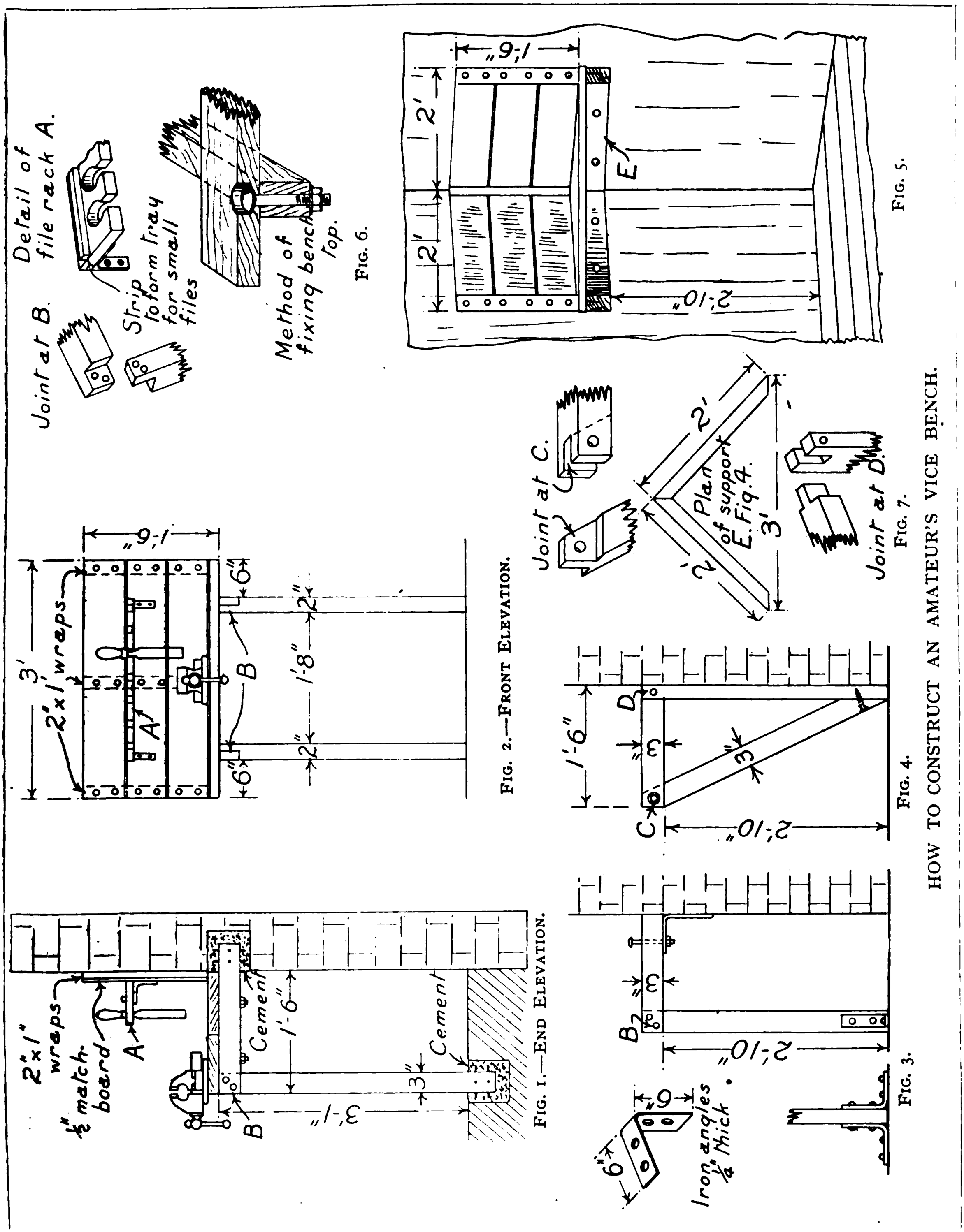


FIG. 1.—END ELEVATION.

FIG. 2.—FRONT ELEVATION.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

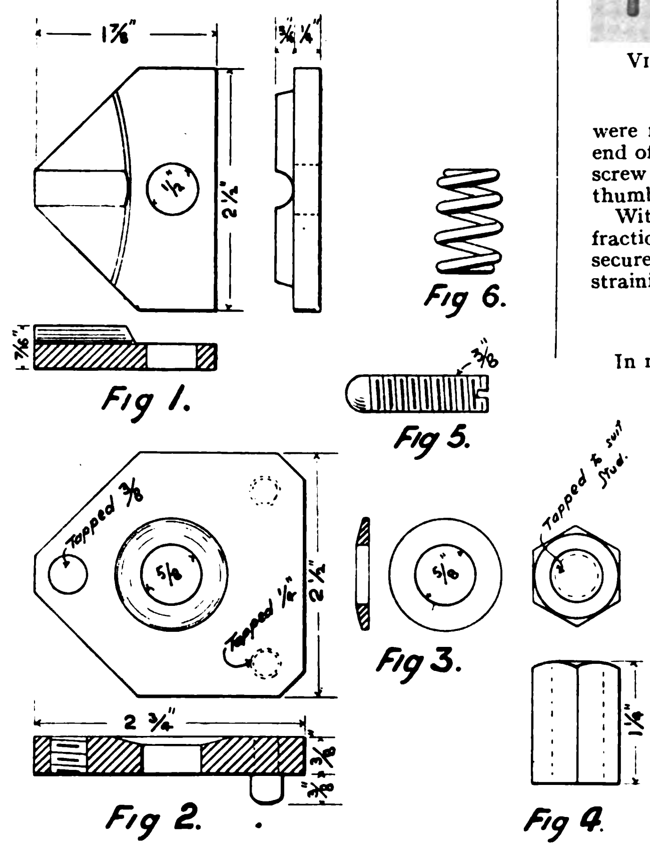
HOW TO CONSTRUCT AN AMATEUR'S VICE BENCH.

bracket table, as in Fig. 4. A corner of the workshop may be used, if found more convenient, and in this case the construction is simpler, and, as shown in Fig. 5, measurements for the last three methods of construction are left to the maker to work out, as much depends on the space and position at the disposal of each individual user. The elevations for supports in Figs. 3 and 4 only are given ; the distance apart and other measurements are as in Figs. 1 and 2. Sketches of joints, etc., are not to scale.

A Tool Post.

By T. Goldsworthy-Crump.

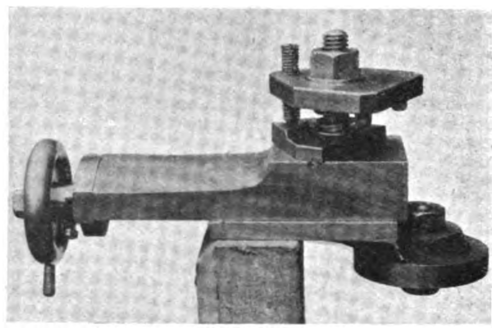
Being for many years used to the excellent tool-post on a Holzapfel lathe, I found the one supplied with Drummond's 3½-in. lathe somewhat longer to adjust and not generally so convenient. This being a purely personal matter, I therefore made a reduced copy of my favourite, according to the drawings herewith, which are almost self-explaining. The base, Fig. 1, was machined on all faces, and the



Details of Tool Post.

½-in. hole bored a good fit on stud, the semi-circular groove being filed out. The top plate, Fig. 2, was also machined on all faces, bored ⅝ in., and hole dished as shown. The holes for studs and back screw were also bored and tapped. The two studs were turned up, tapped, and screwed tightly into plate. The dished washer, Fig. 3, was turned up, also back screw, Fig. 5. The spring, Fig. 6, was made from an old cycle spoke, and is for the purpose of keeping up the top plate. A new holding-down bolt, Fig. 4, should be made, as the extra length allows a spanner to more easily operate over the back screw, but this is not absolutely necessary.

The plates, etc., are mild steel, and all faces



View showing General Arrangement of Tool Post.

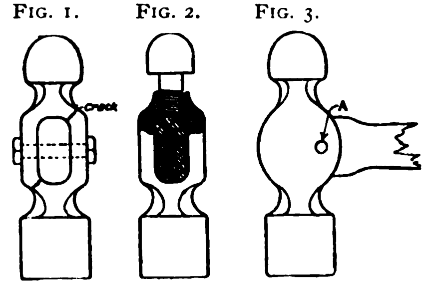
were machined on the face and angle plates. The end of back screw should be case-hardened, and the screw capable of being turned with the finger and thumb in top plate.

With this holder the adjustment only takes a fraction of time, and the tightening of one nut secures the tool, also there is no possibility of straining the stud.

To Repair a Broken Hammer.

In many cases hammers which have been broken can be repaired and made to give good service (says a contributor to *Popular Mechanics*). When cracked diagonally, as shown at Fig. 1, the repair can easily be made by drilling for a small

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



Repairing a Broken Hammer.

bolt, as indicated by the dotted lines. When the pene becomes broken, as shown in Fig. 2, a quick repair can be made by drilling and tapping to receive a steel screw, which should be ground rounded, as shown. When the head of a hammer comes off and nothing else will hold it on, the scheme shown in Fig. 3 is a good one. Drill a hole at A and drive in a steel pin.

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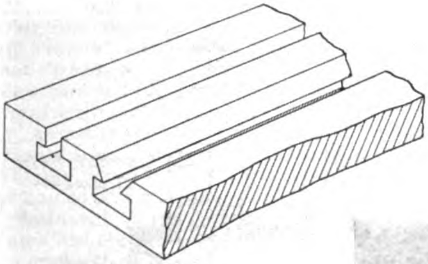
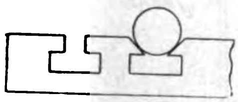
A Hint for Cutting Keyways.

By An Apprentice.

The accompanying sketches show an easy and practical way of ensuring a keyway to run parallel



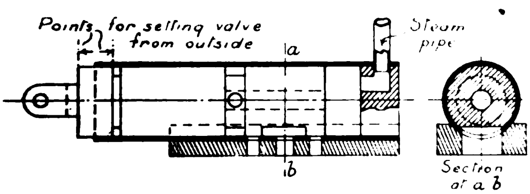


A Method of Cutting Keyways Parallel.

with the shaft. Most planing and shaping machines have one or more slots running longitudinally with the table. If one of these slots be planed the whole length of the table to an angle of 90 degs., so that a shaft may rest in it like a V-block, it will amply repay itself for the trouble expended on it. It will also stop the shaft buckling under the pressure of the cutting tool.

Altering Slide-Valve Cylinders.

A reader having purchased some castings for a model locomotive did not like the design of the slide-valve cylinders, so decided to alter them to take piston valves. He first obtained a piece of brass tubing and cut slots in it to correspond with the ports on the valve face of the cylinder. The valve face was then filed out to take the tube, as shown in the sectional view, and the tube was sweated into place. The piston valve was then turned up a nice fit in tube and the steam way was drilled. In one end of tube is sweated a plug, in which the steam pipe is fitted. A nick with a file should be made on outside of tube to set valve by, as shown in sketch.



Altering Slide-valve Cylinders.

How I Made a Miniature Petrol Motor.

By W. J. Smith.

If my miniature motor could give a verbal account of itself, it might truthfully use the following words: "I am the remains of a German toy gas engine, which took a smell at a light at the side of the cylinder and then blew it out, to the disgust of its owner, who then turned me into something modern, making me to compress a vapour, and charged me with electricity, so that

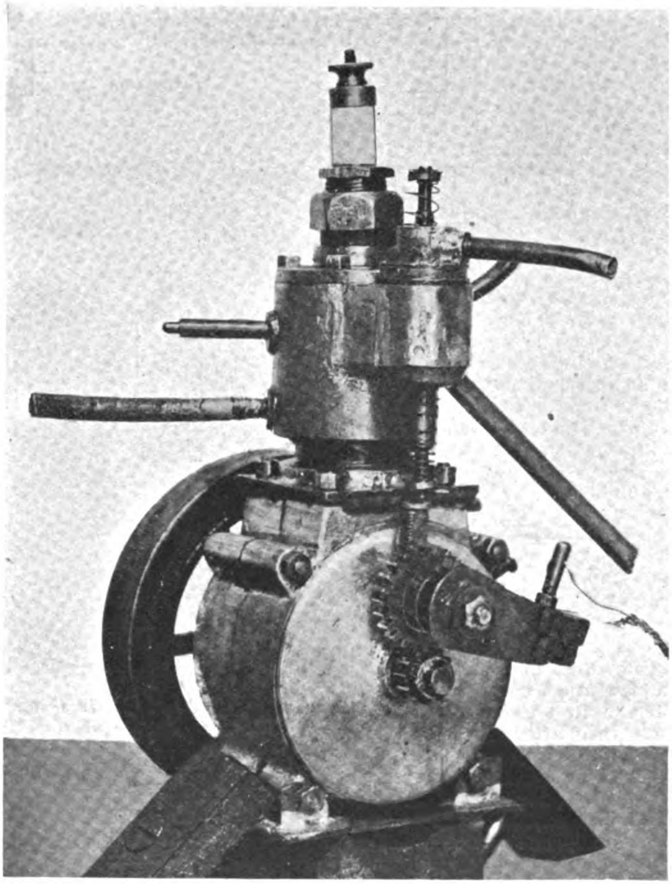


Fig. 1.—Mr. W. J. Smith's Miniature Petrol Motor.

(Bore of cylinder, 15-16ths. in.; stroke, 1 3-16ths. in.

now I spit fire and smoke, to the joy of my owner, and believe I can leave a motor 'bus in the shade for smell."

Commencing then to transform the said toy cylinder, I cut off $\frac{3}{8}$ in. from the back end, refitted the old cover with a sparking plug in it, made a valve box to take the inlet and exhaust, and screwed same to the side of the cylinder. The crank and arm were cut down so as to leave $\frac{3}{8}$ in. compression space. I might say that my tools and appliances are limited, having to use a chuck

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screwed to a sewing machine, a few odd files and small taps and dies. The piston was placed in the chuck, and two recesses for rings were cut with a ward file. Cast iron was tried for the rings, but they broke when being got on to the piston. A piece of nium for a few pence, and experimenting by casting lead till successful, I then cast the aluminium. The water-jacket I had cast to take in the valve chamber and my old valves. The cooling rings were filed off the cylinder and the latter sweated into the

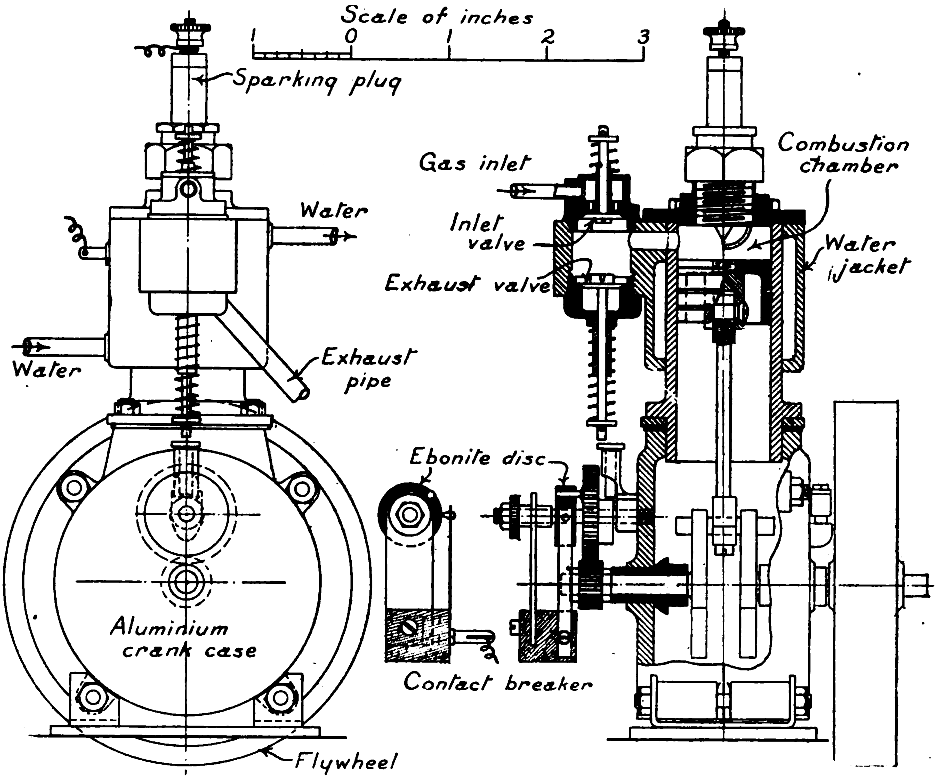

FIG. 2.—ELEVATION. FIG. 3.—SECTION.

A MINIATURE PETROL MOTOR.

cycle tube, 15-16ths in., was obtained, and a few rings cut off; these were a success. The 2 to 1 gear and sparking arrangement was then fitted at the side, with a lever to work the exhaust.

I made a small spray carburettor, and a friend lent me a coil and accumulator, and then the trouble began. First I got a shock; I took good care not to get another. I turned the wheels till I got tired and got no result. The spark and compression was good. I put a drip of petrol in the supply pipe, and got three explosions, so made a surface carburettor out of a tin, and the engine worked well, but it got so hot in a few minutes that it had to be stopped. The conclusion, therefore, was that as a model engine for work it was no good. I then decided to rebuild it with a water cooling arrangement and a crank chamber with flywheels inside just the same as a cycle motor. I started with making my patterns so as to use the old cylinder, piston, and sparking arrangement. After making a moulding box and obtaining a little sand and some scrap alumi-

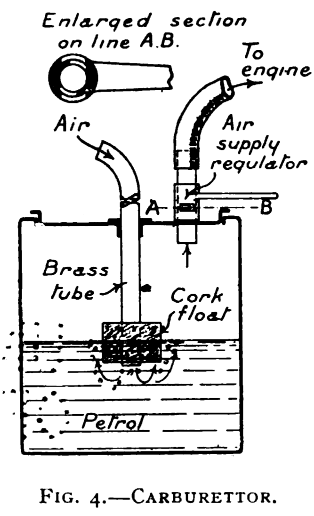

FIG. 4.—CARBURETTOR.

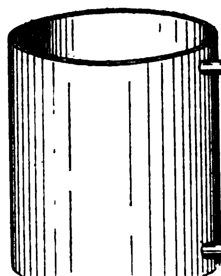

FIG. 5.—WATER TANK.

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water-jacket. I then finished the crank case and made a new top for the cylinder. My next trouble was to tap it for the plug. I tried to buy one, but nobody stocked them. I then counted the threads of the plug. There were sixteen ¾ threads to the inch (11-16ths in. dia.), and as a ⅜-in. Whitworth is sixteen threads to the inch, I saw no reason why I should not solve the difficulty, as I only wanted four threads in my cover. I set it revolving in the chuck and held a ⅜-in. Whitworth tap in a vice and pressed it lightly, and at the same time inwardly. As it cut the thread I used more power, and the result was a thread that the plug fitted nicely. Having fitted it up together with the old 2 to 1 gear and sparking arrangement, which is wipe contact—platinum to gun-metal—and set the exhaust valve, the inlet being mechanically operated, I filled the crank chamber with thick oil, joined up

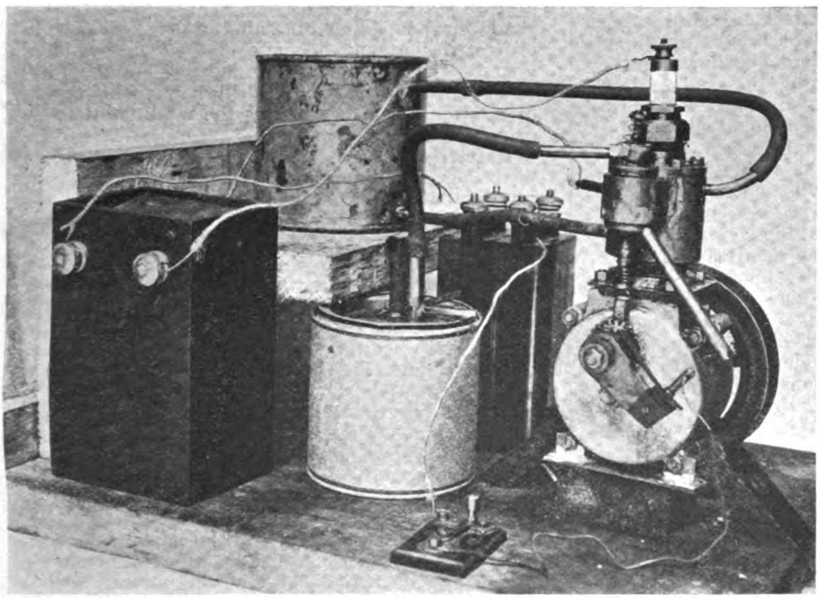

Fig. 6.—Showing Arrangement of Petrol Motor and Electrical Connections.

the wires to coil and battery, and tried for an explosion. I got one at the first attempt, and a continuation of them. The flywheels were not heavy enough to carry it over the compression, so they were taken out and a heavy wheel fixed outside which worked fairly well, but I still found it faulty, so I cut and chopped it about till it run perfectly.

I am working on another motor, and profiting by my experience gained during the past few months during the experimenting described above, and hope to let readers know more of the results at some future date.

Tourists should shortly be able to take tickets at Charing Cross for the summit of Mont Blanc. The permanent way is now nearly half way to the top of Mont Blanc, and as soon as the rolling-stock is purchased and stations are built the first portion will be opened for traffic.

The Latest in Engineering.

Petrol Road Roller.—One of the first petrol or gasoline engine road rollers built in the United States was recently illustrated in the *Engineer*. It is a 12-ton machine, with a 25 h.-p. horizontal gas engine driving a train of gearing arranged in the usual way. The engine and gearing are carried between two massive web frames, the centre of gravity being low, although the machine is set well above the ground. There is a double-speed change gear, while the governor provides for a regulation of the engine speed. The maximum speed of travel is about four miles an hour. The driver has one lever to control the stopping, starting, and reversing, and a hand wheel operates the steering chains in the usual way. The cylinder is cooled by oil circulation, the warm oil being cooled in radiators before being returned to the circulation system. The engine carries a fuel supply sufficient for two days. The front roller is 3 ft. 6 ins. diameter, and carries about 4 tons; the two rear wheels are 6 ft. diameter. For advantages over the steam roller, it is claimed that the machinery is better supported in the heavy frames than when mounted on a steam boiler; there is no dirt or difficulty in the hauling of coal or water; there is no loss of fuel in banking and building fires; and there is no boiler to cause trouble by wear or corrosion due to the use of bad water, and to the racking strains to which it is subjected.

Hardening Metals.—According to the *Brass World*, a novel method of toughening metals has recently been brought out. The metal to be treated is placed in a closed retort, and a small quantity of mercury placed in it. The retort is now subjected to pressure, and then heated below the melting point of the metal. While the heating is going on, a current of electricity is passed through the metal. It is said that metal treated in this manner is greatly increased in toughness and in ability to withstand the effect of sea-water and other corrosive agents. While more particularly adapted for treating iron and steel, it is said to act in the same manner on other metals.

Model Yachting in Sheffield.—Steps are being taken for making provision for the pastime of model yachting in this city. Readers residing in the district and possessing models, or who are in any way interested, are asked to communicate with Mr. W. J. Bates, 63, Tadcaster Road, Woodseats.

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Notes on Drills, Reamers, and Broaches.

By George Gentry.

ONE of the most important factors in the use of the ordinary twist drill is to remember that it is not a reamer, nor was it ever intended to be used to enlarge a hole smaller than itself, except there be a reasonable difference in their sizes. All the work done by a drill of any kind should be carried by the bottom cutting edges or lips equally, the clearance and rake of which are in accordance with the conditions in such as a lathe or planer tool. This is shown on Figs. 1 and 2, and it should be noted that the extremes of these edges (*a a*, Fig. 2) must not be allowed to become worn away, otherwise the edges of the flutes will take some of the work, and the drill, sooner or later, seize and break. If it does not break, the flute edges, not being adapted for cutting, as in a reamer, will rapidly wear, thus throwing the drill out of calibre, and making it useless so far as the worn portion is concerned. The lips should always be of the same length and to the angle given. It may not be generally known that the peripheral portion of a twist or straight-fluted drill—indicated by *b b*, Fig. 1—is, even in the smallest sizes, backed off, as shown on the point elevation, Fig. 2, leaving very little surface to resist wear, as mentioned above. Suppose it is wanted to enlarge a hole ⅛ in. in diameter to ¼ in. This can be done by means of a ¼-in. drill with safety, without putting any undue strain on the flute edges; but the resultant ¼-in. hole is not so likely to be cylindrically true, on account of the point not coming into play and steadying the drill, neither can the exact position of the hole be maintained as in the case where reamers are used.

Fig. 3 is an enlarged section of a twist drill cutting edge, showing how the rake is adapted for cutting wrought and cast iron, steel, copper, aluminium, or other tough and stringy metals. Fig. 4 is the corresponding section of a straight-fluted drill showing the absence of rake. It is this feature which makes the latter drills so useful for brass work, and especially for thin plate work in any metal, as the drill is not able to jump forward, which is usual with a twist drill just before it clears its way through the metal. This trouble arises from the fact that the direction of the twist of the flutes is right-handed (*i.e.*, the same as the direction of a right-handed screw thread, which must be so, or the cutting edges would have a negative rake and would scrape rather than cut), and the tendency of the drill actuated by the feed is to force an 8-shaped hole and to follow the same, screw fashion. It will be shown later on why the flutes of a twist reamer have to be left-handed to avoid much the same tendency. The outline of the flute surface and periphery of the drill, as shown on the point elevation in Fig. 2, will clearly demonstrate the uselessness of a fluted drill for cutting with the flute edges, and compared with Fig. 8, which is a section of a fluted reamer, this will be still more clearly seen.

Reverting to Fig. 3, it will be noted that the angle of rake is 62½° to the plane of the cut. This generally applies to twist drills only, when they have not been worn away much, as it is usual to increase the angle of the twist from that given above at the point to about an angle of 72½° to the same plane at the shank end; the object being to increase the cross-sectional area of the drill near the shank for purposes of rigidity, and to resist torsion, and this without diminishing the cross-sectional area of the flutes. It is obvious that the sharper the angle of the flute in relation to the axis the less metal is removed from the body of the drill to excavate it, and on the other hand, if the angle of flute be kept constant throughout and the depth of same decreased with the above object, the chips would choke the flutes at the shank end. The disadvantage of the increased angle is the decrease of rake to the cutting edge when the drill is worn short. Constant angle drills are made, and one method of obtaining the advantages of the increase in same is to gradually alter the angle of the milling cutter in relation to the flute so as to cut a wider groove at the top end, and at the same time a shallower one, thus obtaining a thicker web in centre without any decrease in the cross-sectional area of the groove or any increase in the total cross-sectional area of the drill itself; the centre of the web being regarded as the weak point to be protected against torsion.

In reference to grinding the cutting edges, it must be borne in mind that just sufficient backing off of the point facets is necessary only, and that too much clearance causes the drill to cut rankly and almost as badly, from a practical point of view, as if no clearance was given at all. The best indication for grinding is to observe the angle of the centre cutting edge in relation to the lips of the drill. Fig. 5 gives this correctly at *c*, while Fig. 6 shows the angle formed (approximately) by too little or no clearance, and Fig. 7 the reverse, or too much clearance; in short, the drill is here too sharp to maintain an even cut with sufficient feed to make it cut at all. (Note that the thickness between the lips is shown greater than necessary for good cutting to accentuate this angle in these views.)

Readers may have found difficulty in grinding very small twist drills such as from Nos. 65 to 80. It is not necessary to round off the clearance in such small drills as these, a flat backed-off clearance to the lips being sufficient. The following method with a little practice will answer the purpose. First use yourself to holding a wire, with both hands on a rest, to the periphery of a revolving stone, which must run at high speed away from you, so that the resultant flat surface ground is approximately at an angle of 60 degs. to the axis of the wire, with a slight inclination of the end of the wire nearest you to the right to give clearance. Then take the drill, and, selecting the position from the operator's point of view, looking downward as indicated by Fig. 7, give the point one touch on a fine grained grindstone, or, better still, a carborundum wheel running dry, with the drill held in position, as mentioned above. Without moving your hand, revolve the drill in your fingers, and treat the opposite side the same, giving the same period and compression to the touch. With a little practice, this is so efficient that one cannot detect with a powerful glass the slightest difference in the length of the lips in quite the smallest drills.

When using small drills, do not try the watchmaker's method of using a drill arbor and bow. This requires a great deal of practice and an extra special sense of touch. Mount the drill in the lathe

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chuck (preferably a three-jaw scroll chuck, which must of course run true). If the drill is too fine for the jaws to grip, take a strip of blotting paper or newspaper about ⅜ in. wide by 1 in. long, moisten slightly, and roll it on the drill shank between the thumb and first finger until the mass of paper is quite tight. This will be found an effective packing, and in the writer's experience, a drill so mounted will run true nineteen times out of twenty. Feed with the poppet head with back centre removed; and if the work is small, back it up with a flat piece of hard wood. Do not support the work in your hand, but pack under so that the drill takes no weight. Run the lathe at the highest possible speed, avoid vibration, and use oil as lubricant for all metals. Only practice and familiarity with your lathe will enable you to feel the proper feed necessary for fine drilling. In any case do not try and drill holes below ·04 of an inch with a hand brace. The writer thinks—from bitter experience—that it is well-nigh impossible. Better results can be obtained with an Archimedean drill brace using the usual spade pointed drills, but great care is necessary with all hand tools. The above hints are given assuming the reader does not possess the luxury of a high-speed sensitive drilling machine, which is doubtless the best tool for actuating fine fluted drills.

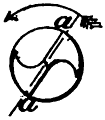

FIG. 2.

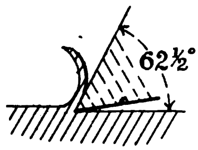

FIG. 3.

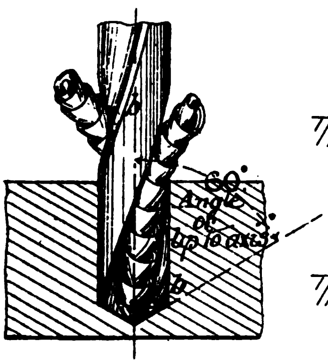

FIG. 1.

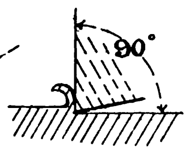

FIG. 4.

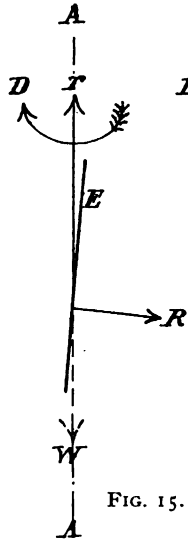

FIG. 15.

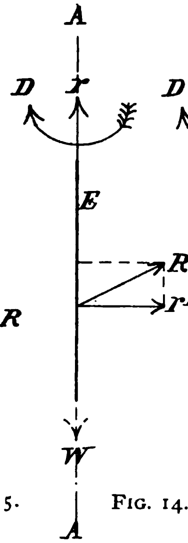

FIG. 14.

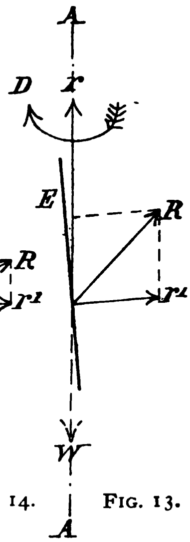

FIG. 13.

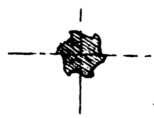

FIG. 8.

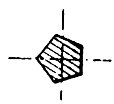

FIG. 11.

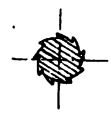

FIG. 9.

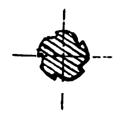

FIG. 10.

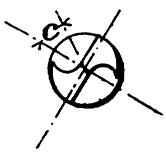

FIG. 5.

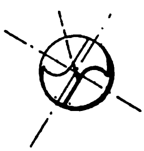

FIG. 7.

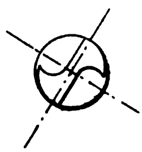

FIG. 6.

FIG. 7.

FIG. 12.

Reamers and Broaches.—Reamers and broaches are tools for enlarging and trueing to a gauge diameter an existing hole, which, though too small, should with respect to the wearing qualities and strength of any reamer, be somewhere near truly round and sufficiently large to allow the point of the tool to enter. They are usually tapered for either the whole or a portion of their length—in the case of so-called parallel reamers for about one-sixth of their length from the point upward. Fig. 8 is a section of the flutes looking on the point of the latest and best form of six-fluted reamer, showing the shape of flute and backing off of cutting edges. This latter is usually done on a special grinder and constitutes the final process of gauging the tool to size. Fig. 9 is also a good form of multi-fluted reamer, which necessitates the turning of the original blank to gauge and very careful fluting, as it will be seen at once that any extra depth of flute

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will rob the tool of its diameter, and any shallowness obviates its cutting capacity. Fig. 10 shows the old original form with five flutes, which retains its gauge diameter and wears well; but is not so efficient a cutter as the foregoing, on account of the lack of backing off, although for strength it is far and away superior. Fig. 11 is the usual section for broaches, which are always made with five cutting edges. In addition to these, square section taper reamers (or more properly broaches) are largely used for cutting taper-pin holes in machinery and for enlarging roughly holes in metal plates for taking wood screws. These usually have tapered square shanks and are adapted to fit carpenters' bit braces.

The best design of reamer for general work is that shown in Fig. 12 with left-hand twist flutes, although this is not the general kind sold in tool shops. The straight-fluted variety is more generally found in stock. This is probably due to the fact that straight flutes are easier to produce and do not require the extra feed necessary in milling machines for their production. A glance at Figs. 13 and 14 respectively will demonstrate the superiority of the left-hand twist flute as against the straight. It will be seen that, for any one cutting edge, there are two resistances, r and $r1$, acting respectively along the axis A W of the tool and at an angle of about 90 degs. to the edge. The first is that against the weight W of the reamer and wrench and any slight down pressure (the slighter the better) divided by the number of flutes; the second that of the resistance of the metal to the cutting of the edge E. Because in Fig. 13 the direction of rotation D (clockwise) is against the direction of inclination of the edge E, r may be approximated as equal to $r1$, and their resultant R, in the direction shown, is one-sixth of the total resistance, forcing the reamer out of the hole and preventing it seizing. In Fig. 14 the resistance r is considerably less, as E is much nearer in direction to that of rotation D, and in the same as that of W, hence R, the resultant, is not so effective in freeing the reamer, and as E is in the same direction as W, unless great care is taken the tool will chatter and form an approximate hexagonal hole, especially if used in thin plate work. Fig. 15 shows that with a right-hand flute the inclination E, being with the direction of rotation D, r is practically eliminated and $r1$ becomes R. This form would undoubtedly seize and very soon break, as the total resultant tends to draw the tool deeper into the hole.

Broaches are made very slightly taper their whole length, and are gauged at the upper shoulder or maximum diameter to Stubb's steel wire gauge. They are very handy tools, as they will cut in either direction and will rapidly enlarge holes in plates using a reciprocating rotary motion with a fairly long stroke. If habitually used one way and they become dull on the edge, a reversal of motion will often be an improvement, and will have the advantage of setting the edge for the first direction. They are used largely in clockwork, and their taper is so slight that in plate work it can be disregarded. These tools are generally actuated by a handle provided with a chuck adapted to take several consecutive sizes.

A well-known London firm are selling out of stock left-hand twist-fluted reamers to Stubb's sizes of the same section as Fig. 9. The writer understands that these are being sold off and will not be manufactured further. They were originally made for the clock trade, which, through improvements in machinery for production, do not now need them. Such reamers should be particularly useful to model engineers, in that pairs of bearings can be shelled out in perfect alignment and to correct size to take bright silver steel shafting, which is drawn to the same gauge. As the firm in question have a rooted objection to advertising, their name is not mentioned. No doubt the Editor will oblige by letting any enquiring reader know where these may be obtained.

Testing Model Warships.

By Harold J. Shepstone.

"The art of accurate shipbuilding has its birth in model-making," said Sir William White, the late Chief Director of Naval Construction, some little time ago. This is undoubtedly true, but few are aware of the time and money spent by the big shipbuilders, and also by the various Governments, on the construction of models of proposed new boats and the exhaustive tests to which they are subjected.

The models are made of wood or paraffin wax, and then drawn through the water in large basins, known as testing tanks. The object, of course, is to ascertain, whether a craft constructed on the lines of the model will fulfil the claims of its designers before the contract is given out for its erection. Many thousands of pounds are saved in this way by these tests, for ideas which look very well on paper are found to be impracticable when subjected to actual experiment.

Undoubtedly the finest testing tanks are those owned by the Governments where proposed new war vessels are continually being tested. It is interesting here to note that our own Admiralty were the first to recognise the value of these model basins, and for many years Great Britain was the only power that could boast of its own tank where models of battleships could be built and tested before the keel was laid in the yard.

The tank belonging to the British Admiralty is at Haslar, near Portsmouth, and experiments are conducted there under the guidance of Mr. R. Edmund Froude, son of Mr. William Froude, who may be described as the "father of testing tanks." So far back as 1870 Mr. William Froude built, at his own expense, a private tank at Torquay, and was the first individual to prove the value and utility of experiments made with model ships dragged through the water. His tank, which was about 200 ft. in length, resembled a sort of covered swimming bath. The Government tank at Haslar is 400 ft. in length and 20 ft. in width. High above the water there is a miniature tramway which runs up and down the basin. It is virtually a moving laboratory, for it is fitted up with many delicate appliances for testing the model, which is clamped to it in the water below.

In making tests Mr. Froude discovered two very important laws. The first of these relates to what is called the "corresponding speeds." Suppose we have a real ship 250 ft. in length, and we make an exact model of this vessel 10 ft. in length. If both

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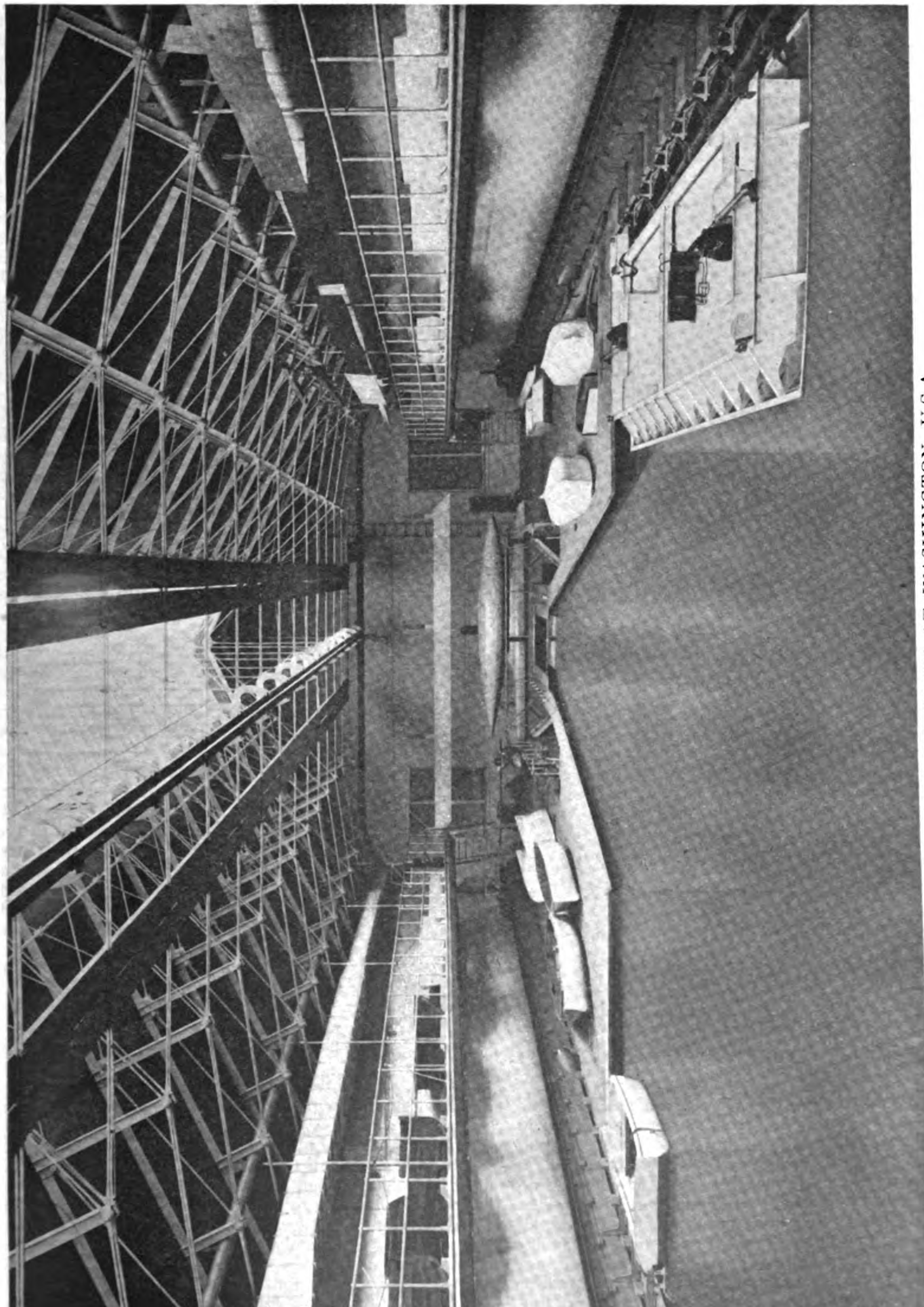

THE NAVAL TESTING TANK AT WASHINGTON, U.S.A.

SHOWING MODELS RECENTLY TESTED.

For description] [see pages 58—61.

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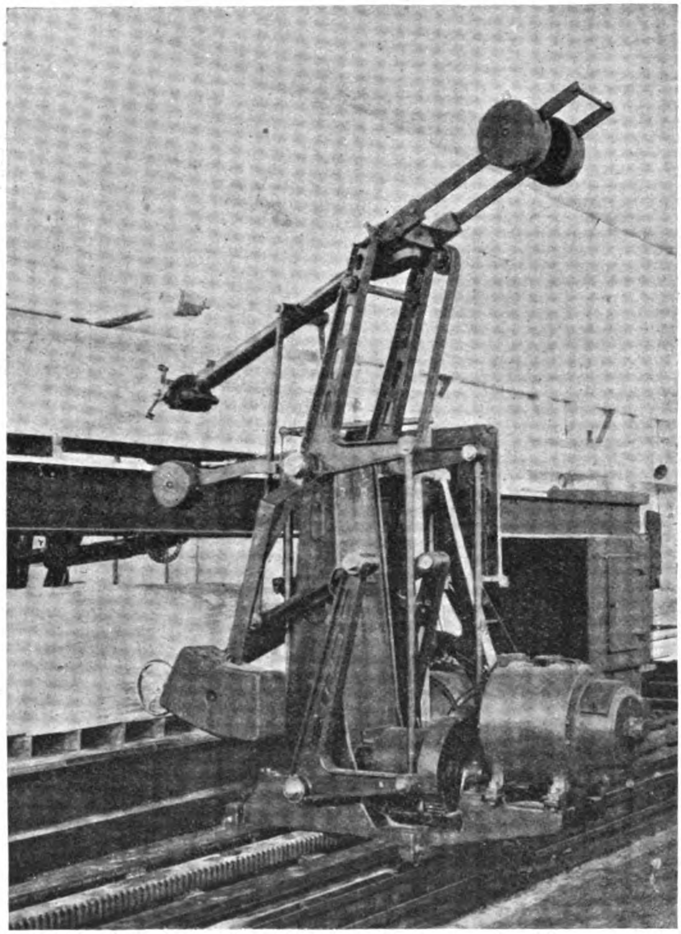
are made to move over still water, the ship going five times as fast as the model, they are travelling at what is termed corresponding speeds; that is to say, the speed of the ship is to the speed of the model as the square root of the length of the ship is to the square root of the length of the model. If two photographs were taken—one of the ship going at twenty miles an hour, and another of the model going at four miles an hour and reduced to the same size—these photographs would be exactly alike in every detail. A second law was then established relating to that part of the whole resistance due to wave-making experienced by a ship and a model, or by two models, when moving at corresponding speeds; namely, that the resistance of motion due to wave-making is proportional to the cube length of the ship and model. From these discoveries a formula was determined giving the ratio of the resistance of a model at a certain speed to the resistance of the full-sized vessel at the speed at which the latter is designed to run. By ascertaining the resistance of a full-sized ship in this way the builder is enabled to determine with great exactness the total horse-power required to drive her at different speeds.



A Machine for Cutting Model Boat Hulls.

The latest Government to build a tank for the benefit of its navy is the United States, and through the courtesy of Naval Constructor D. W. Taylor, The Model Engineer is enabled to reproduce some photographs of this basin and also to give a description of same. It can claim the distinction of being the largest and undoubtedly the best-equipped of all model basins. It is situate at Washington, and was erected at a cost of £120,000. The tank itself is 470 ft. long, 42 ft. 8 ins. wide, while the water in the middle of the basin is 14 ft. 8 ins. deep. A million gallons of water are required to fill the huge tank. The operation of filling occupies a week, though, strange to say, it can be pumped dry in four hours by means of a 12-in. centrifugal pump electrically driven. In the filling of the little lake the water has to pass through a number of filters, and before reaching its destination is treated with a minute quantity of alum, which coagulates with any mud present.

Whereas at Haslar and also in most other naval tanks the models are of wax and invariably melted down again after use, those at Washington are of white pine. Wooden models are used on account of the extremes of temperature. They are fashioned in a marvellous manner. Special and expensive machinery has been devised to accomplish this. So that the models shall be absolutely accurate an ediograph is used for drawing the sections. Two models are made at the same time—one known as the "former" and the other as the "wooden" model. The "former" is made up in sections, and then placed in an apparatus, a roller running over it, while a saw driven by an electric motor at 2,000 r.p.m., fashions another model to the same pattern above. It is the wooden model that is used for testing purposes. All the models in the case of battleships are of the same length, namely, 20 ft. It is not a complete model of the ship that is tested, only a miniature of the "body plan" of the boat—that is to say, the hull. It is not necessary to fashion more than the hull.

The basin is spanned by an electrically-driven towing carriage, which is capable of a wide variation of speed, and is provided with a very complete system of stopping and starting control, all of which is operated from the platform of the carriage. The carriage runs upon eight wheels and is propelled by four motors, one to each pair of wheels. The carriage itself, with its fittings, weighs about 25 tons, and although so heavy, is entirely under the control of the men working upon it. It can be driven at various speeds from one-tenth of a knot per hour, or 10 ft. per minute, to 20 knots an hour, or 2,000 ft. per minute. Curiously enough, it can be pulled up quicker than it can be started.

Upon this platform there are a number of delicate

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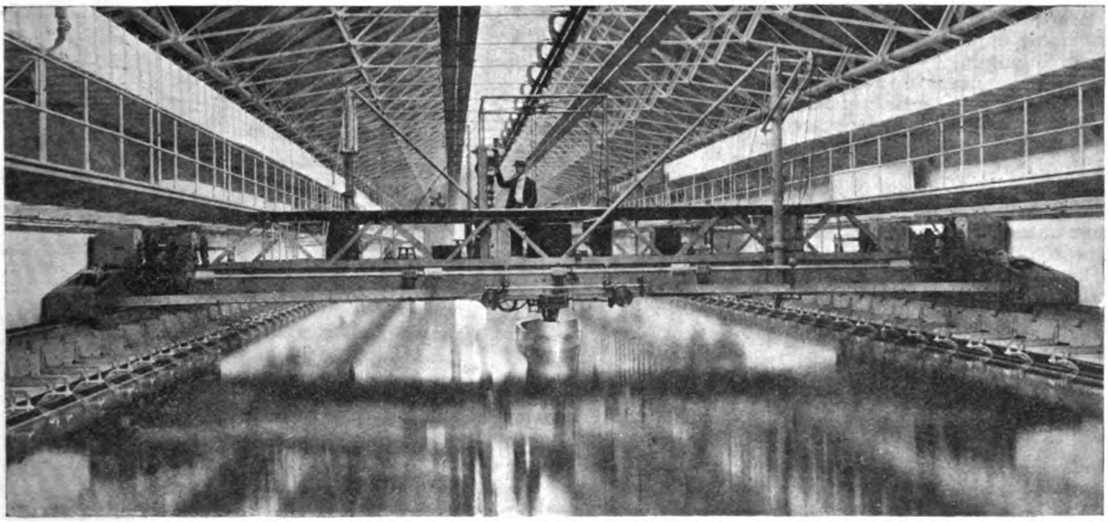
instruments for denoting the behaviour of the model which is attached to the towing rod beneath. This latter is connected with a dynamometric apparatus by which the resistance of the model is automatically recorded upon a drum. It should be stated, perhaps, that although the model is attached to the carriage, it is fixed in such a way that it has free play in the water and perfect liberty to rise and fall with the waves. During a test three men are employed upon the moving platform—one to control the speed, while the other two are engaged in watching the various instruments which denote the behaviour of the little model below. Over a hundred models of men-of-war have been made and tested in this interesting basin. Not so very long ago the in the erection of *Shamrock II*, no fewer than sixty models were made, the experiments lasting over a period of nine months. Before the Cunard Steamship Company gave out the contracts for the building of their two turbine giants, the *Mauretania* and the *Lusitania*, special experiments with models, which extended over several months, were made in the Government tank at Haslar. From these tests the form and dimensions of the liners were determined. Then, Messrs. Swan, Hunter & Wigham Richardson, who built one of these vessels on the Tyne, carried out a special series of experiments with large models in the Northumberland Dock of the River Tyne Improvement Commissioners. These last-named tests were to ascertain many



READY FOR A TEST.

(*Note the model attached to the carriage.*)

authorities experimented with a submarine craft of the Holland type. Then models of steamers and yachts have been also tested upon this little lake. The Government allow private shipbuilders to use the tank, provided they defray the actual cost of same, and that their experiments do not interfere with naval work.

At one end of the tank there are two troughs and a "wave-breaker," which causes the little waves to subside rapidly after a test has been carried out. Without these appliances it would be a very lengthy operation to run trials at high speeds, as very long waits between runs would be necessary in order to allow subsidence of waves. All the models are handled by electric cranes, while the building is artificially heated. All the windows can be opened or closed automatically from the moving carriage.

As already stated, many private shipbuilding firms possess these interesting basins. Messrs. Denny Brothers particularly have a very fine one at the Leven Shipyard. It is 300 ft. long, 22 ft. wide and 10 ft. deep, and holds 1,500 tons of fresh water. In this tank numerous models of Sir Thomas Lipton's racing yachts, the *Shamrocks*, were tested. Indeed, necessary points, not the least important of which was the best position for placing the propellers.

A NEW drawing-office table is being made by Messrs. S. C. & P. Harding, Ltd., of Denmark Hill, S.E., the special features of which are that it is adjustable, portable, and collapsible. The top of the table is carried on a framework of telescopic tubes, and may be locked at any height or at any angle suitable for the work in hand. When locked it is thoroughly rigid, a feature which all draughtsmen will appreciate. There is plenty of room beneath the horizontal cross-bar in front for the draughtsman's knees, when he finds it more convenient or more pleasant to sit at his work, and he can in a moment alter the level of his board, or fix it in any position from horizontal to vertical. The table can be packed into very small compass when not in use. The telescopic rods are closed up, the bottom ties and the wooden head folded against the front legs, and the whole is then quite flat and can be stored away or placed against a wall until required.

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Chats on Model Locomotives.

By HENRY GREENLY.

(*Continued from page* 32.)

VALVE GEARS.

THE recent descriptions of the various valve gears applicable to model locomotive builders, judging by the correspondence which they have evoked, have evidently aroused a latent interest in this most absorbing branch of model locomotive work, and I therefore make it my duty to reply to several readers who have written concerning the "new" valve gear.

Mr. John Lord, of Barrow-in-Furness, who has had some considerable experience in model locomotive building, writes as follows:—"I have never turned attention to the Joy valve gear until the interesting articles have appeared of late. On drawing out the new gear I find that the discrepancy at the admission and cut-off is not quite up to my standard, and have therefore drawn out the gear shown in the accompanying drawing (Fig. 1). The anchor link can be dispensed with and the vibrating link made to pass through a round hole in the brass plate. No *lead* is possible, but I always advise a little *lap* with two cylinders, the power lost being of slight consequence at such a small leverage, the other cylinder, of course, being a full stroke. The only drawback is the friction of the pin in the slotted connecting-rod, but I believe it would prove much less than link gear or rocking motions. The engine I told you about some time ago was a great success, hauling 60 lbs. nicely. You will remember me stating that I had adopted an extended flue; this was a great improvement, and I see that Messrs. Carson have the same idea.

J. L.'s letter interests me very much, as it shows how different people quite independently devise the same mechanisms. The gear illustrated in Fig. 1 was, I believe, used by Messrs. Carson & Co., Ltd., when they first brought out their "Precursor" locomotive, but the anchor link was placed the other way round—that is, in the position which it is usually found in actual practice. This, however, is a point which does not affect the working of the gear except so far as it is more convenient to place the fixed pin or suspension point of the anchor link (marked A on drawing) in front rather than behind the vertical vibrating link, as shown by J. L. Furthermore, I do not think J. L. quite clearly expresses what he means when he says that "the anchor link can be dispensed with and the vibrating link made to pass through a round hole in the brass plate." Should the sentence finish, "made to work in a fixed vertical slot in a suitably arranged brass plate at its lower extremity"?

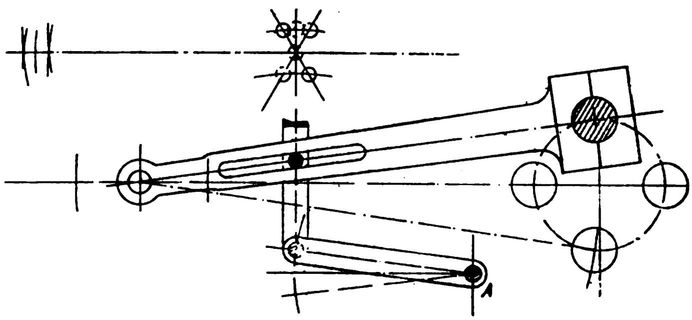

FIG. 1.—MODEL LOCOMOTIVE VALVE GEAR SUGGESTED BY MR. J. LORD.

Then there is another point. J. L. speaks of the discrepancy at the admission and cut-off points. If, however, he will make diagrams of the two motions, one of the "new" gear and the other of the slotted connecting-rod arrangement, he will find that, owing to the extension of the vibrating link of the former to an amount which nullifies the error, no difference will appear in the two arrangements with regard to the *timing* of the cut-off and steam admission points. The valve motion with the lug on the connecting-rod gives an unequal port opening only, which I think we agreed was not important. Nearly all 90 deg. single eccentric and radial valve gears without lap and lead motions open and close the valves at the dead points in the stroke. Therefore the "new" gear is no better or no worse than any other form. The feature of the "new" gear is its absolute simplicity, that is, neglecting any claim made for the superiority of the circular slides.

Of course, the provision of lap without advance upsets the timing a little, but a little lap is necessary, as in oscillating cylinders, to prevent leakage of steam direct from the steam passages to the exhaust as the valve traverses the middle portion of its stroke.

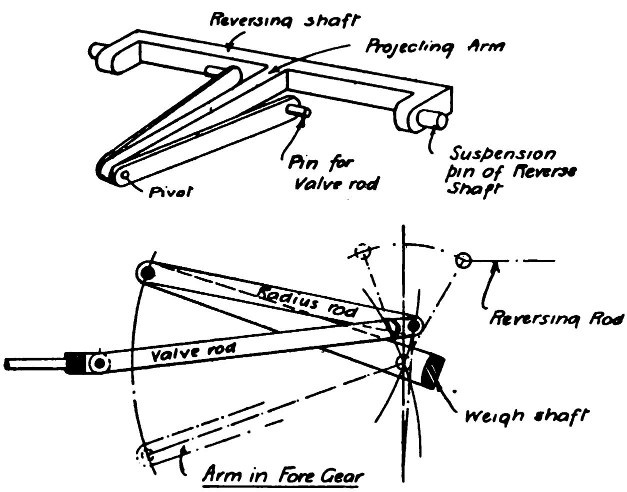

FIG. 2.—PERSPECTIVE SKETCH OF VALVE GEAR WITHOUT CURVED SLIDES, FOR A MODEL TANK LOCOMOTIVE.

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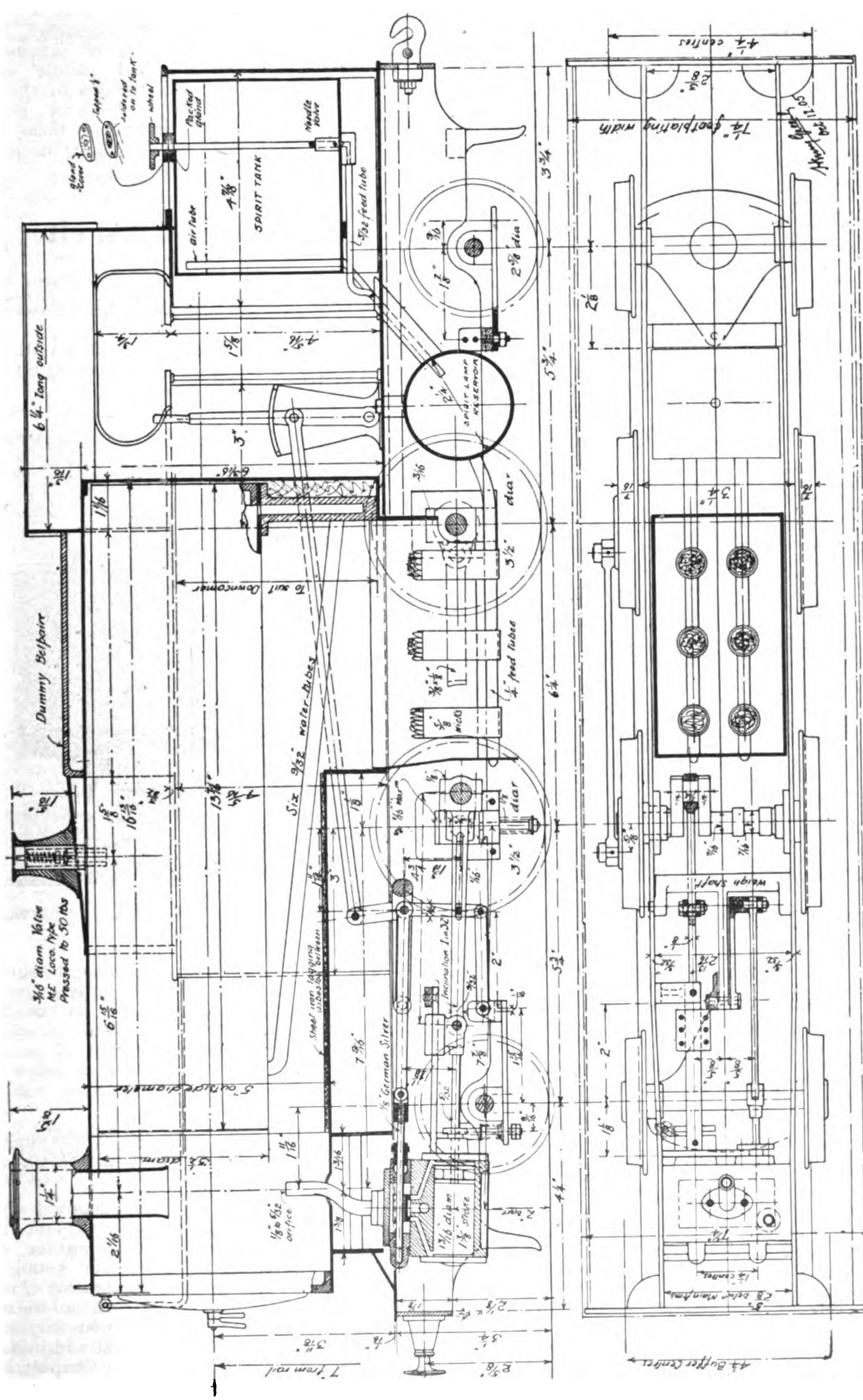

A DESIGN FOR A MODEL 2—4—2 TYPE TANK LOCOMOTIVE.

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Following Messrs. Carson & Co.'s lead, some two years ago I designed a locomotive for a private gentleman which was intended for an out-door track, and which embodied the slotted connecting-rod idea. Curved slides, however, were dispensed with, and in place of these the reversing shaft was provided with a projecting arm at the centre, which carried from a pivot pin or fulcrum at the end of this arm two radius rods, one for each cylinder. A sketch of the arrangement is included, as well as a drawing of the complete engine.

The valve travel was obtained by tilting the reversing arm one way or the other from the central horizontal position, as in Bremme's valve gear. The movement of the pin to which the end of the valve rod was attached was, therefore, exactly the same as obtained by a die working in the slides of the curved slides of a Joy's reversing shaft, the radius of the slides being equal to the length of the reversing rod. The engine had, by request, a very large boiler—practically an inch scale boiler on a ¾-in. scale engine. The contractors for the model (Messrs. W. J. Bassett-Lowke & Co.) made the whole of the motion and valve gear in mild steel, case-hardened. In addition all pins were large and also case-hardened, as the model, having to work over a sandy track, wear and tear of the parts had to be avoided.

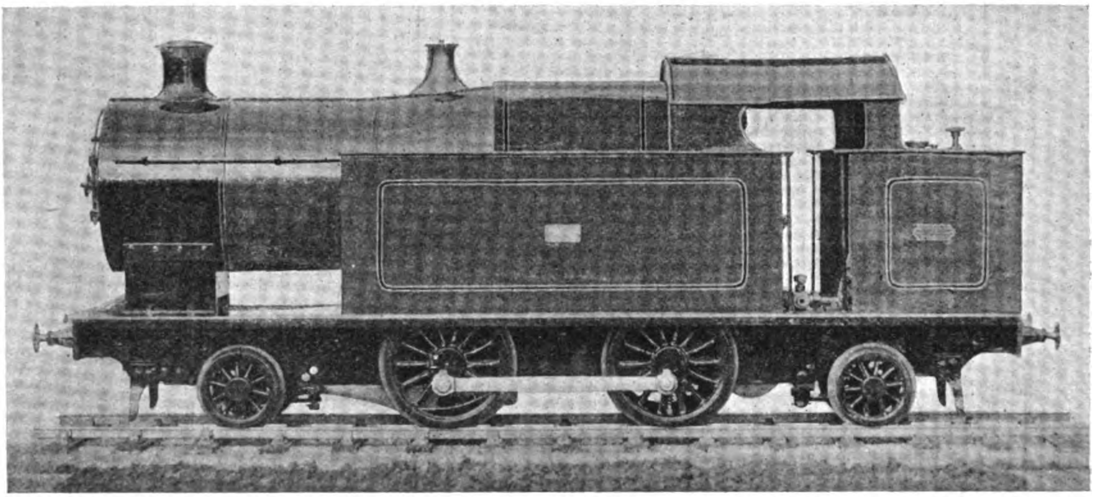

FIG. 4.—PHOTOGRAPH OF FINISHED 3½-IN. GAUGE MODEL 2—4—2 TYPE TANK LOCOMOTIVE.

Except that the gear did away with the sliding or rubbing parts in positions which would materially affect the correct travel of the valve, present experience would tend to show that just as good a steam distribution would have been obtained by a less complex system of levers. However this may be, other readers have used the type of gear with success, *vide* Mr. Marley's description of his 1½-in. gauge tank locomotive in the issue of THE MODEL ENGINEER for December 28, 1905.

Bremme's gear, upon which the gear is based, does not appear to be much used in marine work now-a-days, owing, I presume, to the gear having no practical advantages over "Stephenson's" link motion. Radial gears as a whole have never been extensively adopted by marine engineers, the use of Mr. David Joy's gear being at present more or less restricted to diagonal paddle engines. Wherever space in direction parallel to the crank shaft is limited, radial gears, however, generally score, and it is this fact that makes them worthy of consideration in model inside cylinder locomotives.

(*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.*]

ENGINEERING MATERIALS. By Edward C. R. Marks. London: The Technical Publishing Company, Ltd. Price 2s. 6d.; postage 3d.

The author has entirely rewritten and augmented the second edition of this work. In it is given in a concise form practical information on the characteristics and capabalities of materials largely used in engineering, comprising records of numerous examples of actual tests. A useful index is included, and the volume, making about 100 pages, can be well recommended.

PRACTICAL ADVICE FOR MARINE ENGINEERS. By Charles W. Roberts. London: Whittaker and Co. Price 3s. net; postage 3d.

To those readers who are unacquainted with the first edition of this work we may explain that in that, as in the present edition, the author, who is a "deep-sea" hand, has given the young prospective engineer a very readable collection of reliable notes on the practical doings and duties of the marine engineer. In this the second edition the scope of the book is as hitherto, but several additions have been made, and the text revised. Chapter I deals with the engineer—his social position and his

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duties. In it will be found some very practical and sound advice, which those about to enter the profession will profit greatly by reading and following. Chapter II is "In the Stoke-hold"; Chapter III, "The Donkey Boiler"; Chapter IV, "In the Engine-room"; Chapter V, "Down the Tunnel"; and Chapter VI is on "The Propeller." In short, this little book is the most pleasant and interesting of its kind we have met with. It is essentially practical, and the way it is written holds the reader's attention. Anyone desirous of becoming acquainted with the work of the marine engineer before actually embarking upon such a career will be well advised to read it.

A NOVEL appliance has been installed in the fire equipment of Nuremberg, Germany, in the shape of a three-wheeled motor steamer, the steam being used both for propulsion and for pumping purposes, and the gear for propelling being placed on the front wheel. The idea of the design is said to be both for new engines and for the conversion of old engines. Liquid carbonic acid and benzine are both used for getting under way and for getting up steam rapidly.

ACCORDING to the *Mechanical World*, calcium carbide in the form of sticks or blocks is now being made in the electric furnace at Niagara Falls, New York. In this form the calcium carbide can be

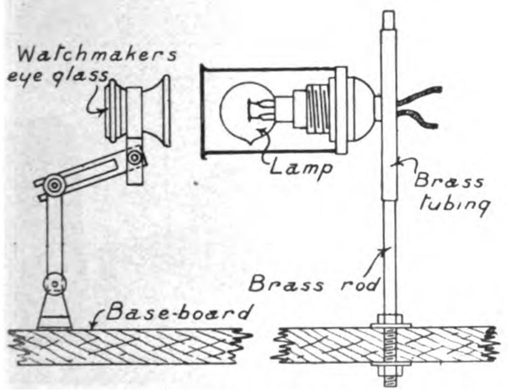

FIG. 1.

exposed to moist air and handled without suffering appreciable decomposition; it can be caused to give off gas with great regularity when used in a suitable generator, and when the generation of gas is to be stopped this can be done practically instantaneously.

A d'Arsonval Galvanometer.

By PERCY W. BAKER.

THE following is a description of a d'Arsonval galvanometer, with scale and lamp, which I have just made, and with which I have obtained some very good results. To construct a similar instrument, first obtain a piece of wood 2 ft. by 6 ins. to form the base for the galvanometer and lamp, which are fixed at the two ends. Next get a piece of brass rod bent and fixed to the end of the base, as shown in Fig. 2. At the end of this a nut is soldered to hold the adjusting screw for

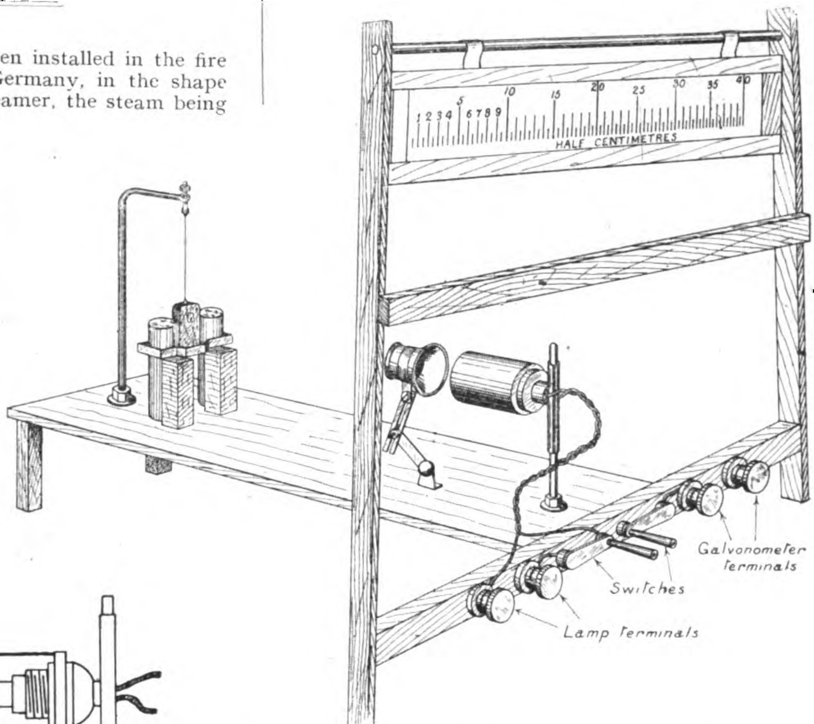

FIG. 8.—GENERAL ARRANGEMENT OF D'ARSONVAL GALVANOMETER.

the coil (Fig. 2), which must come exactly over the centre of the magnet to allow for the coil to swing within the magnet poles without touching either sides. The coil is made of beech wood (Fig. 6), and is wound with eight layers of No. 42 s.c.c. wire, well soaked in paraffin wax, and the two ends are fixed to two brass pins which are fixed at each end of the coil. The top pin is then fixed to the adjusting screw at the end of the brass rod by a piece of silver wire (the finest that can be obtained) to allow for the coil to swing freely within the magnet poles. The bottom pin is then fixed to a pin in the base in the same manner, except that the silver wire used for connecting should be twisted into a spiral, so as to give the coil easier movement (Fig. 4). Near the top of the coil the small mirror is fixed, but care must be

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taken to leave room for the clamp (Fig. 5) which holds the coil in place when not in use. At the other end of the base the lamp is fixed on in the following manner :—First obtain a piece of brass rod and fix it to the base (Fig. 1) for the lamp to swing on. This consists of a round tin with a

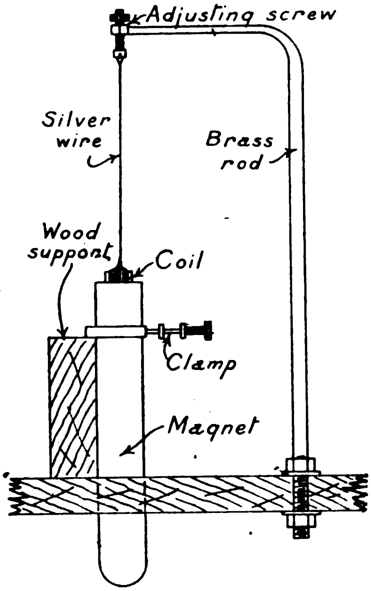


FIG. 2.

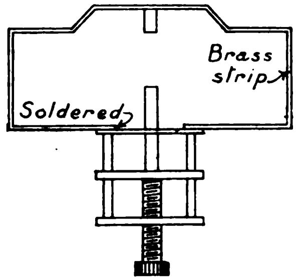


FIG. 5.

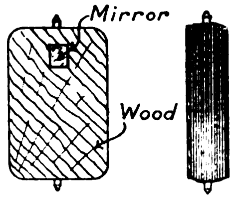


FIG. 6.

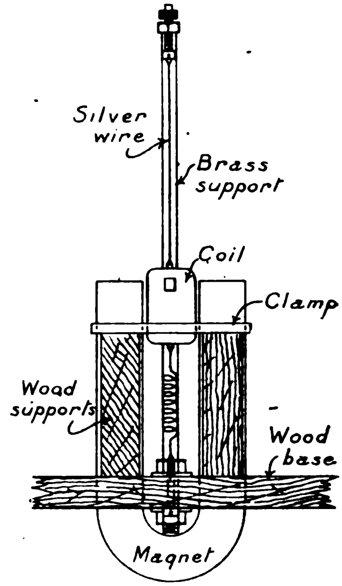
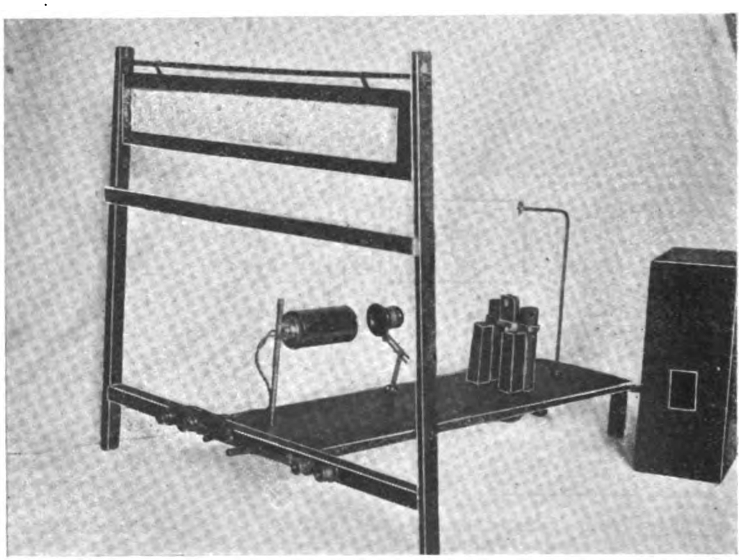


FIG. 4.

hole cut in the end to fix it to the lamp-holder, which is one such as is used for ordinary electric lamps. To the connecting-posts inside the holder connect two pieces of copper wire, which are next connected to a 4-volt 4 c.-p. Osmi lamp (Fig. 1). A small hole about 3/8 in. diameter is then cut in the lid of the tin to allow for the light to shine on to the mirror on the coil. Between the lamp and the coil a watch-maker's eyeglass is fixed (Fig. 1), which can be adjusted so as to focus the lamp on to the mirror and so adjust the reflection on the scale.

The scale (Fig. 8) is made of transparent paper marked off in half-centimetres, and is suspended to a brass rod which is fixed to the two uprights which holds the base in position (Fig. 8). Along the bottom bar to which the base is fixed there are the connecting terminals for the battery and galvanometer, each of which has a switch, the one for the galvanometer being used in the place of a tapping key. The mirror on the galvanometer will have to be fixed on after the scale and lamp are in position, because it will require tilting at an angle, so as to reflect the image of the lamp on to the scale. This can be fixed in position with thick shellac varnish, and then allowed to dry.



MR. PERCY W. BAKER'S D'ARSONVAL GALVANOMETER.

This instrument, if made as described, a 1,000,000th part of a volt should give one millimetre deflection on the scale. To obtain a 1,000,000th part of a volt, get a piece of copper and constantan wire, and solder two ends together. This forms a thermo-couple, the voltage of which is ·00004 of a volt for a rise in temperature of 1° C. Next get some water the temperature of which is 1° C. above the temperature of the room in which the thermo-couple is. Connect the remaining end of each wire to a terminal, and allow the spot to come to rest. Then plunge the soldered ends

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of the wires into the water, and a deflection of about 36 millimetres should be obtained.

It should be mentioned that the photograph of the instrument was taken when the coil was clamped.

An Example of Slender Turning.

An exceedingly interesting specimen of slender turning has been produced by Mr. Henry Lea, of Birmingham, in his private workshop. The specimen is 0·062 in. in diameter and 26 ins. long, and was turned down from a mild steel rod 3-16ths in. in diameter, in a 5½-in. screw-cutting lathe. Of course, such turning as this cannot possibly be done without a "steady" travelling with the turning tool, and upon the kind of steady used depends in a large measure the success of the operation. The steady used by Mr. Lea was designed and made for him by Mr. James Tangye, in his charming private workshop near

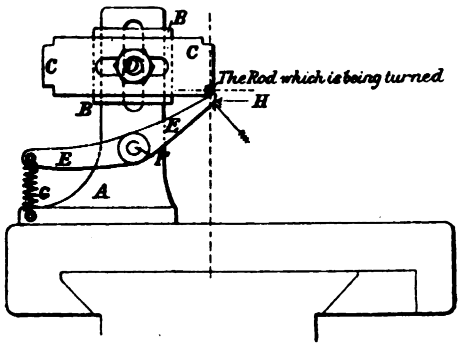

Fig. 1.—Elevation of Steady looking towards Back Centre.

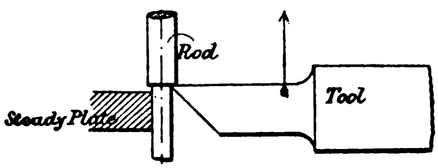

Fig. 2.—Enlarged Plan, showing Lead of Tool.

TURNING A SLENDER ROD.

Redruth, and is shown in the illustration, which we reproduce from *Engineering*. The bracket A, Fig. 1, is bolted to the lathe saddle. It carries a vertical slider B, which again carries the horizontal slider or steady plate C, which is hardened, and has notches in the four corners, of sizes to suit the rod to be turned. The bolt D locks the two plates to the bracket. E is a lever turning upon a pin F and provided with a coil spring G, the effect of which is to press the nose H against the under side of the revolving rod in a slightly inclined direction, shown by the arrow, thus keeping the revolving rod in close contact with the two sides of the notch in the plate C.

One end of the 3-16ths-in. rod from which the specimen was produced was held in a chuck; the other end was supported by the back centre. A portion of the rod next the chuck was turned true, and the steady was adjusted to it. The turning tool (Fig. 2) is a very keen side-tool, facing away from the chuck, and its cutting edge was normal to the axis of the rod, so that the tool had no tendency either to force the rod inwards or to draw it outwards. The point of the tool was set about 0·02 in. in advance of the steady-plate. The speeds were about 250 r.p.m. and 180 turns per inch of travel. Oil was kept dropping on the point of the tool. The first few cuts were about 0·002 in. deep; the final cuts were 0·0005 in. each.

It is most important in work of this kind that the cut should be taken in a direction away from the chuck, and that the pressure of the back centre be so light as not to bend the rod by end compression. As the work proceeds the rod becomes so slender that the steadying effect of the back centre is practically nil, and two loose wooden supports standing on the lathe-bed were used instead, having V notches for the rod to revolve in. As the saddle receded from the chuck, one, and then both, of the supports were transferred to the left-hand side of the saddle, so as to support the portion already turned. The time required for each cut was 12½ minutes.

The first one or two cuts removing the skin left the rod rather crooked, but it became gradually straightened after each succeeding cut, and the last cut left it practically straight. Mr. Lea states that it has not required attention since the tool left it.

One might think that the torsion in so slender a piece of work would be irregular, and would make the process an impossible one; but under the conditions adopted as above described there was little difficulty. The tool marks can be seen to be very regular; in fact, Mr. Lea is convinced that he has not nearly reached the smallest practicable diameter for the length he has treated; but even at 1-16th in. diameter by 26 ins. long, he thinks the work may be regarded as somewhat of a curiosity in turning.

Junior Institution of Engineers.—A visit will be made on Saturday afternoon, July 20th, to R.M.S. "Oruba," and the Tilbury Dock Pumping Plant, &c.

A gas turbine of the Lemale and Armengaud continuous-combustion type, of about 600 h.-p. has been running for some time in the shops of the Société des Turbomoteurs at Paris. Its speed is 4,000 r.p.m., and it drives a Rateau and Armengaud multi-stage turbo-compressor. The speed regulation is effected by throttling the air admission for small speed variations, and by a change in the fuel supply for larger differences, the regulating valves being controlled by a Hartung governor.

A Motoring Record.—In his twenty-four-hours ride, accomplished recently on the new track at Brooklands, Mr. S. F. Edge established a record for distance and also for endurance. The total distance covered was recorded as 1,581 miles 1,310 yards, or considerably over 65 miles an hour. The greatest distance travelled during one hour was over 72 miles, but in one hour Mr. Edge only just cleared his lower limit of 60 miles per hour by a few yards. Two other cars both covered over 1,500 miles on the same track while Mr. Edge was completing his performance. The track was very little damaged by the motors. Mr. Edge stated that he had no mechanical trouble whatever with the six-cylinder Napier car he drove.

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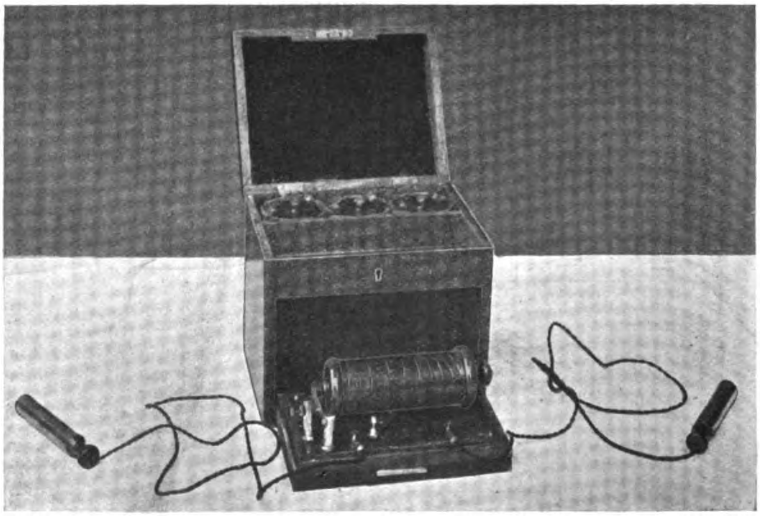
Practical Letters from our Readers.

[*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 First Attempt at Coil Making.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The photograph shown herewith is of my first attempt at coil making. The core consists of a bundle of soft, tinned, iron wire, sweated together, ⅜ in. in diameter; a brass tube slides over it to regulate the current. The primary is made of three layers of No. 18 silk-covered wire, and the secondary is wound with twenty layers of No. 36 wire, waxed foreign note-paper being used between the layers for insulation. The bobbin is 5 ins. long by 2 ins. high; it is covered with fancy leather, which gives it a nice finish. A small resistance is made of German silver wire, and fitted underneath the baseboard, because the current is too strong for some people, even when the slide tube is right in. When the switch is at the left, as in photograph, the current is right off, and as it is pushed to the right it cuts out less of the resistance. When on the third stud from the right the resistance is all cut out; when on the last stud but one, the two cells are being used; and when on the last stud, the three cells are being used. The current can be reduced enough, so that one can bear it on the tongue quite easily; and it can be increased so that twenty people cannot bear the shock for any length of time. The box is made of ⅜-in. oak, dovetailed, stained, and polished. It is 8 ins. by 6 ins. and stands 7½ ins. high.



MR. A. KELSEY'S SHOCKING COIL.

In conclusion, I may add that I have gathered a lot of useful information from both THE MODEL ENGINEER and the No. 11 Handbook on "Induction Coils for Amateurs."—Yours truly,

A. KELSEY.

Re Cleaning Soiled Hands.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I can fully endorse Mr. C. S. Catt's recommendation of "Lasso" soap for greasy hands. It only needs trying to be appreciated, and has the further merit of being cheap. In the cold weather I have found that so much washing in hot water, with any soap, takes considerable natural grease out of the skin that one's hands tend to chap on the backs. This can be prevented by well rubbing in a little vaseline or glycerine before going to bed at night. But it must only be a *little*, or there will be trouble with those in charge of the domestic arrangements.—Yours truly,

Oxford. T. ROLPH.

A Hint for Draughtsmen.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—It has occurred to me that a lot of time might be saved in drawing if the top and one side of the board were marked in inches and fractions. This would dispense with a spare rule, as the distance could be seen from the markings on the board. The same result would be obtained if the square itself were marked instead of the board. Of course, as the stock of the square is short, it would mean marking the edge and top of the board, say, every 3 ins.—Yours truly,

A. ISHERWOOD.

Valve Gear for Model Locomotives.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In common, I feel sure, with the numerous readers of your valuable paper, I have been much interested in Mr. Greenly's notes on valve gear for model engines, and his remarks on the use of slip eccentrics where absolute copying of actual practice is not essential. May I submit a scheme of this nature to your notice which, perhaps, is not very common?

I should mention the rough sketch enclosed is done wholly from memory, so I trust you will excuse any slight inaccuracy in the details. The idea, which I believe is the subject of a patent, but which I should imagine has expired, was carried out very neatly as a reversing arrangement for a launch engine by Messrs. Tipping, of Painswick, near Gloucester.

Briefly, the method consists of a spirally-grooved sleeve surrounding the crankshaft, which is caused to revolve on the sleeve being thrust inwards or drawn outwards by a strong pin or stud (shown black on sketch) inserted in the shaft. The effect, therefore, is to bodily turn the eccentric on the shaft so as to place it in position for "ahead" or "astern," as the case may be. To carry this out,

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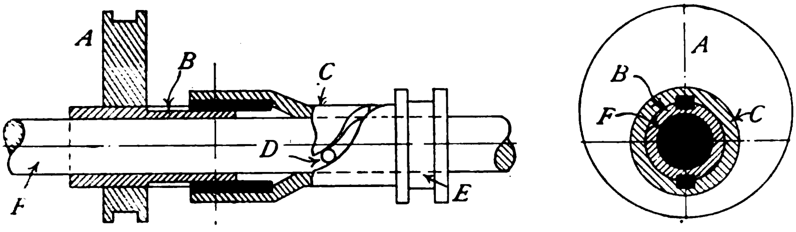
there are two sleeves, one sliding over the other. The outer sleeve is provided with the spiral groove and driven by the stud mentioned; the inner sleeve carries the eccentric and is, of course, loose on the shaft, being connected with the outer sleeve by one or more feathers (shown black on sketch). There is some contrivance, of course, to prevent end suction of the inner sleeve and eccentric, but of this I am not certain, as it is over twenty years since I saw the illustration of the gear in *Engineering*.



A, eccentric; *B*, inner sleeve; *C*, outer sleeve (shown partly in section; *D*, spiral groove and stud; *E*, collars for reversing lever; *F*, crankshaft.

It is probable there are serious difficulties in the way of this device being used for a model locomotive, but I venture to send it on the chance it may be useful to your numerous readers.—Yours faithfully,
SIDNEY RUSSELL.
Cranbrook.

CANDLE-POWER OF FROSTED LAMPS. — The diminution of candle-power of frosted lamps has lately been receiving attention, and the results of investigation show that this diminution is very considerable. In tests reported in the *Electrical World* the average m.s.c.-p. of sixteen new lamps of clear glass was 13·4. The same lamps, acid-frosted and tested again, gave 12·6. Six 88-per-cent. lamps (clear glass) gave 11·6 m.s.c.-p., and frosted gave 9·95. Ten 80-per-cent. lamps of clear glass gave 10·6 m.s.c.-p., and frosted 8·6, so that the loss due to frosting of new lamps was 6 per cent.; of 88-per-cent. lamps, 14·3 per cent.; and of 80-per-cent. lamps, 18·9 per cent. The absorption by glass and carbon in the three cases worked out at 5, 11·7, and 15·7 per cent. respectively.

RAPIDITY IN FITTING STEAMER MACHINERY.—Something like a new record has been made in connection with the fitting of machinery to steamships by Messrs. Barclay, Curle & Co., Ltd., who have recently launched the steamer *Peiho* for the Messageries Maritimes of France. On May 31st they commenced the work of putting aboard the machinery, which includes a set of triple expansion engines, having cylinders 26 ins., 45 ins., and 76 ins. in diameter, with a 54-in. stroke, designed to develop 3,200 i.h.-p., with four single-ended boilers working at 200 lbs. pressure. The four boilers were put in on Friday afternoon, the time occupied being from 6.30 p.m. to 8.30 p.m. The whole of the work in the stokehold, including the fitting of funnel and ventilators, was completed in 7¾ hours. The engineers started work on the engines on Monday morning, June 3rd, and at 5 p.m. in the afternoon the cylinders and the whole of the working parts were on board. This (says *Engineering*) is a very splendid performance in engine fitting.

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:—

[17,836] **Model Steamer Machinery.** W. S. W. (Manchester) writes: (1) Can petrol be used in a burner made for benzoline (as shown in THE MODEL ENGINEER handbook, "Machinery for Model Steamers")? (2) At what speed should a boiler evaporating about ·5 cub. in. of water per minute drive an engine ⅜-in. bore, ½-in. stroke, at 30 lbs. pressure; and would the speed of the engine be increased by fitting a slide-valve with a small amount of lap and early cut-off (the present valve has no lap whatever)? (3) What reduction in speed would be most suitable for a force pump for above engine and boiler, and what efficiency should be calculated in working out size of pump? (4) I find considerable trouble in packing piston of engine. What is the most suitable material to use? (5) About what diameter and pitch twin screws (three-bladed) should be suitable for engine at above pressure—30 lbs.? (6) What device would be most suitable for inducing draught while waiting for boiler to start steaming?

(1) Yes, you can use petrol without making any change in the design of the burner. (2) Not allowing anything for heat losses in steam pipes and for leakages, etc., about 1,000 r.p.m. A little, but this will not be due solely to the fact that an expansion stage is provided, but to the compression stage introduced by advancing the eccentric. The travel of the eccentric may have to be increased if lap is added to the valve. (3) See the recent articles on "Some Wrinkles in Model Making." The efficiency of the pump may be reckoned as 50 per cent. (4) Asbestos or darning cotton. (5) 2 ins. diameter, 3-in. pitch. (6) An auxiliary blower worked by "scent spray" bellows. (See "The Model Locomotive.")

[17,821] **Coal Briquettes.** J. C. (Durham) writes: Will you please let me know where I can purchase compressed fuel briquettes and also cost of same? I wrote to Bassett-Lowke & Co., but they told me that they do not now stock briquettes.

We have made enquiries and find that "Union" briquettes are of Rhenish origin, but there are now no agents in this country stocking them. What about "Coalite"?

[17,834] **Fitting Water Gauges to Boiler.** C. H. M. writes: Kindly let me know what is the usual plan for getting water gauge in correct alignment. Up to the present I have been unsuccessful, for I find that if the glands are in a straight line, they are screwed out different distances from the boiler plate. Not a great difference it is true, but still the glass is not parallel to the boiler-plate. I have brass pad pieces on inside of boiler-plate for fittings to screw into, silver-soldered and tapped 5-16ths gas thread.

There is no special method except the ordinary workmanlike methods of obtaining alignment of parts being fitted together. The shoulders of the portions of the water gauge which screw into the boiler should, of course, be of the same distance from the vertical centre line of the glass, and the pad pieces should be level and in the same plane. If this is not so, sweat on washers of sufficient thickness to bring the two fittings in line.

[17,604] **Marking Planks on Model Deck.** R. P. K. (Manchester) writes: Which is the best way of marking model decks with black lines to represent planks?

The usual method of marking the planking on a model deck is by cutting with a sharp tool the parallel lines just the width apart required, the marks afterwards being pencilled over and the deck varnished.

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[17,820] **Force Pump; Boiler Proportions.** W. J. L. (Heaton) writes: I have a horizontal engine, 2-in. bore and 2-in. stroke, and now wish to fit a force pump to same. Having an eccentric of 1-in. throw, I should be pleased if you would tell me what diameter I should make the plunger and size of suction and delivery valves; also what size of boiler could you recommend to work the engine at a pressure of 50 lbs. per sq. in.?

A horizontal engine with a cylinder 2 ins. by 2 ins., working at 50 lbs. per sq. in., will consume not less than 3½ cub. ins. of water per minute at 100 revolutions. Therefore, with a travel of 1 in. the plunger would have to be, reckoning 25 per cent. on for boiler and engine losses and 50 per cent. for pump efficiency:

2 × actually water consumed = area of plunger × stroke × revs.

2 × say, 4½ = " " "

Therefore $\frac{2 \times 4\frac{1}{2}}{100 \times 1}$ = area of plunger.

·09 in. = area of plunger.

$\frac{11}{32}$ in. = diameter of plunger.

If the engine runs over 300 or 400 r.p.m., then the diameter of the suction and delivery valves should be very little less than that of the plunger, and the lift should be restricted either positively or by the use of a spring. We presume that the maximum number of revolutions per minute will be about 400 per minute, and recommend that you provide for an evaporation of 4 × 3½ = 14 cub. ins. of water per minute. If the choice of generator falls on a coal-fired vertical multitubular boiler with riveted steel shell, then we do not advise a smaller boiler than a 16 × 30 with fourteen or fifteen tubes, 1¼ ins. diameter. Height of firebox, 12 ins.; thickness of plates, 3-16ths in.; working pressure, 50 lbs. per sq. in.; test pressure, 100 lbs.

[17,866] **Bending Brass and Copper Pipes.** R. T. (Cleckheaton) writes: Please tell me the best method of bending small brass and copper piping for making connections between engine and boiler?

In reply to your inquiry, the following methods may be adopted:—(1) Fill with molten resin, and bend when cold. (2) Fill with damp sand, well rammed in, and then bend. (3) Fill with molten lead and bend when cold. In (1) and (3) the respective fillings can be run out after the bending is completed, by heating to the required temperature.

[17,865] **Handy Planing Machine.** R. B. (Kirkcaldy) writes: I have a small hand planing machine, 18 ins. stroke by 7 ins. wide, driven by rack and pinion. I wish to convert it to power drive by an electric motor and shafting. I do not care for the usual pulleys and shafting belt, as it is too complicated, and would prefer to adopt some kind of crank drive. Would you please say how this could be managed?

You could gear the motor to a large toothed wheel which carries a crank-pin, and connect the planer to the crank-pin by a connecting-rod. The latter could be made capable of adjustment within certain limits, and the crank-pin also of variable stroke. If you had sent a scale or dimensioned sketch of your planer we might have been able to speak more definitely. Does the bed or tool travel in your machine?

[17,879] **Motor for Model Electric Boat.** F. H. P. W. (Uxbridge) writes: I have constructed a model cargo steamer, 5 ft. 3 ins. long, 8 ins. beam, and 7 ins. deep to keel., and fairly heavy as well. I wish to fit her up electrically. She has a three-bladed propeller, 4 ins. diameter. (1) Would an Avery tramcar motor be suitable? (2) What voltage should the accumulators be? Would 8 volts 20 amps. do? I hope to take my boat on the sea, so I want it pretty powerful.

(1) An Avery motor would do very well and would need to be about 40 watts size to drive boat. Get accumulators to suit voltage of motor, and find, by trial, the maximum weight boat will carry, then fit accumulator accordingly—*i.e.*, using as large capacity cells as she will carry. We should advise a 10-volt 4-amp. motor.

[17,773] **Small Electric Motor for Model Locomotive.** J. P. (S. Norwood) writes: I should be very pleased if you will kindly answer the following queries regarding my model railway. The following are particulars of what I intend to do. I am going to have a "Don" motor, price 6s. 9d., geared by spur gearing to the wheels of the tender of the engine (4—6—0 type), bogie tender, tender wheels = 1½ ins. diameter. For the current I shall have eight bichromate batteries, each battery consisting of two carbons, 7 ins. by 2 ins. by 5-16ths in., and the zinc 7 ins. by 2 ins. by ¼ in., connecting two sets of four in series in parallel. To pick up current (by a slipper block) there will be a No. 14 S.W.G. copper wire soldered on to screws, screwed at intervals of 1 ft. each in the centre of the sleeper. The armature of the motor is 1½ ins. diameter by ¾ in. wide. (1) I want to wind the "Don" motor for 6 volts. What will be the size and weight of wire for the field and armature respectively? (2) With what ratio shall I gear the motor to the tender wheels? (3) Will the battery give enough current to the motor (when wound for 6 volts and connected by a suitable ratio of gearing) so that it will pull four bogie carriages about 10 lbs. in weight? (4) Could I have thinner wire for the centre rail, or what gauge would you suggest? (5) The rails being strip steel, ¼ in. by ¼ in., and get very rusty on top, do you think I shall be able to pick up the current *via* the wheels or even through a slipper block that slips on the running rails?

(1) Use No. 28 S.W.G. for armature and No. 26 for fields, connected in series. Get on as much as you can in the space. This motor is barely large enough for the work you want it to do, but provided it is supplied with plenty of battery power, you can experiment with various gears to get best results. (2 and 3) See above Try 1 to 5. (4) A flat section third rail is best to get good contact. (5) You will not get good contact if rails are in bad condition. It is immaterial which rail you use provided you obtain good contact. We should advise copper or brass, however, and a sliding shoe to pick up current.

[17,811] **Horse-power of Engine.** A. T. B. (Leytonstone) writes: I have an engine, 3-in. bore, 6-in. stroke; steam pressure, 60 lbs. Can you oblige me by telling me the horse-power?

Assuming 50 lbs. at boiler, and say 33 lbs. at cylinder, also 500 r.p.m., the indicated horse-power will be—

$$A \times L = \text{I.H.P.} = \frac{7 \times 3}{10 \times 2} = \frac{21}{20}$$

or approximately 1 i.h.-p.

[17,838] **Solder for Aluminium.** L. J. E. (Cork) writes: I would feel much obliged if you would kindly let me have a reply as to how I can make some small aluminium castings. My great difficulty at present seems to be a suitable flux, but as I have no experience of this metal I would be obliged for any particulars. I have about 1½ lbs. of aluminium in turnings and filings, chiefly turnings, and tried a little of it under the blowpipe with different fluxes, but whether it was my fault or not I was not very successful. A white oxidation seemed to come and made it very difficult to get the molten metal to unite. I am enclosing a small piece that turned out best with chloride of potassium as flux. Perhaps you know of some inexpensive book that deals with this subject. I found a price-list of solders lately in a dental catalogue, and amongst them was one for aluminium at 10s. 6d. per lb. There were no details, and I have never seen any soldered work, but have often heard that it is possible to get a strong joint. Would you kindly let me have your opinion on this also?

A good solder for aluminium consists of aluminium, 1 part; phosphor tin, 1 part; zinc, 11 parts; and tin, 29 parts. The aluminium should be melted first, and then the zinc added to it, in small pieces, then the tin also in little pieces, and lastly the phosphor tin. Acid is not used for soldering. The surfaces are thinly covered with the solder in the usual way, and then brought together and heated up with the bit, or a blowlamp. The solder then unites the two surfaces, and when pressure is applied, the joint is finished. Aluminium must be brought to a very high temperature —about 600° F.—before it can be soldered. We do not know of any book on the subject, and we daresay you will have to experiment considerably before you succeed in producing good castings

[17,777] **Tractive Force of L.S.W.R. Four-cylinder Locomotive.** H. H. R. S. (Streatham) writes: Could you please tell me the tractive force of the new S.W. Ry. four-cylinder (simple) six-coupled engines? I have your book, "Latest Locomotives for 1906," but it does not give it for this locomotive. Do you consider this locomotive the most powerful in this country?

The tractive force, reckoning 80 per cent. of the boiler pressure in the cylinder, would be—

$$2 \times \frac{D^2 \times L}{DW} \times 80 \text{ per cent. of } 175 \text{ lbs.}$$

$$= \frac{2 \times 16^2 \times 26}{72} \times 140 \text{ lbs.}$$

$$= 184 \times 140.$$

$$= 25{,}760 \text{ nominal tractive force.}$$

The tractive force of the G.W.R. four-cylinder engines is given at 26,360 lbs.—*vide* "Locomotives of 1906," by Chas. S. Lake.

[17,705] **Steam Engine for Dynamo Driving.** S. R. H. (Dublin) writes: I have purchased a slide-valve cylinder (¾-in. bore, 1½-in. stroke). I intend constructing an engine to drive a 100-watt dynamo, which I have built from specifications in your Handbook (No. 10). If you would kindly answer the following I would feel much obliged. What power (brake horse-power) may I expect at 10, 15, 20, 30, 40, and 50 lbs. boiler pressure from above cylinder? What speed should engine run at?

The maximum speed for continuous working would be about 500 r.p.m., and the indicated horse-power at 50 lbs. boiler pressure, and this speed would be—

$$A \times L = \text{I.H.P.}$$

$$\frac{44}{100} \times \frac{3}{2 \times 12} = \text{1-18th I.H.P.}$$

The maximum output in watts would be: ¾ × 1-18th × 750 = 10 watts approximately. Therefore you would want ten engines of the size contemplated. The power at 10 lbs. pressure would be 1-5th of the above, and other powers in direct proportion to the working pressure. A 2-in. × 2-in. (or possibly a 1½-in. × 1½-in.) high-speed engine should be used to drive the dynamo.

[17,752] **Arranging Drive of Small Lighting Plant.** O. K. M. (Putney) writes: I should be very much obliged if you would

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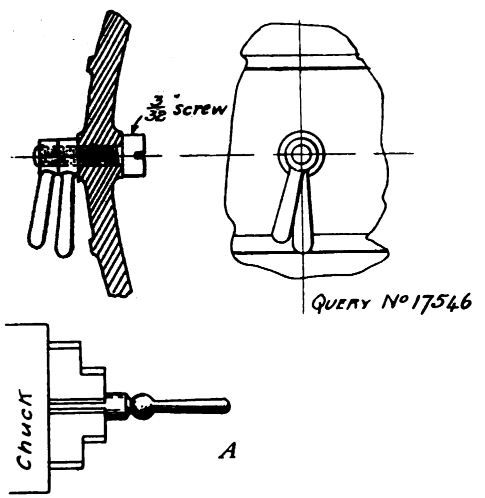
assist me in the following. I am making a small dynamo, to give 25 volts 6 amps. for direct lighting; revolutions at about 2,200 p.m. My trouble is—not how to make dynamo, but how to drive it. I can either drive it one of three ways: (1) from some shafting going at 200 r.p.m. in a sawmill, but, of course, when engine stops for a belt to be put on, electric lights will go out; how to get over this trouble? (2) or, by a water motor, but water is only at 20 lbs. per sq. in., so would mean very big water motor, but as exhaust water can go through circulating pump to mill condensing-tank, I can have a pretty big supply of water; what sized wheel, and how many cups, and size of jet? Which way would you advise? I prefer water motor as being easiest to make, if drive from shafting is not possible. I have asked price of accumulators to discharge at 6 amps. for the few minutes that engine is stopped, and they would cost £6. Can you suggest any improvements?

We should prefer to drive from shafting, this being most economical and suitable provided the speed does not vary greatly. Can you not arrange to drive dynamo from the main engines, or from such portion of the main shafting as is between the engine and the clutch or fast-and-loose pulley? We think some such arrangement is the most feasible and certainly the least inexpensive. With a water motor to develop the necessary ¼ b.h.-p., the pressure being 20 lbs., you would need a ⅜-in. jet, consuming, or rather passing, 6·9 cub. ft. p. m., and a 15-in. wheel. We cannot give fuller details of the former method without fuller particulars of the case.

[17,546] **Locomotive Smokebox Door Handle.** N. M. (Harrogate) writes: Could you suggest a fastener for a smokebox door, cast in one piece. I should like to have two handles to it, like the large locomotives have.

In reply to your query, we submit herewith a sketch showing a simple method of fitting dummy handles to a small model locomotive having a solid cast smokebox front. The drawing is reproduced full size, and shows the door drilled and tapped for a 3-32nds-in. screw. This screw should be long enough to project ¼ in. through



FITTING A LOCOMOTIVE SMOKEBOX DOOR HANDLE.

the front of the door. The handles should be made out of the solid, eye being filed roughly to shape and drilled and tapped for the screw stempiece. Before being parted off from the strip of steel out of which they are formed, the handles should be turned or filed to shape and polished. They then may be held in a pin vice to finish the eyes. A very good result would be obtained by turning up a piece of steel rod, as shown at A, then filing the large spherical end flat on two sides, and drilling and tapping the correct size for the screw.

[17,722] **Wicks for Spirit Lamps.** S. G. B. (Oxford) writes: I have read somewhere that wire, of iron or other metal, can be employed to form wicks for spirit lamps used in firing model locomotives, and I think the same purpose has been effected or suggested as regards asbestos. Perhaps you would be so kind as to enlighten me. Supposing that wire could be so utilised, what should be the fineness of it to ensure capillary action, and should it be plaited or in bundle form; and, further, would the wire act with cycle oil? Also the same queries about asbestos.

In reply to your query, iron binding wire may be used for wicks of a methylated spirit lamp, but although superior to cotton wick—because of its lasting properties—we think that asbestos wick is better. The wire should be about 24 S.W.G. gauge, and need not be plaited. The heat of the lamp helps the action in the case of a methylated spirit lamp, and therefore we are not so certain as to its success in a cycle lamp. We will try it. Asbestos yarn should satisfactorily get over the trouble of cycle lamp wicks burning away; however, this needs a practical trial to find out whether there are any drawbacks to the idea. We are presuming that you intend to apply the wire to a lamp wick. If you wish it for lubricating purposes, what is the construction of the bearing oil-box. A wire is used in the well-known "needle lubricator," and we believe "wire trimmings" are also employed on some railways for syphon as well as plug trimmings in the various bearings.

[17,691] **Steam Engine and Dynamo.** W. C. (Dublin) writes: I have a horizontal engine (1-in. by 2-in.), high-speed type, with two flywheels (6 ins. diameter). (1) What boiler would be suitable for this engine to drive a dynamo? (2) What dynamo would be suitable, and approximate cost of same? (3) What is the best way of firing boiler when gas is not available? (4) Would it be necessary to have a pump for boiler? (5) Does a single propeller always cause a list in model steamers?

(1) The maximum speed in ordinary working would be about 500 r.p.m.; therefore, with 50 lbs. boiler pressure, the engine would consume about 3·5 cub. ins. per minute. The smallest boiler we could recommend would be a 6-in. by 11-in. vertical multitubular boiler, without water-space firebox. The boiler should have fifteen tubes (⅜ in. diameter) or twenty tubes (¼ in. diameter). The boiler could be fired by three burners of the "Hekla" or "Intensive" type. These burners are on the same principle as the Primus burners, but are not silent. The noise, however, is not very great when the burners are not pushed to their fullest output. You can buy a complete stove ready for work, and apply it as shown in Query No. 17,530 in issue of April 25th last. (2) The engine would drive a dynamo having an output of about 20 watts—say, 10 volts 2 amps. (3) Oil or coal. (See answer No. 1). (4) Yes, and unless you can afford to have a very big boiler, you had better work the same from the engine. (5) It depends on the size of the propeller and the power of the engine and boiler whether the list is perceptible, but it is always present in a single-screw boat.

[17,741] **Model Steamer Machinery.** A. F. H. (Neath) writes: (1) What size launch could be driven by a three-cylinder oscillating engine, 1¼ ins. long by ¼ in. bore? I expect that is about 1-in. or ⅞-in. stroke. What length, beam, draught, and depth amidships could it be? (2) What size boiler would be required, and what kind would be most suitable? (3) What size propeller should I want—two or three blades?

(1) A 3-ft. boat at slow speed, say 4½ ins. or 5 ins. beam by 1⅜ ins. draught. A shorter boat might be built, but to carry a boiler of sufficient power greater beam or draught would have to be allowed. (2) A plain cylindrical boiler, about 2 ins. diameter, with a couple of water tubes hanging down from it and a casing of sheet metal to fit the boat. See "Model Boiler Making" (Fig. 1, *a*). (3) Use a 1¾-in. propeller running at high speed. Number of blades immaterial, so long as the propeller is of good design. Pitch, 2¾ ins. You would do better with a two-cylinder (single-acting, we presume) engine of 5-16ths-in. bore and 1-in. stroke.

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.*

Lead Tubing for Model Work.

Those readers requiring strong miniature lead tubing can obtain the same from Mr. C. Pain, 12, Gordon Road, Wycombe, who has sent us a number of samples ranging from ¼ in. outside diameter down to 1-25th in. The tubing is soft and flexible and easily coiled, and will be found suitable for miniature fountains, lubricating models in awkward places, and to serve as a conduit through which to work wires actuating mechanism some distance away. For prices see the advertisement in the last issue of this Journal.

New Catalogues and Lists.

Archibald J. Wright, Leyton Green Road, London, N.E.—The sale list of new and second-hand electrical, mechanical, and other goods includes bells, bell sets, dynamos and motors, telephones and electric lighting fitments, lathes, and other miscellaneous accessories.

The British Cycle Manufacturing Co. (1901), Ltd., 1 and 3, Berry Street, Liverpool.—This firm has issued a very handy little booklet, "The Cyclist's Enquire Within," which will be sent to readers of this Journal post-free upon application.

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The Editor's Page.

THOSE of our readers who may take a Continental holiday, and happen to have an hour or two to spare in Paris, should not omit to pay a visit to the Conservatoire National des Arts et Métiers. Although this building is mentioned in the guide-books, it occupies quite a minor place in the estimation of most of those who write for the benefit of tourists, though this is perhaps hardly to be wondered at when one remembers the many other museums, galleries, and public buildings of importance in this delightful city. The Conservatoire des Arts et Métiers, however, is the Parisian equivalent of the machinery section of the Victoria and Albert Museum at South Kensington, and contains a most interesting collection of models and scientific apparatus, and full-size machines for various purposes. Many of the models of mechanical movements are naturally very much like those in our own museums at home, but there are a number of exhibits which are illustrative of the special genius of French engineers. Amongst these is the original steam carriage or motor-car designed by Cugnot and built in 1770. This is a wonderful piece of constructive skill considering the resources and knowledge of the period at which it was made, and is of great interest as being the first practical example of a self-propelled road vehicle. There are a number of well-made models of locomotives of various types, including several to designs by Stephenson. An interesting historical model is that of the first tubular locomotive built in 1827 by M. Marc Séguin, for the railway from Saint Etienne to Lyons. There is also a model of an American locomotive built in 1841 by Norris, of Philadelphia; and presented by King Louis Philippe to the Louvre Museum in 1846. This model was transferred to its present quarters in 1904. Of modern engines there is a fine model of one of the 6-coupled four-cylinder compound locomotives of the Western Railway of France. This has portions cut away in the cylinders, boiler, smokebox, and safety valve so that the internal arrangements can be seen. The gas engine made by Lenoir, one of the pioneers of gas engine building, in 1861, and presented by him to the museum in 1867, is well worthy of careful examination, as also is the fine model of a Corliss steam engine, built by M. Jourdan, a naval engineer. These are but a few of the many engineering models on view, but we think we have said enough to show that there is much to repay a visit for any one interested in mechanics. There are further sections of the museum dealing with physics, geometry, chemistry, astronomy, metallurgy, the graphic arts, textile work, building, and other branches of applied science.

* * *

We take this opportunity to remind those readers whose custom it is to purchase the bound volumes of THE MODEL ENGINEER as they are completed, that Volume XVI is now ready, and may be obtained from our publishing department price 6s. 6d. net, or post free 6s. 10d. For the benefit of new readers we may say that binding- or reading-cases may also be purchased, price 1s. each, post free 1s. 3d.

Answers to Correspondents.

J. G. (Belfast).—We cannot recommend anything better than pure shellac varnish, made by dissolving shellac in methylated spirit.

W. O. A. (Bengal, India).—A hot-air engine of even ½ h.-p. would be a very ponderous affair, as they are extremely bulky for their power. We strongly advise you to go in for a small oil engine of, say, ¾ or 1 b.h.-p. This would be much more satisfactory and cheaper, too. Hardy and Padmore, of Worcester, would supply you with a reliable engine to run on ordinary paraffin.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

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

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THE

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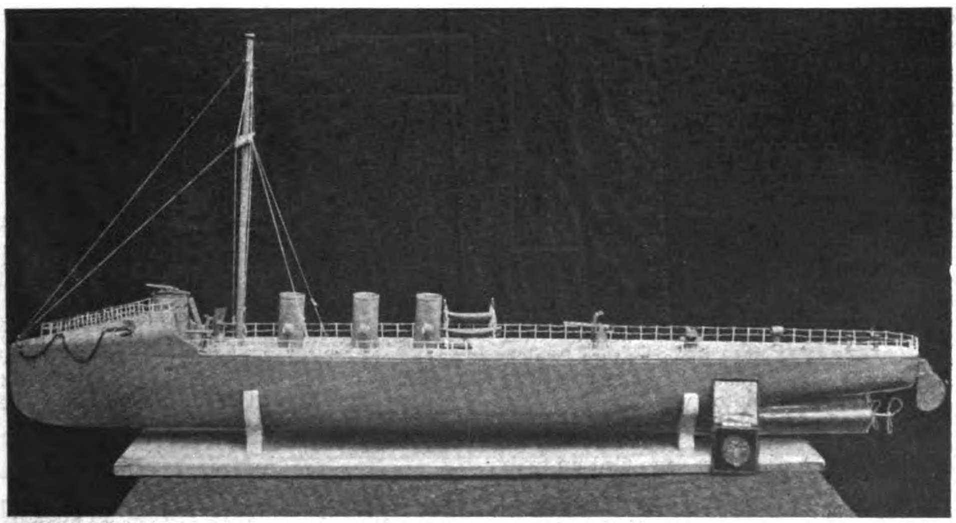
A Well-made Model Torpedo-boat Destroyer.

By E. T. HINWOOD.



MR. E. T. HINWOOD'S MODEL T.B.D.

THE accompanying picture represents a model torpedo-boat destroyer. The hull was dug out of a solid block of yellow pine, and measures 4 ft. 6 ins. in length, 6 ins. wide at centre, and 4½ ins. maximum depth. The turtle deck is also made of yellow pine and, together with the hull, weighs 4 lbs. 2 ozs. The conning tower, which is a circular one, was made from an empty cocoa tin, the bottom of which was carefully cut away and a floor fitted in 1 in. from the top, then fastened to the deck by means of a screw through an L piece, one side of which was soldered to the conning tower. A small ladder, made from two strips of wood and brass wire for the rounds, leads from the deck to the floor of the conning tower in which there is one small gun made of wood. The two forward guns are made of wood and fixed on small stands, also made of wood, and the shields are made from odd pieces of tin.

This model has three funnels, which are round, and measure 4 ins. above deck and 1¼ ins. diameter. They were made from empty chocolate croquette tins. The six cowls are made of wood and were cut roughly to shape with a bow saw and then shaved to proper proportions with a sharp knife. The two small boats are 3 ins. long, and were made from odd pieces of wood, and are slung on davits made from brass wire, the ends of each davit being slightly tapered to give them a neater appearance. The pulley blocks were easily filed to shape from lance wood, and a piece of thin brass wire twisted round them and then fixed to the davits. The large

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gun is made of wood, and is on a stand so made that it can be turned in any direction. This gun makes a convenient handle for lifting a section of the deck to gain access to the propeller, shafts, etc.

The two torpedo tubes are made of brass, ¼ in. diameter, and are mounted on a turntable. The searchlight was made from a piece of brass tube, 1 in. long, into one end of which a piece of wood was driven, and a small pea lamp inserted the other end, and the wires from same carried through the piece of wood just mentioned, and thence by way of a small switch connected to a dry battery below deck. The steering wheel is a dummy, and is made from a cheap watch-chain pendant. The pillar on which the wheel is fixed is a brass one and came from the top of an old bottle bichromate battery. The binnacle, which stands just in front of the steering wheel, came from the back of the watch-chain pendant. The rudder is made of sheet brass, and is made to work stiffly on hinges. The railings were made of stout blanket pins, cut to the proper length and driven into the hull and then thin brass wire fixed to them by means of solder. The anchors were filed out of sheet brass.

This boat is painted grey and has a good finish. The composition was given to me by a friend in Bristol, so I cannot say how it was made. The deck also is grey but has a flat surface. The davits and rails are white, and the anchors and chains black. The chains enter the hull through brass eyelets, such as are used by bootmakers. This boat is electrically driven. The motor castings were bought at a second-hand shop for a few shillings, and required very little work to make them up into an efficient machine for driving the propellers. The field-magnets were wound with 252 turns No. 20 S.W.G., and the armature, which has six slots, sixty-six conductors per slot, No. 24 S.W.G. The weight of motor when finished was 2 lbs. 7 ozs. Two accumulators of 4 volts each are used for driving this motor, and they weigh 3 lbs. each. The two propellers were filed up from castings, and the gearing is by cog wheels. The mast, rigging, and all fittings are detachable, and can be taken off in a few seconds if the boat is wanted to make an extra fast trip. The total weight of this boat with all fittings, etc., is just under 14 lbs. Most of the details and measurements were taken from THE MODEL ENGINEER handbook, "Model Steamer Building," and the instructions therein are so very explicit and simple that no difficulty was found in making this boat. At the Wiltshire Arts and Crafts Association's exhibition, recently held at the old abbey town of Malmesbury, the maker of this model was awarded the first prize medal for the best exhibit in three sections.

AT eight large stations on the Government railroads in Japan tablets are hung up "to provide means for writing reminders for such of the passengers who have anything to communicate to their fellow travellers who do not arrive in time."

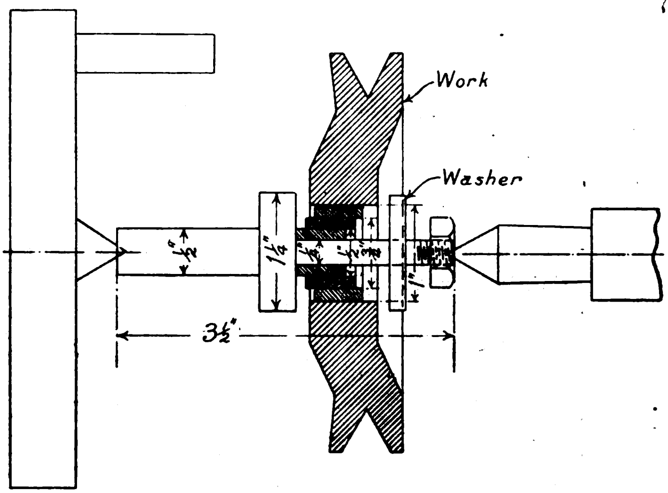
Workshop Notes and Notions.

[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.]*

Device for Turning Wheels in the Lathe.

By C. W. P.

The following is a description of a device which is simple and easily made. It can be used for a great many things, from a motor-cycle pulley to a boiler-end. The shape of the main piece of metal can be seen in the sketch, and should be of hardened

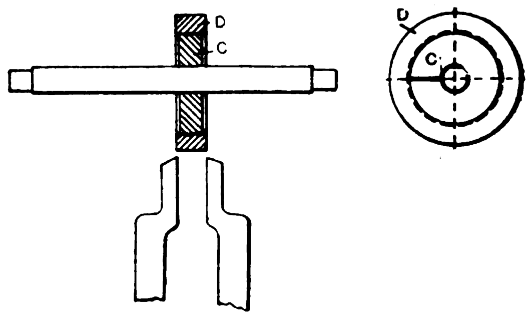


TURNING WHEELS IN THE LATHE.

steel. There are three cylinders (or rings) in my case, but the number and size can be otherwise chosen. They should have a nice fit. When the nut is screwed up against the washer, and the work is pressed against the boss, it is quite rigid and true.

Facing-up Nuts.

A correspondent of the *Mechanical World* gives a neat method—shown in the accompanying sketch —of trueing up nut faces after being made in the capstan lathe. This is an unsatisfactory job to



METHOD OF FACING-UP NUTS.

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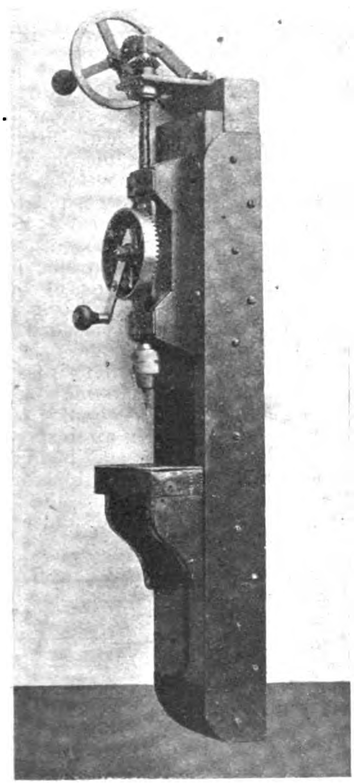
do in a lathe chuck, as it does not ensure the faces being true with the thread or each other, besides needing two settings. Make an arbor with a few thousands of an inch taper, and a collar C bored to fit small end of the arbor, screwed on the circumference to fit the nuts, and split half-way through. Screw nut D on to C, and drive both on to arbor. If two knife tools are set to cut the correct width, both sides can be finished at once, and all nuts will be the same thickness without any trouble.

A Home-made Drilling Machine Frame.

By G. Anderson.

Following is a description of a drilling machine I have fitted up. The baseboard is a piece of hardwood, 24 ins. long, 4 ins. wide, and 1½ ins. thick. To each side of this is screwed a strip of hoop iron,



View of Drilling Machine.

2¼ ins. broad and about 22 ins. long, which projects 1 in. in front of the base to keep the sliding portions of the drill in a vertical position. At the top of the base a piece of iron about 10 ins. long and 2¼ ins. wide is let in flush with back and bent over the top. The top part projects 3 ins. in front of base. At the other end a slot is cut about 9 ins. long and ¼ in. wide, with a recess at the back, so as to allow the head of a bolt to slide up and down.

The table is made of hardwood, and covered with sheet iron, ⅛ in. thick, and filed flat. The sliding part is 6½ ins. long, 4 ins. wide, and ⅞ in. thick; the table is 4 ins. square, firmly fixed to the sliding portion at right angles to the base, and supported by two brackets. It is held in position by a bolt and thumbscrew, so as to allow easy adjustment. The sliding portion of drill is a piece of wood, 9 ins. long, 4 ins. broad, and ¾ in. thick, held in position by four screws. Slots are cut for the screws, 3½ ins. long and ¼ in. wide, which allow it to slide up and down. Screwed to this is another piece, 2 ins. square and 7 ins. long. Upon this is mounted

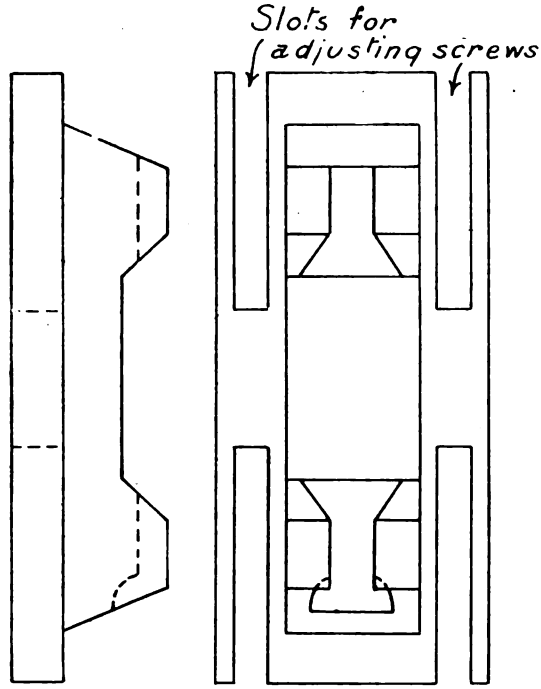


Fig. 1.—Front and Side Views of Drill Carrier.

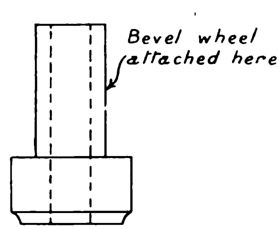


Fig. 2.—Screwed Bush.

a "Millers Falls" hand drill. Both handles are removed from drill. The feeding screw, which is 6 ins. long and ⅜ in. diameter, takes the place of the top handle. The top end of this rod is threaded for a distance of 4 ins. Upon this is fitted a nut, turned, so as to pass through a ⅝-in. hole (see Fig. 2), drilled in the top plate; a shoulder is left on the underside, and on the top side a bevel wheel is fixed.

As will be seen by the photograph, another bevel wheel, which is fitted on an axle with a driving

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wheel, engages with the one on the nut. On turning the driving wheel the nut revolves, thereby causing the raising and lowering action. A space of about 8 ins. is available between the table and drill, but I have centred the ends of an axle 18 ins. long, the table being fixed in a suitable position below the drill. The feeding gear I find very satisfactory, being convenient, and speedy in action. I may add that the bevel wheels were taken from an old sewing machine.

A Small Single-phase Induction Motor.

By C. H. Bell (Canada).

THE following notes on a small single-phase induction motor, without auxiliary phase, which the writer has just completed, may be of interest to some of the readers of THE MODEL ENGINEER. The problem to be solved was the construction of a motor large enough to drive a sewing machine or very light lathe, to be supplied with 110-volt alternating current from lighting circuit, and to consume, if possible, no more current than a 16 c.-p. lamp. In designing, it had to be borne in mind that, with the exception of insulated wire, no special materials could be obtained.

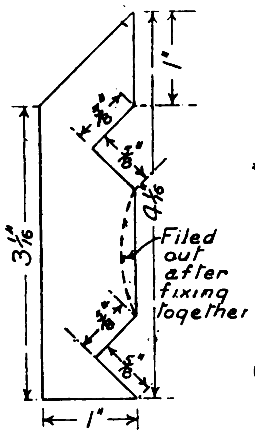

FIG. 1.

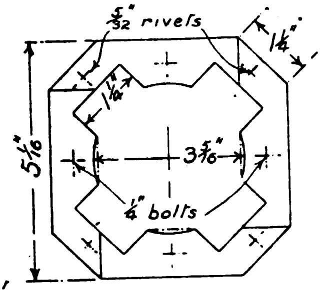

FIG. 2.

(*Pieces in next layer to point in opposite direction.*)

SHOWING CONSTRUCTION OF STATOR.

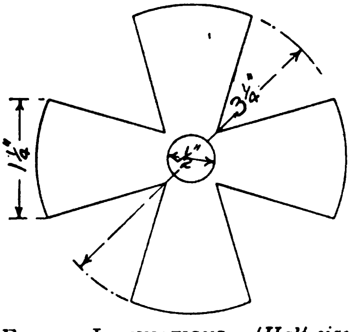

FIG. 3.—LAMINATIONS. (*Half size.*)

The principle of an induction motor is quite different from that of a commutator motor. The winding of the armature, or "rotor," has no connection with the outside circuit, but current is induced in it by the action of the alternating current supplied to the winding of the field-magnet, or "stator." Neither commutator nor slip rings, therefore, are required, and all sparking is avoided. Unfortunately, this little machine is not self-starting, but a light pull on the belt just as current is turned on is all that is needed, and the motor rapidly gathers speed provided no load is put on until it is in step with the alternations of the supply. It then runs at constant speed whether given much or little current, but stops if overloaded for more than a few seconds. As the pulleys on the machinery to be driven, in the writer's case, have V grooves, a loose pulley is not admissible and recourse must be had to a jockey pulley to tighten the belt after the motor has run up to speed.

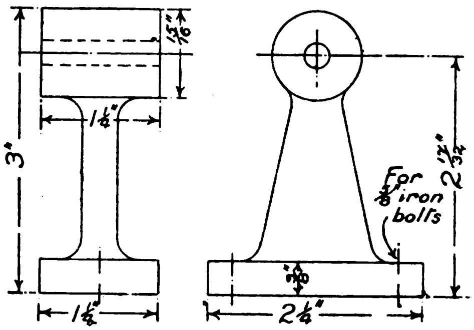

FIG. 5.—BEARINGS. (*Half size.*)

The stator has four poles and is built up of pieces of the sheet iron used in this country for stove pipes, running about 35 to the inch (see Fig. 1). All the pieces are alike, and each layer of four is placed with the pointed ends alternately to the right and left so as to break joint (see Fig. 2). The laminations were carefully built up on a stout board into which heavy wires had been driven to keep them in place until all were in position and the whole could be clamped down. Holes were then drilled and the bolts put in and tightened up, large holes being cut through the wood to enable this to be done. The armature tunnel was then carefully filed out and all taken apart again so that the rough edges could be scraped off and the laminations given a thin coat of shellac varnish on one side. After assembling a second time, the bolts were coated with shellac and put into place

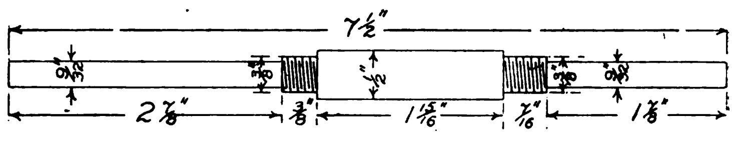

FIG. 4.—SPINDLE. (*Half size.*)

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for good. The rivets at the corners were also varnished before being closed.

This peculiar construction was adopted because proper stampings were not available, and as every bit of sheet iron had to be cut with a small pair of "tinman's snips," it was important to have a very simple outline for the pieces. They are not particularly accurate as it is, and when some of them got out of their proper order while being varnished, an awkward "jog" occurred in the magnet which was never entirely corrected. No doubt, too, some energy is lost through the large number of joints, all representing breaks in the magnetic circuit, but as the laminations are tightly held together and the circuit is about as compact as it could possibly be, probably the loss is not as great as would appear at first sight.

The rotor is made of laminations cut from sheet iron (Fig. 3), which were varnished lightly on one side and clamped on the shaft between two nuts in the usual way. A very light cut was taken in the lathe afterwards to true the circumference. The was well saturated with varnish before the next was put on.

This type of motor has drawbacks as before stated, but if regular stampings were obtained for the laminations it would be very simple to build, having no commutator or brushes, and would not easily get out of order. No starting resistance is needed, and as the motor runs at constant speed, depending on the number of alternations per second of the supply, a regulating resistance is unnecessary. Experience, however, suggests the following modifications in the design. The bed ought to be of metal as wood is liable to shrink and warp; the bearings should be of the self-oiling type as those now used throw the oil about a good deal; and eight bolts through the stator would keep it in shape better than the four shown in the drawings, as the thin laminations tend to spring outwards at the ends when tightly clamped in the middle.

As a meter is not at hand, the consumption of current cannot be stated, but the machine runs from an ordinary lamp socket and does not blow

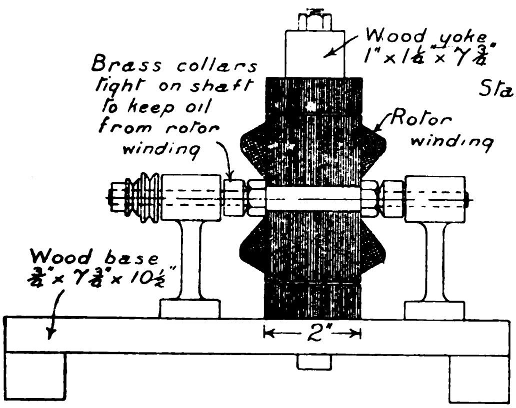

FIG. 6.—LONGITUDINAL SECTION.

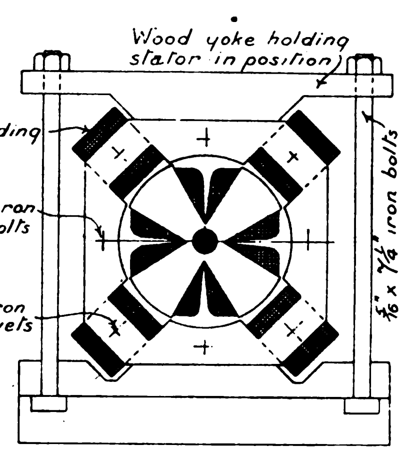

FIG. 7.—CROSS-SECTION THROUGH CENTRE OF STATOR.

(*Scale: ⅓ full size.*)

shaft was turned from ½-in. wrought iron, no steel being obtainable (see Fig. 4). The bearings were cast of Babbitt metal in a wooden mould and bored to size with a twist drill in the lathe (see Fig. 5). They are fitted with ordinary wick lubricators. Figs. 6 and 7 are sections showing general arrangement of the machine.

The stator is wound full with No. 22 D.C.C., about 2½ lbs. being used, and the connections are such as to produce alternate poles—that is, the end of the first coil is joined to the end of the second, the beginning of the second to the beginning of the third, and the end of the third to the end of the fourth, while the beginnings of the first and fourth coils connect with the supply.

The rotor is wound with No. 24 D.C.C., each limb being filled with about 200 turns, and all wound in the same direction. The four commencing ends are connected together on one side of the rotor, and the four finishing ends are soldered together on the other. All winding spaces were carefully covered with two layers of cambric soaked in shellac, and as each layer of wire was wound it

the fuses with which the 16 c.-p. lamps are fitted, so it must take less than 1 amp. The coils become only comfortably warm to the hand while running.

Probably by enlarging the spaces for windings in the stator and adding auxiliary coils, with a choking coil in series fixed to the base, the motor could be made self-starting, but with so small a machine this complication would hardly be worth the trouble.

THE French battleship *Vérité* was launched at Bordeaux with all her boilers and machinery on board, all three funnels up, the lower parts of both masts, most of her armour in position, including the big gun turrets minus the guns, and the secondary turrets with the guns installed. The launching weight was close upon 12,000 tons—that is, within 3,000 tons of the total displacement.

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A Design for a Handy Lathe.

By W. Muncaster.

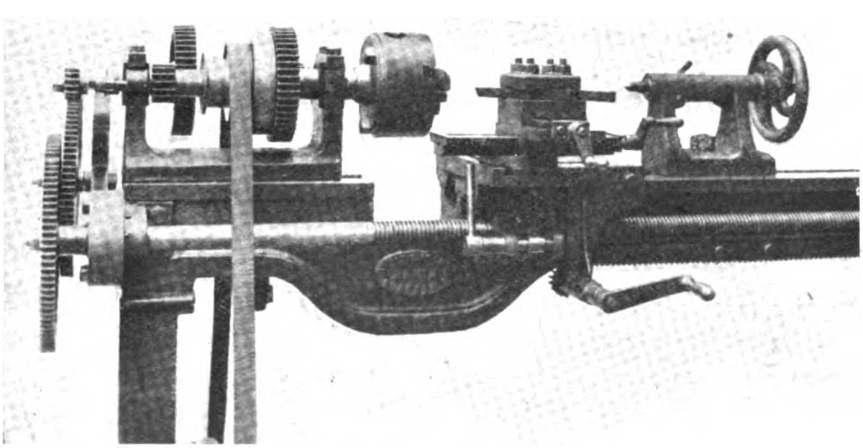
THE lathe is not by any means a recent invention; there is no doubt of its being in use by the ancient Greeks, and the possibility is that so useful an appliance was not unknown in very remote ages. It cannot be said, however, that it was at all comparable at a period so late as the beginning of the last century with the present form in point of usefulness or capacity. In an old encyclopædia, published in 1809, in the writer's possession, an engraving and description shows a foot lathe, the headstocks of which are mounted on a solid triangular bar. No feed gear of any sort is attached, although the machine is said to be made in "the best manner." In those days skill in turning was an important factor, when remarkably good and accurate work was done by means of these somewhat rude contrivances. Nowadays, we do not seem to have a chance to acquire the same expertness in handling tools; we are by force of circumstances led to do as much of the work as possible by mechanical means. We put our work into a chuck and our tools into a slide-rest, and the lathe does what is required.

We sometimes have in "Ours" descriptions of more or less rude lathes made by enthusiasts whose means do not admit of their acquiring the necessary outfit. Such are not without their value as an encouragement and a help to many similarly placed, and as a reminder to some of the more advanced as to their early attempts.

In the writer's opinion the fault of this class of work lies in the fact that the machine is built on lines that, when complete, as far as first intended, it is not in the nature of things capable of further improvement, nor is it considered to be worth the labour involved in bringing it to a state at all near perfection. On the other hand, if we can begin on right lines, making everything perfect as far as our immediate requirements demand or means allow, we may afterwards add, part by part, the supplementing gear and fittings, eventually bringing our machine to a satisfactory state of completeness.

In designing a machine, two points have to be considered. Firstly, the finished machine in its best form as a machine; and, secondly, the same machine as it can be most easily made. The second consideration sometimes becomes very important, and some modification of the original design is thought desirable, which may to some extent render the machine less perfect, while it allows of a more approved method of manufacture. This may be the case where it is intended to employ special machinery to cheapen the cost, as well as where it is intended to utilise the appliance at hand and not to use machinery at all.

The writer is not claiming the lathe illustrated and described in this article to be the best possible form, but merely as a good form of lathe that is quite within the range of the average mechanic to make and equip. The design is not, perhaps, best suited for manufacture on a large scale, but a useful and reliable lathe for ordinary work.



A 3½ B.G. Screwcutting Foot Lathe.

Referring to Figs. 1 and 2, it will be seen that the lathe is of the ordinary box section, gap-bed type on A frames, fitted with back gear, double slide-rest and screw-cutting gear; the centres are 3½ ins., and the distance between the points is 26 ins.

The change-wheels are arranged so that a thread can be cut to varying pitches up to 190 threads per inch. The slide-rest can be removed from the saddle, and the latter used as a table to which work can be bolted for boring, etc. An angle-plate can be fixed to the saddle, converting the lathe into a drilling machine.

The details of the headstock are shown in Figs. 3, 4, 5, and 6. The spindle is ⅞ in. diameter in the main bearing, which is 1 11-16th ins. long, ¾ in. diameter in the tail bearing, and 13-16ths in. diameter in the seat for the large gear wheel. The steps, which are of phosphor-bronze, are fitted into square notches in the headstock casting. The cone pulley, three-speed, is driven on and secured to a cast-iron sleeve, which is cast together with the small gear wheel. On the lathe spindle is fitted a loose collar to take the thrust against the centre. This collar is, however, not allowed to revolve on the spindle a keyway being cut into the bore by means of which the collar is slipped over a key driven into the spindle, and slightly flattened at

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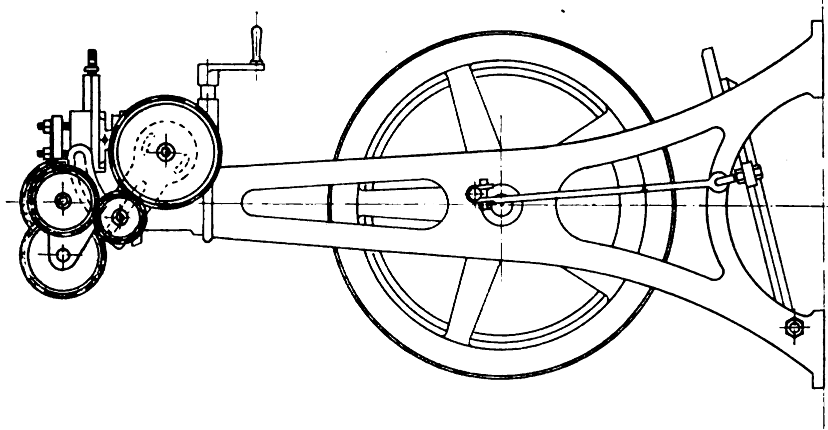


FIG. 2.—END ELEVATION.

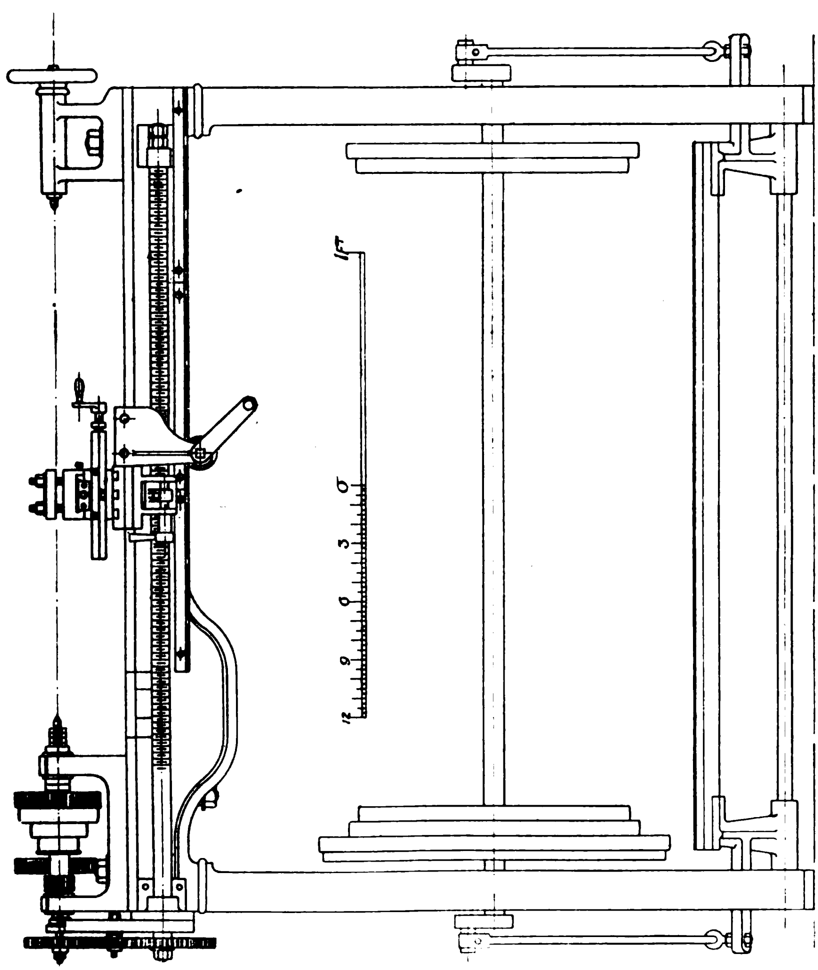


FIG. 1.—FRONT ELEVATION.

GENERAL ARRANGEMENT OF A 3½-IN. BACK-GEARED SCREW-CUTTING LATHE FOR FOOT POWER.

[see pages 78—81.

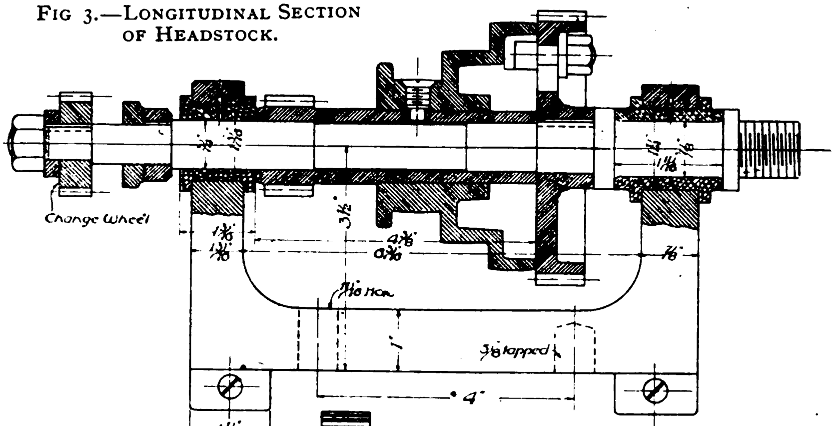
For description]

the sides. The spindle is turned down to ⅝ in. diameter to suit the hole in the collar forming a shoulder on the spindle, to butt against the back of the collar. On the same level as the spindle two 5-16ths in. diameter studs are tapped into the back of the headstock, one on each side of the spindle. A gland, having a hole in the centre, is slipped over the spindle and secured by a pair of nuts on each of these studs, and carefully adjusted to bear against the above-mentioned loose collar. We have thus a means of taking up any wear due to the thrust when any work is being turned between the lathe centres. A groove is cut in the face of the gland, as shown, for the purpose of lubricating the collar. A further elongation of the spindle will be noticed: this is for the spur-wheels operating the feed, or screwing-gear, one of which is shown in place. Each of the twenty-two change-wheels is bored to fit this, a feather key being fitted into the spindle, and a corresponding keyway being cut into each wheel.

The sleeve carrying the cone pulley is free to revolve on the shaft. When, however, it is desired to drive direct, a bolt, sliding in a slot in the large gear wheel, is pushed up into a pocket in the periphery of the large cone. The pulleys cannot then revolve without turning the spindle, being locked to a wheel which is keyed to it.

For the benefit of the younger readers, a few remarks on the back gear may not be out of place here.

FIG 3.—LONGITUDINAL SECTION OF HEADSTOCK.



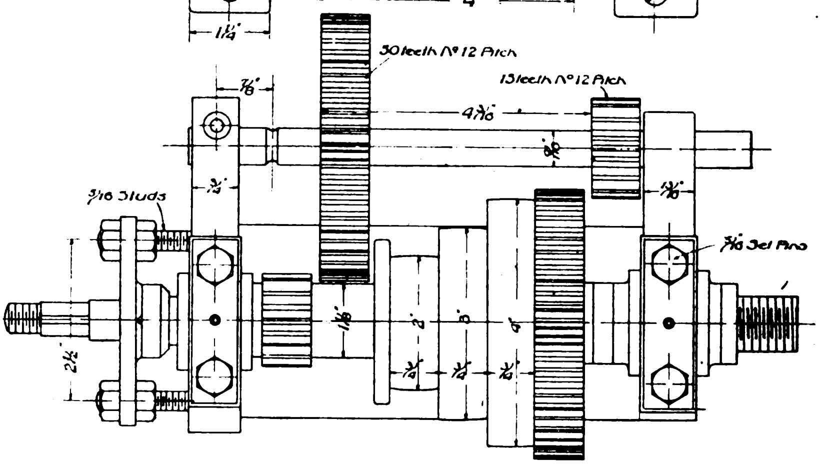


FIG. 4.—PLAN OF HEADSTOCK.

A lathe is generally capable of so great a variety of duties that to make it suitable for these duties we require a variety of speeds. We may, for instance, be turning a pin of not more than, say, ⅛ in. in diameter at one time; at another time we may be turning a wheel of a diameter of 12 ins. to 14 ins.; obviously a speed that is suitable for the one size is not suitable for the other, where the ratio is about 1 to 100. In a small lathe we do not attempt to any great amount of refinement in the various speeds, but we attempt a rough approximation of the most suitable speed. The three-speed cone gives us a variety of speeds suitable for small work, and by the aid of the spur gear a variety suitable for larger work. We have three pulleys, respectively 2, 3, and 4 ins. diameter; these are driven by three wheels 18, 15, and 14 ins. diameter. Assuming that 120 r.p.m. is about the average speed of the treadle shaft, the spindle would have speeds of 1,080, 600, and 420 r.p.m. With the use of the back gear these speeds would be much less. Taking the larger wheels to have fifty teeth each, and the pinions each fifteen teeth, the speeds will be

$$\frac{15}{50} \times \frac{15}{50} \times 1080 = 97{\cdot}20 \text{ r.p.m.,}$$

$$\frac{15}{50} \times \frac{15}{50} \times 600 = 54 \text{ r.p.m., and}$$

$$\frac{15}{50} \times \frac{15}{50} \times 420 = 37{\cdot}8 \text{ r.p.m.}$$

To put the back gear into operation the bolt on the large spur wheel fixed to spindle is disengaged from the cone, allowing the latter to revolve independently of the spindle. The small shaft at the back, on which the gear wheels are keyed, is slid along so that the latter engages the wheels on the main spindle. The cone pulleys now drive the spindle through the double gearing, the speed of the work being reduced according to the ratio of the gear. The back gear is kept in position by means of a key dropped down the side of the bearing into a groove turned in the shaft, as shown on Figs. 4 and 5.

The pattern-making of the headstock should present no difficulties; no prints would be necessary. A little taper, say 1-16th in., towards the top end, would allow it to "draw" in moulding

The lugs, for the back spindle should be detachable. The first operation to the headstock castings would be the facing of the base. Where only one is to be made, no facing strips need be allowed for the steps; the side of the casting may be dressed to suit, and any little variation from the figures given allowed for when fitting the brasses. The

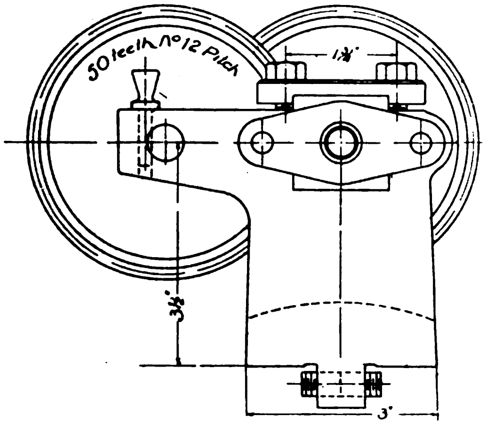


FIG. 5.—END ELEVATION OF HEADSTOCK.

keys are cut out of flat mild steel bar, filed up to suit. The holes for the back shaft will be drilled after the steps are fitted. The distance centre to centre must be taken from the gear wheels. These wheels are generally made to the "Manchester" pitch—that is, the pitch is reckoned not from tooth to tooth along the pitch line, but according to the number of the teeth per *inch of diameter*

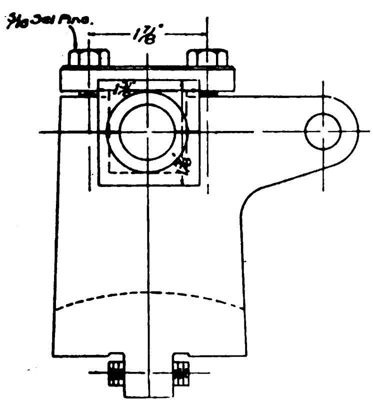


FIG. 6.—ELEVATION OF OPPOSITE END.

of the wheel; thus a wheel 3 ins. diameter would have 36 teeth, No. 12 pitch; 24 teeth, No. 8 pitch; 42 teeth, No. 14 pitch; and so on. The wheels here shown have 50 teeth, No. 12 pitch; so the diameter is equal to $4\frac{1}{6}$ ins. The smaller wheel, 15 teeth, equal to $1\frac{1}{4}$ ins. diameter at pitch line. The distance, centre to centre, of wheels being

$$\frac{4\frac{1}{6} \times 1\frac{1}{4}}{2} = 2\frac{17}{24} \text{ ins.}$$

To make a really good job the teeth should be cut out of the solid. However, fairly good wheels may be obtained with the teeth cast in. These are supplied at a reasonable rate by firms who make a speciality of this class of work.

(*To be continued.*)

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.]

Drilling Square Holes.

By "SREGOR."

TO drill a square hole with an ordinary drilling machine will at first appear an impossible task, but it can be accomplished with a very simple arrangement consisting of a special form of drill, shown in Fig. 1, and a guide, or former, shown in Fig. 2.

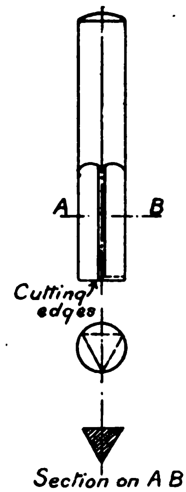


FIG. 1.

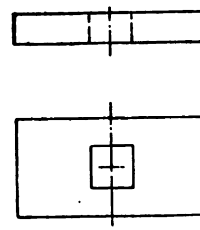


FIG. 2.

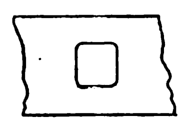


FIG. 5.

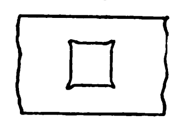


FIG. 4.

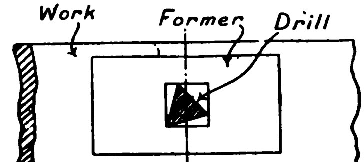


FIG. 3.

DRILLING SQUARE HOLES.

The drill is made from a piece of round steel and filed to the triangular shape, as shown by the section, Fig. 1. The size of the triangle is, of course, decided by the required size of the square hole to be made. That is, the sides of the triangle must equal the length of the side of the square holes, as shown in Fig. 3, which is a plan of the former and tool in position, with the work to be operated upon under the former.

The former is made from a piece of flat steel of

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convenient size, and hardened, and secured in position on the piece of work to be operated upon by any convenient method. To ensure a good result the sides of the former must be filed out to a perfectly square corner; better still, if the corners are filed in slightly, as shown in Fig. 4 exaggerated. A little practice will soon show the necessary amount to produce the best result. When the sides of the tool are shorter than the sides of the former a radius is left in the corners of the work, as shown in Fig. 5. This is convenient on some classes of work, such as a box wrench, when the radius left in will considerably strengthen the tool. To assist the work of the special tool, Fig. 1, an ordinary drill can be put through the work so as to remove the bulk of the metal, leaving only the square outline for the special tool to machine.

The action of this drill will more clearly be understood if the reader will shape a piece of metal or wood the shape of drill and insert this into a square hole cut in a piece of cardboard (or other suitable material), and then revolve the piece which represents the drill; and it will be observed that as this revolves, the three edges of the tool follow the square outline of the cardboard. At the same time the cardboard itself moves, and thus allows the edges of the tool to follow the square outline of the former. As mentioned above, the former is secured to the piece of work to be operated upon, and the cutting, or lower edge of tool removes the metal, and the square hole is attained. The length of the triangular portion of the drill is determined by the depth of the hole required. The edges must be parallel, as shown in Fig. 1, otherwise the tendency of the drill would be to produce a hole of varying sizes as it cuts its way through the metal.

For producing small holes, say up to ½ in. square, the fixed drill which revolves on its axis, and the former and work moving, is successful providing the piece of work is not too heavy; but when it is, obviously it is best to provide the drillholder with a floating head, which allows the drill to conform to the outline of the former.

Locomotive Notes.

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

Recent Italian Locomotives.

The writer has received from a reader of The Model Engineer an enquiry as to whether "the Italian State Railways are continuing the use of the six-coupled bogie express locomotives of the type which run cab in front, as illustrated on page 261 of 'The World's Locomotives'; and whether it is likely, so far as it is possible to ascertain, that more engines of this class will be built?"

On receipt of this enquiry some weeks since, the writer got in touch with the Società Italiana Ernesto Breda of Milan, who state that the latest locomotives of the type in question were built by them for the Southern (Adriatic) Railway late in 1905, and one of these, viz., No, 6,943, was exhibited at the Milan Exhibition last year. Accompanying their letter were several fine photographs and working drawings of these and other engines recently built at their works, also a photograph of their exhibit at Milan. Separate views are reproduced herewith of the locomotive and of a 2—6—0 tank engine completed in 1906.

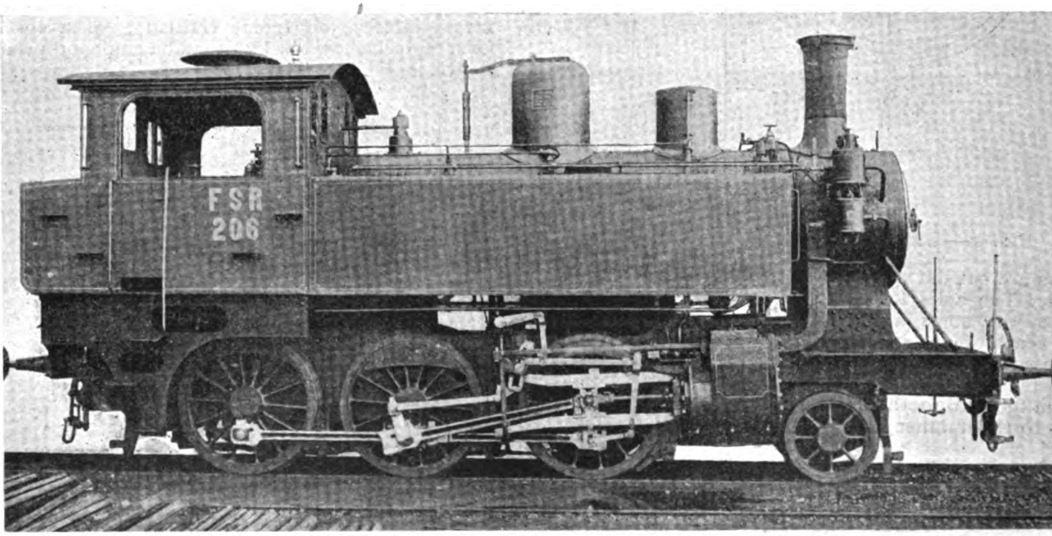

Fig. 1.—Italian 2—6—0 Type Simple Tank Locomotive.

The six-coupled express locomotive (Fig. 2) resembles in most essential features those of the earlier series, but in many respects the dimensions are different, tending to increase the power capacity of the engine.

It will be remembered that there are four-cylinder compounds with the two low-pressure cylinders located on the same side—one inside and the other outside of the frame—and the two high-pressure cylinders similarly arranged on the other side of the engine, so that the arrangement is totally different to that commonly adopted in four-cylinder compound locomotives.

Only two valves, of the piston type, are employed for distributing steam to the four cylinders. These

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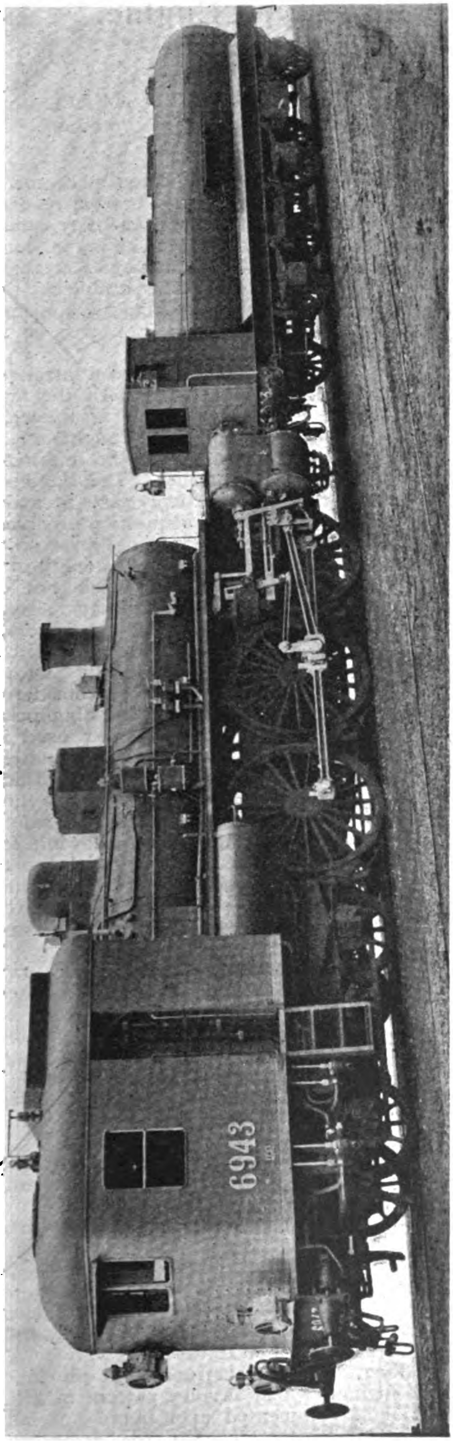

Fig. 2.—Compound Express Locomotive and Tender: Adriatic Railway, Italy.

are located directly above the outside cylinders (one H.-P. and the other L.-P.), and the steam passages cross one another, which makes the use of only two piston valves feasible. The two valve gears are of the Walschaerts type, and reversing is, of course, arranged as for an ordinary two-cylinder simple locomotive. The inside cylinders (one H.-P. and one L.-P.) are placed higher than the outside cylinders and inclined downwards towards the crank axle, this arrangement affording the necessary clearance between the inside mechanism and the leading (or shall we say trailing) coupled axle. In these later engines the firebox is almost wholly enclosed within the cab, which latter has a pointed front and ample window spacing. The platform in advance of the cab has been dispensed with, the prow coming right forward on to the buffer beam—in fact, the cab is of totally different design to that originally fitted. There has also been a re-arrangement of the boiler mountings, the sand-box being now placed in front of instead of behind the steam dome. The same type of tender has been retained, viz., a cylindrical tank mounted on a steel framing carried by six wheels, a brakesman's hut being provided at one end.

The illustration (Fig. 3) shows a cylinder casting incorporating the four cylinders and two steam chests. The engines have leading dimensions as follows :—

Cylinders: H.-P., diameter, 14⅞ ins; L.-P., 22⅜ ins.; piston stroke, 25⅝ ins.
Coupled wheels diameter, 6 ft. 4¼ ins.
Bogie wheels diameter, 3 ft. 7¾ ins.
Length of wheelbase, 27 ft. 4¾ ins.
Boiler: Maximum diameter, 5 ft. 1½ ins.
Length of grate, 6 ft. 6¾ ins.
Width of grate, 4 ft. 11 ins.
Heating surface: Firebox, 125·94 sq. ft.; tubes, 1668·47 sq. ft.: total, 1794·41 sq. ft.
Grate area, 32·29 sq. ft.
Height of boiler centre above rail, 8 ft. 8¼ ins.
Adhesion weight, 43 tons.
Weight of engine in working order, 66·5 tons.
Steam pressure, 213 lbs.
Tractive force, 14,770 lbs.

The 2—6—0 type tank engine (illustrated in Fig. 1) is of powerful build. It is intended for hauling passenger and goods trains on local and branch line services in hilly districts. This is a simple locomotive with outside cylinders driving the middle pair of coupled wheels, steam being distributed by slide-valves working above the cylinders through the medium of Walschaerts gearing. The cylinders are 16½ ins. in diameter with a stroke of 23¼ ins. The coupled wheels measure 4 ft. 7 ins. in diameter on tread, and the total wheelbase is 22 ft. The boiler, with firebox, contains 1,064 sq. ft. of heating surface, and the grate area is 17·50 sq. ft. The steam pressure is 175 lbs. per sq. in., and the engine in working order weighs 53 tons. It is equipped with Westinghouse brake and other appliances for passenger train working.

New American Locomotives.

The "heaviest and most powerful passenger locomotive in the world" has just been delivered to the Pennsylvania R.R. Company from the

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Pittsburg shops of the American Locomotive Company. It is of the 4—6—2 or "Pacific" type, and of enormous proportions. The engine will be illustrated in an early issue of these notes. It is a simple locomotive with outside cylinders, Walschaerts motion and piston valves, and has been specially built for doing away with the practice of running trains in duplicate and double-heading on the Pennsylvania lines west of Pittsburg, where long and very steep gradients abound. The adhesion weight is unprecedented for a six-coupled locomotive, and other dimensions are proportionately astounding. There are some highly interesting features in the construction and these, as well as a full list of dimensions, will be set forth when illustrating the engine. The working drawings are unfortunately too complicated to reproduce. They reveal the wide differences which have to be observed when building these huge and powerful engines as compared with those of more moderate size.

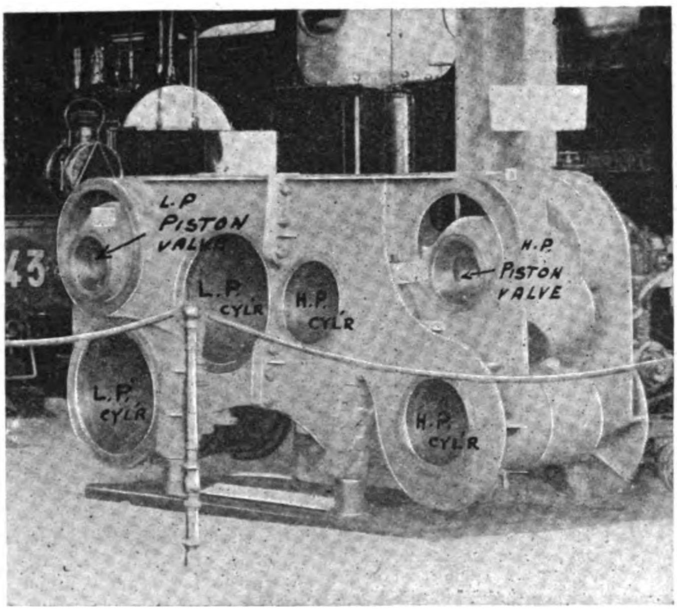

Fig. 3.—Cylinder and Steam Chest Casting: Italian Compound Locomotive.

The Aero system of automatic fire alarm consists of a thin copper tube (which can be fitted near the ceiling in any building) connected with a detector attached to a switchboard at the entrance to the building. When any abnormal heat is created by an outbreak of fire the immediate expansion of the air inside the tube acts by pressure upon a flexible diaphragm with two platinum contacts at the switchboard and signals a fire alarm direct to the fire station. Mr. Inkster, chief officer of the Aberdeen Fire Brigade, claims that the new fire alarm is simple, effective, and cheap, and, by means of a small permanent air-pressure apparatus fixed near the switchboard, can be tested in a moment whenever the building is to be left unattended.

A Design for a Small Model Undertype Engine.

By Henry Greenly.

(*Continued from page 606, Vol. XVI.*)

VIII.—The Boiler.

Although a reference will have to be made to the engine portion again, several readers having expressed an opinion that they would prefer to build a two cylinder $\frac{3}{4}$-in. × $1\frac{1}{4}$-in. high pressure engine instead of the compound arrangement, the last article completed the description of the moving mechanisms, and we can therefore now pass on to the boiler.

As shown in the general arrangement drawing included with the first article, the generator is of the well-known water tube, as brought up to date by the addition of the improved design of downcomer. This kind of boiler is comparatively easy to make (if we leave out the question of silver-soldering), and, once made, gives practically no trouble. The strength of a water-tube boiler when made out of solid drawn tube, properly silver-soldered or brazed, is far superior to any other type, and the cylindrical form remaining practically undisturbed. The ends may be considered the weakest part, the bursting pressure, the shell of the boiler used in this model being approximately 1,200 lbs. per sq. in. But with thick cast flanged ends, pinned and then silver-soldered, the factor of safety is still very large, after allowing for any weakening of the material due to the temperature of the metal when the boiler is steaming, and for the holes made in the shell for fittings and water tubes.

For the complete boiler the raw materials required, not reckoning castings and steel plate, include :—

- 10 ins. of solid drawn (seamless) copper tube, $2\frac{1}{2}$ ins. diameter outside, and not more than 1-16th in. thick, for the inner barrel.
- 13 ins. of common brass tube, $3\frac{1}{2}$ ins. diameter outside, 1-16th in. thick for the outer shell.
- 5 ft. of $\frac{1}{4}$ in. outside diameter solid drawn copper tube (light) for water tubes and blast pipe.
- 2 ft. of 5-16ths in. outside diameter solid drawn copper tube for the superheater.
- 2 ft. of 3-16ths in. outside diameter solid drawn copper tube for steam connections. If a pump is intended, then sufficient tube (say another foot) may be obtained for the connection to the check valve.

Before describing the construction of the inner barrel, the fittings, which involve pattern making, may as well be commented upon, more especially as the writer understands that the firms who are supplying castings are anxious to finish the

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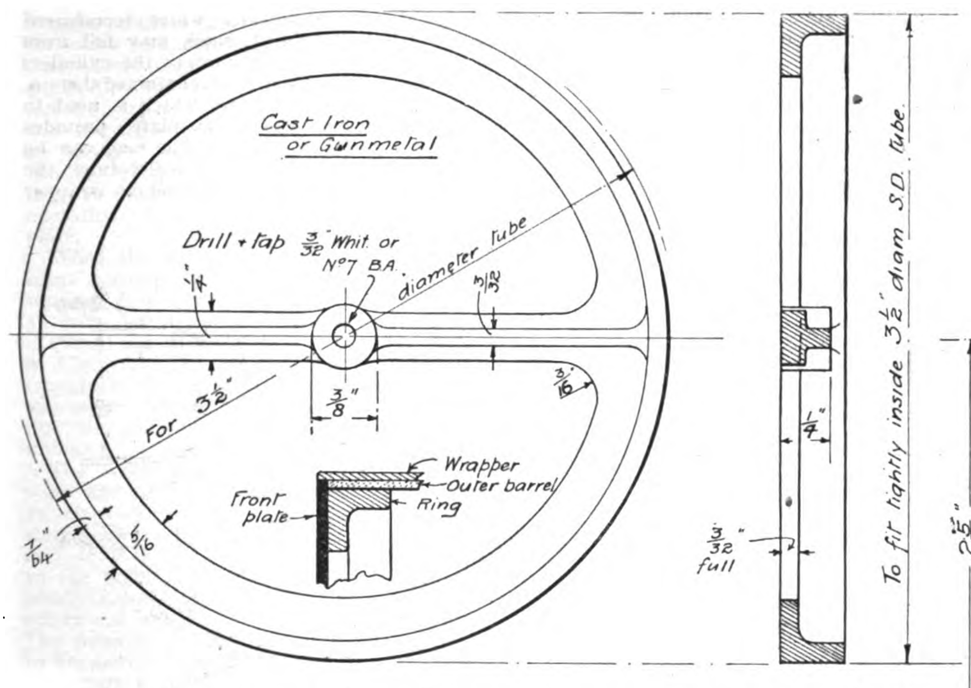

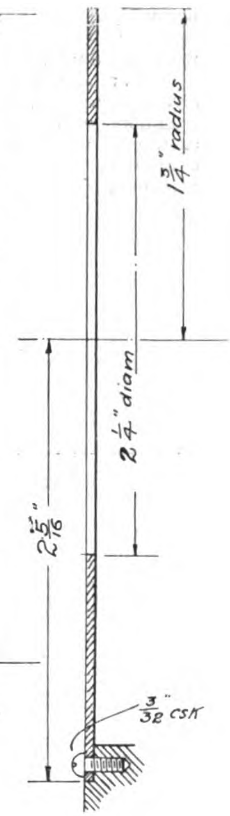

FIG. 35.—SMOKEBOX ANGLE RING AND FULL-SIZE SECTION OF FRONT PLATE.

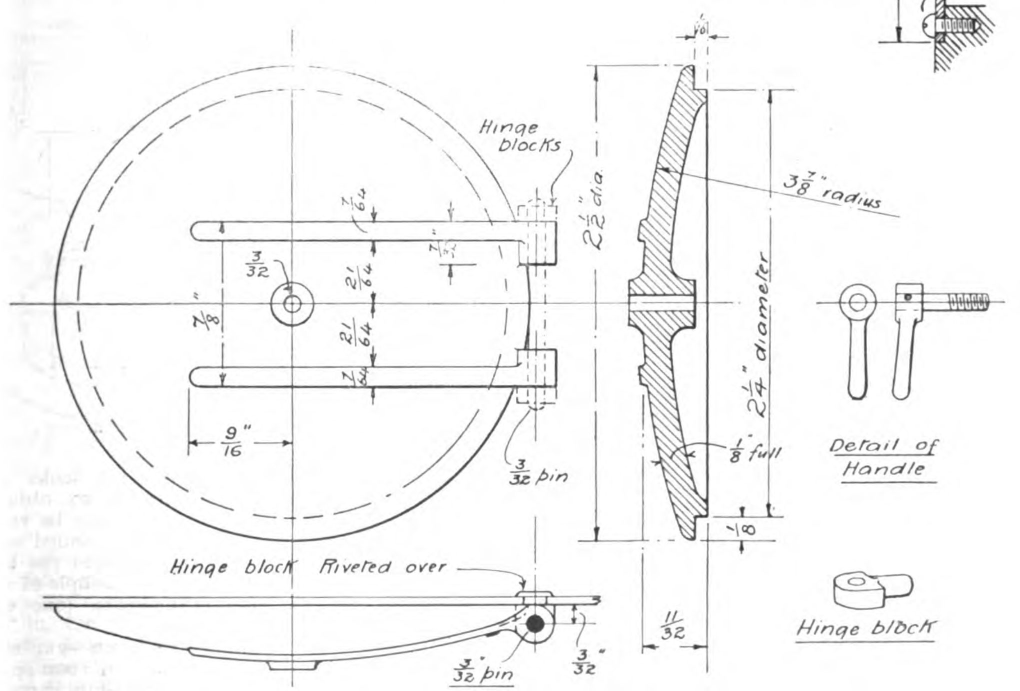

FIG. 38.—SMOKEBOX DOOR AND FITTINGS.

complete set. Therefore drawings will be found herewith of the smokebox fittings, chimney, and safety valve casing, besides the working parts which accompany these fittings.

The smokebox is of the ordinary pattern, with straight sides, and fits directly on the top of the cylinders without the intervention of a saddle casting. Instead of making this out of the piece of tube used for the outer shell, by sawing the tube transversely and then splitting it longitudinally for a depth equal to the length of the smokebox, spreading the sides out to fit the cylinders, the outer tube of the boiler retains its circular shape right to the smokebox front-plate. A wrapper-plate made of planished steel is then folded round the tube, as shown on the general arrangement drawings. This method of making the smokebox, in addition to the better appearance provided by the raised wrapper-plate and the excellent finish afforded by the planished steel itself, has the advantage of preventing any water (condensed steam and other drippings) which may fall from the blast pipe from lying in the top of the cylinders and absorbing heat from the steam contained therein. Then again the cast angle-ring, which is used to attach the planished steel front-plate, provides a very good method of fitting. The ring can be turned the correct size to fit the boiler tube, the front plate fitting inside the smokebox wrapper plate in such a way that the job looks clean and nice, and an air-tight smokebox obtained. At the same time also, the front may be readily removable by taking out the four rounded screws at the bottom (those which screw into the flange of the cylinder casting) and, say, a couple of small screws at the top of the smokebox (one either side of the chimney flange).

The angle-ring may be of cast iron—gun-metal, which was originally intended, having risen so high in price lately that if used too lavishly, soon runs up the cost of a model to a prohibitive figure. Therefore, cast iron, which can be now obtained in very soft qualities, is recommended in the present

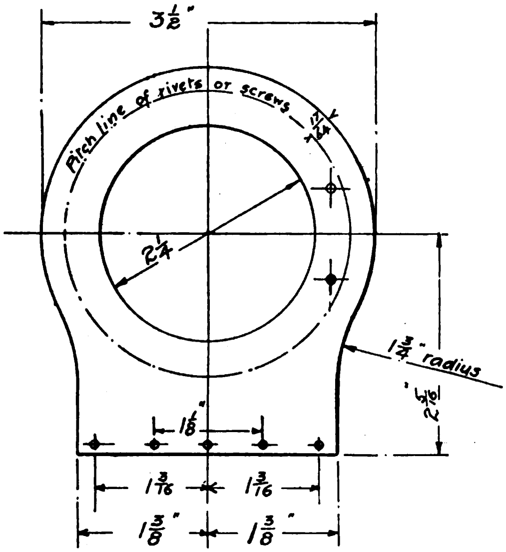

FIG. 36.—SMOKEBOX FRONT PLATE.
(*Half full size.*)

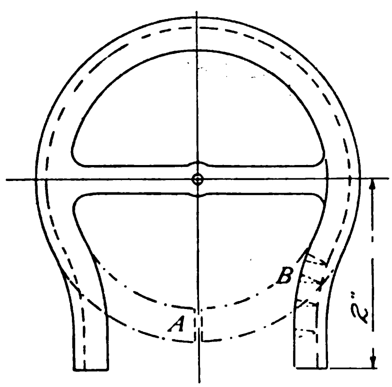

FIG. 37.—SKETCH OF SMOKEBOX ANGLE RING ALTERED FOR PLAIN SMOKEBOX.

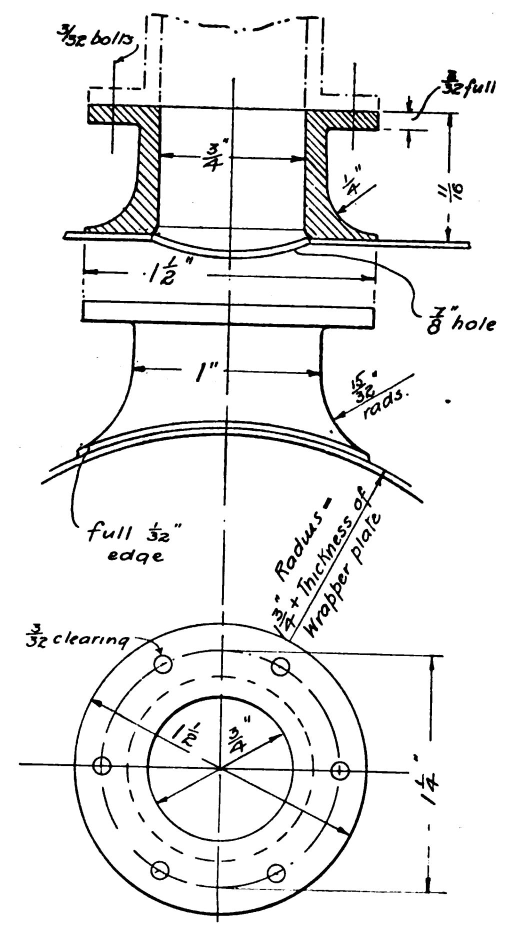

FIG. 38.—CHIMNEY BASE.

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case, as it can be turned quite as easily as brass. Should, however, any reader wish to dispense with the extra wrapper-plate, a common brass casting may be obtained, and after turning and facing the angle, the bottom portion may be sawn through (on the vertical centre line, as indicated at Fig. A), and the angle bent to the shape of the wrapper, as shown. Should any difficulty arise in the bending of the ring to the profile, saw cuts (B) may be made in the front flange to facilitate the operation of shaping the angle to the wrapper plate.

When the writer prepared the general arrangement drawing, he intended to make the cross bar separate from the angle-ring, but, especially where an iron casting is used, there is no reason why it should not be made solid with the ring, as shown in Fig. 35. This method will, of course, save the trouble of fitting a separate cross-plate, and the smokebox front, being so easily removed, no difficulty should arise in getting at the pipes and unions.

The wrapper-plate should be 1 13-16ths ins. wide, and when it is flat, it will measure approximately 10½ ins. long. The thickness of this plate should be about 1-20th in. (say No. 18 I.S.W.G.), and to secure it in place it should be attached to the boiler tube with a row of small rivets or small round-headed screws, just at the point where the wrapper leaves the circular boiler shell. The wrapper should extend over the boiler barrel to an amount *almost equal* to the thickness of the smokebox front plate.

In the general arrangement drawing, a plain drilled, may be riveted on. The holes for the hinge pin should be made slightly smaller than the correct size at the outset, and be afterwards broached out with an "English broach" when fixed in place.

The chimney may be in brass or cast iron. The top flange should be at least 7-64ths in. (finished) if iron is used, and the pattern should allow for this. The top flange should be drilled for six (or eight) 3-32nds-in. bolts, which will be used to attach the flanged extension piece to the chimney, shown in chain dotted lines in the drawings.

The safety valve casing was originally intended to be oval in plan (as at B, Fig. 40), but the maker who is building the model for the writer has anti-

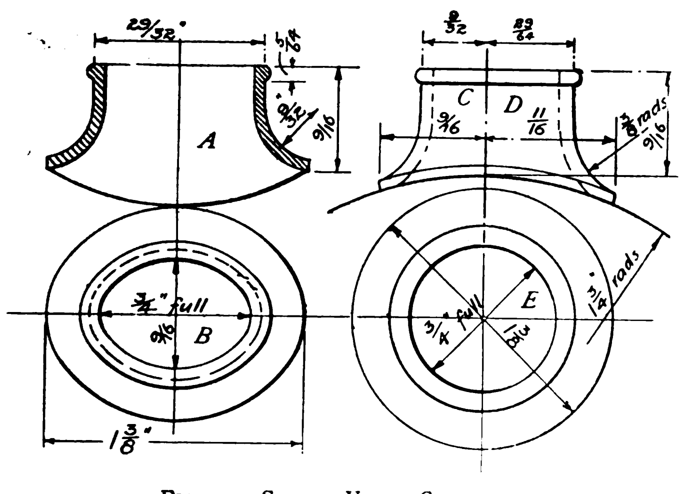

FIG. 40.—SAFETY VALVE CASING.

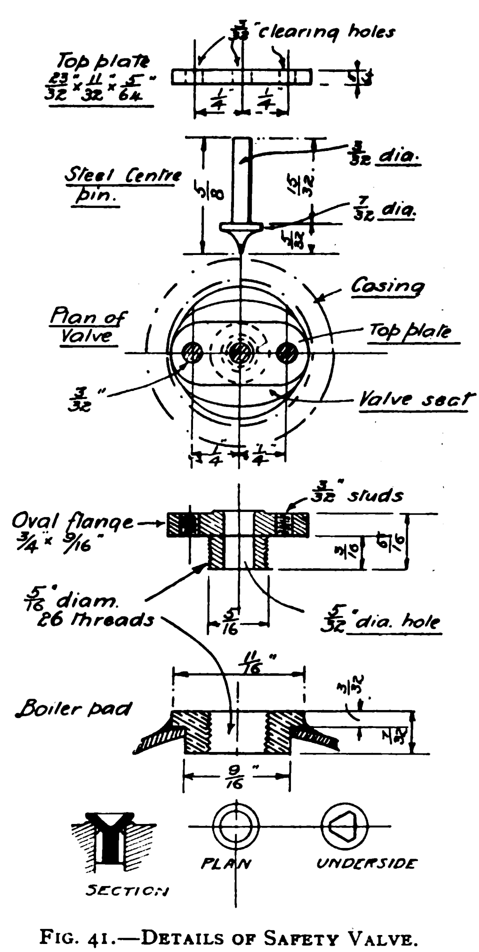

FIG. 41.—DETAILS OF SAFETY VALVE.

turned smokebox door, without hinges, fitting only with centre screw, was intended. As many builders like accuracy in such details, the writer shows in the detail drawings herewith a more complete door with hinges cast on and hinge strips. The door may preferably be cast in soft iron, so that when the hinge strips are polished the effect of steel used for these fitments in actual practice is obtained. The hinge blocks on the front plate may be filed out of the solid, and when

cipated matters, and working from the general arrangement drawing, has made the safety valve casing quite circular. This, however, is not a matter of great importance, as the circular shape renders it possible to finish the casing in the lathe, whereas the oval would necessitate hand work entirely. In Fig. 40, A is a longitudinal section of the casing (oval or circular), B and E are plans of the two types of casings, and C and D are respectively half end-views of the oval and circular

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pattern casings. The safety valve is of the well-known pillar type, direct spring loaded, full details except the spiral spring being shown in the accompanying drawing, Fig. 41.

The centre spring which holds the spring and communicates the pressure to the valve is best made out of the solid, and if a running down cutter is not available, one should be made for the job, as it is certain to prove useful, sooner or later, for making screws, bolts, and similar articles. This "steel centre pin" may—to employ an Irishism, be made of German silver if the builder thinks it desirable to eliminate corrosive materials. This also applies to the studs, which, by the way, should be made 3-32nds in. diameter and 13-16ths in. long. The spring may be of hard brass or German silver, although a steel spring will generally last a considerable time and has more "life." The spring should be 3-16ths in. outside diameter, and ⅜ in. long unloaded, the diameter of the wire being 21-in. or 22-in. gauge. The flange of the piece forming the valve seating may be oval, especially where an oval casing is used, and should screw into the boiler pad, which, by the way, must be silver-soldered to the barrel, so that the inner barrel may be put into place. The flange should be drilled and tapped for the pillar studs, and when finally fitted, these studs may be soldered in and any projections on the underside filed away, so that a steam-tight joint may be obtained with the boiler pad.

To ensure ready action in opening and closing, the valve should be made as shown in the sectional sketch, with a deep sinking in the top. A knife-edge seat, as described in a recent issue of THE MODEL ENGINEER and used in many commercial fittings, may be employed in place of the conical seating shown. However, in either case the *point of contact with centre spring pin must be below the level of the valve seating.*. The top plate may be of brass, the adjustment nuts being of the same material.

(*To be continued.*)

THE Edinburgh and Midlothian Eleventh Annual Industrial Exhibition is to be opened on Thursday, October 17th next. Numerous competitions are arranged for all kinds of home arts and crafts and domestic work. The prizes offered total in value to £400. Further particulars may be obtained of the Secretary—Mr. A. T. HUTCHINSON, 15, Leith Street, Edinburgh.

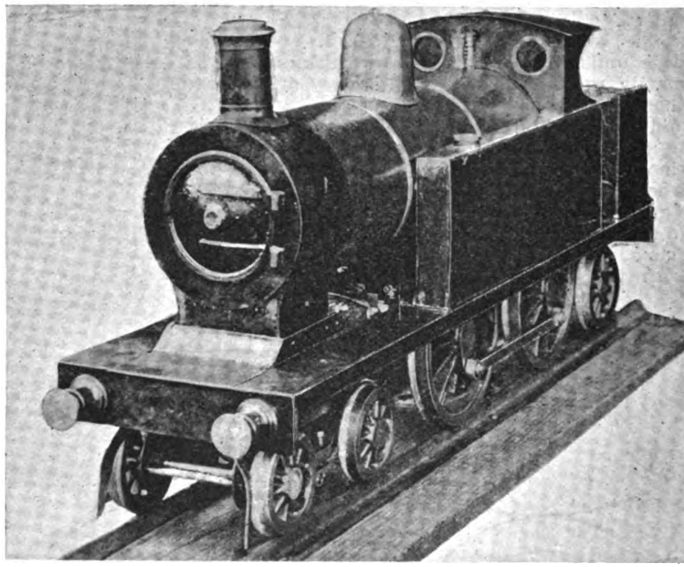
CHEMICAL BALLAST.—In a balloon ascent recently made from Berlin by Capt. von Krogh, a quantity of chemicals capable of absorbing moisture was taken up as ballast. By this means the aeronauts were able to increase the weight of their ballast in mid-air by allowing it to absorb moisture from the atmosphere, and the experiments, which took place under the superintendence of Dr. Knocks, of the Meteorological Institute, are said to have been of a very successful nature.

A Colonial Reader's Model Tank Locomotive.

By THOS. A. MILES (Australia).

THE photographs herewith represent a small tank engine (not quite finished) that I have been making in my spare time during the past eighteen months, and, though built to no particular design, is a combination embodying points from several of our engines out here, and the results it has achieved have far surpassed my expectations.

I am purely an amateur. I do not possess a lathe, and all the necessary turning I have done on that of a friend. I have also made all the patterns except those for the wheels and front, and the fittings that were purchased are—pressure



MR. T. A. MILES' MODEL TANK LOCOMOTIVE.

gauge, small cocks, unions, wheel valve, and cylinder lubricator.

The engine is built to ¾-in. scale, though I have not followed it absolutely as long as the appearance was not materially altered, and the following particulars will give some idea of its proportions.

It is 26½ ins. over-all, 24 ins. between the buffer beams, and 6 ins. across the footplate; 10¼ ins. from rail to top of chimney. The total wheelbase is 20 ins., the bogie and driving and coupled wheelbase being 4 ins. and 6 ins. respectively. The bogie has the usual side-play, the springs being taken out, as I found the engine ran better without them. The trailer also has 3-16ths-in. side-play. The diameters of wheels are—bogie, 2¼ ins.; trailer, 2⅝ ins.; and driving and coupled, 4⅞ ins.; the two former being castings purchased from an advertiser.

The castings of the four-coupled wheels were given me by a friend, and it was from them that I made my drawings. The frames were cut from

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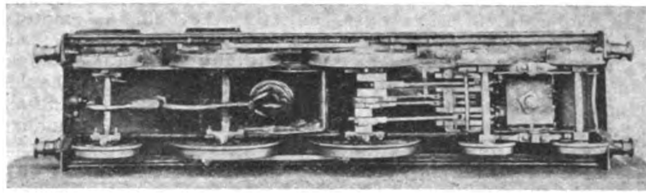
two pieces of mild steel 3-32nds in. thick, riveted together, drilled all round, and finally filed up. The axles are mild steel rod, the crankshaft being built up, pinned and brazed, and turned between centres after the wheels were keyed on.

The cylinders were cast in gun-metal, and are ⅞ in. diameter by 1½-in. stroke, with D-valves placed on top and with rocking-bar taking movement to centre of axle. The steam ports are large, being ⅛ in. by ⅞ in; exhaust, ¼ in. by ⅞ in. The valves have 1-32nd-in. lay, with a cut-off at ⅞-in. stroke. The steam pipe is 3-16ths in. inside copper tube, exhaust ¼ in., with nozzle reduced to 5-32nds in. This makes a wonderful difference to the fire, and as far as I can tell, there is an improvement rather than otherwise in the speed.

The pistons and stuffing-boxes are packed with asbestos yarn, and all the time I have had the engine running not a particle of steam has leaked through the glands, owing, I believe, to the stuffing-boxes being made very deep, with plenty of packing, and the glands very shallow, the piston-rods being gun-metal working exceptionally easy all the while, and I have never had a moment's trouble since putting them in, some nine months ago.

The boiler is of the Smithies type. The outer shell is 4 ins. diameter, lined with asbestos and sheet tin; whilst the boiler is 3¼ ins. outside diameter copper tubing, sixteen gauge, 12 ins. long, with ten ¼-in. water-tubes, and is fired with a small "Primus" silent burner pinched in. There are 140 sq. ins. of heating surface, which makes the engine to keep up its working pressure of 70 lbs. per sq. in. easily, the gauge never falling below this the whole time the engine is running, and as soon as the regulator is shut off the safety valves blow continuously. I have tested the boiler with 120 lbs. steam, and can raise the latter from cold water in six minutes, the water only lasting about twenty minutes, as I have not yet fitted a pump.

The downcomer and backplate are combined in one gun-metal casting, to which both boiler and outer shell are riveted. The tests I have made so far have been—hauling my twin children along the asphalt at the back of my house in a small truck weighing about 18 lbs., which it does easily; and I think it will haul me on a wagon I am now making to run on rails. It also registers a draw-bar pull of 8 lbs. (without the wheels slipping), taken with a spring and balance.



Underside View of Model Loco.

The steam is drawn through a perforated pipe, the regulator being a slight alteration from that given in the "Model Locomotive" (Fig. 303), the back, being hexagon, can be unscrewed from the back of the boiler and a wide screwdriver inserted in the two slots provided in the regulator, when the lot can be withdrawn for re-grinding or other repair. The outer steam pipe has a flange joint with the boiler, is 30 ins. long, and is taken through the hot gases to the firebox, where it is coiled, and thence back to the cylinders, thus acting as a moderate superheater. I have not yet fitted the cylinders with drain cocks, and beyond the condensed water coming through the exhaust for the first turn or two, I have not the slightest trouble with priming; in fact, it is rather conspicuous by its absence.

A Good Test.

I have fitted a blower with a jet of 1-32nd in., and with the "Primus" going to its full extent, I can regulate it to a nicety, the flame never beating back unless blower and blast are both off.

I have a wheel valve to control kerosene (under cab), which is contained in two circular tanks coupled together, and is pumped up with a bicycle pump. The tanks on the side hold about one refill for boiler.

The dome I made partly from flanging a piece of 2-in. brass tube to fit the boiler, and then silver-soldering the top on, which is composed of a bicycle bell, and, after being polished, looks well and is strong.

I intend laying down about 200 ft. of track, and when engine is completed, I hope to make further tests, the results of which I will let readers know, with the Editor's permission.

An experimental railroad for testing signalling devices, materials used in track construction, and different types of motor-cars for railroad use has been built by the railway department of the German Government. The road is double-tracked, and is oval-shaped, having a length of 5,760 ft. The straight stretch is about 800 ft. long.

The Society of Model Engineers at Sheffield.

THE twenty-five members of the Society who visited Sheffield on July 9th have reason to congratulate themselves. Firstly, they all succeeded in catching the 7.15 a.m. breakfast car train from King's Cross—a very creditable performance; and secondly, they found Sheffield to exceed all anticipations in its attractions and hospitality.

Immediately on arrival the party proceeded to the Steel, Iron and Wire Rope Works of Messrs. William Cooke & Co., Ltd., and were shown the many processes necessary to produce the finest steel ropes used in mines, in trawling, and innumerable industries. Some of the ropes used in collieries are required to deal with loads of 25 tons at speeds of 60 miles per hour, so tests are constantly being made of the materials used. A single length of 11-32nds-in. wire about 12 ins. long, showing a breaking strain of 2,456 lbs., endured a torsion test of 33 turns before fracturing.

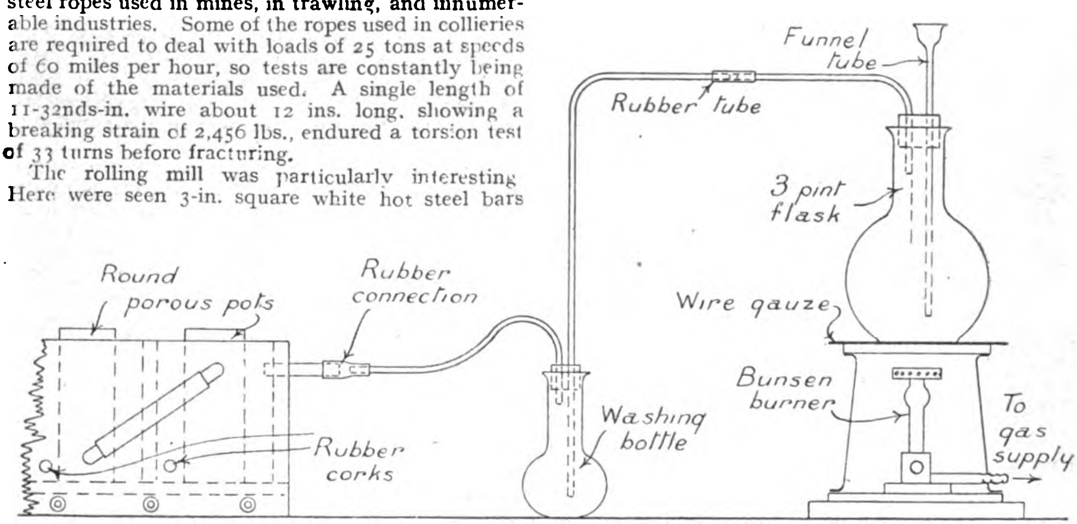
The rolling mill was particularly interesting. Here were seen 3-in. square white hot steel bars being rolled out in a few minutes into a long slithering red hot wire ¼ in. thick, which seemed almost alive, so deftly was it handled. This rolling mill is worked by a 1,000 h.-p. tandem compound engine, and the engine-room is a delight to all lovers of cleanliness and order. There is a special valve for instantaneously cutting off steam from the engine, worked electrically and connected to pushes in various parts of the mill, so that in case of accident the machinery may be stopped immediately.

The firm also manufactures large quantities of machine-made horseshoes at a fraction of the cost of the hand-made article, and the machinery for shaping the shoes was particularly ingenious and interesting to watch at work.

The pleasure of the visit was quite doubled by the kindly way in which Mr. Else and Mr. Ingold piloted the party round. They never seemed to tire of the innumerable questions asked, and when the buzzer sounded for dinner and we could see no more they conducted the party to the ambulance room, where the members found luncheon awaiting them, and, justice having been done to the lavish hospitality, they were most kindly welcomed in a short speech by Mr. Holford, a director of the firm. The only regret was that Mr. Thos. Wilkinson, the chairman of the company, could not be there, being only just recovering from a serious illness. A telegram was subsequently sent him conveying best wishes and thanks.

Then to the River Don Works, where Vickers, Sons & Maxim, Ltd., make guns, big and little, armour plate, steel tyres for railway wheels, electric motors, and other things. It is impossible to describe all that was seen, but mention must be made of the rolling of a steel locomotive tyre from a shapeless ingot, which was completed in less than half-an-hour. It was turned and tossed about under the steam hammer and in the rolling mill in a manner which suggested that a locomotive wheel must be but little heavier than that of a perambulator.

We left Sheffield by the 6.35 dinner train with feelings of great obligation to our secretary (unfortunately absent) who arranged the whole day's programme, and to the firms who so kindly threw open their works for our instruction and delight.



ARRANGEMENT OF GAS BATTERY. (*See "Practical Letter" on page 91.*)

The Aberdeen Model Steamer Club.

THE first general meeting of the above club was held in the Oddfellows' Hall, Crooked Lane, Aberdeen, on Friday, July 5th, at 7.30 p.m. The officers were elected as follows: President, Mr. Wm. Philip; vice-presidents, Messrs. Alex. Middler and Wm. Bunting; and committee of management as follows—Messrs. Philip, Bunting, Middler, Henry, Gibbons, and McDonald. Rules were drawn up for the season, and the subscription will be 2s. 6d.; honorary members, 1s. 6d. Two general meetings of members to be held annually—in November and December.—Hon. Secretary and Treasurer, JOHN S. HENRY, 18, Ferryhill Terrace, Aberdeen.

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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.*]

Re Gas Battery.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Since receiving your reply, *re* above (March 13th, 1903), I have made the "Gas Battery," but instead of producer (Fig. 4) made of lead, I was recommended by a practical manufacturing chemist to use a large glass flask (3-pt.) with a glass funnel tube for charging purposes, and a washing bottle, as per sketch. Also, instead of oblong porous cells A (page 230), I used round porous cells of the Leclanché pattern. Now, I can make the gas right enough, but cannot get any current worth mentioning from the battery. I should be glad if A. W. (Sevenoaks), (Vol. VIII, page 166), or W. R. (Vol. IX, page 431), would communicate their experiences with the battery. I fancy it is of no use applying to Mr. Fred Walker, as I wrote, through you, respecting his promise of air-ejector etc. (Vol. VIII, page 103), but had *no reply*.

If the gas battery is of *any practical use*, I should very much like to use it after all the expense and trouble of making; but if not, I must scrap the lot and look to some other source of electricity for experimental purposes. I may say the battery was well and carefully made, carefully sealed, and tested at every stage.—Yours truly,

Bolton. J. R. BROWN.

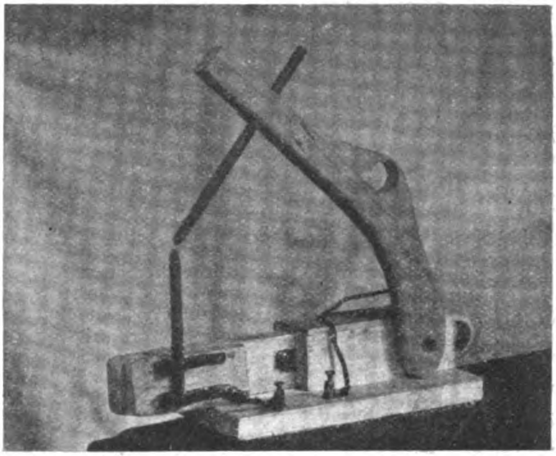
An Arc Light in Three-quarters of an Hour.

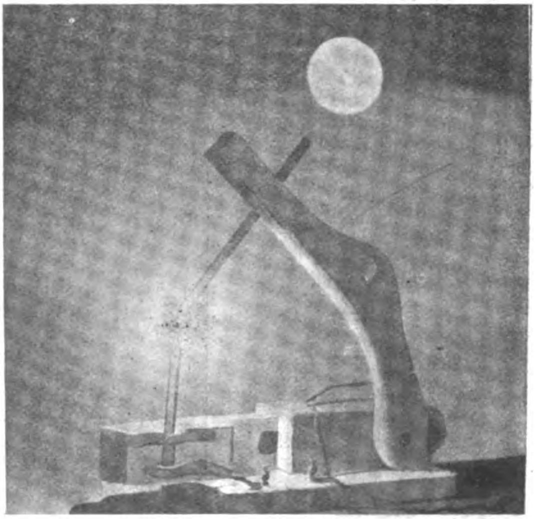
To THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I was called upon the other day to rig up an arc light for temporary use in a lantern, and think that a brief description of the apparatus I made may be useful to readers similarly placed. I do not suggest that it is by any means a permanent affair, but one might, at the same time, require a good light at small cost. The apparatus, of which a photograph is reproduced, was made in three-quarters of an hour, and was working within the hour. The mode of construction is easily seen from the photograph. The piece of wood to which the lower carbon is attached was made so as it could slide in or out of the casing covering the end of it, and the wooden bar holding the upper carbon is simply screwed to this casing by a long screw passing right through it. A slot in the lower bar prevents the lower screw from interfering with its movement. Each carbon is attached by means of two pieces of heavy spring, and the cables are attached to these springs as shown on the lower carbon in the photograph.

The second picture shows an attempt to photograph the light when burning, and has a couple of interesting features. Firstly, that where the greatest light came to a focus on the plate, the heat at the point was sufficient to burn two small holes in the film. The second is the queer-looking "drawing pin" just above the apparatus—this had no existence, and is only the result of a little trick of the lens.

The job was not intended to be a permanent one, but merely a makeshift, and worked well enough. The resistance used consisted of two lead plates in





AN IMPROVISED ARC LIGHT APPARATUS.

dilute acid and a jam jar. The pressure of the mains (alternating) is 200 volts.—Yours truly,

E. J. D.

A 2-FT. GAUGE railway has recently been completed at Swakopmund, German South-west Africa, running about 150 miles from the sea-coast into a copper-mining district.

SAFETY CATCH FOR CARRIAGE DOORS.—The cantilever system is the basis of an invention discovered by Mr. W. H. Chapman and Mr. L. Simpson, which, it is said, will solve the danger of the unexpected opening of railway carriage doors. A thin blade of aluminium is acted on by the pressure of the air, and effectually fastens a bolt once the train is in motion, the direction in which the carriage is travelling being a matter of indifference. The apparatus cannot easily get out of order, and requires no attention beyond occasional oiling.

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Model Yachting Correspondence

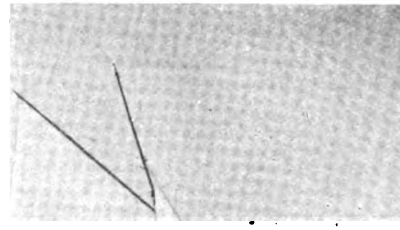
[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.]*

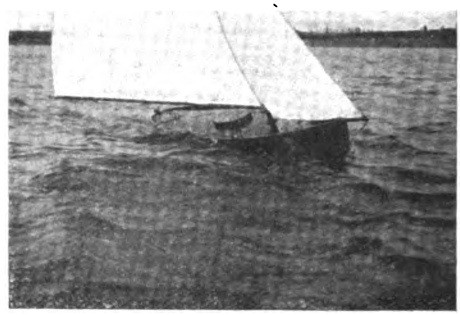
A Model Cruising Yacht.

To the Editor of *The Model Engineer*.

Dear Sir,—I herewith enclose photographs of a 4-ft. model cruising yacht built entirely by my brother, including spars and all metal work, such as blocks, rigging, and rigging screws. The model is built entirely of teak, with the exception of the deck, which is best pine, also spars. The model is fastened throughout with brass screws. She has not competed against any other model at present, but she gets along fairly well, as you can see by photographs. The dimensions of the model are as follows: L.O.A., 4 ft. 1 in.; beam, 1 ft. 2 ins.; greatest depth, 10 ins. She has lead keel, also loose lead ballast to go inside. I am sending this hoping it will be of interest to your readers. I may say that we are willing to part with the yacht if we can meet a purchaser.—Yours truly,

J. Howard.
Maldon, Essex.





Three Views of Mr. Howard's 4-ft. Model Cruising Yacht.

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 Marine Steam Turbine. By J. W. Sothern. London: Whittaker & Co. Price 6s.; postage 3d.

At the present time, when so much interest is being taken in the subject with which this work deals, the issue of its second edition will be welcomed by practical men interested in this type of prime mover. The book is divided into three sections, the first being an explanation of the various fundamental principles which govern the working of the steam turbine and descriptions of the machines concerned, and other data bearing on the special features of their construction. Section II deals with Drums and Casings, Blades, Grooves, Reverse Turbines, Rotor Construction and Balancing, Thrust Blocks and End Clearance, etc.; and Section III includes Data from Practice, Propellers, Consumption of Steam, and Coal, Cruising Turbines, Torsion Meter, Shaft Calibration and Horse-power, etc. There are numerous illustrations, many of them fine reproductions from photographs of machinery installed in well-known vessels. The book contains 163 pages, every one of which, as in this author's other works, is very readable.

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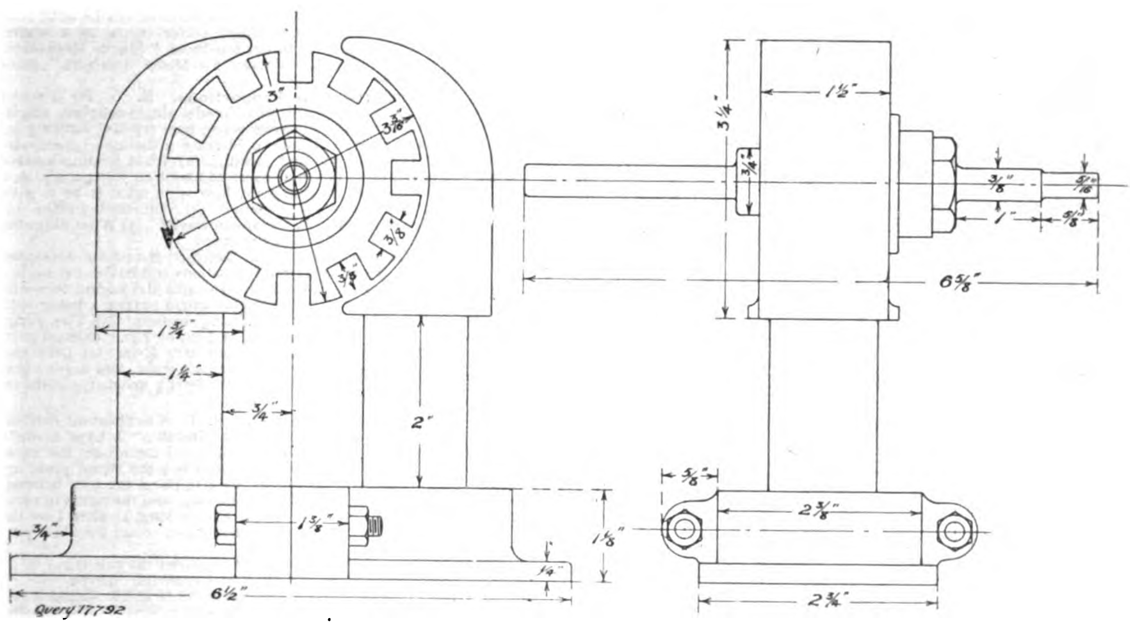
Queries and Replies.

[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:—

[17,792*] **60-watt Kapp Dynamo Windings.** F. W. (Manchester) writes: I have enclosed full-size drawing of a Kapp type dynamo I wish to construct. Would you oblige me by answering the following questions. Will the field-magnets and armature hold enough wire to produce 100 watts—20 volts 5 amps.? If not, how much will they hold and what gauge to produce the same amperes but lower voltage? What power will it take to drive at 2,400 r.p.m.? If I ran it as a motor, what current would it take, and what power could I get out of it? Is the gap between the outer surface of the armature and the inner surface of the tunnel too great?



60-WATT KAPP TYPE DYNAMO.

The machine would not give more than about 60 or 70 watts. Wind armature with 7 ozs. No. 20 and fields with 2½ lbs. No. 23, in shunt. The air-gap should be not more than 1-32nd in. in order to get good results. You are losing in point of efficiency by making armature so short compared to its diameter, owing to so much wire used in end connections, which, of course, are idle so far as producing voltage goes. Power required to drive it would be about 1-5th b.h.-p.

[17,900] **Electric Motor Boat.** G. W. C. (Perth) writes: I am thinking of making a boat about 4 ft. long, to be driven by an electric motor and accumulators. I wish to get the total weight of machinery as low as possible, and I think that by having permanent magnets for the motor field the saving in weight of accumulators (owing to greater efficiency of motor, which will require no current for exciting the field), will more than balance the extra weight of the motor. I shall be pleased if you will tell me if there will be any saving in total weight, and also if you can give me a rough idea of size of motor and accumulators required to drive a light 4-ft. boat of the usual motor-boat type. Of course the accumulators will be discharging at their maximum permissible rate with motor at full load.

We cannot recommend a permanent magnet motor. A good 25 or 30-watt motor, such as described in "Small Electric Motors," 7d. post free, would meet your requirements best. Avery, or Thompson, or Whitney would supply a suitable motor at a reasonable figure. After motor is in boat, find by trial what weight is required to bring her down to the proper load water line, then put in accumulators of that weight, of course, arranging for the voltage to suit the motor. The capacity will then be as large as total weight permits.

[17,899] **Partial Failure of Small Dynamo.** A. G. M. (Kensal Rise) writes: Could you be so kind as to give your advice concerning a mysterious dynamo failure. I am enclosing photograph of machine (not reproduced) built from Fig. 8 in handbook on "Dynamos and Motors," 60 watts—30 volts 2 amps. Have had machine running well lighting six 6-volt lamps and charging 4-volt 20-amp.-hour accumulators. I turned up commutator and have since been unable to light any lamps. The dynamo generates as I have a strong field and spark at brushes. I have re-wired armature, all connections being correct and sound. I find I can charge accumulator slowly, but will not light 4-volt lamp across brush leads. Bedplate brass casting, have reversed connections, and have field-poles correct. Could it be the size of commutator?

We suspect you have partially insulated some of the brush gear or other connections with oil from greasy fingers, etc., when putting the parts together after trueing up commutator. There is no apparent reason for the failure, and we can only suggest a close examination of the machine.

[17,895] **Electrical Examinations.** P. S. K. (Ramsey) writes: I am a new reader of THE MODEL ENGINEER and am an apprentice on the Manx Electric Railway. I will be very much obliged to you if you will tell me the best examinations for me to enter to raise my position.

There are two chief examining bodies, viz., the City and Guilds of London Institute, and the Board of Education. Particulars relating to these examinations are given in our publication, "A Guide to the Electrical Examinations," 1s. 2d. post free from this office which we recommend you to obtain.

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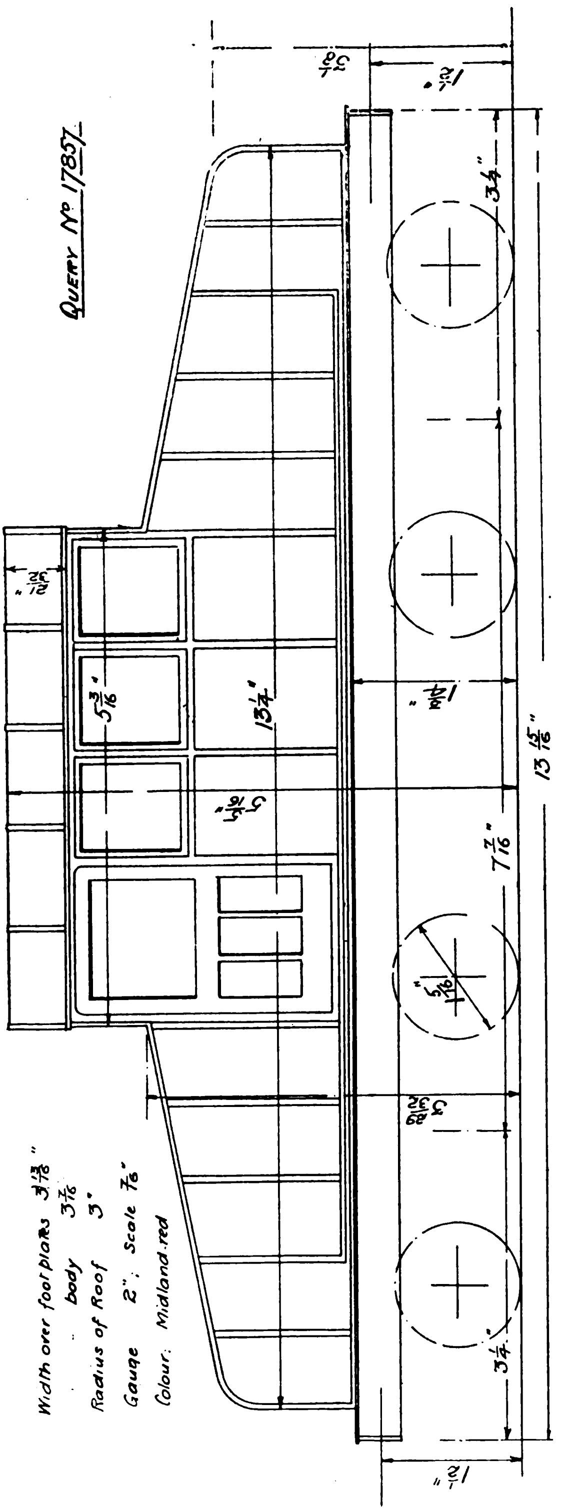

OUTLINE OF METROPOLITAN RAILWAY ELECTRIC LOCOMOTIVE, No. 1 CLASS. (See also photograph in issue of July 27, 1905.)
(Drawing half full size for model.)

[17,857*] **Electric Locomotives.** O. H. B. (Bath) writes: Please give approximate dimensions of a C.L.R. type electric locomotive, 2 in. gauge.

You will find a drawing of a C.L.R. locomotive in our issue for Feb. 15th, 1902 (price 3d., post free), but we would point out that this locomotive will not work with other standard gauge vehicles. All "tube" railway rolling-stock is very low. We include a diagram of the Metropolitan Railway electric locomotives to the scale required, viz., 2-in. gauge, 7-16ths-in. scale. These locomotives are built to suit ordinary rolling-stock. Further particulars may be obtained from drawing.

[17,894] **Charging Cells without Ammeters.** H. S. (Olney) writes: I have a small dynamo about 20 volts 4 amps. Can you tell me how to charge one or more 4-volt accumulators without using volt or ampere meters?

You could use a lamp of known voltage, say a 10-volt one. Then when it shows properly bright, cut out lamp and connect up to accumulator. See replies on this subject in back numbers.

[17,910] **Properties of Platinum.** A. M. T. (Totton) writes: Will you kindly give me one or two tests for platinum other than by heat, also its melting point Fahr.?

Acids will not attack it. The melting point of platinum is 1,772° C., 3,227° F. Thermal conductivity is ·16; specific gravity, 21·2; resistance of 1 ft., ·001 in. diameter—66·0 ohms at 0°C.

[17,871] **Machinery for Model Steamers.** E. E. B. (Bishop's Stortford) writes: I should be obliged if you would tell me if cylinders built up of brass or copper tube, as recommended for a simple locomotive in the issue of June 20th, would stand a working pressure of 100 lbs. per sq. in.? I wish to run these cylinders in "triple expansion" for a model torpedo-boat destroyer; and would like to use six cylinders for twin screws. Would this be satisfactory? If not, could you supply me with a drawing of a built-up cylinder which would not involve very accurate workmanship, as I have no lathe, and am naturally unwilling to have it done for me?

We do not agree with the multiplication of cylinders, and do not advise more than two. The triple-expansion arrangement is not feasible, as a sufficiently high pressure is not possible with the design of slide valve you mention. If you will look into the article again you will find that the cylinders are intended for a simple model locomotive. If you have no lathe, then build an engine with only one cylinder. You will obtain much better results as a whole. We recommend you to refer to our handbook "Simple Mechanical Working Models" and "Machinery for Model Steamers," price 7d. each, post free.

[17,877] **Steam Engine Proportions.** B. G. E. (Purley) writes: I am constructing a small model single-cylinder, single-acting slide valve engine (enclosed type), bore 1¼ ins., stroke ⅝ in. (1) Will this engine be capable of driving a dynamo (multipolar drum)? If so, what size and speed? (2) What heating surface will be required for a boiler pressure of about 60 lbs. per sq. in.? (3) If the steam port is ⅝ in. long, how wide must it be to give the highest possible engine speed? (4) Will one 3-16ths in. diameter hole be sufficient for the steam ways? (5) What diameter steam and exhaust pipes will be required?

(1) The stroke is very small, and, therefore, the power developed will not be very great. At 1,500 revolutions and 60 lbs. per sq. in., the largest dynamo we would care to couple the engine to would be a 50-watt machine. (2) The engine would require a boiler with about 450 sq. ins. of effective heating surface. (3) The steam ports should be ⅝ in. by 3-32nds in., or ⅝ in. by ⅛ in.; exhaust port, ⅝ in. by 3-16ths in. or 7-32nds; port bar, ⅛ in. (4) Drill two 5-32nds-in. holes side by side for the steam ways, and a ¼-in. hole for the exhaust. (5) Steam pipes ⅛ in. diameter; exhaust, 5-16ths in. inside measurements.

[17,879] **Valve Proportions.** R. T. (Cleckheaton) writes: Please help me out of the following difficulty. I have made a small engine, 1⅛-in. bore, 2⅛-in. stroke, but I cannot set the valve right. The throw of eccentric is 5-32nds in., the steam ports are ⅛ in. by ⅝ in., the exhaust is ¼ in. by ⅝ in., and the bars between ports are ⅛ in. by ⅝ in., the valve is 1 in. long, and the recess in valve face is ½ in. by ⅝ in. I think the valve is too long, as when I set the valve right for either port and turn the engine round the other port does not show at all.

Where a plain eccentric motion is employed the rule is:—

(lap + port) opening × 2 = eccentric travel.

Therefore, with ⅛-in. lap and ⅛-in. ports the eccentric should travel

(⅛ + ⅛) × 2 = ½ in.

As you have an eccentric which only gives 5-16ths in. travel you must reduce the lap to about 1-32nd in. Then (1-32nd + ⅛) × 2 = 5-16ths in., and you will be able to obtain an equal and full port opening. Of course, you can arrange the valve only to open three-quarters of port width, viz., 3-32nds in. instead of ⅛ in.; the lap could then be 1-16th in.; with 1-32nd in. lap the valve should be 13-16ths in. long, and with 1-16th in. lap ⅞ in. long.

[17,880] **Consumption of Various Electric Lamps.** G. H. B. (Aberdare) writes: Will you please supply me with the following particulars. What is the number of watts required per candle-power for the following lamps:—Glow lamp, Tantalum lamp, Osmium lamp, Nernst lamp, and Arc lamp?

According to the various tests which have been made, the consumption of the various lamps you mention is as given below:—For carbon filaments, run for 1,000 hours at 230 volts, giving 16 c.-p., average consumption = 4·7 watts per candle. This isa

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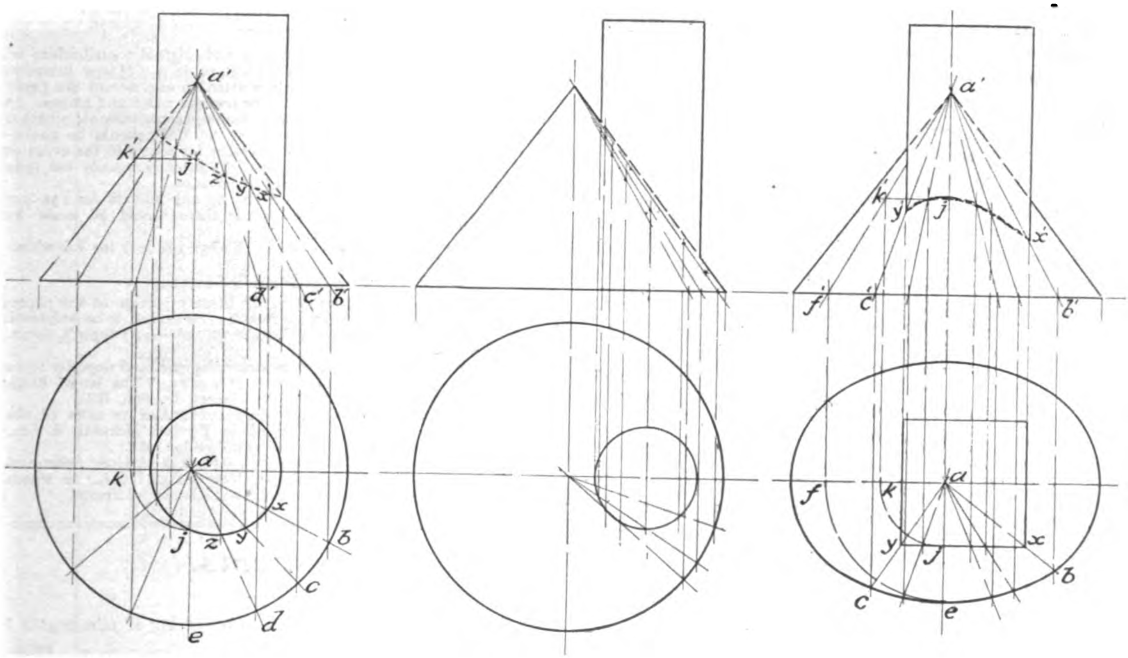
high figure, and was obtained by Mr. H. F. Haworth from some tests which he made. Osmi lamps take from 1·6 to 1·66 watts per candle-power. Tantalum, from 1·7 to 1·9 watts per candle-power. Nernst, 2·2 watts per candle-power. High efficiency "Ediswan Sunlight" lamps of 100 c.-p. can be run at 2 amps. at 100 volts—*i.e.*, 2·1 watts per candle-power approximately. Arc lamps of 1,000 c.-p. take about ·75 to 1 watt per candle-power.

[17,882] **Running Simple Electric Motor.** C. D. Weybridge) writes: I have made the model car motor, as stated in "Simple Electrical Working Models," and have connected the coils up as stated, all being wound the same way with the starting ends towards the bends and the finish at the face of poles, and cannot get the motor to revolve. It moves first from one side and then the other, and that with two batteries I have used chromic acid for charging and only a single fluid with two carbons in each and one zinc, such as is used for a Leclanché cell. The connections are as follows (sketch not reproduced). Can you tell me what I have done wrong?

If you adjust the little brass spring or brush so that it just touches the four corners of the contact-piece as the drum revolves, and so makes circuit four times per revolution, you will find the motor will run well. Give it a good start, of course, by hand. Nothing else appears to be wrong with your arrangement.

[17,896*] **Geometrical Drawing.** N. L. (Barrow-in-Furness) writes: Being a constant reader of your valuable paper, THE MODEL ENGINEER, I take the liberty of writing you asking if you could tell me how to obtain the interpenetration line of the three problems enclosed? If not, could you recommend a book which will contain the problems?



PROBLEM I. PROBLEM II. PROBLEM III.

There are two methods of determining the intersection of conical and cylindrical surfaces. In one method (*a*) the solution is found by assuming a number of horizontal planes, intersecting both the cone and the cylinder and projecting the points where the circles intersect. In the other method (*b*) a number of lines are taken on the surface of the cone and the solution found by projecting the points where these lines intersect the surface of the cylinder. Some reference has been made to both these methods in THE MODEL ENGINEER, page 466, Vol. XVI. In Problem III, the first method (*a*) is not convenient. We, therefore, show the application of the second method (*b*). Beginning with Problem I, draw from the apex *a* of the cone a few lines as *ab*, *ac*, *ad*, by projecting the points *b*, *c*, *d* to the ground line. We can determine the elevation of these lines, as *a'b'*, *a'c'*, *a'd'*. The points where the lines intersect the cylinder is shown on plan at *x*, *y*, *z*. To find the corresponding points we have only to project to *x'*, *y'*, *z'*, which are points in the required line of interpenetration. The line *a c* being vertical, does not admit of solution by the same method, but the point may be found by drawing through the point *j'* the arc of a circle *k*, centre *a*, projecting the vertical *k k'*, and the horizontal *k' j'*, giving *j'* as the required point. Having found a sufficient number of points, it only remains to draw a fair curve through these, as shown by the dotted lines. Problem II is solved by the same method, which will be readily understood from the diagram. In Problem III we have a square prism intersecting a cone with an oval base. In applying the same method, begin by taking the most important points, as the corners of the square at *x* and *y*, through which draw the lines *a b* and *a c*; project as many intermediate lines as may be thought desirable. To find the point *j*, draw from *a* as centre, the arcs *j k* and *e f*; project *f* to *f'*, draw *f' a'*, draw the vertical *k k'*, and the horizontal *k' j'*, cutting the centre line in *j'*, which will be the required point. We hope to give some information on the various methods of determining the intersections of the surfaces of solid figures in "Drawing for Beginners" now appearing in these pages.

Further Replies from Readers.

[17,522] **Telephone Systems.** May I point out the fact that if "E. C. G. (Edinbro')" is endeavouring to work out a system by which long telegraph lines may be worked direct, he is working in an entirely wrong direction. In the first place, his method involves the use of two line wires to free it from interruption from magnetic storms and earth currents, and even then his receiver will be affected by induction from power circuits. Secondly, the system can only be worked at from 25–30 words per minute. I might also point out that the London-Aberdeen circuits with one repeater are worked over a single line on the duplex Wheatstone system at a speed of 200 words per minute—that is, 200 words each way at the same time. Furthermore, on a high-speed "news" circuit, with London, Edinburgh, Glasgow, and Aberdeen in circuit, a simplex speed of 300 words per minute is obtainable, all stations receiving the news. With regard to underground circuits, the present London-Glasgow underground is worked duplex (Hughes') at a duplex speed of 80–90 words per minute.

New Catalogues and Lists.

The Crypto Electrical Company, 155 and 157, Bermondsey Street, London, S.E., send us a leaflet descriptive of their continuous current transformer for charging accumulators, ignition and lighting purposes.

The Universal Motor Company, St. James' Road, Derby.—The illustrated catalogue of this firm's goods includes gas and oil engines from 1 to 30 b.h.-p. A new pattern small engine for for ½, ¾, or ¼ b.h.-p. Prices are given for finished engines and sets of castings and parts; petrol motors for launches, cars, or cycles, etc. List will be sent to readers, on application, for 3d. post free.

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The Editor's Page.

WITH regard to our recent announcement concerning the final arrangement of classes for the forthcoming Model Speed Boat Competition, we are glad to have received from the Secretary of the Wirral Model Yacht Club the following note : "This is exactly as I should have arranged it, and I am sure your decision will meet with universal satisfaction. The only reason we have introduced the 5-ft. 6-in. class of steamer is that we have found the 7-ft. model *very awkward* to carry about to other lakes in Liverpool and District, and a 5-ft. 6-in. boat will be more handy : otherwise for speed the 5-ft. 6-in. boat will not be in it."

* * *

We feel sure sure that many of our readers who are not the happy possessors of good lathes, and the quality of whose work is thereby handicapped, will welcome the articles commencing in this issue on the "Design for a Handy Lathe," from the pen of Mr. W. Muncaster. The drawings are extremely clear, and there should be no difficulty in working from them direct, as they are all to scale and fully dimensioned. Our younger or less experienced readers, although not able to construct the lathe, will find it worth while to follow the articles and glean useful information as to the building and working of a tool which they hope some day to possess.

Answers to Correspondents.

W. S. (Toronto).—We thank you for your interesting post-card, and will insert your request.

"Wild Cluny" (France).—Your contribution is not at all clear. We do not undertake to supply readers with different firms' catalogues. The names and addresses of makers of the machines and tools you mention will be found in our advertisement pages.

J. E. L. (Newport).—Your letter to hand, which will be dealt with as soon as space permits.

R. P. K. (Manchester).—The usual method of marking the planking on a model deck is by cutting with a sharp tool the parallel lines just the width apart required, the marks afterwards being pencilled over and the deck varnished.

H. P. (Bristol).—No detail drawings of this engine are available, and it is hardly a type of locomotive we would recommend a beginner to model. It is unduly complicated. You might get castings of wheels and use stock designs of cylinders. Obtain and study the contents of "The Model Locomotive : Its Design and Construction," price 6s. net, post free 6s. 5d. from our publishers, before you make any outlay on materials and castings.

G. H. C. (Worksop).—No, perpetual motion has not yet been discovered, and we cannot advise you to continue your search for it.

J. B. (Birkenshaw).—Assuming the mean pressure on piston to be 33 lbs. and the speed 200 r.p.m., the indicated horse-power, with 16-in. cylinder and 3-ft. stroke, would be, approximately, 31 h.-p. The brake horse-power will probably be 27 h.-p., but can only be ascertained accurately by an actual brake horse-power test.

F. T. (near Cape Town).—½ lb. of No. 36 is needed for the secondary of your coil. The price of D.C.C. No. 36 is 5s. per lb.; D.S.C. is 10s. 6d. per lb. The connections are clearly shown and explained on page 19 of Handbook No. 11.

P. G. (Manchester).—There is no book dealing exclusively with the matter, but we think you would get what you require from the reply to a recent query on speeds of pulleys, gearing, etc.

Notices.

The Editor invites correspondence and original contributions on all amatuer 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, pabable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

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

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THE

Model Engineer

And Electrician.

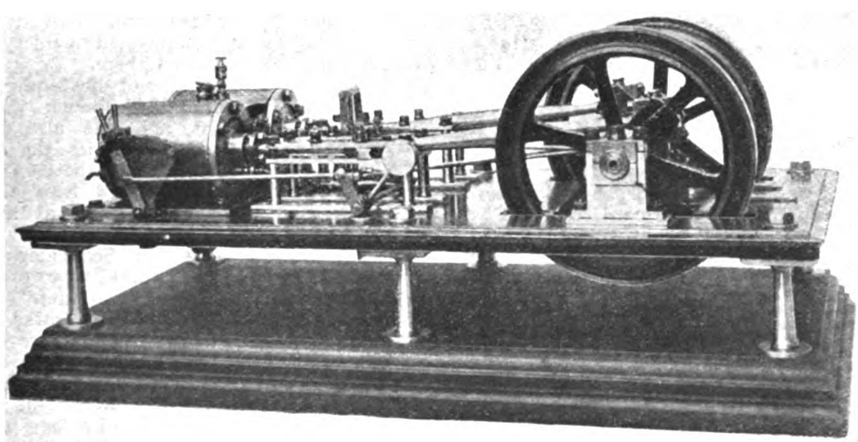
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 327. AUGUST 1, 1907. PUBLISHED WEEKLY.

A Model Double-cylinder Reversing Horizontal Engine.

By W. ASHFORD.



MR. W. ASHFORD'S MODEL DOUBLE-CYLINDER ENGINE.

THE following short account and photographs of a model I have just completed, may be of interest to fellow-readers of THE MODEL ENGINEER. The engine is of the double-cylinder reversing type, and is made (to the scale of 1 in. to 1 ft.) from a large engine. The cylinders are of cast iron, lagged with asbestos and sheet brass, and are fitted with the Stephenson link-motion with D slide-valves working in a common steam chest between the cylinders. The crankshaft was made as follows: The shaft was turned up to ½ in. diam. and both ends were screw cut to allow webs to screw on into place; these were made from two blocks of steel in the following way: A ½-in. tapped hole was put in one end of piece of steel to screw on shaft. The part (B) in sketch was then cut away and the crank-pin and sides and ends of webs turned up. This was repeated for the other crank, and after the eccentric sheaves—which were turned up solid—had been slipped on, the cranks were screwed in position. Two tapped sleeves were now made to screw on ends of shaft, as shown, and the whole was brazed together and the parts of shaft between webs cut away, and the whole polished up. This makes a very strong job and requires much less work than turning out of the solid. I fitted adjustable brasses to all working parts, also oil cups, drain cocks, and lubricator to cylinders. The model is mounted on a bedplate supported on six columns on a polished wood base.

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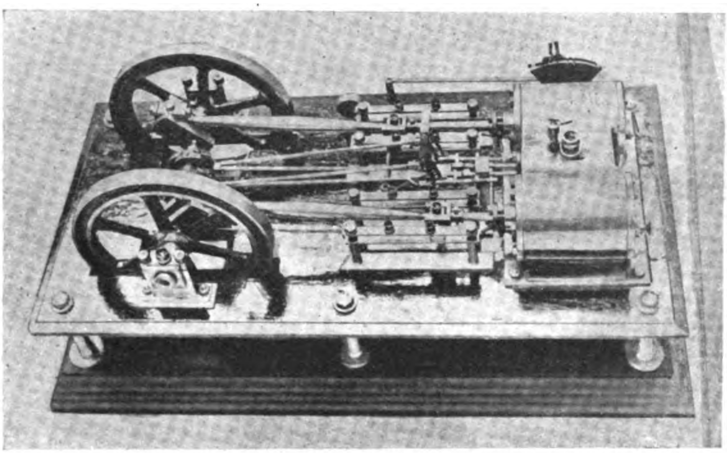
With about 20 lbs. of steam the engine runs at about 300 r.p.m. in either direction very smoothly. I may add that I made my own patterns and had the castings done locally.

The Junior Institution of Engineers.

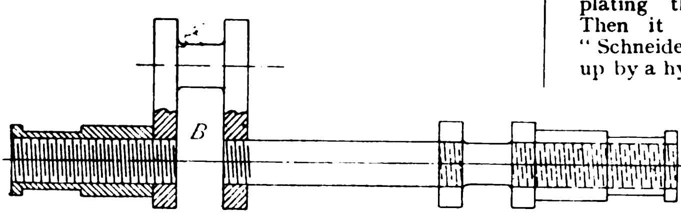
WE have been informed that M. Gustave Canet has been elected President of this ever-advancing Institution for the ensuing session,



PLAN VIEW OF MODEL ENGINE. (*See front page.*)

in succession to Mr. William B. Bryan, chief engineer to the Metropolitan Water Board, and that he will deliver his presidential address on Monday, November 18th next, taking for his subject "The Latest Improvements in English and French Modern Artillery."

It is interesting to note that Jean Baptiste Gustave Adolphe Canet was born at Belfort (Department du Haut Rhin) on September 29th,



SKETCH SHOWING CONSTRUCTION OF CRANKSHAFT FOR MR. ASHFORD'S ENGINE.

1846. After passing through the Ecole Centrale, he obtained the diploma of "Ingenieur des Arts et Manufactures" on August 31st, 1869. He was thus a young engineer when the Franco-Prussian War was declared, and in this capacity he was gazetted lieutenant in the artillery in the "Garde Mobile" of the "Haut Rhin." He was ordered to Neuf-Brisach, where he was present at the siege of the town, taking an active part in the construction of its fortifications, and was afterwards made a prisoner of war and sent to Leipzig. It was thus that his particular interest in artillery was awakened, and as early as 1872 he obtained an appointment as an engineer to the Vavasseur Factory of guns, gun carriages, and torpedoes at Elswick. Under the able direction of Mr. Vavasseur, the eminent successor of Captain Blakeley, he propounded, as early as 1876, the theory of hydraulic brakes and the new principles for gun-carriage construction which have since been universally adopted.

M. Canet remained at the Vavasseur Works till 1881, when he left in order to realise his dream of establishing in France the manufacture of war materials. He did not hesitate to return to his native country to commence operations at the "Forges et Chantiers de la Méditerrané," although he had only obtained very limited provisional rights for the home manufacture of ordnance from his Government. In 1885, a Bill was passed in the French Parliament authorising the free manufacture of war materials for foreign Governments.

The ordnance works established at Le Havre were considerably extended, and now all types of ordnance for coast defence, siege, fort, and field artillery are manufactured there.

M. Canet has equipped a great number of foreign warships with guns, and has also supplied for various countries the new type of turrets or barbettes, with central loading arrangements worked hydraulically, electrically, and by hand. In 1897, at the request of the French Government, M. Canet amalgamated his works with those of Schneider Creuzot, in order to create a standard type of artillery in France known as "Schneider-Canet." The fusion with these great French steel works gave a considerable impetus to the manufacture of ordnance just at the time when all powers were contemplating the rearmament of their field artillery. Then it was that that wonderful field-gun—"Schneider-Canet"—with its long recoil taken up by a hydro-pneumatic brake on the gun carriage, was introduced, and has since been adopted by the Japanese, Mexican, Bulgarian, Norwegian, Servian, Spanish, Portuguese, Peruvian, Chinese, Bolivian, and other Governments.

In spite of being so actively employed on these great works, M. Canet has always found time to take a keen interest in technical, scientific, and philanthropic institutions, and is a member of the leading societies in France and other countries.

TO MODEL ENGINEERS IN TORONTO.—A reader, Mr. W. SHORT, 208, John Street, Toronto, would like to meet with other model engineers in that district.

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Chats on Model Locomotives.

By Henry Greenly.

Valve Gears.

(*Continued from page* 64.)

To conclude, for the present at least, the rather long drawn out dissertations on model valve gears suitable for use on model locomotives and other steam engines, I submit herewith some rough sketches of valve gears I have come across in my travels in "Model-land," and which are variants of the slotted connecting rod idea contained in the last article. From a strictly scientific point of view, the gears shown herewith are not perfect, but in spite of the compromising features present in them, they "work," fulfilling their purpose admirably. What more does any model engineer want ?

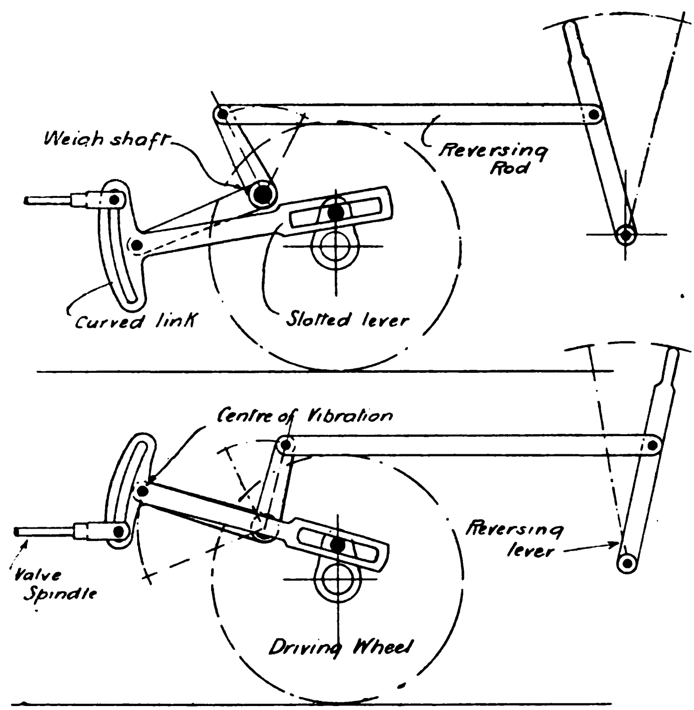

Fig. 4.—Reversing Valve Motion used for Small Toy Locomotives; shown in Forward and Backward Gear.

The gear shown in Fig. 4 is used on some of the cheaper models built of tin-plate stampings, which, within their limits, are very satisfactory models. They are generally ingenious, well finished, and maintain steam in a surprising manner. For under a sovereign, also, that great "fetish"—reversing from cab—is also satiated.

As will be seen by the sketch just referred to, the primary motion is obtained from the vertical component of the rotary movement of the crank-pin. A curved pin is used, but this has a long lever projecting from its centre, the extremity of which is also slotted. The point of suspension, about which the curved link vibrates, is quite near to the slot, the pivot pin being fixed in an arm from the weigh or reversing shaft. To reverse, the weigh shaft arm moves the curved link bodily, so that instead of the forked end of the valve rod engaging with the top of the link, the bottom of link is engaged and moves the valve rod in an equal and opposite direction, thus reversing the motion of the valve and engine. This is shown on the second view. Both of these drawings must be considered only as sketches "on the workshop wall," and methods of setting out such as have been used before in these articles should be employed to design a gear on these lines for a given engine.

For small stationary engines, where a crank is used, the gear is modified in the very ingenious manner shown in Fig. 5. The cranked axle precludes the convenient employment of the crank-pin for actuating the slotted lever and curved link, and therefore a small collar is fitted to the round connecting and the set pin of this collar used to move slotted lever.

Both these valve motions look very bad on paper, but, as explained in previous articles, variations in the amount of port opening do not matter very much so long as the *timing* can be arranged in a fairly accurate manner. Moreover, as linking up is not resorted to, the slotted link may be made quite straight. If it is curved, however, the radius should be struck from about the centre of the slot in the lever. The point of suspension should be as near to the centre of the slot in the curved link as possible, and to obtain greater accuracy, brackets bringing the point of suspension on the centre line of the slot may be employed, if desired. These may be fitted in a similar manner to those often employed in Stephenson's link motion. So much for these interesting gears. I refer in another column of this issue to a letter received in connection with the modified Joy's gear illustrated in May 30th issue, and in which a reader points out that he had already devised the gear, and that an illustration of the experimental engine to which it was fitted is to be found in The Model Engineer for December 15th, 1902. Although it is not clear that the two arrangements are exactly the same, the usefulness of the gear is not affected, rather the reverse, as the correspondent, Mr. C. K. Westcott, evidently obtained excellent results with his own model, and thought it worthy of consideration by his fellows in the art of model making.

In connection with the above *denouement*, it is interesting to note that the locomotive superintendent of the Midland Railway has recently patented a valve gear which in substance is the same as that I devised for models in 1901, and which is illustrated and described in the issue of The Model Engineer for June 15, 1901.

Mr. Deeley's valve motion is illustrated in the accompanying patent drawings and, as will be

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seen, the gear is worked entirely from the crossheads, the crosshead on one side working the link on the other side; but, of course, the model gear was provided with no " lap and lead " functions, and instead of employing two positions, fore and aft of each other, for the pivot pins of the curved links, as in the "Deeley" gear, the model valve motion had a single arm on the weigh shaft, which necessitated the ports on one side being crossed. The motion, of course, is practically only applicable to two cylinder inside cylinder engines, and the

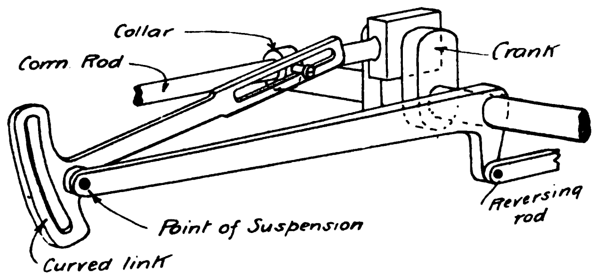

FIG. 5.—ALTERNATE METHOD OF ARRANGING GEAR WHERE A CRANKED AXLE IS EMPLOYED.

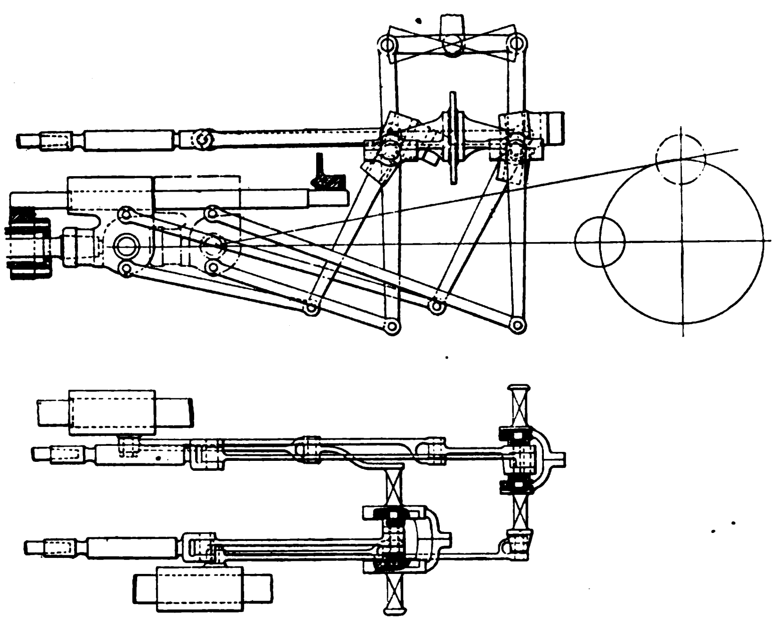

FIG. 6.—MR. R. M. DEELEY'S LOCOMOTIVE VALVE GEAR.
(*For full particulars see Patent Specification No.* 16,372, 1905.)

cranks must be placed at 90 degs. to each other. The most interesting point, apart from the purely mechanical features of this method of actuating locomotive valves, is the fact that THE MODEL ENGINEER is ahead again.

(*To be continued.*)

THE UNIVERSITY SCHOOL at Leeds for the teaching of mining, metallury, and the combustion and chemistry of fuel, now practically constructed, is to be opened in October.

Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page* 26.)

IN drawing a cottered joint care should be taken to show correctly the clearances for the drift due to the taper of the cotter. Take the case of the connection of the end of a piston-rod and a crosshead, as shown in Fig. 60. The end of the cotter must be narrow enough to pass between *x* and *y* when the parts are put together before being driven home. The cotter then bears against the surfaces at *a*, *a*, *a*, and not against the surfaces *b*, *b*, *b*, where the clearance should be sufficient to allow the cotter to be driven right home without quite filling up the space; one side of the cotter will be tapered (about 1 in 16 is the usual amount for ordinary work). A much greater amount of taper will make the cotter liable to slack back, while if the taper is much less the cotter will be required of an inconvenient length. Some device is generally arranged to prevent any slacking back; in the figure a split-pin is put through, which may not prevent the cotter slacking, but will prevent it coming out.

Fig. 61 shows the arrangement of a gib (*g*) and cotter. The object of the gib is to prevent the strap from spreading. In the previous example no gib is necessary; the cylindrical form of the boss prevents it from spreading. In the case of a connecting-rod end, however, the strap would spread on account of the pressure of the edge of the cotter against the surface *a* at the small end, when the cotter is being tightened up. Besides this, there is the effect of the centrifugal force of the motion round the crank path tending to spread the strap. The usual way is to arrange the taper of the cotter and of the gib to be the same angle, so that when put together the outside edges of the pair are parallel to each other.

The proportions of the gib and cotter depend on the character of the work to be done. A fairly good rule for general work is to make $b = C \times \cdot 45$ (Fig. 62); the smaller end of the gib $a = a^1$, the latter letter representing the dimension of the cotter at the middle point of c when beginning to drive; $f = b \times \cdot 25$, $e = a \times \cdot 7$, the total length of the gib $= c + (a \times 1 \cdot 6)$. For connecting ends the taper may vary from 1 in 16 to 1 in 10. Some means of preventing the cotter from flying out must be provided, especially at the large end of the rod. A screw is generally fitted, as shown in Fig. 63.

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There should, in this case, be a slight recess *a* where the point of the screw touches the cotter, otherwise the cotter gets frayed, and, if nicely fitted, is apt to bind in the slot.

A cotter is sometimes fitted with a nut at each end (Fig. 64), so that it can be locked in any position. In this case the thickness of the cotter must be equal to the diameter of the screw thread as a minimum. The back of the cotter will bear the full length against *a*. There must be clearance enough to allow the smaller end of the wedge *c* to take a position in line with *d* when the drift of the cotter is exhausted, and the brasses will require to be renewed or linered up. In this case, where the cotter is held by substantial locknuts and the travel for adjustment somewhat limited, the taper may be fairly steep, 1 in 8, or even 1 in 6 being allowable.

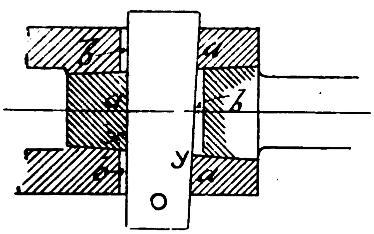

FIG. 60.

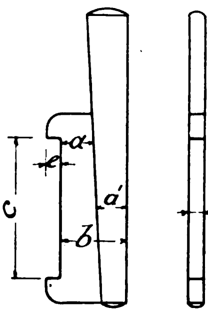

FIG. 62.

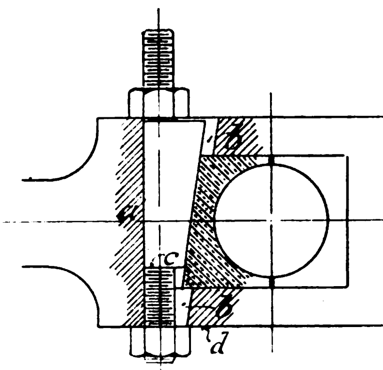

FIG. 64.

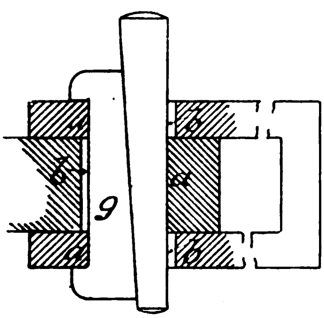

FIG. 61.

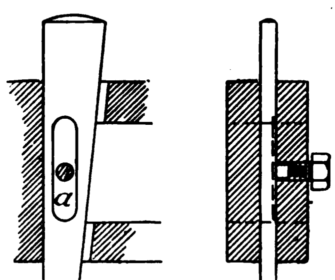

FIG. 63.

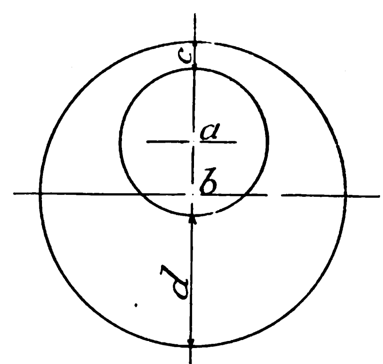

FIG. 65.

ENGINEERING DRAWING FOR BEGINNERS.

In setting out eccentrics the first consideration is the throw or travel, which will be twice the eccentricity. Let *a* (Fig. 65) be the centre of the shaft and *b* the centre of the eccentric; the travel will be twice the distance *a* to *b*; the travel will equal the difference between *c* and *d*. The diameter is determined by the minimum amount to be allowed at *c*. In solid eccentrics this may be small and yet leave a good margin of safety, as the material at *d* adds considerably to the strength.

Fig. 66 gives an example of a small eccentric of cast iron, with cast-iron straps. This is intended for a vertical engine, hence the oil-cup on the top. The bosses for the bolts in the strap are of considerable length; the object is to get the bolts as near the centres as possible and at the same time allow room for the bolthead and the nut. Portion of the strap is shown in section, with a view of rendering the details more clearly.

The lubricator is shown. This is a cup (or boss) cast on the strap, tapped with a ¼-in. gas thread. An oil-hole is drilled, and a small tube is driven in. This tube will, when the engine is put to work, be fitted with a piece of yarn, which will gradually syphon any oil that may be poured into the lubricator. A brass cap is screwed on to prevent the oil from flying out. An arrangement, such as shown, is very handy, as it not only feeds the oil gradually, but it also prevents the grit from getting to the wearing surfaces. A section of the strap as at A B should be added to show more clearly the method of keeping the strap on the sheaf.

In most types of steam engines guides are necessary to the end of the piston-rod. Sometimes these are in the form of link-work, allowing the crosshead only to move in a straight line, but are generally composed of smooth bars, between which a metal block is arranged to slide, this block being

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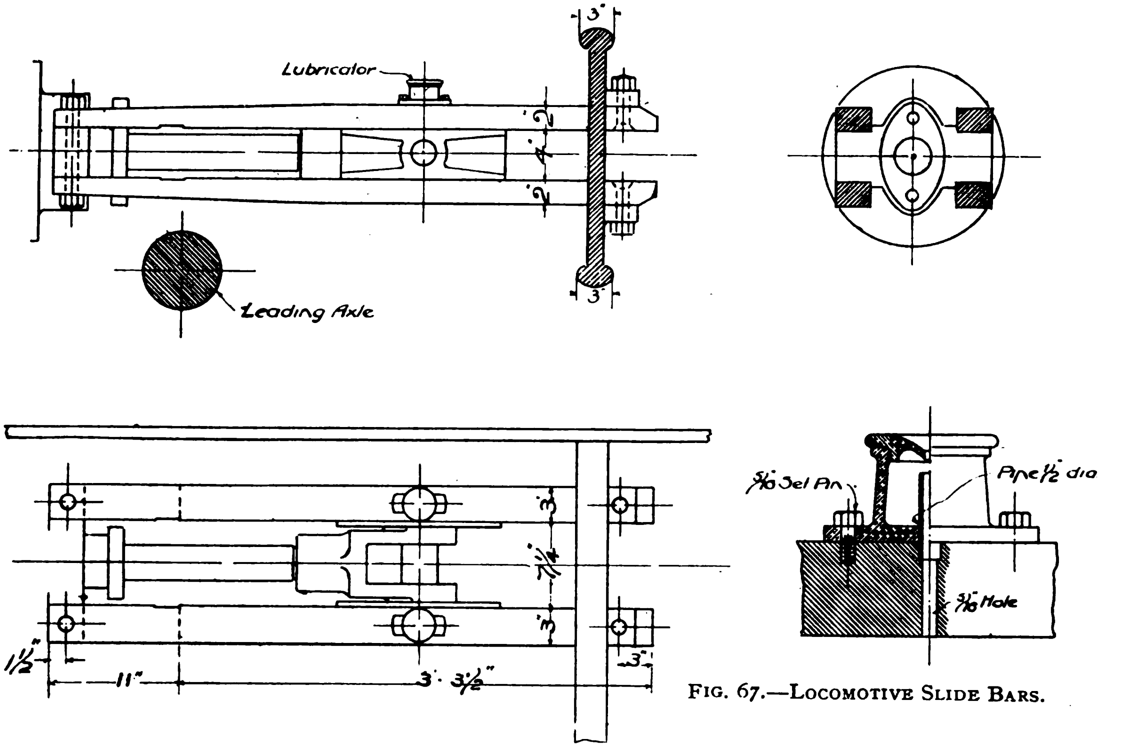

FIG. 67.—LOCOMOTIVE SLIDE BARS.

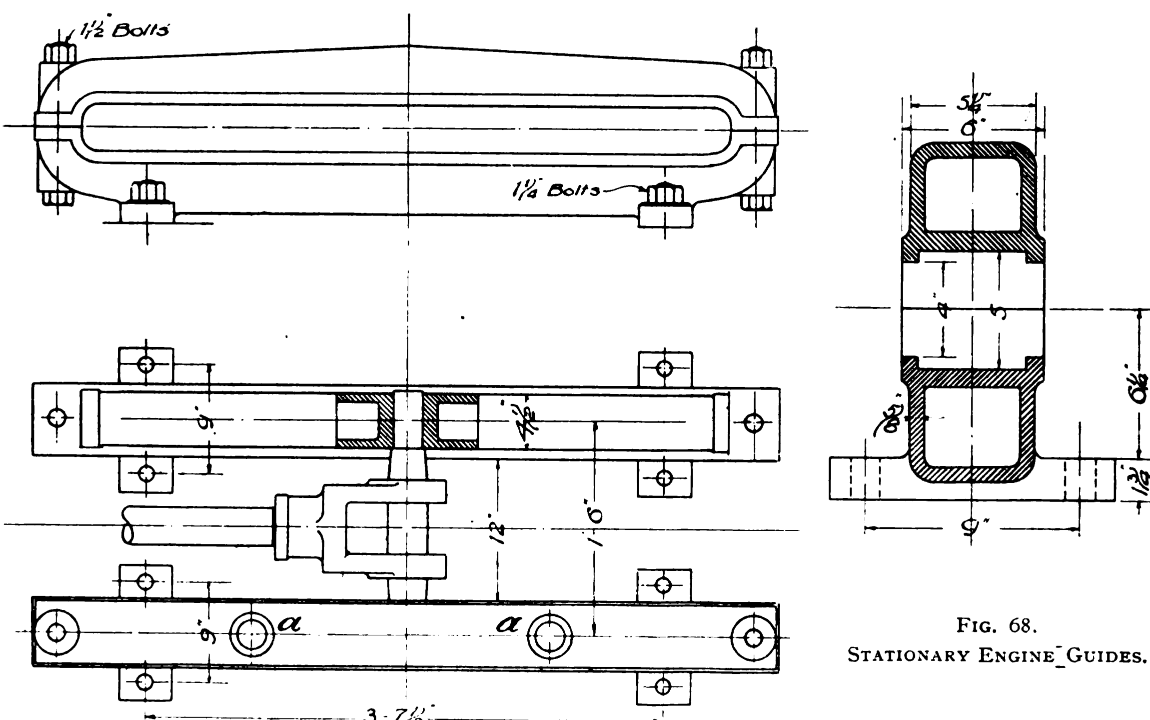

FIG. 68.
STATIONARY ENGINE GUIDES.

ENGINEERING DRAWING FOR BEGINNERS.

fixed to an extension of the crosshead. Several forms of link-work guides will be shown later.

Fig. 67 shows the usual type of locomotive slide-bars. Lugs are cast on the cylinder cover at each side of the stuffing-box. The slide-bars, which are machined out of steel bars rolled and hammered, are bolted to these lugs at one end, the other end being bolted to a cast plate fitted between the frameplates of the locomotive. The blocks, which are of cast iron, are cored out to lighten them, as shown. The bars are recessed at ½ in. each way and the bored hole 1⅞ ins. diameter with keyway.

Fig. 68 shows a pair of guides for a stationary engine. These are of cast iron, cored to ⅜ in. in thickness. In order to get out the holes cores will be left at *a a* over each of the holes. A lubricator, as shown above (Fig. 67) will be fitted, having a pipe extending down to the bottom of the core. The length of the block is 12 ins., the stroke of engine 40 ins., the length of faced surface on slides 51 ins., allowing ½-in. over-run at each end.

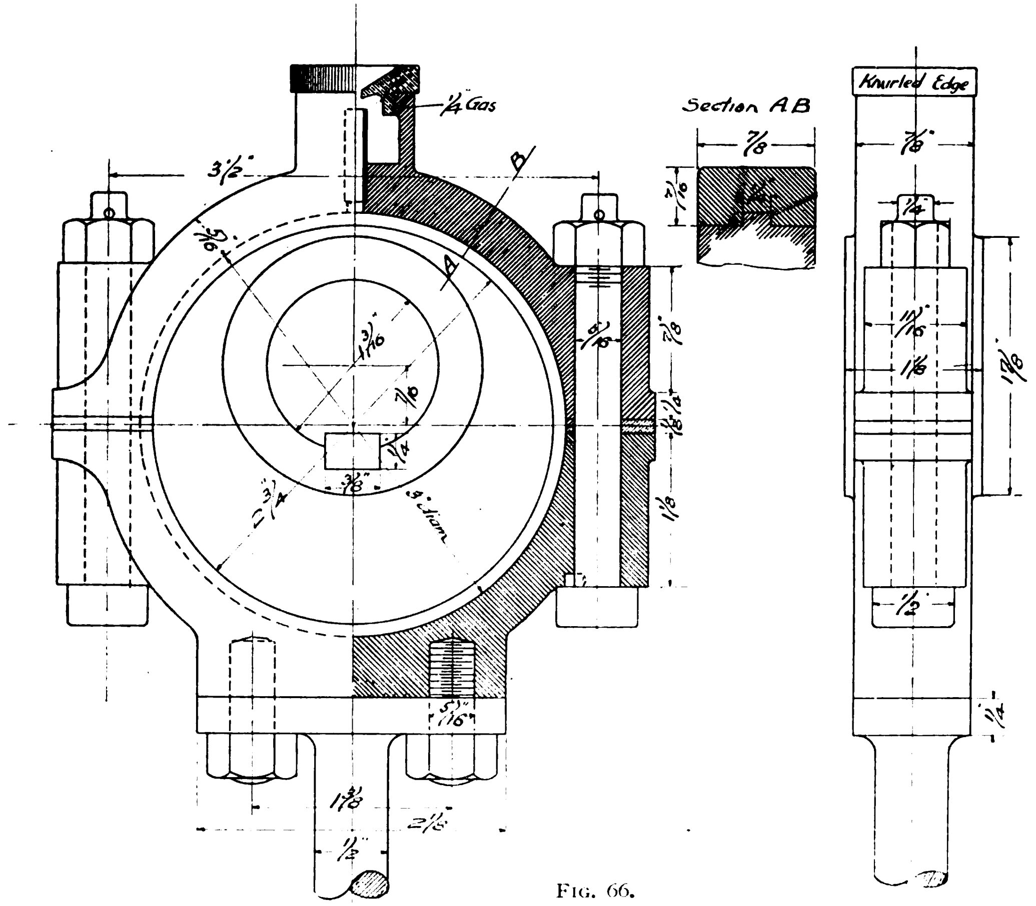

Fig. 66.

DETAILS OF AN ECCENTRIC AND STRAPS.

the end of the wearing surface to avoid the formation of a shoulder. Taking the stroke as 2 ft. 2 ins. and the length of the block as 1 ft. 2 ins., the total length of the slide should be 3 ft. 4 ins. As, however, the drawing gives 3 ft. 3½ ins. of wearing surface only, it is evidently intended that the block should over-run the surface ¼ in. at each end of the stroke.

As an exercise, make a drawing of this to a scale of 3 ins. to 1 ft., drawing in all the bolts and giving all dimensions. Bolts are 1¼ ins. diameter, and the slide-bars at the cylinder end 1½ ins. thick, the recess being 2 ins. wide by 3-16ths in. deep. give separate detail of the block, showing the flanges

This example is taken from a 24-in. by 40-in. reversing-bar rolling engine.

For ordinary engine practice the writer's rule for finding the area of the slides is to divide the pressure in lbs. by 80.

The maximum pressure is (approximately) as follows—

$$\frac{C}{\sqrt{l^2 - c^2}} \times p\,a$$

Where l = length of connecting-rod,
c = length of crank,
a = area of piston (in ins.),
p = pressure of steam (in lbs. per sq. in.).

(To be continued.)

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The Latest in Engineering.

Brazing Cast Iron.—A new and simple process, known as "Castolin," for brazing cast iron is being introduced by Mr. W. H. Lilienfield, of 11, Queen Victoria Street, E.C. By this process broken parts of machines (cast-iron) may be reunited, the only plant required being a charcoal fire or gas blow-pipe. The broken surfaces are well cleaned and the "Castolin" applied to all the pores, and the pieces are tied strongly together, and then placed in the fire. When hand-warm, the grooves are covered with borax and brass spelter. The fire is increased until solder flows well and gives a bluish flame. It is then cooled slowly in sand and cleaned. At the recent Ironmongery and Hardware Exhibition we saw some very satisfactory examples of this process. The repaired castings, having received a blow from a hammer, failed to break in the same place as before.

Liners' Huge Cables.—The well-known firm of Messrs. Brown, Lenox & Co., Pontypridd, have just attained a world's record achievement in the chain-making trade in the shape of the moorings manufactured for the steamships *Mauretania* and *Lusitania.* This gigantic piece of work weighs over 200 tons, was forged at the Pontypridd Works by one set of men, constituting a record both in size and in the time taken, the moorings being forged and completed in the remarkably short period of sixteen days, and this without necessitating any overtime. The anchors, which were also manufactured by the same firm, and which are of their patent mooring type, weigh 12 tons each. Each common link of the chain weighs 243 lbs., and each end link 336 lbs., the diameter of the iron being 4¼ ins. and 5⅜ ins. respectively. The swivel connection in the centre weighs over 2 tons, and each shackle 711 lbs. The main connection where the buoy pendant joins to the bridle chains, of which there are four, are each 720 ft. long. The main chains are composed of square links, each nearly 4 ft. long, weighing about 4 cwts. apiece. The firm has the distinction of being the first to introduce iron cables into the Navy, and it is interesting also to recall the fact that it was this firm which supplied the cables for the famous Great Eastern steamship.

Fusible Plugs.—Instead of having fusible plugs in the bottom of a boiler over the fire, it is proposed by Mr. Yarrow to place a small pipe inside the shell, having one end closed by being sealed to the shell by a suitable fusible metal. The other end passes through the shell and is furnished with a cock, or it may be led to an alarm or to a feed-pump. When the water falls below the safety point the rise of temperature in the boiler acts in the usual way on the fusible metal, but the pipe being protected from the heat of the fire, escapes injury, and when the cock is closed the boiler can be used for steam raising without stoppage for insertion of a new plug.

New German Liner.—The Norddeutscher Lloyd steamer *Kronzprinzessin Cecilie*, which has been under construction at the Vulcan Company's yard, Stettin, during the last two years, will shortly make her maiden trip to New York. Reciprocating engines are employed in the ship, notwithstanding the adoption of the turbine by other companies, and it is expected that she will attain a speed of 24 knots. Her size is 20,000 tons and her horse-power 45,000, developed by four independent sets of quadruple expansion engines, on a consumption of 700 tons of coal a day. Three hundred men will be required to attend to the boiler plant alone.

Dynamometer for Testing Rubber, &c.—A convenient form of dynamometer, suitable for testing rubber, wires, fabrics and paper has been patented by a firm in Paris, says *Electrical Review*, consisting of a cast-iron table provided with a horizontal spring balance, which carries one of the jaws to hold the test-piece. Means are provided to recalibrate the spring, and the pointer is arranged so as to remain at the maximum indication on the breakage of a specimen, thus recording the breaking load. The load is applied either with a hand-wheel and bevel-gear for quick motion, or through worm-gear for heavy loads at low speed, and pulsating stresses of any desired amplitude can be applied by means of an eccentric gear, at adjustable speeds. Samples can be tested in a bath, by means of which the temperaturec may be varied; and the apparatus also provides for compression, plasticity, repeated bending, wear and friction tests, so that it is capable of being applied to a large number of purposes.

The Production of Hydrogen. — Hitherto, when it has been found necessary to fill balloons with pure hydrogen gas, which possesses about twice the lifting power of town gas, it has been a common practice to generate it with iron and zinc turnings and sulphuric acid—a somewhat expensive process. A later method consisted of decomposing an alkaline solution by means of an electric current. During the last month or two a new process has been under trial by the Government, and the plant has, says *Engineer*, recently been accepted and taken over from the makers. By this process steam is decomposed by a red-hot ferric material, a reaction not in itself new, but in conjunction with means of revivifying the material *in situ* in the retorts, an important source of supply of nearly pure hydrogen at very low cost is said to be available. The plant for producing this cheap hydrogen is the invention of Mr. Howard Lane, of Birmingham, who exhibited at the St. Louis Exhibition, and has since erected a large hydrogen installation for the Russian Government.

A New Gliding Boat.—Mr. Peter Cooper Hewitt, a well-known inventor, has just completed some very successful trials with a model of a new type of gliding water-craft invented by him. With his one-man model Mr. Hewitt had no difficulty in attaining a speed of 38 miles, and he confidently anticipates that with a similar vessel of larger proportions he will be able to reach a speed of 100 miles an hour. The main features of the vessel are an exceedingly shallow hull and planes, which enable it to glide over the water like a bird.

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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.]

Fitting the Armature of a Dynamo or Motor.

By A. W. M.

THIS is a peculiar job, of some difficulty even to the professional mechanic who is unaccustomed to similar work. The bearings, as generally designed, and correctly so, are exceptionally long in relation to their diameter, and must be very nicely in line if the spindle is to turn easily. The armature requires to run with a very small clearance space between its circumference and the poles of the field-magnet, which exert

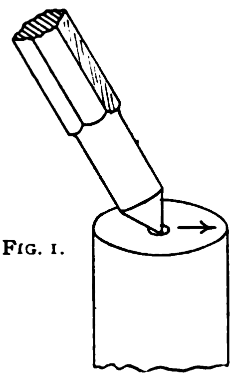


Fig. 1.

a pull upon it due to the magnetism. It must therefore be accurately in the centre (neglecting certain instances) of the field-magnet tunnel. If it is not central, the magnet poles will pull unequally upon it; this tends to bend the spindle and cause friction at the bearings. In some machines the armature is designedly placed slightly out of the centre of the magnet tunnel, to produce a pull in an upward direction or to equalise the distribution of magnetism. But it is still necessary to fit the armature accurately to position, or the desired effect will not be produced.

To fit an armature so that it will be accurately in position and turn easily when the bearing brackets are screwed up tight requires a systematic method of procedure. The bearings must be not only in the correct position, but also perfectly in line with each other. To commence, you should be sure that the armature core and spindle are true. As the process of clamping up the core discs and driving on the commutator bush will sometimes produce a bend in the spindle, it is advisable not to finish the parts which will run in the bearings until the core and commutator are in place. Leave sufficient metal to allow for a finishing cut. Try the spindle between the centres of a lathe and ascertain if the armature core runs true. If it does not, then alter the spindle centres until it does run true. Centres which have not been drilled can be readily altered by drawing them to one side by means of a centre punch. File the ends of the spindle until the existing centres are very shallow, and apply the point of a centre punch so that it is directed towards the direction in which the centre is to be shifted (see Fig. 1). A few blows of a hammer will cause the punch to appreciably draw the centre mark towards the new position. The punch should then be held vertically and the centre deepened in its new place. If the centres have been drilled they can only be shifted (in small machines) by filing the spindle end away until the bottom of the hole is reached; the mark of the drill point can then be drawn to one side by means of a centre punch. In this way the armature core can be made to run true, but the spindle will then

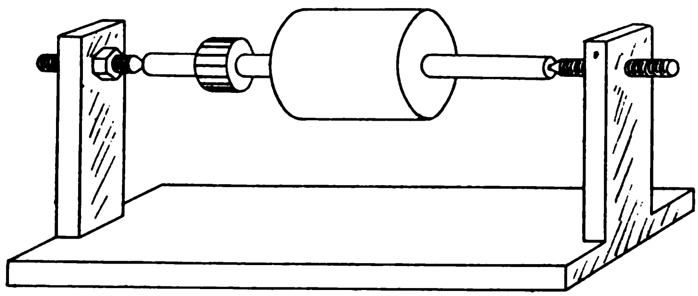
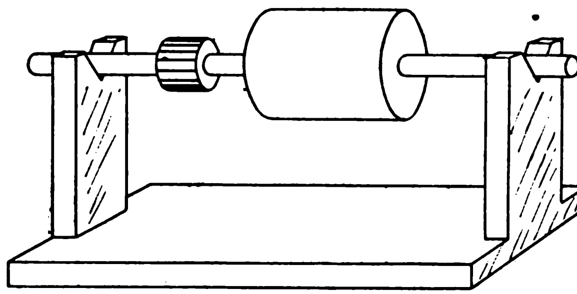


Fig. 2.



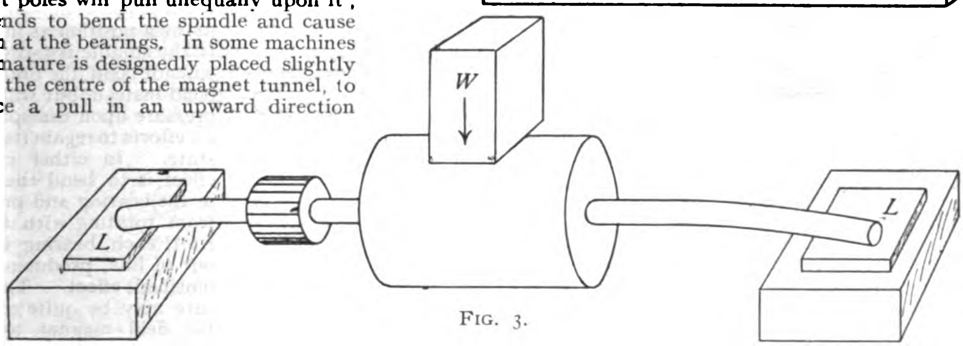


Fig. 3.

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probably be out of truth. This will not matter if a margin of metal has been left for a finishing cut. It is not likely to be much out, but enough to prevent it from turning easily in the bearings when fitted in place if it was of finished size. A final cut carefully taken over the surface will give you a true spindle as well as the core.

If a lathe is not available, and the spindle has been made from bright steel to finished size, it can be tried between a pair of centres rigged up in a wood frame (see Fig. 2), or in a pair of wood or metal V-blocks (see Fig. 3). As the spindle is assumed to be in a finished condition the method of proceeding previously advised should be reversed—that is, the spindle should be adjusted to run true as a first step. If it is bent it may be straightened by placing the ends upon some pieces of iron and giving some careful blows with a hammer (Fig. 3). A piece of lead (L) placed between the iron and the spindle will prevent the latter from being bruised, and a piece of wood (W) can be used to take the blow of the hammer and protect the armature core. When the spindle has been adjusted to run true the core should be tested, the spindle being between centres or in the V blocks. If it does not run true the part which is out can be reduced by a file. To record which place is out of truth, hold a piece of chalk near to the core (or spindle when this part is being examined) whilst the armature is rotated; the high place will strike against the chalk and receive a mark, enabling you to recognise it when the armature is removed from the centres.

If the spindle is not straight the bearings cannot fit properly to it. Fig. 4 shows what occurs when a bent spindle is made to run in a pair of bearings. To permit the spindle to turn easily the bearings have to be enlarged beyond their correct size, which should obviously be almost the same as the diameter of the shaft. The consequence is that the surfaces in contact are small and wear very soon takes place, with the result that the spindle becomes loose in the bearings. A bent spindle can be detected by the fact that it turns stiff in the bearings during a part

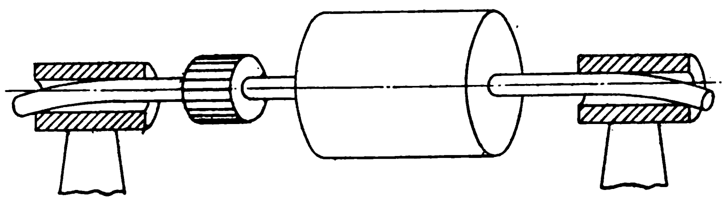

FIG. 4.

of a revolution and easily during the remaining part. In practice a very small amount of distortion will prevent the spindle from turning easily. A novice will in such a case often conclude that the fit is too tight, and ease either the bearing or the spindle, with the result that the armature becomes loose in the bearings and probably makes a rattling noise while running.

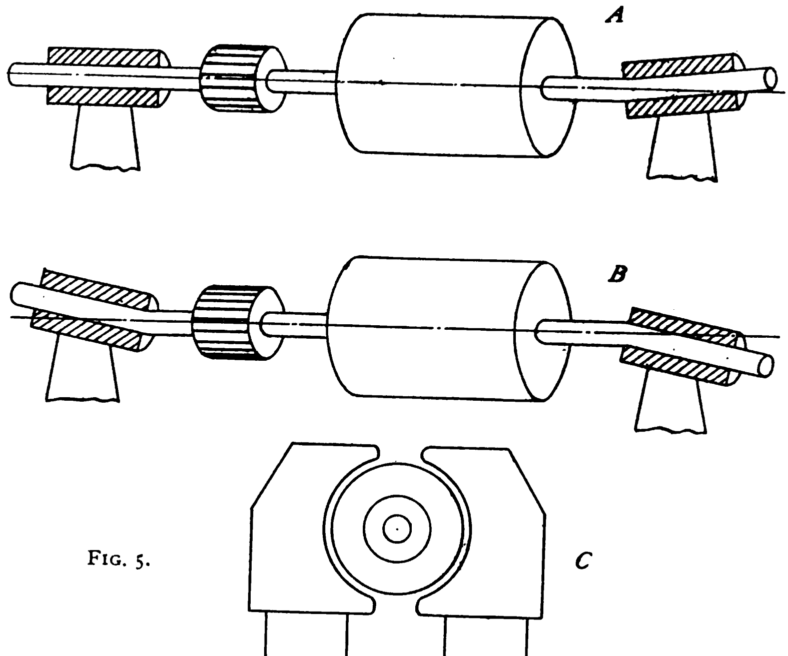

FIG. 5.

Should the bearings be out of line, they will try to bend the spindle and accommodate it to their position. The bearing may be an easy fit upon the spindle, and the latter quite straight, and yet the armature turn stiff when the bearing brackets are screwed tightly in place. In Fig. 5, A shows one bearing out of line with the other. It will try to bend the shaft to suit its own position as indicated. If the spindle is too stiff and will not bend, the bracket will bend instead, but will exert a pressure upon the spindle by its efforts to regain its original state. In either case the effect is to bend the spindle in the bearing and prevent it from rotating with freedom. At B each bearing is shown out of line, producing an intensified effect. The armature may be quite central in the field-magnet, as shown at C, as the bending will not necessarily displace it from the centre line. A pair of bearings are said to be in line when they are straight and true with a line passing through their centres.

The bearings may be straight and yet not in line. For example, in Fig. 6, D, they are both straight and parallel with the centre line of the spindle, but the left-hand bearing is below the proper height. The result is that it will try to bend the spindle as indicated when the bolts are tightened up. As the

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spindle will be too stiff to give very much, the bearing will spring to some extent and exert a continued pressure upon the spindle, preventing it from turning easily; a further bending action will be produced at the right-hand bearing. The latter is also not necessarily in line, though it is at the correct height. It may be displaced to one side as indicated at E, Fig. 6, and producing a bending action of similar nature. If we conclude that the spindle is too good a fit in the bearings and try to remedy matters by reducing it (Fig. 7, F), or, realising that the bearings are out of line, file the holes to one side as G, Fig. 7, a very bad fit is the result, the armature makes a noise when running, and perhaps rubs against one of the magnet poles. The bearing

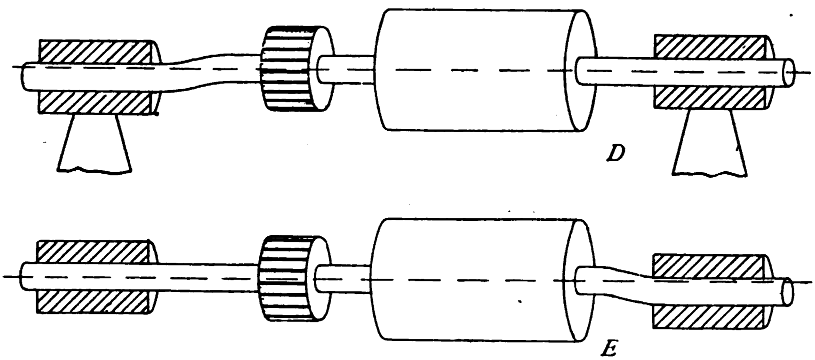

FIG. 6.

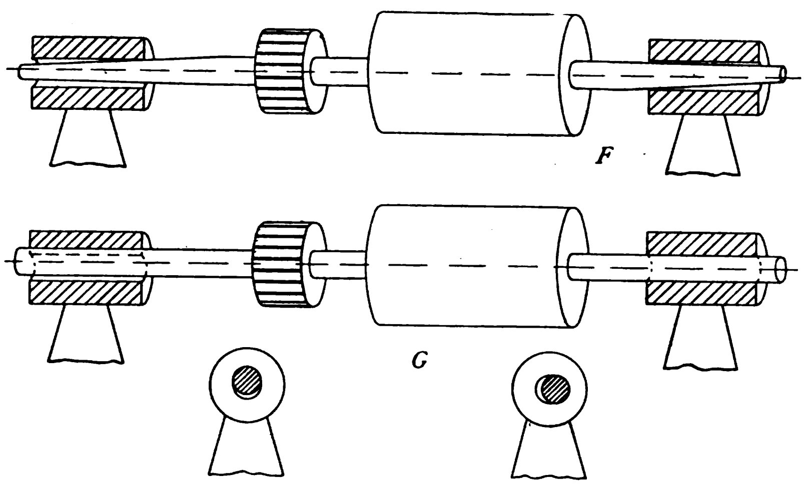

FIG. 7.

surface which should support the spindle has been so reduced that wear rapidly takes place, and the trouble increases. The distortion shown in Figs. 4 to 7 is much exaggerated for purpose of explanation.

(To be continued.)

TO FASTEN CELLULOID TO WOOD OR TIN.—Celluloid can be fastened to wood, tin, etc., by the use of the following compound :—Shellac 2 parts, spirits of camphor 3 parts, strong alcohol 4 parts.

Locomotive Notes.

By CHAS. S. LAKE, A.M.I.Mech.E.

AN INTERESTING LOCOMOTIVE CONVERSION ON THE GREAT WESTERN RAILWAY.

When visiting the new locomotive shed of the Great Western Railway at Leamington recently, the writer was shown a very neat-looking tank locomotive of the 2—6—2 type, one of two which have been converted from 0—6—0 type goods engines with tenders at Swindon works. The engines are numbered 3,901 and 3,902, and will be illustrated in these pages in due course. The side tanks are carried forward to the front end of the smokebox, and there is an opening in them between the leading coupled and driving wheels to afford a means of access to the motion between the frames. The boiler is of the coned pattern, now standard in varying sizes on the G.W.R., and all the features which distinguish the locomotive practice of that line from others are likewise present.

As now running the engines have the dimensions which follow, viz. :—Cylinders, 17½ ins. diameter by 24 ins. stroke; coupled wheels, 5 ft. 2 ins. diameter; rigid wheelbase, 14 ft.; total wheelbase, 28 ft.; boiler pressure, 200 lbs.; tractive power, 21,340 lbs.; weight, 62¼ tons.

NEW EXPRESS LOCOMOTIVE, MIDLAND RAILWAY.

The latest express locomotive type on the Midland Railway is illustrated herewith. The engine, No. 999, has the same boiler proportions as those which apply to the three-cylinder compounds, of which about thirty are now at work on this line. It has, however, two simple cylinders, and is otherwise built on similar lines to the numerous Belpaire two-cylinder locomotives in service on the Midland Railway.

A marked difference is found in the method of steam distribution. This is effected by piston valves actuated by a special valve gear which Mr. Deeley has designed, and the principal feature of which is that no eccentrics are employed, neither is there a return crank or any similar device such as are employed in the Walschaerts and kindred valve motions. The travel of the valve for lead is derived from a pendulum link, and a rod attached to the crosshead of the adjacent motion is utilised

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for the purpose of oscillating the expansion link. The arrangement gives an excellent steam distribution, and the absence of eccentrics on the driving axle is, of course, a great advantage. Further reference to this gear will be made in a later issue, and, if possible, a drawing or diagram given showing the principle upon which it works. Axle boxes of a new design are fitted to the driving and trailing axles. Each box is provided with two cylindrical brasses free to adjust themselves to the bearings.

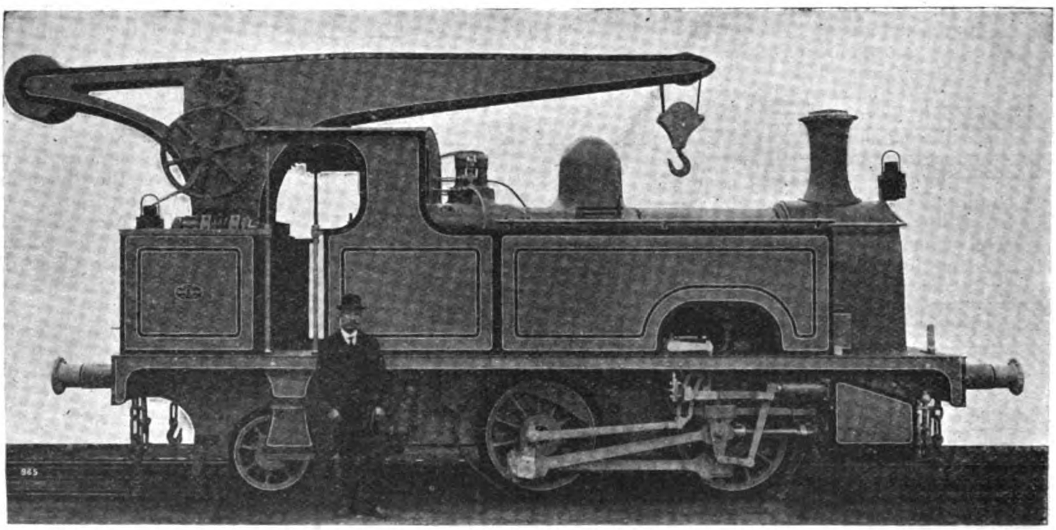
A swing-link bogie is fitted to this engine for the first time in Midland locomotive practice, and altogether the design represents a marked advance on previous standards. All the axle boxes are fitted with sight-feed lubricators, and the piston valves and cylinders are lubricated by displacement, sight-feed, and special suction lubricators respectively. The cylinders are cast in one piece with the valve chests, and smokebox saddle and steam chests are carried beyond the main walls of the cylinders, extending across the ends of both piston valves.

The boiler is pitched with its centre 8 ft. 6¼ ins. above the level of the rails. It contains 249 copper tubes of 1¾ in. outside diameter, expanded to 1⅞ in. at the smokebox end. The length between tube plates is 12 ft. 3¾ ins., and the boiler barrel has a diameter of 4 ft. 9⅛ ins.

The leading dimensions are as follows :—

Cylinders : Diameter, 19 ins. ; stroke, 26 ins.
Bogie wheels diameter, 3 ft. 3½ ins.
Coupled wheels diameter, 6 ft. 6½ ins.
Wheelbase : Engine, 24 ft. 4½ ins. ; rigid, 9 ft. 6 ins.
Heating surface : Tubes, 1404·6 sq. ft. ; firebox, 152·8 sq. ft. : total, 1557·4 sq. ft.
Grate area, 28·4 sq. ft.
Working pressure, 220 lbs.
Weight on coupled wheels, 38 tons 15 cwts.
Weight of engine in working order, 58 tons 10 cwts. 2 qrs.
Weight of engine and tender in working order, 104 tons 9 cwts.
Total wheelbase of engine and tender, 48 ft. 4¾ ins.
Total length over buffers of engine and tender, 57 ft. 9 ins.
Tank capacity of tender, 3,500 gallons.
Coal capacity of tender, 7 tons.
Tractive power, ·0534 ton per lb. pressure of steam.

For the present it is not intended to build any further engines to this design. No. 999 will be thoroughly tested on the heaviest and fastest passenger trains running on the Midland main line, and her performances will be compared with those of the compounds on identical duty. If, as is anticipated may be the case, the results show an equality or even an advantage for the new type, the No. 999 design will become a standard pattern.



Locomotive Crane for Oudh and Rohilkund Railway, India.

(*Vulcan Foundry Co., Ltd.*)

A Locomotive Crane for India.

The Vulcan Foundry Co., Ltd., of Newton-le-Willows, Lancs., have recently despatched a six-wheeled locomotive crane for service on the Oudh and Rohilkund Railway, India. This engine is shown in the above illustration. The four front wheels are coupled, the second pair being driven direct by a pair of outside cylinders, to which steam is distributed by D slide valves actuated by Walschaerts gear. The rear portion of the locomotive is supported upon a pair of radial wheels, 2 ft. 6 ins. diameter. The boiler is fitted with a Belpaire firebox and slightly extended smokebox.

The crane has a radius of 14 ft., at which it is

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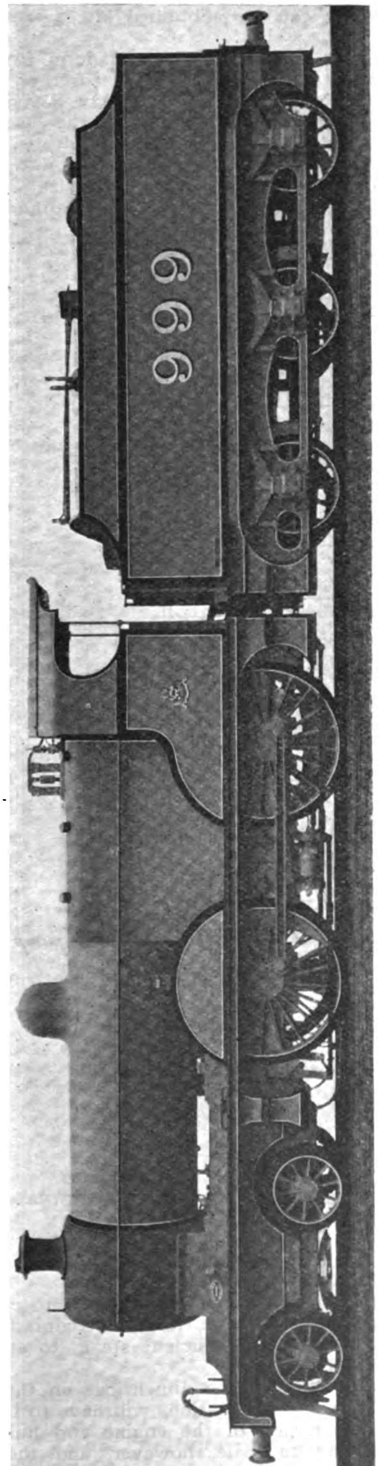

NEW EXPRESS LOCOMOTIVE, MIDLAND RAILWAY.

capable of lifting a maximum load of 6 tons. Steam and hand brakes are fitted, and the equipment includes Gresham & Craven's No. 7 self-acting injectors and a sight-feed lubricator of the Dewrance pattern. The engine cylinders are 14 ins. by 22 ins.; coupled wheels, 3 ft. 7 ins. diameter; radial wheels diameter, 2 ft. 6 ins.; boiler diameter, inside, 3 ft. 7 ins.; length, 8 ft.; working pressure, 160 lbs.; total heating surface, 672 sq. ft.; grate area, 12¼ sq. ft.; weight on coupled wheels, 28½ tons; on radial wheels, 12 tons; total weight, 40½ tons.

A Design for a Semi-flash Boiler.*

By V. W. DELVES-BROUGHTON.

THE accompanying design is of a boiler to work at 500 lbs. pressure per sq. in., to evaporate 15—20 lbs., and to superheat the steam to 100° F.

Undoubtedly a flash or semi-flash boiler has advantages over any other type of boiler where weight is a consideration, but, unfortunately, like most good things, boilers of this type have one serious objection, *i.e.*, absolute dependence on the feed-pump, and to ensure regularity of working this feed-pump must be absolutely free from all chance of derangement. I therefore propose describing this important detail before proceeding to describe the boiler.

The most common cause of failure in pumps of all kinds is due to the suction valve "hanging up." It is therefore advisable to use a so-called "valveless pump," *i.e.*, a pump without a suction valve. There are many types of this, but perhaps the most suitable would be a modification of Clarkson's cylinder lubricating pump, illustrated in Figs. 4 and 5.

This consists of a plunger *a* actuated by springs *b* and cam *c*, the plunger being formed so that it clears the end of the cylinder, a well *e* in free communication with the water in which the boat is working being provided.

The pump is made entirely without packing, the requisite tightness depending upon the accuracy of the fit between the plunger and the cylinder walls.

The cam *c* causes the extension of the springs *b*, and the screw and locknut *f* regulates the length of the stroke; *g* is a non-return valve; *h* and *k* form a union for connecting to feed-pipe. The end of *k* is formed into a guide for the valve *g*; *l* is a spring to produce the return stroke of the plunger; *m* is a double bridle carrying the roller *t* hung on the four rocking-bars *u*; *n* is the pump countershaft; *q* is a prolongation of the main shaft; *p* is a pinion fixed to *q*; and *σ* is a wheel gearing with *p*; *r r* are holes drilled through the cam for the sake of lightness; *s s* is the bedplate and pump body cast in one piece in magnalium or other aluminium alloy.

The construction calls for no special remarks, as it is clearly shown in Figs. 4 and 5. Figs. 1, 2, and 3 show the boiler respectively in plan,

* A prize of one guinea was awarded for this design in the Competition (No. 42).

longitudinal section, and transverse section, whilst Fig. 6 shows the details of the junction-box.

The first coil (1) forms the feed-water heater, and consists of six convolutions of ¼-in. (outside diameter) steel tube, No. 16 S.W.G., laid in three tiers and wired to the packing-pieces (6) in such a manner that the hot gases can circulate freely between them. This tube is welded, as shown, to coil (2), which is of the same diameter and thickness. This, in turn, is welded to coil (3), 5-16ths in. diameter, No. 16 S.W.G., through metal that can be obtained at a reasonable price.

The sheet-metal case (9) is made in two parts, as shown in Fig. 3, and screwed together so as to enable the junction-boxes to project beyond.

The baffles (7) and the lining of the case (8) are formed of thick sheet asbestos, wired where necessary to the tubes or case with thin nickel wire, any irregular openings being made good with a mixture of flock asbestos and water-glass, applied as a plaster and supported on nickel wires.

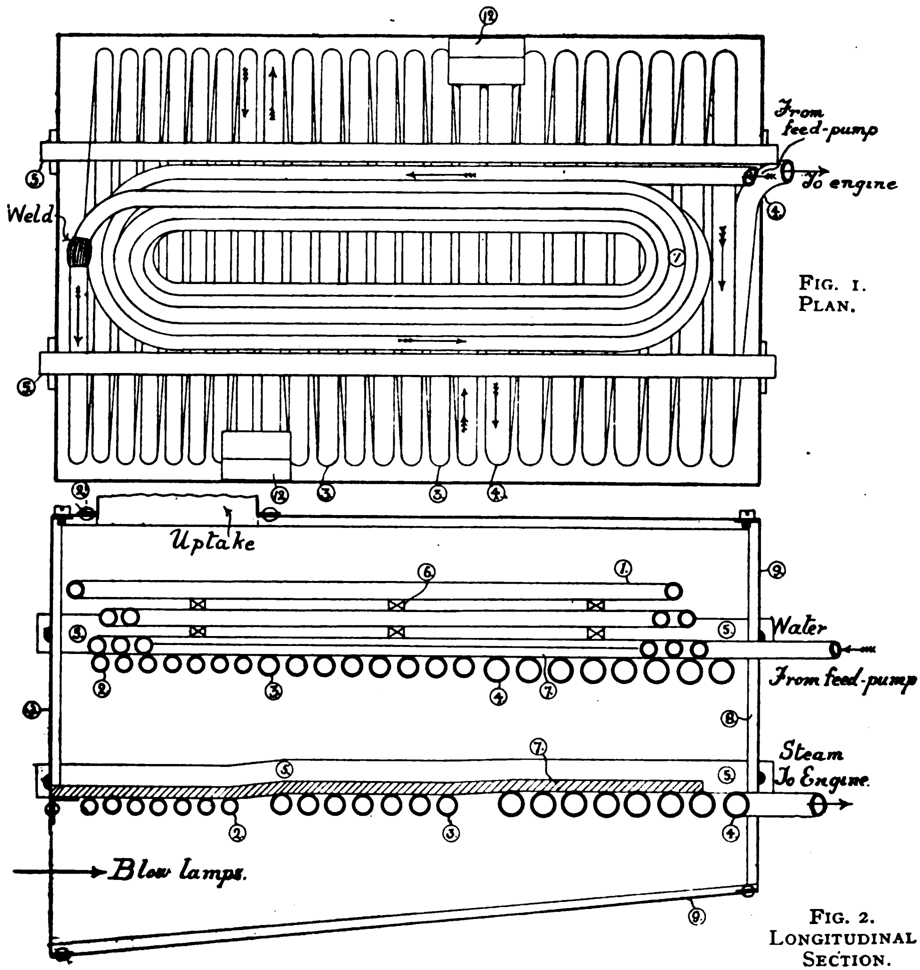

FIG. 1. PLAN.

FIG. 2. LONGITUDINAL SECTION.

A DESIGN FOR A SEMI-FLASH BOILER.

the intermediary junction-box (see Fig. 6), and finally this coil is welded to coil (4), again using a junction-box to effect the weld. The coils are first coiled separately and wired in position on the bearers (5), leaving the ends projecting upwards to enable the welds to be made. When the welds are completed, the ends are bent down into their correct positions and wired.

For wiring the coils, about No. 14 S.W.G. pure nickel wire should be used, as this will withstand the heat of the blowlamps better than any other

The screw plug shown in Fig. 6 is to enable a small quantity of water to be introduced before lighting up to raise sufficient steam to start the engine.

I have not given the dimensions on the drawings, as certain modifications will have to be made to suit the design of the engine and hull. The drawings are to scale, however, and the boiler here described will evaporate from 15 to 20 lbs. of water per hour and superheat the steam to about 100° F.

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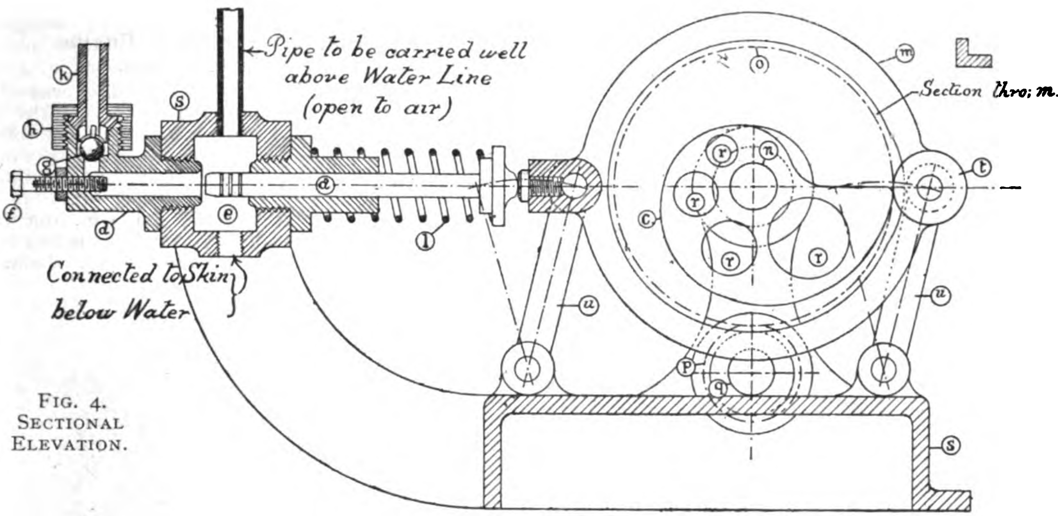


FIG. 4.
SECTIONAL
ELEVATION.

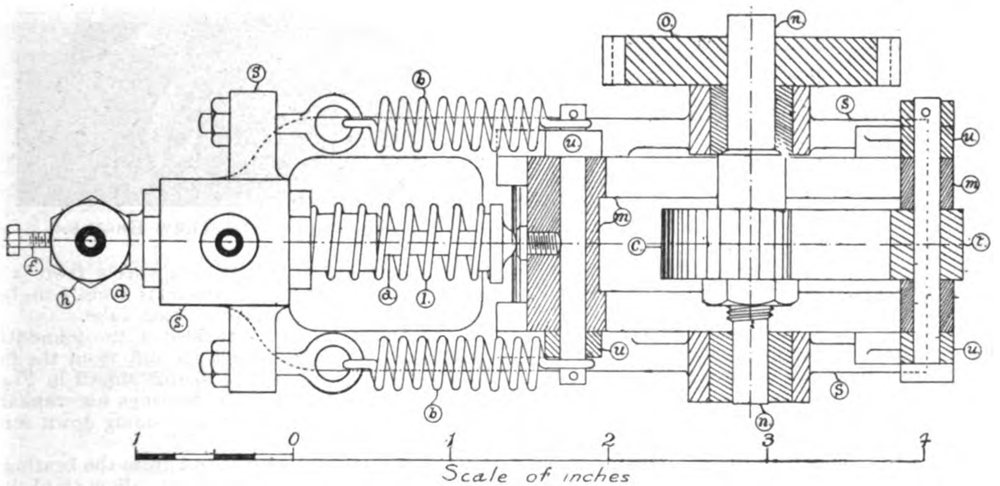


FIG. 5.—PLAN.

MODIFICATION OF CLARKSON'S CYLINDER LUBRICATING PUMP.

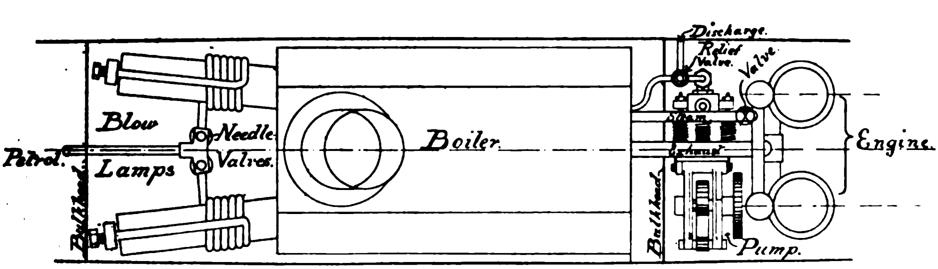


FIG. 7.—SHOWING GENERAL ARRANGEMENT OF ENGINE, BOILER AND PUMP.

If a greater quantity of steam be required, the length of tube used must be increased proportionately, and the diameter or stroke of the pump, or both, must be increased to deliver the requisite quantity of water.

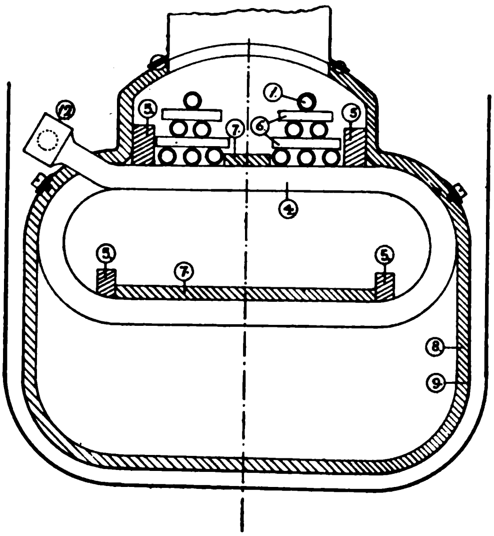


FIG. 3.—TRANSVERSE SECTION.

No safety valve is required for this type of boiler, but a relief valve—indicated in Fig. 7 (which gives the general arrangement of the engine, boiler, pump, etc.)—serves as a bypass, which opens immediately the pressure rises too high and cuts off the supply of water to the boiler, thus reducing the pressure. As shown in Figs. 3 and 7, there is a clear space round the boiler between it and the skin of the hull. The bulkhead abaft the boiler is placed 1 in. away from the boiler, and through this space the air is admitted to the

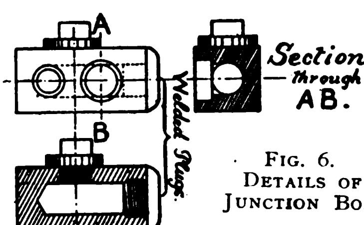


FIG. 6. DETAILS OF JUNCTION BOX.

blowlamps. This arrangement serves the double purpose of keeping the hull cool and heating the air used for combustion.

The blowlamps used for this boiler should consume about 2 pts. of petrol per hour each when working full power, and should be fitted with regulating nozzles to regulate the supply of vapour.

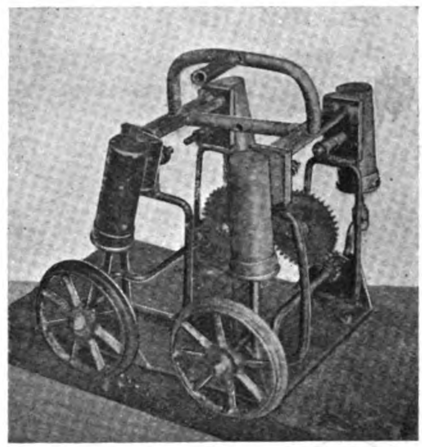
The Thorn & Hoddle Acetylene Co., of 151, Victoria Street, Westminster, will undertake the welding required at a very reasonable price. It is advisable, however, to consult them as to temporarily fixing the parts, as much depends on this, and the price naturally depends on the ease with which the welds can be got at.

Model-Making for Beginners.

A Simple Twin-screw Engine.

By GEO. A. BROWN.

THE engine about to be described was built last winter without the use of a lathe and with no regard to appearances. The following materials will be required to make a similar engine :—Four ⅜-in. by ¾-in. single-action oscillating cylinders; one piece 1-16th-in. sheet brass (4½ ins. by 3 ins.) for foundation, etc.; 4 ft. ⅛-in. iron wire; 1 ft. medium wire; some fine wire for binding while soldering; two wheels (about 1½ ins. diameter)



A SIMPLE TWIN-SCREW ENGINE.

for balance-wheels; four cogwheels (two 1 in. diameter and two ½ in. diameter); 8 ins. ⅛-in. brass tube, and 6 ins. 3-16ths-in. brass tube.

The first thing to be tackled is the foundation-plate and bearings, which are cut from the piece of 1-16th-in. brass to the sketch shown in Fig. 1, and the holes are bored in bearings for crankshaft with ⅛-in. drill, also holes for holding-down screws in foundation.

The pieces must be cut out from the bearings at one end as shown (Fig. 1) so as to allow crankshafts to be fitted in place. On either side of these slots small holes are required for bearing caps, which are of medium wire, fitted as shown in Fig. 3. The bearings are now bent into position, as seen on the photograph.

The crankshafts (Fig. 2) are bent with strong pliers from ⅛-in. wire. Before bending double-web cranks two of the piston-rod ends are unscrewed from their rods and slipped on, one on each crank; also, before bending end cranks slip ½-in. cogs on to shaft and solder them in place ½-in. from end crank.

The cylinder columns are also made from ⅛-in. wire, as Fig. 4. To these are soldered steam blocks with two ⅛-in. steam pipes connecting each pair of blocks. These sets are now soldered down to foundation-plate. At the middle of the ⅛-in. steam pipes connecting each pair of blocks holes are bored, over which 3-16ths-in. diameter main pipes are soldered, as per photographs.

The reason for upper 3-16ths-in. pipe taking such a large bend is to allow a simple reversing valve

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being fitted between the pipes, as described in an article on simple locomotives, which appeared in THE MODEL ENGINEER.

Having steam blocks, etc., in place and all soldered up, the crankshafts will be next to demand attention. Place them in position in bearings, with a small collar of 3-16ths-in. brass tube between double-web cranks and after bearings, and solder 1½-in. balance-wheels in place on ends of shafts close up to bearings, so as to act in opposition to collars and prevent end-play of shafts. A piece of medium wire is now fitted to the cut bearings, so as to form caps.

The two crankshafts should be set with cranks at 90 degs. from one another, and the 1-in. diameter cogwheels on their bracket (as Figs. 4 and 5) should be fitted in place and soldered to cylinder columns. These cogs should now keep cranks of both shafts always at 90 degs. from one another and the shafts revolving in opposite directions.

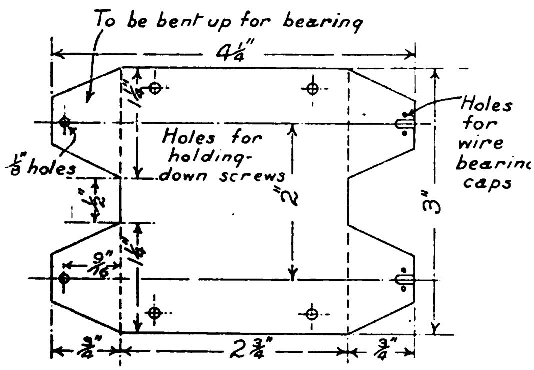

FIG. 1.—TEMPLATE FOR BEDPLATE AND BEARINGS.

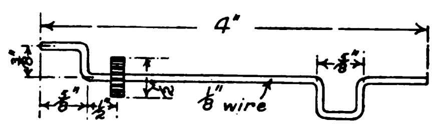

FIG. 2.—CRANKSHAFT.

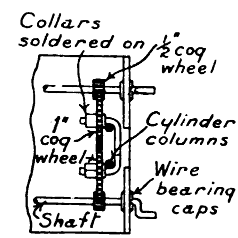

FIG. 5.
PLAN OF GEARING.

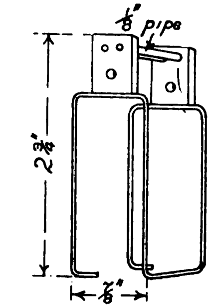

FIG. 3.
CYLINDER COLUMNS.

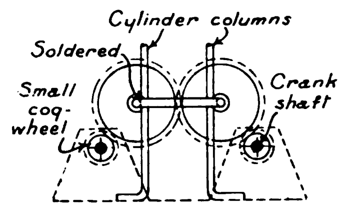

FIG. 4.
ELEVATION OF GEARING.

DETAILS OF A SIMPLE OSCILLATING TWIN-SCREW ENGINE.

To complete the engine fit cylinders in position and screw the two piston-rods of the after cylinders into their ends, already on the double-web cranks. The engine should now run by blowing into it with the mouth.

Generally this engine runs very well under steam, and I should say has sufficient power to drive a 3-ft. boat easily. It is self-starting, having cranks set at 90 degs., and therefore can be run from the water mains.

A LARGE CASTING.—One of the largest iron castings ever turned out of a foundry has been poured in the foundry of the Msetra Machine Company, Pittsburg, and weighs 201,000 lbs. when finished, the requisite 220,000 lbs. of metal being obtained from six furnaces. The casting forms the bedplate on the L.-P. side of a cross-compound condensing piston engine to be used for driving the finishing rolls of the new rail mill of the Bethlehem Steel Company.

A Circuit Breaker.

By "SWITCH."

EVERY user of electricity from the mains, whether experimentally or practically, has experienced the trouble and waste of time in replacing blown fuses. The only safe alternative is a circuit breaker, to make the usual form of which is quite out of range of an ordinary amateur. But this design is quite simple to make, although perhaps its rate of break is not as rapid as might be liked by some. Up to 10 amps. though, the "break" would prove quite rapid enough for ordinary conditions.

It consists of a mercury switch, which may be broken and kept broken by a momentary current, stronger than a certain limit, passing. A is a mercury cup into which a rod B dips. This rod is pivoted at C to a rod D. D is a part of an arm E, which rests on a piece of iron F, in such a manner that if F moves in the direction denoted by the arrow, the arm falls, drawing the rod out of the mercury. This breaks the circuit. The current passes through the coils of a magnet M, which attracts the piece of iron F. This is held by a spring S, the tension of which is controlled by a rod R. By turning the milled boss K the current required to break the circuit may be altered. The lever L is used to reset the arm to complete circuit again. On giving it a sharp movement upwards it lifts the arm E on to the catch of the piece of iron F. It must be noticed that this lever, when pushed up against the stop W, holds the rod B about ⅜ in. from the mercury. This is an advisable precaution, because it prevents the arm being forcibly held in a position which would prevent the circuit breaker acting.

A motor bicycle inlet valve spring does admirably for S. The cup A is merely a piece of glass tubing with a suitable bottom. The tube must be long or

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else the mercury will spurt up out of the cup when the "break" occurs. This is probably owing to the sudden expansion caused in one place when the break occurs.

The magnet is illustrated having only one coil. But another of finer wire, *i.e.*, containing a greater number of turns, could be wound over or alongside the former coil, which would have the effect of breaking the circuit at lower currents.

The wire used in the coils should be about 10 or 12 S.W.G. for currents up to 10 amps., and 18 or 20 S.W.G. for currents up to 5 amps. The calculations for winding are quite simple. Turn the milled boss K until it is about half-way over its scale. Wind, say, 50 to 100 turns of wire on the magnet. Pass through the switch a certain known current, increase this at intervals of not less than 10 seconds between each rise until the circuit breaks. If it does not break, increase the number of turns or decrease the tension of the spring. Suppose the current at which it breaks be x amps, and the number of turns of wire on the magnet be y; then $(x \times y)$ is the number of amp.-turns necessary to break the circuit. If the "breaking" current required be 10 amps., then the number of turns of the 12 S.W.G. will be

$$\frac{(x \times y)}{10}$$

If the second coil is not required and there is plenty of space, use No. 10 gauge. Likewise if the "breaking" current is to be 5 amps., the number of turns of No. 20 gauge will be

$$\frac{(x \times y)}{5}$$

Protect each coil by fuses passing twice the "breaking" current of that coil switch.

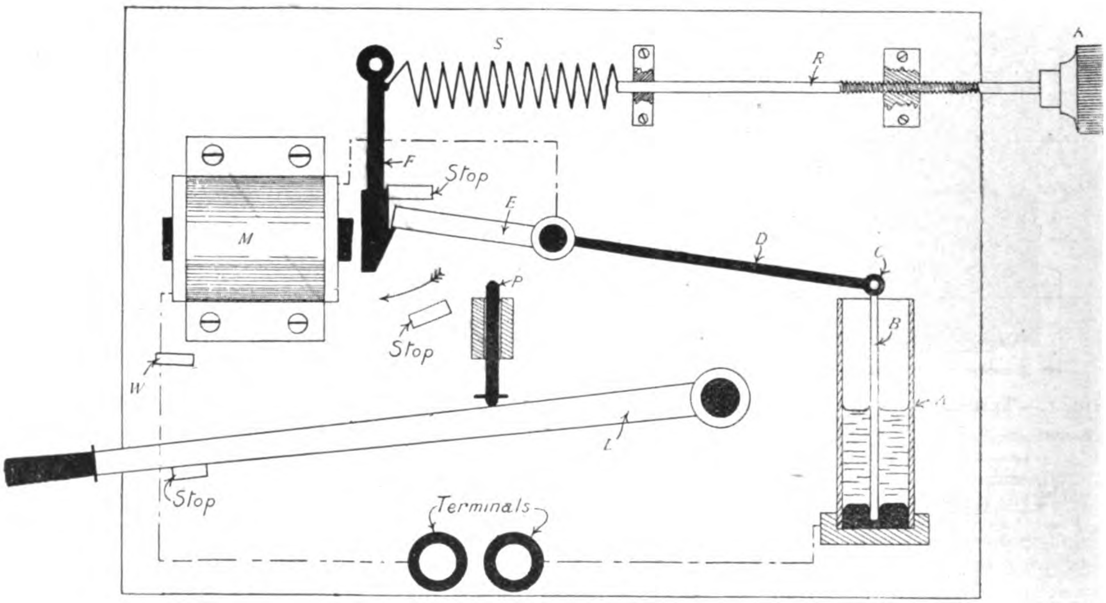

DIAGRAM OF A CIRCUIT BREAKER. (*For description see page* 113.)

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 Group of Working Models.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Herewith are illustrated a number of models which have been made in my spare time. A brief description may be of interest to some other readers, and here follows.

No. 1 is a single horizontal engine, cylinders ¾ in. bore by 1½ ins. stroke, disc crank, 4-in. flywheel, and is fitted with reversing link motion, and is mounted on brass bedplate and mahogany stand. Boiler is 3 ins. diameter, 10 ins. long, with 1-in. tube through from firehole to chimney, with four 3-16ths-in. cross tubes, water gauge, lever safety valve and steam pipe with two levers for steam and reversing.

The model locomotive (No. 2) is built mostly after an N.E. Railway express. This engine has two outside cylinders ¾ in. bore by 1½ ins. stroke, link reversing gear inside of frames, driving wheels are 4 ins. on tread, bogie ditto 2 ins. Boiler is made on locomotive principle with internal firebox and five ¼-in. tubes through to smokebox. Steam regulator in cab, valve in dome and pipe through smokebox to cylinders with exhaust up funnel. Tender is mounted on three pair wheels, and tank has regulating valve in front to supply methylated spirit to lamp in firebox.

No. 3 is a model single-cylinder traction engine acting on fourth motion. Cylinder 1¼-in. bore by 2½-in. stroke, with lubricator on top. Link motion reversing gear, 5-in. solid flywheel cast to

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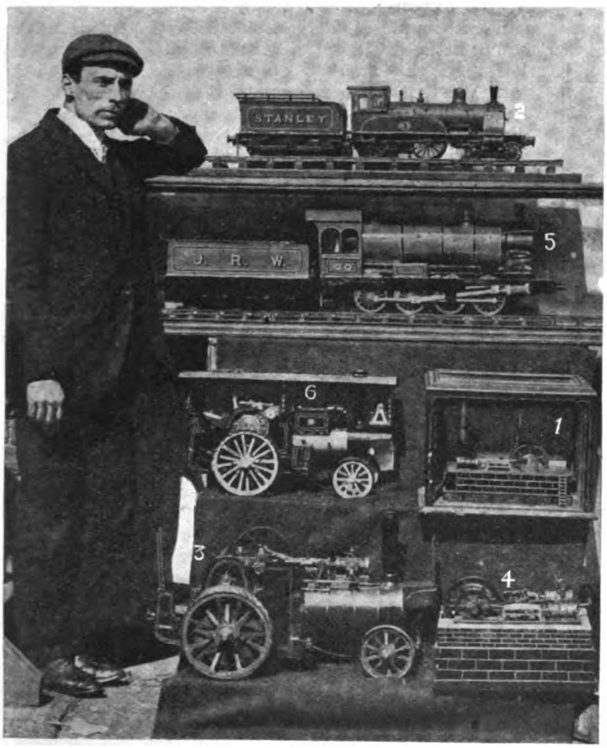
my own pattern. Cogs, of course, I bought ready cut to sizes given. Road wheels are 8 ins. diameter, fore wheels 5 ins., and were built up from iron turned on anvil and creepers, spokes, hubs, etc., riveted into position. Boiler is 4 ins. diameter by 7¾ ins. long. Fire-box outer shell, 6½ ins. by 4¾ ins.; inner ditto, 5½ ins. by 4⅛ ins. by 5 ins. high, and has one 1-in. tube through boiler. This model I steamed by its own fire of small pieces of coal and coke. Steering wheel and worm were the most difficult parts I had to contend with, as I had to cut them by hand. Boiler pressure, 20 lbs. per sq. in.

Model No. 4 is of a pattern largely used in the County of Durham as a winding engine—that is, an engine for winding cages of coal or men up and down



MR. JOHN R. WATSON'S GROUP OF MODELS.

the shaft of a coal mine. The cylinders are 1-in. bore by 2-in. stroke, drum flywheels are 6 ins., and drum 3½ ins. The boiler for this model is not shown in illustration, but is a Lancashire type, having two large tubes (with cross tubes) running through boiler, diameter 7 ins. by 14 ins. long. Tubes, 2⅛ ins., with ¾-in. cross tubes. The heating for this model is by an indiarubber tube from gas and brass Y-pipe, so as to give flame in both tubes, and perforated about 6 ins. to give a number of jets along tube sides and top, by which method I quickly raised steam.

A model eight-coupled locomotive, N.E.R. type, is shown at No. 5. Cylinders, 1 in. by 2 ins. (outside) with connecting-rods coupled to third pair of wheels. Wheels are 3½ ins. on tread and sand-boxes with pipes fore and aft over third wheels. Link motion reversing gear is used inside of frames. The boiler is 11½ ins. long by 4 ins. diameter. Fire-box outer shell, 5¾ ins. long by 3½ ins. wide; inner ditto, 5 ins. long by 3 ins. by 4 ins. high, and has five ¼-in. tubes through to smokebox. Steam is regulated from cab as in preceding locomotive. It is fitted with two spring safety valves, water gauge, steam ditto, firedoor, test cocks, etc. Total length of engine and tender over all, 44½ ins.

The latest model (No. 6) is built largely as a showman's engine, after Burrell & Sons, and the principal dimensions are 1 in. to 1 ft. Third motion system is used. Road wheels are 7 ins. and fore wheels 4½ ins. Cylinders (not compounded) are ¾ in. by 1½ in. with steam chests to outside. Motion bars above and below pistons. Fitted with two speeds, by sliding cogs and levers outside of bearings on crankshaft. Loose drum and cable, link reversing motion, steering gear, brake gear, two water tanks—one under cab and one under boiler forward of firebox, and connected to each other by pipe on under side. Water lifter for filling tanks, hand-feed pump, etc. Boiler is 6 ins. long by 3 ins. diameter. Outer shell fire-box, 4¼ ins. by 3⅜ ins.; inner ditto, 3½ ins. by 2⅞ ins. by 3½ ins. high, and is both riveted and soldered. Has five tubes from smoke to firebox. Front is extended for dynamo, which is a dummy, just for appearance sake. The boiler was tested to 36 lbs.

With the exception of cylinders and cog-wheels, all the above models are my own work out of castings, forgings, etc., to my own patterns. Painting of same has all been done by my brother, Mr. A. Watson.—Yours truly,

JOHN R. WATSON.

Re Model Steam Trap Design.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to the design for a model steam trap in the July 11th issue of THE MODEL ENGINEER, will you allow me to point out to those proposing to construct one of these fittings the impossibility of its working if made in the way suggested by Mr. Dickinson, who, I am afraid, has overlooked one or two important points in the design. Taking the dimensions given in the article, the float comes out at about ⅜ in. diameter and ¼ in. high, and the cubic capacity—

Area of ⅜-in. circle × ¼ = cub. in. capacity
= ·110 × ·25 = ·0275 cub. in. capacity.

Taking it that the weight of 1 cub. in. of water = ·036 lb., we find the displacement or buoyancy of the float—

= ·036 × ·0275
= about ·0009 lb.

Taking a working pressure of, say 10 lbs. per sq. in., and multiplying the area of the ⅛ in. diameter drainhole closed by the float-controlled valve, we get load on valve; or, which is the same thing, buoyancy required of float—

= area of ⅛-in. circle × pressure
= ·0122 × 10
= ·122 lb.,

or a displacement of float over 130 times as great as that given in the design, and this neglecting the weight of the valve and float itself.

Of course, matters might be improved by reducing the size of the drain outlet to 1-32nd in. diameter

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say, but even then the size of float would have to be considerably increased, depending on the steam pressure at which it is proposed to work.

Steam types of the type described are not found very satisfactory in actual practice, as the float takes up a position of equilibrium at which the valve is neither open nor properly closed, thereby allowing of a continuous and wasteful "dribbling" action.

However, this would not be of much importance in model work, and provided a simple calculation was made for the size of float and diameter of drain-hole, taking into account the steam pressure, and the parts proportioned accordingly, an interesting and satisfactory model would no doubt be the result.
—Yours truly, C. BLAZDELL.

Catford, S.E.

Re Model Locomotive Valve Gear.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The letter which has been forwarded to me with reference to the modified Joy's gear I recently put forward for model locomotive work is from Mr. C. R. Westcott, a reader in the North of London, who writes :—"I have read with great interest the articles now appearing on 'Model Locomotives,' and note the author is introducing a valve gear for small model locomotives. . . . . . . May I draw his attention to the fact that his idea is not original, as the result of experiments led me to the self-same gear, and this was illustrated on page 282 of Vol. VII of THE MODEL ENGINEER. It will be noted," Mr. Westcott continues, "that the reversing links are placed too high, which was a miscalculation, otherwise the valve gear was substantially the same."

As the fellow says in the banned opera, "here's a how do ye do." Once upon a time I vowed that I would never patent anything that might occur to me in the course of my dealings with model work—lest I should make a fortune. But I succumbed to the solicitation of friends and filed an application with His Majesty's Patent Office. It was calculated for me that there are thirty thousand amateur model makers in the country, and quite 25 per cent. of them are locomotive enthusiasts, who every year start to build a locomotive. At a shilling a time, per locomotive, per year, this would mean 25 per cent., or 30,000 shillings, viz., £375 per annum income, and I could retire. But I respectfully pointed out that they would not all use the gear, that a certain percentage of the models might never reach the valve gear stage, that a still greater number would take two or three seasons to complete, instead of one, and when actually completed, would not be supplanted by a new locomotive for several years. Therefore the annuity opened up to me by the patent did not seem within reach of realisation; moreover, as being unbusinesslike, I omitted to stipulate the charge, preferring honour and glory to the collection of "bobs."

But what about the validity of the patent? We all know that prior publication upsets a patent, and turning up THE MODEL ENGINEER for December 15th, 1902, I found Mr. Westcott's letter on page 282, as he mentioned. The picture of his engine conveyed nothing. Contrary to the usual high standard of illustrative work in THE MODEL ENGINEER, it was more like the portrait of a celebrity in a morning ha'penny illustrated—one bleary blur.

The text did not help matters, as Mr. Westcott, in describing the model, says :—"The most novel feature is the valve gear, which is Joy's system, being worked with levers from the connecting-rod, the links being straight instead of curved."

But my gear is not Joy's system, and although I must have seen Mr. Westcott's letter when it arrived at THE MODEL ENGINEER office in 1902, I could never have completely understood it, and therefore ask Mr. Westcott, if the two gears should prove to be the same, to relieve me of any suspicion of plagiarism.

What a splendid "test case" this would make, and any reader who would like to settle the question at the expense of a thousand or two might subsidise a couple of lawyers to this extent and have some little diversion for his money. Personally, I forego the retiring allowance, but would ask Mr. Westcott, as the original photograph of his engine does not seem to be very clear, to send a diagram of the gear he devised and fitted to his engine in 1902, as evidently, like myself, he also found the gear very simple to make, and eminently successful in practice. In any case, no doubt he will be pleased to see others use it, which was my sole object in drawing attention to the gear in the recent articles.—Yours truly,

H. GREENLY.

Cleaning Soiled Hands.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—As I noticed that so many of your readers answered your correspondent's query as to a suitable soap for workshop use I did not add my experience. Seeing, however, you are still publishing your readers' opinions I will give mine.

Some months ago I made a special point of trying several makes of soap for washing one's hands after an evening's work at the lathe and bench. I used not only known soaps, but also preparations recommended to me, but I found that a soap called "Manulav," made by Price's Patent Candle Co., of Battersea, gave by far the best results. I found it not only excellent as a cleanser, but it in no way affects the skin, which, of course, is an important point.—Yours faithfully,

A. M. H. SOLOMON.

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.]*

THE first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting, and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from September 25th, 1907, to October 31st, 1908. Full particulars

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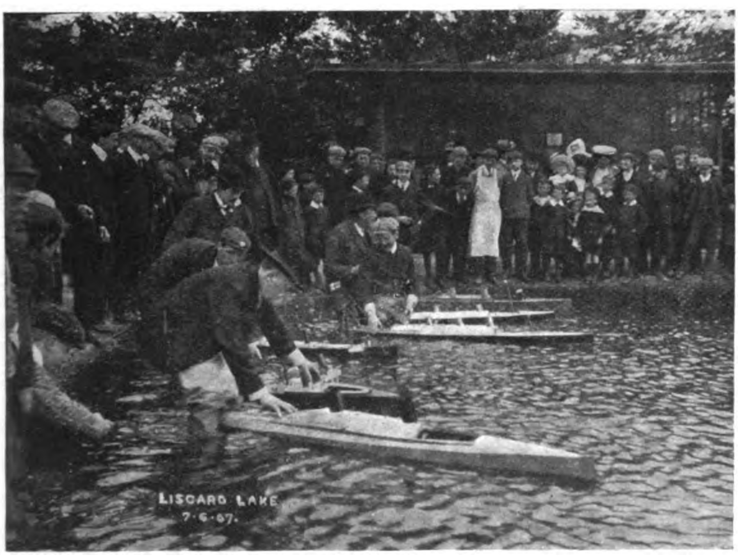
and forms of application may be obtained from—HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

A Model Steamer Social.

ON Saturday, July 13th, the members of the Wirral Model Yacht Club held a steamer social on Liscard Lake with the members of the Sefton Steamer Club and the Stanley Steamer Club. The members of these clubs indulged in an impromptu race for two classes of models, and the silver medal for the large class was won by the Coxon Brothers' torpedo - boat destroyer, *Ades II*, whilst the medal for the small class of models was won by Mr. Carter's model Atlantic liner, *Kate*. At the Park House, kindly lent by the Parks Committee, the company was afterwards entertained in an hospitable manner by the Wirral Club.

LIVERPOOL AND DISTRICT ELECTRICAL ASSOCIATION.—The first meeting of the above Association was held at the Common Hall, Hackins Hey, Liverpool, on Tuesday, the 16th inst. The chair was occupied by Mr. J. J. Richardson, of Liscard. It was decided that the present committee, formed by Mr. Frith, should continue to carry on the business for a term of three months, when the question would come up for further consideration.—Hon. Secretary, S. FRITH, 77, St. John's Road, Bootle, Liverpool.



PREPARING FOR A RACE AT LISCARD LAKE, JULY 13TH.

IT is reported that a new process for the electrical extraction of aluminium from blue clay has been discovered by which the cost of production is reduced to about one-quarter of the present rate.

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:—

[17,892] **Partial Failure of Kapp Type Dynamo.** J. E. (Yorks) writes: I purchased a No. 1 Kapp type dynamo set from advertisement in your paper a while ago. The armature is a solid Siemens H, and commutator slit straight across. The armature and shaft were complete when sent out. In winding fields I did not get all the wire on, but think there is about 10 ozs. on. The tunnel was finished off on a lathe, but at one side the casting runs off a bit from the middle to the end, which has left too much air space. As the armature (as sent out) is not quite round, it has been impossible to get a really small air space. I wrapped armature with very fine soft iron wire, but found armature could not get round, so took wire off. Machine runs very well when given current, but as a dynamo it gives a jerky current similar to a shocking coil, and can be felt fairly strong by connecting handles to brushes if the hands are moistened. The best it has done in the way of lighting is to dimly light a 4-volt Osram lamp for a second or so. You say in handbook that a shunt-wound machine must have a fair resistance in outer circuit or it will not build up. I have tried putting a 10-volt lamp on and running machine for a time and then putting on 4-volt lamp to see if machine had built up, but with no success. On the other hand, when I have had nothing in outer circuit, but put ends of wire together and then separated, stronger shocks were felt. Please say what is probable cause of jerky current? Air space is as small as it could be, without the armature had been turned exactly round, except about the half of one side which widens out because of casting running off. Should I have a bit of wrought iron riveted on tunnel and true up with file again? As the field-magnet is a casting, I suppose I cannot knock poles nearer together and then have tunnel trued again? Should I have both tunnel and armature turned a little and then wrap armature with iron wire? When running as motor there is absolutely no jerkiness, but an even motion.

The jerky effect is probably due to a rough part on the commutator, or the slots are too wide so that the brushes break circuit when passing over them. The increase of resistance in the outer circuit must be maintained. The machine will refuse to build up its magnetism as soon as the resistance is reduced. Therefore, if the resistance of your 4-volt lamp is too low, you will require to work with lamps of higher voltage than this; the voltage which gives best results to be determined by trial. The best thing to do appears to be as follows: first true up the armature core so that it is practically circular and runs evenly, then bush the magnet poles with wrought or cast iron and re-bore them to form a new tunnel, making the new clearance a minimum. You cannot bend an iron casting, but you might cut through the yoke so as to bring the poles closer together. You could join up by a strip of iron at the yoke and a strip of *brass* at the poles to hold them together. The joint must be well faced and in close contact. Another way would be to turn up the armature so that it runs true and rivet on

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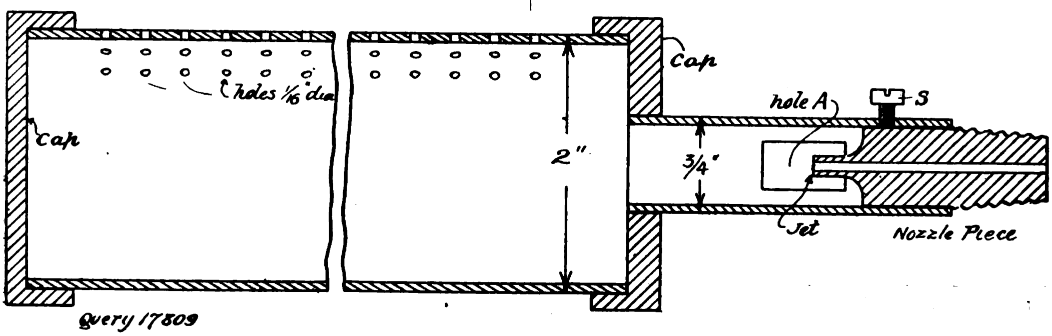
some iron plate, again turning up to finish. Then re-bore the magnet to suit the armature.

[17,809*] **Gas Burner for Boiler.** W. A. (Cardiff) writes: I want to make a gas burner for a boiler I have, the size of which is 17 ins. by 7 ins. (horizontal type). I made one as follows: I got a piece of 2-in. iron pipe and plugged the ends up, then drilled and tapped holes for ⅜-in. gas nipples along the top for the burners, and also drilled ⅛-in. holes at the bottom for air to enter. The gas supply entered at the centre through a ⅜-in. elbow which was connected to a ⅜-in. rubber tube and then to an ordinary gas jet with the burner removed. I found on lighting up that the gas lit at the inlet and burnt inside the pipe instead of at the burners. I should be glad to know why this happened and any information and sketches of a suitable burner that you can give me will be greatly esteemed.

As far as we can make out from your description you failed to make use of the Bunsen principle, and the jet of gas could not induce the required amount of air to produce a blue flame. Examine your gas cooking stove, or somebody else's if you do not possess one, and make a burner on the same plan. We enclose a sketch (reproduced) showing one form of Bunsen burner suitable to your case. The 2-in. tube you have should be capped at both ends and one end fitted with, say, a piece of ¾-in. tube about 2½ ft. long. Cut two fairly large holes in the side of this tube, as indicated, and fit a nozzle with about 1-16th or 3-32nds. in. gas jet. This nozzle should be capable of adjustment so that its correct position in the tube may be found and, if necessary, the air inlet hole A partially blocked up. The exact number of small holes required may be best found by experiment.



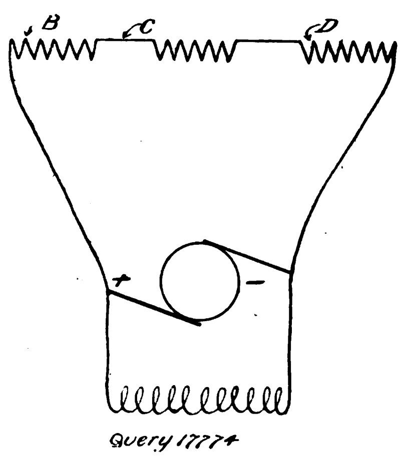
SECTION THROUGH GAS BURNER FOR BOILER.

[17,874] **Readjustment of Rectifier for Charging Purposes.** S. B. (Hammersmith) writes: I have a Batten rectifier, wound for 200 volts 50 amps., and I am using it on a 100-volt 50-amp. circuit, but get very poor results, although it uses a lot of current and it has a peculiar habit, after running some time and giving direct current, of giving out alternating current, and as I use it for charging purposes, I find that after the batteries have been on some hours—although they had been showing signs of charging—they have suddenly become empty again. The current I get at the D.C. terminal is about 20 volts 1 amp. Is there any method of altering this so as to get more amps.? Any advice you can render me will be greatly appreciated.

We advise you to write to the maker; probably the coils do not get enough current at 100 volts pressure. As the apparatus is merely a vibrating contact maker, the only limit to the amount of current would be the capacity of the contacts; provided this is not exceeded, we expect you will be able to obtain a greater flow of current by decreasing the resistance in the battery circuit or increasing the voltage of the supply at the terminals of the apparatus. If you are using resistance lamps, this latter means that you must use more lamps in parallel to obtain the increased flow of current. Evidently your contact maker does not vibrate in constant synchronism with the supply current. The contact maker should be regulated to move exactly central, and the contacts set so close that the vibration is made as small as practicable.

[17,774*] **Electric Shocks and Wiring Systems.** H. B. N. (Westcombe Park) writes: If you would kindly answer the following I should be extremely obliged. I have kept a copy for reference. (1) What precautions have to be taken when working on a live switchboard and you have no rubber gloves or mat? (2) Is the negative pole supposed to be at earth potential, and, if so, can you touch it without being in danger of receiving a shock if you are not insulated? (3) Supposing you touch the positive pole and receive a shock, how does the current travel? Does it go through your body to earth and then back to the negative pole? A diagram would oblige. (4) What decides where the positive polarity ends and the negative begins? For example, is point C positive or negative? (5) What is the object in earthing the neutral of a three-wire system? If you earth the midwire I cannot make out why you do not lose the current. (6) On board ship I believe dynamos have one pole connected to the ship. Does the current travel from one pole through the ship and back to the other pole? Is there any danger in adopting this method? (7) Can you please refer me to a book on the subject of earthing?

(1) Avoid touching live wires and fittings, especially if your feet are damp or the ground is at all wet. (2) Yes, but unless perfect insulation prevails, it is quite possible to get a shock from the negative leads. (3) Yes. (4) C is positive to D, but negative to B—that is to say, the voltage will be less at D than at C or B. If you refer to March 5th, 1903, Query columns, the matter is gone into rather fully in the reply on "Reduction of Voltage." See also article in *The Engineer-in-Charge* for April, "Electric Shocks: Fatal and Otherwise," post free 3½d. from this office. (5) You only lose current—or rather waste current—when there is a fault on either of the outer wires—positive or negative. (6) Yes. The negative or return is practically the shell of the ship, to which the negative of the dynamo is connected. The positive leads must be particularly well insulated when this method is adopted. As the voltage of such systems is usually 50 or 60, there is no danger



WIRING DIAGRAM.

attached to it. (7) We do not know of any publication dealing exclusively with the subject of earthing.

[17,870] **Model Steamer Boiler and Lamp.** W. J. C. (Sierra Leone) writes: I am wishing to build boiler from these designs in Vol. XV, No. 274, pages 88 and 89, but the writer is not plain on the following points. (1) Does oil have to be under pressure for burner, and is it a known success? (2) Burner shown completely enclosed in drawing. What arrangement is made for draught? (3) Will not the asbestos in large pipe dry up with heat and not fulfil its purpose? (4) How is exhaust led up funnel, as the top lifts off? (5) If exhaust is not needed up funnel, does it mean the burner works with natural draught satisfactorily?

The boiler has no special merit, and would be improved by having a larger furnace and a few water tubes. (1) No. A gravity feed is all that is required. The type of burner is well known, and is used on toy locomotives. (2) The exhaust should pass up chimney and

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the bottom should not be enclosed. (3) It does not matter. It simply regulates the flow of spirit like a wick. (4) The exhaust pipe should be led into the funnel below the socket piece. (5) A methylated spirit fire must be well ventilated.

[17,859*] **Magneto Machine Construction and Windings.** H. G. P. (Devizes) writes: Will you be so kind as to help me in the following. I have a magneto machine with 9-in. magnet and two coils. The coils are wound with No. 24 or No. 26 s.c. covered wire, and both ends of the coils are connected to the ironwork of coils. Is this correct? I cannot get any current from the machine. Should the coils be wound with the above wire or, say, No. 36 s.c. wire? Also, how should the ends of coils be connected up? I should be much obliged if you can give me any advice on the above.

As far as we can say from your description, the connections of your machine should be as shown below (Fig. 1). It is usual to have the spindle of the machine made in two pieces, insulated from one another by some insulating bush—ivory, ebonite, or vulcanite—and contact is made and broken by means of a many cornered, or sometimes star-shaped (Fig. 2) piece of metal on the spindle. To all *appearances* your windings *will* be connected to the one shaft or spindle.

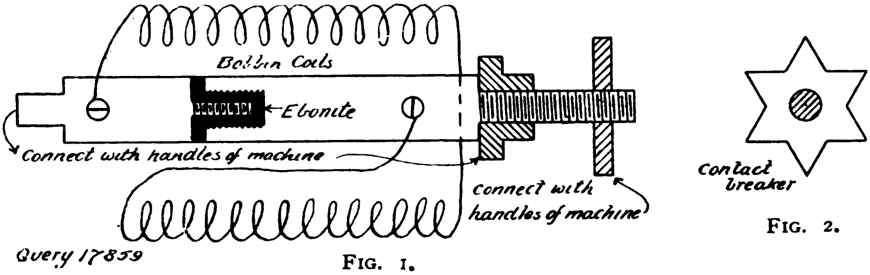
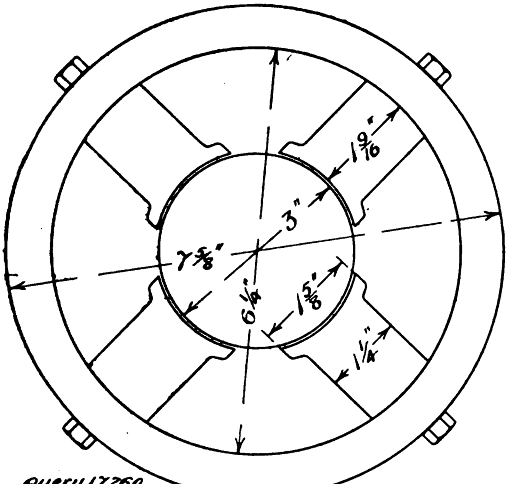


FIG. 1. FIG. 2.

DIAGRAM OF WINDING FOR MAGNETO MACHINE.

[17,760*] **Windings for Small 4-pole Motor.** N. W. (Halifax) writes: I have all the parts for a motor ready for winding. Will you please state the thickness of wire, etc. (turns) for running off a 230-volt circuit at 2,000 r.p.m.? Armature: Length of core, 3 ins.; number of slots, 16; width, 5-16ths in.; depth, ½ in.; number of bars in commutator, 32. (Required a lap winding, two coils per slot, slots can be deepened if required.) Herewith is sketch of the field-magnets showing the four poles. The machine is required to be shunt wound. On the brush gear there are four spindles. All castings are cast iron.



FOUR-POLE MOTOR FIELD-MAGNETS.

Wind armature with No. 32 gauge s.s.c. copper wire, as many turns as possible per slot; about ½ lb. will be the weight. Wind field-magnet with about 1 lb. No. 32 gauge s.c.c. copper wire upon each pole, coils to be connected in series with each other and in shunt to the brushes. If you can get on more than 1 lb. per pole do so. The system of winding is shown in Fig. 49 of our Handbook, No. 10, but as you have 32 bars in your commutator, you must wind four coils into each slot. Go forward round the armature until all coils are wound and connect in way shown in diagram. As you have four brushes you can do away with the cross connections between commutator bars shown in the diagram of the commutator and connect opposite brushes together instead. We advise you to make slots about 1-16th in. deeper as there are four coils to go into each slot.

[17,864] **Strength of Small Boiler.** N. A. (London) writes: I have made a boiler, horizontal type, with water tubes as described at beginning of your book on Boilers. The tubes are blowpipe soldered in and the end soldered and tied in with a stay. It is 12 ins. long by 3 ins. diameter, with five tubes 11 ins. long. What is highest safe pressure for working and also for testing? Would it strengthen boiler to put screws through the flanged end, or would the tubes be too weak to stand pressure?

Do you mean that the tubes are soldered in with tinman's solder with a blowpipe (not brazed nor silver soldered)? If so, we recommend a working pressure of not more than 35 lbs. per sq. in. The boiler is quite "safe" up to a much higher pressure. You can test with cold water up to 100 lbs. per sq. in. The only trouble you are likely to have is that the solder will melt, and the joints of tubes and ends blow if the boiler is worked at a higher pressure than 35 lbs. Unless you have beaded the shell over the ends of the tubes with the hammer or by spinning in the lathe, we recommend that a few brass screws or rivets should be placed in the end flanges. The stay should be used to fulfil its proper purpose, viz., to prevent the ends bulging, and not to secure the ends to the barrel.

[17,873] **Technical Terms: Induction Motor Connections.** "WELSHMAN" writes: (1) What is the meaning of K.V.A. 140 on a 550-volt three-phase alternator? (2) Kindly give sketch of connection of three-phase induction motor with starter.

(1) K.V.A. means kilo., volt, amperes. The output of an alternator is frequently stated in this way, because the output as expressed in watts will depend upon the relation of phase between the voltage and current at any particular moment. A kilo-volt-ampere is equal to 1,000-volt amperes; the alternator mentioned, therefore, is stated to have an output of 140 of these units. If the voltage and current are in phase with each other, a kilo-volt-ampere is equal to 1,000 watts. (2) This depends upon the particular method of starting adopted. The matter is explained at length in *The Engineer-in-Charge* for June, 1907, post free for 3½d. from the publishers of THE MODEL ENGINEER. The starter may be connected by three wires to three brushes placed to press upon slip rings upon the rotor shaft and the stator terminals connected by three wires to a three-pole switch connected to the supply; or the starter may be interposed between the stator terminals and the supply. In the first instance it is in the form of a resistance; in the second it is a kind of transformer.

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.]

Second-hand Models.

The Model Engineering and Electrical Co., 43, Edward Street, Nuneaton, inform us that they are now making a speciality of purchasing second-hand and partly-finished models. Further particulars, also a list of miscellaneous finished models, will be sent to readers of this Journal upon application.

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The Editor's Page.

WE very frequently receive requests from readers—who have either just commenced to take an interest in things appertaining to model engineering, or who, having removed to another part of the country, are anxious to meet with kindred hearts for discussion and mutual help in the pursuit of their particular branch of mechanical or electrical hobby—for the name and address of the Secretary of the nearest Society of Model Engineers, Model Yacht or Steamer Club. Whenever possible, we assist such enquirers; but we regret that it often happens we are not in possession of the necessary particulars. As we heartily recommend our readers everywhere to make the acquaintance of their fellow enthusiasts, we should like to make our present list of such bodies complete and up-to-date. For this purpose we invite Secretaries of provincial Societies and Clubs who have not already communicated with us to help in the matter.

* * *

At the forthcoming MODEL ENGINEER Exhibition, already announced to be held at the Royal Horticultural Hall, Westminster, S.W., on October 22nd, 23rd, 24th, 25th, and 26th next, we are hoping that very many of our numerous readers in the provinces will make a special effort to visit what will be a most unique and instructive departure, as we are sure they will prove it to be a satisfactory outlay of both time and money. In response to enquiries made we are able to state that some of the principal railway companies will be running special long and short period excursion trains to London during the Exhibition week. Further particulars we hope to give at a future date. We remind those readers who may find the excursion arrangements not suitable for their requirements that most railway companies make a substantial reduction for return tickets—something like a single fare and a quarter per passenger for parties of ten and upwards. This will undoubtedly be a consideration to many who reside at a great distance from the Metropolis, and we suggest that, wherever possible, readers should arrange for and keep clear from other engagements at least one day of their holidays for a visit to the Exhibition.

Answers to Correspondents.

A. B. (Cardiff).—A series of articles appeared in these pages for August 25, September 1, 8, and 15, 1904, Vol. XI—all of which can be obtained from our publishing department.

J. H. R. (Wellingboro').—We do not recommend more than about 20 lbs. pressure. The engine will drive a 10-watt dynamo. The type boiler on page 32 of "Model Boiler-making" would be most suitable. The shell should be 6 ins. diameter by 9 or 10 ins. high.

EDW. BARTLE.—Please send your full address to the publishing department, who will then be pleased to forward the book you request.

A. J. K. (Dulwich).—See the "Society of Model Engineers" notice on another page of the present issue.

J. M. (Newcastle).—If you wish to bind your own volumes of THE MODEL ENGINEER, read the articles in March 28, April 4 and June 13, 1907. Binding or reading cases can be obtained from this office, 1s. each, post free 1s. 3d.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

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Contents.

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

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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. XVII. No. 328. AUGUST 8, 1907. PUBLISHED WEEKLY

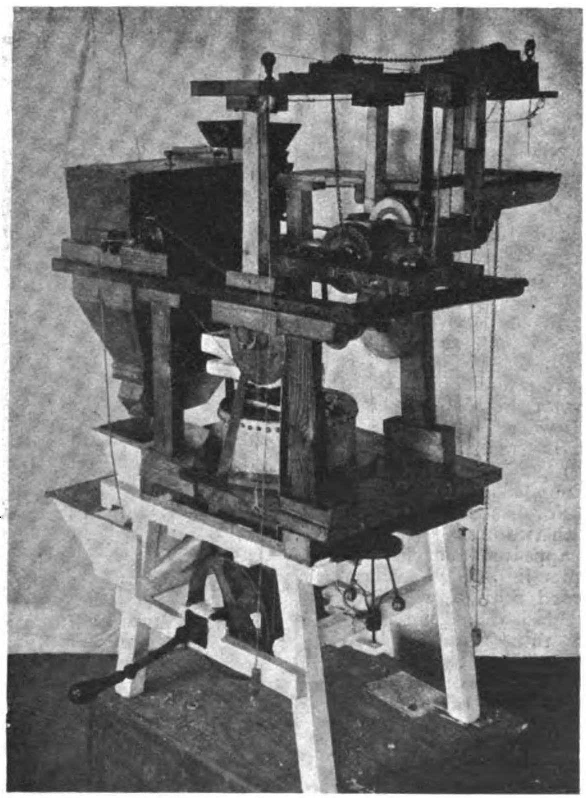
A Model Old Style Flour Mill.

By SIDNEY RUSSELL.

THE accompanying photograph represents a model flour mill built by the writer, and representing (the water-wheel excepted) an old-fashioned water cornmill.

The mill contains a pair of millstones (made of brick earth); the upper stone has, unfortunately, been lost, and is replaced by a dummy "runner" of wood; a flour-dressing machine, a "jumper" or sieve for separating the "offal" left by the dressing machine, and a sack hoist.

The mill has had a rather chequered career, its history being briefly as follows:—The lower part, which rests on four legs and resembles a large four-legged stool, was originally built by the writer's father; but the machinery being required for other purposes, it was dismantled and remained in a very dilapidated state for many years. The writer then, thinking it worth repair, replaced the missing parts, and added others, the whole of the work above the first floor being new.



A WORKING MODEL OF AN OLD STYLE FLOUR MILL.

The arrangement is as under:—The main shaft, about ¾ in. in diameter, is driven by the handle shown in the photograph, this corresponding to the water-wheel shaft in actual practice. On this is a pulley 9 ins. diameter by 1¼ ins. face (made from an old wheel belonging to a small plough), and this drives a countershaft in the floor above, about ½ in. diameter, which drives the dressing machinery and sack hoist, as will be later explained. On the main shaft is also a large bevel wheel with wood teeth (this is a relic from one of the old Sussex windmills) which drives a pinion on the millstone spindle. A wood pulley on the spindle drives a pair of "regulators" or governors, seen in the photograph, and these act in the proper manner on the stone spindle and cause it to rise or fall as the mill runs slow or fast. A proper regulating or "lighter" screw is fitted also to the stone spindle. The millstones (or stone, as the lower stone only remains in the mill) are 9 ins. diameter, and are provided with a proper stone "hoop" or case, made of galvanised iron, and 1 ft. in diameter. There is also a proper feeding hopper, 4 ins. square, fitted with a vibrating "shoe," operated by a "damsel," made of boxwood and screwed to the dummy "runner" stone, which fits on a square at the top of the stone spindle. The "shoe" has a proper spring (made from a broken hacksaw blade), and a "feed line" for regulating it passing over a roller mounted on the hopper frame, and provided below with a proper regulating screw and wheel made from the balance wheel of a defunct American

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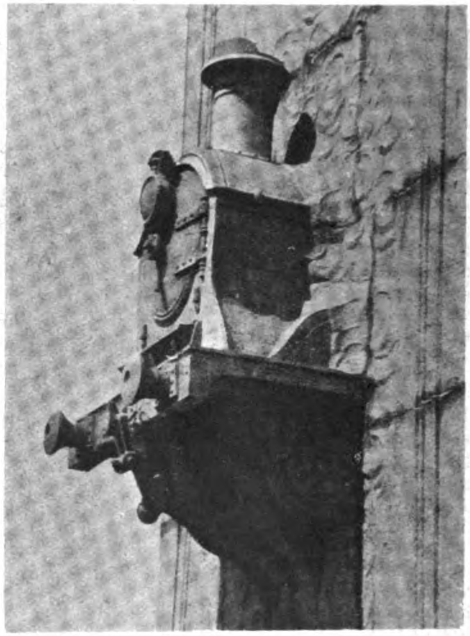
clock, the wheel of the "lighter" screw being also made from a large clock wheel with the teeth filed off. The countershaft in the first floor is driven by the belt shown, which passes over a pulley 3 ins. diameter by 1¼ ins. wide made of deal, this pulley being a double one. Its larger diameter, which is about 5 ins., is turned with a V-groove, and drives the "jumper" or "jogscry" as it used to be called, by a short shaft and crank, shown in the photograph at the end of the dressing machine.

The dressing machine is a correct model of the old type formerly used, and consists of an inclined wire cylinder within which a series of brushes rapidly revolve, the flour passing through the finest part near the top of the machine, the "middlings" passing out lower down, and the coarse part, "rubbles," or "offal," at the bottom of the cylinder, where they pass to the "jumper," which further separates them into "bran," "pollard," and "sharps." In the model the cylinder is about 14 ins. long by 3 ins. internal diameter, the revolving brush being made from a flue brush, this being about the only part of the mill that was purchased. The machine is driven by a belt from an intermediate countershaft interposed in order to get up the speed, this shaft being driven from the previously mentioned countershaft in the first floor and clearly shown in the photograph.

The intermediate shaft was mounted in a rather curious way, in order to save expense, and also to give the appearance of early construction. The shaft was a piece of oak about 1½ ins. square by 6 ins. long. This was bored lengthwise, and a piece of ¼-in. rod iron driven through and turned up at either end for the bearings. The wood was then turned down at each end and the two pulleys bored to fit tight were then driven on and glued, a couple of screws being driven in as a precautionary measure. The whole was then put in the lathe and the pulleys turned true. These two wheels, about 3 ins. by 5 ins. diameter, with the driving pulley on the shaft below of about 6 ins. diameter, were all turned up from lime tree—an excellent wood for this purpose, being easily worked, and taking a good finish. The width of all is about ¾ in., proper leather belts being fitted; the pulleys being rounded on the face, the belts keep on very well. For bearings the larger countershaft is provided with two brass blind-roller brackets, which give the appearance of hangers. The intermediate shaft runs in bushes made of copper tube driven into wood bearers, which also give the old-fashioned effect desired.

The hoisting tackle is thus arranged:—The barrel of yew tree, about 3 ins. long by 2 ins. diameter, and the pulley fixed thereon of elm about 5 ins. diameter by ¾ in. wide, is constructed exactly like the intermediate shaft previously described, and is mounted in a hinged frame which, by pulling one of the lines visible in the photograph, tightens the driving strap passing over the pulley on the hoisting barrel and a smaller one on the countershaft below; the barrel thus revolves, winding up the chain and the sack attached. The hoisting tackle is rendered partly automatic by the following arrangement, which is a copy of that made use of in large mills at the present time. When the sack passes through the falling boards of the hatchway at the top of the mill, the nose of the sack strikes a ring mounted on a vibrating lever, and a bell-crank arm on this operates a long rocking arm, the lower end of which is attached to a sliding belt engaging with the frame carrying the hoisting barrel. The belt being thus drawn back, the frame drops, slackening the driving belt of the hoist, and the sack consequently is lowered on the landing stage. A spring (made from a broken hacksaw blade) restores the device to its normal position, and the whole can be operated from the ground floor, or the self-acting arrangement can be thrown out of action and the hoist worked in the usual manner as previously described. The whole is a perfect working model (except the millstones, as described), with a capacity of about a quart, the hoppers or bins over the dressing machine and "jumper" being respectively 6 ins. square at top, tapering to 2 ins. at bottom, with a depth of 7 ins.; and 5 ins. square at top, tapering to 2 ins., with a depth of 4 ins. By increasing the size of these the mill could deal with a much larger quantity, however. The "jumper," which is almost the only detail now remaining constructed by the writer's father, is about 14 ins. long by 3 ins. wide, and makes one



Detail View of Locomotive carved in Stone.
(Taken with a telephoto lens.)

separation. The total height is about 5 ft. over all with a width of about 2 ft. 6 ins.

The whole of the work necessary was done on a plain 3½-in. centre lathe without a slide-rest, and nearly all the material was odds and ends such as almost any amateur's workshop can furnish. The woodwork was partly enamelled white and part varnished, the ironwork being enamelled black. As there were several holes necessary in the first floor, and a new one was necessary to replace the original one, which was of deal and was much damaged, the writer decided to make the new floor of 1-in. elm, and this being varnished, gives a good appearance, and seems to be likely to prove very durable. The legs of the lower part are about 2 ins. by 1½ ins., and the rest of the framing about 1-in. square,

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except the standards carrying the upper floor, etc., which are about 2½ ins. by 1 in.

The bush in the wood pulley at the top of the governors was the bottom of an old "Snider" cartridge, these making splendid bushes or washers when the cap is driven out with a punch. The governor spindle is a spoke from an old high-wheeled bicycle, while almost all the other details were similarly worked up from odd pieces of hard wood. In conclusion, it may be remarked that the firing pins from old "pin fire" cartridges make splendid cotter's rivets or connecting pins, and the mill contains several of these.

Two Views of the New Bridge at Ostend, showing the Architectural Feature of a Locomotive carved in Stone jutting out of the Pier.

Novelty in Bridge Architecture.

By Henry Greenly.

SPENDING a week-end abroad with my much-travelled friend Mr. W. J. Bassett-Lowke, we came across the novel architectural feature shown in the accompanying photographs, in the piers of the new bridge over the railway and docks at Ostend.

The architectural embellishments of the bridge are altogether very beautiful, and, as will be seen by the three detail views herewith, the front ends of the locomotive carved in high relief on each side of the four main piers are both conceived and wrought in an artistic yet accurate manner. The design of the engine is very like those used on the Caledonian Railway. This is due to the fact that some six years ago, soon after Mr. McIntosh brought out his famous "Dunalastair" locomotives, the Belgian State Railway Administration borrowed the designs and built a series of engines identical in nearly all respects to their Caledonian precursors. Some of these very fine locomotives I saw during my visit. Later on the Belgians produced improved designs with N.E.R. cabs and also some six-coupled goods engines; but in spite of the difference in details, they all bear unmistakably features which show their Caledonian origin. Even in the new six-coupled four-cylinder compound engines which now work the important boat expresses the influence of British ideas is still evident.

The type of locomotive which the architect of the Ostend bridge has so ably rendered in stone, is the six-coupled goods engines referred to above. The size of the carving is approximately 4 ft. by 6 ft., all details being accurately to scale. The way in which the locomotive is represented coming out of a cloud of smoke and steam is also very ingenious, and is a happy method of adapting a part of such a utilitarian object as a locomotive to the architecture of a bridge.

Acknowledgments are due to my friends—the above-mentioned gentleman and Mr. Keigley Cobb—for the very excellent photographs they took at my request for the purpose of reproduction herewith.

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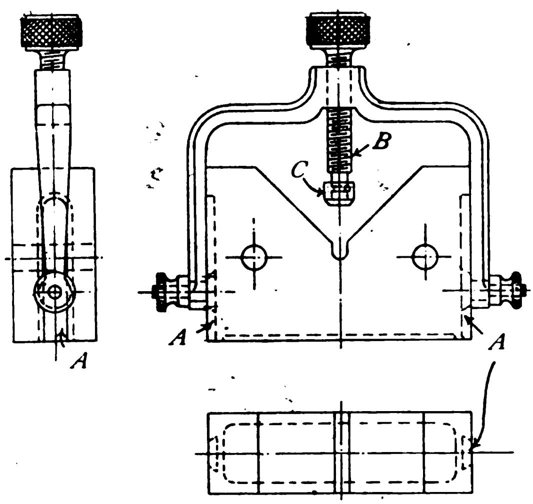
Workshop Notes and Notions.

[*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 Improved V-Block.

By G. BUSBY.

A V-block which I made some time ago is shown by the accompanying sketch. The advantages over the usual type, combined with extreme simplicity, are as follows:—Having dovetail slots A, quick adjustment can be made when working with large or small diameters without moving screw B. When the work is set to the required position a turn of the screw B is all that is necessary to hold the work firmly in position, thereby ensuring perfect rigidity. A small brass plug C is fitted to the end of the screw B, thus obviating any possible danger of damaging the surface of the work. The length of slot A and



AN IMPROVED V-BLOCK.

screw B combined give equal facilities for clamping, whether the work be large or small, and for so small a tool it is obvious that a large range of sizes can be accommodated.

Hints on Brazing.

The following notes are taken from *Railway and Locomotive Engineering* :—

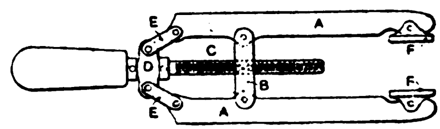
In brazing brass, copper, wrought iron and steel, clean the metal thoroughly at and near the joint to be brazed by scraping or filing. Be sure to fit the edges close together. If great strength is required, lap the edges by each other about ¼ in. A good plan is to rivet the edges together to hold them in position.

Next place the brazing material along the joint. Take borax, finely powdered, wet it with clean water and place a small quantity along the seam. Put the article with the joint down, over a forge, having a coal fire. Heat it slowly and evenly, holding it an inch or so above the coal. Hold the article in one hand and a small iron rod in the other.

If the brazing material should be moved away from the joint by the borax, place it back before it melts. When it is all melted, rap the article lightly with the rod, which will help the brazing material to flow all through the joint. Remove the article from the fire as soon as all the brazing material is melted, and hold it horizontally until it cools, so that it will not run. If the article is brass or copper, it should be plunged into cold water; but if steel or iron, it should be allowed to cool slowly. For brazing brass, use silver; for copper, iron, or steel, use spelter or thin strips of sheet brass.

A Pattern-maker's Clamp.

An interesting clamp for pattern-makers and others is shown in the *Zeitschrift für Werkzeugmaschinen und Werkzeuge.* As seen from the sketch, the device consists of two levers, A, turning around pivots in the intermediate part or brace B, which latter is threaded to receive the clamp screw C. On this clamp screw is mounted a bushing D, provided with projections to which are connected



PATTERN-MAKER'S CLAMP.

the links E. These links in turn are connected with the levers A. The lower part of the levers carry swivelling-jaws F. The action of the clamp is readily perceived from the cut. The clamping pressure is evidently very great on thin work, due to the toggle action of links E E. In the position shown, however, it is not so effective.

THE *Engineer* states that no less than thirty expresses covering 100 miles or more without a stop now run in and out of Paddington Station daily. The station is 700 ft. long and 258 ft. wide.

A REMARKABLE well exists near New Burlington, Ohio, fitted with two pumps—one furnishing fresh water, and the other having such a high amount of mineral salts that it is almost brine. Two water-bearing beds confined between layers of limestone occur at this point, the upper carrying fresh water and the lower salt. The pipe of the fresh water pump is but 16 ft. long; that of the salt water pump is 35 ft. The brine, being heavier than the fresh water, does not mix with it but remains at the bottom of the well, and the longer pipe consequently draws only the salt water.

A PUNCTURE-SEALING COMPOUND. — "Miraculum" is a new process for rendering pneumatic tyres immune from punctures. The material itself, which in appearance is like cream, is applied to the interior of the tubes, and it is claimed by the inventors that their compound automatically seals a puncture immediately it is caused. At a recent demonstration a 4 in. nail was hammered into a tyre that had been treated with "miraculum," and was afterwards withdrawn. The car then left for a half-hour run around the streets, and on its return the tyre showed no signs of having been punctured beyond the mark where the nail had been.

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How It is Done.

Fitting the Armature of a Dynamo or Motor.

By A. W. M.

(*Continued from page* 107.)

SO small is the amount of inaccuracy which will prevent a motor or dynamo spindle from turning easily that designers have taken considerable trouble to arrange the bearings so that they fit into seats bored concentric with the field-magnet tunnel. It may appear that a bearing could be easily fitted so as to be correctly in line by filing its seat until the

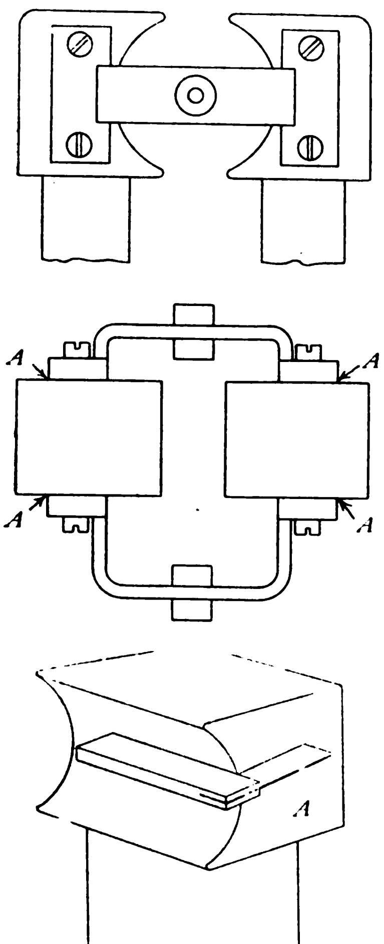

FIG. 8.

necessary adjustment is accomplished. But in practice this adjustment is difficult, and a better plan is to proceed from the first in a systematic manner, so that when the bearings are bolted in place they will be in line and no adjustment required.

Taking an example, we will assume that special concentric seats for the bearings have not been provided. A design frequently used for small motors and dynamos is that of Fig. 8, the bearing brackets being bolted to the sides of the field-magnet poles. The method to be described is, however, applicable to a variety of designs in which similar bearing brackets are bolted either to the magnet poles or to the yoke. The first thing to do is to file or machine the places A so that they are flat

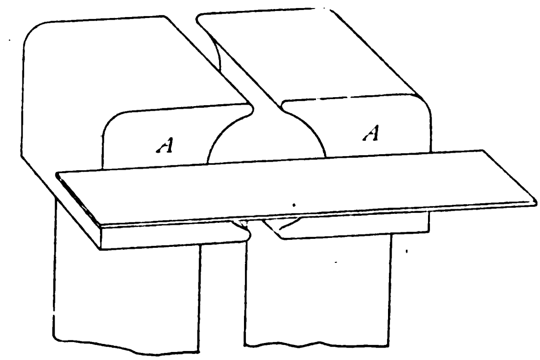

FIG. 9.

and square to the magnet tunnel, which we presume has been bored or filed to size. They should be tested by means of a try-square, as indicated in Fig. 8, the blade being applied in various positions over the surface. In addition the surfaces at each side must be in a line with each other. To test this apply a straight-edge, as indicated by Fig. 9; it

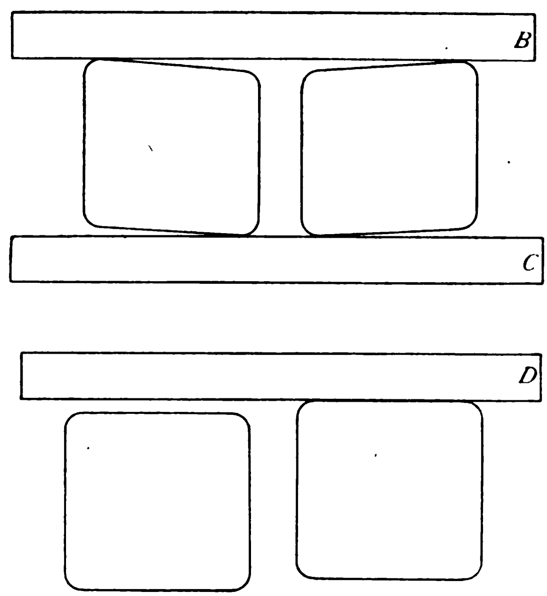

FIG. 10.

should touch the line of surface when placed at various positions. If the surfaces show hollow as at B, Fig. 10, rounding as at C, or out of line as at D, the bearings cannot be screwed up tightly without being put out of line, unless they are each shaped up to suit the particular surface. This, however, would be the wrong method to adopt, as making such an adjustment takes up a considerable

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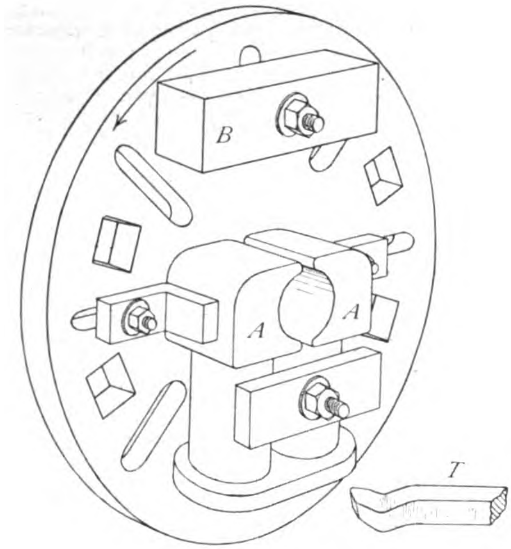

FIG. 11.

amount of extra time, and is an unsatisfactory thing when accomplished. If the field-magnet is not in one piece it should be fitted together and bolted up at the joints before the surfaces A, Fig. 8, are filed or machined. If a lathe having a faceplate sufficiently large is available the magnet can be clamped to it as indicated by Fig. 11, and the surfaces A machined by an ordinary front tool T. The magnet could, as an alternative, be placed upon a mandrel between the lathe centres, as Fig. 12, and the surfaces A machined by the side tools S. Two driving pins X are convenient to take the weight of the magnet as it rotates. With either method the magnet should be counterbalanced by a weight B to ensure an even speed of rotation. In the event of method Fig. 11 being adopted the magnet tunnel should be bored or trued up by means of a tool K, Fig. 16, whilst the magnet is in position upon the faceplate. The magnet is then reversed so that the machined side A A is flat against the faceplate. The remaining side is then to be machined and both will be square to the tunnel.

Having thus prepared the field-magnet, you should in a systematic way machine or file the bearing brackets so that the flanges or feet which will be placed against the surfaces A of the magnet will be straight with each other and square to the hole in which the spindle will be carried. The hole may be drilled first and the flanges machined afterwards, as in Fig. 13. They should be rough filed so as to be approximately flat or square to the boss. When you do this place the bracket upon a flat surface and test with a try-square, as Fig. 14. If the flanges are filed so as to bring the boss in line with the blade of the square you will be on the way to secure an equal thickness of metal at the sides of the hole when the latter is drilled. Should the bracket be much out of shape you should average matters. Perhaps the boss may be cast on the slant, in which case you may decide to work to the web and file the boss to equality after the hole has been drilled. If the casting is of brass or a metal that will bend, you can correct a distortion of shape by a hammer, testing with the square until fairly straight, and then rough filing the flanges so that they bed firmly when the drill exerts its pressure (see Fig. 13). For cast or wrought iron tools, S, Fig. 12, are suitable; for brass tool J, Fig. 13, to face the flanges. Take light cuts if the bracket is thin, and test the flanges

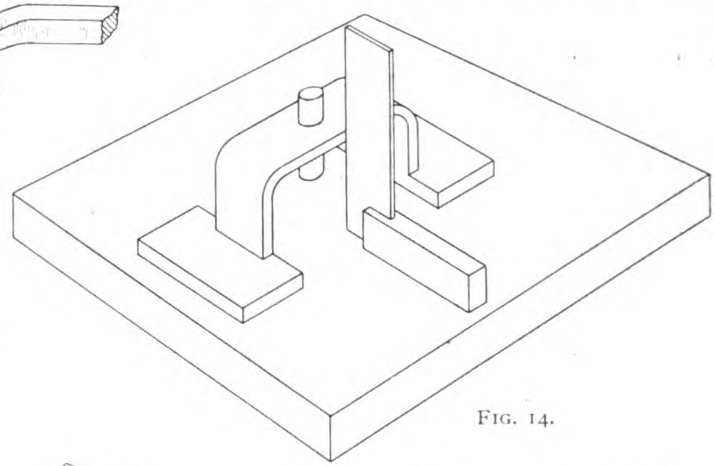

FIG. 14.

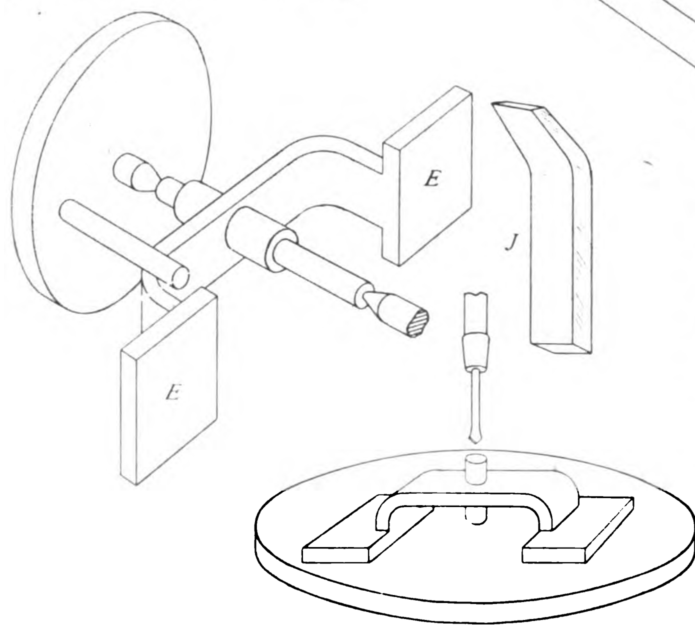

FIG. 13.

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by means of a straight-edge, as Fig. 15, to ascertain if your cut is true. An alternative method is to file the flanges so that they have a finished flat surface, and to drill the hole for the spindle

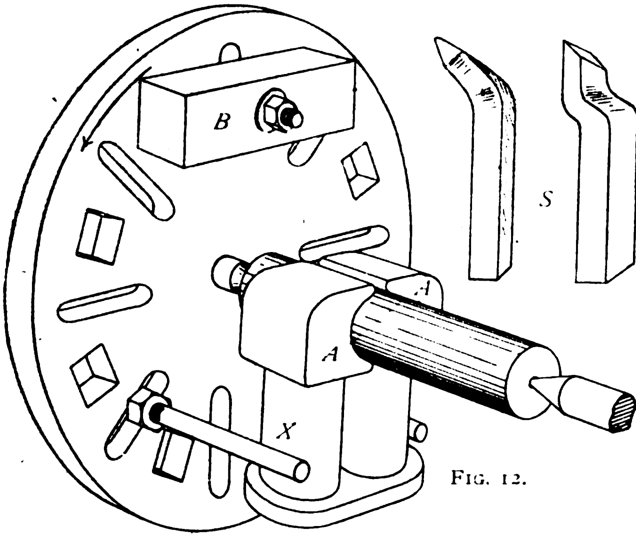


FIG. 12.

as a secondary operation. It should be done by clamping the bracket upon the lathe faceplate, as Fig. 16, and drilling the hole by means of a drill fed forward by the tailstock centre. A plain flat drill P, or twist drill L, will be suitable. The drill is to be held from rotating by means of a convenient clamp (see handbook "Practical Lessons in Metal Turning," by Percival Marshall); the

from the centre line during its passage through. To start the drill correctly, the end of the boss should be faced flat with one of the tools, such as J, and a conical centre turned in it by the point of the

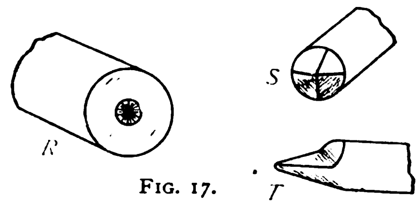


FIG. 17.

tool, as R, Fig. 17. This centre must run perfectly true. It may be made by means of a square centre as S, or a half-round centre, T, Fig. 17. Either of

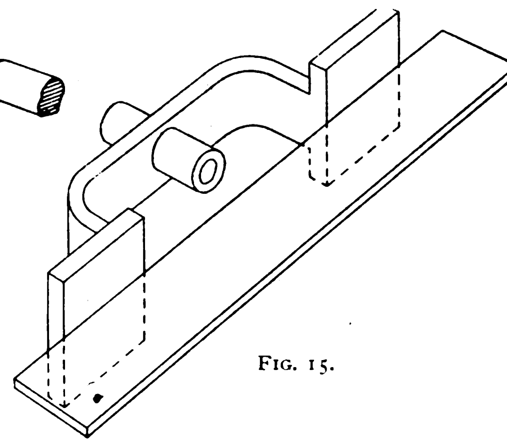
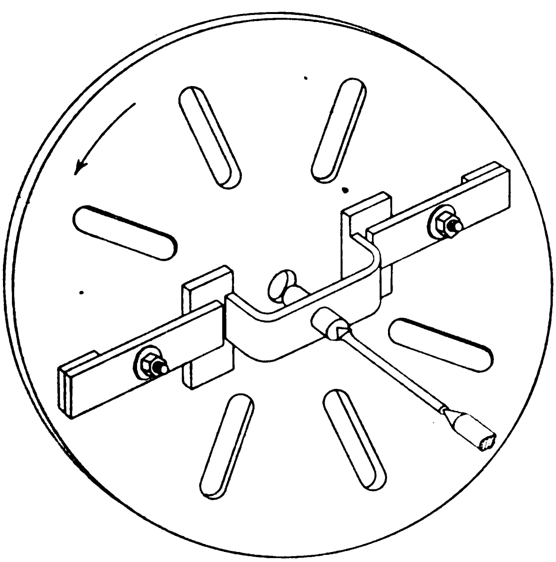


FIG. 15.



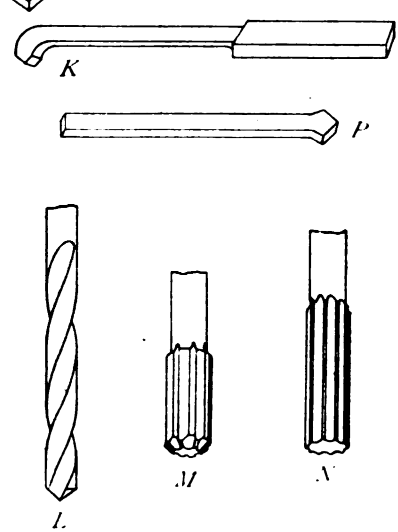


FIG. 16.

bracket rotates instead. Two difficulties will occur: in the first place you must ensure the drill commencing its cut true to the centre of the boss, and, secondly, endeavour to prevent it from deviating

these centres should form part of the outfit of a lathe. They are put into the tailstock in place of the ordinary centre, and pressed against the work whilst it is rotating, and will cut a conical

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centre. They must be made of tool steel hardened and tempered. The conical centre cut in the boss by this means should be nearly as large as the drill at its outer diameter to form a substantial guide for the drill point to start the hole. If the drill point does not follow the centre line during its passage the hole will run eccentric by a gradually increasing amount. This can be corrected by boring with a tool K, Fig. 16, fixed in the slide-rest. The drill should therefore bore a hole which is smaller than the diameter of the armature spindle so as to leave a margin for correction An ordinary flat or twist drill does not produce a smooth hole suitable for use as a bearing to a running spindle, so that even if the drill goes straight a margin of metal is required. To produce the finished surface a rose bit M or reamer N would be suitable. The former will correct a small amount of departure from the centre line if the near part of the hole runs perfectly true. These tools are to be passed through in the same way as the drill; they should be lubricated with oil at the cutting edges. If the finished hole does not run perfectly true the bracket should be mounted upon a mandrel and the flanges refaced as indicated in Fig. 13. Thus far we have a field-magnet which has straight side faces A at a right angle to the tunnel, and bearing brackets which have their flanges straight and at a right angle to the hole in which the spindle will work. Obviously when these brackets are applied to the magnet faces A the spindle holes will be straight with the tunnel.

(To be continued.)

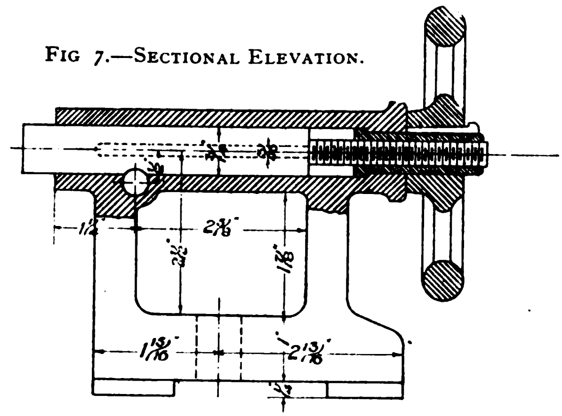
A Design for a Handy Lathe.

By W. Muncaster.

(Continued from page 81.)

In fitting the spindle brasses great care should be exercised in getting the spindle to be perfectly level, and at the same height as the back centre. Sideways, the headstock is capable of adjustment, two lugs being cast on the bottom, as shown, through which a ⅜-in. tapping hole is drilled, and the tap run through. Two pieces of ⅜-in. screwed iron are put in each side, having a nick cut in the end, so that a screwdriver may be used to tighten up. Any adjustment may be made by these when required.

FIG 7.—SECTIONAL ELEVATION.



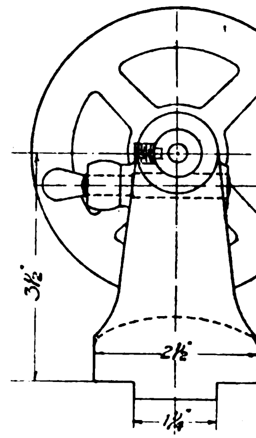


FIG. 8.—ELEVATION.

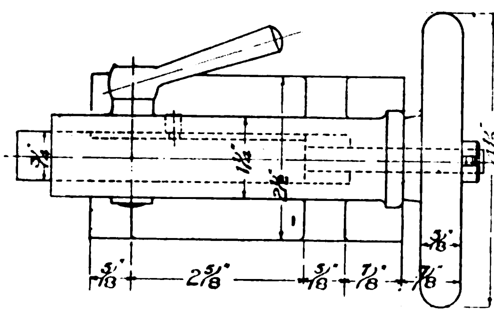


FIG. 9.—PLAN OF LOOSE HEADSTOCK.

Figs. 7, 8, and 9 show the details of the loose headstock. The casting, after being faced along the bottom, is bored in the barrel parallel to this with a ¾ in. diameter hole, except about ⅝ in. from the back end, where the hole is reduced to 9-16ths in. in diameter to form a collar for the screw sleeve to butt against.

A ⅜ in. hole is put through and a pin fitted for locking the slide, the hole being drilled in such a manner that the peg will foul the slide, except a piece be filed off the peg to allow the latter to pass as shown. The peg is screwed at one end and a wing-nut fitted, and pressure put on this will force the peg against the bottom of the slide and lock it To prevent the slide from turning when the hand wheel is turned, a groove is cut along the side and a [illegible] in. diameter pin screwed into the side of the casting filed at the end to fit the groove. The slide is best made out of a piece of steel with a 5-16ths-in. hole right through, one end tapped to receive the ⅜-in. diameter screw, the other end reamered taper to receive the lathe centre. It may be worth while to make the whole out of one piece, turning the end down and cutting a square thread on the smaller part, the ordinary V thread, Whitworth, being rather slow, but otherwise quite suitable. The screwed sleeve should be turned out of mild steel, and fitted with a keyway in the part on which the hand-wheel is fixed. The base may be fitted

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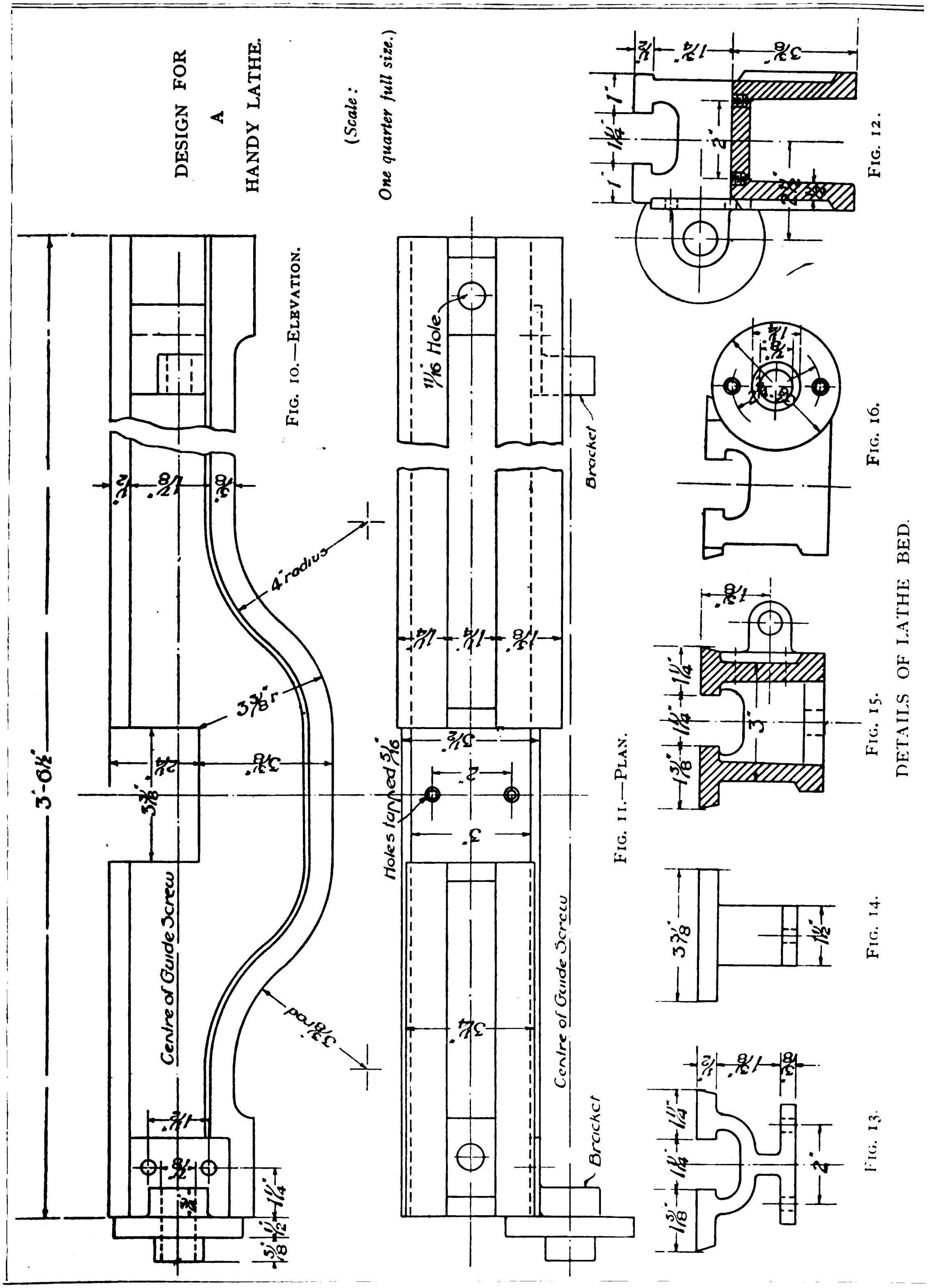

FIG. 10.—ELEVATION.

FIG. 11.—PLAN.

FIG. 12.

FIG. 13.

FIG. 14.

FIG. 15.

FIG. 16.

with screws for side adjustment, as shown on the fixed headstock.

The bed (shown in Figs. 10 to 15) is of the usual box type, with a flat top, and dovetailed flanges. The thickness is ½ in. minimum. There is a cross-stay cast in midway between the gap and the end of the bed, to give to the sides the necessary stiffness. The bed is planed and faced entirely over the top surface, and the full length between the flanges at the top also on the tapered edges. Preparation will be made for bolting to the A frames, and the bearing on these will be faced. Chipping strips will also be required for taking a rack for operating the saddle, and for receiving the bearings of the leading screw. The flanges should be faced to an angle of 65° in relation to the top surface.

The bracket for carrying the leading screw is shown attached to the bed (Fig. 16). The front view is given in conjunction with the bed, Fig. 10. This bracket is bored to fit the leading screw with a nipple turned, as shown. The flange will also be faced in the lathe. Fig. 17 shows the slotted radial arm to carry the intermediate gear for screw-cutting. This arm is bored to fit on to the nipple above mentioned, and is fastened to the flange by means of two studs through the curved slots.

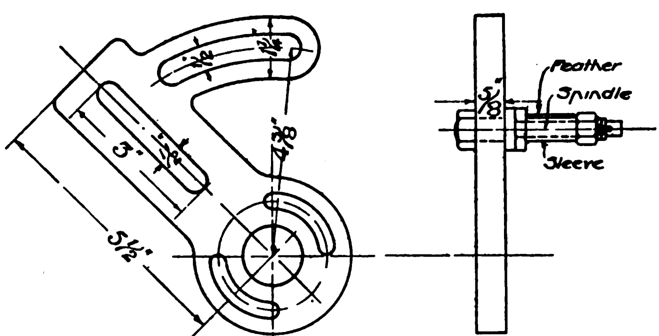

FIG. 17.—SLOTTED RADIAL ARM.

(*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.*]

HOW TO DESIGN A GAS ENGINE, WITH WORKING DRAWINGS OF A 7 B.H.-P. GAS ENGINE. By Horace Allen. Manchester: The Scientific Publishing Company. Price 2s. 6d.; postage 2d.

In this little work of thirty-nine pages the author takes his readers over the elementary ground involved in the designing of a 7 b.h.-p. gas engine. He begins with a consideration of the conditions governing the cylinder volume, and shows how this is approximately arrived at. The crankshaft dimensions are next calculated, followed by the connecting-rod, cylinder, cylinder liner, piston, flywheel, etc. Following this a space is given to a few notes on valve seats, valves, and operating mechanism which are well stated and brief. We note on page 34, fourth line from top, the author says that torsional stress upon the side shaft is introduced by having too great a clearance between the back of exhaust cam and roller on lever. This appears to be a rather unnecessary remark and apt to mislead, at any rate, those who are not conversant with the design of such machinery; for the side shaft of such engines as this type is, as a rule, of the most substantial dimensions and could stand a much greater twisting than it is ever subjected to. It might have been better to have explained that the ill effects through this cause (sudden shock due to the rapid opening of the exhaust valve) would become apparent in damage to the feathers or keys, as the case may be, holding the gear wheel and cam to the side shaft and not, as the author's wording implies, to the twisting of the side shaft itself. Again, we suggest, as the question of twisting of side shaft has been introduced, that mention might have been made of one other likely cause, namely, the great resistance offered when the exhaust valve is set to open much too soon—a state of affairs which will occur now and again; and when it does, the twisting effect on side shaft is very much greater than would be caused by the blow occasioned by too much clearance on back of cam, though the suddenness of shock and the consequent effect on the key or feathers might be less marked. For the rest the book may be recommended as a useful one to those who wish to make an engine of this size, and who wish to work upon something more than mere rule-of-thumb.

ENGINEER'S HANDBOOK. By Prof. Henry Adams, M.Inst.C.E., M.I.Mech.E., etc. London: Cassell & Co. Price 7s. 6d.; postage 5d.

The sub-title of this most useful compilation describes to a nicety the scope of the work. It is "Comprising facts and formulæ, principles and practice, in all branches of engineering." The matter is divided up under subject headings, each item being dealt with in a brief and concise fashion. The index to the complete contents is full and well arranged, thus making reference to any particular subject an easy matter. The book runs to 576 pages.

THE CONSTRUCTION OF DYNAMOS. By Tyson Sewell, A.M.I.E.E. London: Crosby Lockwood and Son. Price 7s. 6d.; postage 5d.

The author's object in producing this work is to combine in one volume of handy size such information on the theory, design, and construction of continuous and alternating current dynamos as will be of real use to students and apprentices in electrical engineering, and also to provide some matter which at the same time will interest civil, mechanical, and other engineers who have occasion to deal with electrical plant. The early part of the book is introductory and, as is usual in such works, deals with the fundamental principles concerned. Later on, polyphase currents and their bearing on dynamos are discussed and various examples are introduced by way of illustration. The work contains about 250 illustrations and diagrams and runs to over 300 pages.

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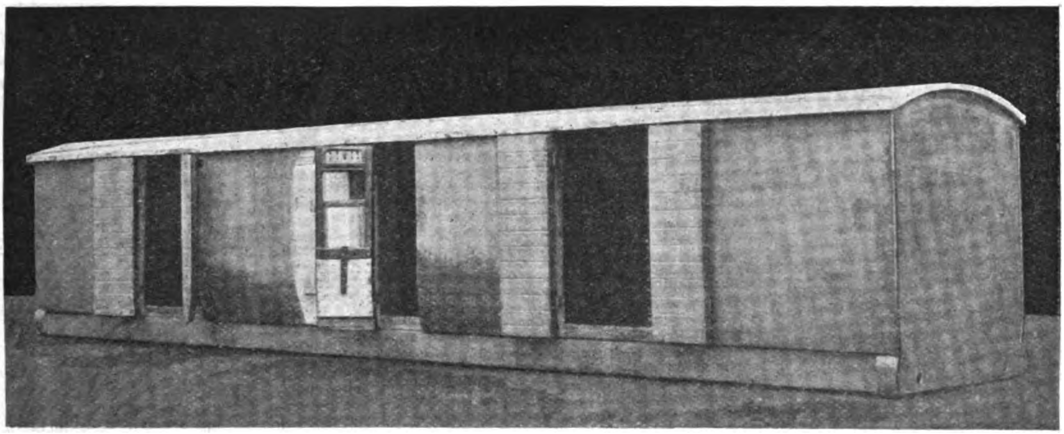
A Design for a Model Railway Guard's Van.

By W. E. Webb.

THE following is a description of our guard's van, being the second car of five for the Great Junction Railway, as explained at the time of describing our dining saloon in January 19th and 26th and February 2nd, 1905, issues of THE MODEL ENGINEER. The depth of framing and sides, style of beading, painting, height of buffers, etc., and similar details are the same as for the dining saloon and for the other carriages being built, so making the train uniform in appearance. The van is practically a copy of a L. and N.W. Railway one, but we do not guarantee all the details to be exact replicas of the prototype, the framing of bogies being the most noticeable departure. These are made on the well-known pressed steel framing principle, and are of a pleasing appearance, being light and very strong. They are more difficult to make than the ordinary flat-framed English bogie, but much lighter and smarter in appearance. For the channel framing 1-32nd-in. thick brass plate is sufficient, whereas for the flat English framing 1-16th-in. plate is necessary. The brake work is as used on the English railways, but it will be noted that the pivot point of each lever (marked A, Fig. 2) is a fixed one, whereas on some railways this is slung on links, thus permitting all the brake blocks to take up practically equal pressure, one brake block on one side of the wheel becoming, as it were, the fulcrum for the brake block on the other side of the wheel; but, on releasing the brake, it is dependent on the weight of the blocks and gear to clear the blocks of the wheels, and although this can be aided by placing the bracket-carrying hanger of brake block as far back as possible from the centre of wheels (this being, of course, limited on the outer ends by the length of bogie framing), it is uncertain in model practice, the weight of blocks being comparatively small, that the blocks will always clear the wheels when the brake is released. It is obvious that the brake work must be carefully balanced and hung. In the system shown on the drawing the first adjusting will take longer, and the pressure on both sides of the wheel may not be the same. But once got right, its action is more certain, and the pressure of blocks on the wheels could be adjusted by small springs, as in the real practice, although this has not been adopted by us, ¾-in. scale being rather small for such work and hardly necessary.

The axle-boxes are of more modern shape than those used for the dining saloon, having a slanting front cover to swing aside when it is necessary to oil journals.

In regard to the springs I have not made a test of a bogie fitted with the laminated springs, as shown; but I do not think they will give such good results as the coil spring used in the manner shown for our dining saloon. I may state that as regards running, the dining saloon bogies have given perfect satisfaction, and only from a point of appearance are we trying a change.



VIEW OF BODY OF MODEL GUARD'S VAN FOR MESSRS. WEBB'S "GREAT JUNCTION RAILWAY."

The car is equipped with an electric solenoid brake, as the dining saloon. The interior of car is a copy of the L. & N.W. Ry. practice, and is painted green after that Company's practice. We used Glaeser's "Hedge Sparrow" green; this is very like the real thing, and an excellent enamel.

The floor is covered all over with strips, 5-32nds in. wide, spaced 1-16th in. apart, as shown by plan (Fig. 3). It will be noticed that tread pieces parallel with sides are placed at the opening of luggage doors, the doors shutting up against these. The hollow boarded sides were made by fixing on 1-16th-in. thick stuff, with 1-16th in. space between; this is realistic and easy to do. The roof was first steamed and bent, and fixed between blocks (three pairs), a pair having one piece shaped a curve for the inside, the other a curve for outside of roof; then the joists were fixed, spaced as shown in the section (Fig. 2). The block with curve for inside of roof was made a little less in length than width of car inside, and placed to come between joists

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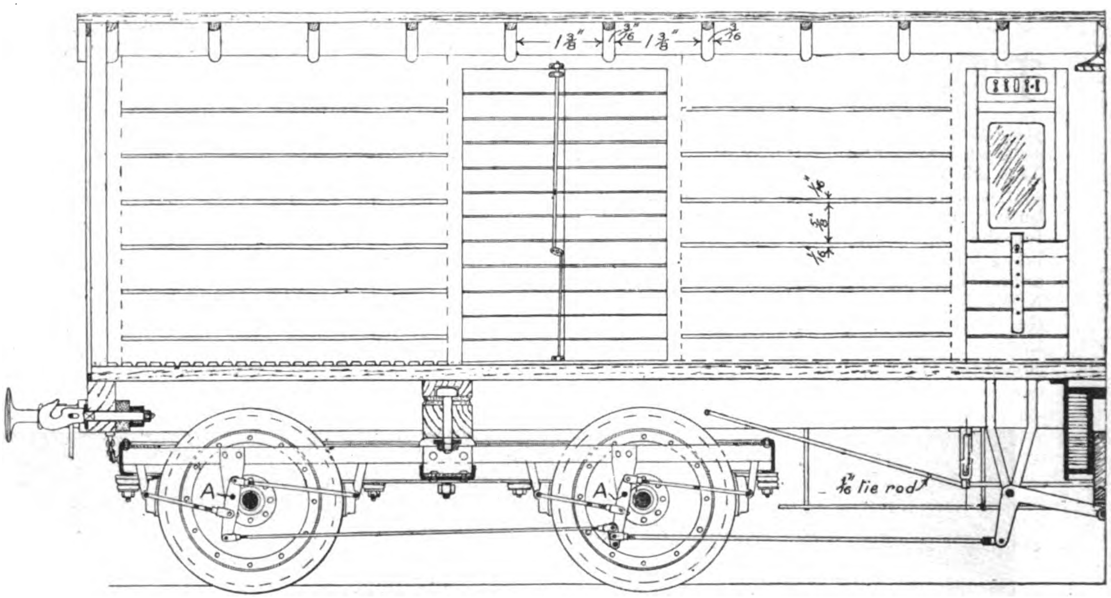
FIG. 2.—LONG



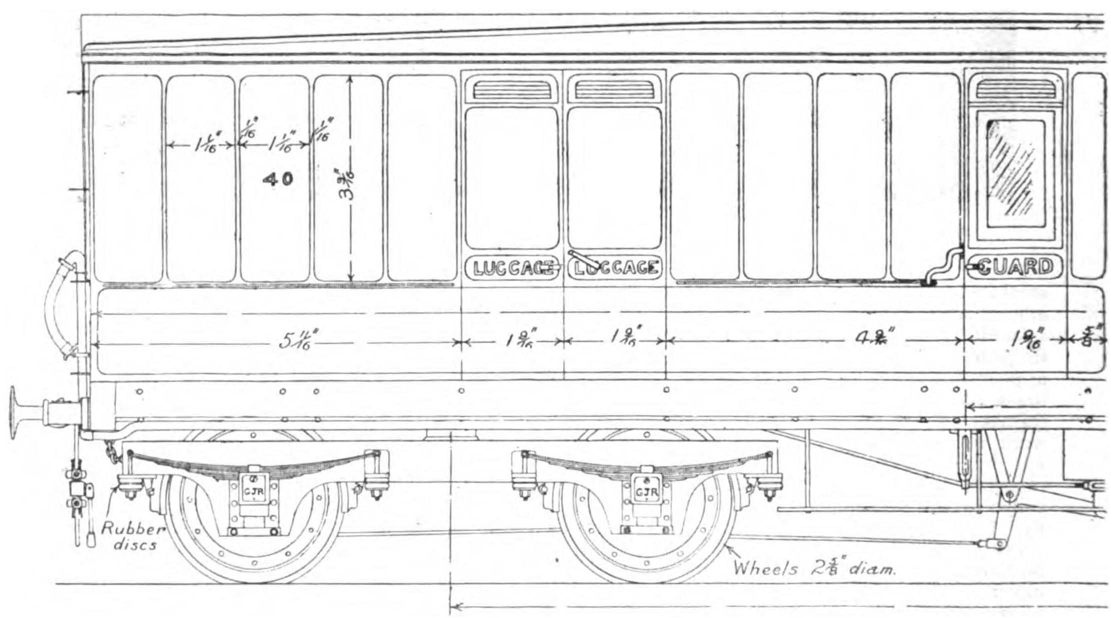


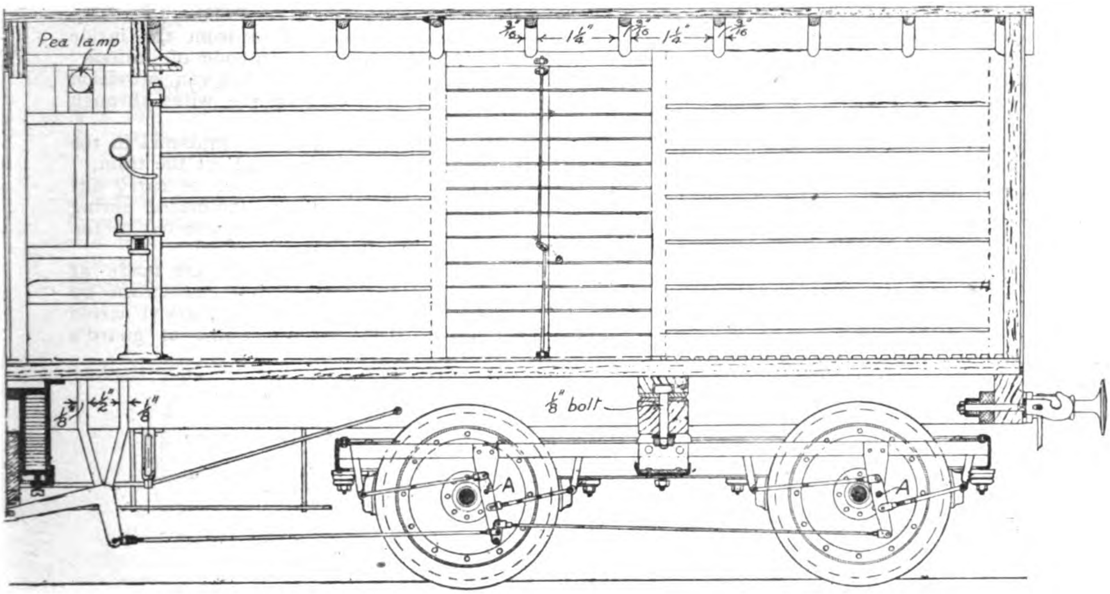
FIG. 1.—LONGI

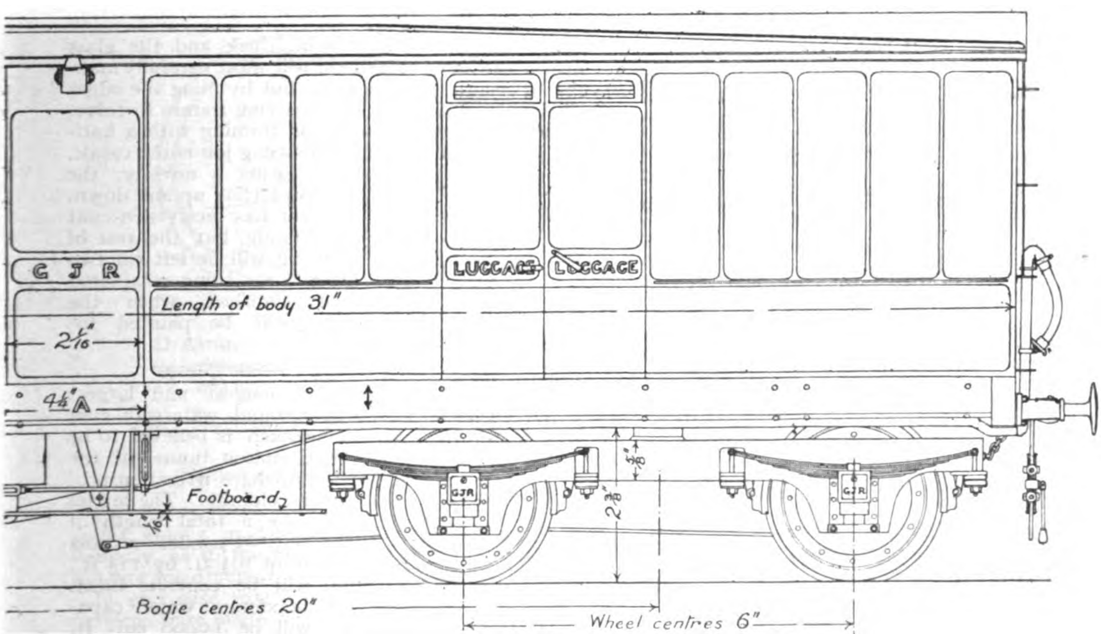
A DESIGN FOR A MODEL RAIL

By WM.

For description]

NAL SECTION.





NAL ELEVATION.

Y GUARD'S VAN. (*Scale: One-third full size.*)

WEBB.

[*see pages* 131—134.

near the guard's door and luggage doors at each end. The roof was fixed after joists had been trimmed to right length, and the template blocks—keeping roof to right curve—were then removed. The roof was painted before being fixed, and only required touching up where blocks had been. For the sides it will be seen that except for the centre

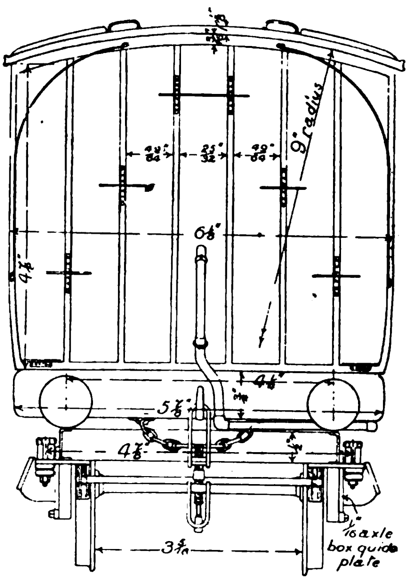


FIG. 4.—END ELEVATION.

where the guard's door and outlook comes, the van is symmetrical. For the four end pieces, cut pieces $5\frac{5}{8}$ ins. long, 4 31-32nds ins. high, and bevel off top edge to make the front or outside face $4\frac{7}{8}$ ins.

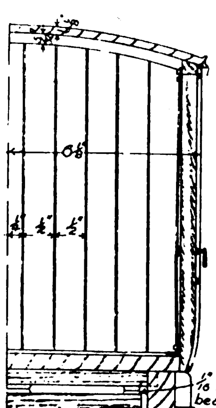


FIG. 5. — HALF - SECTION THROUGH LUGGAGE DOOR, SHOWING THE END BOARDS.

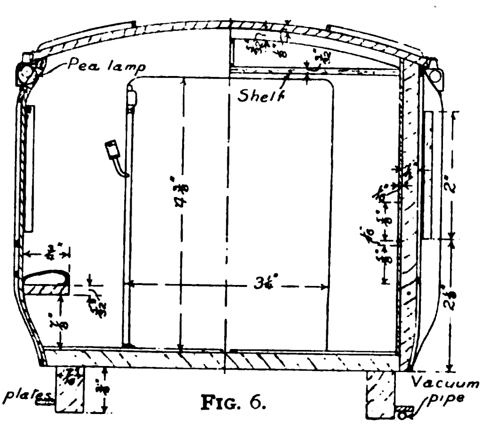


FIG. 6.

HALF-SECTION THROUGH GUARD'S COMPARTMENT.

HALF-SECTION THROUGH SIDE SHOWING HOLLOW BOARDING.

deep. The pieces between guard's door or outlook and the luggage doors are 4 9-16ths ins. long and the same height as the four end pieces, these eight pieces to be cut from wood $\frac{1}{4}$-in. thick.

The piece 1-16th-in. thick for the outside of guard's outlook could, with advantage, be made of 1-16th-in. zinc. This would be stronger, and could be shaped to the bend better than wood. It will be noticed a pea lamp is inserted from the inside to light the lamp shown on outside of outlook; if tail lamps are to be put one end of van, provision should be made for bringing the wires through from inside of van.

It is our intention to carry accumulators in the guard's van to light lamps throughout the train.

The vacuum pipe could be used to carry the electric wires. Instead of the laminated spring for buffers, a coil spring could be inserted in the buffer socket.

On the two ends inside V-dents are made at $\frac{1}{2}$ in. apart to represent boarding, as shown by Fig. 5, also the doors are similarly marked across at $\frac{3}{8}$ in. apart. The window frame of guard's

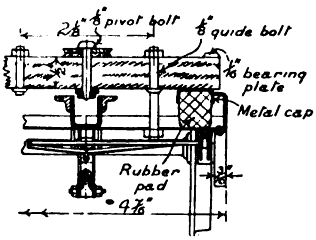


FIG. 7.—PART-SECTION THROUGH CENTRE OF BOGIE.

door, being only 5-64ths in. thick and the glass nearly the same thickness, will want carefully making to ensure a strong job; but by filing the edges of glass to a V-angle, and grooving frames to correspond, and making the wood framing with a half-lap joint top and bottom, a strong job is the result. It is rather a novelty, the window letting up and down. The car has received a coat of priming, but the rest of painting will be left till two other cars—being completed—are finished, when the three will be painted together.

THE longest and largest underground waterway ever undertaken is believed to be the Gunnison tunnel of the Uncompahgre irrigation project in Colorado. The tunnel will have a total length of 30,000 ft.—5·7 miles—a cross section of $10\frac{1}{2}$ ft. by $11\frac{1}{2}$ ft., and will be concrete lined. The maximum water capacity will be 15,000 cub. ft. per second. For the greater part of its length the tunnel is being driven through solid granite, and in some places it is 2,000 ft. below the level of the Vernal Mesa, through which it will run. Progress is necessarily slow, the monthly rate being under 1,000 ft., or about 35 ft. per day.

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Chats on Model Locomotives.

By Henry Greenly.
(*Continued from page* 64.)

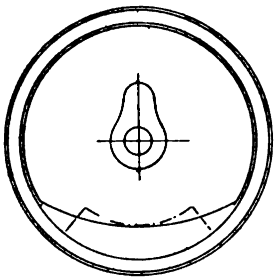
Balancing and Balance-weights.

In this week's article I make it my duty to explain as best I can by pen and pencil the several methods of arranging the counterbalance weights in the driving and coupled wheels of a model locomotive. From conversations which have occurred relating to this interesting subject, and from observation I have made of the many and various model locomotives I have had the privilege of inspecting, there appears to be some doubt among model-makers, amateurs more particularly, as to the proper position of the balance-weights for different types of locomotives.

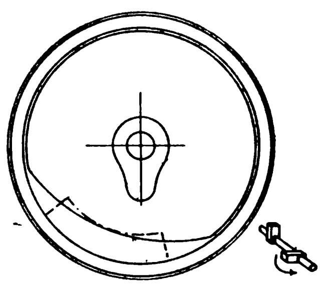
In one case that came before my notice two patterns were made for the driving wheels (that is, three patterns with that for the coupled wheels) of an inside cylinder model, where, of course, one pattern only was required. In other instances the balance-weights have been placed in the wrong quarter for the crank axle employed.* To do the thing quite accurately it is, of course, necessary to resort to arithmetic (at least), although geometrical methods can, of course, be employed; but, as I have more than once been reminded, the amateur has no particular love for the mathematical solution. Even when he is an expert at figures, he very often wishes to leave them alone when it comes to dealing with his hobby, preferring more "practical" methods. This being the case, I will endeavour to treat the subject in this way, although I am forced to admit I find it somewhat difficult. What I would much prefer would be to explain personally by the help of a specially arranged model. But the reader in the far-distant colony mutters that this is impossible.

Then, again, it is questionable whether minute differences, such as would alone be discovered by careful calculations and still more careful measurements, are worth bothering about. Balancing real locomotives is more or less a compromise. *Reciprocating masses*—which, in a locomotive, comprise piston, piston-rod, crosshead, and part of the connecting-rod—*can only be balanced properly by equal and opposite reciprocating masses acting in the same plane.* Such an arrangement is obviously impracticable in the average locomotive, and even in the so-called "balanced" locomotives absolute perfection is not obtained.

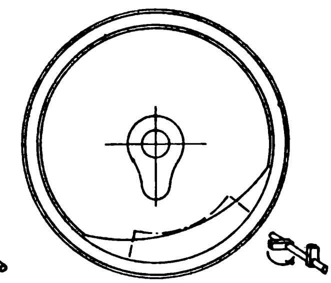
In the common or garden type of locomotive a large proportion of the reciprocating masses are



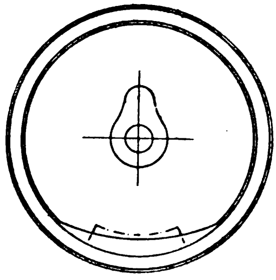
A, Driving wheel, outside cylinder engine.



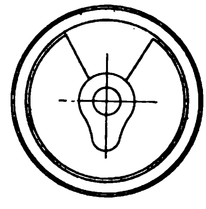
B, Driving wheel, inside cylinder engine, with left-hand crank leading.



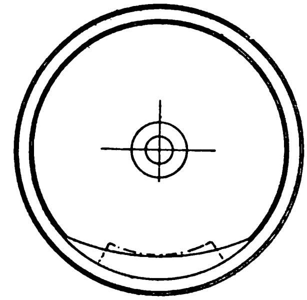
C, Driving wheel, inside cylinder engine, with right-hand crank leading.



D, Arrangement of counterbalance for coupled wheels.



E, Type of counterbalance used for shunting engines.



F, Driving wheel for single engine or for engine with outside frames.

Fig. 1.—Diagram showing Various Types of Wheels and Positions of Counter Weights in Common Use in Locomotive Practice.

(*Square counterweights shown in dotted lines. Scale: approximately 7-32nds in. to the foot, or half-size for 2-in. gauge engine.*)

* Crank axles are made in two ways—right-hand crank leading and left-hand crank leading.

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not balanced at all. It was G. W. Rly. practice to balance one quarter of the weight of the piston, piston-rod, crosshead, etc., by revolving weights in the wheels. Pettigrew, in his comprehensive book, "Locomotive Engineering," gives half the weight as the most desirable proportion. In model work, therefore, where the masses are much smaller, and the speeds—which are such important factors —are much lower than in the actual locomotive, extreme accuracy is not required. For all this, however, it is wise to approximate to the correct thing for both scientific reasons and appearances, and if firms supplying wheel castings deal with the subject properly, and amateurs see that they get the right sort of wheel for their locomotive, no model locomotive builder need be afraid of expert criticism.

There may be among the readers of THE MODEL ENGINEER students who attended Professor Dalby's early lectures on "Locomotive Design and Construction," which were delivered about ten years ago at Finsbury College, and at which the lecturer very ably demonstrated by means of an ingeniously arranged model the disturbances present when a locomotive was not properly balanced. After showing the model at work, with the correct balance-weights in position, laid on to pieces of tube so that any appreciable unbalanced effect in a horizontal direction would be indicated, one of the counterweights in the driving wheels was either displaced or removed. On running the model in this condition it baffled the combined efforts of half-a-dozen students to hold it still. The speed was, of course, rather high, the model being actuated by an electro-motor coupled directly to the cranked axle, and, as far as I remember, was in the neighbourhood of 1,500 or 1,800 r.p.m. In ordinary model locomotive work speeds as high as this do not obtain; at least, when the engine is running on the rails.

At the outset I propose to deal with the arrangement of counterweights necessary to obtain the desirable approximation to absolute accuracy for a small model single-cylinder tank engine built to ½-in. scale. where it is assumed the cranked axle is placed in the middle of the engine. I do this because some time ago I received a letter from a fellow-member of the London S.M.E. asking for help in this direction. He sent a drawing, a tracing of which I shall submit during the course of the articles, and required to know—(1) whether it was really necessary to provide the balance-weights in the wheel of such a small scale model, or whether they were put in simply for the look of the thing; and (2) whether the relative positions of the crank coupling-rods and balance-weights were correct scientifically.

In the first place, as a model is, or should be, a miniature replica, it is always advisable to follow actual practice as much as possible; therefore, I think balance-weights should be fitted in every case, and if they can be arranged to balance the disturbing parts so much the better. In any case the proper spirit should actuate the builder throughout, and he should arrange the counter-weights in such a way that they do not flagrantly violate the scientific principles involved.

Before we go into the matter very deeply a few general principles may be expounded, and in doing this I ask for the indulgence of the reader who is familiar with the laws governing the phenomena involved. A diagram is also included which shows the various type of wheels in common use. This diagram will enable me to refer to any particular wheel without trouble, and with the title and sub-title printed underneath it should be entirely self-explanatory (see Fig. 1).

In the ordinary types of locomotives reciprocating masses are not counterbalanced by equal and opposite reciprocating masses. For one thing, there is no room to do this, and, therefore, a proportion of the weight of the parts which move backwards and forwards is considered in the same way as a rotating mass, and "transferred" to the crank-pin.

To get clearer ideas on the subject of balancing, the reader who is interested should spare the time necessary to make a simple model, the simplest form of which may consist of a piece of steel rod about ⅛ in. or 3-32nds in. diameter, which may be easily spun between the thumb and finger, and a set of arms, which for convenience may be made out of three different cross-sections of steel or brass. The cross-sections chosen should be arranged to weigh as 1, 2 and 3 ozs. or lbs. per given length, and to save calculation two pieces ¼ in. by ¼ in., one piece ½ in. by ¼ in., and another ¾ in. by ¼ in. may be chosen. Each should be the same length, and should be drilled for the rod exactly the same distance from the end. If this is done, accurate results may be obtained from the experiments with the least trouble and without any adjustment of parts. A fixing setscrew may be placed in the end of each bar to clamp them in any desired position on the spindle, which, by the way, to save time in setting up the bars, may be marked with divisions ½ in. long. A ½ × ¼ bar should also be prepared. This should be double as long as the others and drilled exactly in the centre of its length as shown in Exp. D.

When ready for the experiments take one of the arms and fix in the centre of the spindle, as shown in Fig. 2. Twirl the spindle as indicated, when the unbalanced forces will be distinctly felt. The obvious remedy is, of course, to place another arm on the spindle, pointing in the opposite direction. As will be seen by Exp. B, with the arms provided it will not be practicable to place the two arms in exactly the same plane, and experiment will show that while the arrangement is in perfect balance when the rod is placed on knife edges and at rest, if the spindle is rotated rapidly, the presence of unbalanced forces will become evident. To exaggerate the effect the weights may be placed a little farther apart, as in Fig. 2, Experiment C, the diametrically opposite position, of course, being preserved. The balanced rod, which is virtually equal to two ½-in. by ¼-in. arms may then be experimented with, and it will be found that no disturbances are felt at whatever speed the spindle is rotated (Exp. D.)

These simple experiments would tend to prove that perfect balance is not obtained unless the weights are equal, are diametrically opposite, the slightest difference in the weights of the two parts and any displacement from the truly opposite position creating disturbances. Furthermore, although balance may be obtained when the spindle is at rest, the opposing forces are not neutralised unless the weight and counter-weight act in the same plane. This is best exemplified by experiments C and D.

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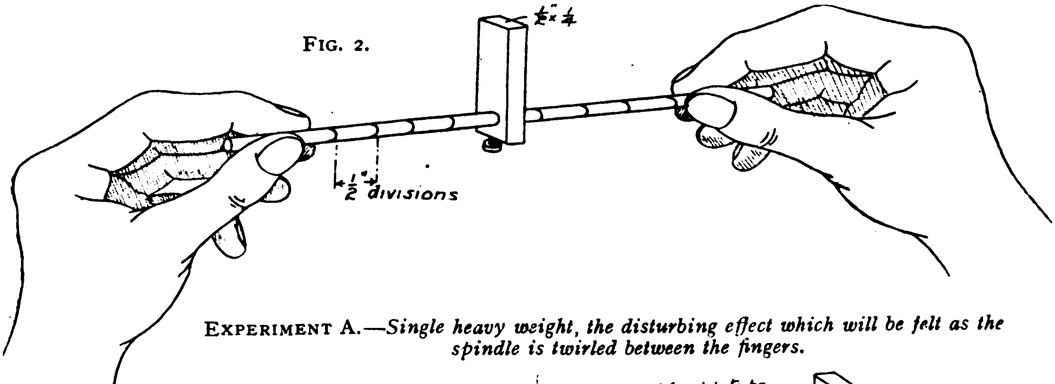
It is, however, not always possible to arrange the weight and counterweight exactly in the same plane, and in some cases where it would be possible other conditions make it undesirable. This being so, engineers divide the counterweights, placing the same opposite, but on each side of, the mass to be balanced.

With given radii of action the total weight of the counterbalances must equal that of the mass being balanced; therefore, for the experimental model we take the ½-in. by ¼-in. rod and counterbalance this by two ¼-in. by ¼-in. rods, placed one on either side of the large one, as in Fig. 2 (Experiment E). This arrangement exemplifies the well-known balanced cranks, and on twirling the rod perfect balance will be evident. The conclusions to be drawn from this experiment are that these two small arms act in the same way as a single counterbalance weight placed in the same plane as the mass to be balanced, and that the essentials to perfect balance are—(1) the two counterbalances must be equal in weight, and (2) equally spaced on each side of the main mass. The weights must, of course, be placed directly opposite, as in other cases.

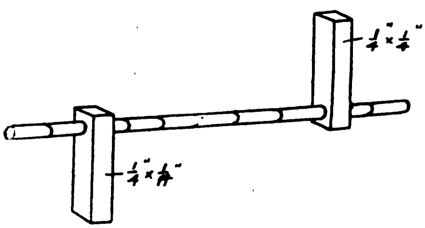
It is, however, not always possible for the designer to place the weights equi-distant. For instance, in an inside cylinder engine without balanced

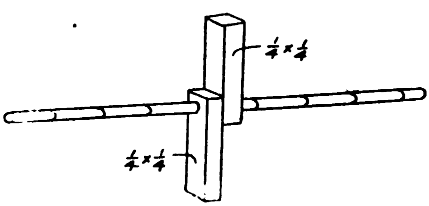
FIG. 2.



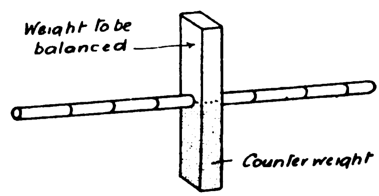
EXPERIMENT A.—*Single heavy weight, the disturbing effect which will be felt as the spindle is twirled between the fingers.*

EXPERIMENT C, *which is the same as Experiment B, except that the two weights are placed further apart to exaggerate the effect.*



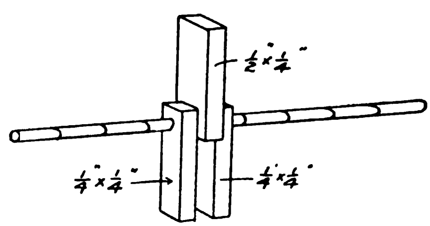


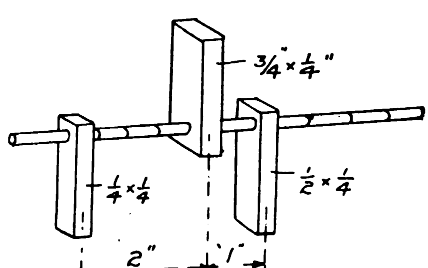
EXPERIMENT B, *showing that perfect balance is not obtained where the two forces do not act in the same plane, although the arrangement may balance when at rest.*



EXPERIMENT D, *showing that perfect balance is obtained by an equal opposite weight in the same plane.*

EXPERIMENT E.—*The weight is used as in Experiment A, perfectly balanced by two weights of half the size on each side, and opposite and equi-distant from the centre of the main mass.*





EXPERIMENT F.—*A weight, ¾ in. by ¼ in., is balanced accurately by a weight, ½ in. by ¼ in., placed 1 in. from the main mass, and one, ¼ in. by ¼ in., placed 2 ins. from the main mass.*

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cranks the moving parts (which would cause disturbances) have to be balanced partly in one wheel and partly in another. This is shown in the simplest way in a single cylinder model, where the crank is not in the centre of the engine and, of course, is present in any locomotive (in duplicate) with two inside cylinders.

To see if this makes any difference, the experimenter may shift one of the counterbalances shown in experiment E to the end of the spindle. If sufficient speed can be obtained, although the weights are not altered, disturbances will then be felt in the spindle. This tends to show that as the counter-weights are placed further away they become less effective; or, what is perhaps scientifically more accurate, the removal of the weight from its proper sphere of action creates unbalanced forces which do not neutralise those in the main mass. In fact, there is not a perfect "couple." We get a state of things shown by Experiment C.

All these experiments, therefore, prove that the lateral disposition of the balance-weights is of paramount importance. The rule to be remembered in balancing masses by counter-weights placed in planes which are not the same distance from the centre of the mass to be balanced, is that mass of counter-weights must be inversely proportionate to the distance between the three planes. This is made perfectly clear by experiment F. We have an arm measuring ¾ in. by ¼ in. in section, and wish to balance this by two arms, one ½ in. by ¼ in. and the other ¼ in. by ¼ in., the total weight of which equals the main mass. To obtain correct balance counterbalance the smaller, since it weighs only one-half of the large one, must be placed at twice the distance from the centre of the main mass. This is shown clearly in the diagram for Experiment F.

This completes the experiments required to fully understand how a locomotive is balanced. There is, however, one other law which must be remembered, and which may be made the subject of practical test. In the experiment we dealt with arms of all the same length. In locomotive work it is not always considered desirable, although some engineers (Mr. Webb particularly) have done it, to place the counterbalance weights at the same radius of action as the crank-pin. The weights are arranged in the rims of the wheels. Therefore, in accordance with the law of centrifugal force, which says that forces vary directly as the distance of the mass from the centre of rotation, to neutralise the disturbing effects of any given rotating weight the counterbalance must vary in weight inversely as its distance from the centre of rotation. This means, therefore, that we can balance any given weight by another half its weight, placed at double the distance from the centre of the shaft to which both are fixed. Therefore in locomotives the placing of counterbalances in the rims of the wheels means that the mass of iron can be made much smaller, and what is very important, the "unsprung" weights resting on the rails considerably reduced.

I trust this is clear to the reader; if it is not, I shall be very pleased to augment my remarks on the subject at any future time. The next article will deal particularly with the case of the single-cylinder tank engine referred to me by my riend.

(*To be continued.*)

The Latest in Engineering.

Launch of a New Battleship.—H.M.S. *Bellerophon*, the second battleship of the *Dreadnought* type, was launched at Portsmouth on Saturday, July 27th. The few bare details made known are her length, 460 ft.; width, 82 ft. Full load draught of water will be 27 ft. She will have engines capable of developing 23,000 i.h.-p., and her speed is to be 21 knots. She will be heavier than the *Dreadnought*, her displacement being 18,600 tons, to the former's 17,900 tons. The engines will be on the turbine principle, the Admiralty having been so satisfied with the results obtained with the *Dreadnought* at her long series of trials that similar engines are to be placed in all three ships of this class which are now building, but as the result of those trials several improvements will be introduced. Steam will be provided by water-tube boilers. As in the case of the *Dreadnought*, the *Bellerophon* will have four propellers, two on either side, and she will also be fitted with twin rudders. The armaments are to be similar, also the masts are to be of the tripod kind. The *Bellerophon* has been close on eight months in reaching the launching stage. She is to be completed for sea within two years of her commencement. Two other ships of the same type are now building—the *Temeraire*, at Devonport, and the *Superb*, at the works of Sir W. G. Armstrong, Whitworth & Co., Newcastle-on-Tyne. The *Bellerophon's* launching weight is 7,000 tons The launching weight of the *Dreadnought* was 6,000 tons.

A New Rotary Engine. — The illustration herewith shows an installation of a 10 h.-p. rotary steam engine which is the invention of Mr. J. M. Evans, of Toronto. The space occupied by the engine is 12 ins. by 14 ins. by 16 ins.; its weight is 250 lbs. Steam pipe, 1 in. diameter; exhaust pipe, 1½ ins., developing 12·1 h.-p., and running 400 r.p.m. The engine consists of a cast-iron cylinder, with heads on either end, the shaft running parallel to the cylinder walls and perpendicular to the heads. On one head is placed the steam chest, and on the opposite one the exhaust chest. The general arrangements are such that when steam is admitted to the exhaust end, and the steam chest opened to the atmosphere, the engine will reverse. The crank of the engine is constructed in two pieces; upon this is mounted the piston which in operation rolls against the cylinder wall.

While revolving, the centrifugal force of the piston tends to keep it tightly pressed against the cylinder wall, and, in addition to the contact, the moisture makes the joint effectively steam tight. The cylinder is divided into three spaces by means of slides or vanes working into fixed pockets. Cylinder heads are grooved so that the edges of these slides are supported, irrespective of the position which they occupy at any instant. The slides themselves are wider than the piston in consequence, and extend down over its edges, carrying shoes which run into ringed grooves cut into the side of the piston. While in motion, the angle between the vanes and the periphery of the piston is constantly changing, and this movement is taken up by means of an ingeniously arranged shoe. There are always two compartments of the engine working; hence

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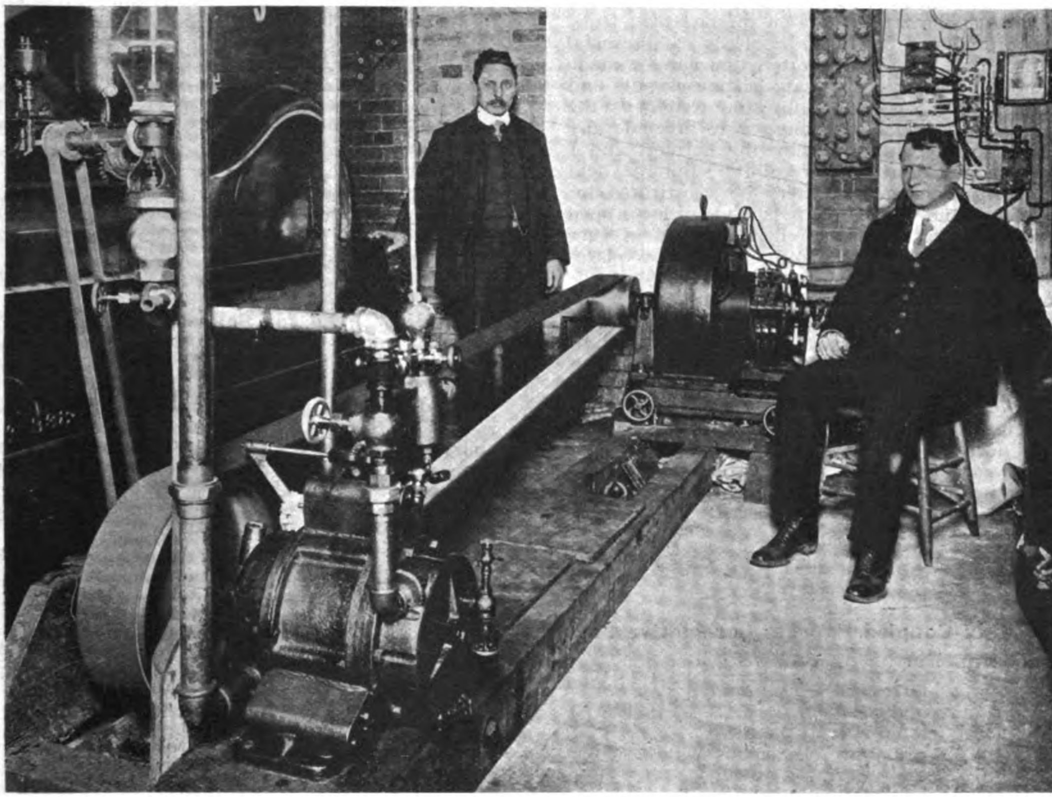
the force on the piston will be the resultant of the pressures and surfaces presented in these two sections. This resultant is invariably at right angles to the throw of the crank, irrespective of the position which may be occupied by the piston.

In the Evans rotary there is scarcely anything that corresponds to clearance in a reciprocating machine. Of course the space occupied by the steam port has an effect of this nature, but similar space must naturally exist in a reciprocating engine. When the piston reaches a certain point steam is admitted to one port at boiler pressure, and at this particular instant the effective area of the piston presented against this steam pressure is practically nil. Advancing a little further, a surface is presented to the steam between the slide and the point of rolling contact before mentioned. A still further advance, and this surface is increased, and so on until the point of cut-off is reached, which corresponds to about 90 degs. or one-quarter of a revolution. The action proceeds as above outlined, and the steam expands until the piston reaches a point corresponding to two-thirds of a revolution, at which instant the area of the space is at a maximum, and the exhaust port opens. The admission and expansion covers two-thirds of a revolution; and there are three such chambers formed in the engine, which means three steam admissions per revolution.

Hence, in Mr. Evans' own language, the engine works six-thirds of the time, for while the engine is only supposed to have three spaces, there are times when it has four, two being the regular spaces, and the other two being formed in one space, which is sub-divided into two parts by the piston itself. Therefore, it is evident that one compartment will be taking steam in one of its halves, while the other half is completing its exhaust.

As a comparison between this 10 h.-p. rotary and a 10 h.-p. reciprocating, it is stated that the latter requires the evaporation of a minimum of 75 lbs. of water to do what the former does on 32 lbs.



A 10 h.-p. Evans' Rotary Steam Engine in operation.

A party of twenty workmen from W. J. Bassett-Lowke & Co.'s Northampton establishment spent their annual outing at Ostend on July 20th. The men left Northampton at six on Friday night and arrived at Ostend at 2.30 a.m. putting up for the night. The return journey was made on Sunday night, the men arriving at Northampton early Monday morning. Special tickets were supplied by the L.N.W.Rly., and the men were able to spend an enjoyable two days in Belgium's premier watering-place with only a Saturday morning off.

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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.*]

Re Gas Battery.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The following may be of use to Mr. Brown. Before scrapping the battery I would advise him to experiment with it. The use of chlorine gas as a depolarizer appears on the face of it to be very promising, it is undoubtedly a powerful oxydizer, will dissolve in water, and can be made cheaply. My opinion is that the porous pots and plain water recommended by the writer of the article offer so much resistance as to preclude any useful current being given by the battery, and I would suggest that ordinary dilute sulphuric acid as used in bichromate battery be substituted for plain water, and the porous pots made of loose open canvas, the crushed carbon being packed in very tightly, or dispensed with and only carbon plates used. The internal resistance will then be only the same as bichromate battery. I must warn Mr. Brown not to pass the chlorine gas through a solution of salammonia, as nitric chloride will be formed and explosion probably result. In fact, before going very far with his experiments it would be as well if he looked up the subject in a good book on chemistry.

This form of battery was patented more than twenty years ago, and a great deal of money spent upon it before it was abandoned. It was said to give a D.P. of 2 volts and current according to size of cell.—Yours truly,

A. GREEN.

Leyton.

Re Six-Coupled Express Locomotives.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I trespass once more on your space to express my obligation to C. M. L. for his letter and to make one or two observations.

The 2,400 ft. of heating surface given by C. M. L. referred to 50, and not to "Cardean"; therefore, the information is four years old, as I previously said. Below I quote figures from *Engineering*, showing the heating surfaces of the respective engines:—

	No. 50.		No. 903.
No. of tubes ..	257 $1\frac{3}{4}$ diam... / 13 $2\frac{1}{2}$,, ..		242 2 diam.
Heating surface .	2,255	..	2211·75
Firebox	145	..	148·25
	2,400	..	2360·00

C. M. L. says the cylinders of 49 and 50 *are* 20 ins. diameter. Nodbody has said they are not. He has wandered off the point, which was his statement that the cylinders never were intended to be, and never were, 21 ins. This is opposed to the official information supplied to the engineering journals.

With regard to the N.B.R. engine, Mr. Field's name was not mentioned in the first letter, but I am very obliged to C. M. L. for his explanation of the apparatus.—Yours faithfully,

Westbourne Park, W. W. G. ROBLIN.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Mr. Roblin will perhaps be interested to know that the trials of the North British Atlantic Locomotive, fitted with the compressed air superheater, have proved very successful. The air pumps are outside and are worked off the tail ends of the piston-rods.

With regard to Mr. Lake's remarks concerning the non-success of No. 40 G.W.R. four-cylinder "Atlantic," I am afraid he has been misinformed, because the engine is the most successful "Atlantic" locomotive on the Great Western Railway, and I refer him to Mr. Churchward or his assistants to bear out the accuracy of this statement. Certainly the locomotive would be all the better for another pair of coupled wheels, and I expect it will be so rebuilt, as "Albion" is now converted to a 4—6—0. The other "Atlantics" will also become 4—6—0 engines in course of time.

I should be interested to hear of Mr. Lake's footplate experiences on the three classes of G.W.R. "Atlantics," as perhaps he was unfortunate when on No. 40.—Yours faithfully,

"MODEL COMPOUND LOCOMOTIVE."

Slow Feed for Self-acting Lathe.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Referring to Mr. Goldsworthy-Cramp's contribution in July 4th issue, I hope he does not suggest that a fine feed such as described is of advantage in ordinary working. It may, of course, answer for some special job, which should, however, have been specified. The teaching at the present day is rapid production, and it is as necessary for an amateur as a professional worker to get the job through as quickly as possible. I have tried the self-acting feed recommended by Drummonds, which is slow enough in all conscience —far too slow for me; 50 or 60 should be slow enough for anyone, and if the work is required to be polished the finishing cut should be taken with a flat-nosed tool.—Yours truly,

A. GREEN.

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 first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting, and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from September 25th, 1907, to October 31st, 1908. Full particulars and forms of application may be obtained from—HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

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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.

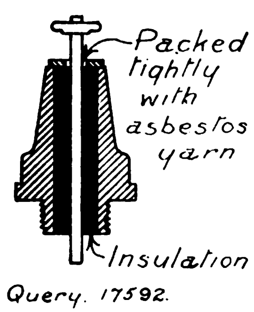
Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, 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:—

[17,918] **Small Lighting Sets for Showcase.** W. C. (Hull) writes: I should be extremely obliged if you would advise me on the following. I have a showcase, and I want to have three small electric lights in it, to burn five to six hours each night. Would it be cheaper in the end to buy a small gas or oil engine with suitable dynamo (complete charging set) for charging accumulator or lighting direct (which I should prefer), or simply have an accumulator to take and have re-charged frequently by someone else? Could you give me an idea as to cost and the name of the firm you think would be best to deal with for the class of goods?

You do not mention the size of showcase, but we presume three 5 c.-p. lamps will meet your needs. Any suitable voltage can be used, and cells must be of at least 30 amp.-hour capacity at, say, 10 volts. If a larger set of lamps be required, it will pay you to instal a small gas engine of first-class make (a cheap gas engine is the worst possible bargain you could manage to get hold of), and run a dynamo from it to light the lamps, and, if you choose, charge cells with it, too. Whitney's, or Thompson of Greenwich, or other of our electrical advertisers would supply everything required at a reasonable figure if you tell them what you want. Write us again if still in difficulties.

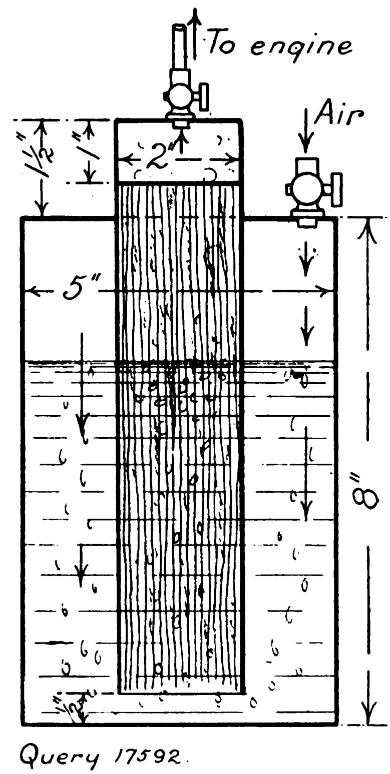
[17,592] ***Re* Small Gas Engine.** L. J. (Liverpool) writes: Referring to the article in March 28, 1907, issue of THE MODEL ENGINEER on a small gas engine, by Mr. Percy Briggs, I have just finished a similar engine, 2-in. bore by 3-in. stroke, which I have decided to work by the same method. I should be very much obliged if you would answer me the following questions and give me dimensions on sketch. (1) The central tube of carburettor, I presume, is packed with wick. What kind of substance will this



SECTION THROUGH PLUG.

be, and is it packed very tightly or loose? (2) Does the pipe marked "to engine" carry the vapour from petrol direct to the inlet valve, or will it require a cock fitted to cylinder head for the vapour to pass through so as to allow adjustment of quantity? (3) Is the sparking plug a metal plug with the central wire insulated from the outer portion, as in sketch? What is the best insulating material for the same to stand the heat of the exploding gas?

(1) The central tube of the carburettor is packed with ordinary lamp-wick and is just hung loosely from the perforated zinc disc. (2) The petrol gases go direct to the inlet valve of the engine and does not require a cock beyond the one fitted to the carburettor. (3) The sparking plug used was an ordinary motor cycle plug with a porcelain insulator, and the central wire straightened out, but if



SECTION THROUGH CARBURETTOR.

you intend making one we think the best material to insulate the middle wire from the body of the plug would be asbestos yarn packed tightly. We give sketch indicating this.

[17,898] **Wimshurst Machine.** A. W. S. (Palmer's Green) writes: I shall be greatly obliged if you will lend me your aid as you once kindly did before. I want to construct (if possible) a Wimshurst machine to give a long spark (8 or 9 ins.). Kindly state how many and what size plates, jars, and sectors should I use? Supposing a certain machine with two jars and two plates gives a 3-in. spark, what would be the effect of adding (*a*) two more jars, (*b*) two more plates retaining only two jars, (*c*) two more jars and two more plates?

It is not possible to say beforehand what the spark length of a Wimshurst machine will be; local atmospheric conditions will also modify results. In THE MODEL ENGINEER for November 17th, 1904, there is a description of a machine which is stated to give 7½-in. spark length. This will be a guide to work from. We advise you to increase the diameter of the plates to 24 ins., but use the same number and size of sectors. To obtain maximum spark length you should not have any Leyden jars. The effect of adding Leyden jars is to increase the density of the spark so that you get few sparks in comparison, but they are greater in volume. The addition of plates increases the density of the spark. Increasing the diameter increases the spark length, but if you have a large number of sectors there is more leakage across the plate. You need not have the Leyden jars as part of the machine; they can be connected to it by wires and you can try the effect of jars of various sizes. Glass plates will probably give best results. The collectors can be carried upon glass rods. It is very important to obtain glass having good insulating properties and to coat it with shellac varnish.

[17,887] **Private Electric Light Installation.** M. D. (Cape Colony) writes: I have lately installed a 2 h.-p. petrol engine and dynamo rated at 100 volts 10 amps. to light my dwelling-house. As I do not use the full output of the dynamo—six to eight lamps, mostly 8 c.-p. being the average number alight at one time—I

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shall be much obliged to have your advice on the following method by which I intend to carry into operation in order to reduce expenses. I propose to replace my present 100-volt lamps with 45-volt ones, and have a set of twenty-three glass accumulators, the latter to be always in series with the lamps when the engine and dynamo are working. I would run the engine only at night time when the lights were actually required, also only when the cells required recharging. While the engine was running I could see that sufficient lamps were alight to supply the necessary amperage to the cells; then after the latter were fully charged, I could light my lamps from the accumulators only, and I need not light more lamps than I actually require and so economise current. In this way I anticipate having to run the engine and dynamo only two or three nights a week, and being able to use the accumulators only for the rest of the week. This would, of course, depend on the size of the accumulators I might obtain. Would the above arrangement, viz., 45-volt lamps in series with twenty-three cells be better than 50-volt lamps in series with twenty-five cells? The former arrangement would be more in accordance with the instructions contained in your No. 1 Handbook about charging groups of accumulators, as the 45-volt lamps would leave 55 volts for the twenty-three cells, which giving 46 volts and requiring 2½ volts per cell, would require a voltage of 57½ volts and 55 volts would no doubt do.

In reducing the voltage of your lamps you will, for a given flow of current, reduce the candle-power in proportion. Therefore, the amount of light which you will obtain from your lamps will be 8 c.-p. each for 100-volt lamps or 4 c.-p. for 50-volt lamps, and so on. To obtain 8 c.-p. from the 50-volt lamps, you must give them double the current. There is no objection to working the installation as you propose. You will have a loss in the battery, as it does not give back all the electrical energy put into it. Any gain in efficiency would be due to convenience in working. The voltage of the cells will fall when discharging, so that if you desire to have a good light two additional cells as regulator cells should be installed. They should be switched in as the voltage falls. The cells can be discharged to 1·8 volts per cell, but not below this, or the battery will get into bad condition. You can get some extra voltage by running the dynamo at higher speed. We are inclined to advise you to use 50-volt lamps and work with twenty-seven cells—that is, twenty-five working and two regulator cells. The dynamo will have to give 50 volts for the lamps, plus 63½ volts for the cells—that is, 113½ volts total. We advise 50-volt lamps, as they will probably be more readily obtained than 45-volt lamps. Any loss of voltage in your wires should be allowed for also, but you can reduce this to a negligible quantity by using wires of ample size. It will be necessary to arrange a method of regulating the dynamo voltage, either by altering the speed of the engine or using a regulating resistance in the field-magnet coils, because the back voltage of the cells will steadily rise during charging. You can determine this by some trial runs. You will probably find that for three evenings' work with the battery, four evenings' charging will be required. If you discharge as low as 1·8 volts per cell recharging ought to be commenced at once to keep the battery in good order.

[17,945] **Cross-sectional Areas, etc.** G. A. M. (Paisley) writes: Being a constant reader of THE MODEL ENGINEER AND ELECTRICIAN, and not being able to find the information I require in the numbers I have got, would you be so kind as to give me some information on the following questions? How to find the carrying capacity in amperes of bus-bars, 1¼ ins. × ⅝ in., ¼ in. × 3-16ths in. What current would these bars carry, working at 1,000 amps. to the square inch? What is meant by cross-sectional area? What kind of wire gauge would you recommend to find the diameter of cables? The kind of gauge I would like, if any are made, to give diameter and cross-sectional area, so that I could work without a wire table at 1,000 amps. to the square inch. Take a bus-bar, for example, ¼ in. × 1-16th in. and one 1¼ in.s × ⅝ in. How do you find the cross-sectional area? Would you show me how to work out same? Having to charge accumulators at times, when the voltmeter reads the full voltage of the accumulator, with a few hours' run from the dynamo (accumulators are motor-car type, 4·5 volts) is it fully charged, or have you to continue for ten or twelve hours?

Multiply the dimensions of the cross-section together, and this gives you the area of cross.section. Thus

$$1\tfrac{1}{4} \times \tfrac{5}{8} = \frac{5}{4} \times \frac{5}{8} = \frac{25}{32} \text{ sq. ins. (area).}$$

and this multiplied by the allowable current density, say, 1,000 amps. per square in.,

$$= \frac{25}{32} \times \frac{1{,}000}{1} = 781\tfrac{1}{4} \text{ or } 781{\cdot}5 \text{ amps.}$$

Wire gauges (circular in form) measuring from 1 S.W.G. to 36 S.W.G. and giving the diameter in inches of each size are to had for a few shillings each (6s. or 7s.) from any tool merchant. The diameter being given, you can find the cross-sectional area by multiplying ·7854 by the diameter squared (*i.e.*, multiplied by itself). *Re* charging cells. When the voltage rises to about 2·4 volts per cell, and they have been gassing freely, you may take it they are fully charged. A better test is the specific gravity of the electrolyte (acid), but this depends partly upon the specific gravity at the start, and you would also need a hydrometer. If you read up previous query replies on this subject you will get some useful information on charging cells, &c.

[17,625*] **Driving Gear for Electric Locomotive.** W. W. S. (Eton) writes: I wish to ask your advice with regard to an electric locomotive which I am making. It is 2½-in. gauge, 16 ins. long, and 4 ins. wide, made of wood. It is mounted on two four-wheeled bogies. I wish to know how to connect motor to the

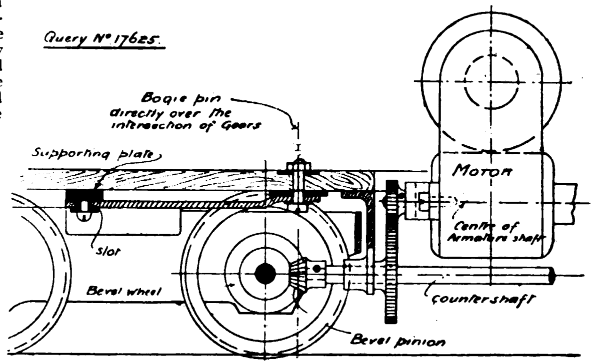

FIG. 1.—ARRANGEMENT OF MOTOR AND GEARING FOR ½-IN. SCALE MODEL ELECTRIC LOCOMOTIVE WITH DOUBLE BOGIE.

driving axle. I thought I might use a piece of spiral spring (such as I have seen used in model motor boats) to allow for the turning of the bogie by the axle of motor, armature being at right angles with the axle of wheels and transmitting its motion to axle by means of bevel gearing. I tried this, but found that the bevel gear did not run at all smoothly, and that in consequence the motor could not turn the wheels so as to move the locomotive. What would you advise me to do? Either with or without spiral spring and bevel gear?

In the first place, the ratio of gearing you have adopted is quite unsuitable. The proper ratio should not be less than 6 to 1. This

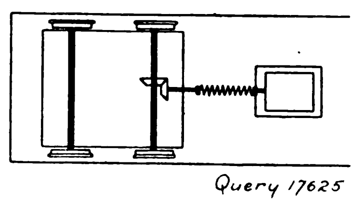

FIG. 2.—PROPOSED ARRANGEMENT OF DRIVE FOR MODEL ELECTRIC LOCOMOTIVE WITH DOUBLE BOGIE.

means a double reduction if spur gearing is employed. You could, of course, use a worm and worm wheel, when the bogie pin would be placed directly over the centre of the driving axle and a flexible shaft used. In the accompanying drawing we show how the motor can be arranged with bevel gearing. The bevel wheel and pinion should give a speed ratio of about 1 to 3 or 4, and the spur gears coupling the countershaft and armature shaft about 1 to 2. The bogies should be arranged on the Bissel principle, the bogie pin being placed directly over the point of intersection of the bevel gears. For further particulars, see the design for a 3½-in. gauge electric locomotive in THE MODEL ENGINEER for August 20th, 1903. The leading wheels may be coupled to the drivers by flexible bands. The device you suggest is not practicable with the ordinary centre bogie pin, as it would either prevent the bogie turning or bring the gears out of mesh. If the gear shaft were fixed to bogie the spiral spring connection would not prove sufficiently flexible to allow of a free movement of the bogie. The slot in the bedplate of the bogie (see Fig. 1) should be sufficiently long to allow of maximum play required by your railway.

[17,917] **Variation of Power with Speed of Engine.** P. M. (London) writes: My oil engine (⅛ h.-p.) with a 10-in. flywheel, drives a dynamo (40-watt) with 1½-in. pulley very nicely. In order to decrease the speed and consequently the noise of the engine, I had a ¾-in. pulley made for the dynamo. What I should like to know is—Why the engine will not work at all with the ¾-in. pulley at the dynamo, while it works very well with the 1½-in. one?

The speed at which any engine runs at is an important factor of the power it will develop. At, say, 300 r.p.m., an engine develops,

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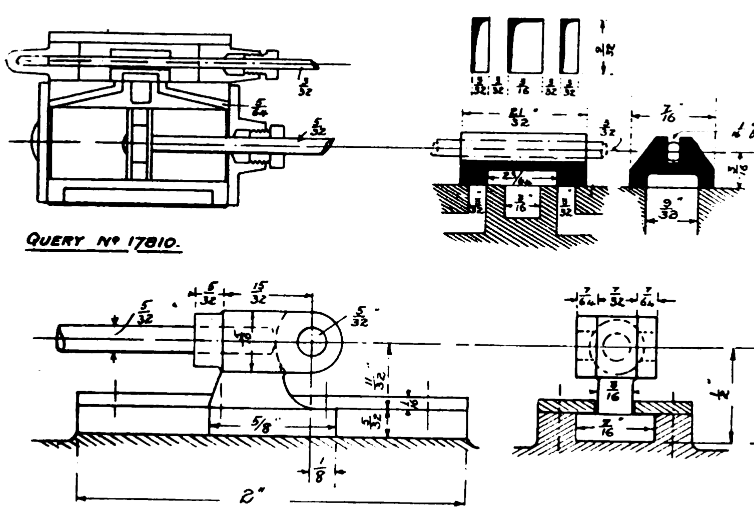
say 2 b.h.-p., and can drive a dynamo at, say, 2,000 r.p.m., giving 1¼ h.-p. (*i.e.*, full load, allowing 25 per cent. loss for inefficiency). If you alter the gearing (pulleys) to as to reduce the engine speed to 150 revolutions, you will find the engine will not cope with the load when it exceeds ¾ h.-p. at dynamo. If you read the notes on testing for brake horse-power in Handbook, "Gas and Oil Engines," 7d. post free, you will get some useful information, and will see by the formula given that the power developed varies with the speed.

[17,810] **Model Steam Engine Details.** J. D. H. (Horwich) writes: My sketch (not reproduced) shows size of cylinder, bore ¾ in. by 1½-in. stroke. Please give—(1) Size of ports and method of fastening valve to spindle. (2) Length of connecting-rod (brass). (3) Diameter of flywheel, heavy type, double rim (cast iron). (4) Thickness of shaft (single crank). (5) Proportions of slide for crosshead, the style to be as shown in sketch (not reproduced). (6) What power might be expected from above, at 30 lbs. pressure and 300 r.p.m.? (7) Size of boiler. (8) Sketch showing slip eccentric reversing gear. (9) Size of steam and exhaust pipes (internal diameter).

In reply to your enquiry we submit some sketches herewith. (1) The ports may be 3-32nds in. and 3-16ths in. by 9-32nds in., as shown, and the lap 3-64ths. Advance the eccentric 1-16th, to give 1-64th in. lead. You will note that inside or negative lap is also added. This will be found advantageous. For details of the fastening of valve spindle to valve see the issue of May 16th, 1907, page 470. (2) Make the connecting-rod the same length as that for the "Undertype" engine now being described (see page 521 of May 30th issue). (3) The flywheel used for this engine may also be adopted. (4) ⅜-in. diameter crankshaft. (5) We enclose sketch (full size) of suitable crosshead and slipper guides. The "gudgeon" or "little end" pin should be 5-32nds diameter, screwed into one fork and secured by a lock-nut. The piston-rod should be secured by a pin about 1-20th in. diameter. (6) About 1-50th i.h.-p. maximum. (7) What type do you fancy? See "Model Boiler Making," price 6d. net. The boiler should have from 60 to 80 sq. ins. of heating surface, according to type. A water-tube boiler will do with the smaller amount. (8) See issue of July 15th, 1901, and also "The Model Locomotive," for description of slip eccentric. You do not read your MODEL ENGINEER very diligently, otherwise you would not have missed the description of the slip eccentric valve gear published

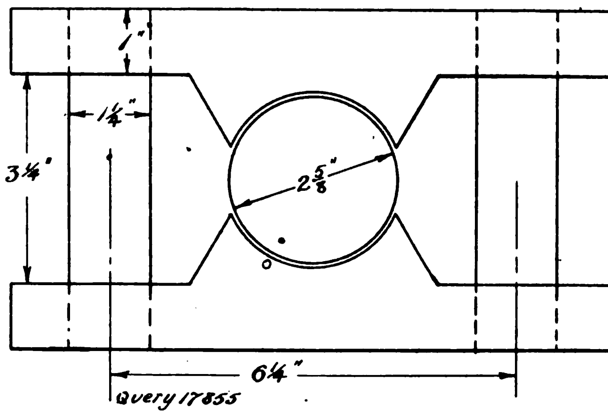


DETAILS OF CYLINDER VALVE AND CROSSHEAD FOR ¾-IN. × 1½-IN. MODEL HORIZONTAL ENGINE.

a few weeks ago. (See "Undertype" articles for June 6th and May 16th.) The same dimensions will do for your model, except that you may make the throw of the eccentric a full ⅛ inch to allow for the extra 1-64th-in. lap. (9) 3-16ths-in. steam pipe; ¼-in. exhaust pipe.

[17,855] **90-watt Drum Armature Dynamo Windings.** A. S. H. (Northampton) writes: I have an armature which was taken from an old fan. I wish to make a dynamo or motor from it. It is 2⅝ ins. diameter and 1¾ ins. long. Could you give me the side and front elevations of the field-magnets suitable for such a model. I wish it to be an undertype four-pole one. What would be a suitable output for a dynamo like this? If I lengthened the armature by about ½ in., would it increase the output very much? What size wire should I require for the field-magnets and armature at the suitable output? Would it want the same wire if armature was lengthened? If not, what size?

We should advise you to make the armature 2⅜ ins. long, and then use a Manchester type field-magnet for it (as sketch). Wind



MANCHESTER TYPE FIELD-MAGNETS.

armature with 13 ozs. No. 20 S.W.G., and field-magnets with 2½ lbs. No. 23, in shunt. Speed, 2,900 r.p.m. Output about 90 watts, 30 volts 3 amps. approximately. We are assuming a drum armature.

[17,923] **Power of Small Petrol Motors.** S. G. W. (Derby) writes: I should be much obliged by an answer to the following, please. I am having an upright petrol motor (water-cooled) to drive a dynamo (60 watts); the bore is 1⅜ ins., and a suitable stroke (I forget length). The water I intend running continually through the jacket from a tap. Will this ensure it being run for a good period? Will the motor drive dynamo sufficiently for me to charge accumulators? Two flywheels inside, two outside (flat 5 ins. and a grooved 3-in.). What amount of petrol will it consume as a surface carburettor? If the bore and stroke is too small to drive comfortably, I should be glad if you will say what would be the smallest possible to do so.

Your motor should drive a 60-watt dynamo well, provided it is of good design and construction, but the only sure way of ascertaining what it will do is to make a brake test, as described in our Handbook, "Gas and Oil Engines," by Runciman, 7d. post free. *Re* water cooling. This may be by a continual flow from a water supply, or by means of a cooling water tank.

[17,921] **Twist Drill Grinders.** A. C. W. (St. Leonards) writes: I would be much obliged if you could advise me on the grinding of twist drills. I have a lathe and a 6-in. emery wheel mounted on a spindle to run between the centres, but am doubtful of the expediency of running the wheel on the lathe, and contemplate purchasing a treadle emery grinder, which would be otherwise convenient for grinding lathe tools when using the lathe. Besides, I am going to India shortly, and will not find it convenient to send away my drills to be ground. Would you therefore kindly recommend me a cheap and efficient grinder and rest, if possible, and refer me to any book or issue of your paper giving details of the process of grinding twist drills and other such tools?

There is a useful device clearly illustrated and explained in February 7th (1907) issue, which should meet your requirements perfectly. Holmes & Co., of Bradford, who advertise in this Journal, also supply a good twist drill grinder, and we advise you to write them for particulars and prices.

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The Editor's Page.

AMONGST the contents of this issue we include some reproductions of photographs taken by our contributor when on holiday, illustrating a novelty in architectural design, in which it will be seen that the idea of a locomotive has entered prominently into the conception of the designer. This will undoubtedly not only appeal to lovers of good sculpture, but to those interested in the subject of locomotives generally, and who have not seen the actual piece of work. We call to mind the fact that we have more than once suggested to our readers that they should send us an illustration, and if possible, a brief description of any interesting mechanical device or feature that they may come across in their holiday or business travels. When so desired we are always willing to remunerate for such items as we think will interest or instruct our numerous readers.

* * *

A reader living in Australia, who has sent us an account of his own model-making efforts, writes to us as follows :—" After a long acquaintance with THE MODEL ENGINEER AND ELECTRICIAN, I have been struck with the comparative absence of work from Colonial readers, and I feel sure that a great deal more could be shown which would be of interest to model engineers in England as well as to others abroad, if our friends in the Colonies could be prevailed upon to photograph their work, and send the prints and particulars along for reproduction."

Answers to Correspondents.

F. G. (Norwood).—Recent replies to queries will furnish you with the information you require.

A. H. H. (Brentwood).—A drawing will be published shortly in the Query and Reply columns.

B. (Royton).—Perhaps the design for a ½ h.-p. gas engine in issue of January 4th, 1906, Vol. XIV, would suit your requirements. The working drawings were published in subsequent numbers.

C. B. (Leytonstone).—*Re* turning up this bowl: we think your best plan is to manipulate the tool by hand by the two feeds on the slide-rest. It is a big job to undertake, but could be done by this means all right. Finish with a hand tool, and then polish with emery. As the job would have to be very true in order to just clear the revolving knives, we think it would pay you to go to the makers and get a new one from them.

R. T. (Cleckheaton).—Your letter to hand, which is having attention.

J. B. (Birkenshaw).—The approximate horse-power given you recently would be obtained by assuming the cylinders to be 6 ins. diameter, not 16 as stated. With a 16-in. diameter cylinder the indicated horse-power would be approximately 240.

R. S. C. (Stourbridge).—We should suggest that you take out a provisional specification. Full particulars as to how to proceed are given in our handbook, "Patents Simply Explained," post free 7d., from this office. We shall be pleased for you to submit for our consideration your Workshop Notes. When a reply per post is requested it is usual to enclose a stamp for the same.

T. J. G. (Queensland, Australia).—This water motor is not intended to develop any appreciable power. As you have 60 lbs. pressure, you could get about 1¼ h.-p. with a suitable wheel, and using a ½-in. jet. The water consumption would be about 7 cubic feet per minute. With a ¼-in. jet you would get about ¼ h.-p. and consumption 2 cubic feet per minute. Follow the design given in December 15th, 1901, issue, page 271, but make wheel proportionately larger, say 10 inches diameter. *Re* boiler. This depends on the design, see "Model Boiler Making," 7d. post free. The article on "Silver Soldering" in April 23rd, 1903, issue, page 401, will assist you. See also page 232, March 5th, 1903, 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, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

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

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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. XVII. No. 329. AUGUST 15, 1907. PUBLISHED WEEKLY.

A Small Power Steam Plant.

By M. JOS. HANLON.

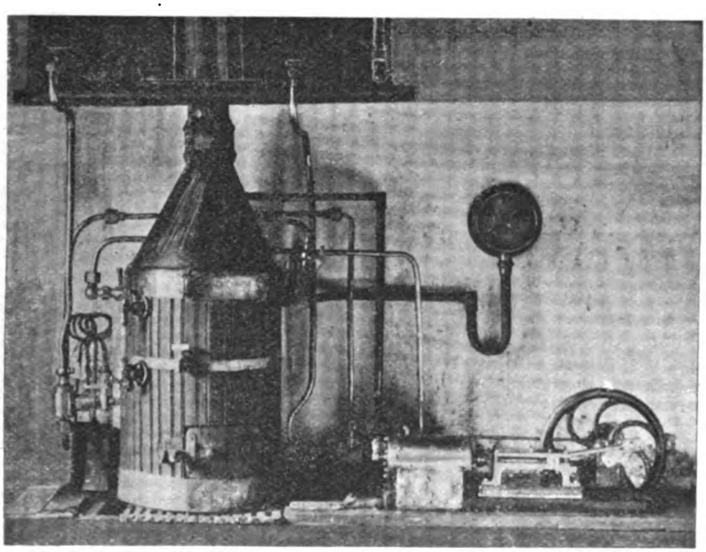

FIG. 1.—MR. M. J. HANLON'S SMALL STEAM PLANT.

THE accompanying photographs and sketches represent the fruits of almost three years of spare time labours, or rather pleasure. The engine portion of the plant absorbed almost two years of spare time, and this can be understood when I state that the cylinder (the only casting in the model) was first filed out almost circular and afterwards lapped out in a 2½-in. lathe by means of a piece of wood with emery fastened to it, the casting being pressed on to the wooden mandrel as the latter revolved at a high speed. The slide bars were made from a piece of mild steel 1 in. thick, being first drilled and filed accurately to shape and height, and were then split lengthwise with a hand hack-saw, thereby ensuring bars of equal height without packing, etc., where machinery such as planers, etc., were unavailable. The piston is provided with two cast-iron rings, 3-16ths in. wide and 1-16th in. thick, and they undoubtedly answer their purpose excellently. The connecting-rod is marine type, as are also eccentric and pump rods; the big and little end brasses and pump and eccentric straps are split; the bearing brasses in the pedestals are made in correct pattern, three pieces to take up wear so that there is practically no knock about the engine. Every portion of the engine is put together with proper bolts and nuts or studs and nuts, as the case may be.

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The boiler is of the vertical tubular type, and the shell is made of 1/8-in. steel plate, firebox of 3-16ths-in. steel, and tube plates of 1/4-in. steel with 1/2-in. iron staybolt. The foundation-ring is 3/8 in. thick, leaving a water space equal to that around the firebox, which is 8 ins. high.

It is fitted with all the usual appliances, which, it may be mentioned, were made from scrap, the pressure gauge having belonged to a steam crane.

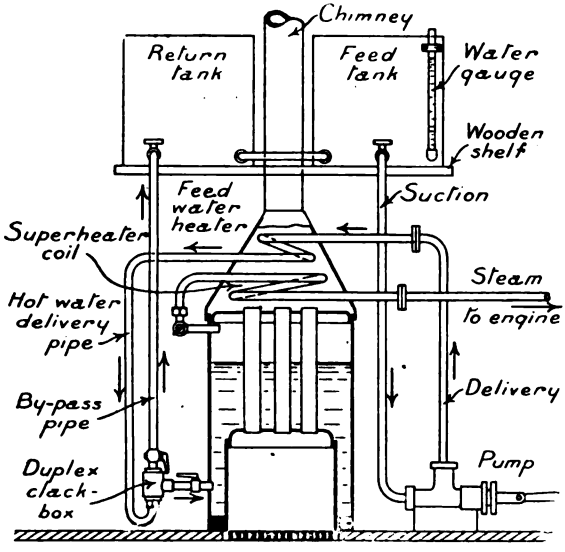

FIG. 2.—SHOWING ARRANGEMENT OF BOILER AND CONNECTIONS.

The pump, which can be seen between the engine and boiler, and is 1-in. stroke and 1/2-in. bore, throws more water than will supply the engine. The feed water is taken from the tank above the boiler to right of the chimney (the feed pipe and tap being plainly visible in the photograph), and is sent through the smokebox in coil of copper pipe and heated therein before it reaches the duplex

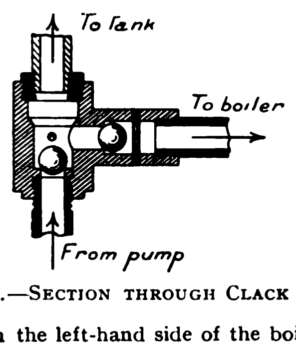

FIG. 3.—SECTION THROUGH CLACK BOX.

clackbox on the left-hand side of the boiler, where there is also a by-pass tap and pipe to a tank seen on the left-hand side of the chimney. An equalising pipe is fitted between those tanks, and a glass gauge is supplied to the one on the right. Reference to the sketch will explain what is meant, and will also show the steam superheater in the smokebox over the tube tops. The steam, being taken from the left side of boiler, is led through a coil of copper pipe, which is kept very hot whilst the engine is working, the result being totally dry steam, no water ever having to be drained from the exhaust drip tap under the bedplate.

A steam jet blower is also fitted off the same branch as the release valve, but is only used for lighting up. As the steam rises the safety valves blow off at 70 lbs. continuously, so much so that a pipe had to be fitted from the exhaust drip tap so that the exhaust was led through the wall into the air instead of up the chimney.

Although from the following table of dimensions the boiler may appear small theoretically, yet in actual practice this is not so. The boiler, as will be seen from the photograph, Fig. 1 (which, by the way, was taken under great difficulties, being in a cellar, and therefore rather dark), is lagged with mahogany and brass bands, whilst the smokebox is painted dead black and trimmed with half-round brass, and the whole, with polished copper and brass pipes, looks very effective, and above all is very economical and easy to manage. When once the

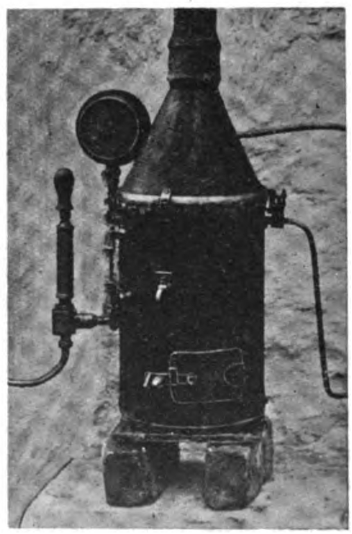

FIG. 4.—SHOWING BOILER PRIOR TO IMPROVEMENTS.

pump is set it only needs coal. This boiler is specially designed for burning coal. Appended are the leading dimensions :—

Engine.—Cylinder, 1 3/4 ins. by 3 3-16ths ins.; shaft, 5/8 in. and 1/2 in. in journals by 7 ins. long; crank-pin, 3/8 in. by 3/4 in. long; flywheel, 8 ins. diameter, 1 in. face; valve travel, 5-16ths in.; ports, 1/8 in. by 1/2 in. and 1/4 in. by 1/2 in.; driving pulley (split), 3 1/4 ins. diameter.

Pump.—1/2-in. bore, 1-in. stroke.

Boiler.—9 1/4 ins. diameter by 16 ins. high by 1/8 in. thick, steel shell; firebox, 8 ins. high by 8 1/2 ins. diameter by 3-16ths thick steel; firebox crown, flanged, 7 7/8 ins. diameter by 1/4 in. thick, steel; top tube plate, 9 ins. diameter by 1/4 in. thick, steel; tubes, four in number, 8 ins. long by 1 3/4 ins. diameter, copper; capacity, 14 pints water; steam superheater, 9 ft. in coil, 1/4-in. bore; feed heater, 5 ft. in coil, 1/4-in. bore, copper; chimney, 2 1/2 ins. diameter,

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12 ft. high; steam pressure, 70 lbs. per sq. in.; exhaust pipe, $\frac{3}{4}$ in. diameter.

In conclusion, I may say that the two improvements which converted this from being a disheartening affair—as seen in the photograph Fig. 4, showing it rigged up for testing with a hand feed-pump attached, when it kept one busy keeping it pumped up to water-mark with the steam jet full on—into a very highly efficient model, as seen in the photograph Fig. 1, are the steam superheater and the feed-water heater, and but for these improvements the model would undoubtedly never have progressed farther than as is shown in photograph Fig. 4, whilst at present it is being actively engaged in driving a small $2\frac{1}{2}$-in. treadle lathe and fretsaw, *via* a countershaft not shown in photograph. The little handle shown in front of cylinder lagging serves to open and close the cylinder cocks, these being placed inside the lagging, and a bent pipe from those cocks can be turned into the ashpan and the steam thereby drawn into the fire to cool it (the fire) as has been proved. This engine has been also tested at 140 lbs. of steam on a locomotive footplate, when it ran beautifully the first time.

Model Yachting in Belgium.

By Henry Greenly.

I know nothing of the mysteries of model yacht racing and, therefore, enthusiasts with experience in the design and manipulation of such craft will pardon me if, in describing what

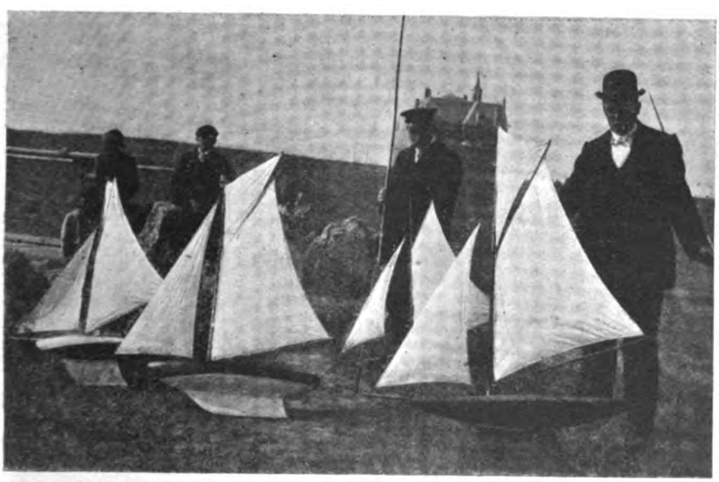

Fig. 1.—A Few of the Yachts of the Ostend Model Yacht Club.

their *confrères* in Belgium are doing, I fall into some grievous error. Staying for a few days in Ostend, and noticing in the local paper that on Sunday, the 21st, there would be model yacht racing on the Lac Albert, about an hour before the time announced our party hired a cab and proceeded to find the place of sailing. We had much difficulty in making the jehu understand where we wanted to go. We talked about the *petit bateau*, drew thumb-nail sketches of miniature *Valkyries*, and described large circles with our arms to represent a span of water—all to no avail. At last Mr. W. J. Bassett-Lowke, whose photographs are reproduced herewith, with that resource for which he is noted, climbed to the

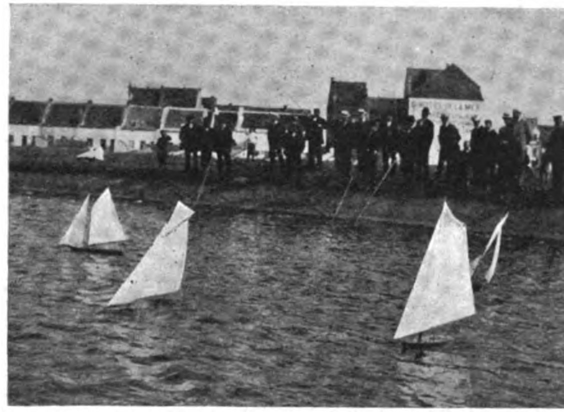

Fig. 2.—The Start of the 1st Class Boats.

top of a large hotel close by where we stopped our cab to make further inquiries, and with the help of an opera glass lent him by the worthy proprietor, he espied a lake, three men, and a boat, only a quarter of a mile away. The rest was then quite easy. In a few minutes we were chatting with the president of the club, Mr. F. C. Tomrekeyn (2, Stockholm Street, Ostend). The lake used by the club is shown in the sketch plan herewith. At the time of our visit the water was rather low, about 2 ft. below the level of the top of the retaining wall. This, however, did not stop the match, although I do not see how the wind could have had a free course. It was blowing between N.W. and N. (I am not acquainted with the true designation), and the boats had to tack as shown in dotted lines.

Of course the question of rating and design was raised, and I found that the new international rule (or something that looks very like it) was employed by the club. At any rate here is the formula:—

$$\frac{L + B + \frac{1}{2}G + 3d + \frac{1}{3}\sqrt{S}}{2} = \text{Rating}$$

which I copied out of a member's rule-book. This rule-book contained on the first page the dimensions of the boat sailed by the particular member and the rating of his boat under the above rule. The book was printed in Flemish, and my knowledge of this language being infinitesimal, I cannot supply further particulars just at present, but no doubt the officers of the club would be pleased to send one of their rule books to any English club secretary desiring more details.

The boats of the club were of various sizes, and

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we understand were divided into five classes, the divisions being worked out in decimeters :—

Class 1	.. .. ..	6 to 7 rater.
„ 2	.. .. ..	7 „ 8 „
„ 3	.. .. ..	8 „ 9 „
„ 4	.. .. ..	9 „ 10 „
„ 5	.. .. ..	10 „ 12 „

Judging from the examples which we saw sailing

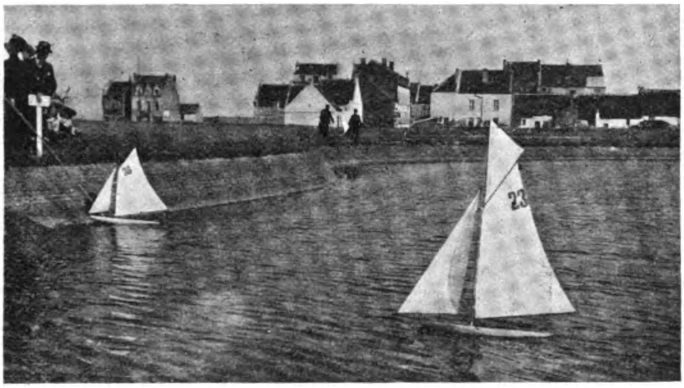

FIG. 3.—TWO SECOND-CLASS BOATS. (*Note the numbers on the sails.*)

on the Albert Lake, Ostend, I do not think full advantage of the rule is taken by our Belgian friends. The difference between the skin and chain girths would appear to be excessive, but perhaps some enterprising secretary will put this to a practical

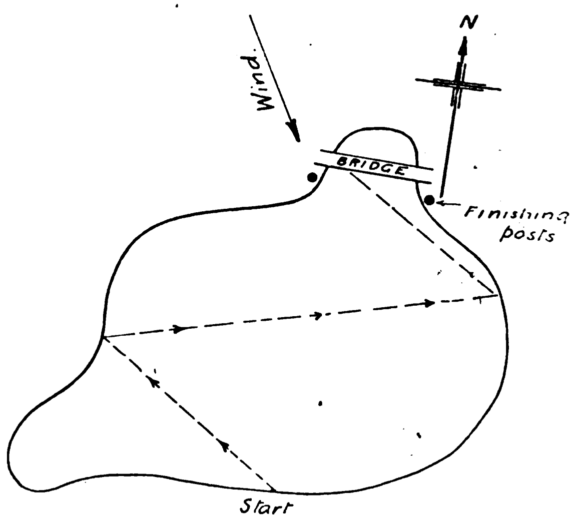

FIG. 4.—PLAN OF MODEL YACHT LAKE AT OSTEND.

test by boldly instituting an international model yacht race. Travelling facilities are now-a-days very great, and I am sure that the Ostend club would welcome the appearance of a few English boats on their lake for at least one afternoon.

Fig. 1 shows a few boats of the club, and Figs. 2 and 3 the start of the first-class boats and two second-rater yachts near the finishing post. In both races there was a foul, but we could not gather from the remarks what was the ruling of the commodore when such events occurred. The races, however, caused some excitement, which shows that we are not the only nation who enter enthusiastically into the sport of model yachting.

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.*]

HOW TO USE WATER POWER. By Herbert Chatley, B.Sc., M.Soc.Arts, etc. London: The Technical Publishing Company, Ltd. Price 2s. 6d. net, postage 2d.

The scope of this work has been confined within the limits of an elementary treatise on the subject dealt with. That water power is daily becoming a question of greater importance few will doubt, and it is mainly because of this fact, because of the increasing popularity—if we may use the term —of water supplies as a source of power, that the author has put this work together in simple language and in a manner which will enable those who have not a deep acquaintance with mathematics and applied mechanics to reap some benefit from a careful perusal of its pages. In Chapter I—Sources of Power—the author makes a few statements the nature of which the title of the chapter will convey to the reader. Chapter II is devoted to considerations of transmission and loss of power, and some lucid explanations are given, and the inherent advantages of water as the medium through which to transmit power are clearly advanced.

The hydraulic press and its application are treated of in Chapters III and IV, and in Chapter V we have some useful notes and data on "Running Water and Water Wheels"—overshot and breast wheels, undershot and Pelton wheels—matters which will interest many of our country readers particularly.

The chapter on water turbines compares the advantages and applications of the various types of these machines, one with another, and with the earlier forms of water wheels. Pumps of different kinds are dealt with in Chapter VII, and hydraulic engines in Chapter IX.

The most interesting chapter to the young engineer is undoubtedly that on "Tidal Power." In this the author outlines the subject in a very comprehensive fashion when we consider the extremely small space devoted to its discussion.

"Sewage Carriage and Disposal," "Dams, and some Notes on Future Prospects," complete what must be acknowledged a useful, if elementary, contribution to the literature on water and its commercial application.

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A Hand Lever Force Pump.

By N. Murray.

THE photograph here shown represents a small hand lever force pump for boiler feeding and testing, which I have made in my spare time. It is placed on the edge of the table to show the suction pipe clearly in photograph. The bore is ½-in. by ¾-in. stroke, the suction and delivery valves being ¼ in., mushroom type. The castings are of gun-metal, made from my own patterns by a local founder, and consist of main casting, gland, and valve-box. The main casting was mounted on the faceplate and bored, the stuffing-box bored at the same time, faced across, and the outside turned, also the seat for the valve-box, and all done by one chucking. The gland is held in place by two ¼-in. studs.

The plunger was turned out of gun-metal rod, then slotted and drilled at right angles 3-16ths to hold the cotter pin, the head of which is ⅜ in., and the washer the same size. The latter is secured by a split pin passed through a hole drilled in

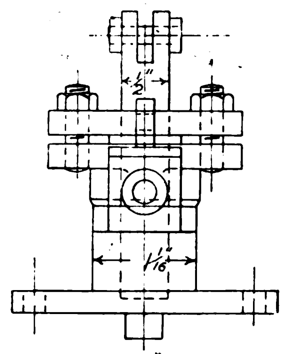


Fig. 2. End Elevation.

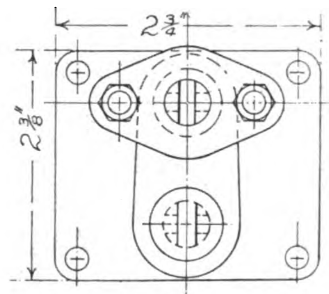


Fig. 3. Plan.

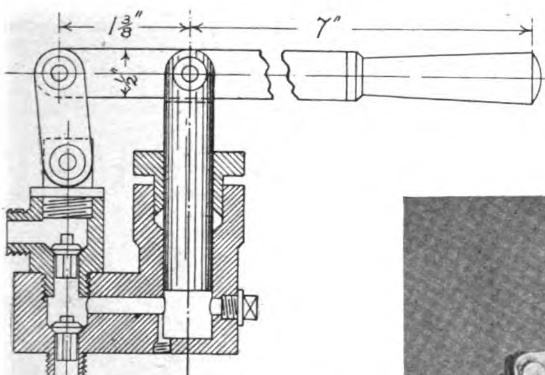
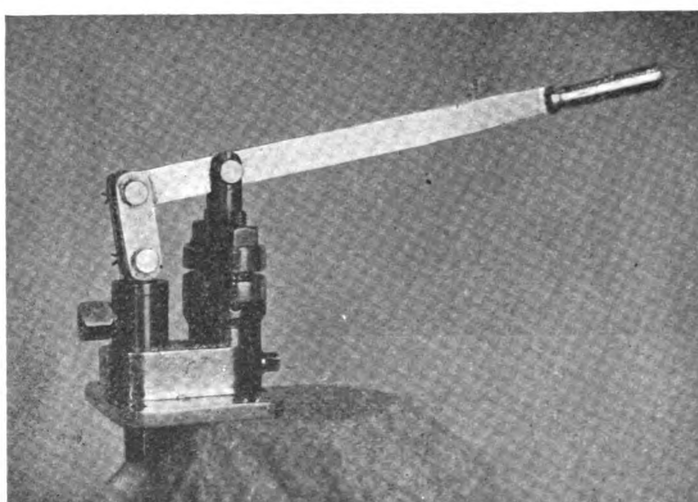


Fig. 1.—Section through Pump.

both the washer and end of cotter pin. The valve-box is screwed into main casting with ½-in. gas, and also the plug of the box, which carries the radius arm, the suction valve being in the main casting immediately underneath the delivery valve.

The waterway from bore was drilled through the main casting, the plug of which can be seen in the photograph. The lever and radius arms are made of ½-in. by 3-16ths in. mild steel. Centres of radius arms are 1 in.; length of lever—to centre of plunger is 7 ins. and from plunger to fulcrum is 1⅜ ins.

The unions for suction and delivery pipes are made from ½-in. hexagon rod, tapped out ¼-in. gas, and the thread cleared at the back to allow for packing. Four holes are drilled in the corners of base to receive bolts for fixing where required, and the whole pump is polished bright throughout. I may add that a friend tested his ½ h.-p. boiler up to 160 lbs. with it, and the work was very satisfactory. It will draw water from 4 to 5 ft. easily.



A Small Hand Lever Force Pump.

Coal oil or water, states *Copper and Brass*, is the best lubricant to use in the machine working of aluminium. Water is just as good for this purpose as coal oil, if used in sufficient quantity.

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Interesting Examples of Intricate Turning.

By Frank Finch.

THERE has come to my mind a recollection of having heard a few years ago my elders discussing the merits of some very excellent and rare specimens of intricate turnery in boxwood and ivory, which had been executed by Mr. A. A. J. Litolff—obviously a very skilful workman—for many years an engineer at the Croydon Gas Works. Prompted by my desire to interest in some small degree the readers of THE MODEL ENGINEER, I made a journey to Croydon, with the result that I was permitted to view the precious articles and to gather some explanation as to their production from his son, Mr. David J. Litolff, who has earned my gratitude for the information—so far as he could remember—as to the methods employed by his father in the production of these objects.

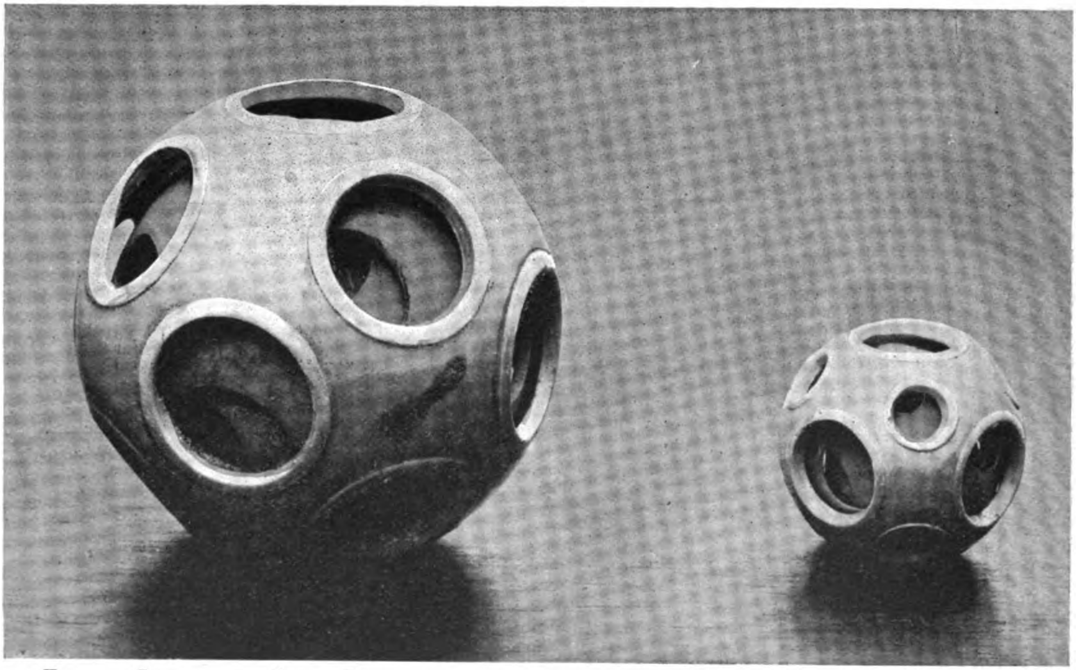

FIG. 1.—SHOWING AN IVORY BALL CONTAINING TWELVE CONCENTRIC BALLS. (*Actual size.*)

FIG. 2.—SHOWING AN IVORY BALL CONTAINING TWELVE CONCENTRIC BALLS. (*Actual size.*)

The task of turning from a solid ball of ivory, 2½ ins. in diameter, thirteen concentric balls, each one independent of the others, will doubtless appear to those readers who have not actually seen such work, an impossibility. An actual example turned from ivory, however, is reproduced in the photograph (Fig. 1). The holes in each ball number fourteen, equally spaced. Other specimens include similar examples in boxwood. The picture (Fig. 9) shows a 2-in. ball, with nine internal balls, having in the outside ball six holes (¾ in. diameter) and eight holes (⅜-in. diameter); also particular interest is attached to a ball exactly a duplicate of Fig. 9, but made from a whale's tooth. Even smaller work on the same principle as above is shown in another ball of 1¼ ins. diameter, having twelve internal balls (Fig. 2).

It is true that the Chinese workmen are very skilful in the ways of intricate turning; but I believe it was the boast of Mr. Litolff that his work needed not the hand-carving of weird devices to hide away the rough finish, and certainly this was true; for, on viewing the specimens very closely, every piece is seen to be clean and smooth, although not touched with any kind of tool since leaving the lathe.

The method by which these balls were produced may be explained as follows; and by the help of the diagrams, which are reproduced full size for a 2½-in. diameter ball, it is hoped that other readers wishing to try their hand and patience will be helped to success.

I propose to base my explanation on the sizes of the example shown in the first photograph; the principle, of course, remains the same, although readers may wish to work larger or smaller examples, the accessories in those cases varying in size accordingly. On the circumference of the solid ball is first of all marked off six points equidistant; then, again, at regular distances, eight points for the smaller conical holes, making altogether fourteen points, which serve as centres for the conical holes. Six holes only are necessary to enable the tools to compass the entire circumference of the balls, the others being merely for ornamentation. The holes are then drilled to the depth as shown

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in the drawing, extending to the circumference of the innermost ball.

The work fits perfectly in a hollow piece of boxwood, as shown in the sketch (Fig. 5), and is held securely in the chuck. A special gun-metal toolholder is requisitioned. This is as shown in Fig. 6;

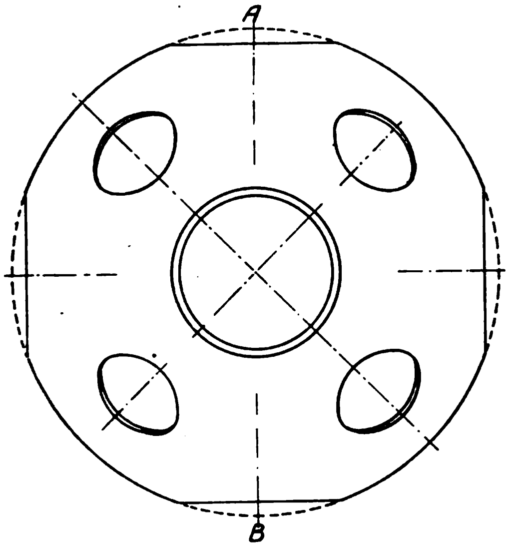

Fig. 3.—External View of 2½-in. diameter Ball. Six Holes only are necessary for the Internal Work.

the radius of the curved part is essentially equal to the external radius of the work. The reason for this will be seen later.

The innermost ball must be first turned, and the specific tool for that operation is shown in Fig. 7.

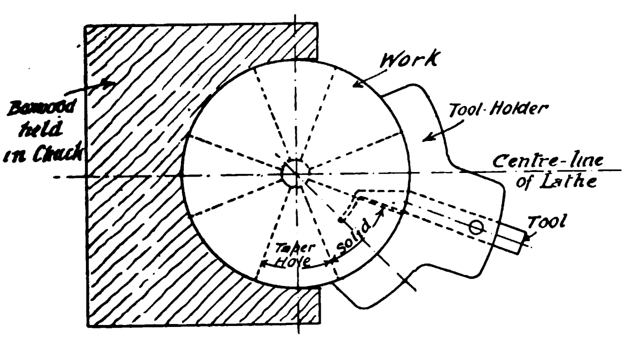

Fig. 5.—Showing application of the Holder and Tool.

For turning each ball a tool suited to that particular radius must be used, so that in the example before us there are no less than twelve tools required for turning the respective balls.

The tool is inserted in the holder, as shown by the sketch, the exact position being determined by placing over a template previously made, which would represent a section through the finished work, as shown at Fig. 4. The segmental part of holder is held by the hand against the work (supported at the correct height, of course, from the lathe bed), or may be rested on a piece of steel held in the slide-rest where for ordinary turning the tool would be held, and in the same manner as a hand chasing tool would be rested, the tool having been

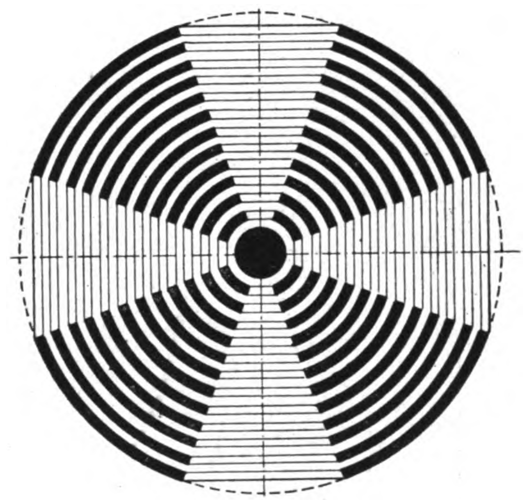

Fig. 4.—Section on Line *A B*, showing Twelve Internal Balls.

inserted in its correct position for its respective diameter ball. As the work revolves it is obvious that the area covered by the cutting tool will overlap

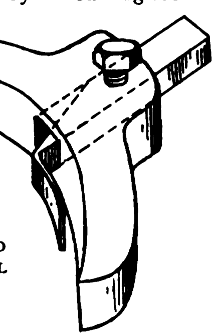

Fig. 6. Showing Tool held in Special Holder.

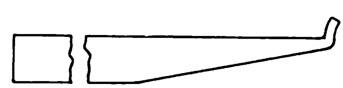

Fig. 7.

Fig. 8.

Smallest and Largest Tools required for the Internal Work of a 2½-in. diameter Ball. (*Full size.*)

the area to be traversed when the tool is in the adjacent hole. Thus, when the tool has covered the area approached by each of the six holes, the

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entire circumference of the ball has been covered, and it is severed. The tool next in size is required for the second ball, and the method is repeated until the outer ball is reached, the largest tool being shown full size at Fig. 8. In the work just referred to it may be mentioned with interest, that for the production of the balls alone, after the preliminary drilling, etc., the work was chucked no less than seventy-two times.

At the first exhibition held in Hyde Park in the year 1851, the examples shown in Figs. 2 and 16 were specially admired by the late Queen Victoria and Prince Consort.

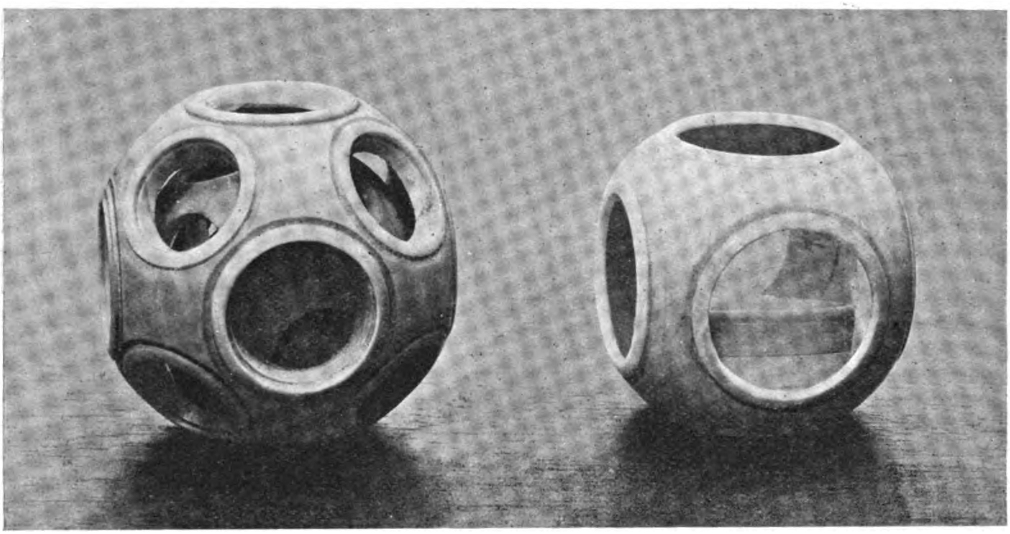

FIG. 9.—A 2-IN. DIAMETER IVORY BALL CONTAINING NINE INTERNAL BALLS. (*Actual size.*)

FIG. 10.—SHOWING AN IVORY BALL CONTAINING LOOSE BOX WITH DETACHABLE LID. (*Actual size.*)

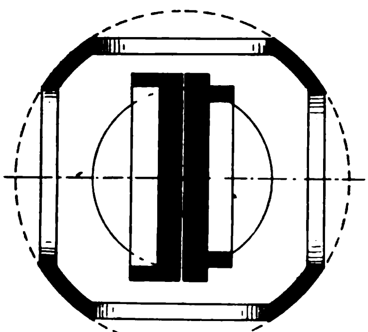

FIG. 11.—FULL SIZE SECTION OF BOX WITHIN A BALL.

It may have occurred to some that the great secret of the successful production of this work —the cutting tool being always out of sight—is the sensitiveness of the hand. As before stated, whilst the tool is fixed in the holder, the latter is controlled by the operator, who relied entirely upon his sense of touch whether the tool was cutting or not.

The next very interesting example that is illustrated by photograph and full size sketch is an ivory ball, $1\frac{3}{4}$ in. external diameter, inside of which is contained a box about 1 1-16th in. diameter, with detachable lid. The finished thickness of the ball is about 1-16th in.; there are six holes, each 15-16ths-in. bore.

Briefly described, so far as my informer could remember, the method employed was as follows :— In the process of drilling the six holes, four were drilled to a depth calculated to reach the proposed circumference of the box; two were drilled respectively to the inside of lid, and as far as the top of the box, then a smaller diameter hole, the depth of the inside of box, was bored. Proceeding to sever the box, tools such as used in the concentric balls were employed (Figs. 7 and 8). These will not, however, remove all the substance between the holes approaching the circumference of the box, and to entirely sever the latter a special tool, something like Fig. 12, was used. The piece to form the box and lid was held between centres, and the ball allowed to hang loosely, whilst the lid and box are separated where the white line is shown on Fig. 11, the pieces then being reversed to take their proper position and generally cleaned up.

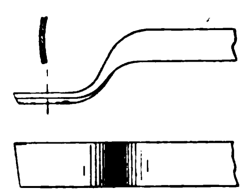

FIG. 12.—SPECIAL TOOL EMPLOYED IN THE PRODUCTION OF EXAMPLE SHOWN IN FIGS. 10 AND 11.

Coming now to the subject of our next illustration, it will be seen that this is again a ball (in ivory), containing in one piece a cube $\frac{3}{8}$ in. square, having on each side a cone, each measuring from base to apex 5-16ths in. The outside diameter of ball is $1\frac{1}{4}$ ins., and this also has six holes of $\frac{1}{2}$-in. bore.

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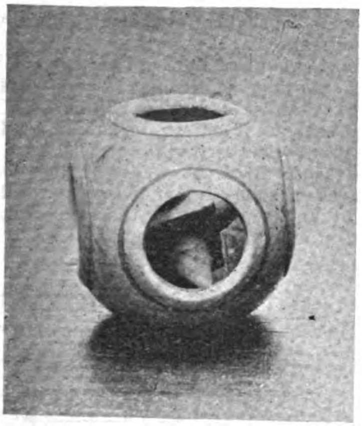


Fig. 13.—Ivory Ball containing a Cube with Cones on each side.

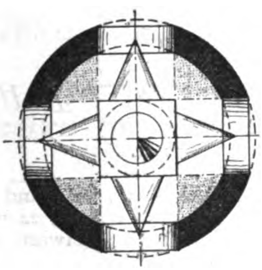


Fig. 14.—Section through Example (Fig. 13). (*Full size.*)

This work was carried out somewhat in the following way :—For drilling the six holes a special tool, such as shown in Fig. 15, was used; holes were drilled to a depth as far as the faces of the cube, and it will readily be seen that the one operation turns the corners and faces the cube. The parts shown in small dots in the sketch (Fig. 14) are removed by tools as used for the previous examples.

The last illustration is perhaps one of the most interesting of this collection. It is certainly a puzzle to the writer, and Mr. Litolff, jun., himself is baffled. Some reader of these notes perchance may solve the problem and find a pleasure in allowing fellow-readers to be enlightened by his solution.

As will be seen, the "puzzle" is composed of three hollow balls, which are linked together, having never been separated, but turned out of a solid piece of boxwood. Each ball is 1¼ ins. in diameter, about ⅛ in. thick, and has six holes, each of ¾-in. bore. The sketch (which is full size) may serve to help some readers in their endeavour to satisfy their curiosity and to explain how such work was done.

It is a matter of regret that the exact tools used for this interesting work by Mr. Litolff, sen., are not now to be found. A fuller description would also have undoubtedly been obtained for readers' delectation, but Mr. Litolff, unfortunately, is now

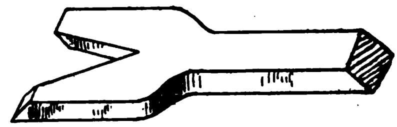
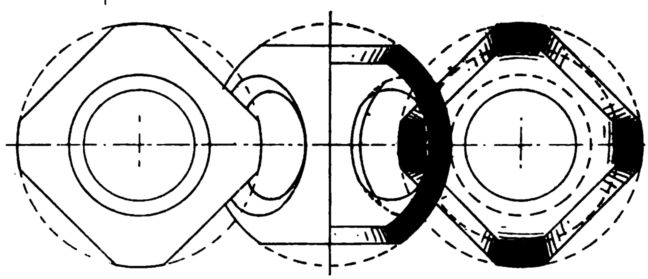


Fig. 15.—Special Tool for Work shown in Figs. 13 and 14.

very old and infirm, and unable to supply his own explanation.

Although the work referred to here must have taken much of the worker's spare time, there are some well-made models, which it is hoped to illustrate in these pages in due course, constructed by



Half-elevation. Half-section.

Fig. 17.—Full-size Sketch of Three Linked Balls, shown also in Photograph below.

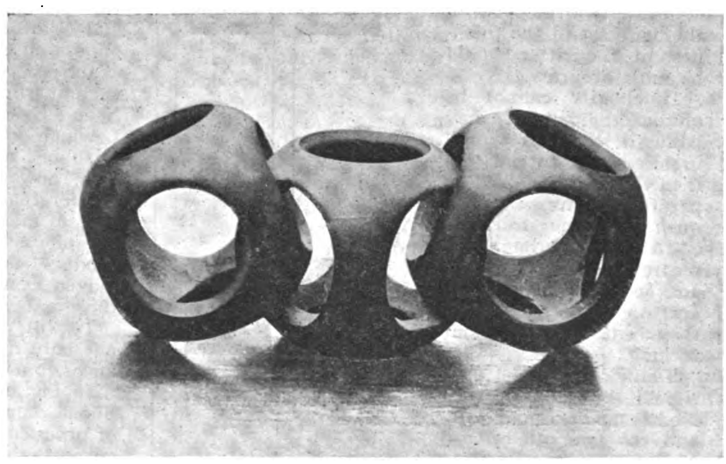


Fig. 16.—Showing Three Linked Balls turned intact from One Piece of Boxwood. (*Actual size.*)

the same hands. We shall expect that the workmanship and finish of these will have been enhanced considerably by the experience in the art of skilful turning which the builder must have derived.

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Some Accurate Electrical Measuring Instruments.

By V. W. Delves-Broughton.

(*Continued from page* 17.)

The Telephone as a Measuring Instrument.

THE use of a telephone for detecting small currents or small fluctuations of a current is well known to professional electricians, but in the writer's experience few amateurs use this simple device, although it is particularly applicable to their use, as a telephone is always ready at a moment's notice, and no elaborate adjustments are required before a measurement can be taken.

The necessary instruments are a telephone receiver, a microphone transmitter, a few cells, and an induction balance, which I shall first describe.

First obtain a bone knitting-needle, ⅜ in. in diameter if possible, but quite straight and of an even thickness; mine was made out of a ¼-in. needle, as I could not obtain a larger one.

Four bobbins should next be turned out of ebonite, about ½ in. between the flanges and 2 ins. in diameter.

These should be made accurately in pairs, and it is most important that the diameter of the central stem, the width between the flanges, and the thickness of the latter should be most accurate.

If ebonite cannot be obtained, boxwood may be used, but this should first be rough turned, and then thoroughly boiled in paraffin wax, subsequently finishing to size.

The holes through the centre should be made an accurate fit for the knitting-needle, so that they will slide without rocking.

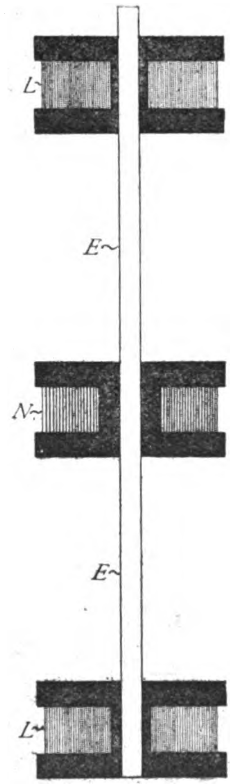

Fig. 1.

Two of these coils should be wound with No. 24 D.S.C. copper wire, and the two others with No. 36 S.S.C. copper wire. These pairs of coils must each have exactly the same number of layers on each bobbin and the same number of turns in each layer, so that when wound each pair of coils will have exactly the same resistance and have exactly the same number of turns. The resistance of these coils must now be tested, and if one is found to have a higher resistance than the other, a few layers must be unwound and re-wound with a slightly greater tension on the wire, in such a manner that it may be slightly stretched, which will add to the resistance.

Finally, the ends of the wire are led out by holes drilled in the edge of the flanges and attached to short pieces of twisted twin flexible wire, which, when in use, are fixed to terminals on the base which carries the knitting-needle.

The attachment of the needle to the base should be arranged in such a manner that it can be easily taken out and replaced, so that the coils can be arranged in any sequence required.

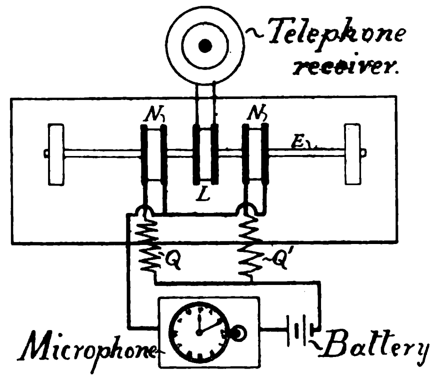

Fig. 2.

Three coils are only used at a time, and the most useful arrangement is two of the No. 24 wire coils, with one No. 36 wire coil fixed between them and spaced at equal distances.

Fig. 1 shows the construction of the coils, L and L being the fine wire coils, N one of the coarse wire coils, and E the bone needle.

Fig. 2 shows the arrangement for comparing the resistance of two coils of wire Q and Q¹. N and N are two coarse wire coils connected so as to oppose one another. L is the fine wire coil placed exactly between N and N, so that the alternating current from the microphone in each of the coils N and N will induce exactly opposing currents in L, which consequently will produce no sound in the telephone receiver.

If, however, one of the resistances, Q or Q¹, is greater than the other, the balance will be upset, and a more powerful current will pass through one of the coils N than through the other, and to produce silence the central coil L will have to be moved nearer to that coil connected in series with the greatest resistance.

It will thus be seen that this instrument will not only detect the difference between two resistances, but will indicate which is the greater.

In Fig. 2 a watch is shown resting on the microphone, and this is an extremely easy manner of producing an unbroken and regular alternating current through the system, but any other appliance, such as a tuning-fork, may be used.

The only objection to this manner of electrical measurement is that it cannot be used for resistances which are not non-inductively wound, as the capacity of such coils is quite sufficient to upset the balance between the coils. Two similarly wound coils can, however, be tested for resistance, as the capacity effect of each will neutralise that of the other.

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If one of the N coils be mounted between two of the L coils, as shown in Fig. 1, the apparatus can be used as a test for hearing; N is connected in series with the microphone and battery, and the watch used as before. The telephone receiver is connected in series with the two coils L and L, which are again connected so as to oppose one another. On shifting N slightly out of the neutral position, the ticking of the watch will be heard slightly at first, increasingly strong as the balance is further upset.

If, therefore, a flat be filed on the upper side of E and a scale marked upon it, the hearing powers of different people can be tested, or you can test the right and left ears of all and sundry.

This is more a medical than electrical question, but the same method can be used in making comparisons between different telephone receivers.

Telephone transmitters can be tested in the same manner, and a number of other uses can be found for the apparatus.

The period of an alternating current can be determined by the note produced in a telephone by comparing the note produced in the receiver with a tuning-fork, producing a known number of vibrations—a C tuning-fork vibrates at 500 per second.

(To be continued.)

A Design for a Model Railway Guard's Van.

By W. E. Webb.

(Continued from page 134.)

FOLLOWING the description given in the last issue, Figs. 10 to 17 show drawings of an English bogie adopted for ¾-in. scale working, from a drawing in the *Locomotive Magazine* for February 7th, 1903. By adopting this type of bogie the guard's van practically becomes a scale L. & N.W. Ry. one.

Independent of this feature of realism, it has a certain amount of novelty for model work in the spring beam. It will be seen that the weight of body of car is transferred through the pivot bolt casting to the bolster beam, and this is carried on four coil springs (two at each end), the coil springs resting on the spring beam, which is suspended by hangers from the channel cross-beams of the bogie (see Figs. 11 and 12.) One slight departure from the drawing shown in the *Locomotive Magazine* is the shape of bolt-supporting hanger. In the drawings mentioned this is a round bolt bent to U-shape and in the curve at bottom a round iron casting, with a groove on the edge, fitting the diameter of the bolt, is fixed. This casting gives a large wearing surface, and, when worn, can easily, quickly, and cheaply be replaced. In the real practice there is great wear at this part. It is not so in the model practice, and the great requirement is a neat, strong fitting not liable to get out of order—hence the design in Fig. 14. Locknuts should be used to the top of this bolt to prevent the nut unscrewing and letting bolt drop out. However, nothing serious would occur, for the safety straps fixed to cross-channel beams of bogie, and passing under spring beam, would catch latter and save it falling to the ground. These safety straps should clear beam by about ⅛ in. (see B, Figs. 11 and 12).

Another detail not required in the real bogie, but introduced into the model one, is a bar fixed to bolster, as shown by R (Figs. 11 and 12). I have put this because from my experience with ¾-in. scale rolling-stock, the readiest and safest way to lift a coach is by the ends of the body, and if we were to lift the guard's van (supposing t fitted with the English bogie) by this method, and these bars were not there, the bogies, not being directly attached to coach, would be left behind. With the bars fixed, on lifting the coach body the projecting lip each end of bar will catch the under side of cross-channel beam of bogie, and so raise it with the body.

The spring beam (5-32nds in. thick and ⅞ in. wide) must be made of a good quality piece of wood. Both the spring beam and bolster in the real practice have an iron plate on each side—the depth of the member—to give increased strength; this is not necessary in the model.

Fig. 12 shows rubbing-pieces of brass on the sides of bolster at each end. These guide the bolster when moving up and down between the cross-channel beams, and there should be 1-64th-in. clearance to permit free movement.

Check rubbers (Fig. 12) take up any play when the coach enters a curve, and the hangers being at an inclination of 1 in 4 would soon bring to rest any side-play of the spring beam from the same cause.

The hangers, being inclined, tend to pull the spring beam girder-bearers towards the centre; they are therefore sunk 1-32nd in. into spring beam (see Figs. 16 and 17) to take the strain off the bolts securing the girder-bearers.

The 3-32nds-in. pin securing hanger to hanger-bolt must have a countersunk head on the inside, otherwise it will foul the coil spring.

Coming to the framing of the bogie, it will be seen that the members are of angle stuff, with the exception of the cross-channel beams in the centre of bogie. These transmit the whole weight of the body to the solebars. All members are of 1-32nd-in. thick plate, except the solebars; these are of 1-16th-in. plate.

All members are flush on top. This simplifies the making generally and the fitting of the cover-plates. These latter, together with the diagonal members, should make the frame very rigid. I should be inclined to fit cover-plates at the four corners as well.

Coming to the brake work, it will be seen that the lever link is pivoted on a swing link, as explained at the beginning of this article. The advantage—and the disadvantage—was also explained of the system in model work. This disadvantage might be partly overcome by making the inner brake blocks a fixture in their off-position, and also the swing link a fixture. The pivot point of lever link would then be stationary, and only the outer blocks actuated at a definite movement each time. This would reduce the number of working joints and the amount of slack to be taken up from the pins. The difficult point in this, as in the pressed frame bogie, is the making of a satisfactorily working laminated spring in conjunction with scale size and appearance. Neither this difficulty, nor that of the brake work, occur in the type of bogie used on our dining saloon.

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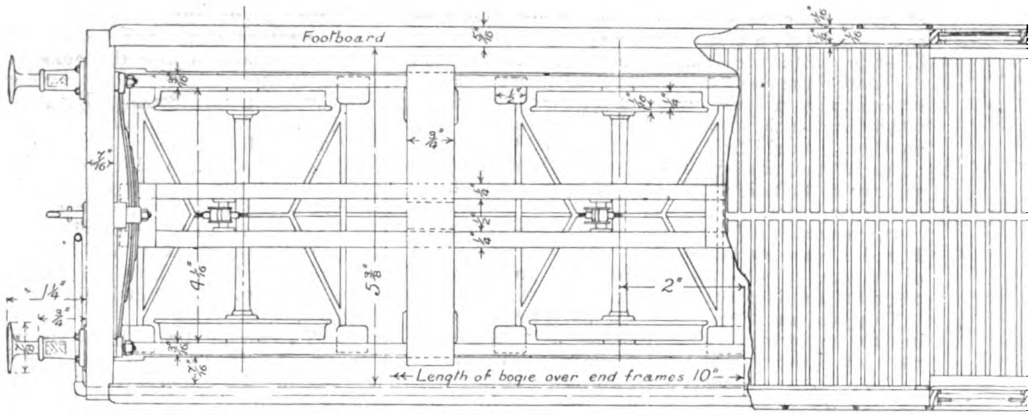

FIG. 3.—PART-SECTIONAL PLAN OF MODEL

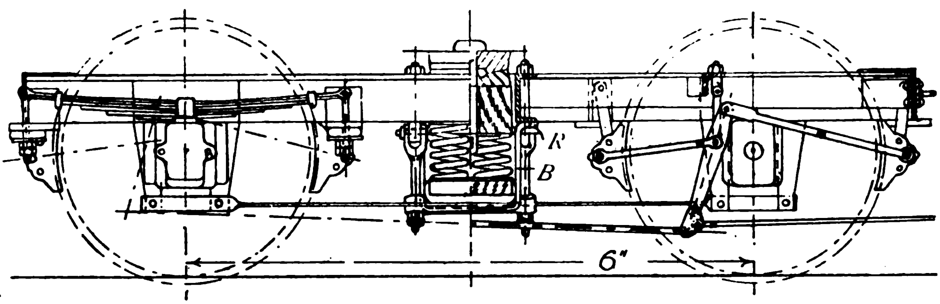

FIG. 11.—ELEVATION AND SECTION OF BOGIE.

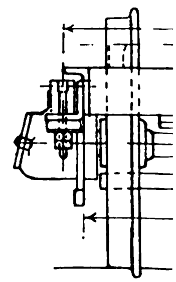

FIG. 1

FIG. 14.—S
BOLT

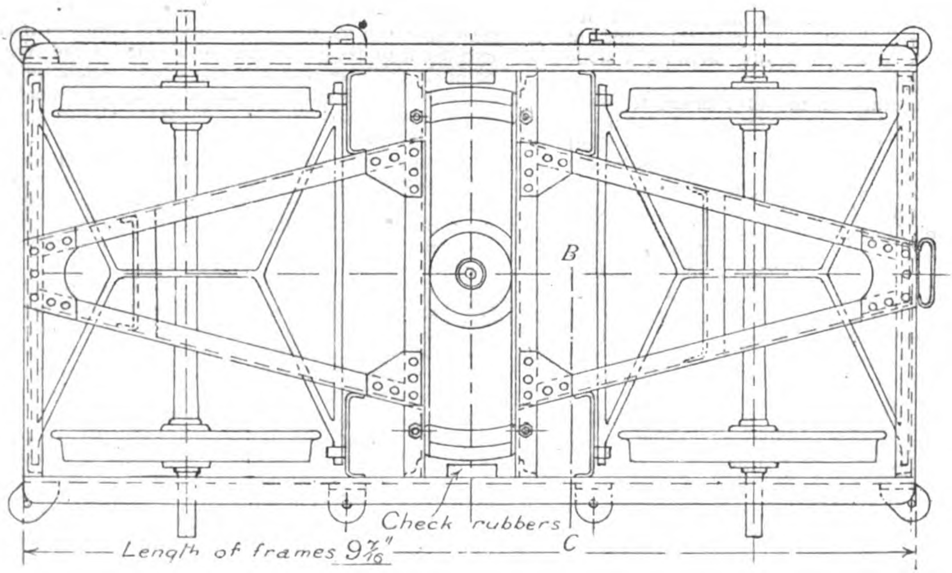

FIG. 10.—PLAN.

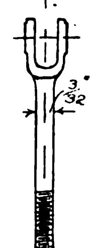

FIG. 15.—S
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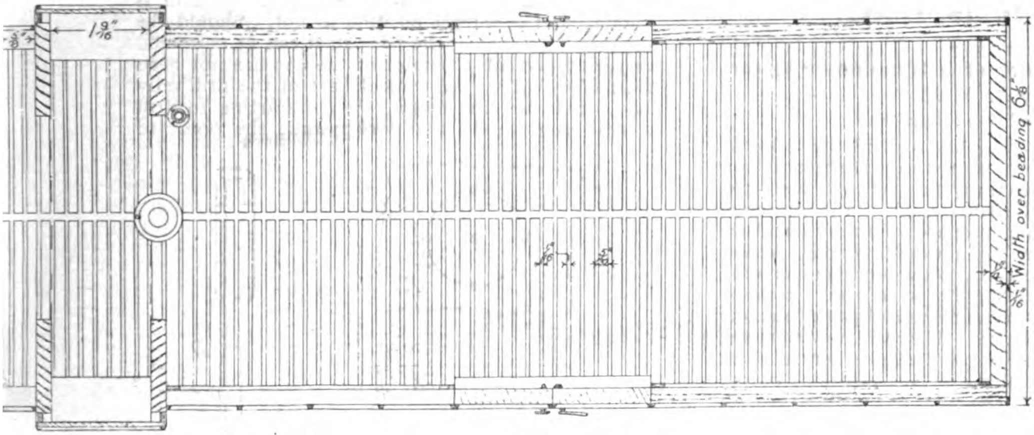
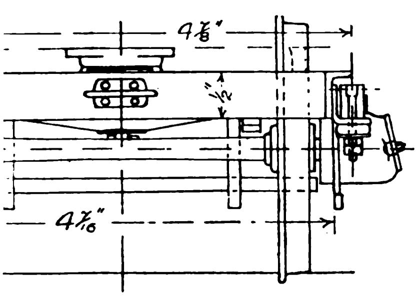
A DESIGN FOR A MODE

By WM.

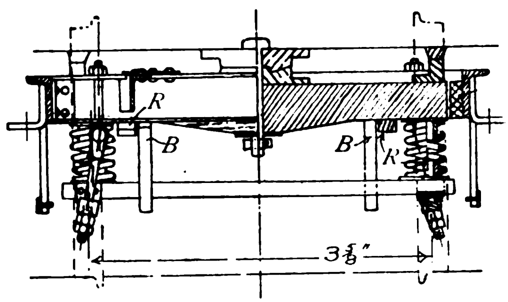
For description]



GUARD'S VAN. (*Scale: One-third full size.*)



.—END ELEVATION OF BOGIE.



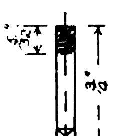
HALF-SECTION THROUGH *B C*.

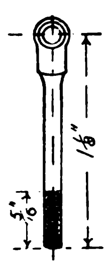
HALF-SECTION THROUGH CENTRE.

(*Scale: Half full size.*)

FIG. 12.

TEEL HANGER (4 *off.*)





EEL HANGER.
off.)
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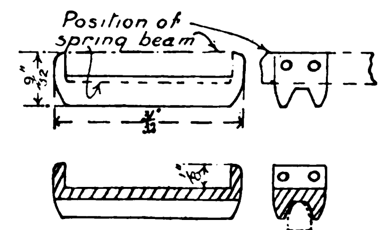

FIG. 16.—SPRING BEAM GIRDER BEARER.

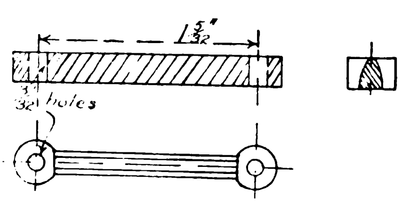

FIG. 17.—SPRING BEAM GIRDER.

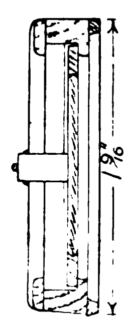

FIG. 9.

SECTION ON LINE *C D*.

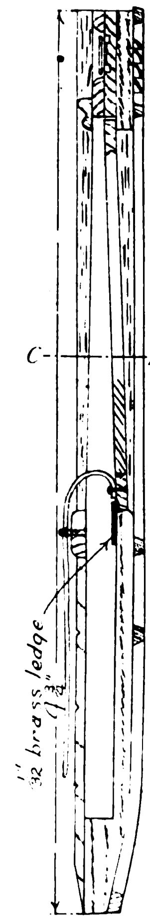

FIG. 8.

SECTION THROUGH DOOR.

RAILWAY GUARD'S VAN.

C. WEBB.

[*see page* 155.

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How It Is Done.

Fitting the Armature of a Dynamo or Motor.

By A. W. M.

(*Continued from page* 128.)

THE remaining operation is to drill the holes for the holding down screws so that the brackets will be fixed with the spindle holes in line with each other and central to the tunnel. Drill the screw holes in the brackets and prepare a dummy armature W, Fig. 18, consisting of a wood cylinder, turned to fit the magnet tunnel and provided with a spindle turned to fit the bearing holes in the brackets. Place the dummy in the tunnel and slip the brackets upon the spindle as Fig. 18. They will now be in the correct position with the spindle holes central with the magnet tunnel. Mark off the positions of the screw holes by inserting the point of a scriber through the holes in the brackets, taking care to keep the latter from moving out of place whilst you are doing this. Remove the brackets and dummy, mark the centres of the circles scribed upon the sides of the magnet, and drill the holes, tapping size, to take the holding screws. If these holes are accurately drilled, the armature will be central and the spindle rotate easily when it is put in place. Instead of making a dummy W, you can used the armature itself. Wrap some paper over the core to make the diameter up to that of the tunnel, place it in position, and slip the brackets on as Fig. 18 for the purpose of marking off the screw holes.

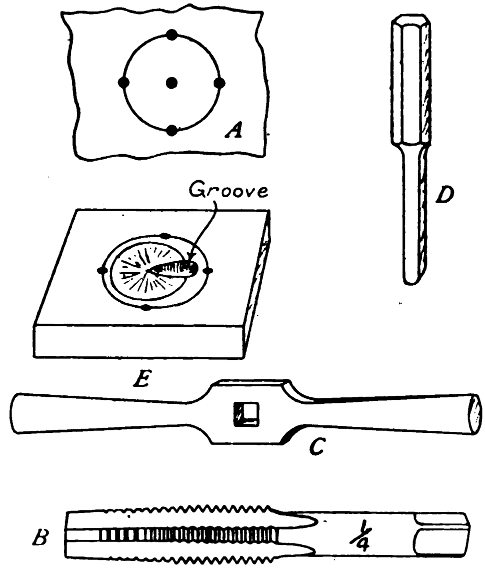

FIG. 19.

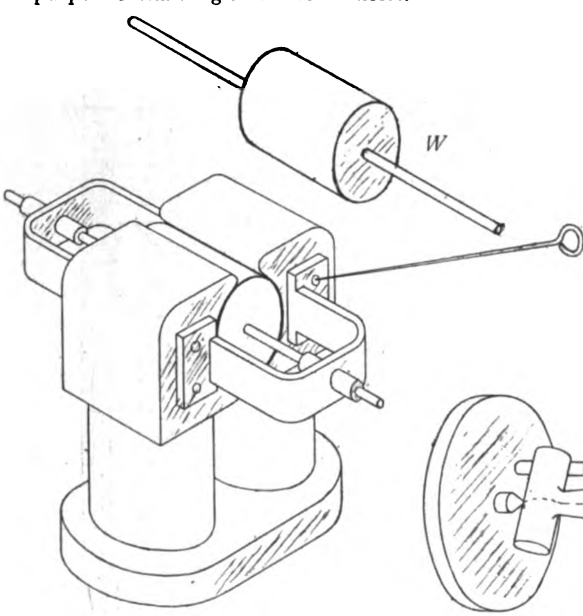

FIG. 18.

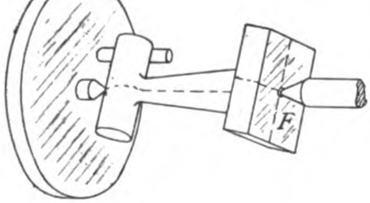

FIG. 21.

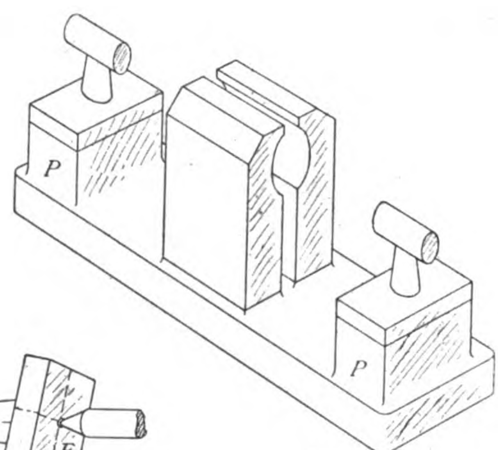

FIG. 20.

When a drill commences to cut a hole the point does not always keep to the centre mark at which it is placed at starting. It may go sideways to some extent, and if allowed to continue without check, cut a hole which is to one side of the desired position. If the circle made by the scriber point is marked with some dots by the point of a centre punch (see A, Fig. 19) you can see more readily if the drill is cutting to the correct position or not. Should the drill cut to one side, the false start can be corrected provided the full diameter of the cut has not been reached—that is, the conical part of the drill only has penetrated the metal. When starting to drill a hole you should therefore permit the point to penetrate for a small amount only, then examine the cut to see if it is keeping central to the scribed circle, and so on until the full diameter of cut is reached. If the cut has remained central, you may assume that the hole will be drilled correctly. Should the point deviate, however, it can be made to return to the true centre if you cut a small groove

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in the side of the hole, as indicated at E, Fig. 19' by means of a round edge chisel D. After making the groove, start the drill again; it should tend to cut towards the groove. When a few shavings have been taken out, examine the hole to ascertain if it is now central to the scribed circle. A second groove can be cut to draw the hole still more to one side, if necessary; but once the drill has cut to a depth beyond the angle of the point the position of the hole cannot be altered, except by chipping away its side.

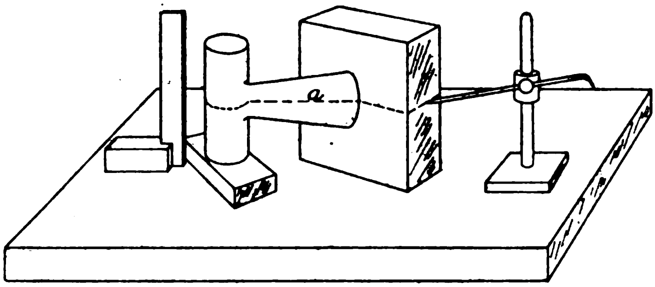

FIG. 22.

As a screw thread is to be cut in the hole, the diameter of the drill must be smaller than the diameter of the screw which is to fit the hole. For example, if the screw is ¼ in. diameter measured near the top of the thread, the hole into which it is to go should be cut by a drill of 3-16ths in. diameter. If you drill it with a drill of ¼ in. diameter, no thickness of metal will be left to form the screw thread. This is cut by a tool B, Fig. 19, called a tap. It is really a screw made of tool steel hardened and tempered, cutting edges being formed by several grooves, as shown. The tap is screwed into the hole by means of a tap wrench, C, Fig. 19, and cuts a duplicate of its thread in the sides. To

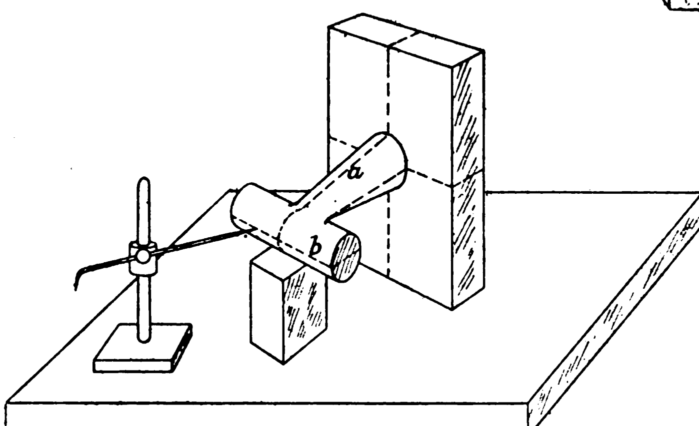

FIG. 23.

enable the tap to start the thread its point is made taper so that it will enter the hole before any thread is cut.

If the bearings are of the type shown in Fig. 20 the seat should be machined or filed to a finished condition before the holes for the spindle are drilled. The magnet should be fitted in place and bored and the surfaces of the pedestals upon which the bearings will rest should be finished before you commence to drill or file the bearings. If you have a lathe and slide-rest the seat can be faced between the lathe centres, as Fig. 21, the important thing being to ensure that the bearing cylinder is parallel to the surface of the seat, so that when it is drilled the hole for the spindle will be central in the metal. To do this the position for the holes to take the lathe centres should be found by marking the casting with centre lines. Place it upon a plane surface as Fig. 22, testing with a try-square to determine if the cylinder is upright. Mark the centre line completely around the casting, which should then be placed as in Fig. 23. Test it with the surface gauge to determine if the cylinder is horizontal, and mark centre line *b*. The points where these lines cross are the places for the holes to take the lathe centres. Face the surface F, Fig. 21, by means of tools S or J, Figs. 12 and 13, so that the height of the cylinder will be to the

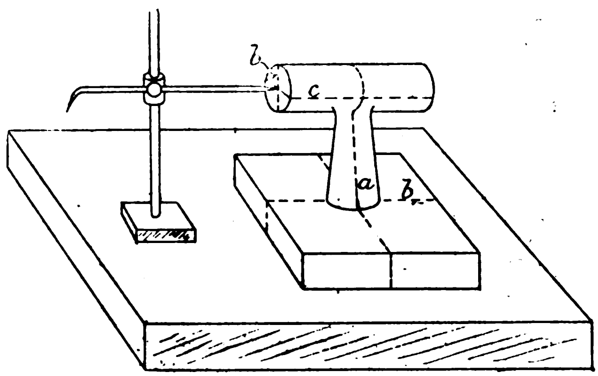

FIG. 24.

required dimension. This can be tested as indicated in Fig. 24. The scriber point is set to the required height for the centre of the spindle; if the cylinder is too high you will take some more metal from the seat F until the cylinder centre is opposite to the scriber point, as Fig. 24. Mark a centre line *c*; the point where it meets centre line *b* is the place where the drill should start to bore the hole for the spindle. If started and made to continue at this centre the hole will be of the correct height to bring the armature central to the field-magnet tunnel. Each bearing should be treated in this way, and if the drilling is accurately done the holes will be parallel to the base and in line when the bearings are placed in position on the spindle. If you have taken too much metal off the seat so that the cylinder comes too low, the thing to do is to solder a piece of metal to the surface F and thus pack up the bearing. This piece can be made of ample thickness and the surplus faced off in the lathe.

(To be continued.)

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Chats on Model Locomotives.

By Henry Greenly.

Balancing and Balance-weights.

(*Continued from page* 138.)

The problem put before us at the outset of the articles on this subject is the balancing of a 2—4—0 type of model tank engine, with a single inside cylinder placed (it is assumed) in the centre of the locomotive.

As the coupling-rods must also be balanced, and seriously affect the disposition of the weights on the driving wheels, I propose to deal first with the coupled wheels, and get these cleared out of the way. Of course, only one-half of the coupling-rod is involved, this being considered as a revolving weight working at the radius of the outside crank-pin. The other half is dealt with when treating the driving wheel.

Extreme accuracy is not necessary in the case of a small model, and to save intricate calculation the difference in the specific weights of the various metals employed will not be accounted for. Instead of doing this, the whole of the masses involved will be worked in cubic inches. Suppose the coupling-rod is 4 ins. long and about ¼ in. by ⅛ in. in section, and the crank boss and crank-pin has about 1-16th cub. in. of metal. Then the total weight to be balanced will be—

Half coupling-rod (⅛ × ¼ × 2 ins.)	= 1-16th cub. in.
Crank boss and crank-pin	= 1-16th „ „
Total	⅛ cub. in.

Now in an ½-in. scale engine this weight will be acting at a radius of about ½ in. from the centre of the axle, and if the wheel is 2½ ins. diameter the balance-weight in the rim will be 1 in. from the axle centre. Therefore, the necessary weight will be in inverse proportion to the two distances, viz., half of ⅛ cub. in. = 1-16th cub. in. On referring to a standard wheel I find that the available space between three spokes is 1 in. by ½ in., and the spokes being ⅛ in. thick, the cubic contents of the metal, approximately, will be 1-16th in. (as required), if the balance-weight is made to bridge three spokes. Those who prefer mathematical accuracy may, of course, work out the size to a decimal point, and allow for the spokes and the projection of the counterweight. The necessary weight is therefore as Fig. 6*a*, which it will be noticed very closely approximates a scale reduction of that used in a goods or tank engine coupled wheel of 5 ft. diameter. Of course, if a half-moon-shaped balance-weight is used, the counterbalance will spread over more spokes, but the average depth will be less to make up for this, so that the cubical contents remain unaltered. This, then, dispenses with the the coupled wheels.

As already mentioned, the coupling-rods also affect the disposition of the weights in the driving wheels, but in the present instance, the engine

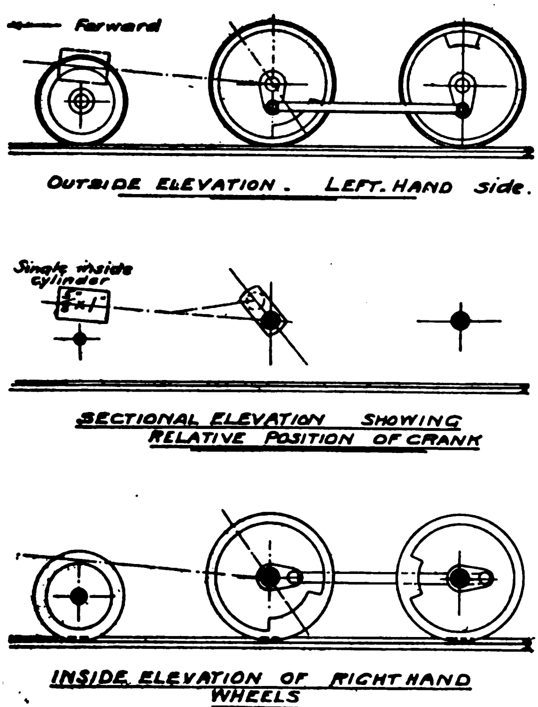

Fig. 3.—Diagrams showing how it was Proposed to Balance a Single-cylinder Engine.

(*The use of the right and left hand pattern for the driving wheel is not necessary, and the balance-weight should not be quite opposite the crank-pin owing to the presence of coupling-rods.*)

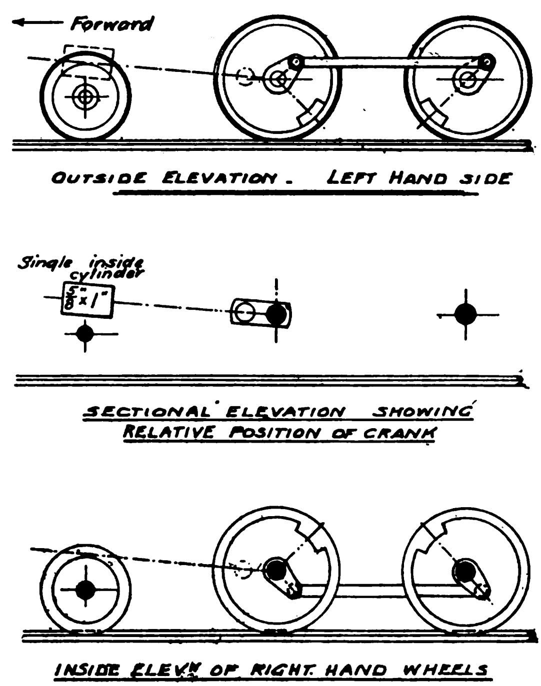

Fig. 7.—Complete Diagram of Balance-weights required for a Single-cylinder Engine.

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having inside cylinders, we will endeavour to employ the coupling-rods, as is done in all inside cylinder engines (Mr. Stroudley's L.B. & S.C.R. locomotives excepted), to help, rather than further disturb, in neutralising the unbalanced effects produced by the crank, connecting-rod, etc.

The first thing is to obtain the necessary data as to the weight of the parts to be balanced. This is assumed in the present case as follows:—

Reciprocating Masses—	
Piston (⅝ in. × ⅜ in. thick,) say ..	·11 cub. in.
Piston-rod	·02 ,,
Crosshead	·06 ,,
Half the connecting-rod	·05 ,,
	·24 cub. in.
Total—say, ¼ cub. in.	
Revolving Masses—	
Half the connecting-rod, with the big end	·10 cub. in.
Crank-pin and webs..	·08 ,,
	·18 cub. in.
Total—say, 1-6th cub. in.	

(All masses taken at ½ in. radius.)

It will be noticed that half the connecting-rod is considered as revolving weight, and the other half as reciprocating. This is the usual locomotive practice. Further, it is usual practice to balance only one half of the reciprocating weight, as mentioned in the earlier portions of this article, and therefore the total mass to be balanced will be—

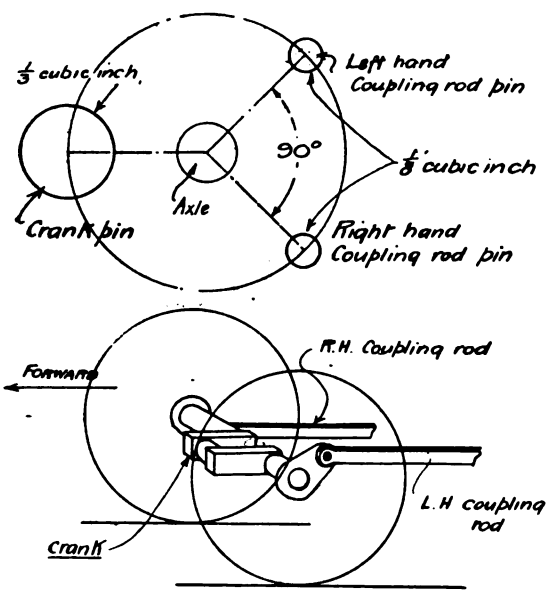

FIG. 4.—SHOWING THE BEST POSITION FOR THE COUPLING-RODS IN A SINGLE-CYLINDER LOCOMOTIVE.

½ of ¼ + ⅙ cub. in. = ⅛ in. + ⅙ in. = 7-24ths cub. in.; or, say, ⅓ cub. in. for simplicity.

While the position of the balance-weights shown in my friend's sketch looks all right, the chief thing against it is that two patterns would be required for the driving wheels—one with the weight in one position, and the other with it in the other corresponding quarter (that is, three patterns in all for the two pairs of coupled wheels); it also leaves out of the question the coupling-rods. I would therefore prefer to use these coupling-rods as part of the counterbalancing weights, as is done, wherever possible, in actual practice. This may be done, as shown in the diagram, by placing the

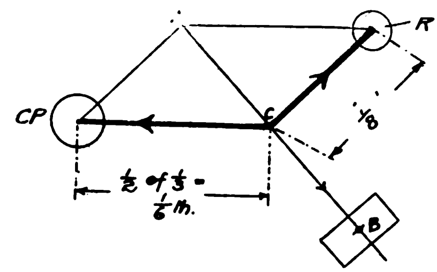

FIG. 5.—SHOWING THE DIRECTION AND MAGNITUDE OF THE BALANCE-WEIGHT NECESSARY FOR A SINGLE-CYLINDER ENGINE.

CP, inside crank; *R*, coupling-rod pin; *B*, counterbalance weight in wheel.

crank midway between the angle of 90 degs. formed by the two coupling-rod pins. Of course, to obtain perfect balance without the use of counterweights at all—that is, assuming the weights are quite right—the coupling-rods would have to be both diametrically opposite the inside crank-pin, like the case exemplified by Experiment E in last article. But this is impossible. Therefore, a counterweight must be placed in each wheel. To do this mathematically is not within the scope of the present article, and therefore I show how the position and magnitude of this counterbalance weight can be found graphically in a very simple way.

It is, of course, understood that only half of the weight at the crank-pin will require to be balanced in each wheel—(see Experiment E, if this is not clear)—and that by placing the crank-pin in the given relation to the coupling-rod pins, we already have a mass of metal measuring ⅙ cub. in. in a fixed position in the wheel.

Fig. 5 shows the magnitude and direction of the forces in each wheel, the angle of the coupling-rod pins in the right-hand and left-hand wheels being exactly complementary.

The mass of metal (half the total amount, viz., ⅙ cub. in.) due to the crank-pin acts in the direction of the black line C P. In my original drawing the length of this line (C to C P) was drawn to a scale equal to the mass of metal, viz., ⅙ of *a foot*,* a foot in this way graphically representing a cubic inch of metal. At the correct angle to the coupling-rod pin R another thick line (C R) is drawn, the length of which is also equal to the mass of metal, viz., ⅛ of *a foot*.† Having done this, draw a line parallel to C—C P and another to C R. These will meet at A, and if a line be drawn from point A to C

* The drawing is reproduced half size; therefore, line C to C P is ⅙ of 6 ins. = 1 in.

† As reproduced, ⅛ of 6 ins. = ¾ in.

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and projected through, the point B may be marked off, the distance C B being always equal to A C. This distance—C B—may be measured off to scale, and in the present case will be found to represent about $\frac{1}{8\frac{1}{2}}$ cub. ins. of metal.

As this diagram shows that in both magnitude and direction the balance-weight required is practically the same as the crank-pin, fill up two spokes of the wheel, but at 90 degs. (instead of 180 degs., as in the coupled wheel) to the coupling-rod pin. Only one pattern will be required, as it will be seen that the balance-weight occupies the correct position in the other wheel, without making any difference in the pattern and casting. This is an important point, and occurs *in all engines of ordinary construction. There is no need to make a right-hand and left-hand pattern* for the driving wheels. To test the accuracy of this diagram I set out the diagram of forces on a piece of card and glued three half-pennies at the ends of the respective lines of forces, and, mounting the card on a spindle, I found that the addition of the third coin at point B exactly balanced the disturbing forces set up by the other two.

As explained in dealing with the coupling-rod counterbalancing the $\frac{1}{8}$ cub. in. of metal necessary on the C to B line will actually be placed in the rim, at a longer distance than that at which it is calculated. The crank-pin circle is a $\frac{1}{2}$-in. scale locomotive about $\frac{1}{2}$-in. radius; therefore, as in a $2\frac{1}{2}$-in. wheel, the centre of the weight will be about 1-in. radius and the mass of metal only half what it would otherwise be, viz., slightly less than 1-16th cub. in. The amount provided by filling up the two spokes, shown in Fig. 6, is as nearly as possible correct.

(*To be continued.*)

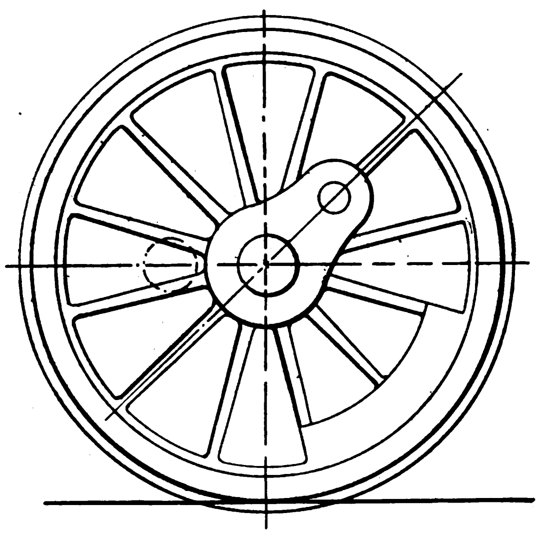

Fig. 6.—Driving Wheel for $\frac{1}{2}$-in. Scale Engine with Single Inside Cylinder.

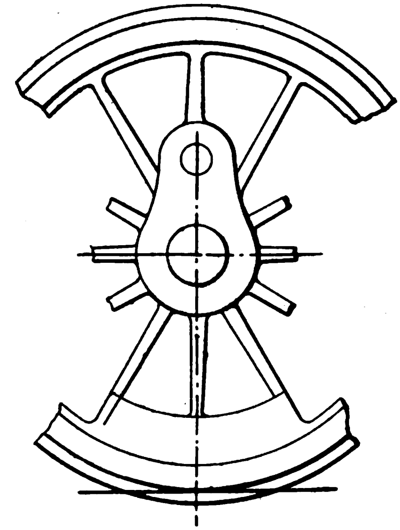

Fig. 6a.—Position of Balance-weight in Coupled Wheels.

(*Scale: Full size.*)

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.

As announced at the last indoor meeting of the Society, Mr. Louis Brennan has courteously given permission for a party of the members, limited to thirty, to witness experiments with his new gyroscopic mono-rail railway, at New Brompton, Kent. The date of the visit is Saturday, August 31st. The party will travel by the train leaving London Bridge at 1.32 p.m., and return by the 5.32 from New Brompton. The special return tickets issued by the S.E.& C.R. are 3s. 2d. each. As it is anticipated that many more than the limited number will wish to be present, immediate notification should be given the secretary, and the party will be made up of the first thirty applications received.

The first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from September 25th, 1907, to October 31st, 1908. Full particulars and forms of application may be obtained from—Herbert G. Riddle, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

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An Undertype Semi-Portable Single-Cylinder Engine.

By P. W. Wilson.

IN the issue of this Journal of September 7th, 1905, a description was given of the abovementioned engine. The engine has been rebuilt with alterations as follows:—New boiler barrel, 2¾ ins. diameter; new firebox with extended top; new front end tube plate, and eight of ⅜ in. diameter (O.S.) tubes fitted.

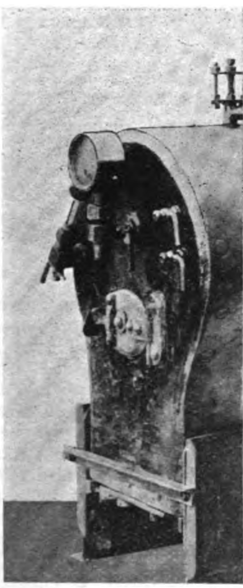
The engine has been fitted with Joy's patent valve gear, in place of Stephenson's, and can be run in either direction, or linked up according to requirements, the radial link being suspended by a bracket attached to motion plate, through which the rocking shaft passes, having an arm connected to a bell crank by means of a link, the short arm similarly connected by link to the reversing lever, placed for convenience near the starting valve, the whole of the gear being designed with a view to ready access to all parts—the type of bedplate facilitating this.

By disconnecting valve spindle head, suspension link end, crosshead pin, and crank-pin brasses, the connecting-rod with whole of the gear can be withdrawn, and to entirely remove clear of the engine bolts can be backed out of bracket and reversing link disconnected, and the whole motion is clear.

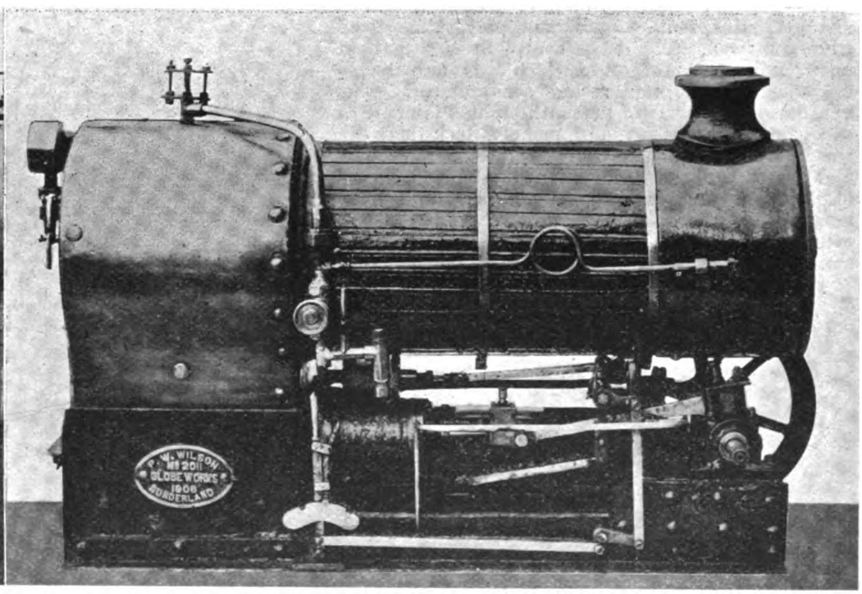
The link is attached to a crank, whereby the centre line of the slot is central to rocking shaft: whilst this may be a departure from the usual type of Joy's gear, the principle is the same. The engine steams well, and is in every way satisfactory.

I might add, in conclusion, I arrived at the correct centres of links, etc., by practical means, brass templates, afterwards replacing by 1-32nd-in. steel. A few notes relative to this gear are here given. The radius of link is from valve spindle eye when in mid-position. When the link is dead vertical all links (up and down) must also be vertical. The centre of gearing is usually ¼ in. from connecting-rod eye. Any projection to link which takes radius block acting as a fulcrum gives lead to the valve.

The gear is interesting to make, and also instructive.



View of Firebox End.



Side View of Engine.

MR. P. W. WILSON'S MODEL UNDERTYPE STEAM ENGINE.

"Model Railways," by W. J. Bassett-Lowke.—The second edition of this little book, a copy of which we have before us, is an entire revision of the first edition. It contains many more pages, is printed on better quality paper, and we notice also that special reference is made to model electric locomotives, signal interlocking, etc., and an extra chapter is included on rolling-stock. Readers who already possess a copy of the first edition will do well to secure a copy of the new issue. The price remains the same—6d. net, 7½d. post free.

An account of an arrangement designed to simplify the removal and renewal of incandescent lamps when these are fitted in inaccessible positions is given in the *Western Electrician*. The device has a set of artificial fingers, which go over and grasp the lamp firmly while it is being removed or replaced in the socket. Rubber bands over the ends of the fingers prevent the lamp from slipping while it is being turned.

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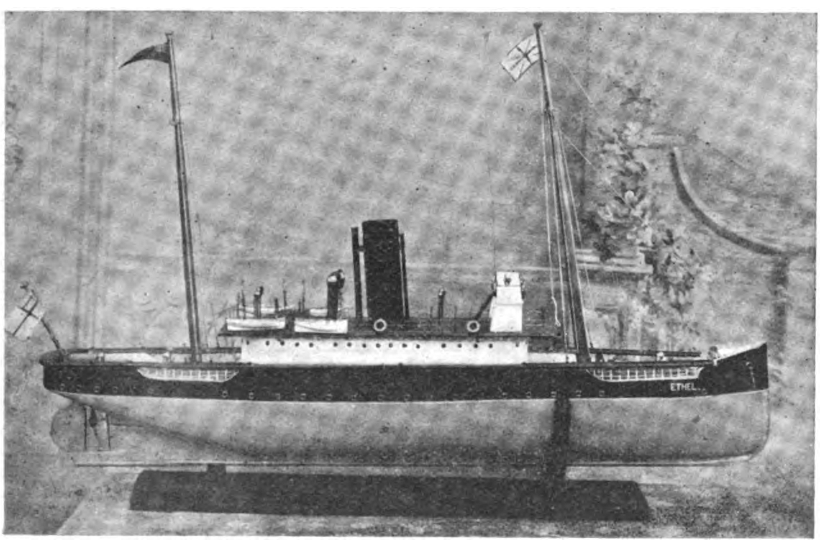
Practical Letters from our Readers.

[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.]*

An Electrically Driven Model Steamer.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Having been encouraged by the numerous illustrations of readers' efforts at model steamer building, I thought I would try my hand at making a model steamer. The result is shown by the accompanying photograph. First of all I got a piece of yellow pine 3 ft. 9 ins. long, 6 ins. wide, and 6 ins. thick, and cut same to shape as directions given in THE MODEL ENGINEER handbook—"Model Steamer Building." The dimensions are 3 ft. 7 ins. long, 6 ins. beam, and 8½ ins. deep from top deck. The decks are pitch pine marked out to imitate planks, all of which are removable so as to get at the motor and accumulator. The ventilators are made of brass, the funnel is made of sheet brass also. On the promenade deck there are the following fittings :—Six ventilators, four boats and davits, captain's bridge, four life-buoys made of indiarubber rings, and two skylights; and on the lower decks two anchors made of sheet brass, two ventilators fore and aft, one capstan fore and aft, two companion ways, two skylights, one steering wheel, and one steam winch for hoisting anchors aboard.



MR. CHAS. JACKSON'S MODEL ELECTRICALLY-DRIVEN BOAT.

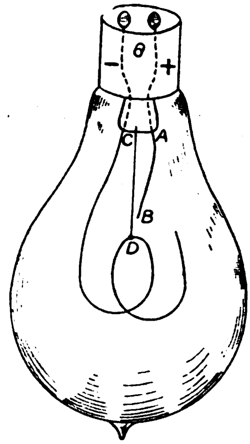
The boat is painted black above water and salmon colour under water. The funnel is painted red with black band. The cabins are enamelled white, and small boats are finished white. The model is electrically propelled. The motor, which I made myself, is of the Manchester type and works well with a 4-volt accumulator. I may say that the boat travels as fast as I can walk.—Yours truly,

Wigan. CHARLES JACKSON.

A Strange Occurrence.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Some of your readers may be able to give an explanation of the cause of a strange phenomena which I witnessed in connection with an ordinary incandescent lamp a short time back.



SHOWING BROKEN FILAMENT IN AN INCANDESCENT LAMP.

In a series of five lamps, each lamp being 120 volts 32 c.-p., making a total of 600 volts direct current, I had occasion to change the first lamp in the series, so I switched the current off and inserted another lamp, and when I had switched the current on again, the lamp flickered and burnt out. I walked over to it, intending to take it out again, but before I reached it the globe seemed to be filled with the light that appears when you draw the discharging rods of an induction coil beyond sparking distance in a dark room. Then the light gradually changed until I could plainly distinguish the broken filament. (The enclosed sketch will show the lamp and how the filament was broken. It is a carbon filament. The short piece, marked A B, you will notice, is about 1-16th of an inch away from the suspension wire, marked C D). The peculiar part about it is that the filament remained dead black, while round it appeared a white light, the diameter of which was about 3-16ths of an inch, the rest remained blue,

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commencing light blue at the edge of the white and changing to dark blue as it neared the sides of the globe.

In the sketch the contact marked +, when making contact with the positive buffer of the lamp-holder illuminated the whole length of the filament and lamp, including the suspension wire marked C D; and when reversed, and the negative contact was making contact with the positive buffer only, the short piece of filament was illuminated.

The four other lamps in the series showed no signs of current whatever, and the vacuum of the lamp itself was perfect.

Hoping some of your readers can advance a plausible theory, yours truly,

R. N.

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:—

[17,940] **Hardening Taps and Drills, etc.** H. W. (Westcliff-on-Sea) writes: Can you inform me how I can keep small things, such as taps and drills, straight in the hardening? I have tried to harden in the usual way for small taps, and I find more often than not they buckle. How are twist drills hardened? They are nice and straight. If you can help me I shall feel obliged.

Making and hardening such tools is an art demanding not only skill and experience, but knowledge and experience of the particular steel used. One workshop method is to stir the water until it is rotating in the containing vessel, such as a bucket, and to plunge the hot drill or tap vertically into the centre of the whirlpool thus formed. Heat the steel as evenly as possible. Hold the drill or tap perfectly upright when plunging it into the water.

[17,945] **Grouping Daniell Batteries.** N. S. (Nelson, New Zealand) writes: I made a Daniell battery of ten jars according to handbook. It will light a small 4-volt lamp, but not extra bright. I have them in two rows. (1) Could I get a spark from them in that way if passed through coil? (2) How are wires placed to get a spark at plugs from such battery? (3) I had them copper to zinc. Is copper the positive? (4) How could I place wires to charge a 4-volt accumulator? I have a two-cylinder motor engine and use accumulator and trembling coil, high tension. (1) When engine is going slow both tremblers work and there is a good spark at each plug, but when engine is going fast one of the tremblers will not work. (2) I have changed wires with plugs and terminals, also trembling blades. (3) If I uncouple the side that always works, the other one will then work. Would you kindly tell me where fault might be?

(1) Do you mean from an induction coil? We should say yes; but you may have to put more of the cells in parallel. You can try any number in combination of parallel and series. (2) If you mean an engine sparking plug, the insulated part of the plug should be joined to one wire and the uninsulated portion to the other wire. A coil is necessary. (3) Copper is positive outside the cell—that is, current is assumed to flow from the copper terminal to the outside circuit and back into the zinc terminal. (4) Wire from copper terminal to positive terminal of accumulator. Re motor engine. Trouble appears to be insufficient battery power.

[17,946] **Half horse-power Water Motor.** K. H. (Plymouth) writes: I should be much obliged if you would give me particulars of a water motor powerful enough to drive a 150-watt dynamo, Simplex type, at 2,600 revolutions. I should prefer a motor of about ½ h.-p. The water pressure varies from 38-45 lbs. per square inch.

You require about ½ h.-p. to drive machine at full load. At 40 lbs. pressure, a 12-in. wheel and a jet ⅜-in. diameter would meet your requirements. The water consumption would be about 3½ cub. ft. per minute, the wheel running at about 800 r.p.m. A good design was given in December 15th, 1901, issue, which you could adapt to your requirements. Find by trial what is the best speed to run at, then arrange pulley accordingly.

[17,947] **Switchboard Connections.** W. E. K. (Kensington) writes: Enclosed please find rough sketch of a switchboard. Will you kindly draw me a rough sketch as to how it should be wired, and also the connections from mains to volt and ammeters? The dynamo to be used is 30 volts 6 amps., and I want the wiring so that I can connect leads from dynamo at bottom and take lighting mains off terminals at top of board. The volt and ammeter

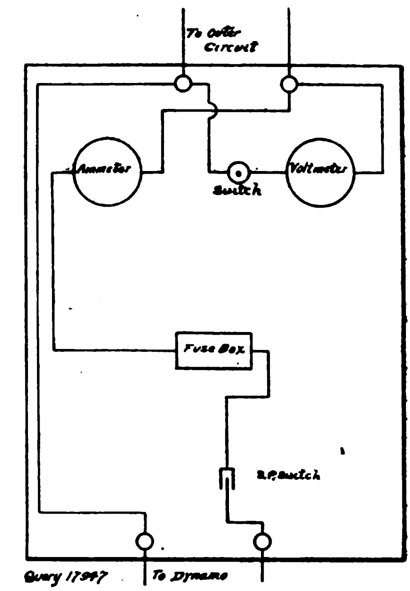

DIAGRAM OF SWITCHBOARD CONNECTIONS.

are those advertised by the Economic Electric Company in THE MODEL ENGINEER, costing only £1 the pair. Kindly give me a plain sketch of wiring.

We append sketch of connections as required.

[17,937] **Apprenticeship Matters.** J. B. L. (Richmond) writes: As a regular reader of THE MODEL ENGINEER I should be pleased if you could give me a little advice as to whether it is possible for me to become an engineer under the following circumstances. I am at present a clerk in a city office, but my chances of promotion are very remote, and I have been thinking of trying some trade or profession, but have never ventured, as I thought I was too old (I am now nearly 19) to start anything fresh. My thoughts were turned in this direction by reading in your Queries and Replies column, a week or two back, of a young fellow who has become an apprentice to the British Westinghouse Company and proposes to study theory in his spare time. Can I do this or am I too old? Would I have to pay a premium, and, if so, how much, and would the firm pay any wages? I see in last week's *Commercial Motor* that Clayton & Shuttleworth, Lincoln, take apprentices up to 21 years of age, and that Mr. D. Drummond (L. & S.W.R.) offers goods chances to apprentices. I consider that if, after all, I only became a mechanic I should be better off than I can hope to be in my present job. I have had a fairly good general education, but had to leave school early (when I was 14) and earn my living. Do you recommend the two Correspondence Schools advertised in the columns of THE MODEL ENGINEER?

If you have never done anything in the practical line before, and are not quite at home with the hammer and chisel and file,

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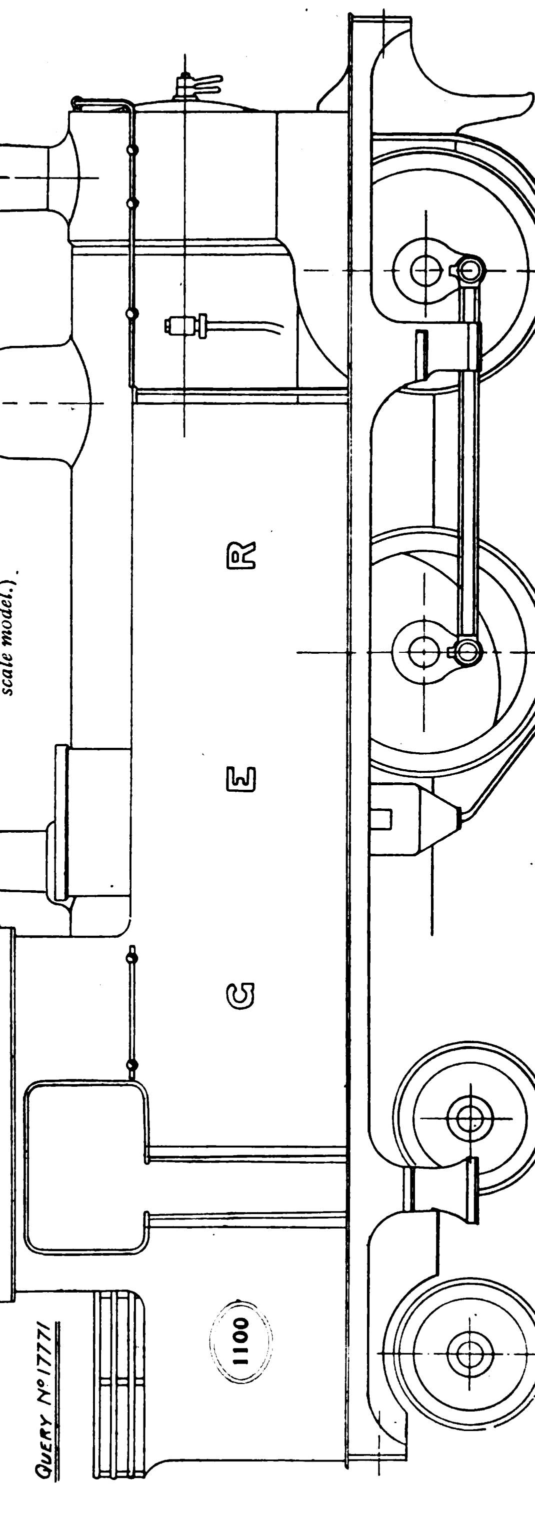
you will find it a bit of a job to turn your energies to an entirely fresh occupation; but if you are naturally clever with your hands, the workshop training would not come as such a big undertaking. With absolutely no knowledge of engineering or technical matters, we could not recommend you to take up the new work unless you have exceptionally good opportunities. In some cases premiums are required, but everything depends on the firm you go to. No rule can be fixed. Apprentices get from 3s. to 12s. 6d. a week, according to the year they are in and their ability. Unless you could afford to live for three or four years with only a few shillings a week in wages, we do not see how you can get a start in the engineering business. The Correspondence Schools are a good and valuable help to men who have daily experience in purely practical work and who wish to get hold of a bit of theory, but they would never teach you to become a skilful mechanic or fitter. Practice and a natural aptitude will alone do that. We much regret we cannot do more to assist you, but can only impress on you the necessity of making many personal inquiries and calls.

[17,771] **G.E.R. 0—4—4 Tank Locomotive.** W. R. H. (Forest Gate) writes: Could you oblige me with a sketch of the No. 1,100 class of locomotives running on the Great Eastern Railway, suitable for a ½-in. scale model? They are leading four-coupled trailing bogie tanks. I should like, if possible, to try the new valve gear on it (May 30th issue).

We include herewith a drawing of the 1,100 class of tank engine used on the G.E.R. We have no particulars of the widths of footplates and tanks, but you reside in the neighbourhood of a G.E.R. station, and can easily get these. We are also unable to include full details of the frames, but this is not important in a ½-in. scale model in places where they are not to be seen. The drawing is ¼ in. to the foot, and is therefore half the size required for your purpose. The boiler barrel in the original engine is 10 ft. long and 4 ft. 1½ ins. diameter. The firebox is 5 ft. 5 ins. long, but in the model we should recommend you to make it longer, extending it further into the cab. Employ a piece of 2⅛-in. tube for the outer shell, and cylinders 7-16ths in. by ⅞ in., or ½ in. by ¾ in., will be found to give good results with the valve gear you propose putting in. Driving wheels are bare 2½ ins. diameter, and castings can be obtained. The bogie wheels have only eight spokes in the original engine.



FRONT-COUPLED TANK LOCOMOTIVE G.E.R.; No. 1,100 CLASS.
(*Drawing half size for ½-in. scale model.*)

[17,929] **Running Small Models from Mains.** G. F. N. (Aldershot) writes: I should feel much obliged if you could tell me through your valuable paper how to make a regulating resistance so as to reduce the flow from 200 volts down to about 4 volts? The only means of electric current that is available is a pendant incandescent lamp, and I want it to supply current to a small motor and other models wanting current ranging from 2 to 6 volts. If you could give me a little idea, I should take it as a great favour

This can be done in several ways, but the most convenient is to connect up the models in series with one or more lamps, according to how much current they may be capable of standing, or may require. Thus, an 8 c.-p. lamp of 100 volts on a 100-volt supply will pass about ·32 amp. If more current is required, then connect more 8-volt lamps in parallel; and if much *less* current is required, then connect two of these lamps in *series*, and the models in series with them too, relative to the supply mains.

[17,914] **Electric Motor and Cells for Small Canoe.** E. H. B. (Tonbridge) writes: (1) Can you tell me if a machine can be designed which would fulfil the following requirements:—(*a*) To drive a light canoe, when run from a battery of accumulators? (*b*) To drive a lathe? (*c*) To charge the accumulators in (*a*) when driven from a separate source of power? (*d*) To act in conjunction with above battery and engine as an electric light plant. A four-pole machine, drum armature, with about 1¼ h.-p. output at 60 volts and 32 amps. supply, say, would be suitable. (2) I suppose a series-wound field is best for the canoe driving, as a large starting torque is required, but that a shunt field is best for the other purposes. Do you think I could have both a series and a shunt set of coils, the two being interchangeable, or should I place two coils (series and shunt) on each pole? (3) In the latter case, would the windings be suitable for use as a compound if required? (4) Can you recommend me a book which deals with the design of a four-pole motor of this size, showing clearly how to decide upon suitable dimensions for a laminated drum armature and suitable windings, etc? (5) Kindly state what you would consider the minimum size and weight of the cells, say thirty-two in number, and sufficient only to drive the motor for three or four hours at one charge? (6) What is the most economical speed of such a motor? (7) What size propeller would be most efficient in the case of the canoe, which is an ordinary three-seated Canadian?

(1) Yes, but a ½ h.-p. motor would do for a canoe unless you want high speed. To work at 60 volts you would require thirty cells for the battery. Eighteen cells would probably be more convenient with a working voltage of 36 volts approximately. (2) Yes, you could have interchangeable field coils, taking care to preserve the same polarity of the poles so that there was no trouble with the excitation when using the machine as a dynamo. (3) To obtain maximum results the two sets of coils should be distinct and placed upon the machine the one or the other as required.

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You can have two sets of approximately half the value upon the machine at the same time and use them as separate series, shunt or compound; such a compound winding would be of no use as a regulating winding but would give a good starting effect for motor purposes. (4) We can advise you through the Expert Service Department, but do not know of a simple book dealing with the design of small multipolar machines. There is some information in back numbers of THE MODEL ENGINEER. (5) See our handbook on "Small Accumulators." (6) There is no "most economical speed," but the higher the speed at which you let the motor do its work the better. (7) About 6 ins.; but you should try several until you find the best size, shape, and pitch to suit your particular boat and speed. The propeller is of great importance, and best results can only be obtained by trial and error. We should prefer to use a comparatively small motor; let it run at high speed, say, 1,500 r.p.m., and gear down by a good belt to run the propeller at about 300 r.p.m.; but if you are going to do lighting and charging as well, the machine should be as large as possible to make a good compromise. As a guide to estimating size of battery, reckon 1½ amp.-hours output per pound of cell complete.

[17,869] **Lamp Control from Two or More Points.** A. B. (Blairgowrie) writes: I am going to put a light at my bedroom window, also plug and switch at each side of bed, switch at door to light window light, and switch for putting it out at each side of bed. If you would send me a sketch of wiring it, I would be much obliged.

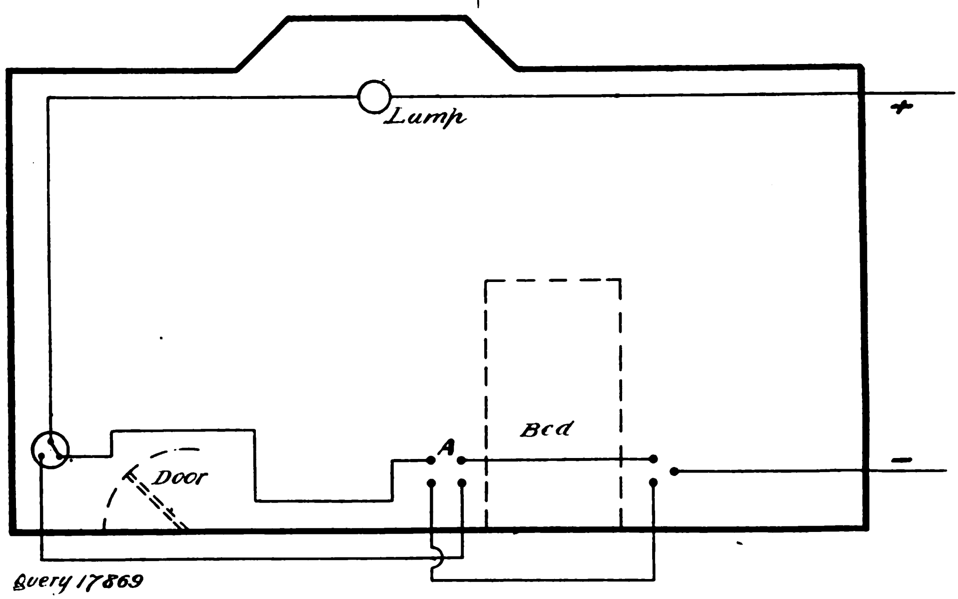

FIG. 1.—DIAGRAM OF WIRING FOR SWITCHING AT THREE POINTS.

We give a diagram above showing how to arrange wiring so that the light can be switched on and off from any three points in the room. Two ordinary two-way switches are needed and one switch of special construction—a four-point switch. You will see that by turning either of the two-way switches, or the cross-over switch shown in detail in Fig. 2, that the circuit can be made or broken at will, from any of the points in question.

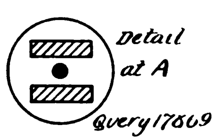

FIG. 2.

[17,927] **Agglomerate Leclanche Cells; Electrolytic Rectifiers; Accumulator Charging.** J. A. (Sheffield) writes: In thanking you for past favours, I would be pleased if you could again help me. (1) I have two 10 amp.-hour accumulators which I would like to charge from the town's mains which supply alternating current, two-phase, 50 periods, at 200 volts. In a letter in THE MODEL ENGINEER for April 7th, 1904, there is a description of a Nodon valve I would like to use. Can you tell me the size of carbon and aluminium plates to use, and also is the solution in the jars a saturated solution of potassium phosphate? From the diagram in that issue of THE MODEL ENGINEER I gather that with four cells grouped as shown in the diagram the whole of the current from the mains is transformed and, therefore, the accumulators will be getting charged the whole of the time. Is this so? How many 16 c.-p. lamps should be put into the circuit to charge the cells at the rate of 1 amp.? (2) I am thinking of making some agglomerate Leclanché cells. Can you tell me what parts, by weight, of crushed carbon and manganese dioxide I must use to make the agglomerate blocks? (3) In a recent issue of THE MODEL ENGINEER there is a query about making accumulators from sheet lead, in which you say that, apart from the trouble in forming these, accumulators so made are superior to pasted grids. I have been wondering if there is no better way to form these sheet lead plates. Could they not be formed by connecting them to an alternating current source and left until formed? In your handbook on Accumulators you say that accumulators can be made from sheet lead by charging in one way and then in the opposite direction. This is what I think would be going on if they were connected to alternating current. Is this so, or must they be charged from continuous current, discharged, and then charged in the opposite direction?

(1) The account given of a chemical rectifier in THE MODEL ENGINEER for September 27th, 1906, page 303, should assist you. Solution is saturated ammonium phosphate. The whole of the current is utilised. An ordinary 16 c.-p. lamp taking about 60 watts passes a current of ·3 amp. approximately, at 200 volts, but you will have the rectifier and accumulator resistance and back E.M.F. as well as the lamp resistance. Probably five 16 c.-p. lamps in parallel will be required. You can add lamps until the required flow of current is obtained. (2) This is in the nature of a trade secret; several compositions have been described. Try 40 parts (by measure) manganese dioxide, 52 parts carbon, 5 parts gumlac, 3 parts bisulphite of potash. The ingredients should be powdered separately and then well mixed. The compound is warmed to 212° F. and compressed in a mould, being finally heated to 662° F. (3) The lead plates cannot be formed by alternating current; it is necessary to continue the current in one direction for a considerable time, say ten hours, before reversal, which must be done gradually through a resistance each time. Various makers have their own methods of expediting the process. Plates are also made in granular form. If the plates are immersed in a solution of nitric acid and water (equal parts) for a period of twenty-four to forty-eight hours and then washed thoroughly in a 10 per cent. solution of sulphuric acid, they can be formed without reversal. The object is to obtain a porous plate. The corrosive acid must be thoroughly washed out. You cannot, however, expect to obtain such good or rapid results as an expert.

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The Editor's Page.

THIS week we direct our readers' attention especially to the photographs and drawings reproduced on pages 150-153 of some very excellent specimens of turning made many years ago. The principles of the methods that were employed in this work are very briefly described, and it is thought that some—having a desire to try their skill in producing similar pieces of work—may by resource to the natural ingenuity which characterises so many of our readers, devise some even better ways and means of turning out such fascinating examples of the turner's art. As intimated in the conclusion of the article, the performance of such work cannot fail to prove anything but good exercise and a test of careful and accurate workmanship.

* * *

The last example illustrated may be particularly attractive to those readers who revel in trying to solve mechanical puzzles. We shall be glad to know that this one has not proved to be their master, and still more pleased to hear for our own as well as our readers' edification, how they would set about the task of producing in the lathe three linked balls from one piece of material.

Answers to Correspondents.

J. A. (Sheffield).—We cannot be responsible for past enquiries which do not comply with our rules; but every effort will be made to trace yours and publish a reply as soon as possible.

H. K. (Hulme).—*Re* racing schooner, your best plan is to either try an advertisement, or keep a look-out on the advertisement columns, and see what is going. We do not know of one personally.

R. N. M. (Plymouth).—Your inquiry to hand. It will be dealt with at the earliest opportunity.

R. H. S. (Fulham).—(1) A good cement can be had from Whitney's, 117, City Road, E.C., or you would find shellac varnish would hold well. (2) Use shellac. (3) Paraffin wax is the best we can recommend.

F. R. (Stroud Green, N.).—We thank you for your letter and photographs, but regret the latter are not suitable for reproduction.

E. S. (Canning Town).—These slots can be put in very quickly by means of a hacksaw.

J. B. C. (Rouen).—We can only recommend you to make application to any of the firms you think you would like to join. Some firms take premium apprentices, and others do not; but in all cases the wages would only go to 10s. to 12s. 6d. a week for even a third or fourth year apprentice. It is a matter which can only be properly arranged by the two parties concerned. Select a few names from any of the large trade engineering papers and then write them.

H. J. R. (s.s. *Rossetti*).—We have no detail drawings in hand for a 1 kilowatt machine at present, and these would have to be specially prepared for you. We advise you to obtain your stampings, castings, wire, etc., from A. H. Avery, Fulmen Works, Tunbridge Wells, Kent. He would supply full instructions, etc., with the parts, ready for winding and putting together.

O. H. (Bradford).—The matter referred to in your letter shall have attention at an early date.

T. J. S. (Hawley).—The series of articles on "Electric Oscillations and Waves" will be continued in an early issue from now.

T. B. (Catford, S.E.)—Some useful hints on cleaning brasswork appeared on page 27 of the issue for January 10, 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, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

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Contents.

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

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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. XVII. No. 330. AUGUST 22, 1907. PUBLISHED WEEKLY

A Model Electric Locomotive.

By Cuthbert B. Davies.

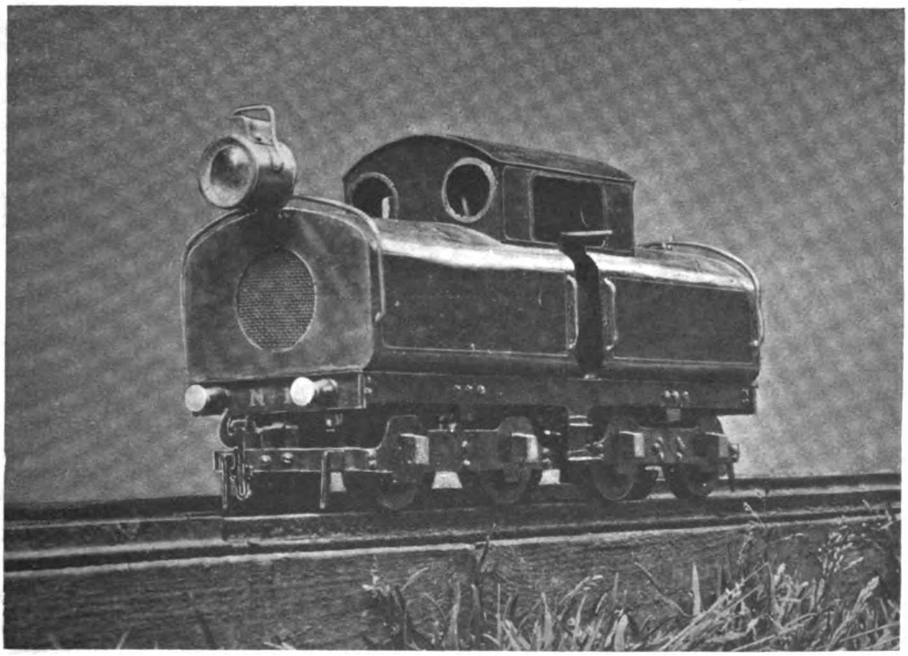

Fig. 1.—Mr. Cuthbert B. Davies' Model Electric Locomotive.

THE electric locomotive here described was built in my spare time (to use a rather hackneyed expression), from an article which appeared in the issue of The Model Engineer for June 14th, 1906, certain departures, however, having been made. The gauge was reduced from 2 ins., as indicated by the original drawings, to 1¾ ins., this alteration being made in order that the engine might run upon the standard gauge tin rails with insulated third rail at present on the market, the 2-in. gauge rail not being obtainable. All other dimensions were adhered to. One other departure lies in the fact that up to the present no accumulator is carried by the engine, the motors, of which two are fitted, being joined up in parallel, each motor being connected in series and picks up current from the track in the ordinary simple way. It is intended later on to adopt the arrangement shown in Fig. 4 of the article.

The motors were purchased from F. Darton and

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Son, being known as their "Pet" type. They are both placed on the same bogie, and drive by friction, the whole of one end of the engine with the motors being found sufficient weight to give adhesion without stopping, at the end of which time the fibre rollers had worn to such an extent that the wheel flanges were running in grooves in the rollers, thereby causing considerable friction (of the wrong

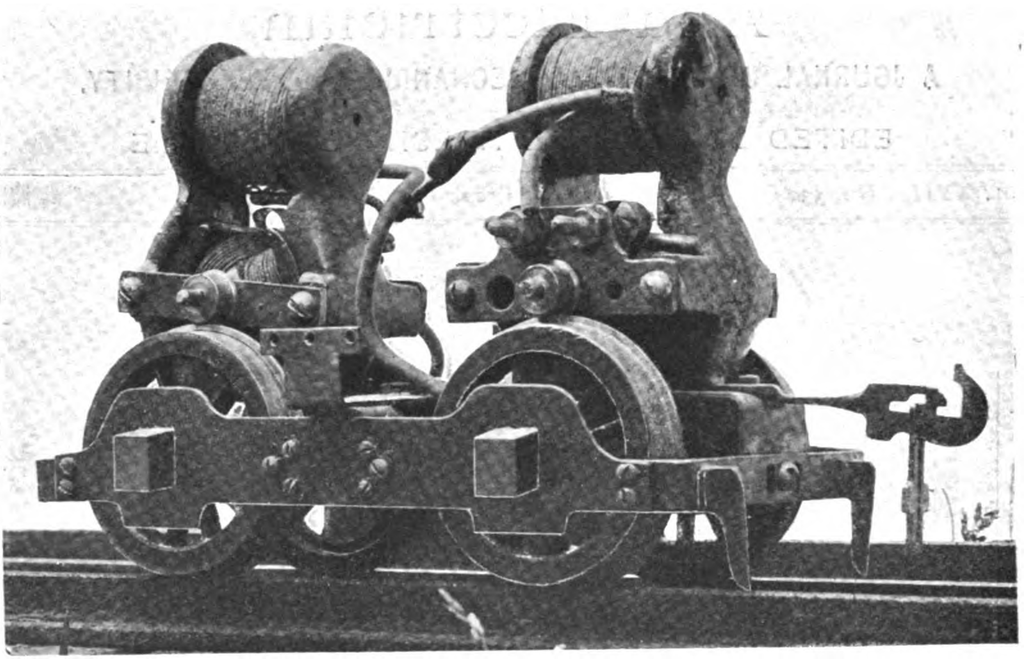

FIG. 3.—A VIEW OF THE MOTOR BOGIE, REMOVED FROM THE ENGINE.

between the wheels and the rollers even when the locomotive is hauling loads of several times its own weight.

I must here point out that the red fibre rollers which the writer of the article suggested, although

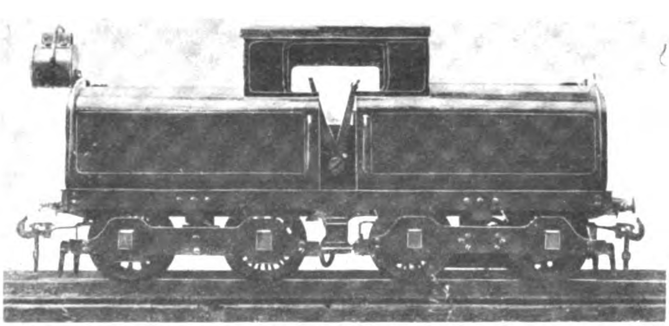

FIG. 2.—A SIDE ELEVATION OF THE ELECTRIC ENGINE.

giving a somewhat better grip on the wheels, wear away very rapidly under continuous work. Once, just after having new rollers put on, my engine was lent to run as a shop window attraction at Christmas; it ran for three-and-a-half hours sort), and the motors were consuming an extravagant amount of current. I then decided to try brass in place of the fibre, with the result that, although the motors slipped at starting and with exceptional loads, for general work they proved quite satisfactory.

I made and fitted a head lamp of polished brass, in form somewhat similar to motor-car lamps. It contains a 6-volt 4 c.-p. Osram lamp, of the flat or double convex form; a bullseye lens in front projects a fine beam of light, which added to the attractiveness of the advertisement for my friend the shopkeeper. The lamp can be removed from one end of the engine to the other, the connections being made by the lamp brackets and by a plug on the end of a wire from the lamp, which drops into metal bushes in ebonite bosses on the bonnets (these bushes and insulating bosses are seen in the photographs). A permanent connection is made inside the bonnets to the metal bushes. Hand-rails have been fitted round the ends of the bonnets, and at each side of the footplate openings. A double-lever switch is placed on one side of the cab, one lever being for the motor circuit, and the other for the lamp,

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so that the engine may be stopped without putting out the lamp or *vice versa*.

The photograph, Fig. 1, is an end view of the engine, showing the brass ends to the bonnets. Fig. 2 gives a broadside, whilst Fig. 3 is the motor bogie shown removed. The engine is painted dark green on the motor casings or bonnets and cab lined with pale yellow; the framing is deep red, and the buffer beams vermilion. The general colouring, with bonnet ends, hand rails, and spectacle rings of bright brass, gives the engine a very attractive appearance.

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.]*

Jig for Grinding Split Dies.

By H. W. Witney.

Dies of the type shown in sketch are very difficult to grind. The following little apparatus, I have found, will do the job very satisfactorily.

A piece of mild steel was taken ½ in. thick, and a groove shaped out about 1¼ ins. wider than the width of the largest die to be ground (Fig. 1). For example take die given in sketch, the other dimensions are made up to that. Next take a strip of ¼-in. by ½-in. mild steel bar, and cut off two pieces the same length as piece A. Now take piece A and drill up as shown in Fig. 1. Now take die and fix comfortably. We can then determine the angle to set die and drill, and mark positions as shown in sketch at E¹ F¹.

If we fix the jig down on our grinding table, we can grind dies on one edge, and then swing top

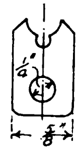

Fig. 2. View of Die.

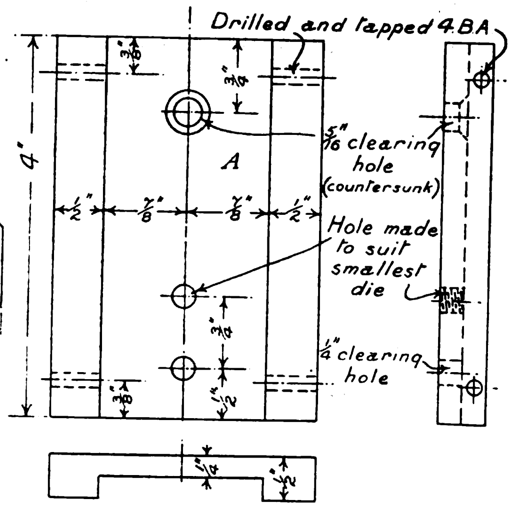

Fig. 1.—Elevations and Plan of Main Part of Jig.

piece round, and do the other edge the same time keeping all our cutting edges the same height. The emery wheel can be shaped to suit curve required on die.

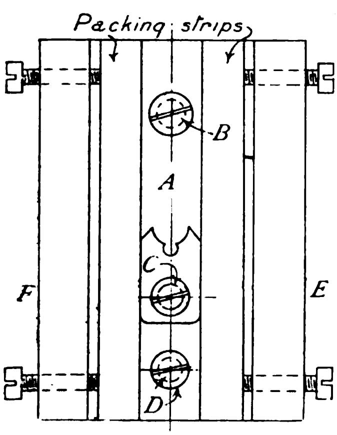

Fig. 3.—Jig, with Die in Position.

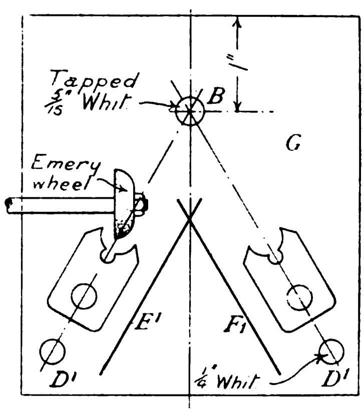

Fig. 4.—Showing Setting of Die to Proper Angle.

to piece A by screwing down at hole C. Set square and adjust up by packing strips and screws, which go through the side pieces E F as shown in Fig. 3. We can now grind all dies of this size in our jig, and if we have any other different sizes we can adjust accordingly. Now take a piece of mild steel ½ in. thick, and large enough to swing A through 45° or more when pivoted at hole B. Next drill this hole and tap 5-16ths-in. Whit. as shown (Fig. 4). At B we fix piece A by a 5 16ths-in. countersunk screw, so that it moves over piece G

Two Useful Hints.

A reader has sent us the following note. He says: To prevent steel from blistering and protect the polish, paint the article all over with a thin paste of boracic acid mixed with water or methylated spirit. Make hot to a cherry red and plunge in water. The boracic acid will nearly all come off in the water. A little rubbing with a fine emery stick or the finest paper will restore the original polish.

To prevent the discolouration of brass, etc., while brazing or silver-soldering, paint the article with the above paste nearly to the part to be soldered while hot. After soldering drop into a weak solution of sulphuric acid and water.

The Edinburgh and Midlothian Eleventh Annual Home-workers' Competitive Industrial Exhibition is to be opened on October 16th, at 6 p.m., by Dr. Andrew Carnegie. As already announced, copies of the prospectus containing particulars of every section may be had upon application to the Secretary, Mr. A. T. Hutchinson, 15, Leith Street, Edinburgh.

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The Latest in Engineering.

New Signals on an American Railroad.—The diagram herewith and the few following particulars which we give will doubtless prove interesting to those of our readers who have not seen the descriptions that have already appeared in the engineering Press. The new system is being tried by the Pennsylvania Railroad on about 12 miles of track near Philadelphia. The signals are of the semaphore type, with two arms and two lights displayed on every high signal. With existing arrangements the number is variable, according to the number of lines of rails, so that there may be from one to five lights on a post. To govern low-speed and special movements, a small arm with a comparatively weak light will sometimes be placed on the same or a separate post, but will be so far below the main arms as not to be confused with them. The signal arms wave upward to the vertical position, instead of dropping down to this position to give a clear signal. Each arm also has three positions—horizontal for "danger," inclined upwards at 45 degs. for "caution," and vertical for "go ahead." The corresponding lights are red, green, and white. The diagram shows the several positions for a signal as used at interlocking plants and for manually operated block signals. The capital letters refer to the colours of the lights. The several indications are as follows:—(*a*) Stop, and wait until signal changes. (*b*) Proceed with caution to next signal, on high-speed line. (*c*) Proceed at full speed on high-speed line. (*d*) Proceed with caution to next signal, on moderate speed line. (*e*) Proceed at moderate speed, on moderate-speed line. All signal arms at interlocking points remain normally at the horizontal position, showing

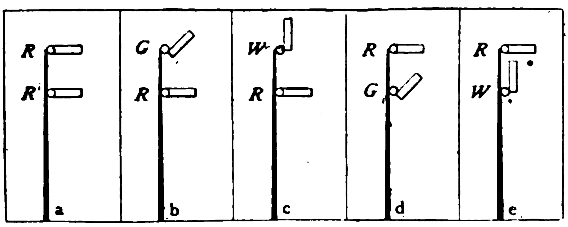
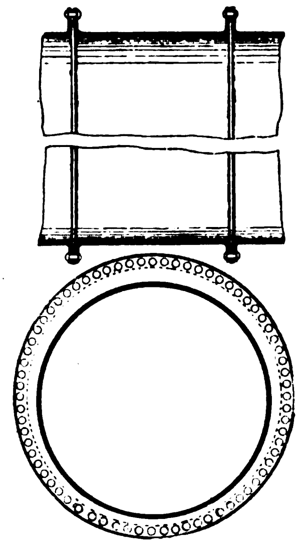


Diagram of New Signals on the Pennsylvania Railroad.

a red light at night. The arms are moved one at a time, so that a driver cannot pass any signal-post unless the signal for his particular movement is at "safety" or "caution."

A New Construction of Boiler Flue.—An improved construction of boiler flue has been patented by Mr. T. C. Beeley and Mr. H. S. Pogson, of Hyde. The object aimed at has been to so design the flue as to provide greater elasticity at the points where the greatest expansion takes place under working conditions, without any reduction of heating surface, without necessarily altering the position of a flue in a boiler, and without exposing the expansion arrangement to the direct or any unusual attack of the heated gases in the flue. This is accomplished by forming each flue of a number of rings or sections fitted with eccentric flanges, as shown. When the boiler is in work the greatest heat will be along the upper surface of the furnace flue where the depth of the eccentric flanges is greatest, as shown, and the joints along the upper surface will yield more readily than the joints at the bottom, because the rivets are further from the flue at the top than at the bottom, the result being that



Beeley's Arrangement of Boiler Flue.

the expansion and contraction of the flue will be more easily taken up and be less destructive to the flue.

A New Boiler Head.—In the United States plain cylindrical externally-fired tubular boilers are much used. The ends, or "heads," are stayed together under the water level by the flue tubes. Heavy longitudinal or gusset stays are required in the steam space. A Mr. Rheutan has patented a head which gets rid of steam space stays. The tube plate portion is left flat, but the upper portion is dished to a depth of some inches. The *Iron Age* gives particulars of tests made with a boiler 72 ins. in diameter and 18 ft. long, made of 7-16ths-in. flange steel, having a tensile strength of 60,000 lbs. The longitudinal seams of the boiler were of the triple-riveted double-butt type, designed for an efficiency of 86 per cent. The heads were made of 9-16ths-in. flange steel, 60,000 lbs. tensile strength, and were riveted to the shell with an efficiency of 86 per cent. Measurements were taken while the pressure was being applied, but no movement was perceptible up to 315 lbs. per sq. in., which was the limit of the pressure test given. This being the extent of the elastic limit of the steel in the boiler, it was not deemed advisable to exceed it. Although under the highest pressure reached an elongation of the shell of 1-32nd in. on each end was observed, there was no perceptible or measurable movement of the head.

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How It is Done.

Fitting the Armature of a Dynamo or Motor.

By A. W. M.

(*Concluded from page* 159.)

To set the scriber to the correct height for the bearing centre, place the surface gauge as shown in Fig. 25. The centre of the magnet tunnel is found by means of a pair of dividers and marked upon a piece of wood (W), which has been wedged tightly into the tunnel as shown. Having set the scriber, the dimensions thus found can be transferred to the bearing, as Fig. 24. Drilling the holes for the spindle so that they will be accurate is a rather difficult operation. The best way perhaps is to use a lathe. Bolt the bearing upon an angle-plate as indicated by Fig. 26. Suspend the bearing between the centres as in the sketch (Fig. 26*a*), then place the angle-plate in position and bolt it against the face-plate; attach the bearing to it, and finally take away the lathe centres. Drill and finish the hole, using tools as in Fig. 16. Take away the bearing without disturbing the angle-plate, and place the second bearing in position. If drilled and bored true, the height of its centre will be precisely the same as that of the first bearing. The success of the operation depends upon your care in making sure that the hole runs perfectly true. If you file or plane the surface F, instead of facing it in a lathe, the casting should be tested as in Figs. 22 and 23, and the height of spindle centre marked as in Fig. 24. As an alternative, to save repeated trials for height,

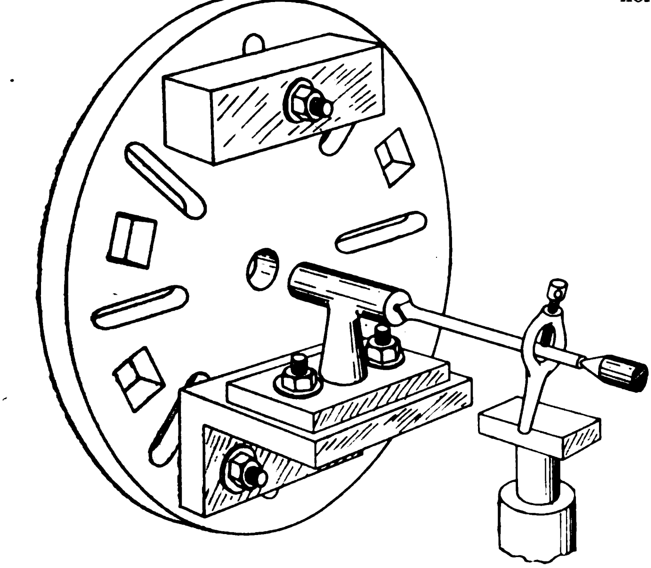

Fig. 26.

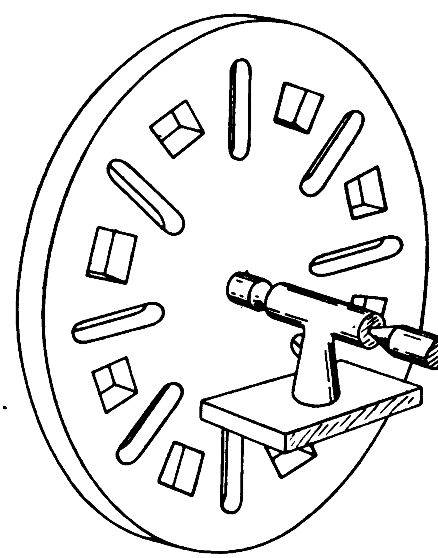

Fig. 26*a*.

you can place the rough casting upon a surface, mark off points *p p* in the centre of the cylinder, pack up the casting until they are at an equal height from the surfaces as tested by the surface gauge, and mark a line *e*, Fig. 27. This line should be marked at a distance below the points *p* equal to the height of centre as found in Fig. 25. For instance, if the distance as found in Fig. 25 is 2 ins., the line *e* should be marked 2 ins. below the points *p*. You can then file or plane to this line, and the

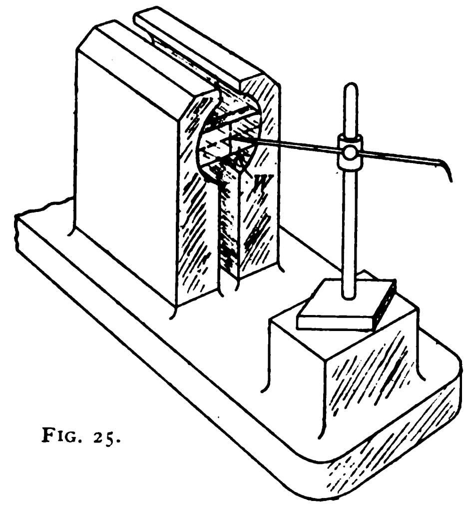

Fig. 25.

height and level of the cylinder will be correct. If a lathe is not available, the casting should be marked off as in Fig. 27, and then the hole drilled before the seat is finished. When the latter is filed it can be tested, as shown in Fig. 28, by placing the scriber point in the hole at each end. This will show if the hole is at the correct height, and whether the surface is parallel to it. If the scriber touches equally at each end, the hole is parallel to the seat; if it does not do so, the seat must be adjusted until the hole is parallel or the spindle will not turn easily. Each bearing must be adjusted in this way until the holes are of equal height.

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To fit the bearings to the baseplate place the dummy armature in the tunnel and slip them over the spindle. The holes for the screws can then be marked off by means of a scriber, as explained with reference to Fig. 18.

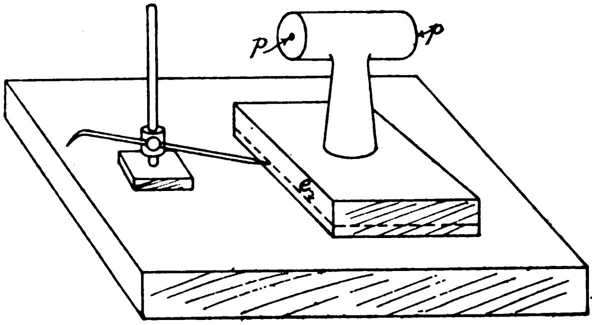

FIG. 27.

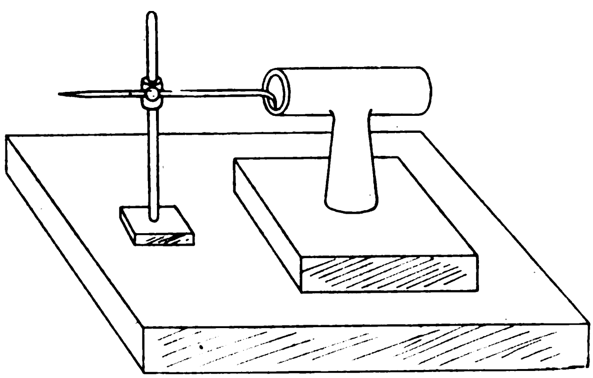

FIG. 28.

The top surfaces of the supports PP, Fig. 20, must be flat and in line with each other. They can be tested by means of a straightedge in the same manner as the surfaces AA, Fig. 9. The magnet should also be fitted so that the tunnel is parallel to these surfaces, a method being adopted to suit the particular arrangement of design. For example, it would be possible to machine or file the surfaces PP first, then to mark off centres to the correct height, as in Fig. 25, and scribe a circle at each end to which the tunnel could be machined or filed. If the dummy armature is well made and a good fit in the tunnel, it will show whether the tunnel is in line with the surfaces PP or not when the bearings are tried on. As a clearance space exists between the magnet faces and the armature, however, a final adjustment can be made by filing if the tunnel is slightly out of line. The principal difficulty is fitting the bearings so that they are in line and practically central with the tunnel. This will be achieved by making sure that the surfaces PP are in line with each other and the holes for the spindle at the correct height and true to the seats by following the method described.

The pattern of bearing shown is sketched as an example; the method is applicable to all similar designs. If a bush is to be fitted, the bearing casting should be faced and bored as explained and the bush turned and fitted to it afterwards.

Some Accurate Electrical Measuring Instruments.

By V. W. DELVES-BROUGHTON.

(*Concluded from page* 155.)

SOME EXPERIMENTS ON LOUD-SPEAKING TELEPHONES.

SOME years ago I began a series of experiments on loud-speaking telephones, but I had to abandon them on account of want of time and appliances. I succeeded in making an excellent transmitter, and think that I was nearly on the right road for the receiver. After a number of experiments the transmitter shown in Fig. 1 was evolved.

My first difficulty was to obtain a suitable carbon. Finally, after a lot of experimenting, I succeeded in making very good carbons in the following manner. One part of high-grade graphite was mixed with 10 parts (by weight) of lamp-black, and the whole made into a thick paste with a strong syrup of crystallised sugar. This was made into a mass that would scarcely adhere together till thoroughly beaten; it was then hammered into metal rings, ¼ in. thick by 1½ ins. in diameter, a piece of paper being laid flat on an iron block and the ring laid over this during the process. Next the rings, with the carbon, were thoroughly baked in an oven. The carbon, during this process, contracted sufficiently to allow it to drop out.

Next, the carbon blocks were packed in an iron box and thoroughly surrounded by charcoal powder, and the whole slowly raised to a white heat. The carbons were, when cool, scraped clean from the adhering charcoal and soaked in syrup for about ten hours; then again baked and heated to white heat, after being packed in the iron box as before. This process was repeated several times till the carbons became quite compact.

This being completed, the carbons were rubbed down on a flat stone with sand and water to the required thickness. One side of each carbon was next heavily coated with copper, using an acid sulphate of copper bath and a piece of zinc suspended in salt and water in a porous pot for the purpose. To this copper coating very flexible wires were soldered to make the necessary connections. After this they should be thoroughly washed for several hours in running water. These carbons should not be too hard, neither should they be too soft; they should be just hard enough to prevent the nail scratching them, and a pin should be able to scratch them fairly easily.

After having made the carbons, a small hardwood box (3½ ins. by 2½ ins. by 2½ ins. internal measurement) was made, the back being screwed on, so that the internal mechanism could be readily reached.

Next a pine diaphragm G (4 ins. by 2½ ins. by 3-32nds in.) was made and fixed at an angle to the wooden block, as shown in Fig. 1. Near the centre of this one of the carbon blocks H was cemented, and round this a cork ring K was fitted, and the intervening space—about ⅛ in.—lightly filled with cotton-wool W in such a manner that it stood up all round and formed a sort of wall. Next a layer of granulated carbon—formed by breaking up one of the carbon blocks—was placed on the top of the carbon block, and another carbon block

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laid on the top of this. Then a layer of cotton-wool, and on the top of all a piece of very thin silk ribbon, to which a penny piece had previously been cemented. This silk ribbon was cemented into a fine sawcut in the wooden block at one end and under a strip of wood fastened to the diaphragm at the other. This silk ribbon must not be pulled the least bit tight, or it will spoil the sensitiveness of the transmitter.

The block holding the diaphragm, carbon blocks, etc., was screwed and glued to the case, as shown, in such a manner that the diaphragm does not touch the box in any part except where fixed to the block.

The flexible wires from the carbon blocks were connected to two small terminals on the top of the box and the whole suspended to the wall by rubber rings, two short lengths of rubber tube being fixed to the back to damp external vibrations. For the same object the lead weight shown in the drawing is provided, and the perforated zinc screwed to the front tends to absorb over-tone vibrations in the air.

The arrangement below the case is the "call," which consists of a pair of pieces of knitting-needle securely fastened to the flange of the box. On pinching these together and suddenly releasing them, they vibrate like a tuning-fork, and cause quite sufficient noise to call anyone in the room at the other end; but this was found to be unnecessary, as that could be done by the voice.

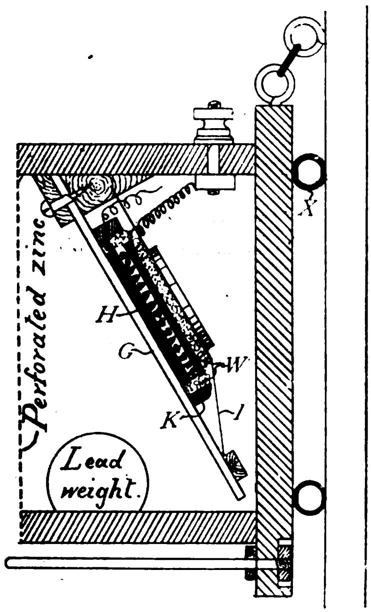

Fig. 1.

Receivers.—I made several experiments in receivers, but did not reach any finality. First a receiver was made after the type shown in Figs. 2 and 3, Fig. 3 being a section through the line A B. In the first instrument electro-magnets instead of the permanent magnets M were used, but these had to be abandoned, as the noise caused by the irregularity of the current due to the imperfect depolarisation of the cells used was very objectionable.

A is a coil wound with No. 36 wire on a paper bobbin, surrounding the soft iron core C, screwed through the plate of soft iron D and locknut P.

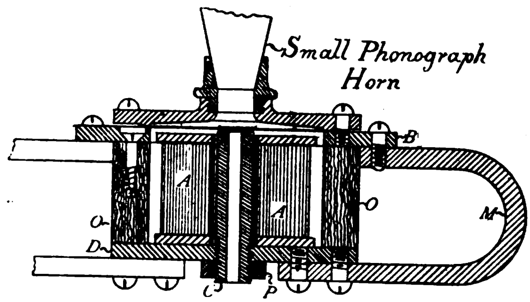

Fig. 3.

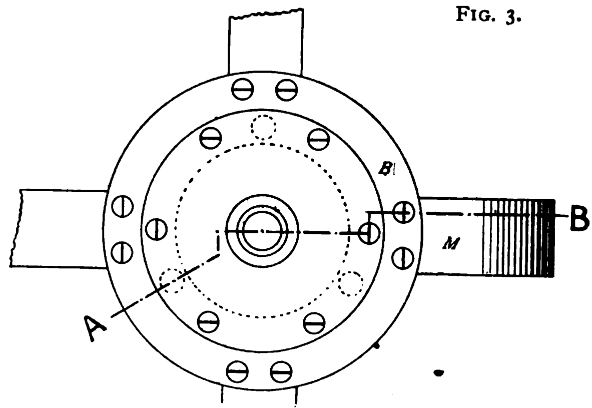

Fig. 2.

A wooden cylinder O was placed round the coil, and over this a ring of soft iron D was placed and held in position by three brass wood screws B and D were joined by the four permanent magnets M, which were about ¾ in. wide by 3-16ths in. thick. As the magnets were made slightly lower than the distance between B and D, the wooden cylinder was tightly held in position when the magnets were screwed up.

The cover was made in ebonite, and screwed down tightly by six screws, as shown in the drawing, a screwed socket being formed to attach the horn, as shown.

Next a number of trials were made with different diaphragms, and finally the diaphragm shown in Fig. 4 was selected, as giving the best results. Various windings were next tried on the bobbin A, but there was very little choice between Nos. 30 and 40 wire, and finally No. 36 was selected. It was found, however, that the best results were obtained when the induction coil was wound to about double the resistance of the coil A.

When A had finally been decided upon, hot wax and resin was run in between A and O (A had previously been well boiled in the same mixture); this quite unexpectedly enormously increased the power of the telephone.

Some bother was caused during these experiments by the magnets M (which were forged out of old files) losing their magnetism, so the telephone

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was reconstructed, as shown in Figs. 5 and 6. The same dimensions were kept, the magnets M only being altered to straight bars of special magnet steel, as shown in the drawings. Six magnets were now used instead of four, and the following alterations were made—first, the soft iron core was split with a hacksaw, as shown; B was parted at S, and secured by a piece of thick fibre and four screws on the underside; and the bobbin A was divided into two parts, each of which was separately wound with No. 40 wire, the four ends being independently connected to four terminals secured in the plate D (Fig 6), the intention being to test the relative values with the two coils in series and parallel, but quite unexpectedly it was found that when the upper coil only was connected up the best results were obtained.

To return to the diaphragm (Fig. 4). This was formed out of sheet iron of 24 gauge. The black marks shown in the figure were painted on with a resisting varnish, and the other side entirely covered with varnish. The iron was then etched away with strong nitric acid, with a little water added till the action became energetic. After a few minutes' action the plate was removed from the acid, washed, dried, the varnish touched up,

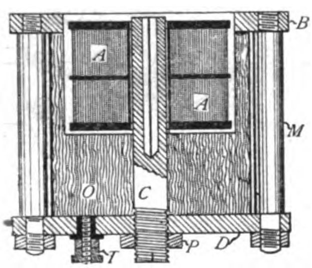

Fig. 6.

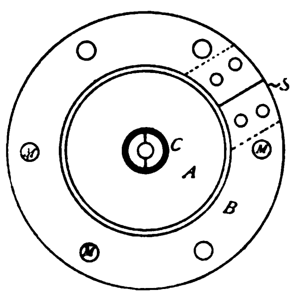

Fig. 5.

heated over a lamp to secure the thorough attachment of the varnish, and returned to the acid. This process was repeated till the unvarnished part of the plate was reduced to the thickness of a piece of paper. Sealing-wax dissolved in spirits of wine seems as good as anything to use for this purpose, but care must be taken that the action is not allowed to continue too long without re-varnishing and heating, or the varnish will peal off in a flake. Any little lumps unacted upon by the acid should be scraped off periodically during the process with a three-cornered scraper. The diaphragm having been completed, it should be thoroughly washed and subsequently japanned.

The induction coil for use with these instruments requires careful working out. I did not get very far in this matter, but it appears that the core should be kept as short as possible, so as to make the period of the coil very short and to enable it to respond to variations of current of very short duration. I am not quite sure if it would not be better to do away with the iron core entirely, but I must leave this for other experimenters to work out.

This article should have appeared before the last on "A Sensitive Polarised Relay," but when that article appeared I had not thought of writing a series on "Wireless Telegraphy." Having seen Mr. Howgrave-Graham's book on this subject,

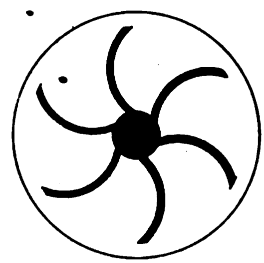

Fig. 4.

it has occurred to me that a series of articles touching on certain points in connection with that subject might at any rate interest those who have had the opportunity of studying this excellent work.

This ends the series of "Some Accurate Electrical Measuring Instruments," and I hope that they have proved of some use to my readers. Judging from the number of private enquiries that I have received, they have stirred up quite a few people to start investigations in this interesting branch of electrical research.

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. Vol. VI. Edited by Joseph G. Horner, A.M.I.Mech.E. London: Virtue & Co. Price 7s. 6d., postage 5d.

In this volume the subject of Indicators is continued, and some of the other important subjects dealt with are Induced Draught, Induction, Iron Foundry Work, Injectors, Insulators, Iron, Jacks, Jacketing, Jigs, Joinery, Joy's Valve Gear, Keys, Kinetic Energy, Lacquer, Lagging, Lancashire Boilers, Lathes, Launching, Lifting Plates, Lifts, Link Motion, Liquid Fuel, Loam Moulding, Locomotives, Lubricators, Mandrels, Manholes, Mechanical Stokers, Metal Mixing, Milling Cutters, Mond Gas Plant, Moulding Tools, Nails, Nuts, Odontograph, and Oil Engines. The illustrations, as in the preceding volumes, are good.

An apparatus for life saving at sea has been invented by Mr. R. Lavachery, a Belgian engineer. It consists of a rifled cannon from which a projectile is fired; to the projectile are attached a cable, an anchor, and a rocket. The mechanism is said to be very simple, and for humanitarian reasons the inventor has not patented it.

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Locomotive Notes.

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

Reference was made in a recent issue of these notes to the fact that on the Great Western Railway some 0—6—0 type goods tender locomotives are undergoing at the present time a process of conversion into tank engines of the 2—6—2 type, and now, by courtesy of Mr. G. J. Churchward, locomotive superintendent, the writer is enabled to provide illustrations and dimensions relating to the engines before and after conversion.

Comparison of the dimensions shows that but very little of the original engines can remain in the new form they have assumed. The boiler is entirely different, and new cylinders have been fitted. Even the coupled wheel spacing is different, and, of course, the frames have had to be lengthened. However, the design as now appearing is a very smart one, and it conforms to modern Great Western locomotive standards in all respects. The side tanks extend the whole length of the boiler and smokebox and a clearance has been made in them between the leading coupled and driving wheels to permit of access to the motion inside the frames. The boiler is of the usual coned pattern with Belpaire firebox, and the extended smokebox rests in a saddle cast in one with the cylinders and valve chests. The two ends of the locomotive are carried upon pony trucks having radial movement, and

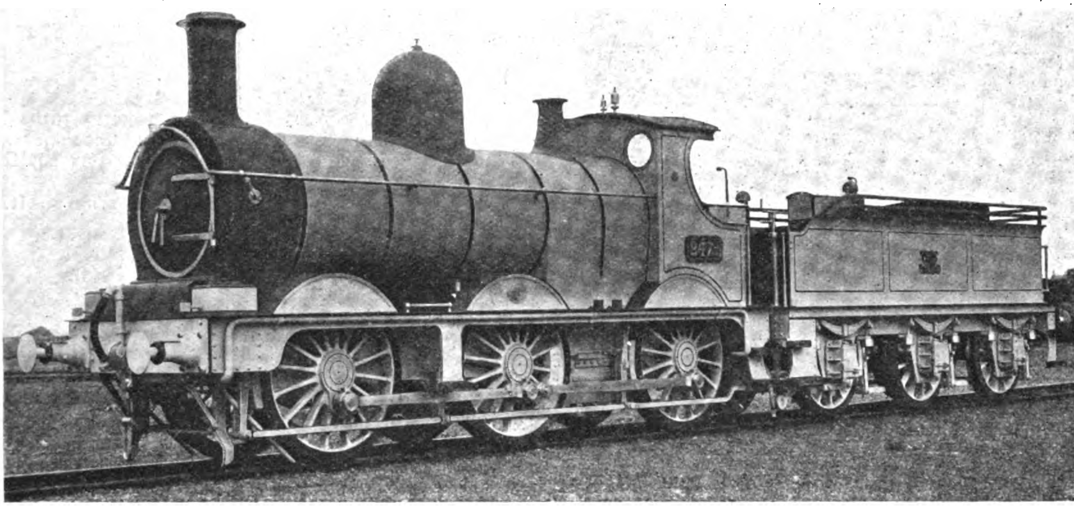

Fig. 1.—Great Western Railway 0—6—0 Type Locomotive with Tender, now Converted to 2—6—2 Type Tank Engine.

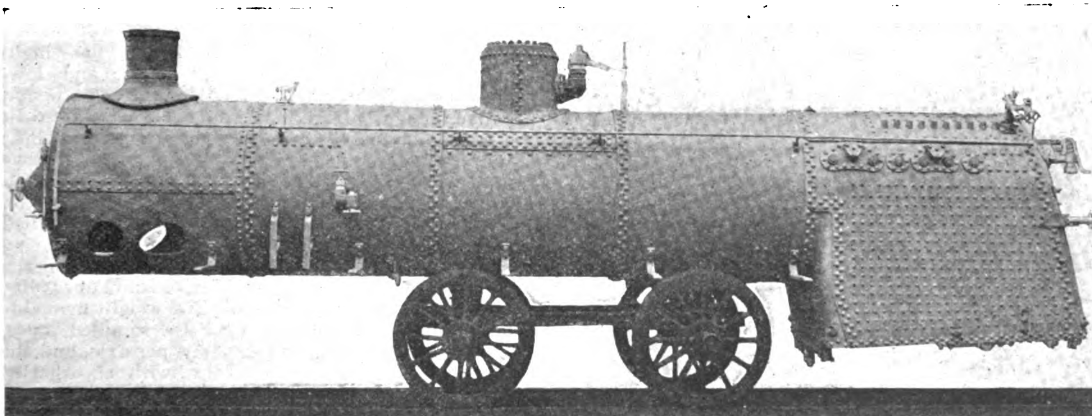

Fig. 4.—Boiler of Italian 2—6—2 Type Express Locomotive.

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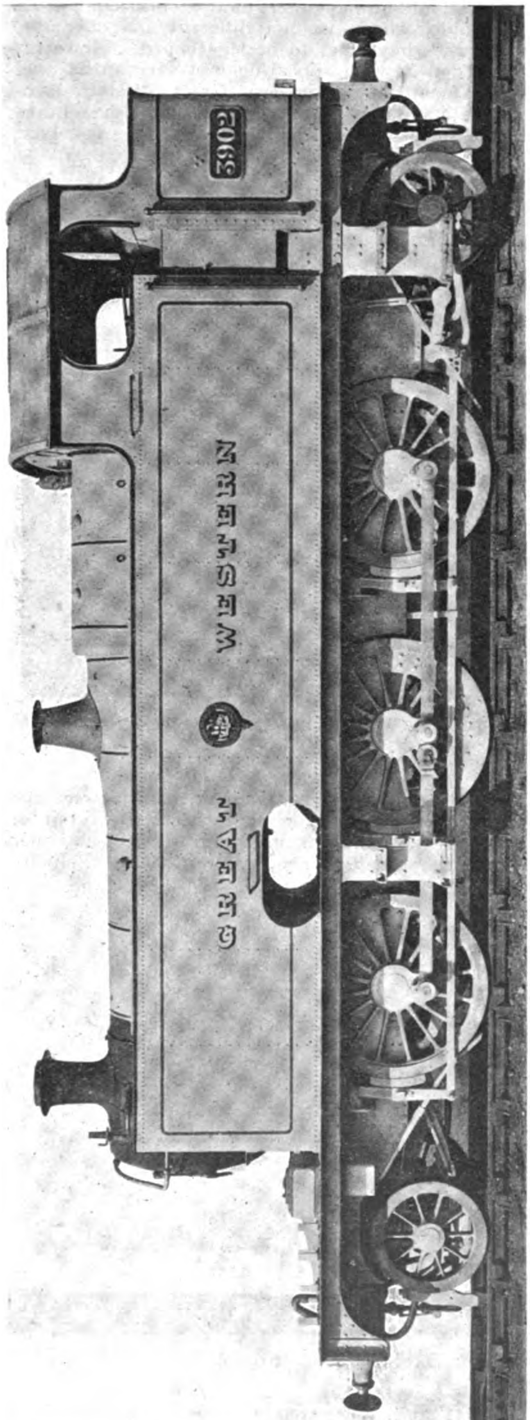

FIG. 2.—GREAT WESTERN RAILWAY 2—6—2 TYPE TANK ENGINE CONVERTED FROM 0—6—0 TYPE GOODS ENGINE.

these impart the necessary flexibility to the wheelbase. Altogether, the engines should prove very useful in heavy and fast suburban service.

The following are the leading dimensions, both before conversion and as now existing:—

	Original Dimensions.	Present Dimensions.
Cylinders	17" × 24"	17½" × 24"
Track wheels diam. ..	—	3' 2"
Coupled wheels diam.	5' 2"	5' 2"
Wheelbase	15' 6"	28'
Boiler, diam., outside	4' 5"	4' 9½" & 4' 2"
,, length ..	10' 3"	10' 6"
Tubes: number ..	249	255
,, diameter ..	1¾"	1⅝"
,, length ..	10' 6¼"	10' 10 5-16ths "
Heating surface: tubes	1200 sq. ft.	1178·01 sq. ft.
,, ,, firebox	107·72 sq.ft.	93·85 sq. ft.
Total ..	1307·72 sq.ft.	1271·86 sq. ft.
Grate area	17·33 sq. ft.	16·6 sq. ft.
Working pressure ..	150 lbs.	200 lbs.
Tractive force ..	15,102 lbs.	21,339 lbs.
Weight in working order	36 t. 12 c.	62 t. 4 c.
Height of boiler centre	7' 3"	8' 3"

ITALIAN 2—6—2 EXPRESS LOCOMOTIVE.

The four-cylinder arrangement illustrated on pp. 83 and 84 of THE MODEL ENGINEER for July 25th has more recently been applied to some heavy express locomotives of the 2—6—2 type built by the Societa Italiana Ernesto Breda, of Milan, and the first of the engines is illustrated on page 179.

The method of disposing the cylinder and valves, and the driving arrangements generally, may be followed from the previous description, which applied to another type of engine. The "Prairie," or 2—6—2 locomotive, has hardly ever been employed outside America; but it is a very good type indeed, and offers advantages where it is not desired for one reason or another to employ a leading four-wheeled bogie as well as a pair of trailing carrying wheels.

The Italian locomotive illustrated has high-pressure cylinders 14¼ ins. diameter, and low-pressure cylinders 23¼ ins. diameter, the piston stroke being 25⅝ ins. The coupled wheels are 6 ft. 2 ins. diameter, leading truck wheels 3 ft. 1½ ins., and trailing carrying wheels 4 ft. diameter. The total wheelbase is 27 ft. 8¾ ins. The boiler has an outside diameter (maximum) of 5 ft. 2¼ ins. It contains 273 2-in. diameter tubes, and is pitched with its centre line 9 ft. 3 ins. above rail level.

The total heating surface is 2,430 sq. ft., and the grate area 37·6 sq. ft. A working pressure of 235 lbs. to the square inch is carried. The weight available for adhesion, distributed over the coupled axles, is 90 tons, an average of 13·3 tons per axle, and the total weight in working order, with six-wheeled tender, is 120½ tons.

NEW BRITISH BUILT LOCOMOTIVES FOR INDIA.

The Vulcan Foundry Company, Ltd., of Newton-le-Willows, Lancs., have quite recently despatched to India some fine express and goods locomotives for service on the Bombay-Baroda and Central India Railway, and the Bengal-Nagpur Railway respectively. The express locomotives are of the

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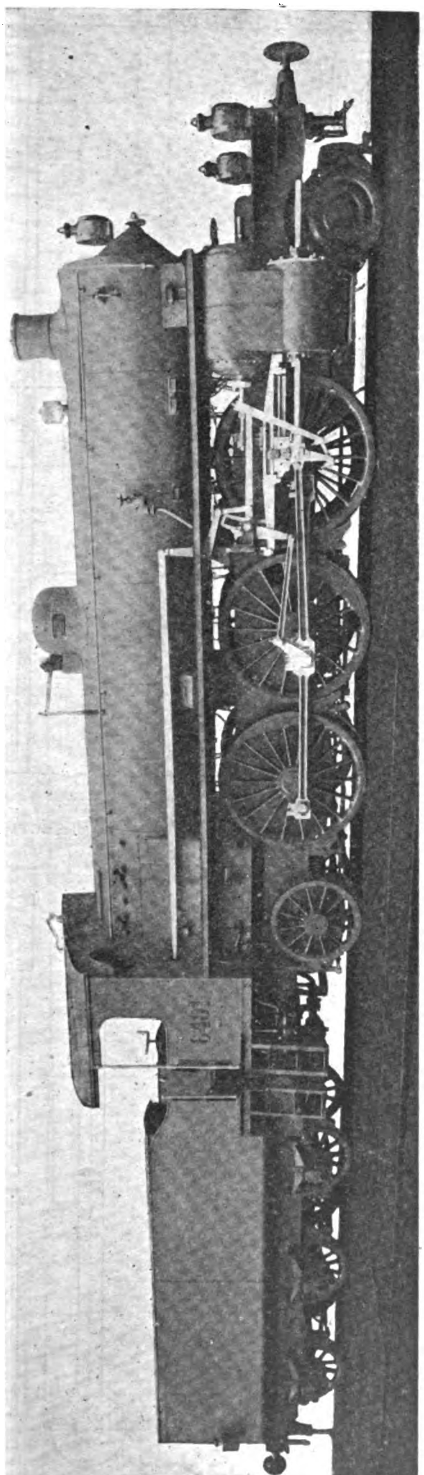

Fig. 3.—"Prairie" (2—6—2) Type Compound Express Locomotive: Italian State Railways.

4—6—0 type, and the goods engines of the "Consolidation" (2—8—0) type.

Both designs are remarkable for the largeness of the proportions adopted, and both are for the 5 ft. 6 ins. gauge. The engines will shortly be illustrated and described in these notes. The recommendations of the Engineering Standards Locomotive Committee are exemplified in the design of both types, although a few departures from the dimensions published in their report have been made. At the present rate of progress the Indian Railway Companies will in a few years be in possession of as fine and efficient a range of locomotive types as is to be found anywhere in the world.

A Design for a Handy Lathe.

By W. Muncaster.

(*Continued from page* 130.)

HEREWITH are given further drawings of various detail parts of the lathe. Fig. 18 shows the dimensions of the leading screw. The details of spindles, etc., are shown; these should be made out of the best mild steel. The lathe spindle (Fig. 19) will be turned all over, feather keys fitted, peg for loose collar driven in, screwed for faceplate, chuck, etc., bored at end for taper lathe centre. The shaft for back gear (Fig. 20) is turned out of ⅝-in. rod and keyways for seats of spur wheels. The slide for loose headstock (Fig. 21) turned, screw-cut, bored for lathe centre, and slotted as shown.

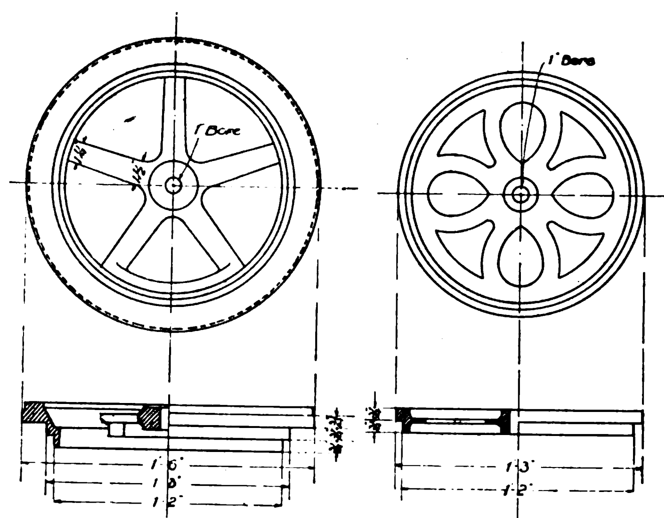

Fig. 29. Fig. 30.

Details of Flywheels.

The standards are shown in Figs. 26, 27, and 28. These are two in number, precisely alike in every respect, full details of which are given on the drawing.

The flywheel is shown in detail in Fig. 29. There are three different diameters of driving, 18, 15, and 14 ins. diameter, all ¾ in. wide.

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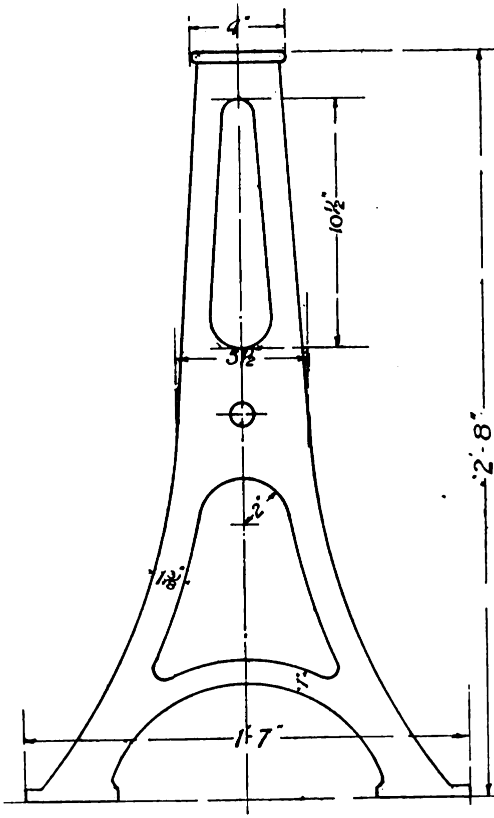
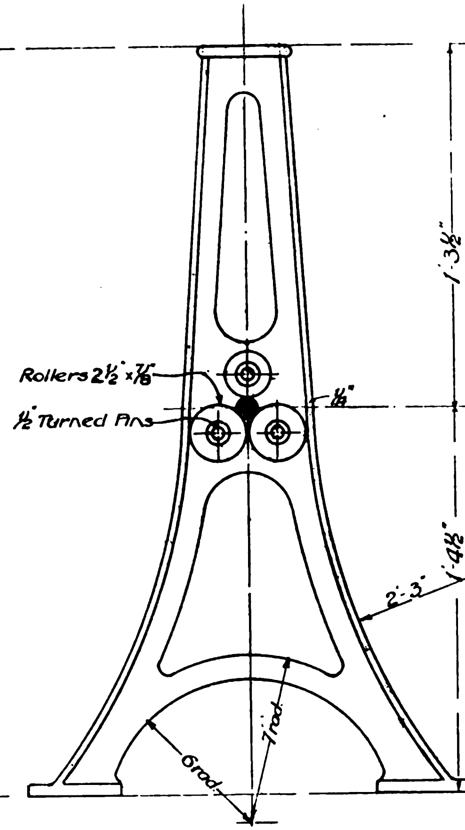




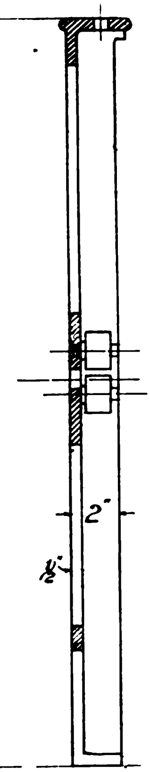
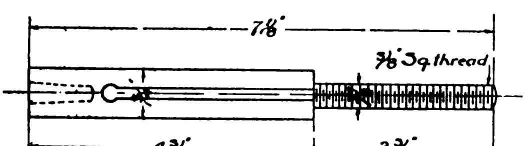


FIG. 26.—OUTSIDE ELEVATION. FIG. 27.—INSIDE ELEVATION. FIG. 28.—CROSS-SECTION.

CAST IRON STANDARDS. (*Two thus.*)



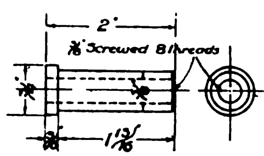


FIG. 21. FIG. 22.

SPINDLE AND SLEEVE FOR LOOSE HEADSTOCK.

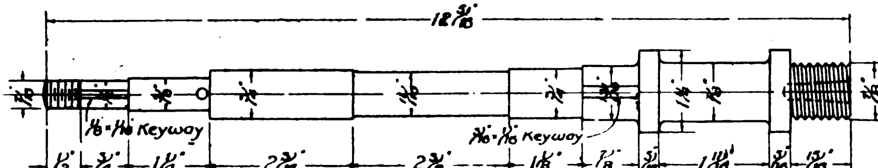


FIG. 19.—LATHE SPINDLE.

DETAILS OF A 3½-IN. SCREW-CUTTING LATHE.

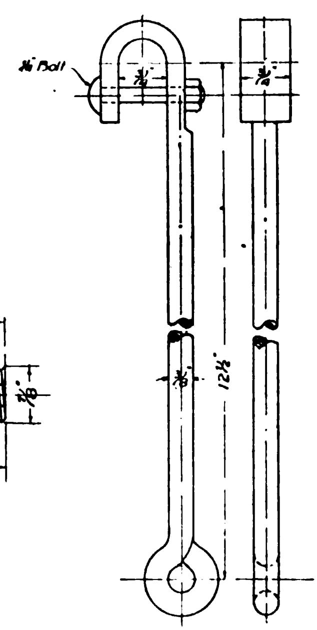


FIG. 31.—CRANK ROD

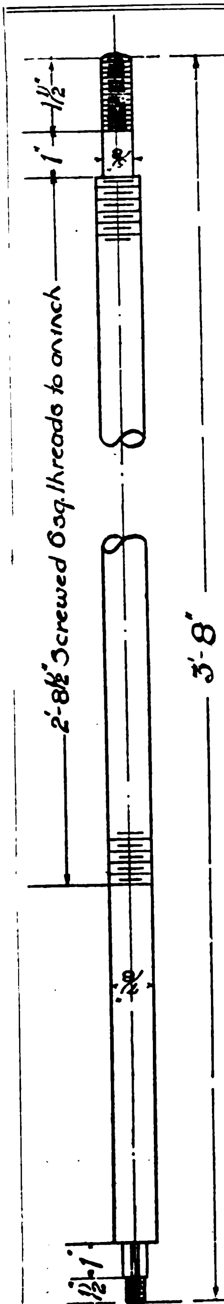
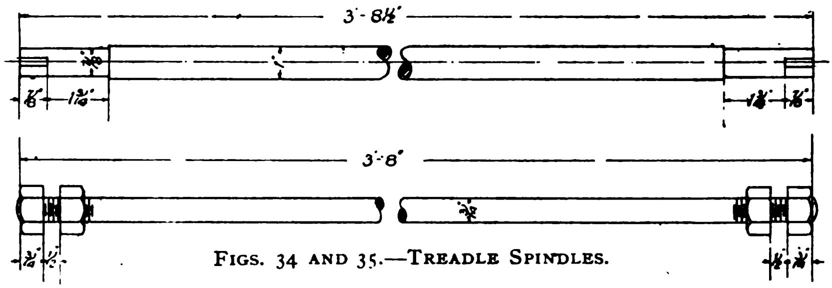


FIG. 18.—LEADING SCREW.



FIGS. 34 AND 35.—TREADLE SPINDLES.

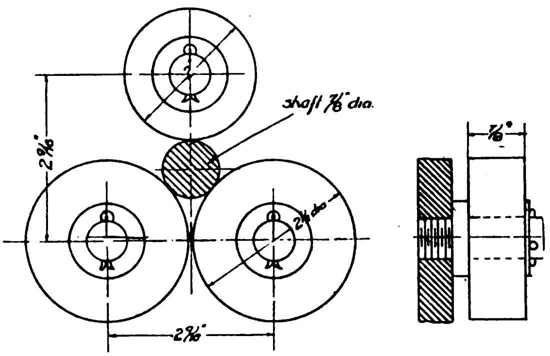


FIG. 37.—ANTI-FRICTION WHEELS.

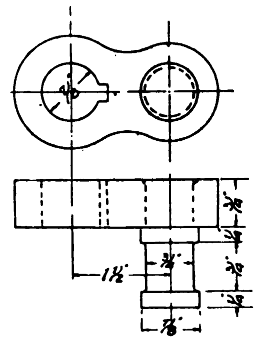


FIG. 36.—CRANK.

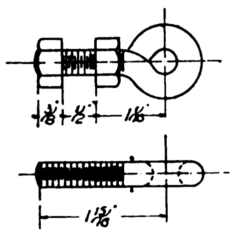


FIG. 32.—(*One off.*)

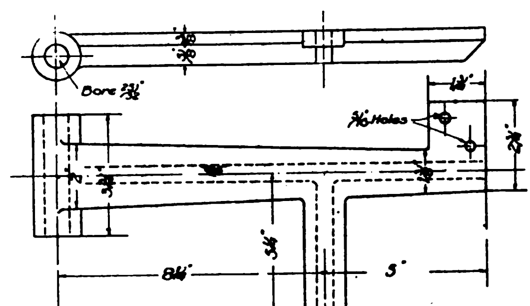


FIG. 33.
TREADLE DETAILS.

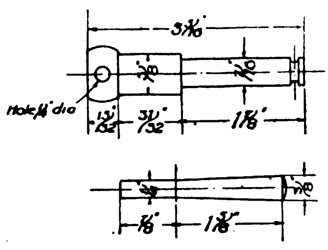


FIG. 25.—(*One off each.*)

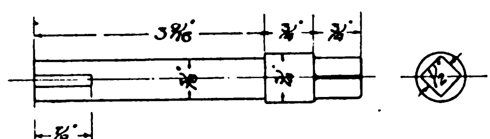


FIG. 24.—(*One off.*)

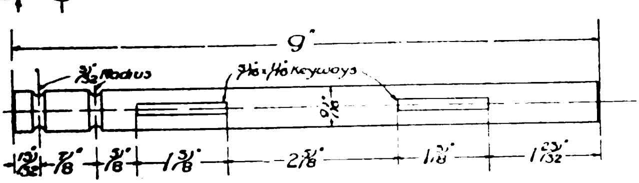


FIG. 20.—SHAFT FOR BACK GEAR.

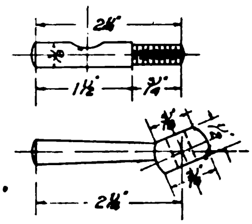


FIG. 23.
(*One off each.*)

The remaining details of foot gear will be understood from Figs. 31 to 35 without any further description. Details of the cranks (Fig. 36), of which two will be required, are given, and of the anti-friction wheels (Fig. 37).

A lathe that is fitted merely with rests for hand tools may be of great service in the hands of an expert, and suited to a great variety of uses in wood and metal working. The capacity, however, may be greatly multiplied if we go a step further and fit the lathe with screw-cutting gear. To this end we require a saddle, a slide-rest (compound), a leading screw, and a set of change wheels.

(To be continued.)

A 1½-in. Induction Coil.

By H. Cooper.

HEREWITH are photographs and description of my 1½-in. induction coil (with other apparatus for use with same), which I have recently completed. The coil is of my own design and measurements, and is the result of nearly nineteen months' work. To begin with the baseboard, this is made from well-seasoned mahogany, stopped with plaster-of-Paris, and French polished, this giving a beautiful finish to the woodwork, and contrasting nicely with the brasswork. The base is 4 ins. in depth, 18 ins. long by 13 ins. in width. The mahogany cheeks of the coil, and the base of the mercury-break, are also French polished. The primary winding consists of two layers of No. 18 D.C.C. copper wire wound tightly and evenly over a soft iron core of No. 22 S.W.G., 8 ins. long and 1 in. diameter, the whole finally soaked in shellac varnish. A tube of brown paper, also soaked in shellac varnish, insulates the primary from the secondary. Over this tube is wound the secondary: 1½ lbs. of No. 36 s.c.c. copper wire, first a layer of wire which is well shellaced; then over this a turn of thin and stiff paper, also shellaced over, then another layer of wire, more paper, and so on throughout the coil. This I have found a very satisfactory way of insulating the secondary. Each layer of secondary diminishes in its number of turns by three each end.

My object of winding in this manner is to reduce the possibility of internal sparking from the ends of secondary to the iron core. The secondary itself

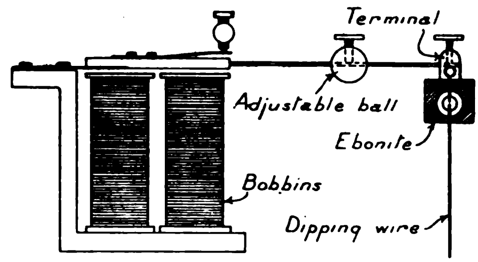


Fig. 3.—Diagram of Mercury Break.

is finished off with a covering of paper ebonite, and the ends of secondary led out to the terminals mounted on the cheeks, and from these terminals to the discharging pillars, these being turned from ⅜-in. brass rod, screwed at one end with nuts and washers to screw to baseboard.

The next thing undertaken was the mercury-break. The base of same (which will be clearly seen in the photograph), is of ⅜-in. mahogany, 3½ ins. square. On this is mounted the armature, bobbins, and contact-breaker, of an electric bell. The long wire on which the hammer was mounted was removed from the armature and in its place was screwed a 4-in. length of silver-steel. A ½-in. brass ball was drilled and tapped for a setscrew, so that this ball can be slid up and down the armature and clamped in any desired position. Obviously a slow or fast "make-and-break" can be obtained at will. This method was recommended by a reader of The Model Engineer some time ago. The dipping wires are adjustable vertically and horizontally for the purpose of obtaining the best results, *i.e.*, a long make and a sudden break, which, in my opinion, are the two essential points of a good contact-breaker. This method of adjusting will be readily understood by referring to the sketch (Fig. 3). The mercury pots are filled with ⅜ in. of mercury, the mercury in one pot being covered with ¼ in. of alcohol.

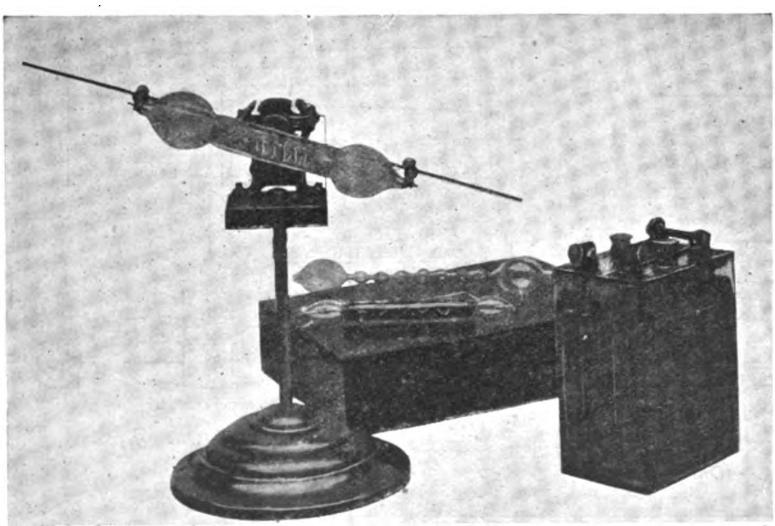


Fig. 4.—Showing Vacuum Tube Rotator.

The next piece of work was the commutator, and is made in precisely the same way as recommended by Mr. Pike in his series of articles on "Induction

Coils." Its barrel was turned and French-polished in the lathe, the brass work is of springy brass, 1-32nd in. thick, 1 in. wide, fitted with 1¾-in. terminals to screw down to baseboard, which in turn are connected underneath to the primary. The condenser consists of a shallow mahogany box 7 ins. by 6 ins., French-polished outside. Tinfoil sheets are fifty in number, measuring 6 ins. by 4 ins., interleaved by parafin waxed papers, and the whole compressed into a compact mass while warm, the two wires from same connected up in the usual way across the mercury break. Other apparatus which I have made for use with the coil will be seen in the photograph, Fig. 4. On the extreme left of same will be seen a vacuum-tube rotator. It consists of an overtype motor, with Siemens armature wound for 6 volts, mounted on a heavy brass stand to prevent of its toppling over when revolving. The vacuum tubes glowing while revolving on the motor afford a beautiful effect in the dark. On the right of the photograph will be seen one of the two accumulators which furnish the current for the coil, and which is of 4 volt 30 amp. capacity. Plates 4 ins. by 4 ins. and three negative; and two positive plates in each cell.

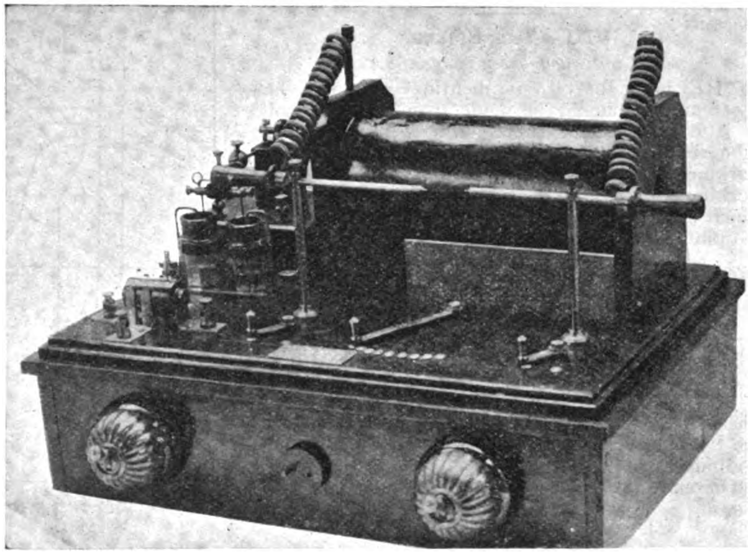


FIG. 1.—FRONT VIEW OF COIL.

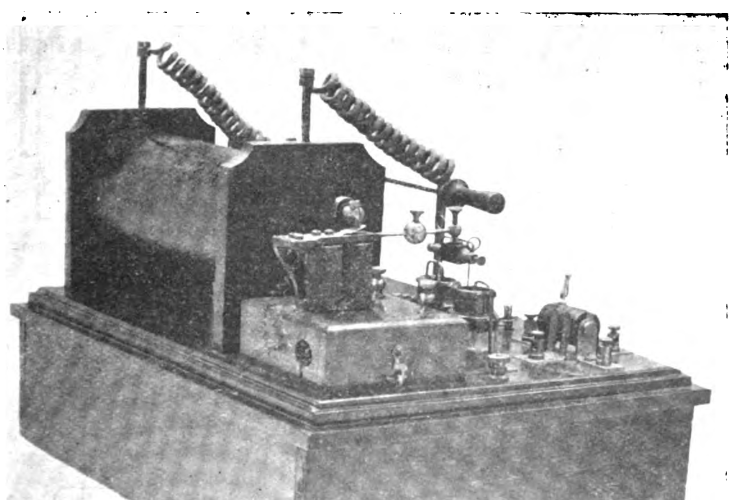


FIG. 2.—SIDE VIEW, SHOWING MECHANISM OF MERCURY BREAK.

The coil can also be used for medical purposes if required, by cutting out the condenser (the switch for this will be seen on the extreme right of coil, in front of discharger pillar), and inserting the 9 way resistance (which is seen between the discharging pillars). Other tumbler switches will be seen on the bottom of the baseboard, the one on the left is for switching on the mercury break, which, by the way, is furnished with current from a 4-volt accumulator; and the one on the right is for switching on the primary. The plug which is seen between these two tumbler switches is an ordinary wall-plug, and by using this a ready and secure connection between primary and accumulators, without the disadvantage of screwing up terminals and twisting up wires, can be made.

A peculiar characteristic of an induction coil is, I have found, that a longer spark discharge may be obtained with the commutator in one direction than in the other. I have seen a difference of nearly ¼ in. I may say that the building of the above coil has helped me to pass many an insfructive evening, and an induction coil is a piece of apparatus quite within the scope of any amateur who has a little patience and time at his disposal.

IT is stated that a new German composition is to take the place of cedar in lead pencils. The principal ingredient of the substitute is said to be potatoes. The manufacture of these pencils will take about half of the time required to make cedar pencils.

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A Design for a Small Model Undertype Engine.

By Henry Greenly.

VIII.—The Boiler.

(*Continued from page 88.*)

THE inner barrel, as mentioned in the last article, should be made from 10 ins. of solid drawn copper tube. The thickness of the tube should not be more than necessary for the working pressure. Reckoning 100 lbs. as the working pressure and a factor of safety of 10, which is amply sufficient to cover all contingencies, the plate thickness should be:

$$PT = \frac{D \times WP \times F}{S \times 2}$$

Where PT = plate thickness.
WP = working pressure.
F = factor of safety.
S = strength of copper plate (say 25,000 lbs. per sq. in.).

There is no riveting allowance to make, therefore the "R," which is usually employed in this formula, is eliminated.

Therefore:

$$PT = \frac{2\frac{1}{2} \times 100 \times 10}{25{,}000 \times 2} = \frac{1}{20} \text{ in.}$$

and the recommendation that tube should not be more than 1-16th in. thick is well within safe limits. If the tube is too thick the boiler will not steam quite so freely, and also it will be needlessly heavy. With mistaken ideas of the strength

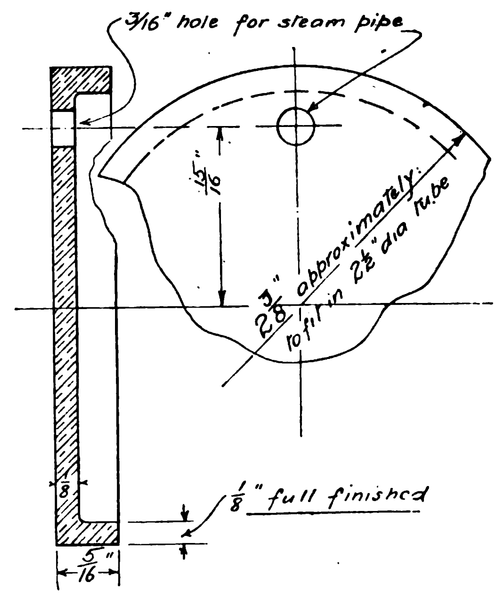
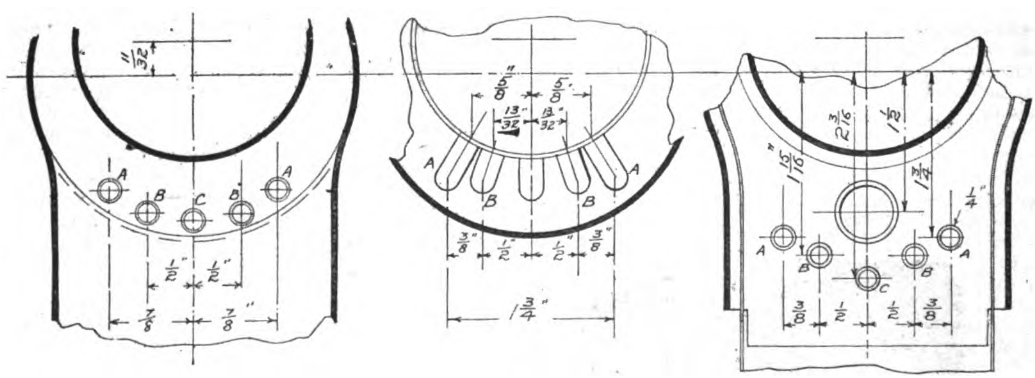
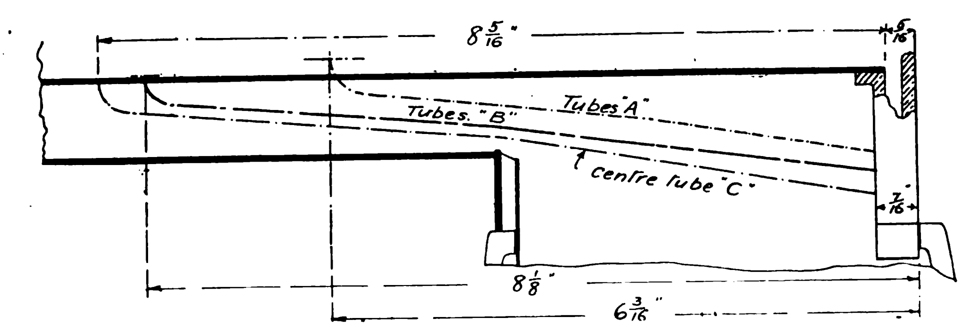


Fig. 42.—Flanged End for Inner Boiler Tube.



Cross-section at Throat-plate. Cross-section at Front of Boiler. Cross-section at Downcomer,



Longitudinal Section, showing Inclination and Bending of Water-tubes.

Fig. 43.—Setting-out of Water-tubes.

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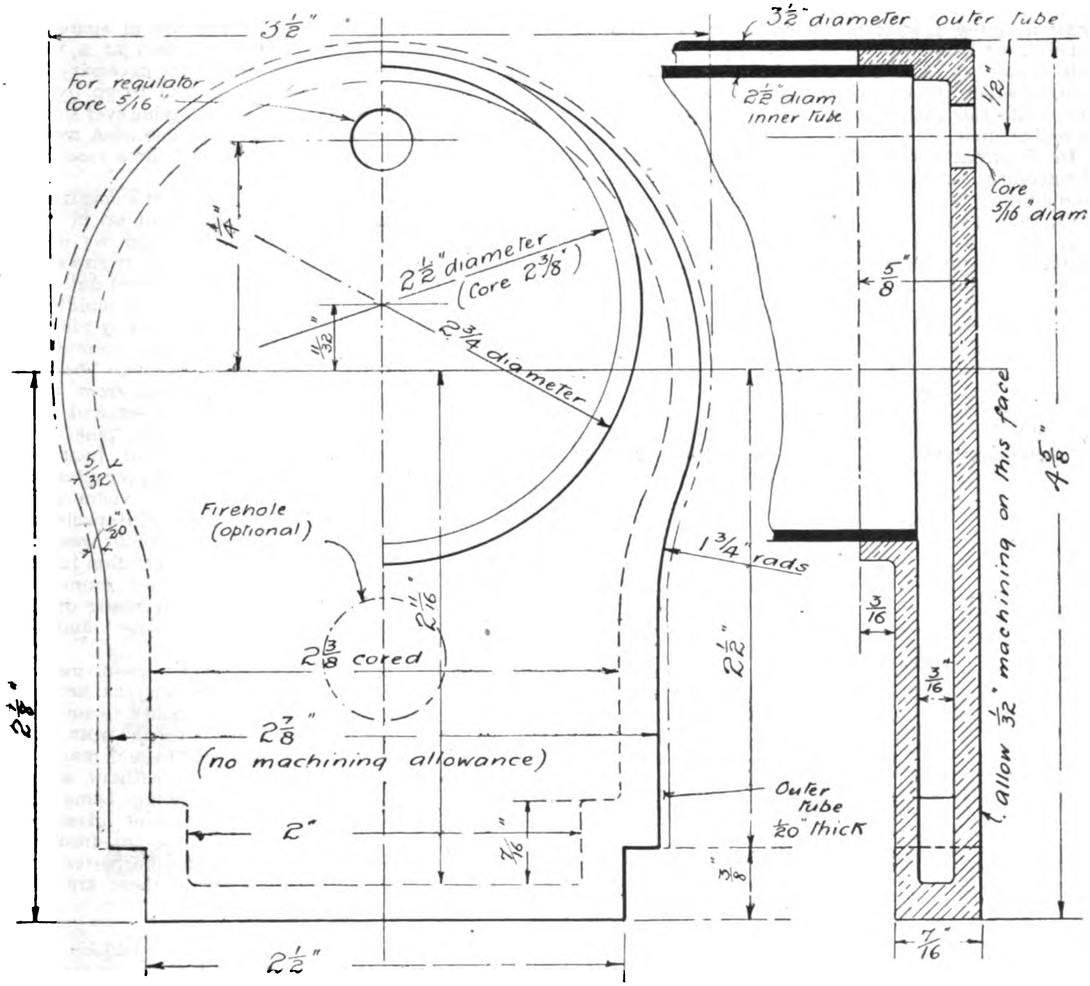
required, the writer has seen even ⅛-in. tube used for such a boiler as the one at present being dealt with; but this sort of thing is sheer waste of good copper.

The tube should be trued up on a wooden mandrel, and the inside of one end and the outside of the other cleaned for silver-soldering. The downcomer is of the improved pattern, which does away with the separate end used in the earlier forms of this type of boiler, and is a standard size for model locomotives with 3½-in. and 2¼-in. tubes. The outer face of the downcomer casting should be cleaned up on the lathe, and when this is done it may be reversed and fixed on the face-



Half Elevation of Outer Face. Half Elevation of Inner Face. Section with Inner and Outer Barrels fixed.

FIG. 44.—IMPROVED DOWNCOMER AND BACKPLATE.

positions of the tubes should also be marked, as shown in Fig. 43, and the centre lines also drawn in for the safety valve. The front end of the inner boiler should be a sound brass casting, and if there is any tendency in the casting to be porous it should be hammered before turning the flange to fit inside the boiler. The thickness of the casting should not be more than ⅛ in. all over when finished. For those who intend to do their own pattern making, Fig. 42 gives the proportions of this particular portion, and shows the position of the main steampipe.

plate eccentrically, and bored to take the 2¼-in. tube.

Where a standard casting is obtained, no provision will be found for the firehole (see opening marked "air tube" in the general arrangement drawing). If this is desired, then the downcomer should have a ¾-in. hole drilled in it as shown. Where new patterns are to be prepared this hole may be cored right through, not as at A, Fig. 45, but as at B. This will help the moulder to provide a better casting, as the writer understands this particular design of downcomer is a little trouble-

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some in the foundry. The long thin core, unsupported at the end, causes a considerable number of "wasters" to be produced, and although the second method of arranging the fire-hole (Fig. 45, B) is all right as far as it goes—it saves the subsequent fitting of the piece of tube—it weakens rather than strengthens the core. The writer therefore suggests the method A as the better of the two. When the flange for the 2½-in. tube is being bored, the portion of the downcomer from which the water tubes start may also be cleaned up. Of course, this is not so essential as in the case of the outer face, to which the boiler fittings have to be affixed, but while the casting is on the faceplate it may as well be done.

In the matter of silver-soldering the front end downcomer, the pad for the safety valve, and the water tubes, little can be said which will be of very great value to the builders of the model. It is here that skill and experience tells. However, it is important that the work should be clean. The downcomer and flanged end should be service-riveted on to the shell, or screwed with two or three brass pins or screws round its diameter to prevent the movement of the parts. The work should be built round with asbestos or broken fire bricks to retain the heat, and the heaviest parts should receive the greatest attention of flame so that the work is thereby evenly heated throughout. Furthermore, the "slicker" the work is done the better. Several bites at the cherry will tend to produce a rough, dirty job. Borax should be used as flux, and the silver solder may be held in a pair of tweezers or an old pin vice and applied to the joint when the work reaches the proper temperature. To clean off the borax, dip the work in a pickle of diluted sulphuric acid (about 1 to 20) when the boiler is nearly cold.

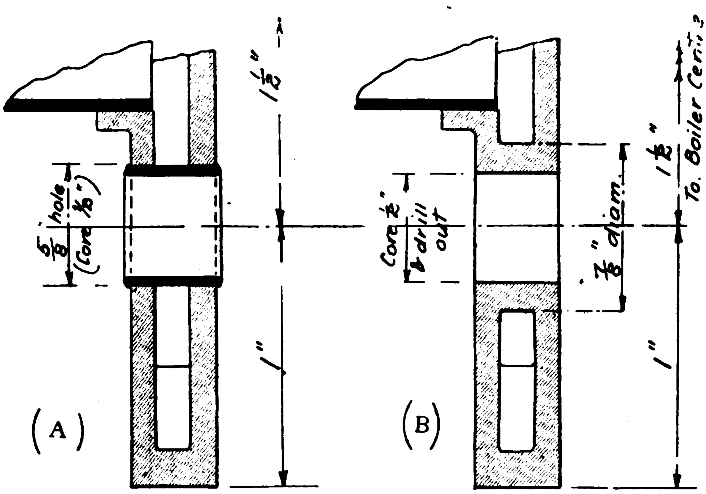

FIG. 45.—ALTERNATIVE ARRANGEMENTS OF FIREHOLE IN DOWNCOMER.

(*To be continued.*)

ACCORDING to the *Engineer*, the first railroad in Morocco was opened some months ago. It was built by a German company to haul stone from a quarry to tide water, and is only about 1¼ miles long.

Model Making for Beginners.

A Model of H.M.S. "Dreadnought."

By A. R. H. AND C. F. W.

IN describing this model of H.M.S. *Dreadnought*, we hope to encourage readers who are not able to make up their minds as to the subject of a "first model." It has been made in spare time, from practically scrap material and at a merely nominal cost, only a few tools being necessary. The only "working drawings" we had to go by were picture post-cards, neither of us having ever seen the original battleship. No attempt has been made to put engines in, as she is intended for a case model only.

We do not propose to deal with the construction of the hull at length, as it was built up in a way both tedious and unsatisfactory, and we do not advise anyone to try the same way—at any rate, in so small a model. The stern was carved out of two pieces of pine glued together along the middle line. The remainder was built of ¼-in. by 3-32nds in. planks, glued and screwed to permanent templets. The raised forecastle was cut from a 1-in. plank, glued and screwed to the deck which is ⅛-in. pine. The superstructure and boat deck was built up of pine planed to 1-16th in., but where curves had to be negotiated, pasteboard of the same thickness was used. The bridge-like erection just forward of the after funnel is a ventilating shaft made of pine, carrying a bridge and two searchlights.

The guns, ten 12-in. mounted in pairs—six on the keel line and two on either beam amidships—are turned from green heart on an old and inaccurate fretsaw lathe, without a toolrest, the shaping being done mostly with fine glasspaper. The turrets are cut from pine and fitted to barbettes by a wood screw; these are glued

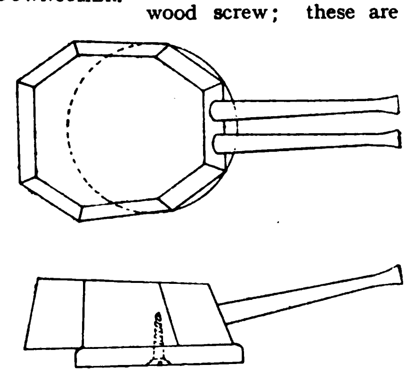

FIG. 1.—GUN MOUNTINGS. (*Half size.*)

to the deck, thereby allowing the guns their correct arcs of fire (Fig. 1). Each turret has depression

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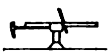
rails and carries on top a pair of machine guns behind shields. Machine guns are made of wire and paper and can be best understood from the drawing (Fig. 2). The funnels are worked up in

FIG. 2.—THE MACHINE GUN.



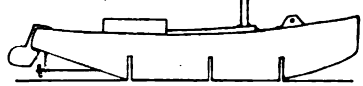


FIG. 4.—PICQUET BOAT.
(*Half size*).

pine, oblong on section, tops and bases fitted separately.

The boats, twelve in number, are made of paper with pasteboard thwarts and decks. The picquet boat has rudder and propeller, a pin acting as shaft forms and a searchlight on the fore. The yards are knitting-needles. The four upright booms—two

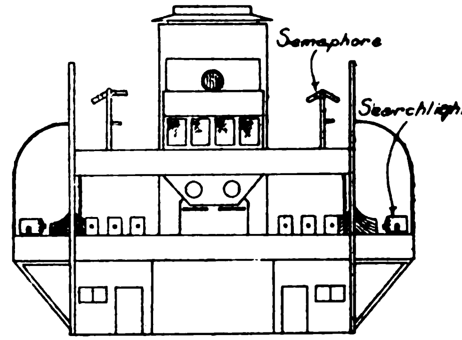
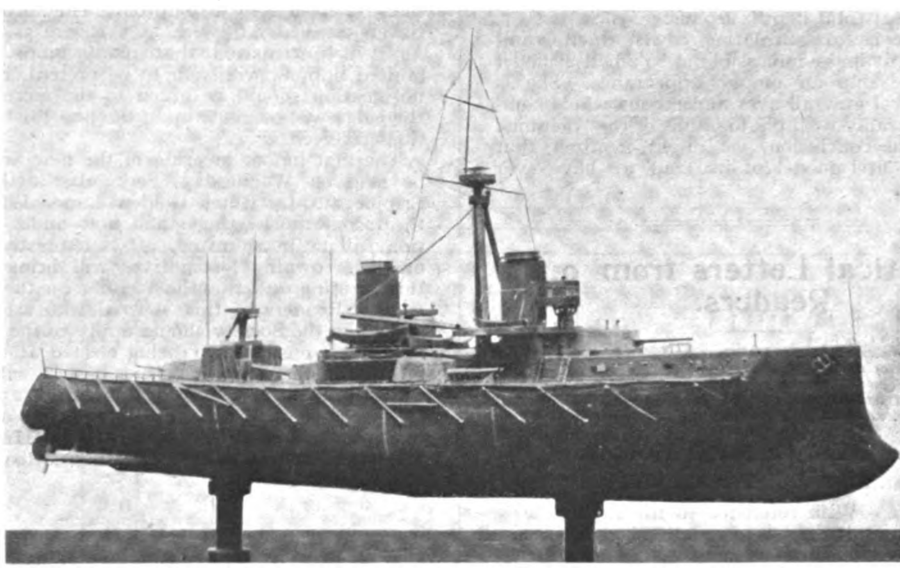


FIG. 3.—BRIDGE FROM FORECASTLE LOOKING AFT.



MODEL OF H.M.S. "DREADNOUGHT."

and cobbler's brads for funnels (Fig. 4). The absence of davits is noticeable in the original.

The masts are of correct tripod pattern, made entirely of wood and carrying fire-control platby the after funnel and two by the main mast—are for hoisting out boats, as is also the one above the picquet boat.

The ladders on to the bridge and forecastle are

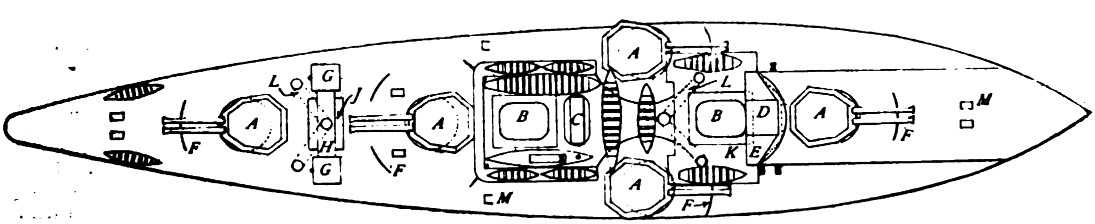


FIG. 5.—PLAN OF DECK. (*One-sixth full size.*)

A, Turrets carrying machine guns; *B*, Funnels; *C*, Ventilator and bridge; *D*, Chart house; *E*, Fore bridge; *F*, Depression guards; *G*, Fresh-water tanks; *H*, After bridge; *J*, Shelter decks; *K*, Boat deck and machine gun platform; *L*, Tripod masts; *M*, Hatchways.

1 in. high and fitted with eleven steps. They are fairly easy to make if the top and bottom steps are fitted first and allowed to dry, the intermediate ones being seccotined while the ladder is lying down.

The anchors are cut out of sheet lead and are ½ in. across and of the patent stockless type now used in the Navy.

The railings are "lace pins" hammered through the deck, gauged the right height, and carrying three strands of fine cotton, seccotined to each pin. This was the most trying job of all.

The torpedo nets were a stumbling-block. We first tried "netting" used by milliners, in rolls, but they looked heavy and ungainly, so we fixed on bundles of thread running between the fore and aft torpedo net booms. These are galvanised iron wire, seccotined at their lower ends to the ship's side and to the nets above.

The bridge and conning tower are best explained by the drawing (Fig. 3). Two semaphores are fitted. The somewhat massive erections around the mainmast are fresh water tanks used during steam trials. The dimensions are: Length, 3 ft.; beam, 6 ins.; total depth, 4·5 ins.

The absence of ventilating cowls, davits, and small deck fittings—impossible in so small a model—gives the ship an empty appearance. She is painted naval grey all over and on the whole compares favourably with photographs of the "genuine article." In conclusion, we might mention that this is the first model of its kind we have ever undertaken.

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.]*

Slow Feed for Metal Turning.

To the Editor of *The Model Engineer*.

Dear Sir,—With reference to the recent correspondence on slow feed to a lathe, perhaps some of your numerous readers may not be aware that there is a method to obtain a very fine feed for metal turning (where a self-acting lathe is not available) that can be applied to any lathe with a slide-rest, either large or small, while the rate of feed within certain limits can also be varied. This is what is known as the "Star" feed, and consists simply in placing a star-shaped cam on the end of the parallel slide of the rest. On the end of the work between the centres is a light arm, and as this revolves it strikes the points of the star, thus giving the feed to the tool. Of course, by varying the number of points of the star and also by having more than one arm the feed can be varied. Another variation of this method, but more suitable for turning rods, etc., is to put a ratchet wheel on the screw of the parallel slide. Fitted to this is a spring pawl, and this is reciprocated by an eccentric temporarily fixed to the work by a setscrew. The eccentric-rod is telescopic for the purposes of adjustment to the work. This variation of the device is more costly, and is, I believe, employed on some of the Holzapfel lathes, but the star feed is simple and can be adapted to any lathe for a shilling or two.—Yours faithfully,

Cranbrook. Sidney Russell.

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.

As announced at the last indoor meeting of the Society, Mr. Louis Brennan has courteously given permission for a party of the members, limited to thirty, to witness experiments with his new gyroscopic mono-rail railway, at New Brompton, Kent. The date of the visit is Saturday, August 31st. The party will travel by the train leaving London Bridge at 1.32 p.m., and return by the 5.32 from New Brompton. The special return tickets issued by the S.E. & C.R. are 3s. 2d. each. As it is anticipated that many more than the limited number will wish to be present, immediate notification should be given to the secretary, and the party will be made up of the first thirty applications received.

The first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from September 25th, 1907, to October 31st, 1908. Full particulars and forms of application may be obtained from—Herbert G. Riddle, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

Wireless Telegraphy. — A wireless message has just been sent from the Atlantic, over Ireland and England, to Steiglitz, near Berlin, a distance of over 500 miles. This record has been achieved with the Poulsen system. An apparatus was recently fitted on board the *Hellig Olav*, belonging to the United States Shipping Corporation, of Copenhagen.

"The Theory of the Steam Turbine."—This is the title of a paper by H. M. Martin, Wh.Sc., and R. H. Parsons, Assoc.M.Inst.C.E., read before the Junior Institution of Engineers on May 8th, 1907. The principles of steam turbines are dealt with in a concise manner, commencing with Barker's Mill, which is the earliest turbine on record. The Pelton water wheel, and Girard turbine (which is an impulse water wheel) are described, having a number of analogues amongst steam turbines. The de Laval, Curtis, Rateau, and Parsons' steam turbines are dealt with, and numerous diagrams and tables are reproduced. The price is 1s. 6d., postage 1½d.

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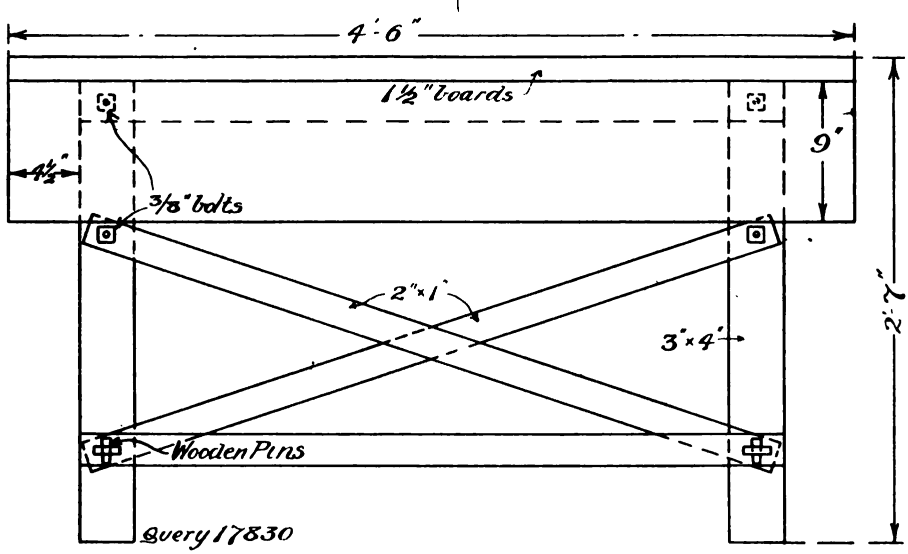
Queries and Replies.

[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:—

[17,830] **A Light Work Bench for Lathe.** H. W. N. (Lincoln) writes: I shall be obliged if you will furnish me with a design for a small combined lathe and work bench (about 3 ft. in length) so that it shall be light, rigid, and strong. It is a 12s. 6d. lathe I am thinking of purchasing to start with, the driving wheel of which will be one taken from a sewing machine. I am in "diggings" and have to bear in mind the possibilities of flitting, hence my desire for a bench which will combine lightness with strength.



ELEVATION OF A LIGHT PORTABLE WORK BENCH.

We should advise you to procure your lathe first of all, and then make your bench to fit it if necessary. Consult the lists of any of our advertisers, and then if you have any difficulty in making your bench, write us again and we will be pleased to assist you. The rough sketch above may be of service. If you make every part to bolt together, it will be convenient for packing up and carrying about with you if need be.

[17,960] **The Apprenticeship Question.** C. E. H. (Bellville, Cape Colony) writes: I should be very glad if you could give me any information as to whether there are any firms in or near London or in Glasgow or Edinburgh who take apprentices; at what premium; the conditions under which they take them; and whether one could support oneself by the pay received? I am 17 years of age, and I want very much to learn electrical engineering, but as the trade is so low at present I cannot get into any decent firm here. I will be very glad if you could give me the name of any book which tells about silver-soldering, brazing, welding, sweating, and soldering.

In reply to your enquiry *re* firms taking apprentices, we regret we can only give you some general information on the matter. All firms take apprentices, but under varying conditions. Some make it a rule that a test examination has to be taken; others take lads upon satisfactory reference; others stipulate for three or four or five years indentured service. Again, there are firms who take apprentices upon a month or two's trial with the option of either side to say "yes" or "no" as to continuance of service. In most cases the wages range from 3s. per week for the first year to 12s. 6d. or even 15s. during the third or fourth year. The premium system is not always a satisfactory one, as a heavy premium—signifying that the lad so apprenticed is more or less independent—has an ill-effect sometimes, owing to the tendency of the better-off apprentice presuming upon this, and causing trouble amongst his fellow workers and also the foremen and chargemen he comes in contact with. As we have an article in hand on this subject which will be published in an early issue, you will get more detailed information when it appears. We advise you to make application to several or any of the firms you like best, addresses of which you can obtain from any of the trade engineering papers. *Re* hard soldering, see article in April 23rd, 1903, issue; also page 232, March 5th, 1903, issue.

[17,962] **Ignition for Small Petrol Engines.** J. B. (Lymington) writes: I am writing to you with regard to a small petrol motor I am building. As it is a very small model and I do not want to be bothered with bulky electrical apparatus, I am thinking of using tube ignition. Will you be good enough to send to me a description of one and, if it is not asking too much, a sketch of the tube fitted to combustion chamber and timing gear, as I am quite ignorant of this form of ignition. Will you also tell me if it can be fitted to an engine of more than one cylinder? Will you also tell me if I should have to make any alterations in the ordinary carburettor to use methylated spirit, and would you advise a surface of spray carburettor? Do you think methylated spirit would give a better result in a small model than petrol? Will you kindly tell me the subjects a R.N. engineer officer has to be examined on and who are eligible?

We should advise you to adhere to spark ignition on such a small engine. If you still care to try porcelain tube, however, you can obtain full details of this kind of ignition from our handbook "Gas and Oil Engines," by Runciman, 7d. post free. We should not advise methylated spirit, as you would have trouble with the firing. *Re* R.N. engineers. Particulars can be had from the Secretary to the Admiralty, Whitehall, London, S.W.

[16,989] **Small Gas Engine Trouble.** A. C. (New Cross) writes: Should be greatly obliged if you could assist me with a little information on a small gas engine which I purchased through the columns of THE MODEL ENGINEER. From the drawings I think you will understand my trouble. The only valve that is worked mechanically is the exhaust, the gas and air being worked by suction only. I read in your sixpenny book, "Gas and Oil Engines," that 10 parts of air and 1 part of gas is required to

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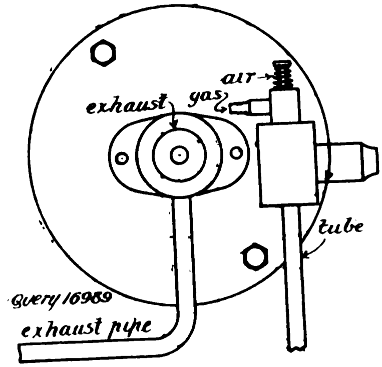
make an explosive mixture. Well, as far as I can see, I cannot see how the air gets in at all (only very little) through the spring on the top. I have had no experience of gas engines and am only experimenting with this one. Would you say if I am connecting the gas to the right inlet (shown on drawing), because if I hold a light there and turn the flywheel it draws the flame in greatly? But when I hold it over the air valve (which I expect is the air valve) it does not affect it a bit, and that is why I think I have not got it somehow right. As it is now, it would be about 10 parts of gas and 1 part of air. There is no arrangement to the engine to heat the tube, and also could you say which is the tube to be made hot from the photograph or drawing, and whether this is heated by a separate gas connection apart from the gas supply to the engine? Could you suggest to me any way in which I could make a Bunsen burner to fit the same? The tube, which is to be heated, is a piece of ¼-in. gas barrel about 2½ ins. long, under the air valve. Is this correct?

This is evidently a small engine with no proper arrangement for taking in gas and air in correct proportions. In such small engines, in fact, it is usually found that a much richer mixture is used than in engines of larger size. It runs at a high speed, and thus a very small charge is taken each time. We expect you are quite correct in coupling up gas as you describe in photograph. The gas enters through the air valve. It is quite possible that unless running at a high speed you would not get much suction at the air valve unless everything—piston, exhaust valve, etc.—were absolutely tight. When exhaust is opened mechanically and the engine pulled round by hand, of course you get an in-draught. There is so little to be seen on photograph that ignition arrangements cannot be distinguished. Tube should enter somewhere at the back end or near the back end of combustion chamber. A separate tube to supply the burner for this is desirable, as explained in our handbook on the subject. A description of a Bunsen burner is also given therein. Surely you can devise some arrangement yourself to carry the Bunsen to heat the tube? Any kind of chimney will do, so long as it allows tube to become well treated. A 2½-in. long (¼-in. gas pipe) tube should do well enough. From your red ink sketch it looks rather as though you had got hold of some kind of simple vaporiser, and the air valve is mounted on it. The square standing out from block is perhaps intended to be bored out and an oil inlet made there for a gravity feed—if required to run engine on oil at any future time. A paraffin blowlamp, such as plumbers use, would do to heat the tube, which, as it is at present, points vertically downwards. We trust these suggestions and hints will assist you. Can you tell us the maker's name?



BACK END OF QUERIST'S ENGINE.

[17,756] **Electric Bell Circuits.** J. A. (Sheffield) writes: Would be pleased if you could help me out of the following difficulties. I have a bell circuit here and want to add extra bells and pushes and am not clear as to how connections must be made. Bells No. 2 and 3 to be rung by push No. 3; bell No. 1 to be rung by pushes Nos. 1 and 2; bell No. 3 to be rung by push No. 4. Would be pleased if you can show me how to do above by a diagram, if possible. Would also be pleased if you could answer me the following questions as soon as possible, through the query columns of your paper. (1) What is the average candle-power of ordinary acetylene bicycle lamps, one that will give a good beam of light of about 6 yds.? (2) Which would be the cheapest to get done—a casting in cast-iron or in brass? The proposed casting is to be a mould for casting lead grids for accumulators, and where can the above be done in Sheffield if I supply a pattern?

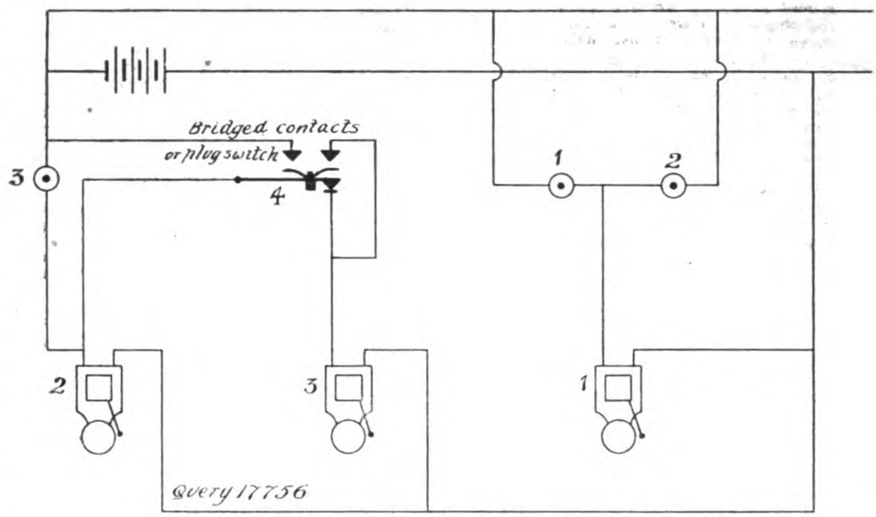


DIAGRAM OF ELECTRIC BELL CIRCUITS.

The connections given above fulfil the specified conditions. Push No. 4 will have to be of special construction, and the wire connecting the positive terminal of bell No. 2 with bell No. 3 will be led to push No. 4 as shown. Thus, except when No. 4 push is being used, the two bells, Nos. 2 and 3, will be in parallel and will ring when push No. 3 is depressed. On pressing push No. 4 the circuit between bells 2 and 3 will be broken and only No. 3 will ring. (1) We have never measured the candle-power of these lamps, but might estimate it at 8 to 10 c.-p. (2) Very little difference, but brass is the more expensive. We should advise cast iron. Gilbert & Co., 11–13, Gray Street, Waterloo Road, London, S.E., would supply you and quote price on application.

[17,969] **Train Lighting, etc.** W. D. G. (Heyside) writes: How is the electric light supplied on the railway carriages? I notice underneath railway carriages sometimes a box which seems to me to be an accumulator or a dynamo. Could you tell me what this really is? How is the electric wire connected from one coach to another so as to enable them to be coupled or uncoupled at will? Would it not be possible to run a dynamo off the carriage wheels or the engine and then when the train is stopped to switch on to an accumulator? If any of the subjects in question 4 are followed out, would you please explain them. If a train, say, is going a mile a minute and you have a given radius of a carriage wheel, how would you find the speed of the carriage wheel? (1) What pressure is there usually on the trolley wire system on the trolley wheel? (2) What is the material of the trolley pole? (3) Is the trolley pole made to completely turn round? (4) If the trolley pole was placed in the front at the top of car instead of at the middle, would it drive the car you think as well?

By various systems, two of these being the Leitner-Lucas system, and the other an ingenious one devised by Rosenborg, which is used on the Prussian Railways. In the latter dynamo, an auxiliary pair of brushes are introduced, and these are short-circuited together. The current produced in them is proportional to the difference between the ampere-turns of the field-magnet coil and the ampere-turns of the working armature current. When the speed increases, the working current tends to rise too. The short-circuit current will diminish and so will the terminal voltage of the machine. The result is a fairly constant working current

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over a wide range of speed. Train dynamos are always used in conjunction with batteries, and are connected in parallel to them, in order to not only steady the light but because cells are a necessity when the train stops or slows down. The dynamos are driven from the wheel axles. Connections from coach to coach are made by flexible leads. An account of the systems referred to will be found in the *Electrical Engineer*, April 28th, 1905, and the *Electrician*, July 7th, 1905. In reply to speed of train wheels—Multiply the wheel diameter by 3·14 and divide the result into 5,280. Thus, for a wheel 2 ft. radius and speed 1 mile per hour—

$$3{\cdot}14 \times 4 = 12{\cdot}5$$

$$= \frac{5280}{12{\cdot}5} = 422 \text{ approx. revs. per min.}$$

(1) *Re* Trams. 500 volts is the usual pressure. (2) Steel. (3) Yes. (4) Difficulties with curves would arise.

[17,786] **Locomotive Valve Gear Questions.** F. D. M. (St. Thomas) writes: Would you be so kind as to answer a few perplexing questions concerning the new G.W.R. engines? (1) Could you tell me how to measure the travel of the piston valve? I, having stopped the crank down, find the valve-rod moves 5¼ ins. by moving the lever rom fore to back gear. What would be the travel? (2) How far does the valve travel with the piston? I may say all the engines are fitted with inside admission and outside exhaust. What is the relative position of the eccentric to valve and crank? (3) Would you please explain the direction of the ports, having heard they are longer than the ordinary valve ports?

We have no details to hand, but believe that some particulars which were published in the back issues of *The Engineer* or *Engineering* (about a year ago) would be of use to you. See also the *Engineer* for February 22nd last. (1) With regard to the method you have tried for finding the travel of the valve: this will not lead to accurate results. As we show in the accompanying Fig. 1, the movement of the reversing lever when the engine is stopped with the crank-pin on the bottom will not move the valve spindle to the full amount of its travel. The distance which the valve spindle will travel will vary according to the angle of advance of the eccentrics, and is represented in Fig. 1 by the measurement T. To obtain the correct travel, put the engine in such a position that either the forward or backward eccentric is at the extent of its travel with the lever placed in forward or backward gear, as the case may be. In Fig. 2 the forward eccentric is the one dealt with. The position of the other is immaterial so long as the gear is arranged in a symmetrical manner. The forward eccentric is then in position F E₁, and the lever in fore gear. Having marked the valve spindle or intermediate valve spindle (I.V.S.), move the engine so that the forward eccentric is in exactly the opposite position (F E₂).

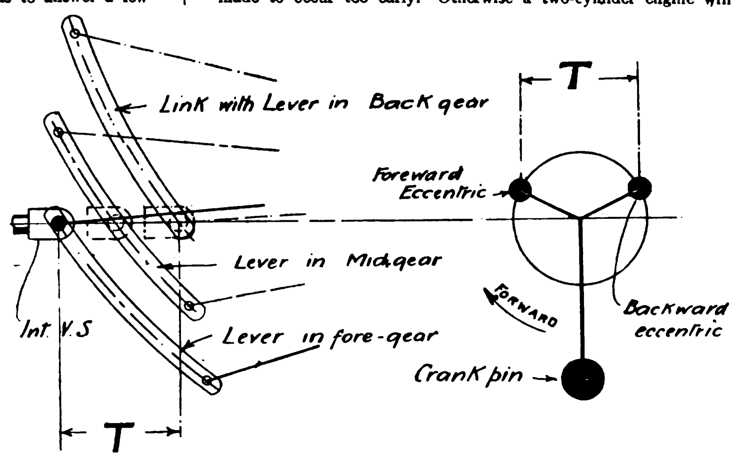

Fig. 1.—Showing that the Method of Obtaining the Valve Travel by Setting the Locomotive with Cranks down and Moving the Reversing Lever does not give an accurate result. (*T is less than the maximum travel of the valve.*)

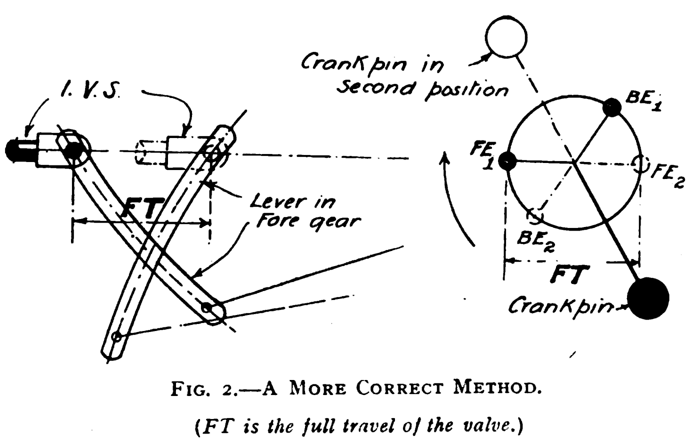

Fig. 2.—A More Correct Method.

(*FT is the full travel of the valve.*)

Again mark the valve spindle or I.V.S., and measure the distance between the two marks. This will, as indicated by F T in Fig. 2, give the trave of the valve almost exactly. The second sketch shows the two positions of the crank-pin and eccentrics. The particular arrangement of the eccentrics does not affect the rule and, therefore, if the engine you are dealing with is differently constructed, then adapt the rule to the circumstances of the case. (3) With inside steam admission, if the rocking gear does not reverse the direction of motion of the valve spindle to that of the die in the link, the eccentrics are placed each at 180 degs. from the position in a normal engine with ordinary outside admission. We recommend you to make a small wooden valve gear model, as shown in Greenly's book, "The Model Locomotive: Its Design and Construction." The cut-off in most all locomotives is in the neighbourhood of 75 to 80 per cent. of the stroke with the lever in full gear. Your method of stating the first part of this question is not scientifically accurate and is apt to mislead. You should not speak of the distance the valve travels with the piston, but how far does the steam follow the piston; or, better still, what is the point of cut-off in full gear. In shunting engines and tank locomotives used for "stopping trains"—which engines are required to start quickly—the point of cut-off in full gear should not be made to occur too early. Otherwise a two-cylinder engine will very often become "blind" and constantly require to be reversed. This was a fault noticeable in the L.N.W.R. 4-ft. 6-in. tank engines (2—4—2 type) used for the Broad Street-Mansion House traffic. (3) The ports in a piston valve engine may be more easily made "longer" than where flat valves are used. Several of the newer Great Western Railway engines are stated to have ports 31¾ ins. long, whereas the ordinary flat valve express engines have only 16-in. ports. We recommend you the following books in addition to the above:—"Locomotive Simply Explained," price 6d. net; 7d. post free. "The World's Locomotives," price 10s. 6d. net; 11s. post free. "Locomotives of 1906," price 1s. net; 1s. 6d. post free. "Locomotive Engineering," price 21s. net; 21s. 6d. post free. "Locomotive of To-day," price 2s. 6d. net; 2s. 9d. post free.

[18,008] **Resistances for Charging from the Mains.** S. P. L. (Walton-on-Thames) writes: I should be much obliged if you would kindly put me right on the following points. I have two 4-volt 60 amp.-hour accumulators. Supply current here is 240 volts 10 amps. I wish to set up a charging board for above. I want to use a lamp or lamps for resistance. What number and candle-power is necessary for charging first, each accumulator separately; and secondly, the two together? Should I have an ammeter in the circuit; and, if so, to what number should it read. I have The Model Engineer for the last five years. Can you refer me to any past article for a good design of charging board, showing position of resistance, fuses, etc., or could you give me a sketch of a good plan? Do you recommend resistance wires or lamp for resistance?

Charging current would be (maximum) 12 amps.; twenty lamps (32 c.-p.) in parallel would give you 10 amps., each lamp passing about ·5 amp. at 240 volts. A wire resistance would have to be of 24 ohms. Three lbs., No. 18 S.W.G., German silver wire would give you 28 ohms. You could make this into a regulating resistance, and cut out, as required, to get a heavier current. Either method can be used. We should prefer the lamps, especially if you can make use of the light.

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The Editor's Page.

WE shall be pleased to hear from any other readers who are willing to exhibit models in the loan section of our forthcoming Exhibition. A number of very interesting models and other exhibits have already been promised, and it is necessary that those who wish to be represented should forward particulars of their models at an early date, so that space may be reserved. This, of course, does not apply to those who intend entering for our competition, for which a special entrance form will shortly be published, but is a general and cordial invitation to those who have suitable models, to join in making a display which shall be thoroughly representative of model making in all its various branches. The leading trade firms are taking a very keen interest in the Exhibition, and the names of those who have already booked space is sufficient to guarantee a show of models, tools, and scientific apparatus of the utmost interest to our readers and to the technical public generally. One of the great advantages of an Exhibition of this kind is that it gives customers an opportunity of making a personal acquaintance with many specialities which are only known to them through advertisements and catalogues, and of satisfying themselves as to the quality and advantages of the various goods offered. This fact alone will ensure many new friendships between buyers and sellers being established during the Exhibition week, while there is no doubt that the sight of so many attractive and interesting examples of work will tempt many recruits to enlist in the enthusiastic army of model engineers.

* * *

We give in this issue the concluding portion of the article on armature fitting in the "How It Is Done" column. We propose to follow this up with further articles of the same instructive nature, but in order to render the subjects as useful to as many as possible, we should be glad to have suggestions from readers as to workshop operations or difficulties which they would like to see treated in this way. While it is not always possible for us to adopt our readers' suggestions, we make a point of doing so if at all practicable, and we may mention in this connection that our recent articles on planing and shaping were the outcome of requests from several correspondents.

* * *

May we ask those readers who send us requests for information outside our Queries and Replies Column, and who require a reply by post, to remember to enclose a stamped addressed envelope for that purpose. The cost of a single reply to a single reader is not in itself a matter of great moment, but when this is multiplied by hundreds, or even thousands in the course of a year, the tax is one which makes itself felt. For this reason many papers make a rigid rule of not replying through the post at all. In our desire to help our readers as much as possible, we have adopted a more generous attitude, but we look to our correspondents to make the work as easy for us as they possibly can.

* * *

The amended conditions for the 1907 Speed Boat Competition are now in type, and will appear in our next Issue.

Answers to Correspondents.

R. N. W.—This is not possible. No particulars have been published.

J. D. (Wigan).—Try Palmer & Co., 82, Old Street, London, E.C.

S. L. T. (Manchester).—We thank you for your letter and photograph of your work.

Notices.

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

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

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Contents.

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

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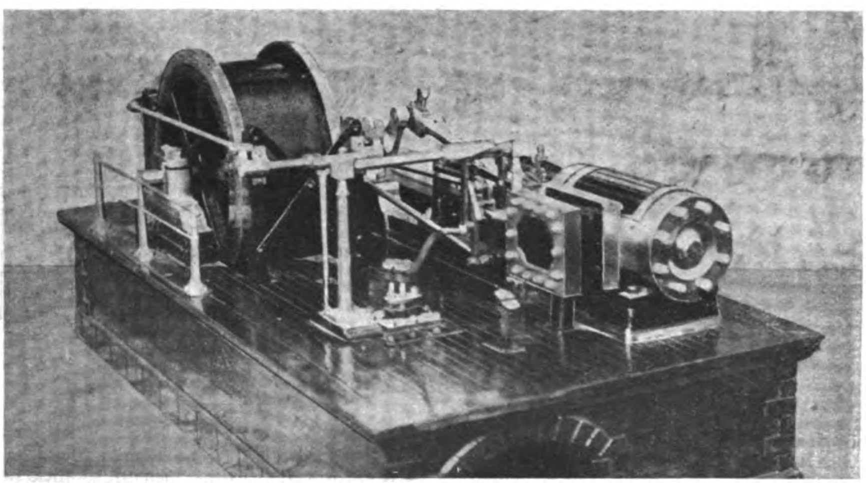
THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 331. AUGUST 29, 1907. PUBLISHED WEEKLY.

A Model Winding Engine.

By WM. INCH.



MR. WM. INCH'S MODEL WINDING ENGINE.

THESE photographs illustrate a model winding engine, with link reversing gear, that I finished a few years ago. All principal parts are castings and steel forgings. The cylinder, which is covered with mahogany and bound with brass bands, is fitted with drain cocks on underside. It is bored out to 2 ins. and has a stroke of 5 ins. The connecting-rod has a fork-end, and is fitted with split brasses and screwed jibs and cotters throughout. The drum is 10¾ ins. diameter over the flange, and is 9¼ ins. over the cleading, which is mahogany fixed to the drum cheeks with sixty ⅛-in. bolts and hexagon nuts. It is also fitted with a double jamb brake. The crankshaft is 12 ins. long by 15-16ths in. in diameter. The link is all adjustable, which will be seen in the photograph. The stop-valve is a built-up one, and consists of four castings, the top of which may be seen in the photograph. The hand-rail in front of the connecting-rod and crank is a piece of ¼ in. for the bottom and 3-16ths in. for the top made of iron and brass respectively, and is supported by eight iron balusters fitted to a brass plate fixed to the floor. The engine is mounted on a wooden foundation painted to represent stone base and corners and brick walls with an arch at each end. Hexagon nuts are fitted to bolts throughout. Two first prizes have been gained by this engine—one at Dunfermline in the year 1904, and one at Kirkcaldy in 1906.

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The Design of High-Speed Bearings for Small Dynamos, Etc.

By "Bridge."

THE design of a first-class self-oiling bearing, which looks neat, and at the same time does not occupy much more space than the ordinary type, is a problem that confronts the builder of a small dynamo, motor, or other high-speed machinery. There are people who are of the opinion that there is no necessity for this refinement in small machines; but the mechanical success of a machine that may be required to run continuously for a number of hours, as when charging accumulators, etc., depends almost entirely upon efficient bearings. The wearing surface of a bearing is another important point that requires consideration in small dynamos and motors more particularly than other classes of machinery, because of the trouble caused by the shaft lowering gradually, through the bush of bearing wearing away. There is really very little to wear on in small machines, as the air gap has to be kept small to get a decent result.

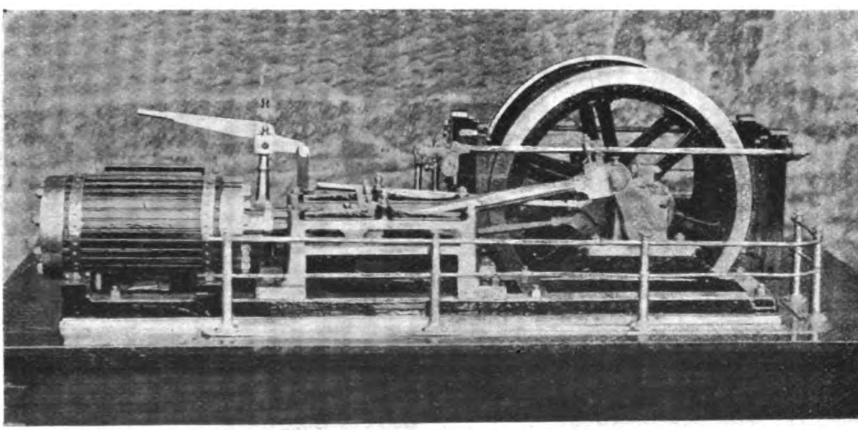
In designing a good bearing the important points to watch may be classed as follows: (1) Ease of construction, both in pattern-making (*i.e.*, no intricate core-boxes) and in the mechanical part. (2) Ease and cheapness with which wearing parts can be removed. (3) Plenty of wearing surface. (4) Not to be bulky in appearance, and not to be pinched in size of oil channels, otherwise clogging might take place.

There are two distinct methods of getting the oil from the well on to the shaft, viz.:—Either by a metal ring running on the shaft, or by using a fine link curb pattern chain. We will deal with the ring method first, as applied to a solid bearing (*i.e.*, having no loose cap), and afterwards compare it with the chain method applied to a split bearing.

A self-oiling bearing for a ¾-in. diameter shaft of the ring type is shown in Fig. 1. It will be seen that the oil well A, the two end oil recesses B B, and the elongated hole D in the top half of bearing, will have to be cored out. This, it will be admitted, is a rather intricate bit of core-box making. The hole D is bound to be large enough to get the ring through into the bearing.

The only alternative is to use a split ring, which comes in half, and each half can be inserted separately and closed after they are on the shaft. This is what has to be done in some extreme cases where the bearings are solid. The objections are that the ring is not truly circular when it has been split, and tends to jump on the shaft when running, even at slow speeds. In the case under consideration it is advisable to leave it off, and use a solid ring, making the slot D large enough, and a neat inspection lid to cover the hole up. The oil channels C C, Fig. 1, are, of course, drilled out from each end, afterwards fitting screw plugs on the outside, where the drill entered. The channels are shown drilled slightly on the angle, so as to get the oil to run back into the well. As regards the end oil holes F F, they can be drilled out if drilled on the angle (see Fig. 2), but it is rather an awkward job at the best. The length to make the bearing is another point that does not seem to have sufficient consideration in a good many cases. It is obvious that the longer a bearing is, the more wearing surface there is for shaft: a line, however, has to be drawn somewhere. The latest practice in modern high-speed bearing design is to make the length equal to about three or four diameters of the shaft, thus a shaft having a diameter of 1 in. would require a bearing about 3 ins. or 4 ins. long. Of course, the whole of this length does not represent bearing surface, actually, in the case of self-oiling bearings, because of the amount to be deducted for the end oil recesses, where the shaft is not supported on the bush. Therefore, in all cases it is wise to keep the recesses fairly small, so that the reduction of bearing surface is not so great.

We will now consider the same bearing as in Fig. 1, only splitting the bearing and fitting a cap, but still keeping the bush solid (see Fig. 3). This alteration will simplify the pattern-making



SIDE VIEW OF MODEL WINDING ENGINE.
(*For description see front page.*)

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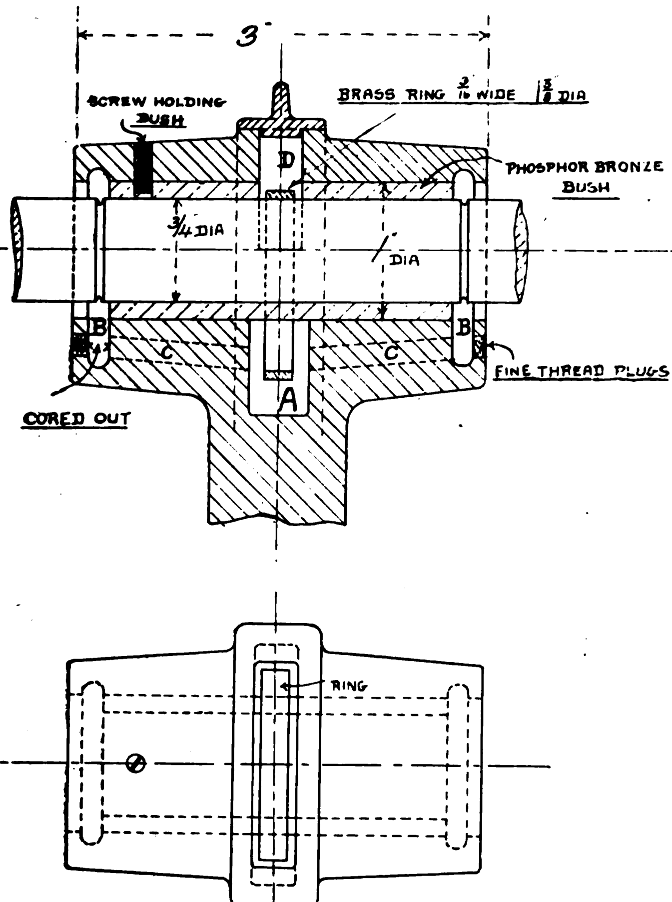


FIG. 1.

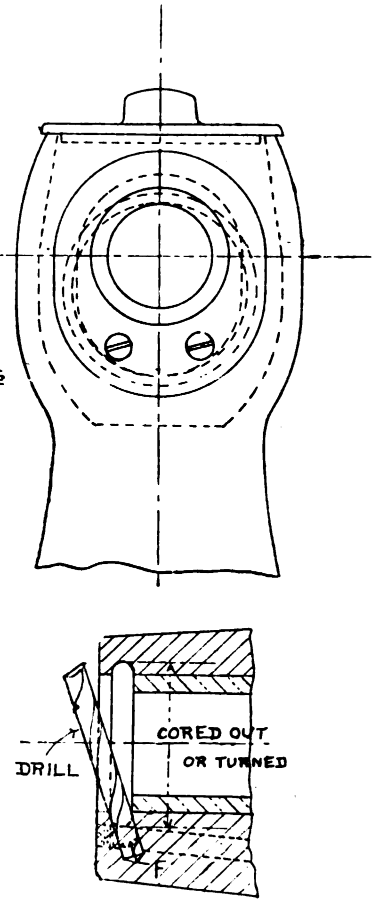
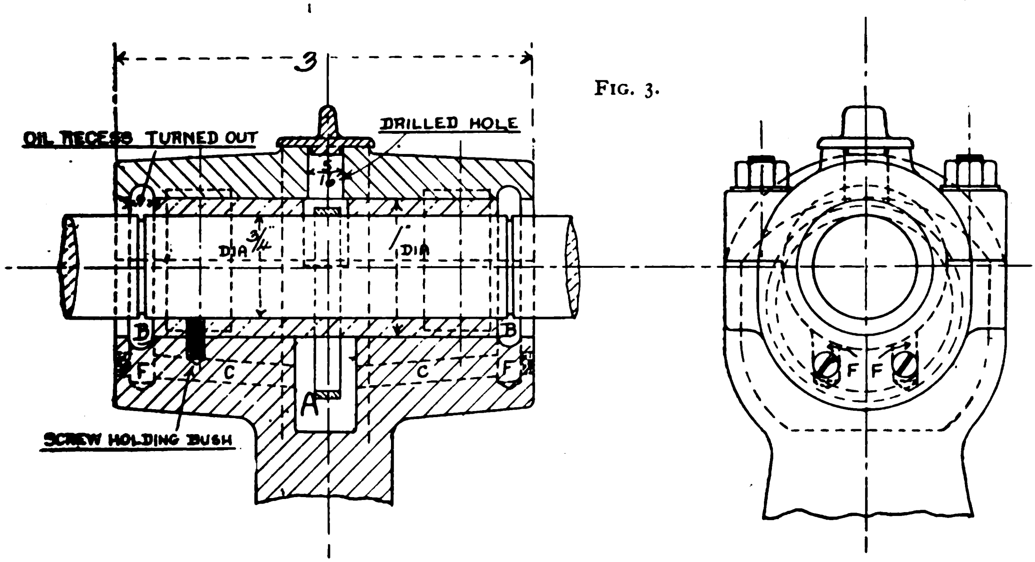


FIG. 2.

FIG. 3.



THE DESIGN OF HIGH-SPEED BEARINGS FOR SMALL DYNAMOS.

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considerably, although it increases the mechanical portion of the work; but most amateurs would rather have things this way, unless they are very skilled at pattern-making. The loose cap eliminates the cored hole D (Fig. 1), in place of which we shall require a 5-16ths in. drilled hole for inspection purposes. Then again, we shall be able to drill the end oilways F F quite easily: this leaves us with only one core, viz., the oilwell A (Fig. 3) and the core for bush. This core will be all in one piece, having a print on top of bearing to carry core in mould: this will be understood on looking at the drawings. The cap is shown let in to the bearing 1-16th in., but this can be left off if desired, providing the studs for cap are a decent fit, so as to prevent any movement when boring the bearing out. It is advisable to make a small gauge for turning the bush to, as the trouble saved when making renewals will repay for the making of gauge. It may be asked why the bush has not been split, like the bearing; it may be if desired, but seeing that the cost is so small, and it is easily replaced, it really is not worth while, as it will wear a long time before requiring renewal.

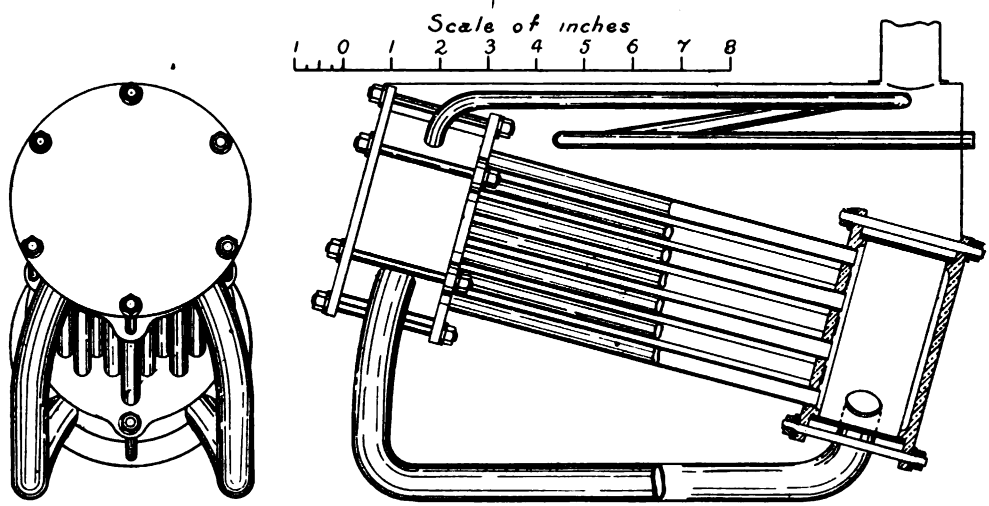
(*To be continued.*)

A Small Water-Tube Boiler.

By Barton Mott.

AMONG the most interesting and useful possessions of model engineers the small boiler will always hold its own—at least, as long as the model steam engine retains its popularity. Even the polished brass and tin-pot types, with whistle and filling-plug complete, have their admirers. But it is for those readers interested in making workmanlike and useful boilers that this description is intended.

The boiler to be described was built to supply steam to a 60-watt electric power plant. It will be seen from the drawing that it is a legitimate member of the water-tube family. The main objects in view when designing it were efficiency, safety, and accessibility to all parts, so that it might easily be taken to pieces for cleaning and repairs, if necessary. It was also intended to be easy to construct, a condition which, though mentioned last, is by no means the least important. The designers' chief assistant was that very well-known and excellent member of The Model Engineer Series, namely "Model Boiler-Making." The result is a type well suited for high pressures, since there is little chance of a serious explosion. If a tube should burst there would be no great calamity, and it could easily be replaced. This boiler has a good circulation, and the quantity of water that it contains is enough to enable t to work "steady" and quietly, and even to make short runs without the use of the feed-pump. It holds about 1 quart of water. Many small water-tube boilers are a constant anxiety and continually making trouble for their owners, because they hold so little water. When the attendant forgets to work the hand-pump at the correct moment, or the donkey-pump sticks just as the feed-tank runs dry, etc., confusion arises much faster than the pressure, and he has some splendid excitement at the expense of his boiler, perhaps. In making this boiler no rivets are used and no solder, except a little silver for the two downcomers, and the bush for the safety-valve and the superheater. These downcomers, as the two ¾-in. pipes which support the boiler may be called, project through the drums and are silver-soldered on the inside. The two drums are of 1-16th-in. solid drawn, seamless copper-tube 4 ins. diameter. Each one is clamped between the tube-plate and the cover by six 3-16ths-in. bolts. A piece of asbestos string put between the joints before clamping up makes them absolutely steam-tight. By this arrangement it is a very simple matter to clean the tubes or to put in a new one if necessary. In the



End Elevation. Side Elevation.

A Small Power Water-tube Boiler.

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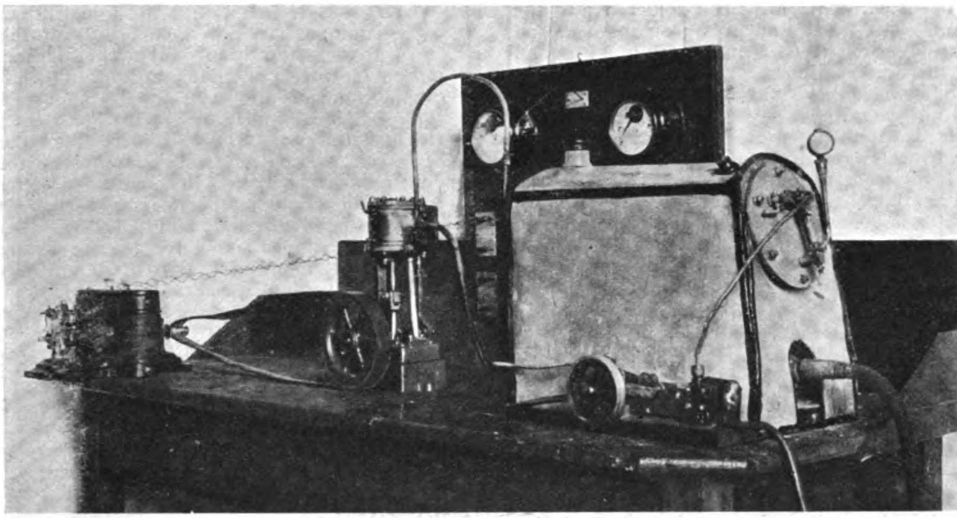
design there are twenty-six ⅜-in. tubes 1-32nd in. thick, though in the finished boiler I only have twenty-four. Putting the tubes in is an interesting job. After drilling the tube plates, which I did with a ⅜-in. drill, in the lathe, the tubes are all driven into their places in one plate, with their ends projecting through for about ⅛ in. The other plate is then placed in position and the tubes knocked back one by one into their proper places in it. It will be of great assistance to have a small piece of brass rod to guide the tubes into their respective holes. When this is done the tubes should project through both plates for ⅛ in. It would, perhaps, be better to soften the ends before putting them in, though it is quite possible to do so with a blow-lamp after they are in position.



Mr. Barton Mott's Small Electric Light Plant.

View of Boiler, Outside Case removed.

They may now be expanded in between the lathe centres, using plenty of oil, and riveted over.

It will not take much skill to bend the two downcomers to the required shape if they are first softened and filled with lead. They should hold the tubes at an angle of 15 degs. to the horizon. If for a boiler as illustrated herewith they would be at an angle of 30 degs., but the lower end is held up by a fire-brick support, so that they really are at an angle of about 12 degs.

The fire consists of asbestos coals heated by a gas ring, but I have found by experiment that this arrangement is not much better than when the gas ring is close up to the tube so that the flames play directly on to them. A gas ring or a rectangular burner provides a very economical way of heating this boiler, but in many cases a blow-lamp is more convenient, and a more intense heat can be obtained. The outside casing is of sheet zinc, a very ductile material, lined with asbestos. No persuasion is required to induce the pieces of asbestos to stick to the zinc if they are pasted on with silicate of soda. When the casing once gets heated they will be cemented on, and, as far as I know, will stay for ever. Inside the casing are two pieces of thin sheet iron which are arranged to guide the hot gases

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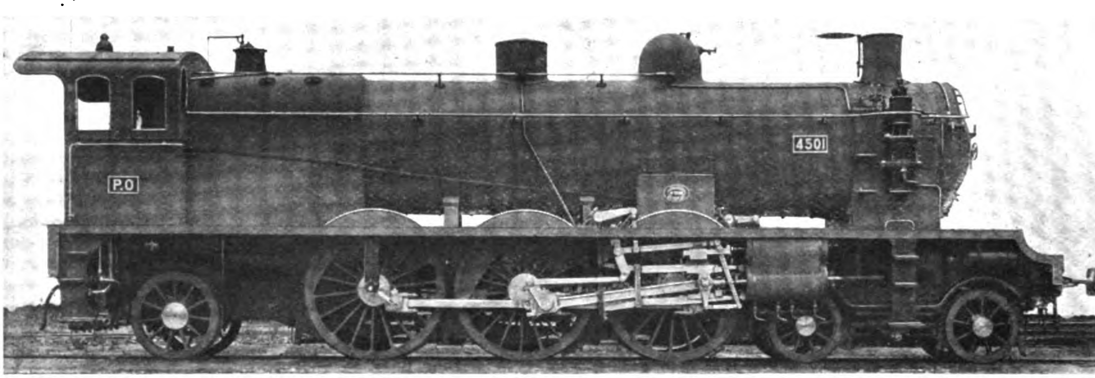
up between the tubes. It is possible to make the castings for the tube plates and covers from one pattern. They should be turned, in the lathe, to fit tightly into the drums, a little tapered, so that when the bolts are tightened up, they will make a very nice joint. The seatings for the safety valve and the end of the superheater are silver-soldered into the top drum. The water and pressure gauges are on the front cover on which there is also a 3-16ths-in. tap for the donkey pump. On the back or lower cover are a check valve and a blow-off cock.

I will not attempt to say how much amusement this boiler is capable of providing, but it may be of interest to a few readers to know what practical results I get from the one that I have made, the efficient heating surface of which is about 260 sq. ins. Rain water is generally used for the feed, because my tap water has so much lime in it. Starting with 1½ pints of water at 50° F. in the boiler, 30 lbs. pressure is indicated on the gauge in five minutes. When working steadily at 50 lbs. absolute pressure, it evaporates 6 pints an hour, or 3½ cubic ins. per minute. This is equal to about 1,900 cubic ins. of steam per min, which, it will be seen, is enough to enable a 1¼-in. by 1¼-in. engine, running at about 600 r.p.m., to drive a 60-watt dynamo. 60 lbs. is the highest pressure that I have worked the boiler at. It is capable of working at a much higher pressure, but the gas fire will not keep it any higher for so large an engine. During long runs the feed-water is kept heated, by the exhaust steam, to a temperature somewhere near 120° F. The superheater serves its purpose well, and the steam turned out is very dry. No doubt more power could be obtained if desired, with a rectangular shaped gas burner instead of a small ring. This ring consumes about 20 cubic ft., or less, of gas per hour. With the price at 2s. 6d. per 1,000 ft., the cost of firing the boiler comes to a little more than a halfpenny an hour. Of course, much more water could be evaporated if the boiler was fired by a powerful blow-lamp, but it would not be so convenient or so cheap. The stop valve is the combined regulator and safety-valve described by me in The Model Engineer for June 6th, 1907.

New Heavy Express Passenger Locomotive for the Paris-Orleans Railway.

The Société Alsacienne de Constructions Mécaniques have now redeemed the promise made to the writer upwards of a year since, and again more recently, by forwarding a photograph of the first of the new 4—6—2, or "Pacific" type engines built by them for the Paris-Orleans Railway. These are very fine locomotives of great power, and they represent the latest development in French locomotive practice. The system of compounding is, it is perhaps needless to say, that devised by Mons. A. G. de Glehn, and the usual cylinder and valve gearing arrangements have been followed: the inside (low-pressure) cylinders driving the crank-axle of the leading coupled wheels, while the outside (high-pressure) cylinders drive the middle pair. The 4—6—2 wheel arrangement affords a good opportunity of enlarging the proportions of the firebox, while retaining the advantages of six-coupled wheels. In this type all three coupled axles are, of course, in advance of the firebox, whereas in the 4—6—0 type one of the number is either at the rear of or underneath the firebox.



The New "Pacific" Type Locomotive: Paris-Orleans Railway.

The boiler of these new "Pacific" locomotives is of great size. It carries a high working pressure, and contains a large aggregate of heating surface, combined with ample grate area and steam space, so that its efficiency as a steam generator will be high. The cylinder capacity and adhesion weight are in proportion, and the engines will, in practice, be able to deal with heavy train loads at high average speeds, all the essential features necessary for the accomplishment of this purpose being incorporated in the design. Perusal of the list of dimensions given below will serve to emphasize this statement. The particulars are :—

Cylinders : High-pressure, diameter, 15¾ ins.; low-pressure, diameter, 25¼ ins.
Stroke of pistons, 26 ins.
Bogie wheels diameter, 3 ft. 3 ins.

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Coupled wheels diameter, 6 ft. 2 ins.
Trailing wheels diameter, 3 ft. 10 ins.
Wheelbase: Bogie, 7 ft. $6\frac{3}{4}$ ins.; coupled, 13 ft.; total (engine), 35 ft.
Boiler: Mean diameter, 5 ft. 7 ins.; number of tubes, 261; diameter of tubes (inside), 2 ins.
Heating surface: Tubes, 2,602·6 sq. ft.; firebox, 165·4 sq. ft.: total, 2,768 sq. ft.
Grate area, 45·8 sq. ft.
Boiler pressure, 228 lbs.
Weights, in working order: On bogie, 21 t. 10 c.; drivers, 45 t.; trailing wheels, 15 t.: total, 90 t. 10 c.

C. S. L.

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 Tube Vice.

By JOHN HEYES.

The sketches and photograph show a tube vice I have recently made. It consists of an iron

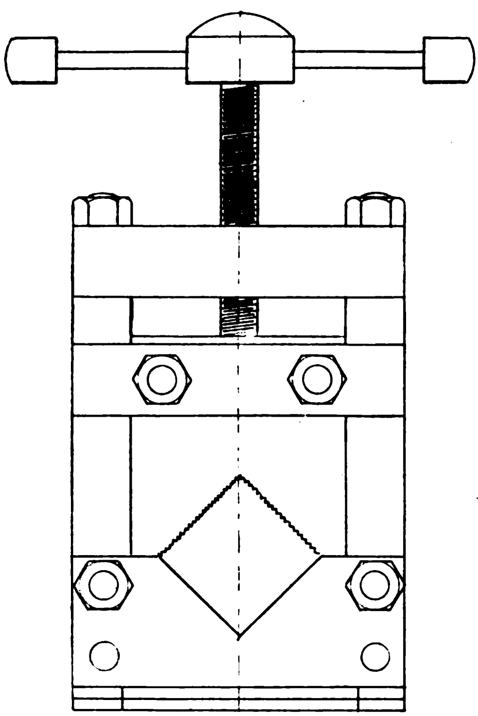

FIG 1.—SIDE ELEVATION.

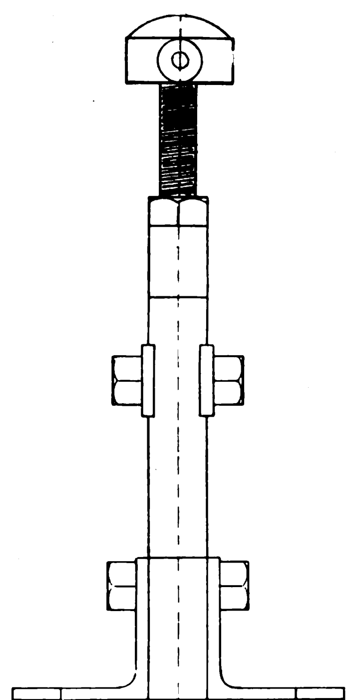

FIG. 2.—END ELEVATION.

AN EASILY-MADE TUBE VICE.

(*Scale: Half full size.*)

By JOHN HEYES.

base, to which is riveted two angle-irons (obtained from an old iron bedstead). To these angle-irons are bolted on each end an upright, as shown. The uprights have a shoulder turned on the top to carry the cross-piece or yoke. The yoke is held down by nuts screwed on the turned portion of the uprights. The top jaw is a piece of iron drilled to take the bolts that secure the guiding strips on each side. The guiding strips cover the hole up in the top jaw. This hole, which is first drilled and then filed out, as shown, is to admit the washer being put on and the pin being put through the end of screw, as shown. This arrangement is to enable the top jaw being lifted by the screw. The screw is a round-headed bolt turned down and tapped $\frac{3}{8}$ in. The bottom end is turned down to $\frac{1}{4}$ in. to pass into top jaw as shown in sketch (Fig. 3). The vice handle is a steel rod with two iron ends screwed

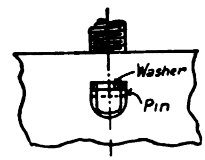

FIG. 3.—METHOD OF ATTACHING SCREW TO TOP JAW.

on as shown. The gripping portion of the top jaw is filed (to make the teeth as represented), and afterwards case-hardened. It acts efficiently, and is very useful, as it will take up to $1\frac{1}{2}$ ins. I painted it a light blue, the streaky marked appearance on the photograph being due to this paint getting scratched.

Brightening and Colouring Brass.

A writer in *Machinery* gives the following useful hints on brightening and colouring brass: The work to be brightened and coloured is first annealed in a red-hot muffle or over an open fire, allowing the cooling to extend over one hour, the object of the heating being to remove the grease or dirt that may have accumulated during the process of fitting.

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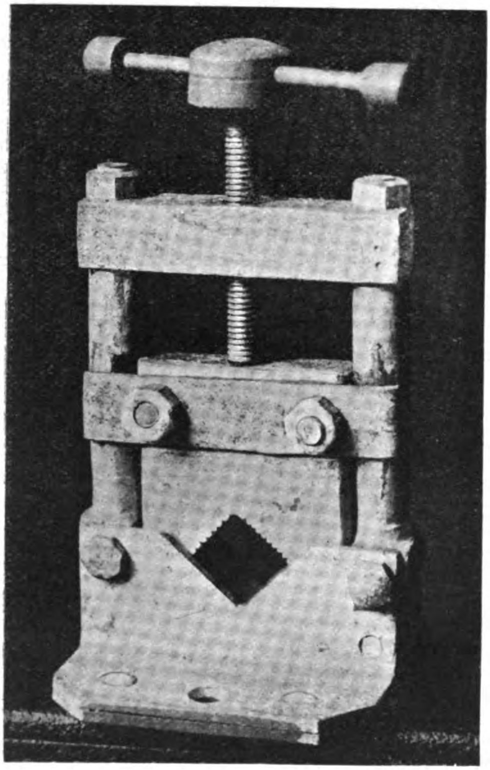
Soft soldered work, however, must be annealed before being fitted together, and afterwards boiled in a potash lye. This is also done with work having ornamental surfaces. Next it is immersed in a bath of diluted oil of vitriol or aqua fortis, either of which may be made with two or three parts of water and one of acid, but the old acid that contains a small quantity of copper in solution is frequently preferred. The work is allowed to remain in this liquid for one or two hours, according to the strength of the acid. It is then well rinsed in water and scoured with sand, which is applied with an ordinary scrubbing brush, and washed. The pickling bath is made by dissolving 1 part of zinc in 3 parts of nitric acid



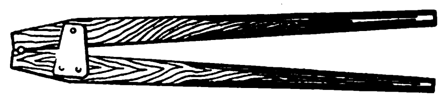
MR. JOHN 'HEYES' HOME-MADE TUBE VICE.

(*For description see page* 199)

of 36° Bé. in a porcelain vessel and adding a mixture of 8 parts of nitric acid and 8 parts of oil of vitriol. Heat is then applied, and when the liquid is boiling the work is plunged into it for half a minute or until the violent development of the nitrous vapour ceases and the surface is getting uniform. Then it is plunged into clean water and well rinsed to remove the acid. The ordinary dark greyish yellow tint which is thus often produced is removed on immersing the work again in aqua fortis for a very short time. Then it is plunged into clean and slightly alkaline water, well rinsed to remove the acid, and plunged into warm, dry beech or boxwood sawdust, and rubbed until quite dry. To prevent the action of the atmosphere it is lacquered; if a green tint is to be produced, the lacquer is coloured with turmeric. A dark greyish but agreeable tint is obtained by immersing the work previously in a solution of white arsenic in hydrochloric acid, or in a solution of bichloride of platinum with a small addition of some vinegar, or rubbing with plumbago.

Simple Wooden Tongs for Handlin Fuses.

A contributor to *Power* describes a simple pair of tongs made for the object of replacing fuses where it is necessary to reach in, past exposed bus-bars that carry current at 625 volts and 125 volts, respectively. These fuses blow out quite often, in synchronising the machines, and sometimes they have to be replaced while the current is on.



SIMPLE WOODEN TONGS.

To avoid accidental shock, these wooden pliers or tongs are made to handle the fuses with, and shown in accompanying sketch. The tongs comprise two pieces of oak, 1 in. thick and 1½ ins. wide, the handles being rounded with a plane. The jaws are tapered for a distance of 3 ins. to about 1 in. at the ends. The pieces were clamped together, and a hole bored laterally through the jaws, near the end as indicated, so that half of the hole is in each jaw piece. This hole is just the size of the smallest fuse. A piece of strap-iron was riveted on each side to form the hinge, there being two rivets in one leg to keep the parts from "sawing" back and forth.

A Useful Hint.

To prevent hot lead sticking to work, mix common whiting or cold-water paint with wood alcohol, and paint the part that is to be annealed. The hot lead will not stick, no matter how long the piece is held in the pot. Water will do as well as alcohol to mix the paint; but alcohol is the most convenient, inasmuch as it can be used without waiting for the paint to dry. If water be used the paint must be thoroughly dry, as otherwise the moisture will cause the lead to fly.

A NEW LIGHTHOUSE.—In the construction of the new lighthouse at Blythe, steel rods have been carried from the foundations of the pier to the summit of the lighthouse. The base measures 35 ft. in diameter. The height to the focal plane is 63 ft. above high water level. Oil for lighting purposes will be stored in the basement, and the service room and lantern chamber are situated above. The focal plane of the principal or flashing light will be elevated 63 ft. above high water. The light will be white group flashing, giving four flashes in quick succession every 10 seconds, and will be visible from all directions, except where cut off by the land. The intensity of the beam will be 60,000 lighthouse units. The light will be visible in clear weather from a distance of 13½ nautical miles.

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How It Works.

XI.—The Marshall Valve-Gear.

By CHAS. S. LAKE, A.M.I.Mech.E.

DURING the year 1904 a commotion was caused in locomotive circles by the publication, in the non-technical Press, of particulars relating to a new valve gear, which, according to report, was going to revolutionise locomotive practice, and at the same time greatly improve the prospects of railway shareholders by introducing economies never before heard of in connection with locomotive working.

The inventor of the gear, Mr. James Thompson Marshall, of Leeds, was, it is hardly necessary to say, less optimistic, although, having made the perfecting of the apparatus one of the principal concerns of his life for some years previously, he had assured himself of its practical utility and superiority over some of the other valve-motions in daily use. Locomotives and other steam engines, including those for both high- and low-speed service, such as torpedo-boat and mill engines respectively, have shown vastly improved results after being fitted with the new motion, and the writer has personally investigated the matter in a practical manner by riding upon two locomotives of the same design and under identical conditions of service and noting the results, the one engine being fitted with the Marshall valve gear, and the other with Stephenson link motion.

In 1906 a fresh patent was granted in respect of improvements in the gear, such improvements tending towards simplifying and cheapening its construction, and also reducing the dimensions in the transverse direction of the engine, so as to better adapt it for application to inside cylinder locomotives and even to those intended for the narrow gauge. Another object was to render the motion applicable to existing engines of various types without having to alter the design of such engines beyond substituting the new valve gear for the old. Furthermore the gear, by its improved construction, has been rendered self-correcting in regard to the lead of the slide-valve, which would otherwise be affected by the angular position of the engine connecting-rod, whether the rod be long or short, the construction, however, being such that the lead of the slide-valve will, as in the earlier arrangement, be the same both when the valve gear is set for forward and for backward running. It is in this later form that the gear is illustrated and described in the present article.

The development of the Marshall valve motion is the outcome of long experience with all classes of engines, and has been more especially designed to overcome the difficulties which have always existed up to the present time in reversing or ordinary engines which are controlled by one slide-valve only. This has been done by re-arranging the ordinary link-motion reversing gear in such a way as to give to the slide-valve a differential motion, which greatly increases its power and efficiency. Engines controlled by an ordinary slide-valve gear are subjected to a considerable reduction in steam pressure as compared with those which are controlled by an efficient expansion gear, because, in order to propel the engine at a uniform speed under great variation of load the throttle valve has to choke the steam so as to lower it from the boiler pressure to that which is just sufficient to maintain the speed, therefore much of the original power of the steam is wasted.

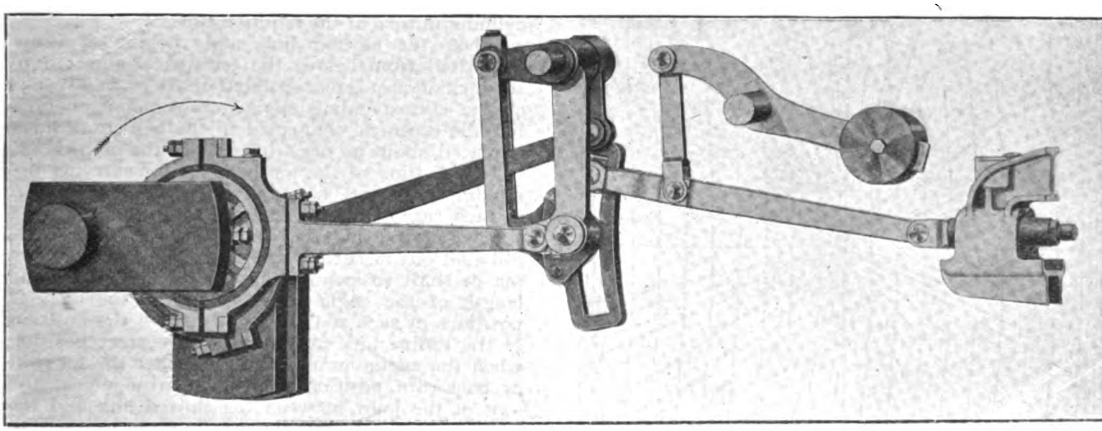

FIG. 1.—THE MARSHALL PATENT (1906) VALVE MOTION.

This fall of steam pressure and loss of power increases with the speed of the piston, as the steam, being choked, cannot follow it up quickly enough. The steam, however, will continue to flow from the boiler until the slide-valve closes, which is often almost at the end of the piston stroke. Consequently, a very short period of expansion follows when at the point of exhausting a considerable volume of steam at high pressure is released into the atmosphere or condenser, which steam might have been converted into more useful work. Besides this loss of power, the exhaust pipe is full of steam at high pressure, which exerts a heavy back pressure on the return stroke of the piston, which still further reduces its efficiency. The valve gear now under consideration is intended to remedy these defects without disturbing the cylinders or affecting their construction.

Referring now to the accompanying drawings,

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As will be seen, two eccentrics, A and B, are used for actuating the motion for each cylinder. One of these eccentrics, viz., that marked A, is designed to impart the to and fro movement of the expansion link, and it is connected by its strap and rod to the lug or projection extending rearwards from the lower extremity of the swinging rocking arm F, the end of the rod being forked or slotted, and embracing the lug or projection to which it is

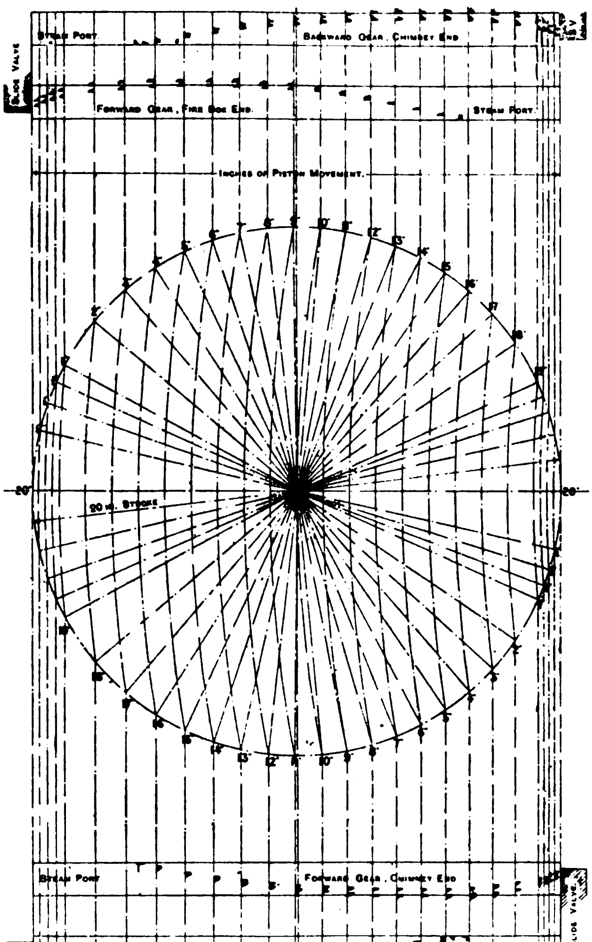

FIG. 4.—DIAGRAMS SHOWING STEAM PORT OPENINGS IN RELATION TO PISTON TRAVEL FROM A 15 IN. X 20 IN. LOCOMOTIVE.

Shown cross-sectioned when fitted with J. T. Marshall's gear.

Shown black when fitted with Stephenson's link motion.

jointed by a pin. The other eccentric B is connected by its strap and rod to one arm of a bell-crank lever, L, that is mounted to rock about the same pin or pivot as the rocking arm, and has a backwardly extending and practically horizontal arm M, that is connected by connecting links N to the rearwardly extending arm of the bracket secured to the arm O, which is solid with the trunnion P fixed to the radius link Q. The first-mentioned arm of the bell-crank lever is located between the rocking arm and the radius link, and is vertical, or nearly so, when in the mid position of its travel. The rod of eccentric A extends in a more or less horizontal direction, and the rod of eccentric B in an upward and forward direction, and, when, as in the present case, the radius link and rocking arm are supported from above, the arrangement of the eccentrics relatively to one another and to the engine crank-pin and the throw of the eccentrics, the eccentric connected to the rocking arm is arranged about 180 degs. in advance of the corresponding engine crank, and the other eccentric is arranged at about 90 degs. in advance of the first eccentric, the throw of which latter is equal to the lap and lead of the valve, whilst the throw of the second eccentric is sufficient to move the valve so as to fully open each inlet port of the engine cylinder in turn at the required times.

When the slotted link and rocking arm are supported from below, the eccentric connected to the rocking arm is placed about 180 degs. in advance of the corresponding engine crank-pin as before, but the eccentric connected to the bell-crank lever is placed about 90 degs. in front of the crank.

The position of the pin or shaft for carrying the rocking arm and bell-crank lever is determined in each case by the aid of a diagram of the engine connecting-rod motions, the diagram being carefully set out in such a way and the position of the pin or shaft so located that whatever may be the length of the engine connecting-rod, the angular positions of such rod shall not disturb the position of the radius link from its true or correct position when the engine crank-pin is in either the forward or backward positions. In each arrangement the axis of the joint between the slotted link and the rocking arm carrying the same is constrained to oscillate in a longitudinal direction through an arc of a circle, the centre of which coincides with the axis about which the said arm rocks under the action of the first-mentioned eccentric. In such arrangement the die in the slotted link is connected to the valve-rod as before by a connecting-rod that is capable of being moved up and down on the slotted link in the ordinary way as by a connecting link suspended from a lever fixed to the reversing shaft. The end of the valve rod to which the connecting-rod is joined is mounted so as to slide to and fro in a fixed bearing.

The differential motion of this gear causes the slide-valve to open and close the steam port quickly, with a considerable dwelling of the valve during the period of exhaust, thereby enabling the full boiler pressure to have free access to the cylinder, and thus allowing perfect expansion from the point of cut-off as well as a free exhaust, whereby the exhaust steam is more prolonged and softened, which prevents the throwing out of fire and sparks, and also very much reduces the wear and tear of the tubes and firebox.

The diagrams on page 203 are instructive, as they show five different positions of the crank with corresponding position of the slide-valve. No. 1 shows the crank straight out with the slide-valve open to the amount of lead. Nos. 2, 3 and 4 posi-

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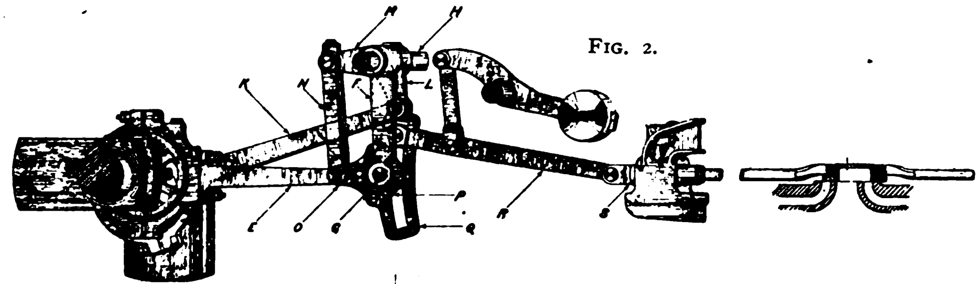

Fig. 2.

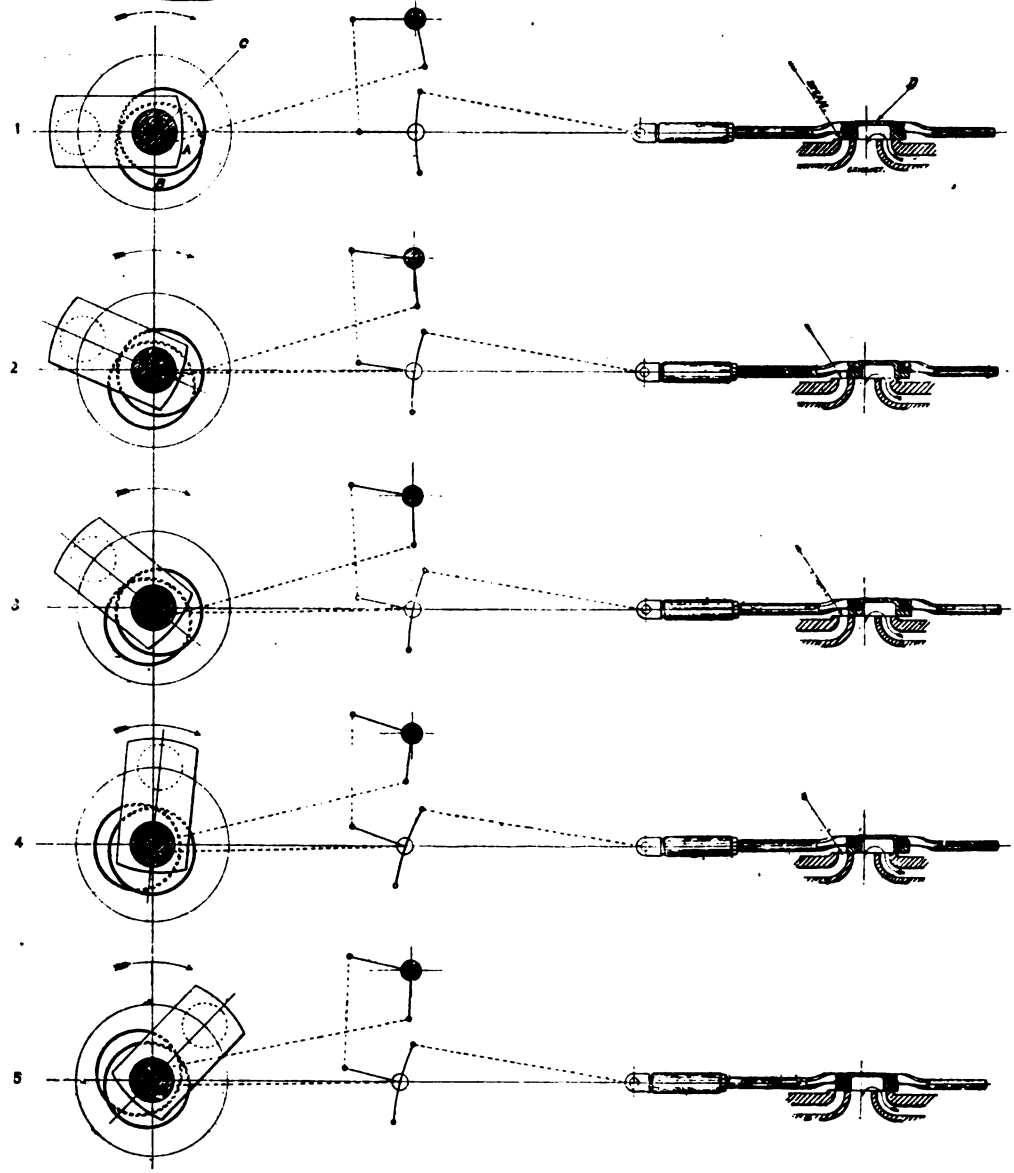

Fig. 3.—Five Positions of The Marshall Patent Valve Gear.

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tions show the slide-valve fully open for steam, and the fifth position where the steam is finally cut off.

The steam distribution is similar to that of the Corliss valve motion, the fast travel of the slide-valve being when the steam port is opening and closing, and the slow travel and dwelling motion when the port is fully open, and during the period of exhausting. The gear gives a rapid opening of the steam port as soon as the lap of the slide-valve is worked off, as well as a rapid closing, and at the same time, as diagrams 2, 3 and 4 show, the steam port is maintained fully open for the admission of steam as well as for exhausting at the positions where the greatest power is required, while there is little difference in the events of induction, release, and compression on either stroke. The action of the gear when reversing is exactly the same whether going forward or backward, the lead of the slide valve being constant.

The Marshall valve gear has been subjected to tests on locomotives in this country and abroad, and is at the present time being fitted to a series of locomotives now in course of construction at the works of one of the principal locomotive building firms in the United Kingdom. It was first adapted to engines in use on the Great Northern Railway, and later to an express passenger locomotive and some rail motor cars in Ireland. Successful results have also been obtained from its use on the L.D. & E.C. section of the Great Central Railway. The Irish express engine to which the gear is fitted belongs to the Great Southern & Western Railway. It was designed by the locomotive superintendent of that line, Mr. Robert Coey, M.Inst.C.E., and has four coupled wheels, 6 ft. 7 ins. diameter, cylinders 18 ins. by 26 ins., and 1,277 sq. ft. of heating surface. The work this engine is doing is the hauling of express trains a distance of 160 miles daily upon very irregular and steep roads, with loads varying up to eighteen vehicles—equal to 335 tons—behind the tender, the profile of the line being all against the engine for a distance of thirty miles. This, however, does not prevent the engine keeping good time all the way, as it has often been able to make up a good deal, and has made up as much as 17 minutes when hauling the heaviest trains, and this with a boiler of only small dimensions. The engine has run a distance of over 50,000 miles in eleven months without any trouble or delay, and has never refused to promptly start the heaviest train, whatever the position the cranks have been in, the secret of this being, of course, that with this gear fitted engines have always a full steam port open. It has been found that the gear promotes smoothness of running on the part of a locomotive at high speeds, there being an absolute freedom from vibration, even when notched up to the centre with the regulator wide open, running at high speed down a bank.

Train miles and engine miles on the work of the G.S. & W.R. locomotives are practically identical, as there is no shunting or light running. The coal consumption is 35 lbs. per mile, which includes lighting up and all other charges.

Ergin is a liquid fuel which has found much application in Germany. It is obtained from tar by a secret process, and is reported to have a heating power of 16,500 British thermal units per pound.

Chats on Model Locomotives.

By Henry Greenly.

Balancing and Balance-weights.

(Continued from page 162.)

As will have been noticed by readers interested in this subject, the previous articles to this have dealt with the question in two ways, and those who do not care to adopt the geometrical or mathematical solutions submitted, will be able to

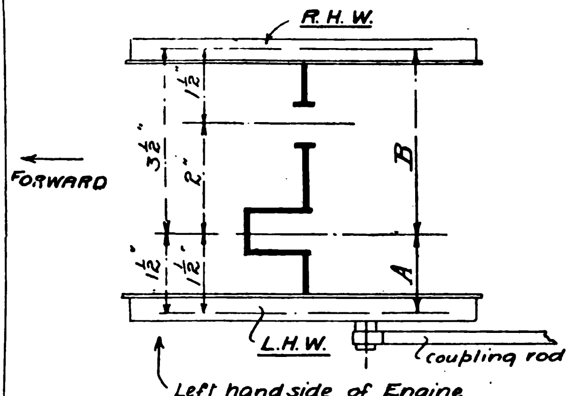

Fig. 8.—Balancing on Inside Cylinder Locomotive.

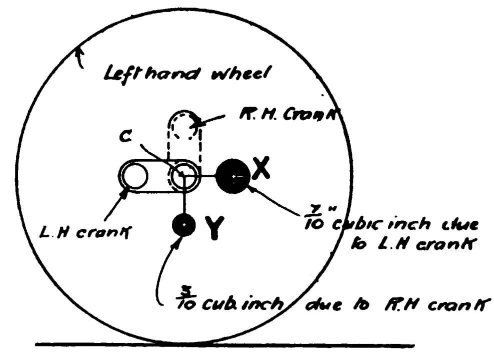

Fig. 9.—A View of Left-hand Wheel showing the Two Balance-weights required, and which will later on be resolved into one.

(Note.—The larger counterweight is always opposite the crank nearest the wheel being dealt with.)

apply the principles in an empirical or experimental manner. I propose a similar course in treating the more difficult problems, as I do not wish it to be said that the presence of mathematics has debarred any reader from following the discussion or prevented him from being able to arrange the counter-balance weights correctly on any model he may be building. The subject should also be interesting to builders of model stationary and marine engines, although I intend to particularise in this subject when time permits me to resume

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the desultory series of articles—" Notes on Model Steam Engines," which started in these pages last year. But to come to business:—

The outside cylinder engine is simplicity itself, as all the disturbing and equalising forces are generally considered as being in the same plane. Therefore, the rule exemplified by Experiment F (see page 138, issue of August 8th) need not be resorted to. The counter-balance weights in the wheels are always directly opposite the crank-pins (see wheel A, Fig 1, page 135 of the issue just referred to), and the only difference between the driving and coupled wheels is in the magnitude of the balance-weights, the coupled wheel requiring only sufficient to counteract the effects produced by the coupling-rod, whereas the driving wheel counterweights have to balance a proportion of the reciprocating masses and the connecting and coupling rods as well. The rule is as follows:—

Add together the weights of reciprocating parts (piston, piston-rod, crosshead, half the connecting-rod), and divide by half. Consider this as a revolving mass situate on the crank-pin, and add to this the unbalanced weights of the crank boss, crank-pin, the other half of the connecting-rod, and also half of the coupling-rod.

The total weight should be balanced by an equal and opposite weight working at the same radius,

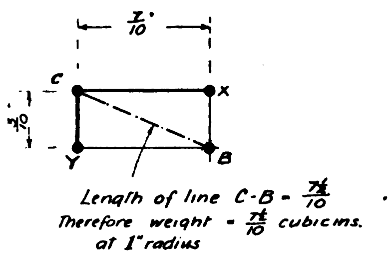

FIG. 10.—FINDING BY DIAGRAM THE DIRECTIONS AND MAGNITUDE OF SINGLE COUNTERWEIGHT REQUIRED TO BALANCE A GIVEN INSIDE CYLINDER LOCOMOTIVE.

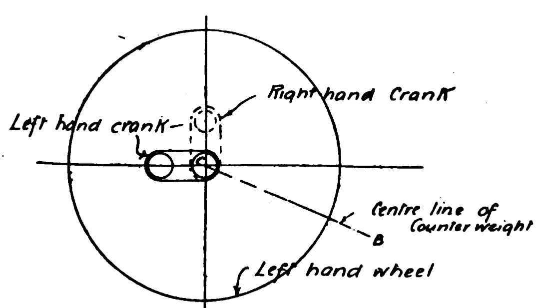

FIG. 10*a*.—POSITION OF COUNTERWEIGHT MARKED ON WHEEL.

or by an opposite counterbalance weight the magnitude of which is in inverse ratio to the distance from the centre of the axle. In every case the counterbalance weight multiplied by the distance from centre should be equal the weight to be balanced multiplied by its radius of action.

Supposing the unbalanced weight equals 1 cub. in. of metal (4 ozs. roughly) at a radius of, say, 1 in., which would be the crank-throw for an inch scale model. With a driving wheel 7 ins. in diameter the balance-weight would be about 3 ins. from the centre of the axle. This being the case the weight would have to be in inverse ratio to the

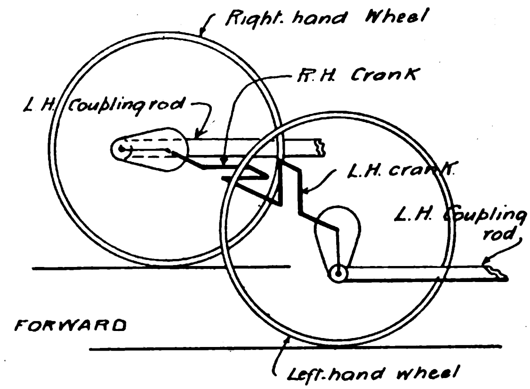

FIG. 11.—RELATIVE POSITIONS OF CRANK AND COUPLING-RODS USUALLY ADOPTED FOR INSIDE CYLINDER LOCOMOTIVE. THE COUPLING-RODS ARE PLACED OPPOSITE THE CRANK ON THE SAME SIDE.

(*Notable exception to this, Mr. Stroudley's "Gladstone" class 0—4—2 locomotive, L.B.S.C.R.*)

distance, viz., inversely as 3 is to 1 which equals one-third of 1 cub. in. = ⅓ cub. in.; or, which is the same thing, one-third of 4 ozs. = 1⅓ ozs.

The diagram (Fig. 7) explains this graphically, and its truth may be checked arithmetically in the following way. In each case the weights and counterweights by the distance should equal each other, as laid down by the rule—

Weight × distance = Counter-weight by distance.
∴ 1 cub. in. × 1 in = ⅓ cub. in. × 3 ins.
or, 4 ozs. × 1 in. = 1⅓ ozs. × 3 ins.
because 1 = 1
or, 4 = 4.

In dealing with inside cylinders the rule exemplified by Experiment F is involved, because the two cylinders are respectively set at unequal lateral distances from the wheels. The moving parts of the left-hand crank have to be balanced mostly in the left-hand wheel and partly in the right-hand wheel, and the mechanisms of the right-hand side balanced mostly in the right-hand driving wheel and partly in the left-hand wheel. In addition to this, as it is not desirable to have two sets of weights in each wheel, the two masses which would otherwise be necessary have to be resolved into one counterweight which will act in the same way as the two. The rule is as follows:—

Add up the reciprocating and revolving masses at the crank-pin, as before mentioned, and balance them in each wheel, the amount varying inversely as the distance. If the mass of metal to be balanced is represented by 1 cub. in. (or 4 ozs.), then with an inch scale locomotive A will be 3½ ins. and B 1½ ins., and the weights on wheels R.H.W. and L.H.W. will have to be in the proportion of 1½ to 3½, or 3 to 7 respectively

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As 3+7=10, the weights in the right-hand wheel will be three-tenths of 1 cub. in.=3-10ths cub. in. (or three-tenths of 4=1 1-5th ozs.), and in the left-hand wheel seven-tenths of 1 cub. in.=7-10ths cub. in. (or seven-tenths of 4 ozs.=2 4-5ths ozs.). This result having been obtained, make a diagram, as shown in Fig. 9.

Now the arrangement for the two sides of the engine is quite symmetrical, and the right crank will affect the left-hand wheel in the same manner as the left crank affects the right-hand wheel (R.H.W.), and therefore, without further calculation, we can add another weight equal to the small one we said was required in the wheel (R.H.W.) to balance the left-hand crank, viz.: 3-10ths cub. in. (or 1 1-5th ozs.). This we add to Fig. 9. We now have two balance-weights in the wheels X and Y acting in the directions shown, viz., at right angles to each other, and the next thing to do is to resolve these into a single weight, the magnitude and position of which can be found by a simple diagram. From a centre-point C (Fig. 10) draw a line in the same direction as line C to X in Fig. 9—that is, horizontally. Draw this line to a scale representing its weight or cubic capacity, say 7-10ths in. From point C draw another line (C Y) to represent the direction of the C Y line in Fig. 9. This should

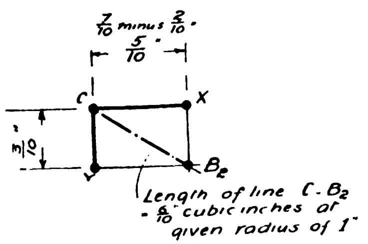

FIG. 12.—DIAGRAM GIVING DIRECTION AND MAGNITUDE OF BALANCE-WEIGHTS WHEN ENGINE IS A COUPLED ONE.

(*Compare with Figs.* 10 *and* 10*a*.)

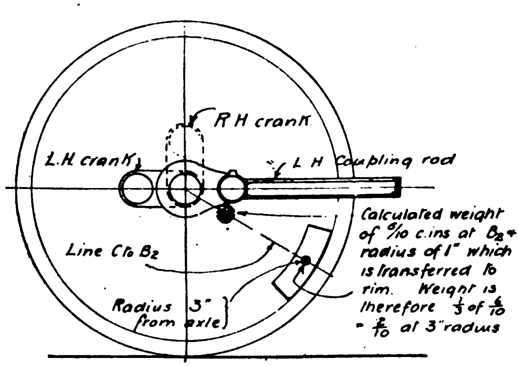

FIG. 13.—ELEVATION OF LEFT-HAND WHEEL, SHOWING BALANCE-WEIGHT FIXED IN ACCORDANCE WITH DIAGRAM FIG. 12.

be 3-10ths in. long to represent the mass of metal being dealt with. Make a parallelogram by drawing two lines parallel to C X and to C Y, respectively, which will meet in B. The thick chain-dotted line C to B gives the centre-line of the single balance-weight required, and the length of the line represents its magnitude. In this case it will measure 7½-tenths of an inch (see Fig. 10). The next sketch (Fig. 10*a*) is then prepared and the relative position of the balance-weight to the crank is fixed up. It will be noticed that it always falls on a line which, if produced, bisects the crank angles. But, as before mentioned, the weight is usually placed

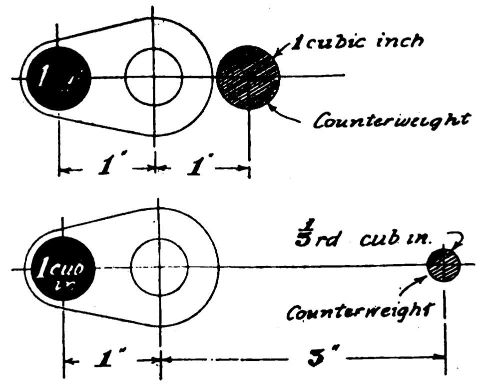

FIG. 14.—SHOWING THAT SIZE OF COUNTERWEIGHT MUST BE INVERSELY AS THE DISTANCE FROM THE CENTRE OF AXLE.

in the rims, and by the rule exemplified in Fig. 7 we find that the cubic capacity of B will be one-third of $\frac{7\frac{1}{2}}{10}$ if placed at 3 ins. radius instead of 1 in. like the inside crank-pins. No further calculation is required for the right-hand wheel, as the same wheel casting will do for this as for the left-hand wheel.

Nothing, however, has been said about coupling-rods in this case, and whilst the magnitude and direction of the counterweights determined by diagrams (Figs. 10 and 10*a*) would be quite correct for a single driver engine, the presence of coupling-rods adds another factor to the problem.

Coupling-rods are usually placed diametrically opposite to the crank-pins on the same side—that is, the coupling-rod in the left-hand wheel is fixed directly opposite the left-hand crank, as indicated in Figs. 8 and 11. Therefore, the coupling-rod crank-pin, being placed at point X (Fig. 9), it to some extent balances the crank on that side of the engine: or, which comes to the same thing, nullifies—wholly or partially—the weight necessary to counteract the disturbing influences of the main inside crank-pin and before the parallelogram of forces which is made to fix up the position of the final counterweight is made, we require to know how much has to be deducted from the X (Fig. 9) weight. Assuming the mass of metal revolving at the coupling-rod crank-pin (calculate, as before, half the coupling-rod + the crankpin + the unbalanced portion of the wheel boss) is, in the case we are dealing with, 2-10ths cub. in., then the weight required *in addition to the coupling-rod* is 7-10ths − 2-10ths = 5-10ths cub. in., in the direction C to X. Knowing this, we set out the parallelogram (Fig. 12). By this diagram we find that the mass of metal required is 6-10ths cub. in. in the direction C to B2 (Fig. 12), acting at the radius of the crank-

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pin, and we have only to find out the amount of metal required necessary at the rim (by the "weight varies inversely as the distance rule") and to fashion the weight on the centre-line C to B2, so that the right amount of metal is obtained, to complete the problem. It will be seen that the approximate position of the weight agrees with sample wheel for an engine with the left-hand crank leading, shown in Fig. 1B on page 135 of the first article on this subject.

This concludes my part on the discussion of balancing model locomotives; but should any reader have some abnormal case he would like me to deal with, I shall be most happy to do so, if it is likely to prove of use to other model engineers.

(To be continued.)

Experiments on Electric Oscillations and Waves.

By R. P. Howgrave-Graham, A.M.I.E.E.

(Continued from page 323, Vol. XV.)

SINCE October, 1906, the articles in this series have been published at regrettably long intervals, but as the unexpected and overwhelming mass of work which rendered this necessary has been to some extent cleared off, it is hoped that a more regular supply of matter on this subject will now become possible.

In the meantime, the writer seized the opportunity offered by some experiments which had to be made for a lecture and took a further series of photographs, some of which illustrate effects already described, while others show new experiments of a somewhat remarkable character. Where the experiments have been described previously, the writer will give an abstract of the letterpress in sufficient detail to save the necessity of referring back to old numbers.

Fig. 50 illustrates a very remarkable experiment, described in the issue of April 2nd, 1903. The oscillatory discharge is sent through a tall hoop of ½-in. copper rod, which shows a prodigious fall of potential along its length by reason of the excessively high frequency of the current. So great is the choking effect that the 50-volt lamp shown connected across the top of the loop burns brightly, though apparently short-circuited. Further, it must be borne in mind that the voltage between the lamp terminals is enormously in excess of the 50 volts required to make it glow in the ordinary way. Not only does the self-induction of the filament assume far greater importance at very high frequencies, but the resistance is also increased by reason of the "skin-effect."

Thus the terminal voltage of the lamp in question was not less than 3,000, and was sufficient to burst across between the ends of the filament, causing it to act as a vacuum bulb and glow in the well-known manner. The violet light thus produced accounts for the apparent excess of brightness over the 100-volt lamp lower down the hoop; the latter has the platinum leading wires sufficiently far apart to prevent a discharge. Lower down still is an ordinary vacuum tube glowing with excessive brightness, and on the right, just above it, is a 4-volt lamp burning across a straight piece of the copper rod, about 8 ins. in length.

Thus we have the weird phenomena of two ordinary glow lamps of different voltages and a vacuum tube requiring several thousands of volts to

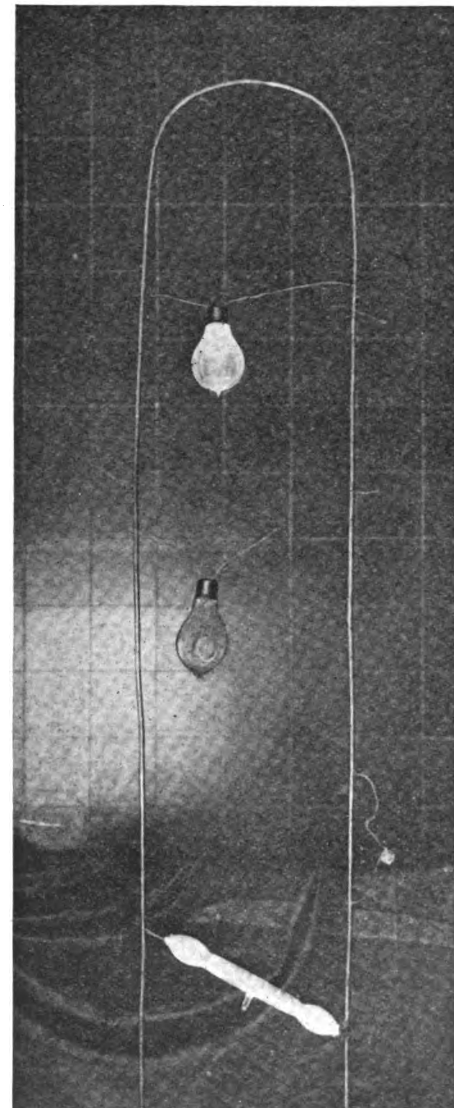

Fig. 50.—Lamps and Vacuum Tube Glowing, though apparently Short-circuited by thick Copper Wire. Exposure: ½ sec.

actuate it, burning in parallel with each other, and apparently short-circuited by a stout copper rod. Across the two lower ends of the hoop a spark about ⅞ ins. in length can be made to pass. This represents about 27,000 volts, and therefore an average potential gradient of about 3,000 volts per foot. To produce such a potential gradient with a continuous current, the value of the latter must be about

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16,000,000 amps., and the total horse-power expended in the hoop must be about 432,000,000,000. Would the hoop stand it for long?

Fig. 51 is from a photograph of an experiment described in the issue of May 21st, 1903. The oscillatory discharge is passed through a coil of seven turns of stranded lighting wire, wound so as to form a primary about 16 ins. square. The secondary consists of a single square turn of broad brass sheet wound on a wooden frame, and provided with a pair of terminals at the top. The combination forms a step-down transformer, and currents of very considerable magnitude are induced in the brass if it is short-circuited. The photograph shows an old file being drawn across the terminals. The current is sufficient to generate great heat, and to give the blue light and yellow scintillating particles of burning metal which are characteristic of sparks from iron; there is also sufficient fusion between the surfaces of contact to cause the file to stick with considerable force. After the experiment the terminals are seen to be deeply pitted and burnt. The photograph was taken on an extremely rapid plate in a darkened room; a few inches of magnesium ribbon were used to show the terminals and the file, after which the discharge was started, and the file rubbed for less than a quarter of a second over the terminals. No part of the picture has been touched up except the thumb of the operator and the wooden frame to which the brass strip was fixed. Some of the scintillations shot out to a considerable distance in front and behind, consequently only those in the same plane as the terminals are sharply focussed.

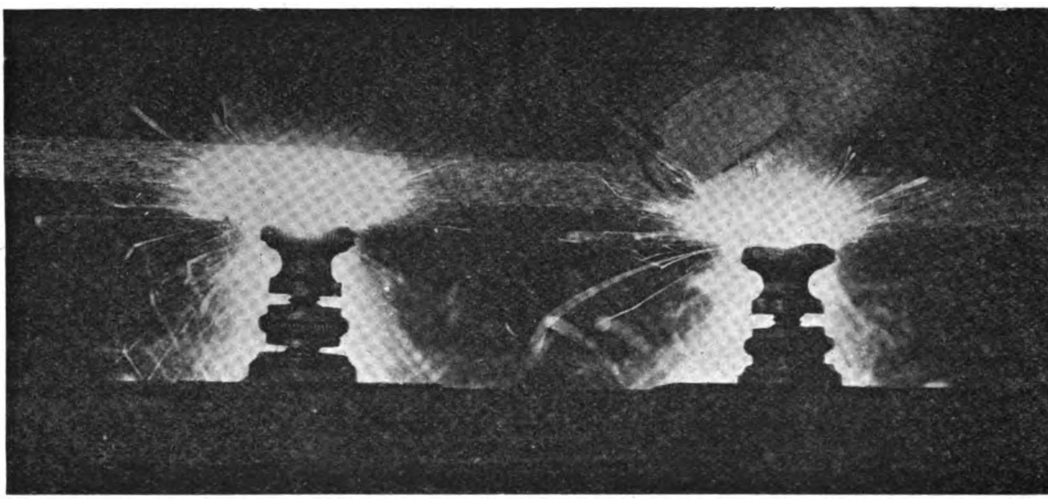

Fig. 51.—Sparks produced by Short-circuiting Secondary of Step-down Oscillation-Transformer. Exposure less than ¼ sec.

In the issue of June 4th, 1903, a remarkable experiment is described, its object being to show the great waste of energy produced when an iron core is used for high-frequency transformers or impedance coils. About thirty turns of ordinary bell-wire are wound on a glass tube containing an ordinary French nail, and the oscillatory discharge is sent through the coil thus formed. Although the diameter of the nail is small, eddy-currents and frictional hysteresis combine to cause a rapid rise of temperature to red heat. Above recalescence point the heating is due entirely to eddy-currents, and consequently the temperature rises more slowly after red heat is attained. When sufficient time has elapsed the coil gets very hot and the insulation begins to smoulder; before long the whole coil bursts into flame and the covering of the wire becomes carbonised; the voltage between the turns being very high, the final result is that a torrent of blue sparks passing through the insulation causes a complete breakdown. The photograph was taken at the moment when the coil burst into flame. The head of the red-hot nail can be seen in the right-hand end of the glass tube. A piece of the small wire used in the cores of ordinary induction coils also gets red-hot when treated similarly. This shows that an iron core, however finely subdivided, is worse than useless where currents of very high frequency are employed.

(To be continued.)

Three new corridor saloon trains have just been put into service by the L.N.W. Railway. Each train is composed of eight vehicles—three ordinary saloons, two dining saloons, one kitchen car, and two brake vans—and will accommodate in the ordinary saloons 220 passengers—105 first-class, 56 second-class, and 59 third-class; and in the dining cars, 102 passengers—51 first-class, 24 second-class, and 27 third-class. Access to the train is by wide vestibules at the end of each of the coaches. The saloons are lighted by electricity, and the arrangements for heating and ventilation are in every way admirable. Lavatories are provided at each end of all the saloons. The new trains have been designed to run between Euston and Liverpool in connection with the sailings of the Transatlantic liners.

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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 first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from September 25th, 1907, to October 31st, 1908. Full particulars and forms of application may be obtained from—HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

MR. EDWARD FEARN, 149, Walford Road, Sparkbrook, would like to meet with other model engineers in the district of Birmingham.

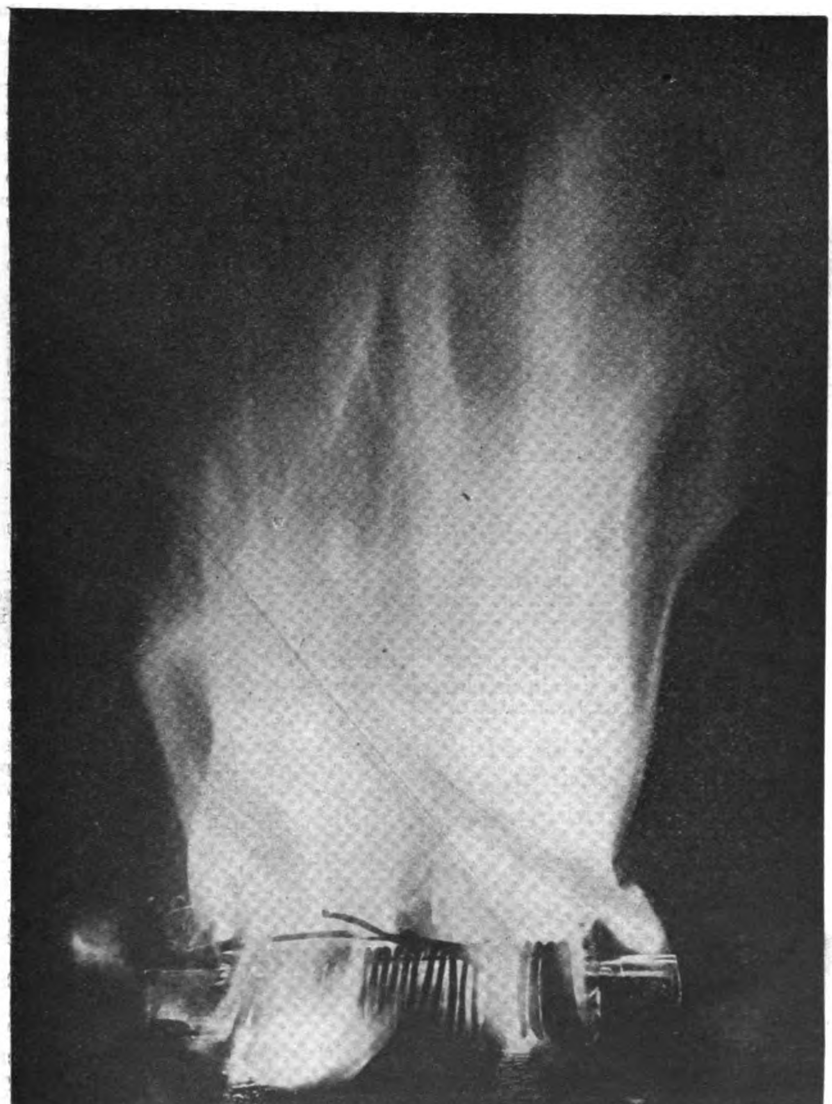

FIG. 52.—EXPERIMENT SHOWING HEATING OF IRON NAIL BY HYSTERESIS AND EDDY CURRENTS. EXPOSURE LESS THAN ½ SEC.

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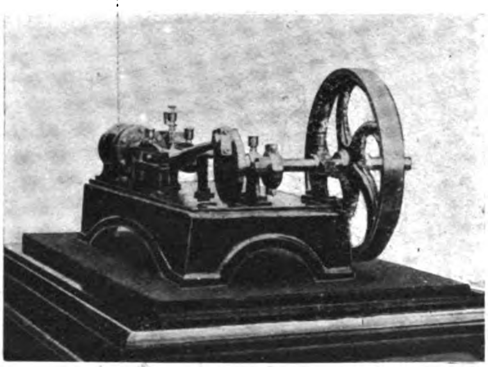
Practical Letters from our Readers.

[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 Well-made Simple Horizontal Engine.

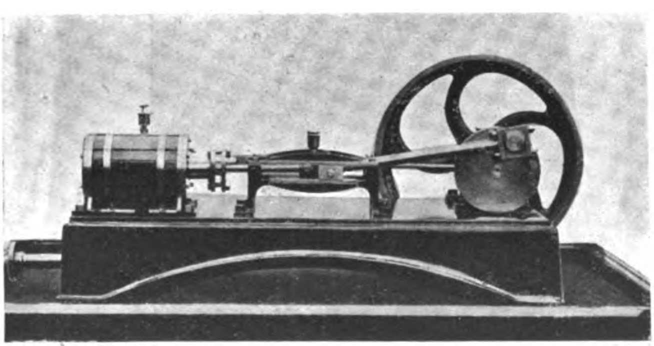
To the Editor of *The Model Engineer*.

Dear Sir,—Being desirous of making a simple engine which would work well, I first made a drawing, then began the work proper, with the final result as shown in illustration herewith. The



End View of Engine.

whole of the patterns were made by myself with the exception of the flywheel. The cylinder ports were cored, the steam ports being $\frac{7}{8}$-in. by $\frac{1}{8}$-in., and the exhaust $\frac{7}{8}$-in. by $\frac{1}{4}$-in. All castings are gun-metal with the exception of the soleplate and flywheel, which are cast iron. The cylinder is 1 7-16ths in. bore by $2\frac{1}{4}$-in. stroke, and the travel of the valve is $\frac{3}{8}$-in. The piston is a built-up one and has two rings. I have taken off back cover of



Side View of Engine.

cylinder and let steam into other end of cylinder at 40 lbs. per sq. in. pressure and no steam passed the piston. The cylinder is lagged with mahogany, the mahogany being fitted on in as few pieces as possible and lined to represent planks. The lagging is polished and held in position by two brass straps. The engine is painted dark green. All the turning work was done on a $3\frac{1}{2}$-in. centre woodturning lathe with the exception of the cylinder and flywheel, which I had to get turned for me. The engine has been run several times, and a speed of abou t1,000 r.p.m. has been obtained with a steam pressure of between 20 and 30 lbs. per sq. in.—Yours truly,

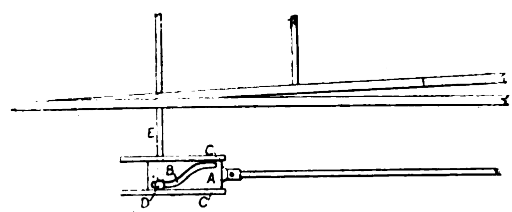
Kilmarnock. Wm. Thomson.

Facing Points for Model Railways.

To the Editor of *The Model Engineer*.

Dear Sir,—Many contrivances have been suggested for locking facing points without resorting to the second lever necessary for the ordinary lock and safety bar. On model railways facing points are seldom locked, but at the same time it is desirable that where fairly heavy locomotives are used, running at speeds up to ten miles an hour, precautions should be taken to prevent derailment at facing points.

The arrangement in use on some of our Irish



Locking Model Railway Facing Points.

railways might suit the ordinary model railway This arrangement consists of a plate A, in which there is a curved slot B. The longitudinal movement of the plate between the fixed guides C C causes the pin D to move laterally. The pin D is attached to the point rod E. This arrangement, when properly adjusted, keeps the point rigidly fixed against the rail. Movement of the points, due to a passing train, is practically eliminated, owing to the short distance between the rigid plate and the points. With the ordinary crank, movement due to the same cause can take place along the whole length of the bar connection from the cabin to the points. Messrs. W. J. Bassett-Lowke & Co. have adopted a somewhat similar principle in their small point levers.—Yours truly,

Wm. J. Ward.

Cookstown, Ireland.

A Model Steamboat.

To the Editor of *The Model Engineer*.

Dear Sir,—The model steamboat, *Seamew*, which is illustrated by the photograph herewith, was made by myself some years ago. It is built in layers about $1\frac{3}{8}$ ins. thickness. This method being preferred for the following reason: The size being 5 ft. 6 ins. by 10 ins. by 10 ins., timber of these dimensions being difficult to obtain of even quality and free from

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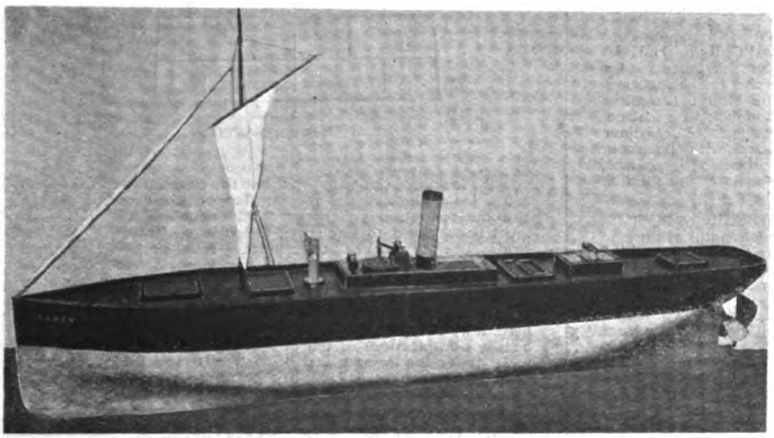
defects. Again, the built method is also more economical and less laborious to shape, as the six or seven layers can all be cut out with a saw of the keyhole type. The middle and end portions will be useful for battens, etc. Having the layers ready, I proceeded to fix dowel-pins, 3-16ths in. diameter, to prevent the sections shifting after the glue has been applied. When building this boat, I obtained the use of six or eight screw cramps. With the assistance of my nephew and the aid of two glue pots, we got all the layers together quickly, the smoothing off of the sides being left until the next day. This was very satisfactorily done by using laid templates and curves made from the drawings, which showed all the intersecting lines, which were numbered and lettered, the layers being set out with central line and cross section lines on both sides, the saw being sloped to suit lower layer. The middle portion of the boat is fitted with U-shaped angle brass, ¼ in. by ¼ in.; these were covered with sheet tin to form air space round boiler. This method of protecting the boat from heat was quite successful. The bottom layer being formed to leave a keel of ⅜ in. in depth, into this long brass screws were used to form the holes in lead which was cast in place, the same being rendered smooth and finished with ¼ in. by ¼ in. square strip iron, this and the lead being connected to the keel with brass screws.



Mr. Hepworth's Model Steamboat.

The deck is fitted with sliding hatches and raised sides round boiler space to prevent the water getting in. The bulwarks are fixed with screws and finished with line and varnish. The rest of the boat is painted green and black; French grey inside—three coats of oil and colour in all, to protect all the joints.

The boiler is of the multiple tube type, fuelled with charcoal and maintaining a pressure of 40 lbs. It can be attended to either from deck or below. It has baffled fireholes, uptake, blower, water and steam gauges, pump, and clack valves, and supplies ample steam to double engine of the oscillating type, but fitted with slide valve gear; the ordinary cutting off and inletting of steam in this kind of engine being improved. The cylinder is 2 ins. by 1¼ ins., covered with felt and sheet steel, and all parts are fitted with oil cups.—Yours truly,

Chelmsford. P. G. Hepworth.

Portsmouth Model Yacht Club.

A MODEL YACHT race for 10-raters, held under the auspices of the Portsmouth Model Yacht Club, took place on Wednesday, 14th inst., at the Canoe Lake. Among those sailing were two gentlemen connected with London model yacht clubs, who expressed themselves delighted with the opportunities enjoyed by Southsea model yacht enthusiasts for carrying out their sport in such a beautiful lake. The scores were Mr. Braine's *Ada* (London Model Yacht Club), 20 pts.; Mr. Coxon's *Saucy Sally* (P.M.Y.C.), 20 pts.; Mr. Tallack's *Dorothy* (P.M.Y.C.), 12 pts.; Mr. Wilson's *Florence* (P.M.Y.C.) securing fourth place with eight points. Mr. Stubberfield's *Foam* (Highgate Model Yacht Club) was very unfortunate in not having the right suit of sails, which heavily handicapped her. In the final for first and second place Mr. Coxon's *Saucy Sally* beat Mr. Braine's *Ada*, thus securing first position.

The Portsmouth Model Yacht Club is a new club, formed with the idea of giving an opportunity for tradesmen and others to participate in the sport of model yacht sailing in mid-week, the existing club holding its fixtures on Saturdays. The type of boat adopted is 10-rater. Formula :—

$$\frac{\text{L.W.L.} \times \text{S.A.}}{6{,}000} = 10$$

Any gentlemen in the district, or who are in the habit of visiting Southsea for their holidays, are invited to become members. Annual subscription 7s. 6d.; entrance fee to races 1s. Hon. members' subscription 5s.; entrance fee to races 1s. 6d.; if unattached to the P.M.Y.C., visitors can participate in open races on payment of 2s. entrance fee. All who wish to join should communicate with the undersigned.—Clive Wilson, Hon. Secretary, 343, Fawcett Road, Southsea.

Wireless Clock Regulation.—The regulation of clocks by wireless telegraphy, says *Electricity*, seems to have been quite successful. In the experiments at Vienna of Reithoffer and Morawetz, the clock was controlled by wireless impulses from a regulator 3¾ miles away, and it kept perfect time, with no interference from stray currents.

A Motor-car forms part of the equipment of the *Nimrod*, which left the Thames recently on her voyage to the Antarctic Pole. Lieut. Shackleton, who was Captain Scott's right-hand man in the *Discovery*, is in command, and will rejoin the ship four months hence in New Zealand, when the journey proper to the Polar regions will be commenced.

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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.

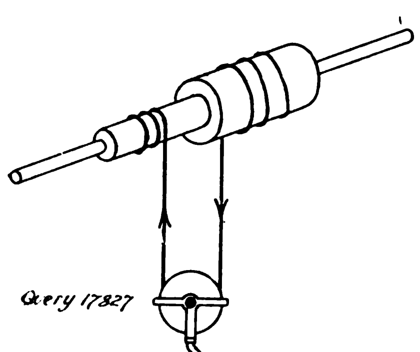
Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, 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:—

[17,979] **Increasing E.M.F. of Daniell Cells.** J. J. M. (Thurles) writes: I will thank you for some assistance in the following: I made a Daniell gravity battery to charge small accumulators, according to your instructions in THE MODEL ENGINEER (No. 22). Although I have taken every care to follow your instructions, I cannot get more than ·5 or ·6 volt per cell. I have even tried reducing the distance between the plates, without success. The cells are quart Leclanché jars—Copper, 9 ins. × 2½ ins.; zinc, 3 ins. diameter × ⅜ in.; electrolyte, copper sulphate, and solution of zinc sulphate; well amalgamated.

We suspect your trouble arises through the density of the fluids not being correct. By increasing the density (strength) of the zinc sulphate solution you diminish the E.M.F. of cell, and by increasing the density of the copper sulphate solution you increase the E.M.F. Therefore, your plan is to take the latter course, and we trust you will get better results.

[17,827] **Differential Gears.** A. N. (Carshalton) writes: I should be much obliged if you could help me with the following. I wish to make a resistance board for charging accumulators from a small dynamo. (1) I want to know what gauge and quantity of iron wire I shall require per ampere. (2) Could you kindly give me a rough sketch of a defferential gear, showing its action?

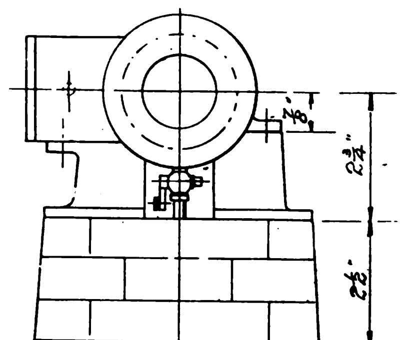


A SIMPLE DIFFERENTIAL GEAR APPLIED TO A HOIST.

(1) As you do not supply any figures we cannot give a definite reply; but in any case, probably only a few feet or yards of iron wire would give you all the resistance you require. It is generally very wasteful to employ resistances such as you propose in such small work. (2) Differential gears are used for many purposes. A simple one as used for hoist work is shown above. In a differential gear the difference between the velocities or powers of two distinct moving parts is made use of.

[17,661] **A Model Horizontal Engine.** E. W. S. (Whittlesea) writes: I have a cylinder 1½ ins. by 3 ins. and I want to build a horizontal engine to drive a dynamo to light a small workshop. Could you show a design for same and give dimensions and length of piston-rod, connecting-rod, diameter of flywheel, slide-valve rod, eccentric rod, and crankshaft?

We publish herewith a sketch of an engine which we think would suit your requirements. You do not send full particulars of the cylinder, and, therefore, you will have to settle the over-all length of the bed and the distance between the centre of the slide-bars and the centre of the cylinder (marked 5½ ins. on drawing) for yourself. The soleplate and masonry base may both be of cast iron, the metal being about 3-16ths in. thick. We cannot give



END ELEVATION.

you the length of the piston-rod, but the connecting-rod should be 8 ins. long; the flywheel 10 ins. diameter (six or seven spokes), and the piston-rod 5-16ths or ⅜ in. diameter. The valve gear must be arranged to suit ports, dimensions of which you do not send. They should be: Steam ports, 3-16ths by ⅞ in.; port bar, 3-16ths in.: exhaust port, ⅜ by ⅞ in.; valve, 1 5-16ths ins. long with cavity 11-16ths in. long; lead, 1-64th in.; crankshaft about 11-16ths in. diameter; flywheel bearing, ⅞ in. long; crank bearing, ⅞ in. long. Other dimensions may be taken from the sketches herewith. As will be seen from the end view, the cylinder rests on the side members of the bed and a space is allowed directly under it for the cylinder drains. Space is provided on the crank shaft for a governor pulley. The bearings may be cast solid with the bed and have loose brasses fitted into milled or bored recesses.

[17,944] **Marine Engineering.** F. W. (Southampton) writes: Will you kindly oblige me in the following. I have served four and a half years' apprenticeship in a small paddle steamer repair shop and have another six months to serve. I regret to state that during this time I have neglected the theoretical part of my trade. Being desirous of obtaining my ticket immediately I have put in my sea time, I should esteem it a great favour if you could recommend to my notice a few books that would coach me up in the theoretical as well as the practical work in engineering (marine). I have Reid's and Wannan's "Hints to Marine Engineers," but find that these do not fill the bill, as they consist largely of examination papers and advanced mathematics; the latter, I may say, being my weak spot.

We can recommend Reid's "Engineer's Handbook" (the large one, 12s. 6d.); "Verbal Notes and Sketches for Marine Engineers," by Southern, 5s. 10d. post free. For ordinary arithmetic we should recommend Colenso's, to be had from any bookshop; we believe price is about 1s. 6d. or 2s. We should advise you to go to one of the special schools for coaching engineers intending to sit for these examinations, for a month or two, directly your time is up. Two months with a good coach will put you right for the second's examination as you are well up in the practical and only require polishing up about your figures, and so on. We believe there is a school (nautical) at Southampton, but if not, any local skipper would give you the nearest address, or it can be had from the Board of Trade, Whitehall, London, S.W.

[17,977] **150-watt Dynamo Trouble.** J. T. B. (Walthamstow) writes: I have one of the British Engineering & Electrical Company's dynamos—a 30-volt 5-amp., according to their advertisement; but I cannot get the output from same, although it excites all right. Can you inform me what is wrong, or what I can do to get the machine to give full output? The armature was wound by makers, so I do not know what quantity of wire was wound on. The field-magnets were wound with the wire supplied, of which there was 1½ lbs. Samples of wire of armature and field enclosed, also rough sketch. Can you inform me what the gauges are; the shortest piece is off armature and longest off magnets. Is the trouble on account of not enough wire on fields? The makers said about 2,500 r.p.m. I have had it running at a

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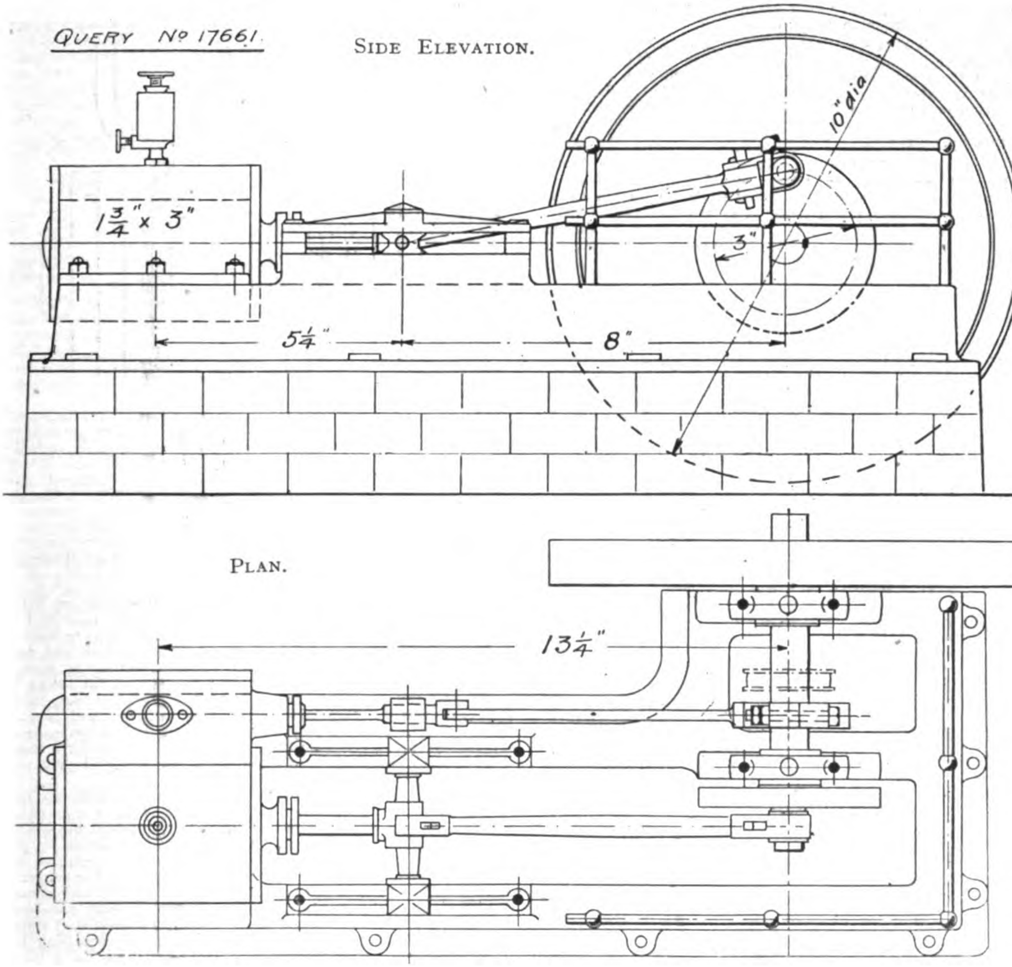
little over 3,000 revolutions, with no improvement. It makes a 30-volt lamp glow, but does not light up properly. The particulars are as follows: Armature, 2½ ins. × 3½ ins. (cog drum); armature tunnel, 2 3-32nds ins.; length of field-magnets, 4½ ins.; width of field magnets, 3½ ins.; thickness of field-magnets, ⅜ in. × 3½ ins. at cores; wire space on field cores, 2 ins. deep.

There is far too little wire on the field-magnets. About 4½ lbs. is the correct weight. The wires you sent are, as near as we can say from their condition, each No. 22 S.W.G. We think if you add more wire to the field coil you will get a better output. The firm you got the goods from have probably made a mistake, but we cannot say whether they will rectify it now. You could write and see, and we hope you will get good results with machine after this.

[17,889] **Model Water-tube Boiler.** J. G. (Birmingham) writes: I should esteem your advice *re* water-tube boiler described on page 45 (Fig. 17) in "Model Boiler" Handbook. Would this style of boiler be suitable, if made of sufficient size, to supply steam for engine with cylinder 2¼ ins. × 2¼ ins.; and will you favour me with necessary sizes of tubes, drums, and best suitable material and pressure to work at? The engine is well made, and runs most satisfactorily with steam from small central-flue boiler at 20 lbs. pressure.

The heating surface required to run the engine with 50 lbs. boiler pressure and at 500 r.p.m. would be about 1,500 sq. ins. This would mean about forty tubes: ⅜ in. diameter, 18 ins. long and rather large drums—too large to be safe, we think, without considerably modifying the design of the boiler. We should recommend that you divided the tubes into two drums, with twenty tubes in each, connecting them to a large steam drum above. As you will see by the second edition of the book, this type of boiler must not be over-cylindered, and to prevent priming a steam drum should be fitted. In a launch, of course, this steam drum would add considerably to the weight of the boiler, but where the generator is intended for stationary purposes this objection cannot be raised. We would prefer to recommend the use of a modified "Yarrow" boiler, something like that described in the issue of March 28th, 1907. The drum should be slightly larger in proportion.



DESIGN FOR A MODEL HORIZONTAL ENGINE. CYLINDER, 1¾ INS. × 3 INS.

(*Scale: ¼ full size of model.*)

[17,976] **Fitting Heavier Flywheels to Small Gas Engine** O. P. (Handsworth) writes: Some time ago I bought castings for a ⅜ (actual) h.-p. gas engine. My trouble is that the engine fires one charge, but will not pull herself over the compression for the next revolution, and when I am pulling her round by hand I cannot rotate her *continually* without her stopping on the compression, and have to get a firm hold with the hand and give a sharp pull, in spite of having a relief cam for the compression at starting. The reason for this is undoubtedly that the two flywheels are much too light, only weighing 4 or 5 lbs. each. They would

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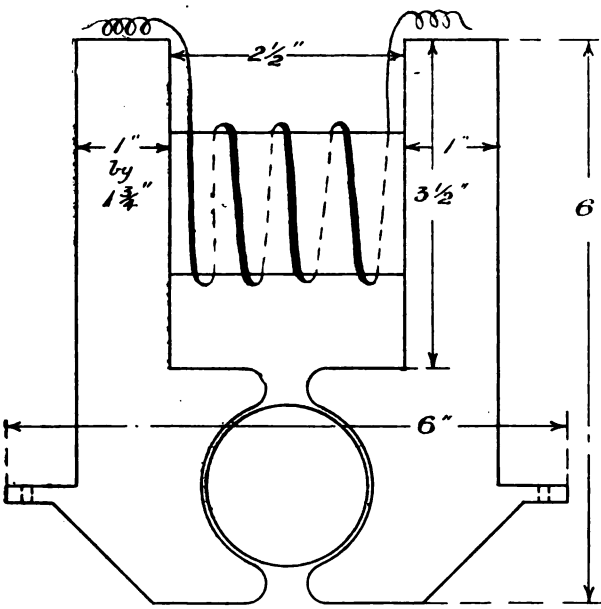
no doubt be right if I had used the little end brass (which screws into the piston), and in which case the compression would only have been about 30 lbs.; at present the compression is about 70 lbs., the cylinder being 2 15-16ths ins. diameter × 3¾ ins. stroke, and clearance 1 5-16ths ins. between piston and cylinder cover (both of which are flat). I propose putting a new flywheel on in the place of the two old ones, and of the following dimensions—14 ins. diameter, 2¼ ins. wide rim × 1¼ ins. deep (this is the maximum width of flywheel boss possible). The crankshaft is ⅞ in. diameter through journals, the crank-pin journal ⅞ in. diameter, and therefore I do not want too heavy a wheel on. Please advise me on this before I order flywheel (see sketch for dimensions, which please correct, if necessary). Could I also keep one of the old flywheels on, or would it strain the crankshaft too much? I have fitted an exhaust pecker governor and cam since your gas engine articles were published. Will my engine give ½ b.h.-p.?

Fitting heavier flywheels will get over the compression difficulty, but you must be careful what strain you put upon the cylinder, as no doubt the engine was not designed to work at such high pressures as will result from 70 lbs. compression. The dimensions of your sketch (not reproduced) appear about correct, and should answer very well. You must test to find the brake horse-power. It cannot be got by any other means.

[17,901] **40-watt Meter Windings.** C. J. (Edge Hill) writes: I would be much obliged if you would show me if I have made any mistake in the motor I have just made. I think I have stated all the particulars I can think of in the enclosed sketch. I cannot so much as get it to start. I want the motor to be shunt wound. I would also like it to be about 1-9th h.-p. or near that. I would be very much obliged if you would let me know, as soon as possible, because if the wire is wrong I could get it changed, providing I do not keep it too long. The sketch shows the way I have coupled the motor up and it is meant to be a shunt wound. Have I coupled up right? The field-magnet casting is 1¾ ins. wide opposite way. The two wires leading from battery, one on one brush by itself and the other connected with the wire from field on the other. I have used tripolar stampings and have wound it the same as Fig. 18, No. 10 Model Engineer Handbook series. Diameter of armature, 1¾ ins.; length, 2 ins.; field and armature



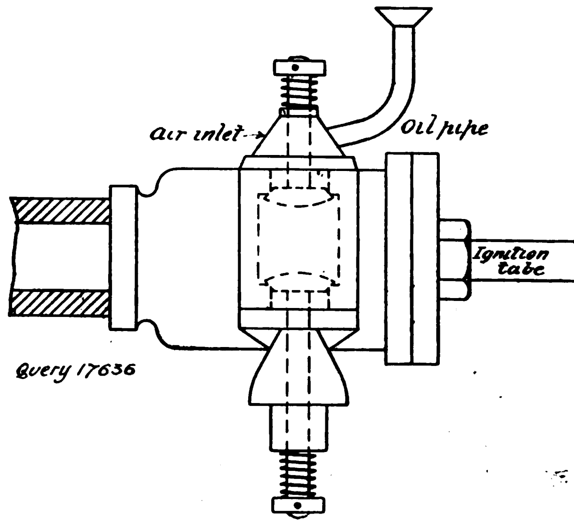
Query 17901

A 40-watt Motor.

wound with No. 19 D.C.C. The current I meant to work it with was 8 volts 10 amps., making it about 1-9th h.-p. Please state if this is right.

We should say your chief fault is that there is not enough wire on field coils, and that its resistance is too low. Hence practically no current will go through the armature circuit as your arrangement stands. If the core of your machine is as shown on your sketch, it is quite out of proportion, and we advise you to study the scale drawings of Figs. 5, 6, and 7 in handbook No. 10. Again, it is possible your source of supply is quite unable to cope with the demand for such a heavy current. We should advise rewinding armature with No. 24 S.W.G., and field-magnet with No. 26, connected in shunt. The respective weights will be approximately 6 ozs. on armature and 2¼ lbs. on field. Maximum power — about 40 watts—*i.e.*, 1-18th h.-p. Supply it with 10 or 12 volts and cells capable of giving a 5-amp. discharge.

[17,636] **Small Oil Engine Trouble.**—"Puzzled" (Cockermouth) writes: I find myself in a difficulty similar to that experienced by W. J. (Margate), whose query appears in a recent issue. I have made a small oil engine from castings supplied by the British Engineering Company, Leek, and it refuses to work. The cylinder is 2-in. bore, 3-in. stroke, water-cooled. I enclose herewith sketch of vaporiser. Oil (paraffin) drips into funnel at end of oil pipe from separate tank and inlet valve is automatic. In place of single air-hole shown, I have made adjustable air inlet.



Query 17636

Feed Arrangement for Small Oil Engine.

Ignition tube is heated by blowlamp. Tube about 2½ ins. long ½-in. bore. After a lot of persuasion engine will start and go at terrific speed for few seconds and then stop. I have tried all I can possibly think of in way of adjusting mixture and exhaust setting, but with no improvement. Exhaust works by lever from 2–1 gear. I have carefully studied The Model Engineer handbook on the subject, but can find no solution of the difficulty. I think that probably design of vaporiser is faulty, and as many of your readers may have made up these sets, their experience might be of great help and interest, as would also a design for a vaporiser which had been used with an engine of this size. I shall be glad of any help or suggestions.

With small ungoverned engines such as this, the difficulty appears to be caused by the speed becoming so excessive once engine is started that insufficient oil is available to keep engine going. If you could regulate the speed to within normal limits by placing a load on engine and then at the same time regulate the oil supply, we think you would obtain better results. The vaporiser (as shown in sketch) is truly of primitive design, but with great care and nicety of adjustment, we believe these engines can be made to run fairly well. Have you tried various strengths of spring on air valve? You might also try the effect of vaporising the oil by passing it round a coiled pipe encircling the ignition tube and passing from there to the inlet as at present arranged. Do not apply too much heat, as too high a temperature is as undesirable as too low a one. Arrange coil so that a greater or lesser portion of it can be brought in close contact with ignition tube flame. You might also utilise the exhaust pipe as a means of heating a vaporising coil once the former has become sufficiently hot. If you have further trouble, write us again saying exactly what you have done in the matter. Meantime we trust these few hints will assist you.

[17,975] **Design for Boiler Required.** A. B. H. M. (Ealing) writes: I want to design a boiler capable of evaporating 1 cub. in. of water per minute under 80 lbs. in. (gauge). How do I find the heating surface, and also which of the types of boiler described in "Model Boiler Making" would be most suitable?

We shall be glad to know for what purpose you require the boiler. Is it for a stationary plant, a locomotive, or a boat? If for stationary work, say whether you can use gas, or what would be the most suitable fuel. Will it be possible also to induce the draught of the boiler by the exhaust steam from the engine? On receipt of these particulars, we shall be pleased to assist you.

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[17,990] **Baume Hydrometer.** G. L. (Kettering) writes: Will you kindly answer me the following questions with reference to gravity Daniell cells, of which I have a number (6-in. × 8 in.)? What is meant by "25° Baumé" in article in THE MODEL ENGINEER, No. 5, page 88, on "Hints on Running Small Electric Motors"? What resistance should be put in circuit to enable cell to work up, or form, and also to prevent copper depositing on zincs when cells are not in use (*vide* your reply to Query No. 13,771, in No. 210)? What size, quantity, and kind of wire should I use to wind resistance coil with (cheapest)? About what would be internal resistance of these cells? What should the specific gravity of zinc sulphate solution be? Please say what class of hydrometer should be used to test same.

Baumé is a certain make of hydrometer; it means that the solution is concentrated to show a reading of 25 with one of these instruments; it is a well-known measurement. Resistance for use with battery about 100 ohms, say ½ oz. of No. 30 gauge Eureka or similar resistance wire. We cannot state resistance of cells—a measurement is necessary. Use a Baumé hydrometer; if you state your wants, a reliable firm of instrument makers will supply a suitable hydrometer and tell you the reading to correspond to Baumé scale; try Messrs. F. Darton & Co., St. John Street, Clerkenwell, London.

[18,012] **Capacity of Accumulators.** R. L. (Middlesex) writes: Am I right in believing that the accumulators that I am in charge of are about 19 or 20 amps. capacity? Their plates (positive) are three in number, 8 ins. × 9½ ins. And also, if when fully charged by a dynamo whose output is 25 amps., the amperemeter only shows an output of 5 amps. under the fullest load capable from the dynamo, is this as it should be?

Reckoning 15 amp.-hours per sq. ft. of positive plate surface, your cells should give about 45 amp.-hours output. The voltage depends on the number of these cells in series. Reckon 2 volts per cell. The rest of your query is too vague, and we advise you to read recent replies on this subject and our handbook, "Small Accumulators," 7d. post free.

[17,803] Coil for High-frequency Experiments, etc.; Articles on Tesla Coils. X. Y. Z. (Bethnal Green) writes: I want to ask you a few questions referring to some of the back numbers of THE MODEL ENGINEER. Firstly, in the issue of July 12th, 1906, you give some experiments on electric oscillations and waves, showing the brush discharges from the fingers to a metal plate. Will you kindly tell me the size of sparking coil used for this experiment, also the size of Tesla coil, and if it has been in any of the back numbers of THE MODEL ENGINEER? In the issue of October 4th, 1906, you show very similar experiments, also Tesla coil. Will you kindly tell me the size of spark, coil, and Tesla coil, and if these have appeared in any of the back numbers? I have your 6d. handbook on "Simple Experiments in Static Electricity," and have got a sparking coil giving a good fat inch spark, yet I cannot produce one of these experiments. Will you kindly tell me what size coil I need for this? In your 6d. handbook on *X*-rays you mention a mineral, namely, Willemite (or mineral silicate of zinc), and that it gives an intense green light, amounting to 2 or 3 c.-p. Does Mr. Cossor, of Farringdon Street, make vacuum tubes with this mineral in them; if so, can you kindly tell me about what price they would be?

The spark coil used for the experiment named gave a 10-in. spark, but was used with an alternating current, with which it gave a flaming arc. A 6-in. coil would work, and smaller coils would give results, though, of course, less vigorously. The Tesla coil was described in detail in the articles appearing February 4th, March 3rd, May 19th, August 4th, August 25th, October 27th (1904). Experiments shown in issue of October 4th (1906) are part of the same series of articles, and the same Tesla and spark coil were used. These articles are still running. We cannot see why you cannot do the "simple static" experiments with the coil described. Many of them would require a gap in the secondary circuit, as if the secondary is directly connected to the experiment, no charge can be maintained. The apparatus will merely be charged momentarily, and then will discharge back through the path provided by the coil secondary. Mr. Cossor, of Farringdon Street, makes excellent tubes such as you describe, and charges about 12s. 6d. or 15s. for fine ones. He might supply smaller ones for 7s. 6d. or 10s. 6d. These are merely rough estimates, and we would suggest that this part of your enquiry might have been advantageously addressed directly to Mr. Cossor.

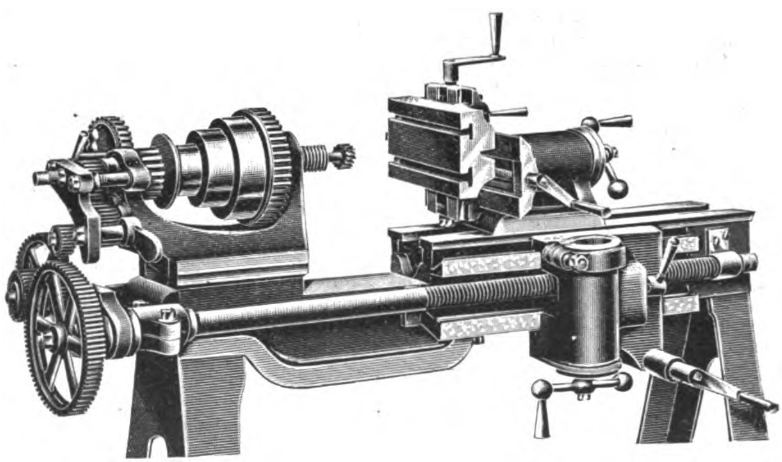
The News of the Trade.

[*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.*

The "King" Lathe.

The accompanying woodcut illustrates a 4½-in. centre lathe of novel design, made by Messrs. King & Co., engineers and high-class tool-makers, of Armley, Leeds. It has been specially designed for use by amateurs and in small workshops, where occasional work requiring milling, wheel-cutting, shaping, or boring operations has to be done. It should also appeal to cycle and motor repairers, and to those owners of cars who are fortunate in having a chauffeur who has a sufficient acquaintance with the use of tools to be able to do his own repairs. In design it is a lathe of a not very extraordinary type, the chief departure being that the saddle is carried on V's cast on to the front of a very strong and rigid bed. This saddle carries a pocket in a vertical position. The barrel of the tailstock is enlarged to a size corresponding with the saddle pocket. On the under side of the compound slide-rest is cast a shank which is made to fit both saddle pocket and the tailstock barrel, a nut in the end of the shank engaging with the screw in both barrels. It will thus be seen that by a very short process the tool is converted from a lathe to a perfect milling machine. The top slide of the compound slide-rest is 8 ins. × 5 ins., and it carries two T-slots on which to secure tools and jigs when acting as a lathe, and jigs and work when acting as a milling machine. It has a traverse of 10 ins. and a cross-traverse of 5 ins., and any-



MESSRS. KING & CO.'S COMBINATION LATHE.

thing can be done on it which can be done on a milling machine, within the limits of those traverses. As a wheel-cutter, we are informed that it is very successful, and will cut wheels comfortably up to 10 ins. diameter × 1¼ ins. on the face, or wider faces up to 7 ins. diameter. Another not unimportant feature is that advantage is taken of the increased size of the tailstock spindle, its centre being dropped ⅜ in. It is then bored to carry centres, tools, or chucks in three holes, any one being brought into position by turning the spindle round like a barrel. This can be made use of for many chucking operations. An attachment (not shown) is also designed to fit the lathe, which converts it into a boring lathe and a shaping machine. This firm also have a more elaborate lathe of a heavier type under course of construction, which they hope to introduce in the near future, as well as one or two other novelties in machine tools.

Aluminium Solder.

Messrs. T. W. Young, of 220, Old Street, London, E.C., have introduced an aluminium solder. There are only two agents needed for making repairs, viz., flux and solder, the soldering bit being such as used by tinsmiths. An advantage with the use of these is that the parts to be mended need not be cleaned. Those interested should write direct to Messrs. T. W. Young for fuller particulars.

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The Editor's Page.

ACCORDING to our promise in the last issue, we give below the general conditions of the forthcoming Speed Boat Competition.

* * *

The entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signatures of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows :—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

Answers to Correspondents.

W. S. (Toronto).—Thanks for good wishes *re* Exhibition. We shall publish a fully illustrated report in due course. Shall be pleased to receive photograph of model railway.

G. (Stratford).—The address of the Junior Institution of Engineers is—39, Victoria Street, Westminster, S.W. The Secretary will be pleased to send you full particulars of membership, subscription, etc., on application.

A. J. P. (Moseley).—Yes. Cheaper slide-rests are supplied by Wilkins, 59, Silvan Avenue, Wood Green, London. Write to him for particulars. An article appeared in the issue for July 4th, 1907. Detail drawings of one will appear shortly in our pages.

"APPRENTICE" (Southsea).—We regret your contribution is not suitable for publication in our Journal. The Sixth "Gauge" Competition is now closed.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

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

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THE

Model Engineer

And Electrician.

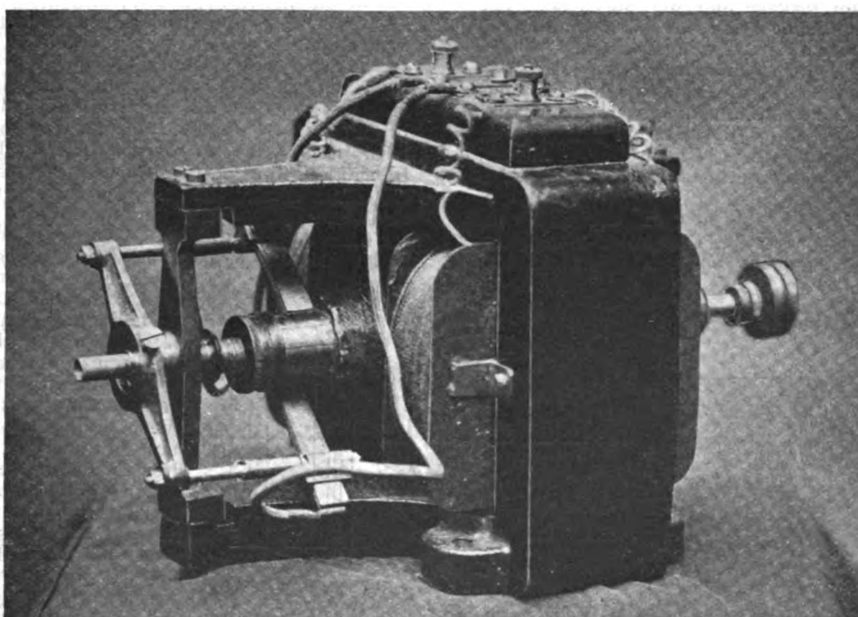
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 332. SEPTEMBER 5, 1907. PUBLISHED WEEKLY

A 100-watt Compound Wound Dynamo.

By F. HANCHET.



MR. F. HANCHET'S COMPOUND WOUND DYNAMO.

THE illustrations herewith represent a 50-volt 2-amp. compound wound dynamo I have recently completed. Drawings were first got out with the help of Mr. Avery's "A B C of Dynamo Design," and THE MODEL ENGINEER handbook, "Small Dynamos and Motors." Then the patterns for the field-magnet were taken in hand, all the dimensions of which are shown in Figs. 1, 2, and 3. The pole-pieces in the pattern were made in a solid piece, and the armature tunnel cored out. The pattern was given three or four coats of good shellac varnish, sandpapered down between each coat. This gives a good hard surface, and the little extra work is compensated by the very smooth casting obtained. While the field-magnet was being cast, the armature was the next step. This is a cogged drum with twelve slots, 11-32nds in. by 11-32nds in. by 2¾ ins.

The shaft was turned down from ⅝-in. tool steel, being ⅜ in. at the bearing and ½ in. at the commutator and armature stampings. The latter were collected on the shaft, turned true, and all rough edges filed off, being clamped tight with ½-in. Whitworth nut and locknut. Before winding, the

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commutator was built up. This consists of a piece of brass rod, 1¾ ins. diameter, turned down to 1½ ins. and leaving ⅛ in. lugs for soldering armature windings to. It was then bored 11-16ths in. with a groove turned at the armature end, and a projection at the other for clamping up. It is mounted on a fibre bush having a shoulder turned to fit the groove in the end of segments. This backs on to a brass washer, as shown, for support. A fibre collar, recessed at back to fit on the brass nut, clamps the segments up. These are twelve in number, the casting being sawn nearly through with a circular saw and finished with hacksaw.

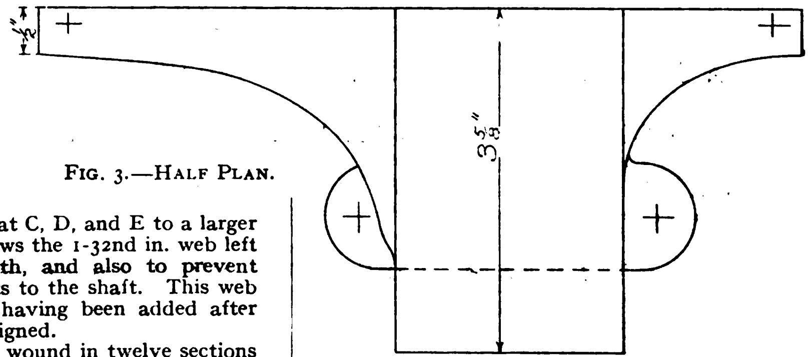

Fig. 3.—Half Plan.

Fig. 4 shows the collar at C, D, and E to a larger scale than Fig. 2, and shows the 1-32nd in. web left in the centre for strength, and also to prevent leakage from the segments to the shaft. This web is not shown in Fig. 2, having been added after the machine was first designed.

The armature was then wound in twelve sections with about 13 ozs. No. 22 S.W.G., each section being tested for leakage and well shellaced. The winding is kept from flying out when running by three binders about ¼ in. wide, consisting of fine iron wire. I ought to have mentioned that two stout brass discs filed to same shape as the stampings with all sharp edges rounded off were made, and placed one each end of the stampings B, Fig. 2. The shaft is fitted with an oil thrower each end, which keeps the commutator and end windings quite free from oil.

The machining of the field-magnet was then started, the tunnel and also the ends to receive the bearings being bored at one setting, in order to

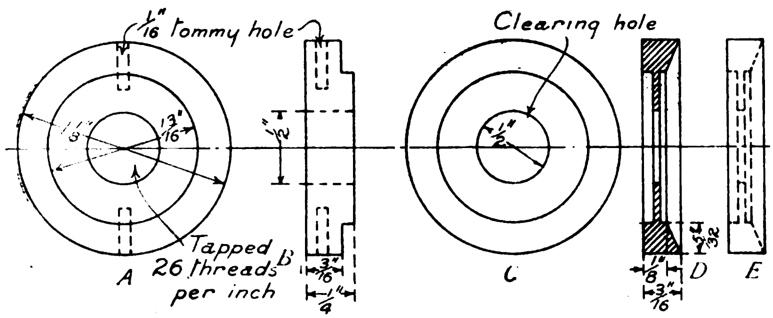

Fig. 4.—Details of Collars. (*Not to scale.*)

assure perfect alignment; but I would advise anyone adopting this method to have shorter bearings, as I found that although mine were turned a tight fit to their seatings, the small curves at top and bottom did not prevent a small amount of side movement. Another mistake I made was putting the holding-down lugs just under the field-magnet coils. They should have been placed as shown at A, in Fig. 2, as in their present position bolts have to be passed up from underneath in order not to foul the coils.

The field-magnet is wound with 2½ lbs. No. 25 S.W.G. for the shunt on brass bobbins, as shown in photographs and in Fig. 1, and one layer of No. 18 D.C.C. for the series winding. The coils are well varnished and then overwound with tape, and finally a dark green cord. This gives a very neat appearance and affords effectual protection from knocks, etc. The bobbins are secured by having brass angle-pieces soldered on to them and screws passing through these into the field-magnet. The bearings are gun-metal castings fitted with barrel-shaped bushes, each pivoted on a pointed screw fitted with locknut as shown in the drawing, Fig. 2. These bearings are quite satisfactory for short runs, but I intend fitting oil ring bearings before using for any lengthy run. It will be noticed in the photograph that the lugs at the top and bottom of the bearings are placed inside instead of outside, as shown in Fig. 2; this alteration was found necessary in order to give more room for the end windings. The copper gauze brushes and rocker are clearly shown in photograph and, being of a common type, need no further description.

The highest output I have obtained up to the present has been 40 volts at 5 amps., or twice the output for which the machine was designed. When taking less current I have obtained 60 volts, the drop to 40 volts being caused by the belt slipping under the increased load of 5 amps. Even at 200 watts the armature only warmed up very slightly, and by giving the brushes more lead the machine ran practically sparkless.

All metal surfaces in armature and field-magnet bobbins were well covered with silk and shellac before winding. The field-magnet is enamelled black, the bobbins and all brass work being picked out with dark green. The terminal board is polished mahogany, all wires being taken thereto and connections made by brass plates.

In conclusion, I might say this is my first attempt at dynamo building, and also I am in no way connected with the engineering profession. I have received no instructions whatever, excepting what I have read in The Model Engineer and handbooks.

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For the Bookshelf.

Model Steam Engine Design. By R. M. de Vignier. New York: Spon & Chamberlain. London: E. & F. N. Spon. Price 1s. 6d. net; postage 2d. extra.

Only a few days before penning this short notice of Mr. R. M. de Vignier's little volume, a correspondent wrote asking for some book which would give him scientific information on the subject of model steam engines. He said that he did not so much want details of construction as properly arranged notes on the proportions of the parts of models, properties of steam, and other formulæ and data which would help him in the design of any particular size of model. While Mr. de Vignier's book deals to a certain extent with constructional details of model steam engines, it is unquestionably one which should satisfy our correspondent and any other reader who requires practical and reliable assistance in the design of small power model engines.

The book, among other things, includes notes on the speed of model engines, cylinder condensation, ratios of stroke to bore of cylinders, safe piston speeds, power calculations, materials and strength of parts, the design of feed pumps, and advantages of compounding, and also explains the use of the condenser and air pump. The slide-valve forms the subject-matter of a very important chapter and, as it should be, is very well illustrated by diagrams. The final chapter deals with the setting out of the design, pattern-making problems, shrinkage and machining allowances, and interspersed throughout the book are tables invaluable to the model maker, which further recommends its possession to the reader interested in the deeper questions involved in the design and construction of small power and model steam engines.

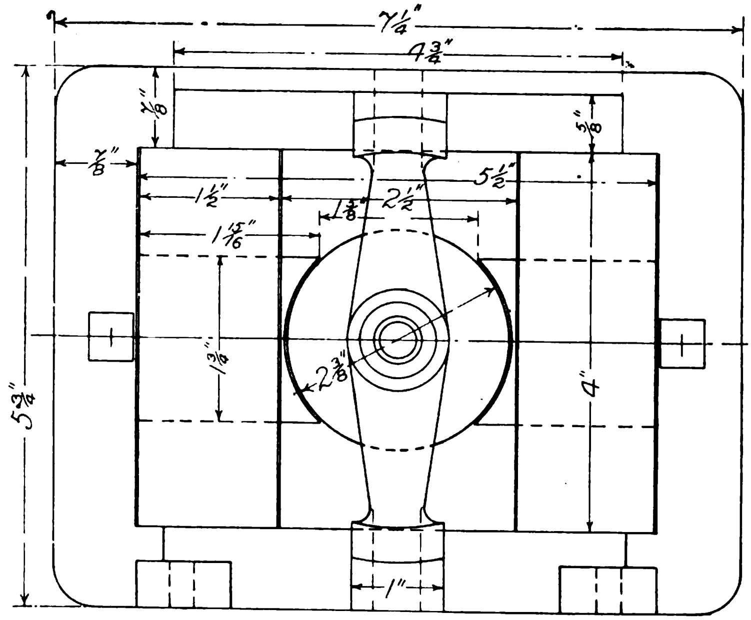

Fig. 1.—End Elevation.

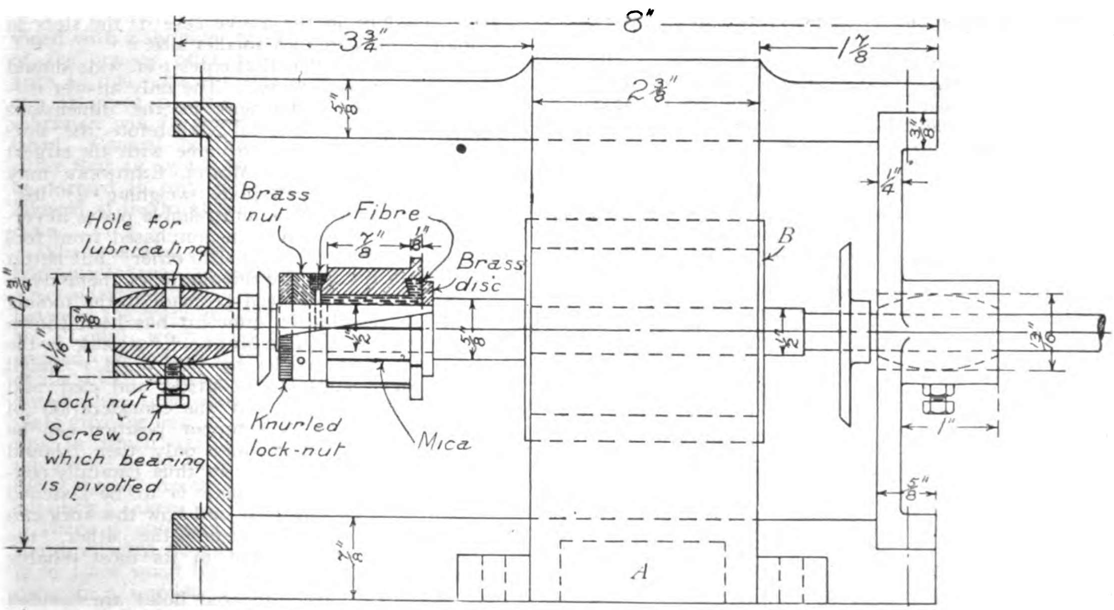

Fig. 2.—Part Longitudinal Section of 100-watt Compound Wound Dynamo.

Owing to its American origin, the book contains several terms which are foreign to our ears, but this should not reduce its usefulness in any appreciable degree. We note also that the writer discounts the coring of steam ports in smaller models, but it may be mentioned that we on this side of the Herring Pond are already getting 1-in. bore cylinders with ports of proper proportions cast in iron very neatly and cleanly. Otherwise we cannot at the moment question any of the statements in the book and again most heartily recommend it to our readers.

Notes on The Uses of Angle-plates.

By Alfred Parr.

THE term "angle-plate" is given to an accessory much used in every workshop where metal is tooled—from the heaviest class of marine work down to the smallest model. It is made usually, of tough cast iron, and has its adjacent sides accurately machine-faced, so as to form a right angle (90 degs.). These most useful appliances deserve our consideration, and for convenience may be classified in two sections. First, we have those employed on rectangular surfaces at the planing, shaping, and milling machines, also for supporting work to be bored or drilled. The second class can be called "lathe angle-plates," which, indeed, are capable of a further division, as those employed on general lathe work, and those made expressly for special work at the lathe.

It will be seen that there are advantages to be obtained by these distinctions peculiar to each section. For instance, it frequently occurs that almost every available inch in a rectangular angle-plate is in requisition when certain classes of work are to be planed or milled, and the same may be said when we have to support the same pieces of work at the drilling machine or the boring machine.

This inconvenience, however, is not so general in lathe work, hence the necessity for the above divisions. It will not be without interest to discuss some forms of plates, designed for general work in the first place, and consider those of a more special character afterwards. Figs. 1 and 2 illustrate an ancient and a modern angle-plate respectively. Fig. 1 has had its weak back broken through too much coring in the pattern—a defect to be again referred to.

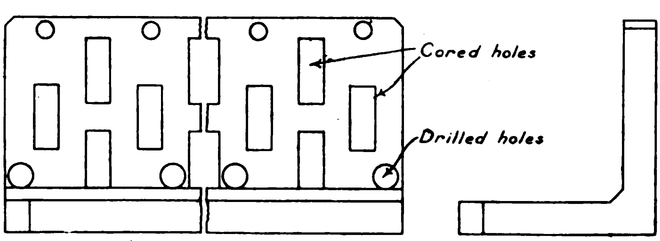

Fig. 1.—Showing a Weak Angle-plate.

It will be seen that Fig. 2 is a more typical design—the length of the plate is about twice the depth; it is provided with cored slots of a rectangular form, spaced at fairly uniform intervals; there is a good fillet, and each end is tied with a substantial web to prevent any possibility of warping. This plate was recently purchased; its weight is 47 lbs., and for general work at the planing machine, the shaper, or drill it is quite in place, and in my opinion not any too strong to resist all the strains it is there subjected to. Now a ¾-in. bolt, having a squared neck, is a little over 1 in. measured diagonally, and although it must be admitted that ¾-in. bolts are very strong, yet there is no margin of material left to prevent their turning even when used in an angle-plate 7 ins. by 7 ins. by 15 ins., such as is given in Fig. 2. When this happens, it is necessary to hold a spanner on the head of the bolt to prevent its turning; but the work is frequently of such a character as to require holding in position, and a second pair of hands must be engaged to assist with it. This is always best avoided, and, indeed, could be in the above case if the slots in the angle-plate were of a smaller size.

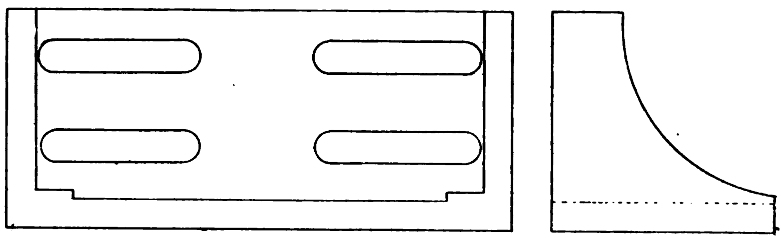

Fig. 2.—A Modern Angle-plate.

We may ask how it is that cores 1 in. wide should be put in so small a plate? The only answer is—that there is no agreement in the dimensions of the slots in machine table, therefore the slots in angle-plates are made to agree with the largest tables. Readers of The Model Engineer may never require an angle-plate weighing 47 lbs., but they will require true and reliable plates nevertheless. Such plates may be purchased from tool shops, or they may be "made to order," but better still if made by the amateurs themselves. No reference need be made to the tooling of the plates; sufficient has been shown recently in The Model Engineer in the excellent articles by "A. W. M." Small angle-plates can be made, and cast, and tooled, leaving out the consideration of holes until their proper position can be located; then, and only then, should holes be drilled. By thus carefully considering how the plate is to be fastened down on one face, and how the work can best be secured on the other, the plate will be kept in its most reliable condition, *i.e.*, always true.

On the other hand, if cored holes are decided upon, they should always be as *few* and as *small* as is consistent with the dimensions of the work

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they are intended to support and the machines at which they are to be used.

An angle-plate with surfaces well riddled with holes can be bought cheap enough at a dealer's, but too much accommodation in these appliances may quickly prove to be worse than none, especially to an amateur, whose work is always particular, and whose bolts and tools are small and delicate. The most skilful mechanics will never use an angle-plate without first overhauling it, that is, all burrs are removed and a reliable try-square is applied to the faces; even after the plate is fastened down a further test for truth will be made. This shows that the plates are sometimes bent by an over-strain, and when this occurs thin strips of paper are used for packing and the plate secured hard down, and then tried at different points with the square until the plate is true. There are two causes for a bent plate—one, abuse; the other shows a permanent weakness. Obviously, the packing inserted will do the surface no real good, and after a time the surfaces must be re-tooled and made true again.

If matters could remain thus, no further overhaul would be necessary; but, unfortunately, after trueing a bent plate, it is made a little thinner, and therefore a little less liable to resist bending. It will now be clear that original plates—to do good service—must be thick and well tied with fillets and webs to keep them accurate.

The great disadvantage of using an angle-plate at the lathe is owing to the increased weight overhanging the spindle nose; the smaller the lathe, the greater this defect is to be seen. It will be noticeable in different ways, the most frequent one being an increased vibration of the whole lathe, especially when the gearing is out of use. Another thing will be the heating of the front bearing, because of the downward pressure on the spindle neck. Journal bearings, being provided with a shoulder fitting each end of the brasses, offer the most resistance to this vertical thrust, and if the cap is given a little extra grip, the vibration will be considerably diminished. Conical bearings are so sensitive that an oval bearing will quickly be formed if any slack whatever is allowed at the front end of the spindle cone.

When turning has to be done the horizontal thrust can generally be given a considerable help by placing a drill between the work and the poppet centre. Cored work can be similarly treated, or a thin shaft used instead of the drill. Articles to be turned and bored while thus carried on an angle-plate give the best results when bored first, in which case a fitting shaft or mandrel can be inserted. This ensures the work being tooled concentrically, and permits of deeper cuts being taken.

There is still one further suggestion respecting the downward thrust on the spindle neck, and that is to place wood blocks in the lathe gap and then drive in a wooden wedge between the blocks and the rim of the faceplate, the lathe being first started, and the rim of the plate oiled before the wedge is inserted.

Now the unfortunate thing is that small lathes are ever provided with gap-beds, the gap being bridged over by a satisfactory plate, which can be secured so that the bed becomes as rigid as one made solid. It is, however, when the gap is open that the trouble may commence; the saddle is robbed of an important part of its support just at the time when it is most needed—that is, when overhanging work has to be tooled while riding on an angle-plate or other device. This brings me to my second order of plates—those to be used exclusively for lathe work.

It will be seen by referring to Fig. 3 that faces A and A1 are tooled parallel to each other and at right angles to B, and that by fixing the work on to the table A1 instead of the face A the face B can be turned inwards towards the centre of the faceplate. By this alteration the advantages are threefold—more room for bolts, little or no overhang (therefore less wear and vibration), and the bed bridge kept intact. Compare Figs. 3 and 6, which represent a piece of work from the same pattern.

The above points should be sufficiently conclusive to warrant the adoption of this method by all readers of THE MODEL ENGINEER who have small lathes and who have been content to use one angle-plate for all purposes, such a plate being dressed only on its adjacent sides.

In works where it is the practice to manufacture a speciality, such, for instance, in brass works where brass valves and cocks are made, then special angle-plates are used at the lathe. The pattern for the plate is designed to carry one particular piece of work, in which case the plate is converted into a "holding jig," and the castings are simply placed on the jigplate and are self-set, needing only to be clamped down.

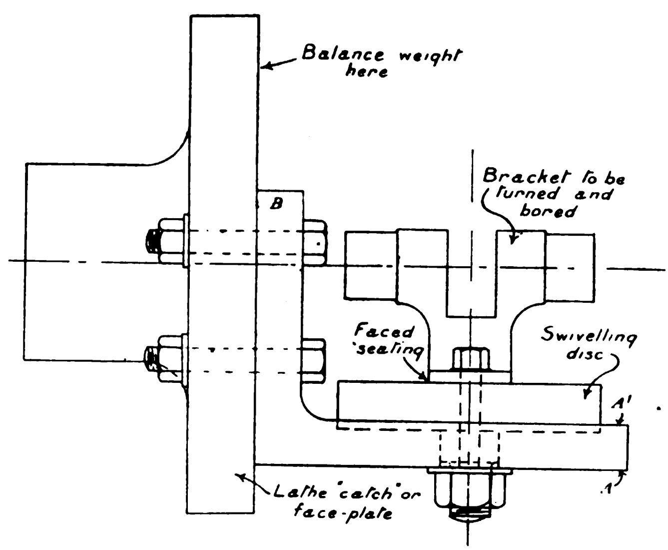

FIG. 3.—SHOWING THE USE OF AN ANGLE-PLATE IN THE LATHE.

(To be continued.)

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Locomotive Notes.

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

New Six-coupled Locomotives Abroad.

The use of six-coupled express locomotives is much resorted to on foreign railways, and the tendency to employ them grows as the loads to be hauled and the speed of trains increase. Reference has already been made in these columns to the fact that an exceptionally large and powerful six-coupled locomotive was recently turned out of the American Locomotive Company's Pittsburg Works for the Pennsylvania Railroad, and an opportunity now presents itself for illustrating and briefly describing the engine. As will be seen from the illustration, it is of the "Pacific," or 4—6—2 type, with outside cylinders driving the middle pair of coupled wheels. Steam distribution to the cylinders is effected by means of superposed piston valves worked by Walschaerts gearing, and the latter has been carefully designed to bring its working parts in one plane, a special supporting frame being provided on the outside of the link for this purpose.

Each cylinder, with its piston valve chest, is cast in one piece with half the smokebox saddle. The boiler is of very large proportions, even for an American locomotive. It is of the straight or parallel type, with wide firebox and extended smokebox, contains a large aggregate heating surface, and carries a high working pressure. These features, combined with the large, non-compound cylinder capacity and enormous adhesion weight, give collectively a very high-powered engine.

The design has been specially prepared for the purpose of doing away with piloting of trains on the heavy West of Pittsburg division of the Pennsylvania Railroad. Hitherto locomotives working this service have been of the "Atlantic" type—very powerful machines, but hardly suitable for hauling the heaviest express passenger trains under the varying conditions of load and weather. It was decided, therefore, to introduce a much larger and more powerful type of engine for this particular work, and the outcome is seen in the production of the engine illustrated, which is claimed to be the heaviest and most powerful passenger locomotive in the world, a claim which it is hardly likely any one will be able to controvert. A list of dimensions is here given, together with those of the Argentine locomotive, which is illustrated on the next page.

This last-mentioned locomotive is a four-cylinder balanced compound of the 4—6—0 type, built by the Vulcan Foundry Company, Ltd., of Newton-le-Willows, for the Buenos Ayres Great Southern Railway. The cylinders are arranged in line below the smokebox, with the high-pressure outside the frames and the low-pressure between them. The high-pressure cylinders drive the middle pair of coupled wheels, and the low-pressure ones the crank-axle of the leading coupled wheels.

There is a separate Walschaerts valve-gear for each of the cylinders, and all the gears are reversed by means of the Vulcan Company's patent reversing gear, which is designed to allow of a variable cut-off being retained in the cylinders. The four valve-gears are reversed by means of a single hand-wheel in the cab. The engine is also fitted with the Vulcan patent starting valve, which permits of steam direct from the boiler being admitted, at a reduced pressure to the low-pressure cylinders, thus increasing the power of the locomotive very considerably when desired for temporary purposes.

The boiler is fitted with a Belpaire firebox and the extended type of smokebox. The tender is of the eight-wheeled double-bogie variety.

Below are the leading dimensions of both the locomotives illustrated :—

	Pennsylvania Engine.	Buenos Ayres. Engine.
Cylinders diam. ..	24"	H.-P., 14" L.-P., 23"
Piston stroke ..	26"	26"
Bogie wheels diam.	3'	3' 2"
Coupled ,, ,,	6' 8"	6'
Carrying ,, ,,	4' 4"	—
Boiler: Diam., inside	6' 8"	4' 9 11-16"
Length ..	21'	14' 4½"
No. of tubes ..	343	204
Diam. of tubes ..	2¼"	2⅛"
Firebox : Length ..	12' 3"	6' 10⅛"
Width ..	6' 8"	4' 2¾"
Heating surface :		
Tubes	4·222 sq. ft.	1·667 sq. ft.
Firebox	205 sq. ft.	136 sq. ft.
Total	4·427 sq. ft.	1·803 sq. ft.
Grate area ..	61·8 sq. ft.	28 sq. ft.
Working pressure	213 lbs.	220 lbs.
Wheelbase :		
Rigid	13' 10"	12' 8"
Total (engine) ..	35' 2½"	25' 11"
Engine and tender.. ..	67' 1"	50' 6"
Weights :		
On bogie ..	20t. 13c.	21t. 10c.
On coupled wheels	79t. 7c.	47t. 10c.
On trailing wheels	23t. 5c.	—
Weight of engine in working order ..	123t. 5c.	69t.
Weight of engine and tender in working order ..	193t. 5c.	115t.
Tractive force ..	31,000 lbs.	—
Coal capacity of tender	11t.	7t.
Water capacity of tender ..	7,000 galls.	4,000 galls.
Weight of tender loaded ..	70t.	46t.

The writer is indebted to the respective builders of the engines for the photographs and foregoing particulars.

New Electric Locomotives for London.

The Metropolitan Amalgamated Railway Carriage and Wagon Company, Ltd., recently delivered to the Metropolitan Railway of London five 50-ton electric locomotives which have been built at their Saltley Works, near Birmingham. These locomotives, which the writer has had opportunities of inspecting during construction, are virtually of the same size and power as those already in use on the Metropolitan Railway. They differ, however, from the earlier type in matters of outline. The cab portion, if such it can be termed, is continued the whole length of the framing instead of being only at the centre with sloping ends. Thus the driver

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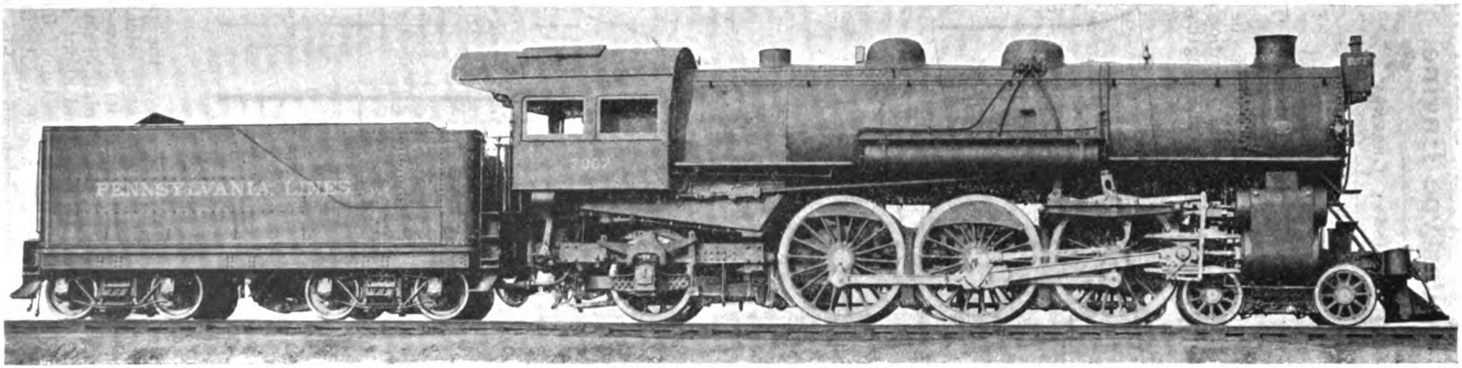
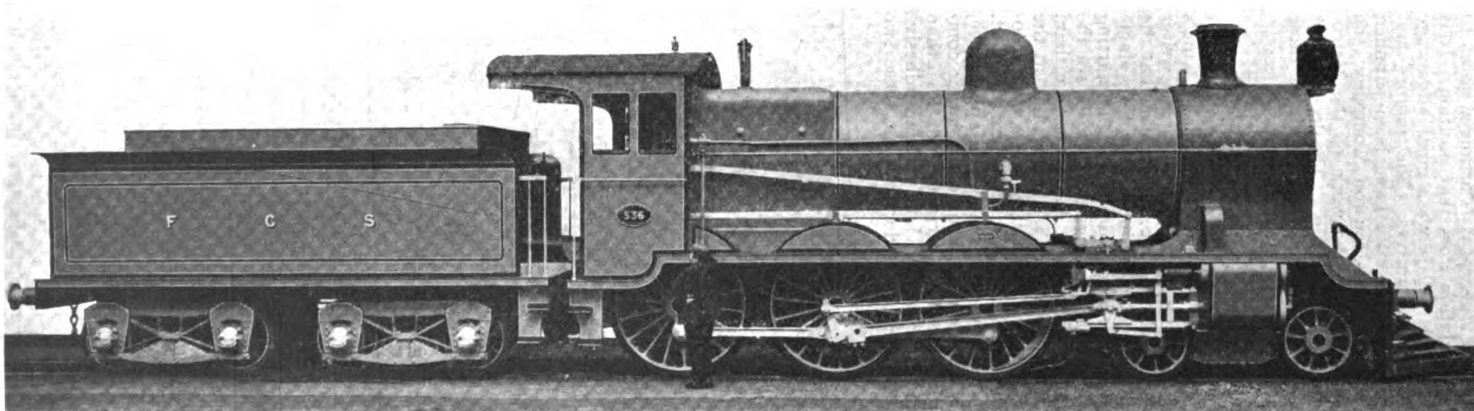


THE WORLD'S LARGEST PASSENGER LOCOMOTIVE: 4—6—2 TYPE, PENNSYLVANIA RAILROAD.
(Built by American Locomotive Co.)



FOUR-CYLINDER COMPOUND LOCOMOTIVE: BUENOS AYRES GREAT SOUTHERN RAILWAY.
(Built by the Vulcan Foundry Co., Ltd.)

For descriptions] [see page 222.

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obtains a closer view of the line ahead than formerly, and the controlling apparatus is arranged so as to be easy of manipulation from that position. It is anticipated that this will prove a great advantage in operating the locomotives. The motors and electrical equipment generally have been supplied by the British Thomson-Houston Company, the remaining portion being the work of the Metropolitan Amalgamated Company. The locomotives are painted and lined out in similar style to those previously in service.

Great Northern Locomotive Work.

As a passenger by one of the most important and consistently heaviest expresses leaving King's Cross daily during the summer months, the writer was surprised to find on a recent occasion that the train was headed by an engine of the 8-ft. single type. Up to within three minutes of the starting time it appeared that this engine was to be set the task of hauling this important express to Grantham in 1 hour 57 minutes without assistance; but, at the last moment, one of the small 2—4—0 type locomotives, with 17-in. by 24-in. cylinders and 6-ft. diameter coupled wheels, made its appearance, and was duly attached in front of its larger companion. With a load of certainly not less than 380 tons behind the tender, and with an adhesive weight between them of under 50 tons, these two out-of-date locomotives hauled the train to Grantham in 1 hour 56 minutes, or one minute less than schedule timing, including slacks through Peterborough station and at Newark and Stoke crossing. At Grantham the two engines were replaced by an "Atlantic" of the latest series, which took the train to York, stopping at Doncaster and Selby. At York one of the North-Eastern four-cylinder compounds was attached for the run to Newcastle.

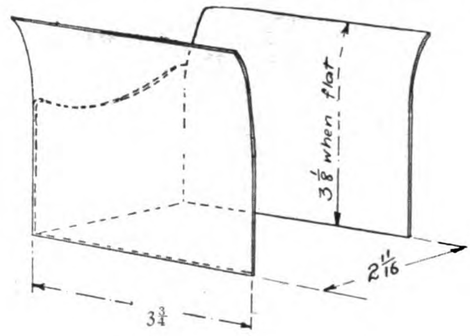
A Design for a Small Model Undertype Engine.

By Henry Greenly.

VIII.—The Boiler.

(*Continued from page* 186.)

We now come to the outer shell. This has several features which require special attention. The tube should be trued up in the lathe as herebefore mentioned. It may then be lined out for the lengths of the



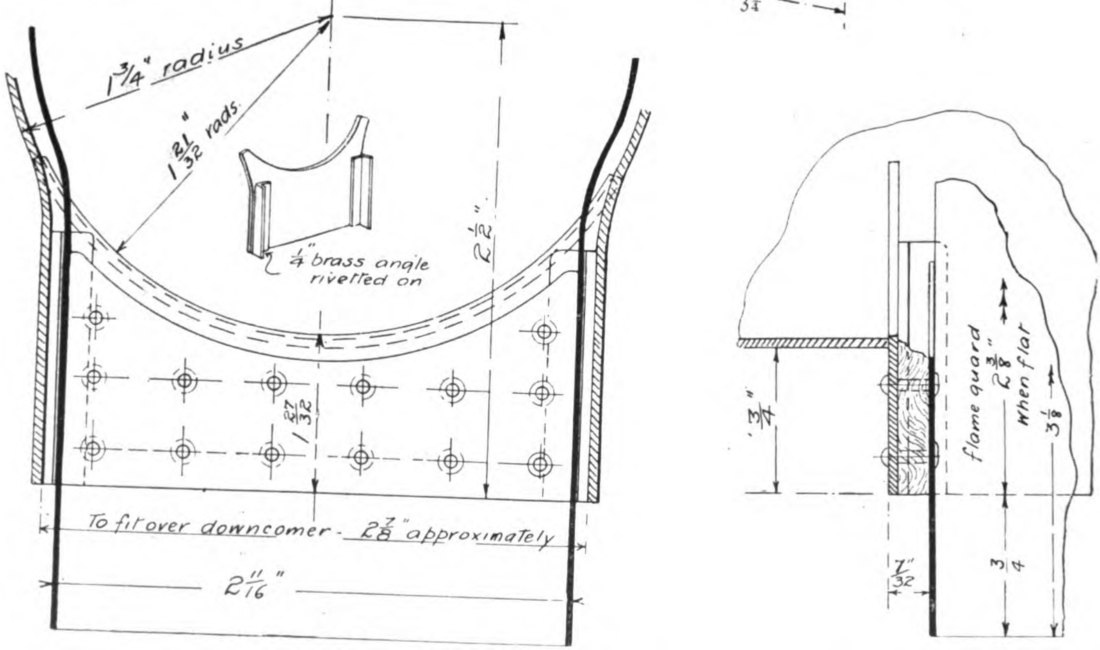


Fig. 47.—Throat-plate of Firebox and Flame Guard.

firebox and smokebox, and have the positions of chimney and safety valve marked. Holding the tube firmly (but without kinking it), a saw-cut may then be made to receive the back plate of the smokebox. This saw-cut should extend about 15-16ths ins. from the periphery of the tube. The saw chosen should make a cut about 1-20th in. wide, so that the plate, which is shown in Fig. 47, will just slip into place and require no further fixing

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than a touch of solder. The plate, which we call the backplate of the smokebox—but which in actual practice would be the lower portion of the front tube-plate—should be flanged in the manner shown, so that it may be riveted or screwed to the wrapper-plate of the smokebox. If it is not desired to have this flange wrought out of the solid, then a piece of

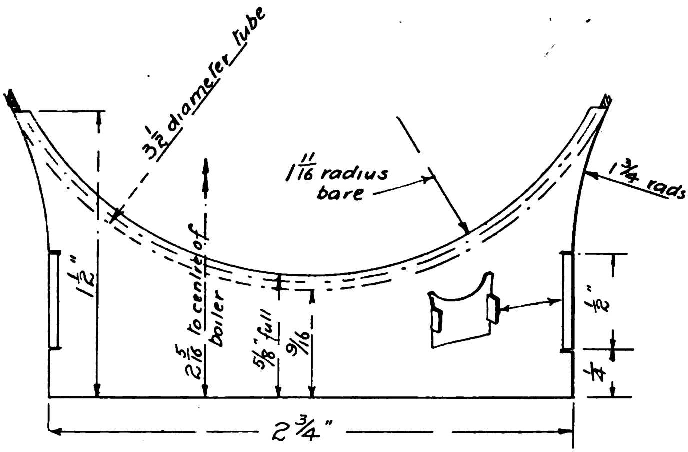

FIG. 46.—SMOKEBOX BACK PLATE.

angle brass may be riveted on for the purpose of tying the plate to the wrapper.

The firebox throat-plate is arranged in a similar manner, but in this case the tube is split longitudinally to form the side sheets. To fill up the space made by the transverse saw-cut, the portion which may now be called the wrapper-plate must fit flush with edge of the throat-plate, and to accomplish this, the angle brass which is used to attach the throat-plate to the wrapper (see Fig. 46) should be set back from the edge a distance equal to the thickness of the outer shell.

The end of the firebox is then fitted to the downcomer, which, it will be noticed, is stepped at the side so that it projects into the well hole in bedplate casting. To protect the side sheets of the firebox as much as possible from the effects of the fire, the inside of the furnace may be fitted with a tin plate or sheet-iron flame guard. This should extend round the front and two sides, and be shaped as shown in the perspective sketch, Fig. 47. The space between the outer shell and the tin plate may be packed with asbestos—the sheet form will perhaps be found the more convenient, and those who do not mind the extra work involved may rivet up the plate and asbestos as indicated in Fig. 47. Only five rivets were shown in the general arrangement, but those who prefer to adopt that course which will give the greater amount of realism will fit the larger number. To imitate

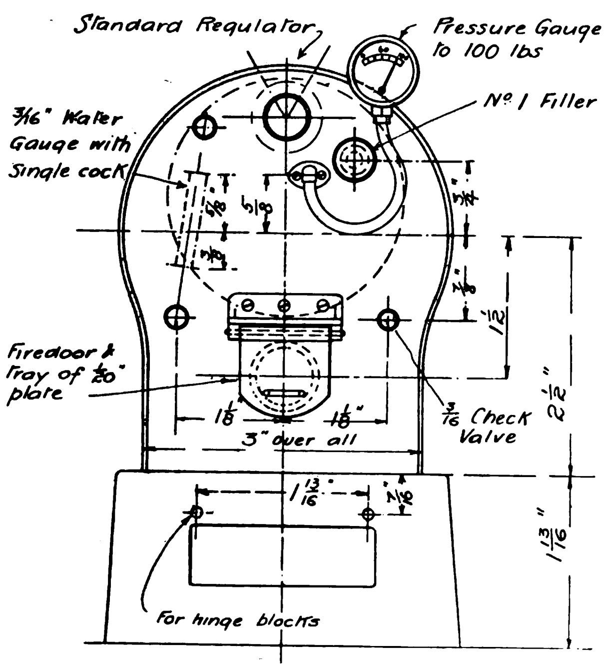

FIG. 49.—ALTERNATIVE ARRANGEMENT OF FITTINGS, INCLUDING WATER GAUGE AND FIREDOOR MADE UP OF PLATE.

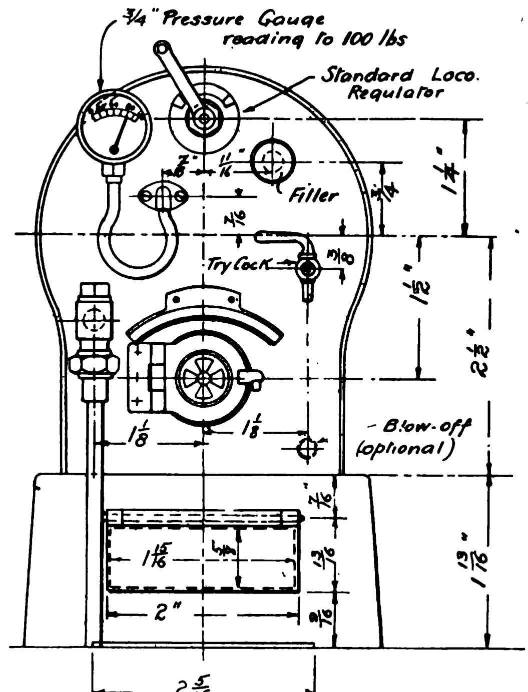

FIG. 48.—ARRANGEMENT OF FITTINGS WITHOUT WATER GAUGE, BUT WITH SWINGING FIREDOOR.

the heads of the side stays, which nearly always show in actual undertype engine boilers, the same setting out may be adopted for the rivets as in the throat-plate of the firebox.

This brings us to the boiler fittings and to a

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subject upon which there is much difference of opinion, or rather, difference of taste. Fig. 48 shows the arrangement originally intended, and in this no water gauge is shown. For a working model the writer does not believe in too many fancy fittings, but, except perhaps the try-cock and blow-off cock, those shown in the arrangement, Fig. 48, are essential—that is, if a pump is to be used. With a properly silver-soldered boiler of this kind, fired by a plain lamp, no harm can accrue through any forgetfulness on the part of the attendant to supply the boiler with water. All that would happen would be that the engine would stop for want of water. Therefore the try-cock may be dispensed with, as it is sure to become leaky sooner or later. The blow-off is, of course, optional, as, with a copper boiler, and where boiled feed-water is employed, there is no absolute need for this fitting. Those who feel they must have such fittings and do not mind the trouble of making them, can, however, insure against all risks by providing fittings of the screw-down type, as shown in Figs. 51 and 52. These fittings are not commercial articles, although the writer has for some years advocated their adoption. The filler is, I think, a necessity, and is, moreover, a fitting which does not usually suffer from leakages. It is purposely placed on the back of the boiler, and at the particular level. A filler placed on the top of a boiler never looks well—it gives the model the appearance of a toy—but in the position shown, the filler adds to the general effect produced by the fittings on the back plate, and at the same time provides a means of preventing the boiler being

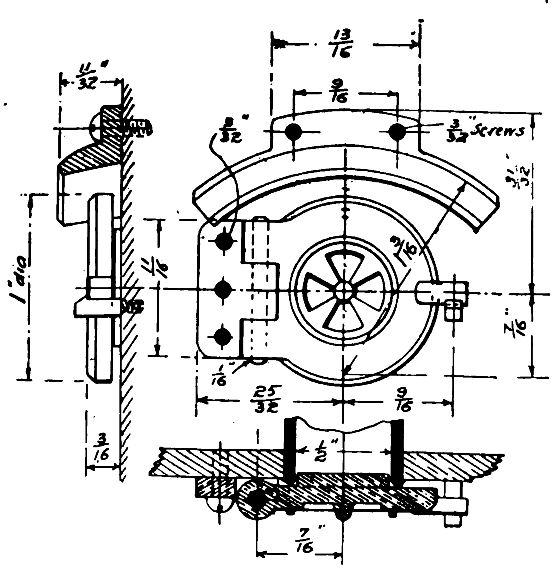

FIG. 50.—DETAIL OF SWING PATTERN FIREDOOR.

filled with water to too high a level. The funnel used should have a piece of bent tube sweated to it, so that no trouble will be occasioned in getting the water into the boiler.

The firedoor shown in Fig. 48 is different to that shown on the general arrangement drawing, and in the alternative arrangement of boiler fittings shown in Fig. 49 herewith. As castings will be obtainable for this model, the hinged firedoor may be used instead of the simpler form made up from plate. This firedoor is a copy of that used on Messrs. Marshall's (of Gainsboro') undertype engines, and includes the smokeguard shown in the full size detail drawing, Fig. 50. The door is rather too small to be fitted with a movable latch, therefore it is suggested that

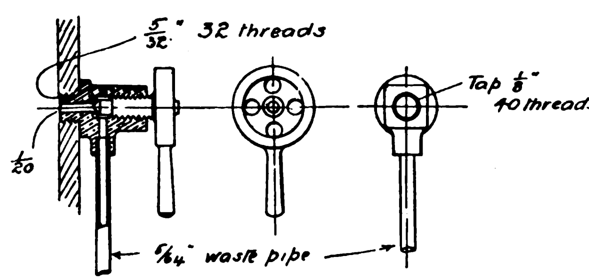

FIG. 51.—TRY-COCK WITH SCREW-DOWN VALVE.

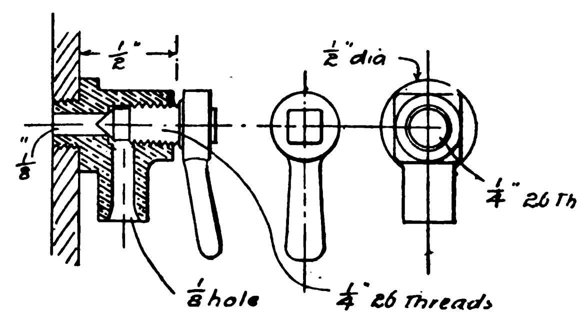

FIG. 52.—SCREW-DOWN BLOW-OFF COCK.

the hinge should not be fitted too tightly, so that when the door is shut to, it rides up the catch and the latch piece falls into the notch formed in this catch, as indicated in the drawing.

The alternative arrangement of fittings provides for a water gauge, which should be of the single cock form with a pin valve blow-off if possible. The check valve is placed on the other side, but, of course, there is no reason why the fittings should not be arranged the other way round with the check valve and pressure gauge on the left-hand side and the water gauge on the right-hand side, except for the fact that if placed up as high as that shown in Fig. 49 the pressure gauge will look better on the right-hand side of the regulator. If a blow-off cock is fitted this would look well if placed under the left-hand corner of the firedoor.

(To be continued.)

A THREE-WHEELED motor steamer has been installed in the fire equipment of Nuremburg, Germany, the steam being used both for propulsion and for pumping purposes, and the gear for propelling being placed on the front wheel. The idea of the design is said to be both for new engines and for the conversion of old engines. Liquid carbonic acid and benzine are used for getting under way and for getting up steam rapidly.

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A Reader's Work.

By W. Smith (Dublin).

FOLLOWING are a few notes descriptive of some of my model-making attempts. The locomotive is a ¾-in. scale model, made after Mr. Greenly's design for a N.E. locomotive. There are, however, several points of difference, notably, the cab and splasher construction, also the adoption of inside cylinders. In fact, I have made the model as similar as possible to the G.N.R. of Ireland "Uranus" and "Neptune" class, the framing and general appearance closely approaching those engines. As will be seen by the photograph, the engine is not painted—in fact, the cylinders and motion and all boiler fittings have to be fitted as yet, also the tender.

The boiler is made slightly different in dimensions to the N.E. design, having a slightly shorter barrel, but of larger diameter, being 2 ins. inner and 2¾ ins. outer barrel. The firebox is, of course, about 1 in. shorter, so as to allow for the cranked axle. The downcomer is Messrs. Bassett - Lowke's patent casting, which is fastened to barrel with 3-16ths-in. brass pins, spaced ½-in. apart, the whole being silver - soldered together. The three water-tubes are screwed into downcomer, and silver - soldered as well. I have tested the boiler to 100 lbs. steam pressure; but I managed this by putting it in the coal cellar outside, and retiring until I heard the valve blowing off. This prevented any possibility of an accident, as I had no means of testing with water. However, I should say that a small boiler like above should require an extremely high pressure to burst it, especially when made of solid drawn tube. The smokebox front and door were cast in brass and turned in the lathe, being fastened to a hardwood disc attached to faceplate of lathe (one of Holmes', 17s. 6d.). The cranked axle was built up of steel rod and plate, being well fitted and pinned together, and then thoroughly sweated with soft solder. The buffers were turned out of brass rod, and the sockets of tube. They are fitted with spiral springs. The cab and splashers are made of red metal sheet screwed and sweated to the middle piece of cab, which is a casting. The edges are finished with German silver joint wire. The wire is sweated to the edges. The wheels are bored a tight slip-on fit to axles, after which they are well sweated, and a grub screw fitted half into wheel and half into axle.

The bearings are made with a slot and keep, to screw on, so as to be removable without taking off wheel. They are borne by ⅛-in. steel spiral springs sliding on ⅛-in. steel pins with hexagon nut, the springs bearing on long strips of ⅛-in. brass screwed to bottom of main frames. The coupling irons are of steel bushed with brass and kept on the pins by means of small G.S. washers and a screw into end of coupling pins, which latter are screwed and riveted into wheels.

The bogie frames are castings, and are fitted with same kind of bearings as drivers, each bearing having a spiral spring. There is no equaliser, the bearing simply sliding in slots in the frame, the same as the drivers. It will be seen that the clearance between main and bogie frames is very great, as, owing to the railway being very small at present, the bogie is required to swing right out under frame.

There is no spring between bogie and frame stretchers, as I do not think it necessary when bearings are sprung.

Perhaps the most difficult part of the model, I found, was the hard soldering of the boiler, as I had to manage with a paraffin blow-lamp. I also had to fit a fire-hole in downcomer, which I managed by making a hole of an oval shape 1 in. by ⅝ in., and fitting in a piece of solid drawn copper tube hammered to an oval. The silver solder in this case was most obstinate; perhaps, however, it was owing to insufficient heat, although I had it well built round with asbestos blocks.

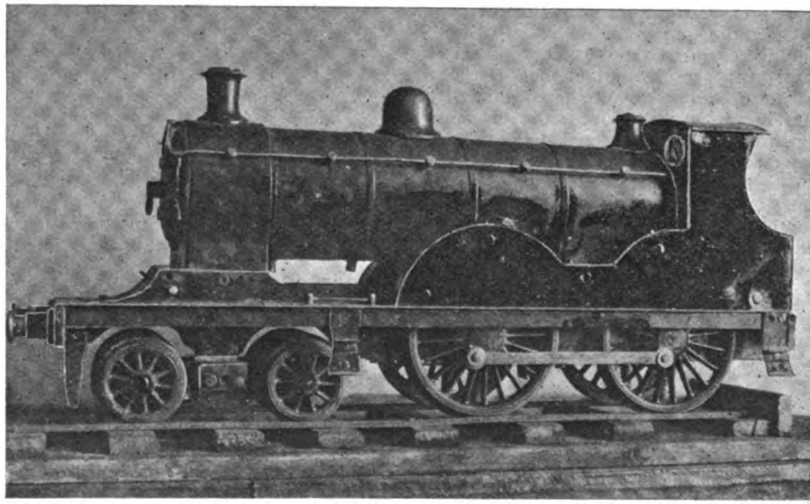

Fig. 1.—Showing a nearly finished ¾-in. scale Model Locomotive.

The boiler will be fired by means of a spirit lamp. I have experimented a little in this matter, using in one instance a 6-wick lamp, as advised by Mr. Greenly, and also with a lamp having two long wicks in front of axle and one crossed wick behind axle, governed by two separate tubes having a cock on each, so that spirit can be turned off either of the forward wicks, thereby leaving either all wicks going or only the back wick and either of the forwards, according to load behind engine. I found the long wicks to do better in the shortened firebox than the six single wicks, especially as regards consumption of spirit.

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I expect quite a happy time when fitting motion, as I have never attempted a steam locomotive before, and I intend fitting with the simplified link motion, as described in "The Model Locomotive." I hope to send a complete photograph, also results, when I have finished her. I might mention that I consider any form of paraffin blow-lamp quite unsuitable for a ½-in. scale model, as I have tried several without success.

The Wimshurst machine, shown in the photograph (Fig. 2), has nothing out of the common in its construction. The glass plates are not drilled through, but are mounted on two half axles, which run through the bosses to within ¼ in. of plates. The bosses are bushed with 7-16ths-in. copper solid drawn tube. The axles are held firmly to the standards by means of a collar and hexagon nut. I find this a great improvement over the drilled plates, as I have never had a plate crack, especially if a piece of flannel be inserted between the glass and the boss. There is certainly a slight difficulty in getting the plates in line, but it can be managed with patience. There is also the fact that you cannot detach the plates without taking down the standard, but this is unnecessary once the machine is finished, especially if oil holes are provided in the bosses.

The machine has 18-in. plates mounted 3-16ths in. apart. The frames are made of pine, the standards being screwed on with 3-in. by 5-16ths-in. square-head coach screws. The conductors are supported on Leyden jars, formed of spirit-testing glasses cemented to base. There are binding screws fitted to same for connecting outsides of jars.

The main collecting balls are round bed knobs fastened to brass sockets, and attached to jars by means of wood bosses boiled in paraffin wax and then shellac varnished. The plate bosses were turned out of pieces of mahogany sofa legs, as were also the driving pulleys and centre piece of same. I can get easily a 6-in. spark from machine in dry weather, and even in damp, foggy weather it has never failed to excite. I have got a 10-in. spark over a piece of silvered paper, using the large Leyden jars. The spark in this case is intensely thick and brilliant, making one rather nervous in handling the machine.

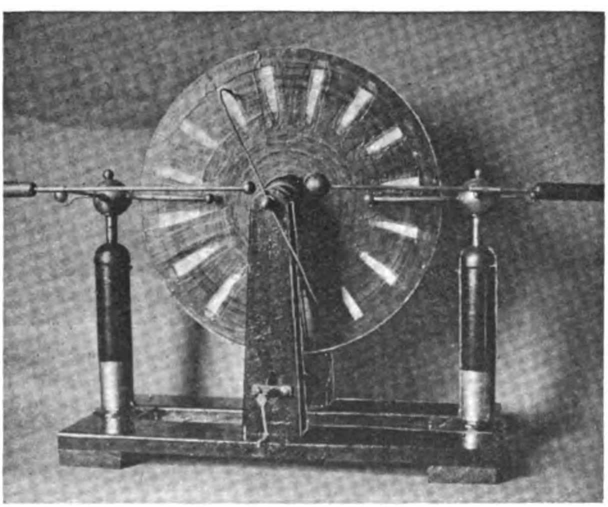

Fig. 2.—A Wimshurst Machine constructed by Mr. W. Smith.

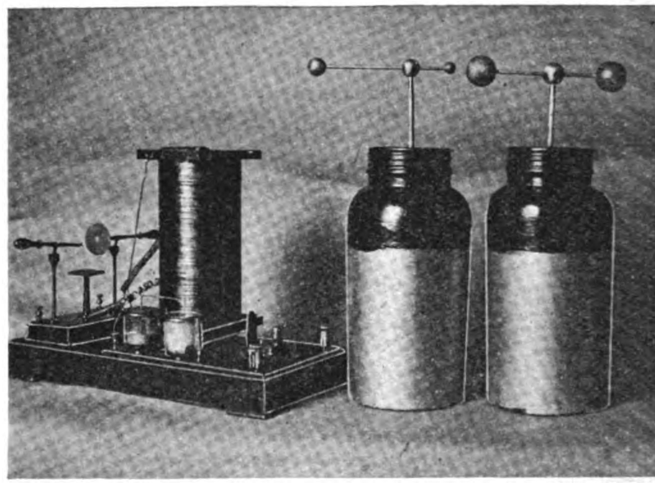

Fig. 3.—Induction Coil and Home-made Leyden Jars.

The Leyden jars mentioned above are made of sweet jars of about 3 quarts capacity. They hold the charge well, and the upper rod is made to slide in the ball, so as to facilitate using it with the Wimshurst. The covers are mahogany with cork stoppers. I can get some very beautiful discharges with these jars and a few old incandescent lamps when coupled to machine, especially in frosty weather.

The induction coil here illustrated was originally a bought one. It was fitted with the ordinary spring break, and gave a 1½-in. spark. I have fitted it with a mercury break, and mounted the coil on its end, so as to utilise its own core for working the break, thus avoiding a separate magnet. A 2½-in. spark is obtained when working it with a 4-amp. 20-volt dynamo, foot driven. I daresay a battery would give better results. It might be mentioned that I have electrocuted eight rats in a trap with this coil, the process being almost instantaneous, and therefore painless. At the same time, I do not desire to repeat the experiment.

British Patents.—According to a report in the daily Press, the President of the Board of Trade stated that over 65 per cent. of British patents are allowed to expire at the end of the fourth year, presumably because the patented invention has not proved a success. Only 4 per cent. of British patents remain in force for the full term of fourteen years.

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The Design of High-Speed Bearings for Small Dynamos, Etc.

By "BRIDGE."

(*Continued from page* 196.)

THERE are a few points about the bush that it will be as well to mention, as a number of bearings are not properly treated in this respect. In the first place, when the ring has lifted the oil on to the shaft, it is not done with; means must be provided to get the oil into the bearing itself. For this purpose the inside of bush is grooved and provided with notches at the inside edges where the ring runs, as clearly shown in Fig. 4. Care must be taken not to let these grooves run right out at the end of bush, as they are for the purpose of containing the oil, and spreading it over the shaft; the oil gradually works out at the ends of bush and returns to the oilwell, after it has been thrown from the shaft into the oil recesses B B. Opposite the recesses B B the shaft has a little groove turned in it, as shown in Fig. 3: these grooves will be found to throw the oil quite as well as knife-edge washers shrunk on to shaft, and are a deal less trouble to make.

Now let us consider the same bearing as in Fig. 3, replacing the ring with a close curb-link chain (see Fig. 5) about 3-16ths in. wide, such as are used for cheap white metal watch chains, and can be had for a few pence. This style of chain is fairly heavy and rides beautifully on a high-speed shaft, picking up a greater quantity of oil than a ring would under the same conditions, owing to the links getting full. It will be seen that the whole bearing can be reduced in width, because the chain hangs vertically from each side of shaft, and does not stick out at the sides like a ring would do. This is a great consideration in a small bearing, as it reduces the width across oilwell appreciably. The difference between the total width occupied by a

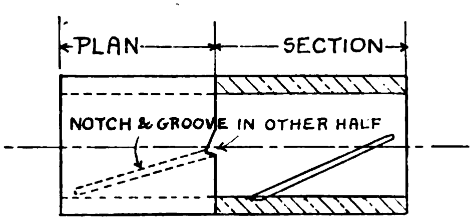

FIG. 4.

bearing having ring lubrication and one having the chain method is very much more marked in small bearings than in large ones. Another advantage of the chain method is that the oil well can be deeper and the chain dips in further below the oil channels C C without increasing the width of bearing, as would have to be done were a ring used. This will be admitted to be an advantage in designing a small bearing, so as to keep it a reasonable width (see Fig. 5). In both cases of ring and chain lubrication (Figs. 3 and 5) the bearing has a loose cap. the advantages of which have already been pointed out. In all bearings the end recesses for the oil can (unless the bearing be a fairly large one) be turned out, whilst the bearing is on the faceplate for boring purposes. The oilwell in all cases is cored out, and may either have a round or square bottom, whichever is most suitable for the particular case in point. The most important point to watch is that the chain has sufficient clearance when running. It must be borne in mind that the form a chain takes when hung on a stationary shaft is not the same as when the shaft is running

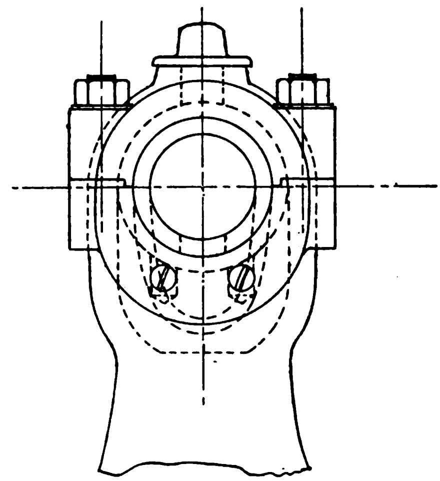

FIG. 5.

especially if it is a high-speed shaft. Fig. 6 shows approximately the form taken by a ¼-in. wide chain on a shaft ½ in. diameter, running at 2,100 r.p.m., in an oil bath. The sketch was made from an actual test; the arrangement was specially rigged up, and consisted of a ½-in. spindle overhung from an ordinary bearing, the chain being allowed to hang in a jar of oil underneath. The chain was first run without the oil bath, and the deviation of the chain from the vertical was a little less than ¼ in., but when allowed to run in the oil, this deviation was reduced to less than 1-16th in. It will, therefore, be seen that the clearance between the chain and the sides of the oilwell must be a little greater than appears necessary when designing the bearing.

Care must be taken when choosing the style of chain, and also when jointing it, as any small irregularity is magnified a great many times when running at high speeds, causing the chain to jump about on the shaft. The same remarks apply to the ring method of lubrication, and seem very much more marked.

Another distinct advantage of the chain system is that the amount of contact between tne chain and the shaft is practically equivalent to half the circumference of the shaft, whereas in the case of the ring method the amount of contact is really a line equal in length to the width of ring. This advantage is very desirable, as any tendency to run against the side of bush is not a quarter as fatal to the stopping of lubrication, as in the case of the ring system. If the bearing is carefully levelled, this trouble will be reduced considerably. Fig. 7 shows the end view of the bush for bearing,

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and the amount of metal cut away to allow the ring to clear. The same thing is shown in Fig. 8 suitable for chain method. It will almost be as easy to make the bush in two separate pieces, as very little will be lost in bearing surface; at the same time, every fraction of it is real bearing. Anyhow, this must be decided by the maker.

There has been nothing said as to what a collar will run against when keeping the shaft in place. There are two methods to choose between. A collar can be turned thin enough to enter the bearing and work against the edge of the bush, or, as an alternative, the outside of bearing can be faced up, and the collar allowed to run against it. If the former method be adopted, a groove will have to be turned on the outside of collar to throw the oil into the recesses, as the collar will cover the groove turned on the shaft for that purpose. This method

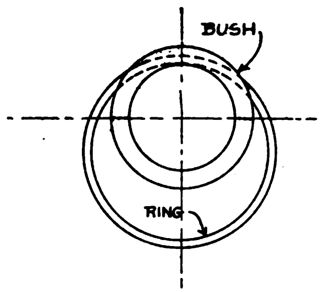

FIG. 7.

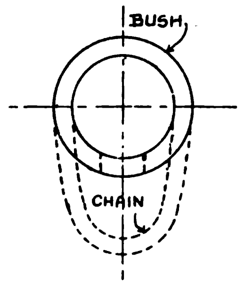

FIG. 8.

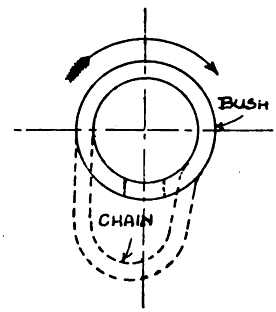

FIG. 6.

is much to be preferred, as it looks much neater. In the case of a dynamo or motor, where the brush rocker is carried from the bearing, a projection can be cast with the bearing, and turned up in the usual way. If the bearing is split, one half will cast with the cap and the other half with the bearing. A small brass tap can be fixed into the lower part of bearing for drawing the oil off. It is advisable to fix the tap lower than the bottom of oilwell and drill through the oilwell to the tap; a small gas plug will serve the same purpose if tapped fairly tight.

No attempt has been made to describe vertical self-oiling bearings, as these are only used in special classes of machinery. They are, however, made for high speeds, and are quite as satisfactory as the horizontal type. The different methods of making the patterns, core-boxes, etc., have not been treated in any portion of the article, as no doubt some abler pen will take up this branch. May I venture to say that, if some of the amateurs will follow on the lines put forth in this article, plus improvements they themselves may deem wise, there will be neater and more efficient bearings on high-class models than are to be seen on some makes of machines. Any queries for information on points which may not be quite clear will be answered with pleasure.

THE North-Eastern Railway Company is experimenting with a new ticket-dating machine. Instead of marking the date with ink the machine indents it in the ticket. This system is in operation on some of the Continental railways.

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.]

Making a Small Wheel Pattern.

By H. MUNCASTER.

SOME time ago the writer was in want of a small flywheel, and not caring for any of the designs on the market, decided to make a pattern for a suitable wheel. From former experience he judged that the making of an actual pattern in wood would be a very trying task, and not at all times satisfactory, such a pattern being fragile, and also liable to warp with damp or heat. The method adopted was so successful, and is so full of possibilities, that it is offered to readers of THE MODEL ENGINEER, in the hope that it may prove equally serviceable.

The wheel required was to be 4 ins. in diameter by 1 in. wide on face, with five flat tapering arms, as shown in Fig. 1. Two pieces 6 ins. long were sawn off a piece of 6 ins. wide by 1¼ ins. flooring board, and roughly planed, back and front. These were mounted (in turn) on the faceplate of the lathe by means of wood screws through the slots in the faceplate, a washer being put on each screw to give a suitable bearing for the head.

No other tool than a ½ in. wide joiner's chisel was available, but this proved quite suitable, and the wood was faced by the aid of this and a 4-in. hand turner's rest. After facing, an annular groove representing half of the rim, plus the half thickness of arm, was cut into the face (see *a*, Fig. 2). The middle was then cut away a depth equal to the thickness of the arm, and, finally, a ¾-in. hole was cut in the centre to form the boss of the wheel. The second portion was mounted in a similar manner and turned to suit the faces (see *b*, Fig. 2), being complementary to the first part, as shown on sketch, the hole in the centre being cut right through the wood. The isometrical views of these are shown in Figs. 3 and 4. The arms were then drawn in pencil on the piece *b*, and cut out to the required depth, the outer portion having been cut back previously in the lathe 3-16ths in. to allow of this being done conveniently, the turned portions forming a capital means of gauging the depth for cutting the arms. The whole of the work only occupied about three-quarters of an hour.

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The two parts were then put together as shown in Fig. 5, arranged so that the grain of the wood should cross in the different pieces. A ¾-in. diameter mandrel was put through the hole to keep the two parts of the mould central, and a stout wood screw put in at each corner to hold them together, a hole being first bored through to the rim to

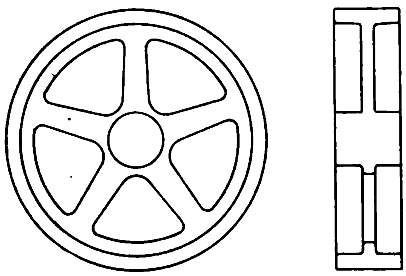

FIG. 1.

allow the air to escape when pouring the metal. The mould was thus completed and ready for the metal.

The kitchen fire was then stirred up to make it burn brightly. Having no melting pot for our metal, the stove shovel was requisitioned, and as it was moderately deep, was quite suitable for the work, it being only necessary to keep the edge at *a*, Fig. 6, a little above the level. About 1½ lbs. of good solder, containing a large percentage of tin, was used, and about a thimbleful of antimony. The shovel was placed on the fire and the solder melted, then the antimony added, the whole being carefully

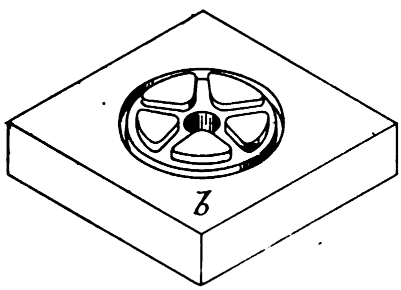

FIG. 3.

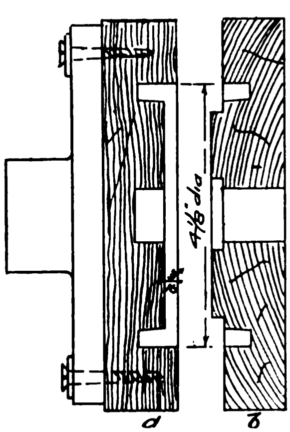

FIG. 2.

stirred before pouring. The mould should be set so that the vent hole is slightly higher than any part of the casting; a penny piece was about the right packing when the mould was set on a level surface. The metal was poured from the corner of the shovel into the centre hole (the mandrel, of course, having

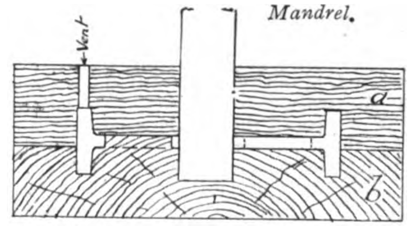

FIG. 5.

been withdrawn after the parts were screwed together), keeping a steady stream until the metal showed at the vent hole. The metal seemed to shrink to some extent in casting, and a little more metal was added. A piece of ¼-in. rod was warmed, and worked into the hole until the whole had set. After about half-an-hour the casting was taken from the mould, chucked in the lathe, and

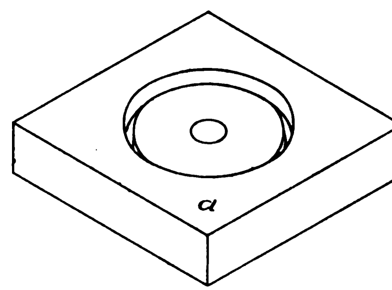

FIG. 4.

turned up, making a beautiful job, perfectly true and clean, and quite hard enough for use as a pattern.

There may be some risk of the metal escaping from the mould if the faces do not quite touch. This can, however, easily be remedied by daubing clay round the outside, or by placing the mould in a box and packing damp sand or garden soil around it.

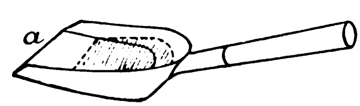

FIG. 6.

Many uses for this method may be suggested, as the making of patterns for boiler ends, cylinder covers, blanks for gear wheels, etc., and the pattern can be melted up when used, if not likely to be again required.

It should be kept in mind that a pattern must be at least ⅛ in. per foot longer than the required casting, and should allow a reasonable amount for any machining that may be necessary to the casting.

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A Design for a Handy Lathe.

By W. Muncaster.

(*Continued from page* 182.)

THE details of the saddle are given in Figs. 38 to 42. This is primarily a plate sliding on the planed surface of the lathe bed and retained by the strips passing under the dovetailed edges of the bed, so that only a movement in a longitudinal direction in relation to the bed can take place. The upper surface of the saddle is faced and transversed by three (or more) grooves, dovetail shaped in section, which should be machined, not cast, and at right angles to the bed. These grooves are useful for a variety of purposes besides that of fixing the slide-rest. The method of adjusting the saddle for wear will be understood by reference to

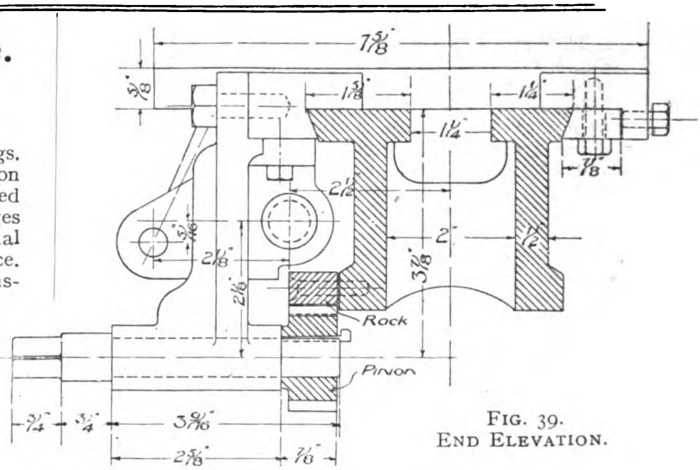

Fig. 39.
End Elevation.

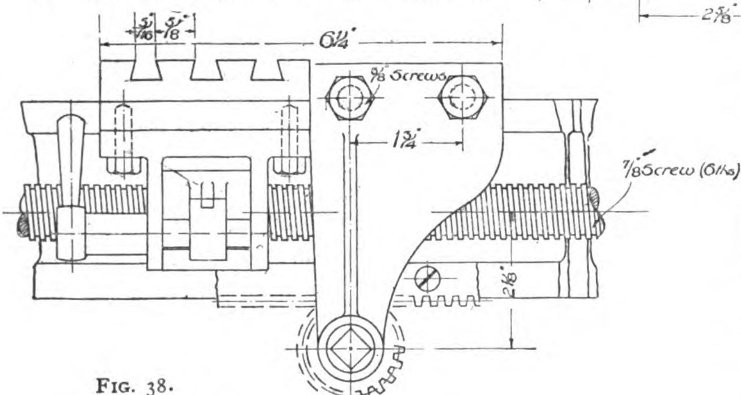

Fig. 38.
Front Elevation.

Fig. 39. To the underside of the saddle overhanging the front of the bed is bolted a bracket carrying a nut or die, which can, by means of the lever shown (Fig. 41), be made to engage the leading screw. The die should be made to fit very accurately between the wings of the bracket, so as not to allow of any side play. The die should also fit the screw very closely. There is a second bracket attached to the front of the saddle. This is fitted with a spindle (Fig. 24), on which is a pinion gearing into a rack bolted to the side of the lathe bed. A handle (Fig. 42) runs on the square on the spindle, and by turning this we are enabled to move the saddle backwards and forwards when the nut is disengaged from the leading screw.

The leading screw, details of which are given in Fig. 18, is $\frac{7}{8}$ in. diameter, cut with a "square" thread of six threads to the inch pitch. A "square" thread is hardly a correct description, as the sides have an appreciable amount of taper to enable the nut or die to be more readily withdrawn.

The saddle will travel 1 in. for every six revolutions of the leading screw. If the screw revolves at the same speed as the work in the lathe, a screw of equal pitch could be cut, or a feed equal to a cut of $\frac{1}{6}$ in. taken. If the leading screw turns slower, that is, makes fewer revolutions, the feed will be less; if faster, the feed will be more. In any given time let the revolutions of the work = A, the revolutions of the leading screw = B, the pitch of the leading screw C. Then $\frac{A}{B} \times C =$ the pitch of the feed. By means of change wheels we can make the proportion between A and B anything we like. Suppose we require A to make three revolutions to one of B, we could arrange to put a wheel on the end of the lathe spindle with,

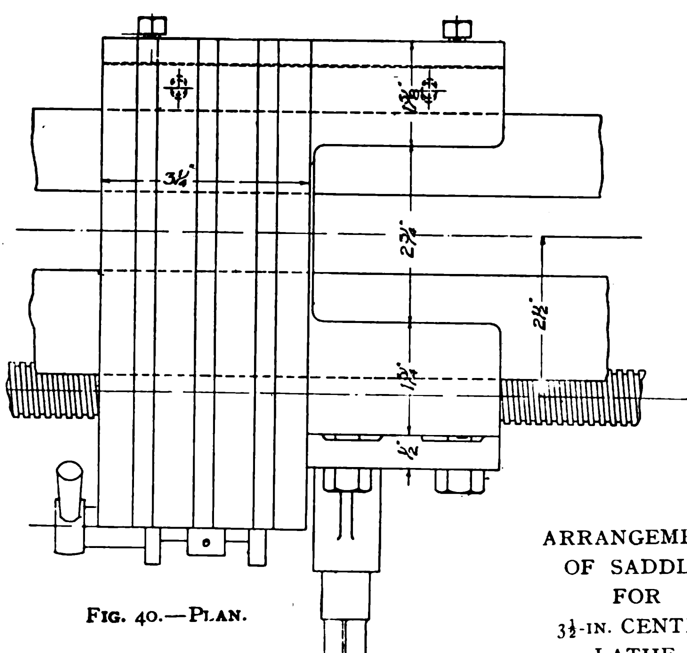

Fig. 40.—Plan.

Arrangement of Saddle for $3\frac{1}{2}$-in. Centre Lathe.

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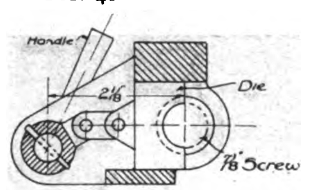
say, twenty teeth, and a wheel of sixty teeth on the end of the leading screw. Where the pitch of the leading screw is $\frac{1}{6}$ in. we get

$$\frac{20}{60} \times \frac{1}{6} = \frac{1}{18} \text{ in. pitch of feed.}$$

There is another point we have to attend to, that is, the *direction* of rotation. If we have both rotating in the same direction a screw cut in the lathe would be to *the same hand* as the leading screw, whether the pitch were greater or less. If they rotate in different directions, the screws will be to different hands—one we should call a right-hand and the other a left-hand threaded screw. We must arrange in our gearing for R.-H. or L.-H. If two spur wheels gear into each other direct, they will revolve in different directions; if they be both geared into a third wheel (which precludes the possibility of being geared also into each other), they rotate in the same direction. A third wheel

FIG. 41.



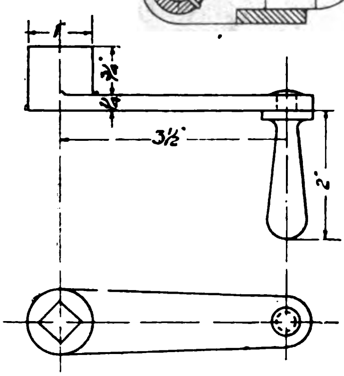


FIG. 42.

is generally necessary for quite a different reason—that is, that it is impracticable to find wheels of the required ratio that would at the same time give the correct distance centre to centre, the centres of the screw and the spindle being two fixed points. We are therefore obliged to find wheels of any convenient size with the given relative number of teeth, and then find a third wheel of any suitable size that will gear into both of the ratio wheels. This is done by fitting a wheel on the slotted radial arm at the end of the leading screw so as to gear first into the wheel on the leading screw and afterwards swinging it round to engage into the wheel on the tail end of the lathe spindle.

If a contrary handed thread is required, a fourth wheel will be necessary. This will not alter the ratio but only the direction, provided the first wheel gear into the second, the second into the third, and the third into the fourth; this must not be confused with compound gear, which is often necessary to get a very fine cut by using the screw-cutting gear.

(*To be continued.*)

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length. and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line, Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows:—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

COAL oil or water is the best lubricant to use in the machine working of aluminium (says *Mechanical World*). Water is just as good for this purpose as coal oil, if used in sufficient quantity.

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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.]*

Re Six-coupled Express Locomotives.

To the Editor of *The Model Engineer.*

Dear Sir,—In reply to the letter of Mr. Roblin published in The Model Engineer for August 8th, I am sorry to say that his figures concerning the heating surface of the "Cardean" class are not correct. To prevent any misunderstanding, I quote a portion of a letter recently sent to me and signed by Mr. McIntosh. He states "The heating surface of the 'Cardean' type of locomotive is as follows:—Firebox, 148·25 sq. ft.; tubes, 2,251·75 sq. ft.; total, 2,400 sq. ft." This letter I shall be pleased to show Mr. Roblin, if he will give his address.

I have also confirmation that my original statement concerning the cylinders of Nos. 49 and 50, is correct: namely that the cylinders of No. 49 and 50 "Caledonian" 4—6—0 class, are 20 ins. in diameter, that they have always been 20 ins. in diameter, and that Mr. McIntosh never intended that they should be 21 ins. in diameter.

With regard to the amusing remark that the details of the French Pacific locomotive with wide type firebox were not for publication, I have it on no less an authority than M. E. Sauvage, M.I.M.E., and Ministére du Commerce et de L'Industrié, Paris, that that statement was correct. As there are four or five types of "Pacific" locomotives being constructed in France, it is possible that Mr. Lake was informed of the details of one of the others.

The N.B.R. "Atlantic" locomotive mentioned in my previous correspondence shows a very marked saving in coal over that burned when in its original condition. It will be interesting to note the difference when running with a fast heavy train.—Yours faithfully,

"Model Compound Loco."

A Reader's Petrol Motor.

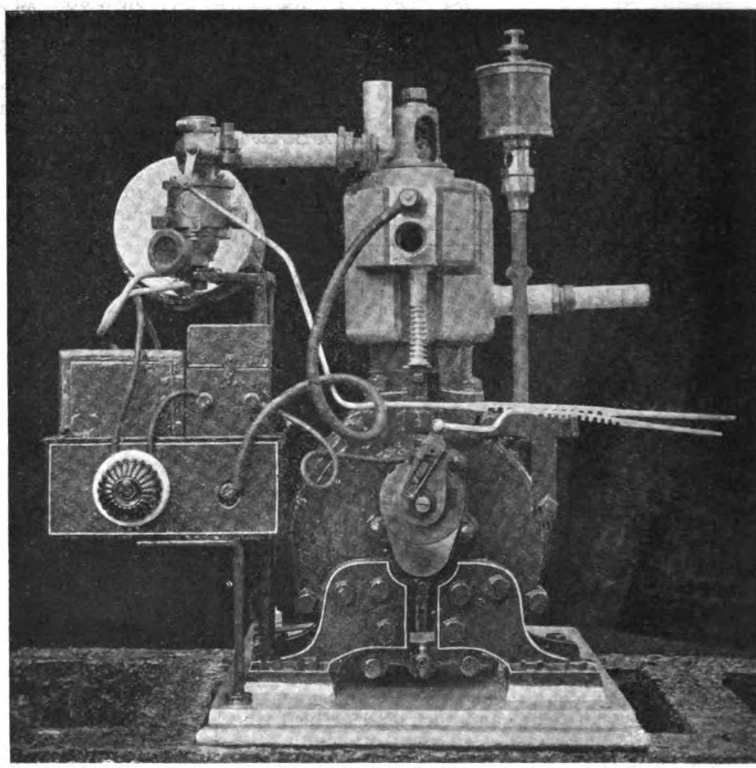
To the Editor of *The Model Engineer.*

Dear Sir,—The petrol engine of which I send photographs was designed and constructed in my spare time. The patterns were the first of my work; the crank-case was made from an M.C.C. engine, air-cooled, which I made into patterns; then I constructed the bedplate and arms to erect the crank-case on. The cylinder was the next undertaking with which I found some difficulty in coring, as I wanted a water-cooled cylinder. I may say that I had five cylinders cast before I got a good one. Then I started to machine same, which turned out all right. I bored the cylinder out 3 ins., and it has a 3-in. stroke. The crankshaft was the next item; it was forged in the solid, and I cut the web out with a hacksaw and then turned it to 1 in. The inlet valve seat I made of brass, but I found it would not stand the hammering and heat, so I got one made in cast iron and have had no further trouble. The bearings are made of hard brass and bored out 1 in. and faced at both ends, and the valves are of mild steel. The crankshaft bearings fit close to the web and take all the side play. The crank and piston pin are casehardened.

The piston I turned on a casting which I fitted in the piston end and then I put lathe centre up to the other end, and by this device I turned it very true. The piston rings I turned concentric and fitted in the cylinder separately. For starting the engine I cut a key-way in the shaft and have a hooked handle to fit same. The coil, accumulator, petrol tank and engine are all on the bedplate, which is 2 ft. square.—Yours truly,

J. T. P. Shepherd.

Ripon.



Showing General Arrangement of Petrol Motor and Ignition Apparatus.

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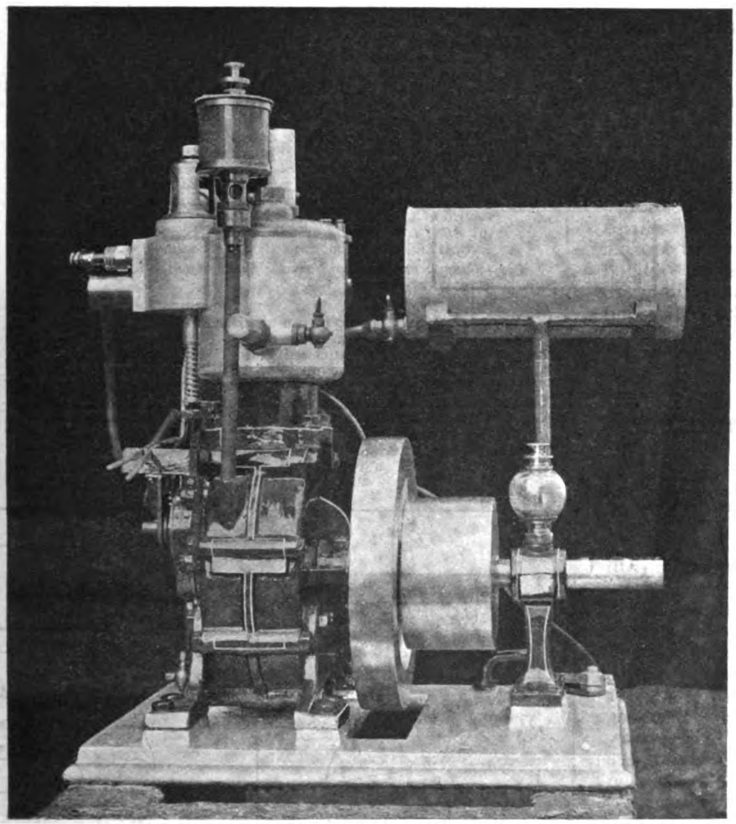
A Petrol Motor Repair.

To the Editor of *The Model Engineer*.

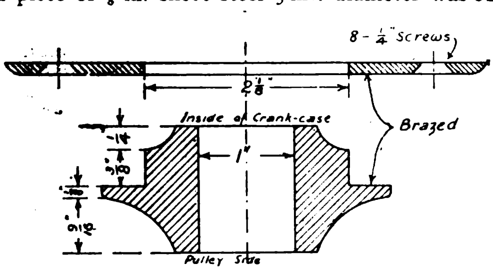
Dear Sir,—I have had at different times some very curious jobs in connection with motors. The following repair may be of interest to your readers. A 2¾ h.-p. motor had a broken crank-case (aluminium); the boss on the pulley side came right away. This was mended in the following manner:—A piece of ⅛ in. sheet steel 5 ins. diameter was obtained and a hole bored in the centre 2½ ins. diameter. Eight ¼-in. holes were drilled and countersunk, as indicated in the sketch. A piece of mild steel, 3 ins. diameter, was bored and turned as shown. These were then pinned together and brazed. The crank-case was chucked dead true and bored to suit the boss I had made. The engine is a little heavier, but there is this advantage—when the crank-case wants rebushing it is only necessary to unfasten the eight screws of the flange and replace new bush, which could be done on the road. It would also act as a sight-hole at times to save pulling the engine entirely to pieces.—Yours truly,

R. King.

Plumstead.



Another View of Mr. J. T. P. Shepherd's Petrol Motor.

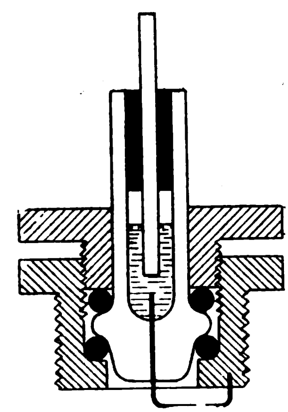


Repairing Motor Crank-case.

Re Small Sparking Plug.

To the Editor of *The Model Engineer*.

Dear Sir,—In your answer to "L. J." (Query 17,592), you propose to insulate sparking plug with asbestos yarn. This will not answer, as the sparks will jump through asbestos as easily as across an air-gap. A small sparking plug can be made as per sketch above. A short length of platinum wire is fused into a bit of uranium glass tube so that it projects both inside and outside the tube; a few drops of mercury are then placed in the tube and a copper wire introduced into the upper end and cemented with a paste formed of flock asbestos and water-glass. The same cement can be conveniently used to cement glass tube into the gland box.



Section through Sparking Plug.

Excellent insulators for sparking plugs can be made of steatite, but it is difficult to obtain this material free from flaws, and several may have to be made before a good one is obtained.

If carefully annealed when first made, a glass insulator will last a long time, but is liable to fracture if this precaution has been neglected.

The stem of a clay pipe with a wire cemented in the hole can be used if it be subsequently boiled in paraffin wax, but will lose its insulating properties in a short time owing to the wax melting out.—Yours truly,

V. W. D.-B.

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G.N.R. 8-ft. Singles.

To the Editor of *The Model Engineer*.

Dear Sir,—Can you or any of your readers tell me if any of Stirling's 8-ft. single express locomotives are now running into Doncaster station? If so, what trains do they generally run?—Yours faithfully,

E. Exley.

Bank End House, Carlton, S.O., Yorks.

Correct Scale Model "Dunalastair" Loco. Wheels.

To the Editor of *The Model Engineer*.

Dear Sir,—You might please let me know where I can get correct scale driving wheels for the ¾-in. scale locomotive "Dunalastair, No. 902, Model Engineer, Vols. IV. and V. I have tried several well-known firms, such as Bassett-Lowke, Stuart Turner, W. Martin & Co., Liverpool Castings Company, etc., without success. None of these firms make these wheels which are absolutely to Model Engineer drawings. I would be much obliged if you could let me know of any firm that can supply them or any private person who could lend me patterns.—Yours truly,

W. Ballantyne.

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 first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from September 25th, 1907, to October 31st, 1908. Full particulars and forms of application may be obtained from Herbert G. Riddle, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

The Junior Institution of Engineers.—A visit will be made on Saturday afternoon, September 7th, at 3 p.m., to the works of the Metropolitan Water Board at Hampton-on-Thames.

Mr. A. L. Norris, 17, Whitehall Park, Highgate, N., will be glad of the address of the Secretary to the Highgate Model Yacht Club.

The present digging equipment on the Panama Canal consists of sixty-three steam shovels—thirty-two of 95 tons, twenty-eight of 70 tons, and three of 45 tons each; while fifteen further 95-ton and seven 45-ton steam shovels are to be delivered this year. There are also 184 locomotives in service, 228 steam or pneumatic drills, and 73 machine or well drills.

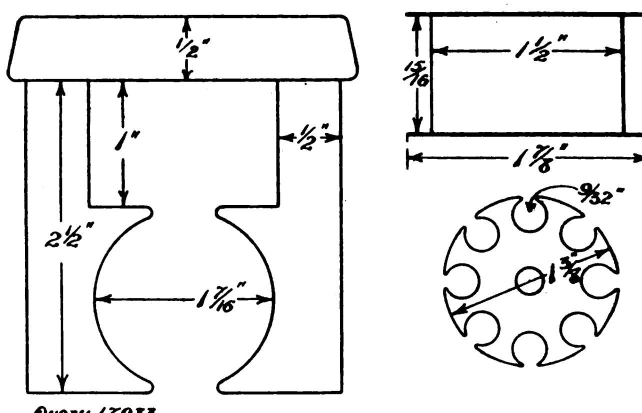
Queries and Replies.

[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:—

[17,933] **Small Dynamo Failure.** G. S. (Margate) writes: Will you kindly assist me on the following subject? I made a dynamo to the enclosed sketch. I wound field coils with No. 26 S.W.G. I have a quantity of the enclosed wire I should like to use for same, if possible. I have wound armature with No. 26 S.W.G. in eight sections, forty wires in each slot, connected up end of first to beginning of second, and so on round to the eighth section. I tried it with the No. 26 S.W.G. on the field coils, also the armature, but was unable to get it to excite, driving it from lathe flywheel. Could you kindly tell me what would be about



Details of Small Dynamo.

the output, and how many revolutions to run it at? What thickness brass should I have between magnets and bedplates?

We can hardly say definitely what is wrong from your description; but most probably some error has been made in the armature or field windings. If you study "Small Dynamos and Motors" carefully (7d. post free from this office), you will find diagrams of connections which will put you right. Perhaps the field coils are opposing one another. See that they give N and S poles respectively. Sample wire is 21 S.W.G. (barely). Output should be about 15 watts. Run at 3,000 r.p.m. Keep magnets well off bedplate by about ¼ in. or more.

[18,010] **Miscellany.** G. W. S. (Cleckheaton) writes: As a regular reader of your Journal will you kindly answer the following questions: (1) Why are electric bells, when used for long distances wound with finer gauge wire than for short distances? (2) How is the gauge of wire and number of turns of same calculated for the winding of a relay—say to actuate an electric bell—on to a local circuit for, say, 500 yds. and 2,000 yds. distance between the sending and receiving station—ordinary Bell installation and ordinary Leclanché cells? I want to know how to ascertain the

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least number of Leclanché cells to work each installation efficiently. (3) Can you give me the addresses of two firms who make a speciality of celluloid, ivorine, and bone name-tablets, such as one sees on electrical instruments and machinery, etc., who would supply lists and prices? (4) How is a 5-amp. arc lamp distinguished from, say, a 10-amp. lamp? That is, suppose a 5-amp. lamp is placed on the mains, what will be the difference in construction of a lamp to take 10 amps. on the same mains? Is the size of the carbons the same in both lamps; and how are the lamps arranged so that one lamp takes 5 amps. and the other lamp 10 amps.? (5) Where can I get a good book on arc lamps?

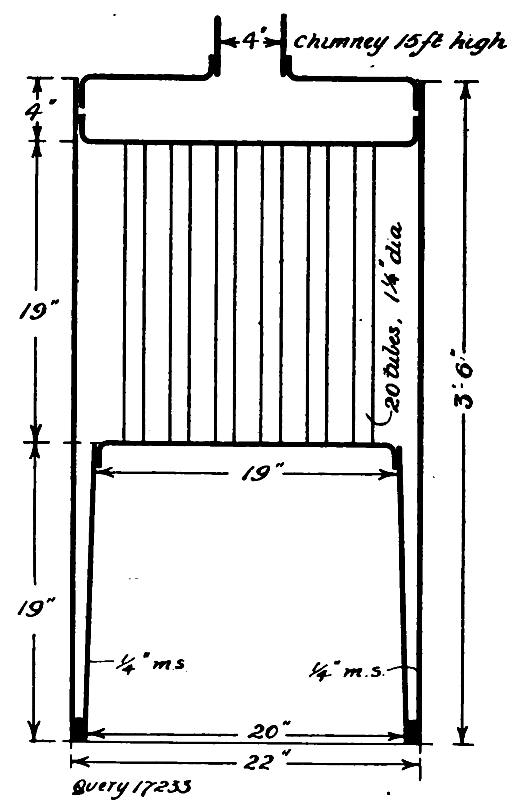
(1) Because the greater the length of the circuit the more desirable it is to work with very small currents. The resistance of the circuit increases with its length, so that if you work with very small current there will not be so much loss of voltage. To obtain an equal magnetising effect the bell magnet is wound with a large number of turns of fine wire, so that the current, expressed in amperes, multiplied by the number of turns, is equal to that obtained by a heavier current multiplied by a smaller number of turns of thick wire. This figure is called the ampere turns, and may be produced by either method. Economical working is obtained by keeping the resistance of the batteries, bell, and line as far as possible in proportion. That is, if you have a long line, you should have a high-resistance bell and use a larger number of battery-cells in series. (2) There is no formula which we can give; you must determine it by trial, and add more cells if you do not get good effect, by making the relay resistance equal to that of the line plus resistance of battery. (3) The Endolithic Manufacturing Company, Ltd., 61½, Fore Street, London, E.C. (4) It may not be easy to distinguish the one from the other—different makes and types of lamps have their own peculiarities. A 10-amp. lamp will probably be somewhat larger than a 5-amp. lamp; the series-wound regulating coil will probably have coils of thicker gauge wire for the 10-amp. size; the carbons will certainly be larger in the lamp which takes the heavier current. A 10-amp. lamp, for example, may have 10 mm. diameter positive carbon and a 5-amp. lamp 8 mm. positive carbon. The 10-amp. lamp would require a few more volts at its terminals, and be regulated by means of its adjustment screw until it was taking the correct current. (5) Ask for instructions from the makers of the lamps. Information can also be found in the "Practical Electrician's Pocket Book," price 1s. 8d. post free. Also in "Electrical Engineering," by Slingo and Brooker, 12s. 6d. See also The Model Engineer for Nov. 16th and 23rd (1905), "How an Electric Arc Lamp Works," 3d. each post free.

[18,009] **440-watt Dynamo, Run from Wind Power.** H. (Barcaldine, Queensland) writes: I have just completed a 440-watt (55-volt 8-amp.) 120 c.-p. Manchester type shunt-wound dynamo. On test, it lit up the eight lamps brilliantly while running at about 1,900 r.p.m. I think of lighting my house with same, but the motive power is the difficulty. The long distance from the coast (361 miles) makes the price of oil very high, therefore it is costly to run an oil engine for a very small installation. I have a 30-ft. tower on which I could erect a windmill. Could I charge accumulators during the day with the above dynamo sufficient to light the eight lamps (16 c.-p.) each for five hours each night? How many accumulators would I require, and what is the probable cost? A mill will work about twelve or fourteen hours out of the twenty-four, and I could regulate same to give the required speed for charging. I may state that the dynamo referred to was made under exceptional difficulties by my son and myself. We had no lathe, and had several failures, but the success attending the last test has quite repaid us for all our trouble. It has taught us the uselessness of attempting model work without a lathe of your own. If I can get the dynamo photographed, I will do so, and send you a copy; and if you think our experiences in the making will be of any interest to your readers, I may give them. You can hardly imagine the troubles of a person who takes up this kind of hobby in the bush parts of Queensland, and perhaps English readers would hardly credit some of the difficulties which were encountered. In my query as to the charging of accumulators by day and lighting by them at night, I may state that there is no scarcity of wind here, and a mill will work part of the night and at least half of the day.

Each accumulator cell will give about two volts when discharging; from this you can calculate the number required in series to give the voltage necessary for your lamps. You should add two cells more for regulation, as the voltage will drop slightly under 2 volts per cell, but should never be allowed to fall below 1·8 volts per cell. Good accumulators to discharge at 8 amps. for, say six hours, would cost about 17s. per cell. You would have to charge for about eight hours at a stretch, unless you had not taken a full charge out. The plan would be to always charge as soon as possible after use, no matter how much current had been taken out; by this you will keep the plates in good condition. Your dynamo must give a pressure of 2½ volts per cell for charging; you can obtain this extra voltage, say 67 volts approximately to charge twenty-seven cells, by running at higher speed. An automatic cut-out should be used when charging, so that the current is broken if dynamo speed falls, and is re-made when speed rises to the required amount. Mr. A. H. Avery, of Fulmen Works, Tunbridge Wells, or the makers of the accumulators, would probably supply such a cut-out. Accumulator plates deteriorate if the cells are allowed to discharge until their voltage is less than 1·8 volts per cell, or if allowed to stand in a discharged or partly discharged state for any considerable length of time. To keep them in good condition, never discharge below this figure, and always re-charge as soon as possible after they have been doing work. If you charge without an automatic cut-out in circuit and dynamo speed falls, the cells will discharge back into the dynamo and run it as a motor. Accumulator charging has been successfully done by wind power. If the velocity of wind varies very much, you may find a mechanical governor necessary to prevent an excess of voltage, unless you can control the plant by hand.

[7,233] **Boiler for 1 i.h.-p. Engine.** S. P. (Douglas) writes: I have a vertical steam engine with a cylinder about 6 ins. by 3 ins., and an 18-in. flywheel, so please let me know what size boiler I shall require and probable cost of same to give me 1 i.h.-p., and cost of firing per hour? I am not particular as to cost of boiler if it economises fuel.

With a good draught a heating surface of about 2,000 sq. ins. will be sufficient for an engine developing 1 i.h.-p. You may expect a consumption of fuel of 7 to 10 lbs. of coal per hour. The



SECTION THROUGH BOILER FOR A 1 I.H.-P. ENGINE.

boiler we would advise is a vertical multitubular generator of the proportions shown in the accompanying sketch. The shell should be 22 ins. diameter by 42 ins. high, the smokebox being fitted with a coil superheater. You will do well to employ a feed-water heater, heated by the exhaust steam. You should use a good steam coal to get the best results.

[17,905] **Model Locomotive Hand Pump.** T. W. (Balham) writes: What boiler feeding arrangements would you advise for a 1-in. scale loco, cylinders 1¼ ins. by 2¼ ins., working pressure 80–100 lbs. per sq. in.? Would one injector and one hand-pump be sufficient?

You will have difficulty in maintaining 80 to 100 lbs. of steam in an inch scale locomotive with cylinders 1¼ ins. by 2¼ ins. The cylinders should not be larger than 1¼ ins. by 2¼ ins. for this pressure. Yes, we would recommend one small injector and one hand-pump having a plunger ½ in. diameter and a stroke of at least 1 in., worked by a lever. The hand-pump may be in the tender and always under water. Use the smallest injector you can get.

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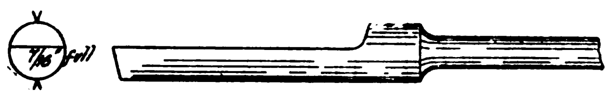
[17,639] **Making Model Locomotive Cylinders.** W. S. (Dublin) writes: With regard to a model locomotive I am making I have been considering the possibility of making cylinders myself. I wish to have valves on top. I have only a small Holmes lathe to do the job. Which way would you recommend fixing up the casting on faceplate for boring? Of course, I have no slide-rest. I was thinking of fastening the square block of gun-metal to a flat brass plate with solder and screwing this to a wooden disc bolted to faceplate. I would then drill the bore with a 7-16ths twist drill fed up from back centre. Do you think this plan would work? Also would you suggest a way of drilling the valve glands accurately by hand. I would fit studded glands to both valve and piston-rods. I would, of course, drill the casting through and fit the top and bottom covers afterwards. I think the twist drill would leave a fairly clean bore. What do you think? Of course, the job would be only an experiment, as if not successful I could still purchase the cylinders. But I would rather make them if possible.

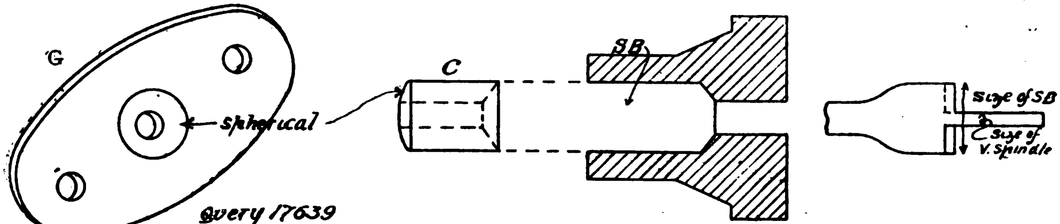
You will not get a finishing hole with a 7-16ths in. twist drill in gun-metal and, therefore, you will have to use a standard reamer or a home-made D drill to finish the bore smooth. If you have no self-centreing chuck you may turn and face and drill the glands in the lathe with the pieces of metal roughly filed to shape and cemented to a wood chuck with a shellac cement. The writer has used Prout's glue for such work. Another good way is to turn up and drill collars as at C, making gland plates (or gland flanges if they were all in one piece) out of sheet material, as at G. The severe fright. If it is not possible to use the tank, could I use one of those compressed gas cylinders (same as mineral water makers use) and get it charged with gas? If so, could you let me know where I could get same and probable cost, and how long it would drive engine at each charging? Any help or advice will be very welcome. I only require this make-shift for a few weeks, as by then I shall have a place with gas laid on, and all my trouble over, I hope.

We are afraid your proposed method of using gas (compressed) and releasing it in a large tank, and then supplying engine from tank, would not be practicable. In any case it is only possible for some one well acquainted with such work to make a job of it and we cannot possibly instruct you on this matter by writing. One would have to be on the spot, and even then it is a question whether the expense of trial and the rigging up of the temporary apparatus would not exceed a reasonable amount. If it were for a considerable period we should say the best plan would be to get the makers to fit up engine to run on oil or petrol. Some makes of gas engines can be converted in the matter of a few hours.

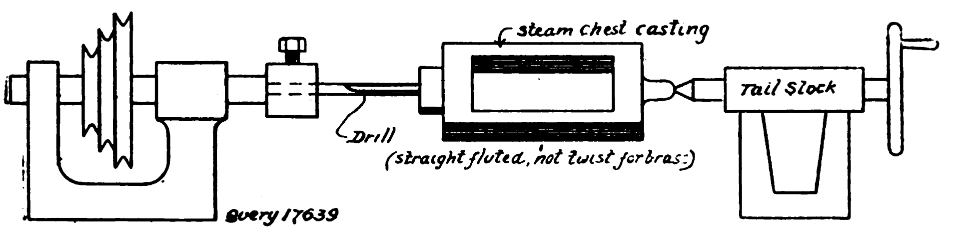
[17,971] **Small Petrol Motor.** T. G. B. (Harrow) writes: Will you kindly answer the following query? I am making a petrol motor (1¼ by 1¼), as per diagram (not reproduced), to drive a model boat. Will you kindly send me a section of the valve box A, as I do not understand the arrangement of the valves and ports, etc. Where ought the sparking plug to come? How



D-Bit for finishing cylinder bore.



Making the Glands.



Drilling for Valve Spindle.

MACHINING AND FITTING SMALL MODEL LOCOMOTIVE CYLINDERS.

outer face of the collars may be made spherical and the gland-plates countersunk to suit, when, as a matter of fact, the glands will be superior to solid glands as there will be no tendency for the glands to bind on the rod if the studs are adjusted unequally. To drill the stuffing-boxes (S B), first drill for the valve spindle, centreing the steam chest casting in the back centre and then use a pin drill, as shown in the sketch herewith.

[17,973] **Converting from Gas to Oil or Petrol.** W. H. F. (Moston) writes: I have a gas engine (about 3 h.-p.), and I am in a fix how to drive it. The place where I am is so far from any gas supply that the cost of having it laid on bars it. Can you give me some advice as to how I could drive it, either with paraffin or petrol. Or is it possible to take gas in a cylinder for engine and to use a blow-lamp to heat ignition tube? I have a circular galvanised iron tank (6 ft. × 3 ft.), which I have made and fitted with small tap at bottom for filling and large tap at top to supply engine, but could not get any result. Should I have connected a pump between meter and tank and forced the gas in? The first time I tried fitting it was rather disastrous. Not being sure whether the pressure was sufficient to fill it, I opened the small tap and applied a light. Result: an explosion—tank bottom blown out, burnt hands, and a can I make a cam so as to open the valves at the correct time Can you describe some simple form of carburettor which will suit this engine and which I could easily make? Ought there to be an additional air-inlet besides the one to the carburettor? The crank case is to be in aluminium, and the end A is all one piece. I suppose I had better fit some form of brasses for the shaft to run in. How can I make and fix them in, and what would they be like? I may mention that I have your handbook on gas engines and several others, but find no description of this sort of engine. What metal had the cylinder and cover best be cast in, and what ought the valves and spindles to be made of? Does it follow that the speed at which an engine goes is the correct speed for the screw of the boat, or ought there to be some reduction or increase in screw speed? What pitch and diameter of screw, and what size and lines of hull, do you advise for a fast boat to suit?

We strongly advise you to study the article and drawings on pages 53 and 54 of July 18th issue, from which you will get a good idea of the construction and working of a small petrol motor. As regards setting out a cam for the opening of exhaust valve, you cannot do better than refer carefully to the handbook, "Gas and Oil Engines," by Runciman. Chapter VII explains the matter

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in great detail, but you need not worry to get things mathematically correct for such a small engine. We cannot explain how to set about this job more clearly than is done in the chapter referred to. The type of carburettor shown in article in July 18th will meet your requirements. *Re* speed of propeller. A fine pitch propeller can be run direct from engine; but, if the efficiency appears to be not all that is desired, then you must make alterations, based on results of trials and experiments, as the matter is one for experiment.

[17,955] **Heating of Small Dynamos; A Resistance Switch.** K. H. (Plymouth) writes: I should be glad if you would give me some help. I have made a 150-watt Simplex dynamo from drawings and calculations in your No. 10 Handbook. The type is Fig. 7, and it is a great success except in one particular. After running it for a half-hour with two sets of two 15-volt lamps in series (high efficiency), one 60-volt 16 c.-p. ordinary lamp—(it made this glow red)—and one 30-volt 8 c.-p. lamp (high efficiency), I found that the magnet coil had got quite hot, while the armature coils were cold. I shall be glad if you will explain this and suggest a remedy for it. Would putting more lamps on stop it? I might say that the commutator is 8-section 1⅜-in. × 1⅜-in. copper, and when generating current enough for the above lamps there is not a sign of sparking; in fact, one could not tell at sight whether the dynamo was generating. The dynamo has generated 45 volts at 3,000, and it is now running at about 2,300–2,400 r.p.m. The wire (20 gauge, 6 lbs.) is evenly wound by hand, because I took particular trouble over it. I shall be glad of an early reply, as I want to get it running continuously. (By the way, the coils do not get hot so quickly as they did when I had one lamp on.) Please give me particulars for a resistance switch suitable for a 30-volt 5-amp. dynamo. (1) What kind of wire? (2) Gauge? (3) Length? (4) Cost? I wish to charge accumulators of 2, 4, or 6 volts 5–40 amp.-hours, either separately or severally. The resistance switch I have has twelve notches, so that I want to get a 12-section resistance, of which one notch is to be full current.

(1) The heating of the field-magnet coil will depend upon the voltage at the dynamo terminals, that is, the higher the voltage produced the greater the heating. A certain amount of heating is unavoidable, and does no harm provided it is not carried to excess. If you can bear your hand upon the coils whilst the heating is taking place, say after half-an-hour's run, they are not too hot. The winding, according to the tables on page 46 of Handbook is intended to be used with an output of 30 volts, and it will stand this satisfactorily, even though it may appear to be hot; this design will heat up rather more than if you had made a dynamo to, say, Fig. 8. If you raise the voltage to more than 30, then the field-winding is not suitable, and will take too much current and become over-heated. The armature did not become hot because you were working it at a very light load; it will stand a useful output of 5 amps., whereas your lamps were probably taking only about half this current. (2) It is impossible to answer this unless you state the current in amperes required by each size of accumulators. You can regulate your dynamo voltage by running it at lower speed and by putting some resistance in series with the field coils. You should use some form of resistance wire; German silver would do, or Eureka. You can calculate the resistance required by the formula $e = C R$. That is, the resistanee, multiplied by the flow of current desired, will equal the volts absorbed by the wire. Write to a dealer in electrical supplies, stating the resistance required and the flow of current to be carried, and he can quote you for wire of a suitable size.

[17,984] **Steam Launch.** R. F. (Alexandria, N.B.) writes: Being desirous of having a small steam launch on Loch Lomond, I shall be very pleased if you could supply me with designs of hull in iron and all sizes for it. Length, about 18 ft.; beam, about 5 to 5½ ft. About power—I was looking up some of my old MODEL ENGINEERS. I found an engine which I think will suit me, that is, if you think it advisable. It is by Mr. H. R. Ricardo, in your issue of August 27th, 1903, page 204. Cylinder bore, 1¼ ins.; stroke, 1¼ ins.; speed, anything up to 5,000 revolutions; boiler pressure, 400 lbs. I can get castings for it, I think. I should like a good speed out of her—about 7 or 8 miles per hour.

We cannot undertake drawings such as you require. They would cost us probably about £10 10s. You will require a much bigger engine than that mentioned, and 500 r.p.m. is quite out of the question. To get 7 or 8 miles an hour, we should not think of fitting less than a 3 h.-p. engine, and Stuart Turner, Ltd., would supply you with a set of castings for about £6. As the building of such a craft would be a rather costly affair, the best course you can adopt would be to buy an old hull, and fit it with either a second-hand steam engine or petrol engine, doing all necessary repairs yourself.

[18,023] **Capacity of Accumulator.** R. L. (Stanwell Moor) writes: I am sorry to see that you are so badly acquainted with your own publication. You advise me to buy your book on accumulators. It so happens that I have been in possession of that book from the day of issue nearly. And if you turn to page 11, you will see that it states 6 ampere-hours per square foot of positive plate surface; not 15, as your reply to me states. A wide difference, you will no doubt perceive. I could almost imagine that something is wrong somewhere by this slight difference. As to my query being vague, I thought I made myself clear. But I will reiterate it. I asked this: That if an accumulator of 20 amps. is being charged, and is fully charged, by a 25-amp. dynamo, would the amperemeter only show 5 amps. as the output of the dynamo under a full load? I cannot quite see where the vagueness of this is so apparent.

In reply to your letter, we respectfully wish to point out that a considerable time has elapsed since the publication of the edition of "Small Accumulators" you are referring to. The Seventh Edition does not contain any such statement; and the correct estimate for capacity of cells has been given repeatedly in more recent issues of this Journal. In some amateur-made cells it is quite safe to reckon on 6 amp.-hours per sq. ft. of positive plate, but in a better-made cell it is possible, with ordinary care, to get much more than this. However, there is no harm in your working on the 6 amp.-hour basis. With regard to your repeated inquiry *re* charging, we can only say again that we can make neither head nor tail of it, as it stands. The only possible construction we can put upon it is to assume that you mean this: "If a set of accumulators is taking 20 amps. from a given dynamo capable of giving 25 amps., can the remaining 5 amps. be utilised on, say, a separate circuit, and would they be registered on an ammeter connected in that separate circuit?" To this we answer Yes; but whether the above is really what you wish to be at is another matter. We are still reluctantly compelled to suggest your wording is a trifle vague.

[17,958] **Model Locomotive Boilers.** S. V. S. (Bristol) writes: Will you kindly give me your advice on the details of a boiler for ½-in. scale G.W.R. "Atlantic"? The inner and outer tubes are 2⅜ and 2 ins. diameter respectively; length of barrel, 8¼ ins. Will you kindly tell me: (1) The number and diameter of water-tubes to use? (2) Can you give me the correct curve for throat-plate? I see Messrs. Carson prefer it, but in the drawing you publish no particulars are given. (3) Is firebox long enough (4½ ins. long × 2 ins. wide)? Is boiler too long (12 ins. total, with firebox)? The outside shell (14½ ins. × 2⅜ ins.) cannot be altered as I am trying to build the model, with the exception of the cylinders, to scale. Pressure of boiler, 50 lbs. (4) Your correspondent, J. L. (page 62, first column, last line, July 18th, 1907), is quoted by Mr. Greenly as having adopted an "extended flue." What is this? I cannot find it in Mr. Greenly's big book.

(1) Four water-tubes will be found ample. The tube used should be light and 3-16ths in. outside diameter. (2) The curved throat-plate is not absolutely essential to success, which statement is to be substantiated by the fact that there are hundreds of perfectly successful water-tube boilers which have no such throat-plate, and also that free-steaming boilers can be made for G.W.R. 251 class "Atlantic" models, where the length of the firebox is so greatly restricted. Where it could be done without being seen externally, we have often slightly curved the top of the throat-plate to obtain a more favourable inclination of the water-tubes. In your case this applies. (3) Yes, the firebox is sufficiently long. We have found that you can have too much firebox. The dimensions you give are normal, and the length of the boiler cannot very well be altered without upsetting the design of the engine. (4) The correspondent evidently means the curving of the throat-plate, but as mentioned by the writer of the article, the letter is not clear on certain points.

[18,014] **Gas Turbines.** J. W. S. (Birmingham) writes: In your issue, No. 198, Vol. XII, you give an account of experiments with a gas turbine. Will you kindly furnish me with these further details: (1) The terminal velocity of the gases at 400 lbs. pressure. (2) How does a fan of the reversed turbine type work? Could you give me a diagram? (I have your book on "Model Steam Turbines.") (3) Could a greater pressure be obtained with a turbo-compressor fan than with an ordinary fan? If so, how many times greater could the pressure be, neglecting power required to drive them?

(1) Probably 8,000 ft. per second. (2 and 3) See F. Foster's book on "Turbines and Turbo-Compressors." The subject is too large for our correspondence column.

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.*

* Castings for Small Undertype Engine.

The castings and parts for the construction of the small model undertype engine to the drawings which have appeared in these pages recently, are being supplied by Stuart Turner, Ltd., Shiplake, Henley-on-Thames. The specimens of the bedplate and cylinder castings which we have received are in every way satisfactory. The machining of these two principal castings is included in the price charged for the complete set of parts. Further particulars may be obtained upon application to the above.

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The Editor's Page.

ONE of the most pleasing announcements we have to make in connection with the Loan Section of the forthcoming MODEL ENGINEER Exhibition is that Dr. J. Bradbury Winter has kindly consented to send his model locomotive, the "Como." Some few of our readers have already been privileged to see this splendid model, and there are thousands more who have read with interest the story of its building as set forth in our pages nearly ten years ago. As one of the finest examples of amateur mechanical work in the country, and as the first model locomotive to be illustrated and described in THE MODEL ENGINEER, the "Como" will possess a double interest to our readers, and we are sure that its appearance in public will be enthusiastically welcomed.

* * *

Another item of exceptional interest in the Loan Section will be a selection of several models from the valuable private collection of Mr. E. D. Löwy. Mr. Löwy has for many years past been collecting historic locomotive and other engineering models, and has acquired some most interesting examples of engineering design and construction. He has very kindly promised to lend some of these for the Exhibition, and thus add greatly to its attraction from the point of view of the engineering student and enthusiast.

* * *

Our readers will have noted that in our last issue we published the entry form for the open competition at our Exhibition. To enable us to make proper provision for space for the competing models, we should be glad if those who intend entering would kindly fill up the forms and send them along as early as possible. We may point out that there is no entrance-fee whatever, and no distinction between competitors. The competition is open to all readers of THE MODEL ENGINEER alike, and each competitor may enter as many models as he likes, provided each is packed separately and is entered on a separate form.

Answers to Correspondents.

J. S. (East Finchley).—We can only suggest making application to the nearest electricians. We know of no one personally in that district.

A. R. (Worsley).—Go in for all three subjects.

W. R. (Gosforth).—Thompson, of Greenwich, would supply anything in this line.

A. E. L. (Prince's End, Staffs).—We do not quite understand what you wish to do. Is the intercommunication set to be connected permanently to the line or to one or other of the two stations at will. Further, are the two out stations to communicate with each other? Do not write on both sides of the paper in future.

A. F. (Torquay).—You should read up the articles in back numbers on the construction of motor cycles. We cannot give full description and instructions in these columns.

W. L. (Blaina).—You will find a drawing of the L.Y.R. shunting tank you refer to in our issue of June 6th last, page 550. The scale of feet below the drawing will enable you to read off the required dimensions at once.

B. J. B. (Shorncliffe).—With engine running at 450 revolutions, a flywheel or *driving* pulley of 9 ins. diameter will be needed. A 1-12th h.-p. motor should drive a 5 or 6-ft. boat at a good speed if supplied with plenty of power. To reverse motor, reverse the flow of current in either armature *or* fields, but not in both.

A. C. (Melrose, N.B.).—We note your request. Kindly enclose a stamp, if a reply per post is required.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

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Contents.

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

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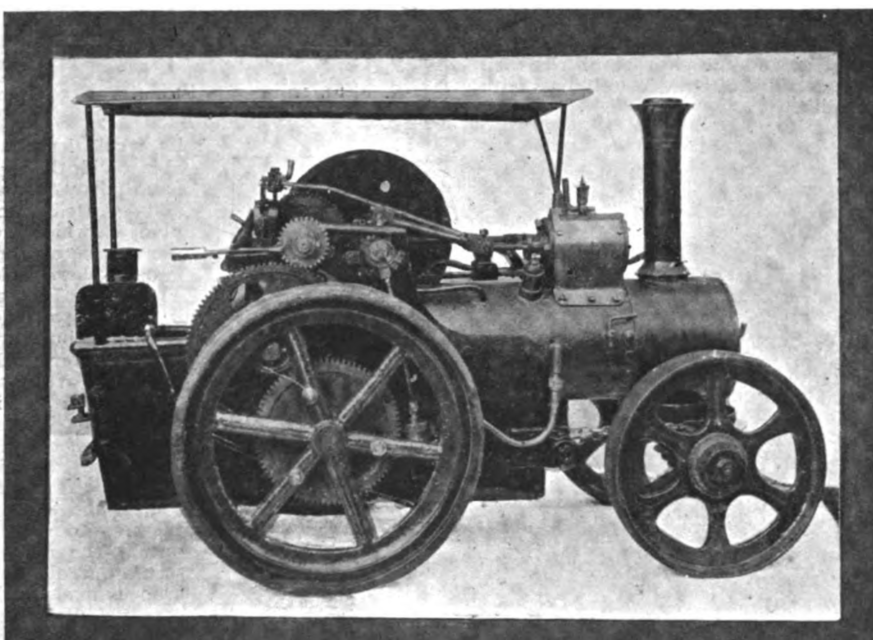
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XVII. No. 333. SEPTEMBER 12, 1907. PUBLISHED WEEKLY.

A Model Traction Engine.

By H. STEVENS.



A VIEW OF MR. H. STEVENS' MODEL TRACTION ENGINE.

THE model steam traction engine shown in the photographs is 18 ins. long over-all, and about 14 ins. high to roof. The boiler is of copper tube of the usual pattern, fitted with three 1-in. tubes through barrel, and is fired with a spirit flare in the firebox. It is riveted and sweated and has been tested to 80 lbs. hydraulic pressure, working pressure being 30 lbs. by the gauge. As in the real engines, the firebox sides extend upwards to receive the bearings.

To briefly describe the engine, the cylinder is a gun-metal casting, 1-in. bore by 1½-in. stroke, slide-valve having about 3-16ths in. travel, steam ports 3-16ths in. (round), being chiselled out oblong at valve face.

The crank is a steel forging turned up ¼ in. diameter. Reversing gear is by slip eccentric. The gearing was taken from old sewing machines and fitted in very satisfactorily, gearing down 14 to 1. This may appear very low, but the engine travels at a good rate and hauls well, the rear road wheels (cast iron) being 7 ins. diameter. The engine is fitted with throwing-out lever, regulator, and the usual fittings, including feed pump. I may add that the steering is effected by a worm gear, as in the originals.

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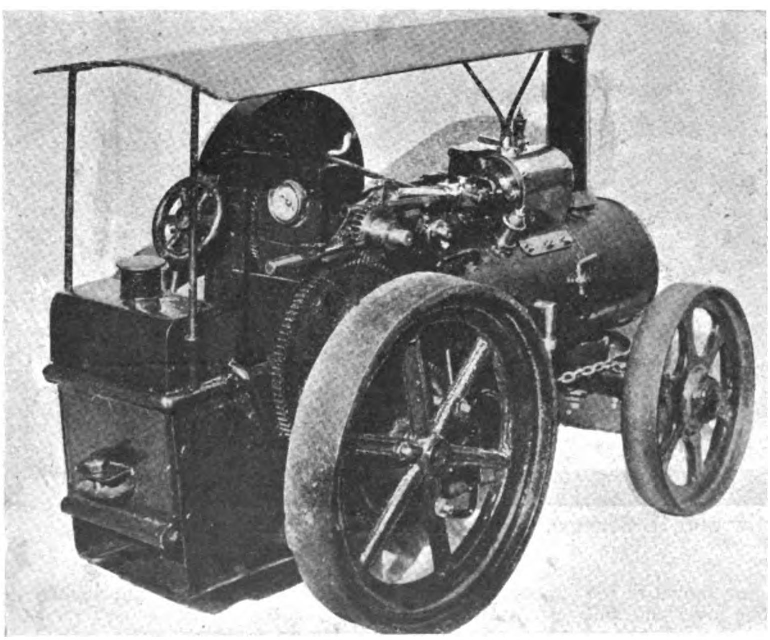
Workshop Notes and Notions.

[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.]*

Aluminium Paint.

The following, taken from *Mechanical World*, may be of use to some readers requiring to mix their own aluminium paint. It is made from powdered aluminium, and contains about 91 per cent. of metallic aluminium, 6 per cent. of aluminium oxide, 1·5 per cent. of silica, and 1 per cent. of water. The powder is made by forcing gas or air under pressure into the molten metal at the time of setting, this being accompanied by vigorous mechanical stirring. The granulated metal thus formed is partly oxidised, and is easily pulverised in stamp mills, after which it is run through sieves and then polished in polishing mills. The powder is then mixed with a varnish of the following composition: Turpentine, 1·5 gals.; palest copal varnish, 0·5 gal.; palest terebine, 4 ozs.; magnesium carbonate, 4 ozs. The magnesia is allowed to settle, and the clear varnish is then drawn off. About 2 lbs. of powder are mixed with 1 gallon of varnish.



Rear View of Model Traction Engine.
(*For description see front page.*)

A Cheap Pair of Dividers.

By J. E. G.

The following is a description of a pair of dividers, costing practically nothing, and not difficult to make. The legs were made of steel, although other metal would do, filed to the shape shown in Fig. 1. They were then drilled to take two short pillars, Fig. 2; these were then placed in their respective holes and riveted, not too tightly, as they must move freely over thin steel washers. 2 ins. of $\frac{1}{8}$-in. brass rod having been threaded along

FIG. 2.

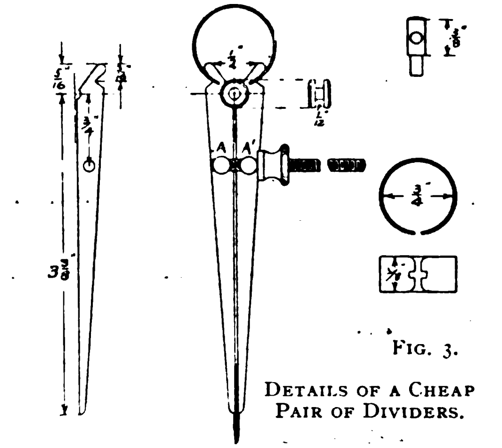


FIG. 3.

Details of a Cheap Pair of Dividers.

FIG. 1. FIG. 4.

its whole length, and being able to slide through the right-hand pillar A1, was screwed and sweated into A. The pivot on which the legs open was a piece of iron wire with two washers soldered on. These must be a good fit, so it is best to solder while in position; but care must be taken to prevent the legs getting fixed at the same time.

The spring, Fig. 3, was a broken hacksaw blade bent into a circle, hardened, and tempered in oil to a deep purple. It must act, of course, above the centre of the pivot to press the dividers open. The points, as will be seen are needles, soldered into grooves made with a three-cornered file. In soldering them it will be best to melt some solder in the grooves, press the needles in place, and cool in water before the heat has time to travel to the points and soften them. It only remains now to place the parts together and fit the screw with a milled nut, as shown in Fig. 4. In conclusion, it may be added that all the materials used were "scrap," excepting the needles, which cost a penny.

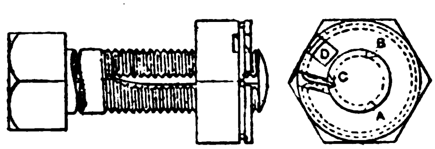
Mending Broken Hacksaw Blades.

By E. L.

A simple, and not very generally known, method is as follows: The blade is cleaned near fracture and a piece of tin about ¾ in. by ⅜ in. soldered on each side over fracture. Another way is to bend a piece of tin of about ¾ in. square over the top edge of blade, and sweat it on. The above are more particularly useful when the saw is a new one, and breaks near one end, as they frequently do.

A Positive Locknut.

The accompanying illustration (taken from the *Horseless Age*) shows a locknut and bolt invented by a Chicago man. The bolt has three grooves, A, B, and C, which act as ratchet teeth. The upper part of the nut is so formed that a spring-ring encircles it, the end of the ring being turned inward, as shown at C, thus coming in contact with the side of the groove, and effectually preventing the nut from being turned in a left-hand direction. However, right-handed rotation is possible, as the grooves are so shaped that the end of the spring-ring slides up the inclined surface easily. In order to release the nut, a slot D is provided, which allows the point of a nail, or any similar object, to be placed under the spring-ring, and thus raise the point out of the groove, when the nut can be taken off. This arrangement allows an adjustment at any time of one-third of a rotation.



A Positive Locknut.

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

The entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length. and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in The Model Engineer. The awarding of the prizes may be summarised as follows:—

Silver Medal to the fastest boat in Class A beating previous records.

Bronze Medal in Class A to all other boats beating previous records.

Silver Medal in Class B to fastest boat, provided speed is not less than 5 miles per hour.

Bronze Medal in Class B to the second fastest boat doing not less than 5 miles per hour.

Silver Medal in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

Bronze Medal in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

Notes on The Uses of Angle-plates.

By Alfred Parr.

(*Continued from page 221.*)

Another form of angle-plate is shown in Fig. 4, which is really a combination of two plates fitted face to face, one of which is capable of swivelling on a turned pin P. It will be seen that the face of the plate A is divided into degrees of a circle and the plate B fitted with an indicator. By this arrangement the exact position of any surface can be determined and any desired angle obtained with precision without the necessity of first marking out the work, as is the case in the ordinary way of working. Two plates used in this way considerably facilitate the output in some classes of work. Take the example illustrated in Fig. 4, which represents a "strip" for a machine slide, which requires tooling on each of the four faces. There will be two "settings" of the work instead of three, because the angular surface can be swivelled into the horizontal plane and there treated without altering the cutting tool. While for amateur milling—where it is practised—slab cutters can generally be utilised, instead of purchasing special cutters

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for angular work. Readers of THE MODEL ENGINEER who may not have the convenience of an accurately divided wheel can get the angle-plate done, *i.e.*, graduated, at any reliable tool-makers or, if they choose to dispense with the indications,

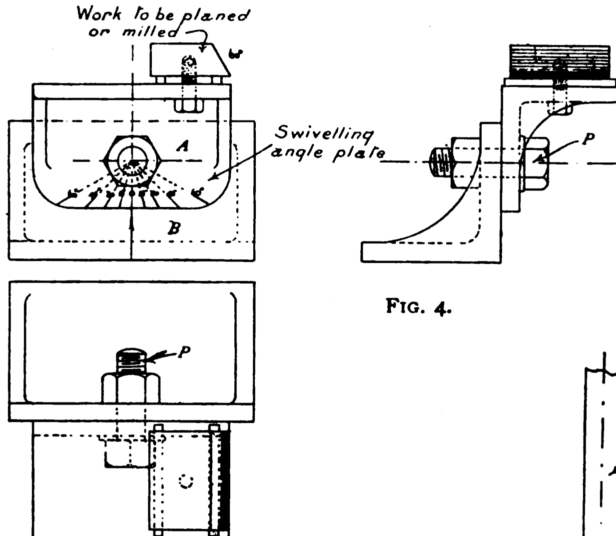

FIG. 4.

they will have to mark out their work first and then use the swivelling-plate, locking it in position, as shown, and testing by the use of a surface gauge on each surface to be tooled.

The above combination of plates is equally useful at the drilling machine whenever holes are to be made at an angle, either to each other or to any given surface. By having radial slots suitably placed in each plate, and a bolt placed on either side of the centre-pin, ample support is given for almost any class of work.

There are many pieces of work which could be accomplished at the drilling machine quite satisfactorily if "special angle-plates" could be used. This, of course, could not be considered for single jobs, but where examples recur they should always be considered.

A simple case is to bore or drill a deep hole in a cylindrical shaft. Ordinarily, this would be mounted in a "self-centreing chuck" or a "bell chuck" in the lathe, while the outer end of the shaft would require a "stay" or "boring collar stay" to support it. An ordinary angle-plate could be used and a pair of V-blocks taken from the marking-out table; but when a number of these shafts require drilling, then it is advisable to cast a pair of V-blocks to an angle-plate, and, after planing, shaping, or milling up the surfaces, the plate is ready for use with just a bolt and clip with which to secure the shaft in place without setting. This arrangement is shown with a shaft ready for drilling in Fig. 5. It will be seen that the extremity of the shaft stands on a centre point; this is to ensure the shaft being properly located axially in alignment with the centre of the drilling machine spindle.

Another example is illustrated in Fig. 6, representing a bracket to be bored in two parallel holes, and the bosses to be faced and tooled, as in Fig. 3. In a usual way this would be considered pure lathe work: the bracket would be mounted upon an angle-plate after the base had been tooled either by shaping or milling, and the holes drilled, bored, and reamed. Afterwards the bracket would be fitted with a mandrel and mounted on the lathe centres, each boss being tooled in turn. Now by using an angle-plate in the way illustrated, all the tooling can be accomplished at a drilling machine quite satisfactorily.

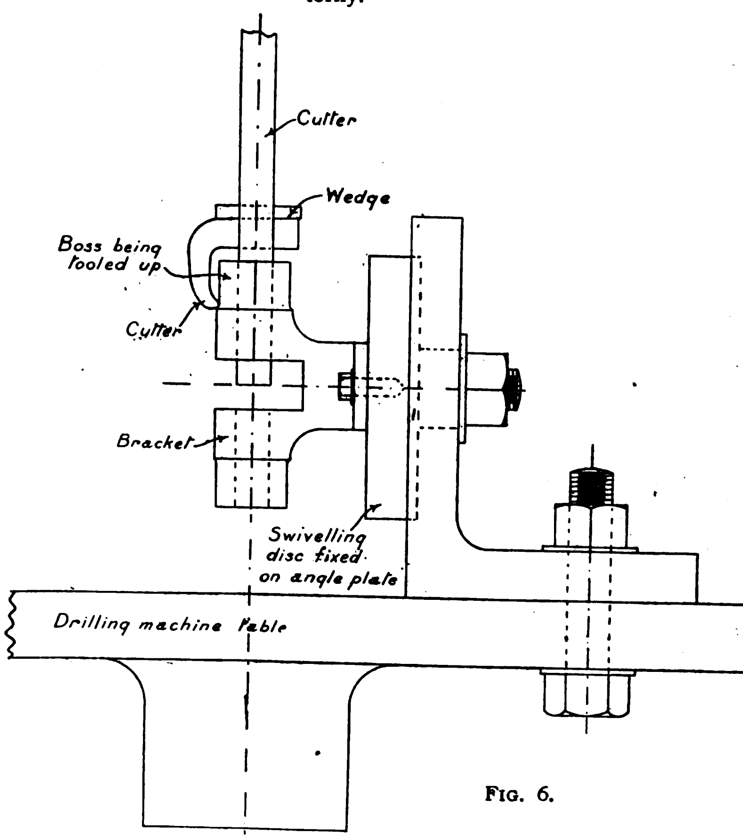

FIG. 6.

If the brackets are to be anything less than ¾-in. bore they can be more reliably tooled when the bosses are cast solid; the drills can also be run at a much higher speed and with less damaging effects.

In this case the angle-plate is fitted with an indicated disc controlled by a "central pin" and "dowel pin" for further security. The angle-plate proper is bored for the pin and counterbored a little to receive the disc. The drawing is simple,

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and should fully explain the arrangement. It is by this principle, in which boring bars taking a bearing in the machine table, that drilling machines can compare favourably with lathes on many jobs of a similar kind. (See also Fig. 3.) Of course, the angle-plate in all work of the above character remains in a permanent position until all work of a given pattern has been executed, for by so doing the original dimensions are accurately repeated in each example without any possibility of error; the appliance therefore resolves itself into a "jig," illustrating a method of working now fast becoming universal.

It will be seen that the same appliance could be used at the lathe without alteration, but

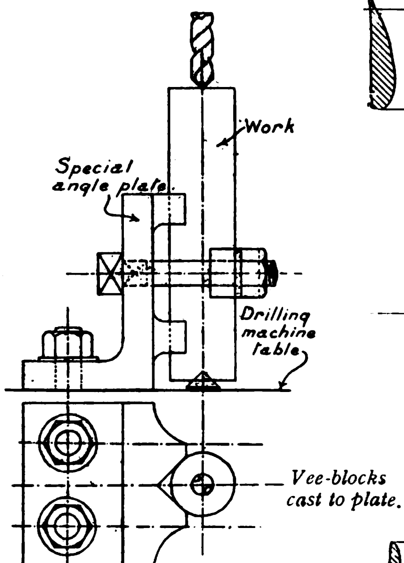

FIG. 5.

nothing would be gained unless a turret carrying all the required tools were employed; then, of course, the lathe would surely make a decided gain, because it would be much more easily manipulated.

An angle-plate of a special character is given in Fig. 7, illustrating a piece of work to be tooled on four faces without removal when once properly set. The example given has to be bored and screw-cut on the two opposite ends B D, while C A has to be bored taper and faced at each end.

The disc is accurately divided into four, and these four lines are made to agree in turn with an index mark on the face at the front of the angle-plate. Of course, one angle-plate will answer for a considerable number of different discs; but each disc, being specially designed to fit a certain form of casting, can be quickly changed, as required.

To ensure the work remaining in one position after fixing in the jig, a clip made of the same contour is placed above the work. This has to be very carefully adjusted in the first instance, but when once properly made to coincide no possible movement can be given to the work during tooling operations. Tools carried in a turret may each take their respective turn, and thus reduce the

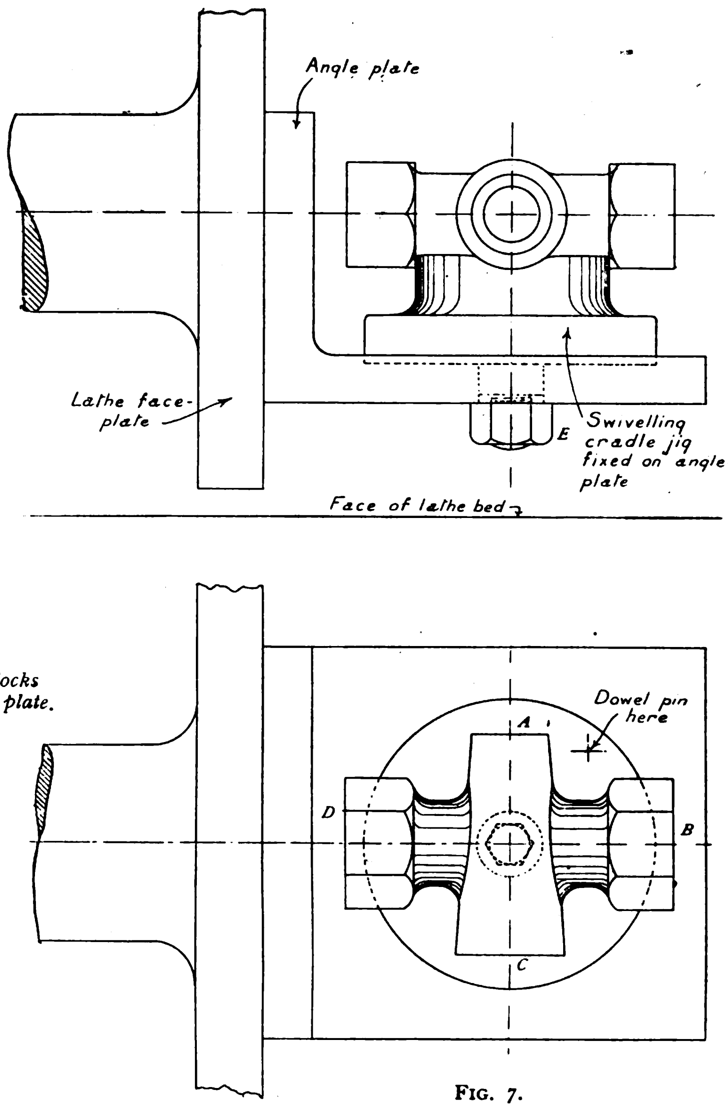

FIG. 7.

time, the skill, and the cost to a minimum, points of growing importance in work of a repetitionary character.

IT is reported that the suburban lines about Melbourne, Australia, will be electrified, for which purpose the Government is prepared to spend £3,000,000. The system to be adopted is now under discussion.

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Model Railways.

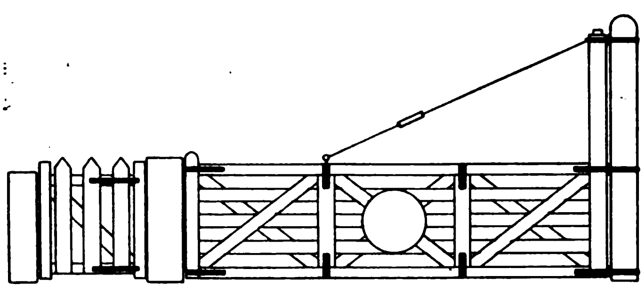
No. XVI.—A Miniature Model Railway System.

THE numerous model railways which it is our pleasure to view from time to time comprise a charming variety, as evidenced from those that have been illustrated in our past volumes. Some have been built regardless of cost, others with a prime object of hauling human loads, whilst in others strict attention has been paid to appearance, and an attempt at a picturesque effect has been more or less successful.

The railway to be here described and illustrated forms yet another class to those above stated, being one of the many miniature railways that have evolved by degrees from the cheap table set with circular track to an extensive and properly organised and complete miniature system of permanent way, buildings, rolling-stock, and signalling. The credit of this railway belongs to Mr. W. G. P. Sanders and his brother, J. L. Sanders, of New Cross, and to their courtesy we owe the pleasure of imparting the following particulars to our readers.

We may say that the builders have had the advantage which many of our readers have not—of a long garden, and of this they have made good use, but not, in their case, to the detriment of the well-cared-for flower-beds.

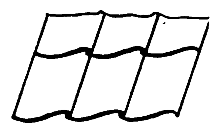
Generally.—The railway began with one of the cheap ordinary circular tracks with tin trucks and clockwork engine in 1898. This was before the gauges for model railways were standardised, which accounts for the gauge, which is 1-3-16ths in., approximately 1-48th of actual size. At first the rails were bought, but these have now rusted away, so that new ones have been made and painted with non-corrosive paint. The only articles bought now are wheels and the mechanisms for new engines. It must be understood that the line is in course of construction, and will not be complete for about another year. It is proposed to extend it to a second



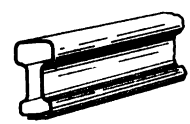
Level Crossing Gate. (*Half full size.*)

station, the terminus of the branch of which this line is a model. All stock is of the G.E.R. pattern, save some G.N.R. goods trucks, relics of a former line, and some of private owners. The junction points and signals are worked from the signal-box, the junction-box being the only one at present completed. The single line is worked on the staff-and-ticket method, no train being allowed to proceed without the train staff or a ticket. The line is either fenced in or lined with hedges of a suitable and proportionate size. Everything is made with a view to withstanding the weather, so that tar and non-corrosive paint are largely used.

The actual time-table of the real branch is used, consisting of seven passenger trains up and eight down, three of which are mixed, and two goods trains each way daily. Engine discs—white, red, and green—are used to designate the different classes of trains. Through carriages from the main line to the branch trains are run in summer, of these there are three down and four up. The signal-boxes and stations are lit up at night with small oil lamps, one of which is placed also in the guard's van of the train when dark. Goods traffic consists of garden produce and rubbish, and railway material and coal. The whole length of the line is 80 ft.—along a straight garden bed. All the stock is made from observation and private



Miniature Roof Tiles.



Sheet Zinc Rail.

drawings of the G.E.R. rolling-stock, and the buildings from sketches of the real objects.

Rolling - Stock.—The rolling - stock consists at present of two *locomotives*—a tank engine to work the branch, four-coupled in front with a trailing bogie; and one of the standard G.E.R. four-coupled express engines, of the older pattern, with large driving wheels, to work the through goods trains and the main line trains. Another tank locomotive of a different pattern will shortly be made to replace the bogie tank engine as required. All these engines go by clockwork, steam being impracticable on so small a gauge. They can draw three coaches and about five goods trucks.

The coaches are made of wood, painted and varnished, with glass windows, doors to open, and are upholstered inside. They are fitted with springs to the wheels and have spring buffers. Stock consists of: Composite bogie car with monitor roof; six-wheeled saloon with monitor roof; six-wheeled composite; two four-wheeled thirds; four-wheeled first, and four-wheeled guard's van. Others are being completed, including a six-wheeled guard third; six-wheeled guard's van; six-wheeled composite; six-wheeled third; four-wheeled composite; four-wheeled guard's van. They are carved outside, and are fitted with details such as steps, handle-bars, etc.

The goods stock comprises about forty trucks, including many varieties—open trucks, coal wagons, box trucks, low-sided, and timber trucks, cattle, vehicle, and bolster trucks, and machine cars, brake vans, and a goods crane; also a ballast train with brake van.

The Permanent Way.—This is laid in the mould, save for the main line, which is ballasted with fine gravel and heavier material for the sub-ballast. It has been found that it is not necessary to relay the line more than once a month where it is laid in mould, owing to the large quantity of sleepers,

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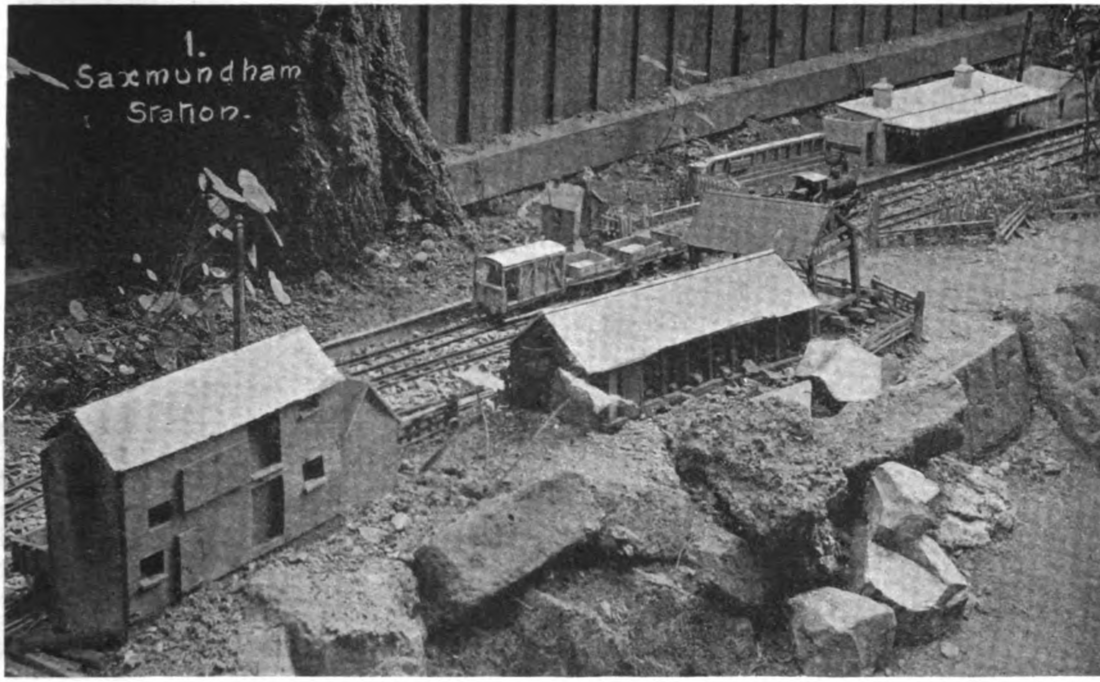

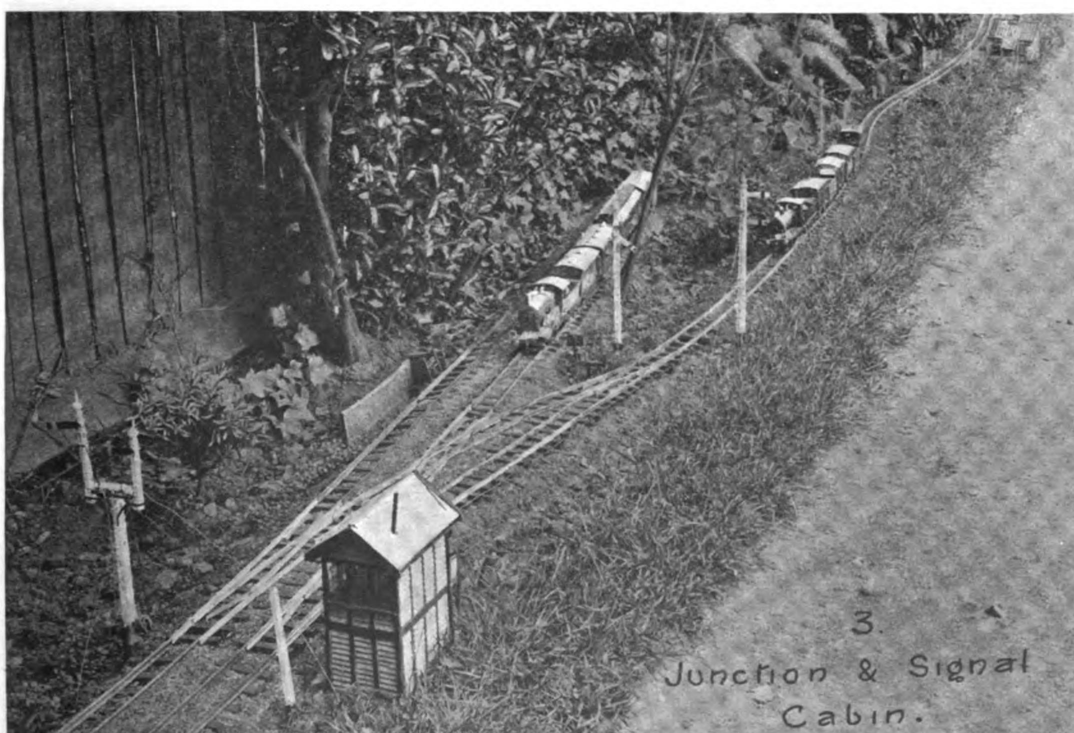

TWO VIEWS OF A MINIATURE MODEL RAILWAY.

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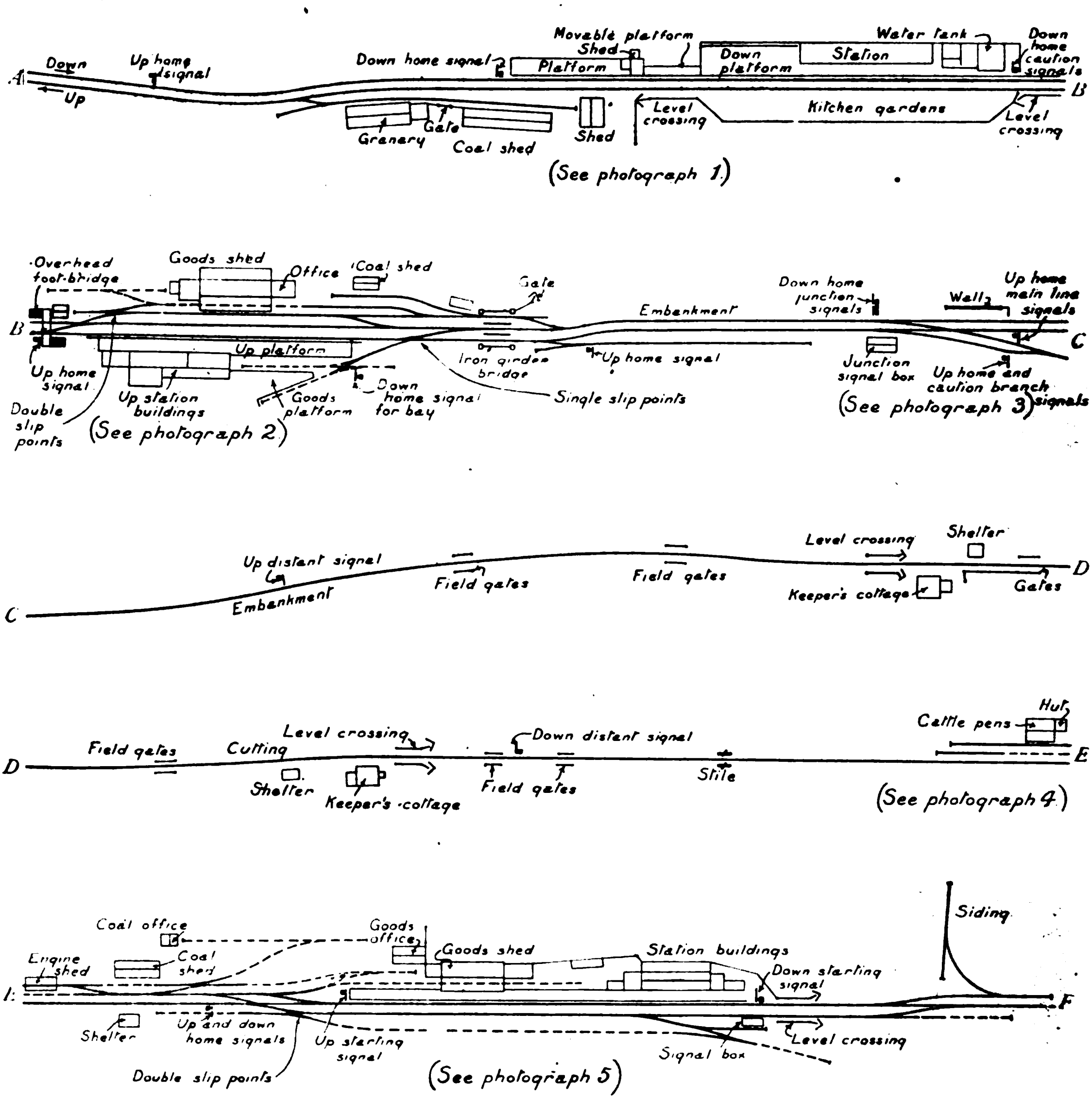
which are placed an inch apart centres. The points, with one exception, are made of flange rails, whereas the ordinary line is laid with bull-headed hollow rails, supported upon lead chairs, with keys. The fishplates are made of lead also.

(see sketch). The larger buildings have gutter and drain pipes to carry off the heavy—more than tropical—rain. Inside they are fitted with partition wall, stairs, and doors, and all the grates can be lit, though it is necessary sometimes to employ



THE GENERAL PLAN OF MESSRS. SANDERS' MINIATURE MODEL RAILWAY.

For description] [*see page* 246.

Buildings.—The buildings are made of wood, with chisel-marks to imitate bricks or planks (as the case may be) and painted. The roofs are of felt (for the small shelters) and slate or imitation tiles, each of which is made separately of tin the station firebuckets. The gates are made of wood (a drawing of one is reproduced on page 246), painted correctly, except some of the field gates, which are of tin. The signal parts are of wood, with arms of metal and metal ladders.

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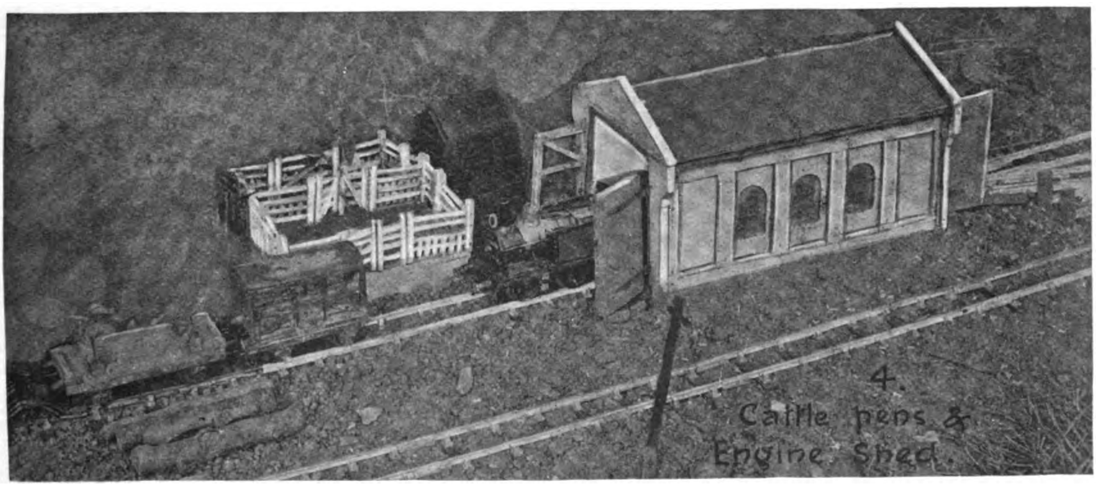

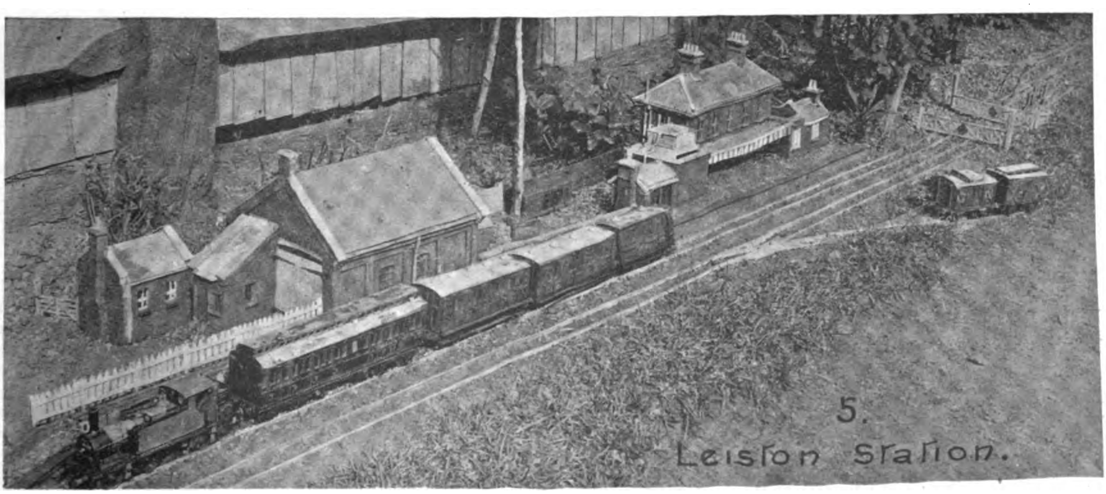

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Chats on Model Locomotives.

By Henry Greenly.
(Continued from page 207.)

An Interesting Rebuild.

In the seventh volume of The Model Engineer—the issue of November 15th, 1902, to be particular—I described, in more or less of a general way, the construction of a miniature locomotive belonging to Mr. H. A. Bennett, a member of the London Society of Model Engineers, and recorded the intention of the owner to make some improvements in the model and rebuild it with a water-tube boiler. At the time nothing tangible had been done, but, shortly after, drawings were prepared for the new boiler, which has now been finished and fitted to the locomotive.

A reference to the article in question will show that the original engine laboured under some disabilities, and it was rather surprising that it worked so well as it did. The engine was evidently built from the designs and castings supplied by "J. H." some fifteen years ago, and which many readers will remember were among the few sets of castings for locomotive work then on the market. Judging by the light of present experience, the design was very poor indeed. The size of the cylinders—compared with the boiler power—was quite out of it, only 22½ sq. ins. of grate area being provided for cylinders 1⅜ ins. by 2¼ ins.

When, owing to slight structural weaknesses, as well as its inability to provide sufficient steam for the cylinders *continuously and at the proper pressure and under all circumstances*, the generator was finally condemned, at Mr. Bennett's request I submitted the drawings already mentioned. These drawings have not been published in these pages, although they are included, with a reference to this engine, in my book, "The Model Locomotive," and therefore, as the boiler is now finished and I have seen it working, the present moment is opportune for a special reference to this interesting rebuild. The design of the boiler was frankly an experiment. I had tried nothing so large in the way of a water-tube boiler for a locomotive; but Mr. Bennett, in a sportsmanlike spirit, undertook to make and try it on his locomotive in lieu of the coal-fired boiler already described.

The type of boiler was then well known, although

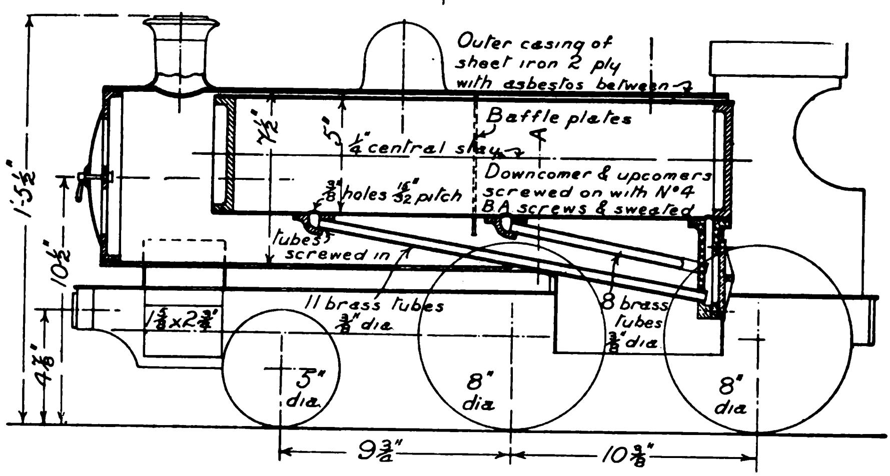
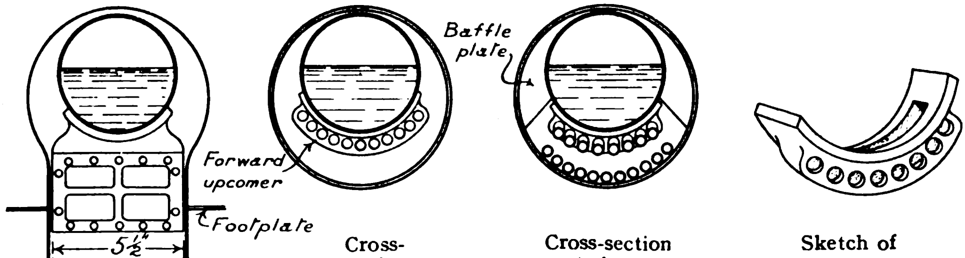


Fig. 1.—Section of Engine showing General Arrangement of New Water-tube Boiler.



Section behind downcomer. Cross-section at front upcomer. Cross-section at throat plate (A). Sketch of upcomer.

Fig. 2.—Details of New Water-tube Boiler.

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it was not long before that I had first suggested the use of a downcomer. The boiler for Mr. Bennett's locomotive, however, embodied one or two new features—at least, they were perhaps new in 1902 when the rebuilding of the engine was mooted. As it would have been difficult to silver-solder or bronze the numerous small water-tubes into the heavy boiler shell and downcomer, I suggested the use of upcomers into which the tubes could be screwed (32 or 40 threads per inch). To do this the downcomer was arranged with a door at the back so that tubes could be fixed in this way, and if desired the holes in the upcomer drilled and tapped at the proper angle with a long tool passing through the respective holes in the downcomer. The tubes were intended to be expanded in at the downcomer end and to be sweated with soft solder (if necessary) as a caulking. One of the chief reasons for adopting the water-tube boiler was the presence of an extremely short coupled wheel-base in the original engine, which entirely prevented a firebox deep enough for solid fuel, of a length sufficient to meet the needs of the engine. The provision of a 9-in. by 5½-in. firebox in place of the 6-in. by 5½-in. firebox of the original locomotive would have entailed a drastic reconstruction of the rear portion of the engine. In an oil-fired boiler a smaller grate may be used without reducing the efficiency of the generator as a whole, and it was thought that, so long as the heating surface of the new water-tube boiler could be kept at least equal to that of the old fire-tube generator there would be a distinct gain, owing to the greater efficiency of water-tubes. Then again there was the advantage of oil fuel, which could be controlled easily, and would make the driving somewhat less disagreeable. In addition the water range and the reserve of steam would be much increased by the adoption of the water-tube generator. All these desiderata have been obtained in the new boiler Mr. Bennett has just completed, and, furthermore, the appearance of the engine has been improved and modernised.

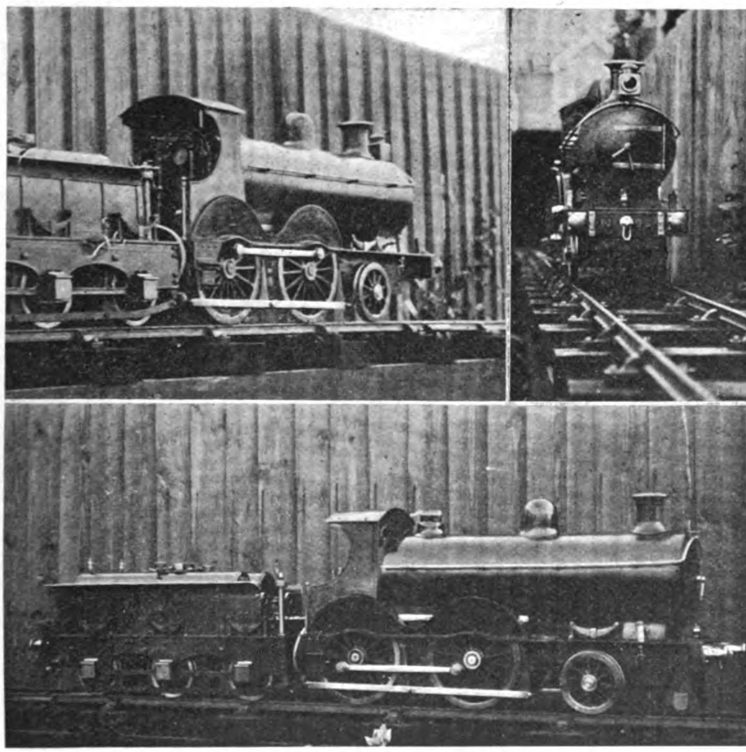

Fig. 3.—Three Views of Mr. H. Bennett's re-built 6¾ Gauge Model 2—4—0 Type Passenger Locomotive.

Although conclusive tests have not yet been made, owing to the engine portion not yet being quite right (there is always something wrong with a model—wherein lies its interest), the new boiler is perfectly successful. The pressure is maintained much better than by the original boiler, and steam is raised much quicker. The boiler may not evaporate so much as the coal fire boiler did when the fire was at its best, and under the influence of the fierce exhaust, but it picks up after any reduction of pressure in a surprising manner. The only question is what to do with the engine cylinder and valves, as there is a bad "blow" of live steam to exhaust at one portion of the stroke, owing to some trifling defect in the bore of one of the cylinders, which I have not yet had the opportunity of examining. When this is put right I think the boiler will do very well, and in spite of the evident over-cylindering, the combination of boiler and engine will be quite satisfactory. The burners, when first fitted, were placed too close to the tubes, and the blower being temporarily stopped up, the flames were beaten back by the tubes, which are purposely close together to extract as much heat from the flame as possible,* but this trouble, I believe, is not now noticed.

The dimensions of the two boilers are as follows:—

The Old Boiler.

Boiler barrel: diameter, 6 ins.; length, 14½ ins.

Firebox: outside, 6 ins. by 5½ ins. wide; inside, 5 ins. by 4½ ins. wide; height, 7½ ins.; heating surface, 430 sq. ins.

The New Water-Tube Boiler.

Inner barrel: diameter, 5 ins.; length,

Outer barrel: diameter, outside, 7½ ins.; inside, 7 ins.

Firebox, 7 ins. long by 5½ ins. wide.

Tubes: 19, ⅜ in. diameter, in two rows.

Heating surface: tubes, bottom row, 244·5 sq. ins.; top row, 84·25 sq. ins.; barrel, half-surface, 140·25 sq. ins.: total, 469 sq. ins.

It will be seen that the new generator, at a

* Do not apply this principle to a methylated spirit-fired locomotive.—H. G.

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liberal estimate, has something to its credit in nominal heating surface, which circumstance is not usual where the engine has a properly designed fire-tube boiler, the nominal heating surface for a 1¼-in. scale model being from 500 to 600 sq. ins. However, the fact that the new boiler has a greater heating surface, and being a water-tube generator should be slightly more efficient than a fire-tube boiler, explains the success obtained.

or two model engineers who are making similar boilers for shop engines and dynamo driving, and in case any reader may wish to obtain castings, I may mention that Messrs. Stuart Turner, Ltd., of Shiplake-on-Thames, have the patterns from which Mr. Bennett's castings were made, and I believe can supply from stock or on a few days' notice.

The other interesting point about Mr. Bennett's engine is the high- and low-pressure oil tanks, by

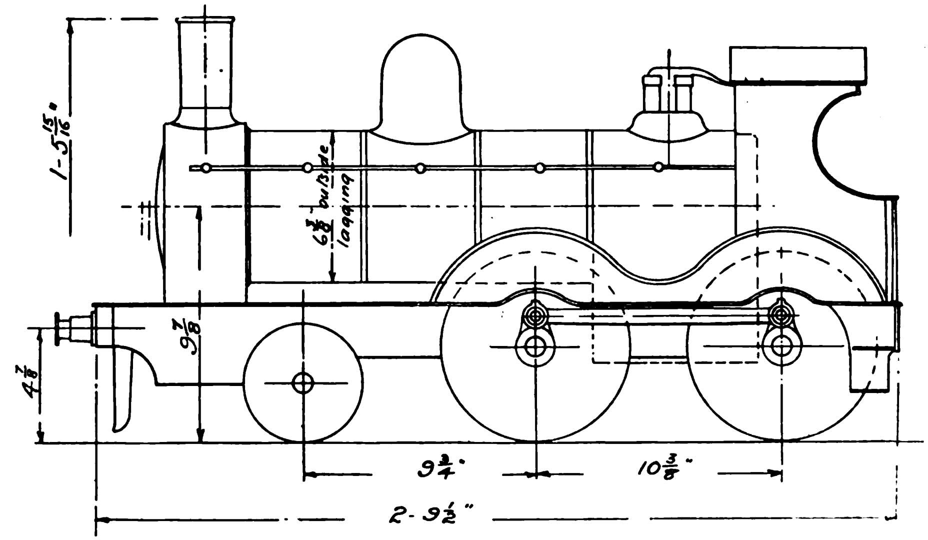

FIG. 4.—ENGINE BEFORE RECONSTRUCTION.

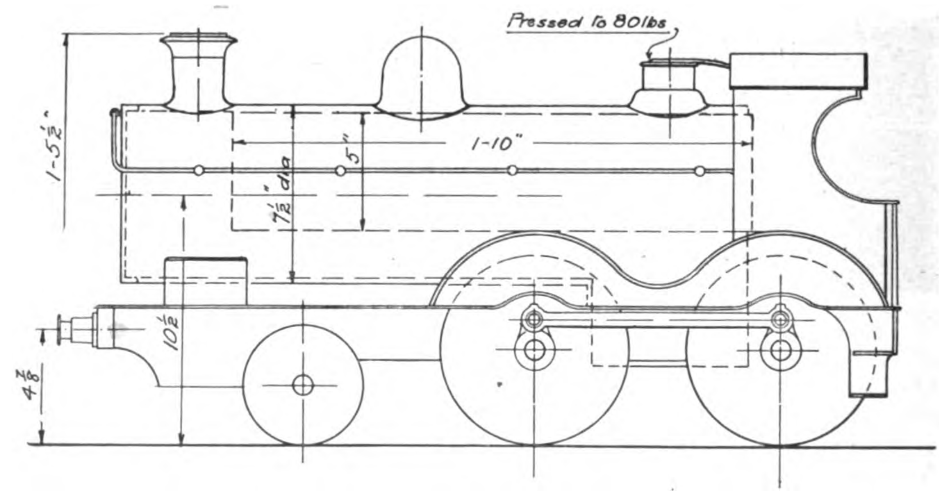

FIG. 5.—ENGINE AS REBUILT.

MR. A. R. BENNETT'S 6¾ GAUGE MODEL LOCOMOTIVE BEFORE AND AFTER HAVING NEW WATER-TUBE BOILER FITTED TO IT.

(*Scale : ⅛th full size.*)

The type of boiler used on Mr. Bennett's locomotive is also to be recommended for stationary purposes. The boiler should drive a 3-16ths to ¼ i.h.-p. engine quite well. Indeed, I know of one which fire can be regulated in intensity without having to relieve the air pressure from the top of the oil. The burners used are four No. 5 (3 ins. diameter) "Primus" silent burners, and they are

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connected all to one supply pipe. They have drain valves to allow any condensed oil to escape when the burners are not alight, as described in "The Model Locomotive," page 242, Fig. 346.

The connection is then led to a main valve, which shuts off the oil entirely, and can be used as a throttle to prevent the surging of the burners when they are being started and under a slight draught. From this valve the supply pipe branches out to the two oil tanks—one of which is used as a low-pressure tank worked at about 3 lbs. to 5 lbs.; and the other for high pressure, working at 20 lbs. to 30 lbs. per sq. in. Two screw-down valves are used on the branch pipes, and the engineman can switch over from full burner power to a pressure which only just keeps the burner alight by screwing down the high-pressure valve (H.P.V.), and then opening the low-pressure valve. There is always plenty of time

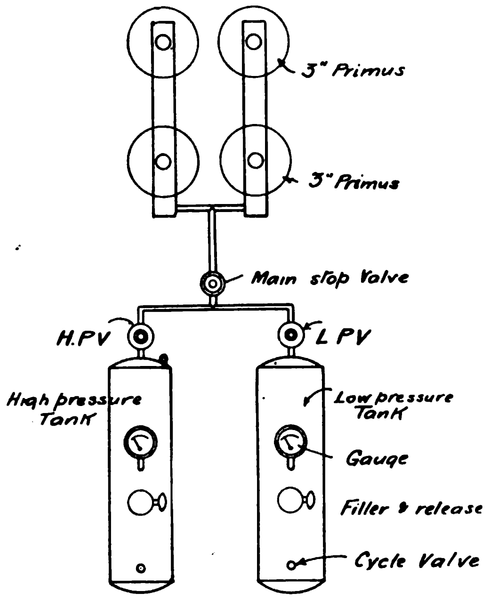

Fig. 6.—Arrangement of High- and Low-Pressure Oil-Tank, Connections and Valves.

to do this, as the oil stored in the pipes keeps the burners alight for some minutes. The oil tanks are arranged in the same way as those used in the early days of Mr. Holden's experiments on the Great Eastern Railway, viz., in two long drums, one on each side of the tender. Each tank has a pressure gauge, a combined filler and release, and a Lucas tyre valve by which the pressure can be pumped up with cycle inflator. The two tanks also enable the attendant to replenish the oil supply without having to let the fire out, which is certainly a great advantage.

In acknowledging the prominent part Mr. Bennett has taken in this experiment, the labours of his fellow member of the Society and near neighbour, Mr. F. R. Welsman, must be recognised. Personally, I have to thank the latter gentleman for the pleasant day spent at his house in company with Mr. Riddle, Mr. Blankenburg, Mr. Claudet, and other interested members, testing the powers of the engine in its new *rôle*.

(*To be continued.*)

Mechanical, Electrical, and Other Aids for the Deaf.

By John Pike.

The appliances available for those unfortunate persons who suffer from deafness are very numerous and of variable utility. For the one simple fact remains that there is every shade and degree of deafness: one person may, by simply holding the hand to the back of the ear, gather and intensify or reflect the sound sufficiently for his purpose; another requires the assistance of an ear trumpet, resonator, or elongated cone-shaped appliance; while a third hears only with the aid of a conversation tube.

In a great many cases a small and almost invisible cone-shaped instrument made in vulcanite or silver, and worn simply for the purpose of enlarging the ear channel, serves admirably: the same effect is produced by gentle pressure of the ear at the back and low down, in order to keep the orifice open. Miniature ear trumpets or resonators, otophones to fit behind and project the ears, and small ear cornets worn singly or in pairs also serve an extremely useful purpose.

The ear trumpets are by no means unsightly, and if of the best design—resonators is the proper term—they certainly magnify the sound considerably without altering its pitch and value. The larger sizes are stronger than the small, and there is a great difference in the strength—between those of one maker and another. With a good resonator conversation is carried on easily between two persons sitting side by side, one of them being very deaf; but the best appliance for conveying natural sounds to the ear of a very deaf person with the least exertion on the part of the speaker is the conversation tube, a flexible and slightly tapering tube, having at one end an ear piece and at the other a cup-shaped mouthpiece; with this a very deaf person will hear distinctly a quite low conversational voice.

But the first point is, what does one mean by a deaf or very deaf person; or how does one tabulate the degree of deafness? Well, in answer to this there are appliances sold for the purpose. Hughes' Electric Sonometer consists of two induction coils, one at each end of a rod of wood which is divided into millimetres; between these coils slides a primary coil, the whole being connected with a battery, rheotome, and telephone. When the sliding coil is at zero on the scale, the ticking of the rheotome is not heard in the telephone, but on approaching the sliding coil to one of the other coils, the ticking becomes louder and louder, and the distance from zero, at which the sound was first heard, is indicated in millimetres, which is the test of hearing by this instrument. A rather rough substitute will be found in a small sledge coil—the form of coil, that is to say, which provides for the secondary bobbin—sliding over the primary. This is a coil very easy to make. We also require a good telephone watch receiver. Two dry cells will be connected to the primary terminals of the coil and wires from the secondary terminals taken to the telephone receiver. On making contact, the hammer, or clapper, of the coil begins to vibrate, and the sound heard through the telephone is very weird and painfully loud when the secondary

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is fully over the primary. The instrument to be useful should be on a small scale, and it is desirable to know the amount of wire on the primary and secondary, and the amount of current used. If, also, we can make it so that with the secondary drawn out to a point when no sound is heard, we may put on the side of the apparatus a measured scale and pointer, and thus provide some reliable data from which to gather any variation in a case of deafness.

Many other instruments are made for the like purpose, but most persons determine these facts for themselves by means of their watches and clocks. A deaf person will estimate his disability by the ordinary and everyday incidents of modern life: the noise and rattle of the streets, the raucous

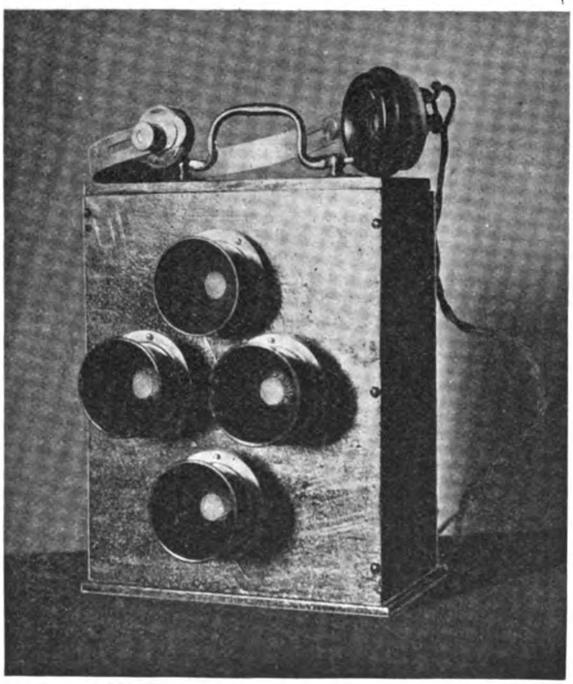

Fig. 1.—Showing an Instrument comprising Four Microphones.

voice of the newspaper boy, the click of the tram conductor's ticket punch, the office bell and telephone buzzer, and so on. It is painful and mysterious to find the city noiseless, people rushing here and there, and cabs passing, but not a sound. Church and chapel a dead stillness; he may hear the church bell, but very little of the organ, and of the latter only two or three predominant notes. If a cyclist —a steady one, let us hope—he may hear the toot of the motor car when too late to be of much service, and he is apt to wish another sense absent when that malodorous vehicle has passed in front of him. As a fact there is much in the way of sound and noise that will never be missed. The poetic and sentimental church bell in the distant village we can—after all—do without, and who wants to hear the pianoforte exercise next door, or the hawker in the streets. Our estimable vicar is not invariably interesting, but above all, the deaf person is never the victim of the "bore"!

On the other hand, we want to hear the voices of our family and friends; and our business necessities, fellow workers, and clients must be given a first place; and it is essential to simplify, by all the means possible, communications with those we have to meet and talk with. Hence the use of anything mechanical or electrical—if useful—becomes a duty.

Conversational sounds may be collected and heard most readily by the aid of a conversation tube. This is a tube, flexible and slightly tapering, about 4 ft. in length, having a bell-shaped mouthpiece at the wider end for the speaker and a narrow slightly curved ear-piece at the other. The natural tones of the voice are preserved and a conversation may be often carried on in whispers. A modification of this may be put up out of a tube and one of the horn collectors supplied with gramophones. A deaf person will hear a much greater range of sounds corresponding with the size of the collector. Various devices rigged up similarly follow the lines of the glass flower epergne; imagine a cluster of three or four elongated cone-shaped ear trumpets, with their ear-pieces jointed and connected to a rubber tube, which will terminate in an ear-piece. Such an instrument collects and transmits sounds from all round the table and enables a deaf person to hear general conversation.

In some cases two ear-pieces are better than one, and for such an arrangement the double ear-piece attached to the physician's stethoscope is a convenient appliance, but the tubes should be of slightly larger diameter.

The curved hand placed at the back of the ear acts as a reflector, and appliances are therefore made in ebonite or metal to act in place of the hand. Spherical, elliptical, and parabolic reflectors are made, the latter being a very efficient substitute for the hand. The instrument can be placed on or to clasp the ear, thus leaving the hands free. Ear trumpets or resonators are extremely useful, the best shape is, in the writer's opinion, that of a parabola. There is a big variety, and some are not only efficient, but very expensive instruments.

On page 16 of The Model Engineer handbook, "Telephones and Microphones," &c., there is figured a simple form of microphone which is useful in certain cases for transmitting sound, *e.g.*, the instrument placed upon a pianoforte, and in series with a small battery and telephone watch receiver, transmits, sometimes with faithfulness, the notes played. The writer uses in these trials, etc., a *pair* of receivers with spring and adjustable headpiece, as supplied by the National Telephone Co. In this same handbook (page 18) is described the Pantelephone, but with the pianoforte the hanging plate vibrates too much, and the musical notes become very jerky and discordant. Now, if a simple microphone like the one just referred to (three carbon pencils) be placed upon an empty cigar box and a small clock placed thereon, we may (and of course this refers to deaf persons) hear the ticking of the clock very distinctly through the telephone receiver; such a person will probably hear very well on any decent telephone service. It may be mentioned that, in fitting this "three pencil" microphone, the pointed piece should be

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carefully and evenly filed, with the corresponding holes reasonably accurate, and the points should not be touched with the fingers; a tight fit is not permissible, but it should not be absolutely loose either.

With a telephone circuit in the best condition and with instruments of the best, the person whose hearing is distinctly good will often hear the transmitting voice without putting his ear close to the receiver, and, oppositely, the person speaking may be by no means close to the transmitter and still be quite distinctly heard by the person at the other end. Appliances are made, *e.g.*, electrophones, carrying out this idea. A watch receiver is held to the ear and is in electrical contact with a small battery and a microphone of special design. The latter is carried on the person or placed on the desk or table, and collects and transmits the conversational voice of a person in greater or less proximity. The effectiveness of these cannot be doubted, but the persons to derive most benefit from their use must not be very deaf. By means of electrophones the theatre and music hall may be brought into one's private sitting-room, but in such cases there is very little advantage to the deaf.

It is comparatively easy to make trial of such apparatus, and the best way is to fit up at least four microphones (which may be purchased ready made) in an upright shallow box, which may also contain the battery and be provided with a switch for turning on or off the current. The photograph (Fig. 1) shows four microphones fitted, as described. They are connected in series, as shown in Fig. 2, and the battery consists

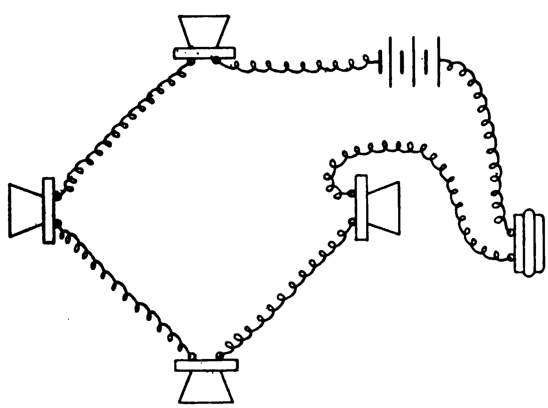

FIG. 2.—DIAGRAM SHOWING CONNECTIONS OF FOUR MICROPHONES.

of three of the flash-lamp combined cells so much in use, and so readily obtained. The three batteries are connected in series by soldering strips of wire from positive terminal to negative, &c., and are then tied together and placed in the box.

(*To be continued.*)

THE German army, says a contemporary, is to be supplied with paper kettles, a Japanese invention. Though made of pliable paper, they can be hung over a fire long enough to bring the water to a boil. One kettle can be used about eight times.

Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page 103.*)

THE examples previously given in these lessons have been taken from steam engine practice, not only because this affords suitable subjects, but also that it is in more general interest than most other branches of engineering. The following set of working drawings are introduced principally to show how the work should be arranged in detail for the shops and the character of the information required by the workmen.

Fig. 69 gives the elevation and plan of a horizontal self-contained engine, 9 ins. cylinder diameter, 12 ins. piston stroke, suitable for a steam pressure of 60 lbs. per sq. in. The bed is of the bored guide type, which makes a very efficient arrangement, substantial and cheaply manufactured.

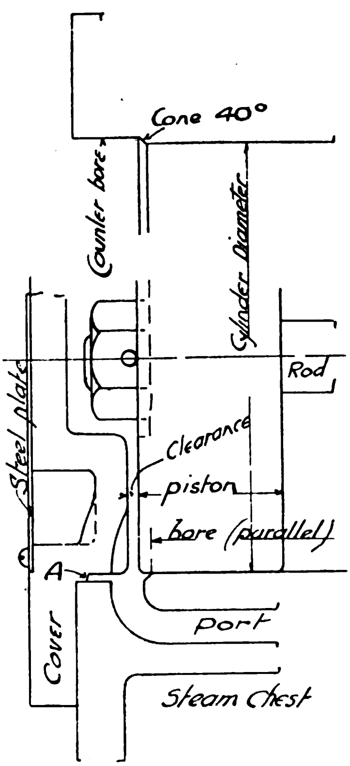

FIG. 70*a*.

The general arrangement is not suggested as an example for drawing, but is given here to show the type of engine we are to draw out in detail, and we must for the present assume that it only exists in our imagination, as it is not usual to begin on the general arrangement until most of the principal details are done. When these are carefully worked out the various parts are assembled (generally in outline only, as shown) to see that they fit each other properly and will come together

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conveniently, also that where the parts are in motion there will be sufficient room to clear each other.

The flywheel is not shown on the plan, but may be added if desired, and would be arranged to fit on either end of the crankshaft.

The first drawing to be commenced is usually the cylinder (Fig. 70). The views required are—longitudinal section through the cylinder and ports, showing the piston clearances, the stuffing-boxes, glands, etc. This view will decide for us how near the boss of the crosshead can come to the cylinder when the piston is at the "inner" end of its stroke, also the most suitable position for the valve spindle. The area of the steam ports are about one-sixteenth the area of the cylinder—a fair proportion for this type of engine. The usual shape of the port in cross-section is in the valve face rectangular, the width being about one-eighth to one-tenth the length. The travel of the valve is then kept within moderate limits.

The diagram shows the working of the valve, with the eccentric having an angular advance of 120 degs. This, with a travel of 1¾ ins. and a lap of ⅜ in., gives 1-16th-in. lead, the greatest amount of opening to the steam port being ½ in. The engine will run very satisfactorily with the valves so arranged; no smaller lap or lead should be given. In setting out the parallel part of the cylinder bore allow the piston to slightly overrun at each end to prevent as far as possible the formation of a shoulder.

If we give the piston a depth equal to one-third the cylinder diameter, say 3 ins., allowing ¼ in. overrun at each end, the length of the bore will be 12 ins. (stroke) + 3 ins. (piston) − (¼ in. × 2) = 14½ ins.

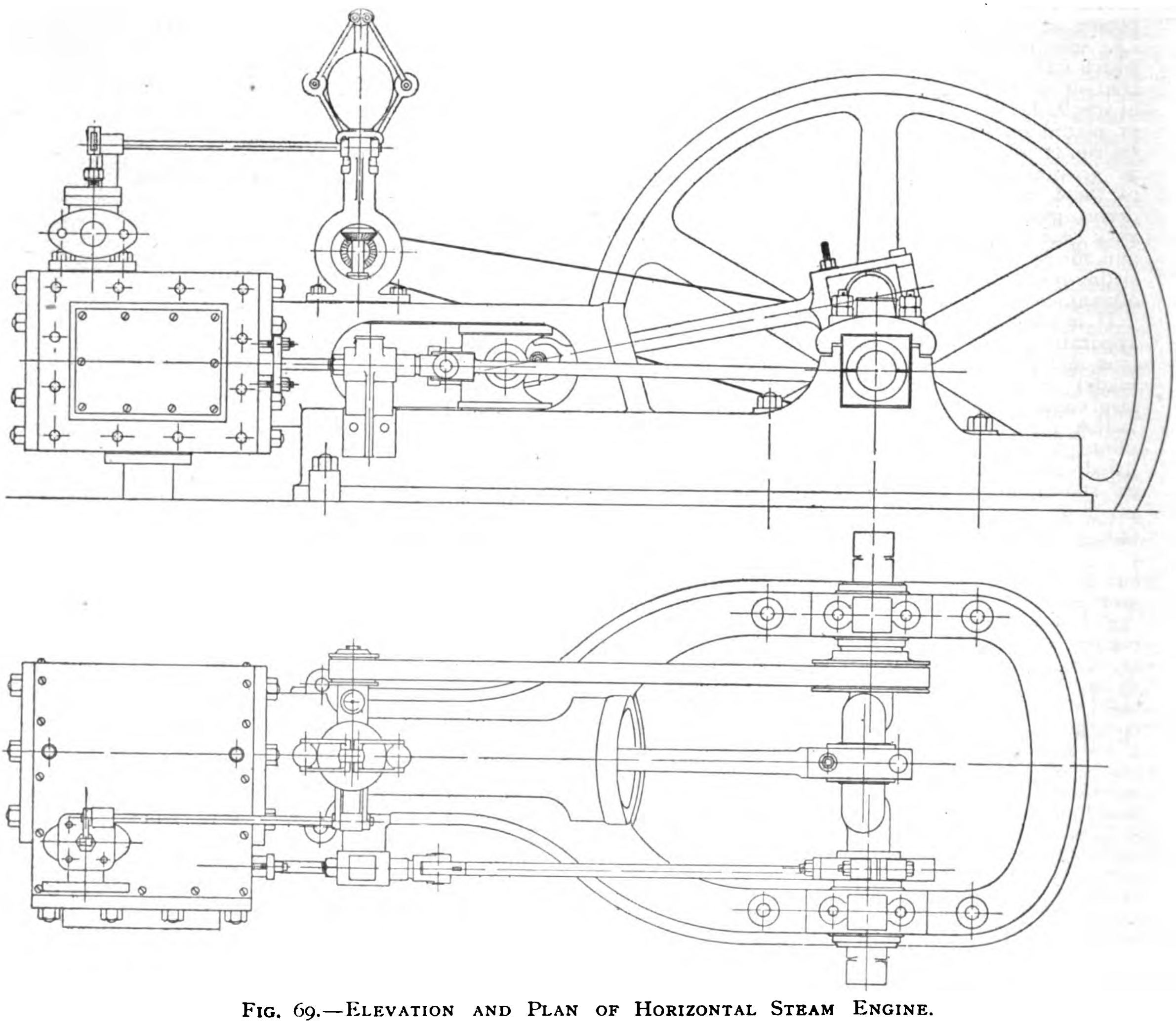

FIG. 69.—ELEVATION AND PLAN OF HORIZONTAL STEAM ENGINE.

BORE OF CYLINDER, 9 INS.; STROKE, 12 INS. (*Scale: One-sixteenth full size.*)

The detail drawing (see Fig. 70*a*) shows how the ends of the cylinder are counterbored to a diameter of 9¼ ins. This shows that the ports come beyond the ends of the parallel part so as to allow the taper all round; this should be about 35 degs. to 40 degs., and is a great help in getting the piston into place. The cover is arranged so that there is a clearance of from ⅛ in. to ⅜ in. between it and the piston. The cover has a small bead (as shown at A) turned to fit into the counterbore of the cylinder.

It will be noticed that the ports are actually 11-16ths in. wide, while the opening in the face is only ⅝ in. A strip is usually cast in, which is afterwards dressed to make the opening in the valve seat the required size.

The front cover is practically only a stuffing-box, and in this case is only cast separate from the cylinder to allow the boring to be more efficiently done. The cylinder being bored and faced at the same setting, all parts are concentric and the ends perfectly normal to the bore, its attachment in perfect alignment to a bed similarly bored and faced is a very simple matter.

In showing the position of bolts and studs, it is not necessary nor desirable to show this other than by a circle, the diameter of the bolt or stud giving the centres from the centre-line of the cylinder or from any *faced* surface, the showing of hexagon nuts, except in side elevation, not being generally done.

The cylinder should be drawn to a scale of half size and full dimensions given. The dimensions given on drawing are rather meagre, owing to the small scale. For the sake of convenience of projection, the views should be arranged as shown.

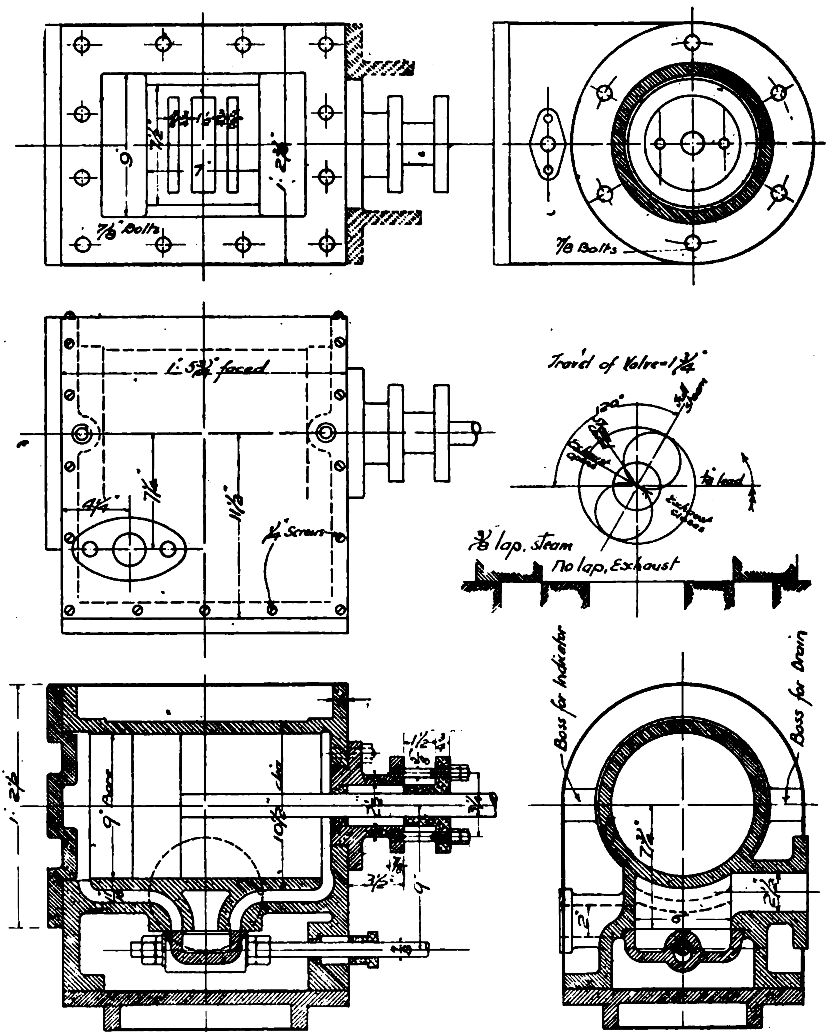

FIG. 70.—CYLINDER DETAILS.

(*To be continued.*)

A COMMON method of blueing small steel goods by dipping is to melt saltpetre in an iron pot; then immerse the previously polished and cleaned articles until sufficiently blued; remove and cool at once in paraffin oil, and afterwards dry out in sawdust.

The Society of Model Engineers.

London.

THE first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from Sept. 25th, 1907, to Oct. 31st, 1908. Full particulars and forms of application may be obtained from HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

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The Lavery Electric Phrenometer.

OF the many applications of electricity to the edification of mankind, probably one of the least expected, but certainly not the least interesting, is to be found in the Lavery Phrenometer, an appliance for measuring what are termed in common parlance a person's "bumps." The science of phrenology has its ardent supporters, as well as its captious critics; but it is not the purpose of the present article to discuss the *pros* and *cons* of the subject on its physiological side. We are rather concerned with the new appliance as a piece of mechanism, and, judged from this standpoint, Mr. Lavery's highly ingenious invention is worthy of careful study.

The accompanying photographs show very clearly the form which the appliance takes. It consists of two distinctive portions, the measuring device and the recording mechanism. The former consists of a double dome-shaped cap (Fig. 1), which fits over the head of the person whose bumps are to be measured. A section of this cap is shown in Fig. 2, from which it will be noted that a series of small sliding rods project at intervals round the interior so as to touch the surface of the subject's head. These rods, when the cap is once in position, adjust themselves automatically to the height of the particular bumps on which they rest, and according to the distance through which each rod is moved, so it completes one or other of five different electric circuits, through a series of contacts which can be seen in the drawing. These contacts are numbered from 1 to 5, and according to the contact which is reached by the sliding rod, so the degree of development of any particular bump is indicated. The number 3 is taken as representing normal development, while a reading lower or higher than this represents a corresponding lower or higher development.

FIG. 1.—THE LAVERY ELECTRIC PHRENOMETER.

The electric circuits thus completed by the contacts of the sliding rods are utilised to control the rotation of a circular recording drum, contained in the cabinet shown in Fig. 3. This recording drum carries round its periphery 140 separate delineations or records. The measuring apparatus measures twenty-eight different bumps or faculties, and as there are five different degrees of development allowed to each faculty, so the 140 different records are required. The records are cast in the form of permanent type on the surface of the drum, and from these lines of type the delineations for each particular person are automatically printed on a slip of paper cut from a continuous roll. The entire operation is quite a simple one. The subject

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places his head in the cap, the attendant starts the machine, and in less than half a minute a printed record of the subject's bumps is delivered.

The machine, which hails from the United States, is being introduced into this country by Mr. W. T. Lovell, Carlton House, Lower Regent Street, S.W.,

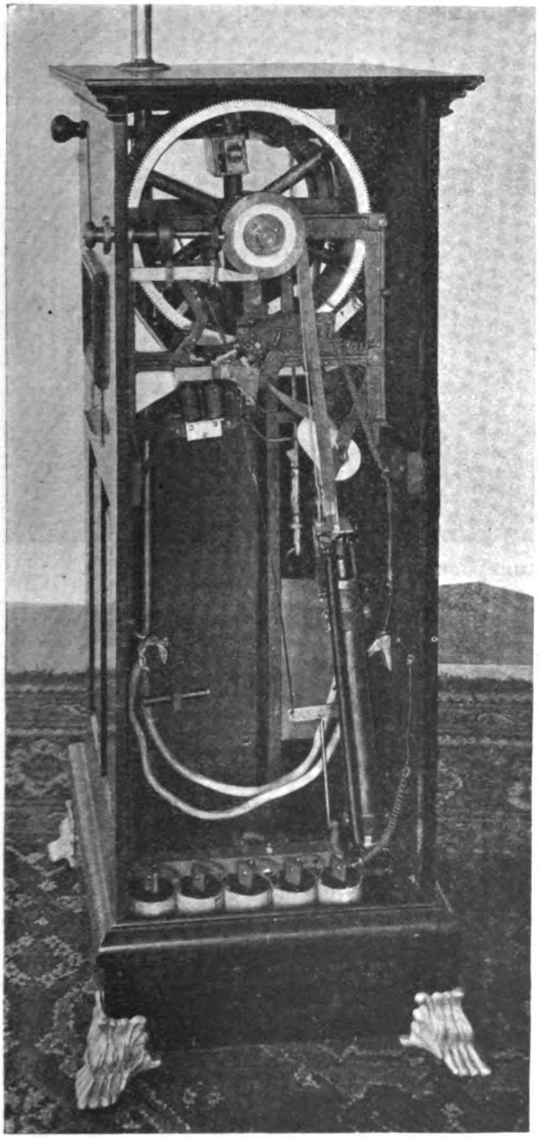

FIG. 3.—VIEW OF CABINET, WITH SIDE PANEL REMOVED.

and has already aroused a widespread interest. Our readers will be pleased to note that it will be shown in operation at the forthcoming MODEL ENGINEER exhibition, where they will have an opportunity of examining its clever mechanism, and of testing its abilities to delineate their strong points and—may we say it?—their weak ones.

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.]*

Railway Signalling.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I am very much surprised to learn that an American railway engineer has brought forward, presumably as something new, such an obsolete system of semaphore signalling as that

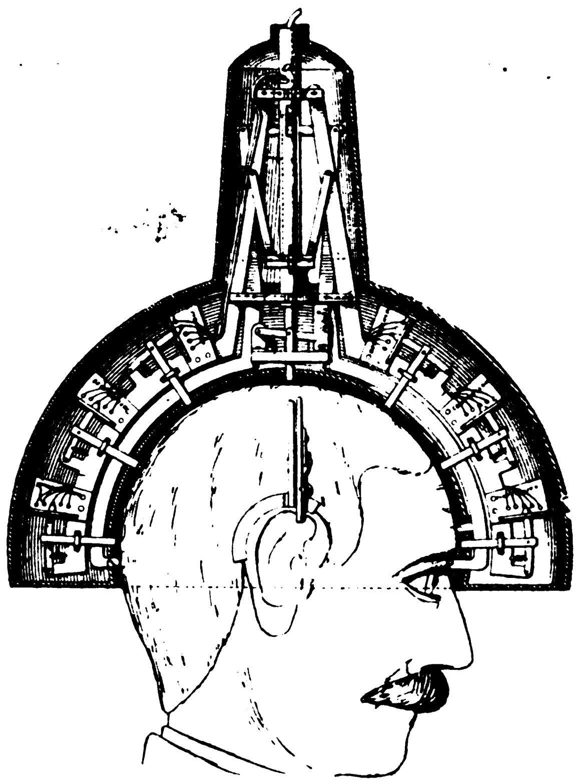

FIG. 2.—SECTION THROUGH MEASURING APPARATUS OF THE LAVERY PHRENOMETER.

described in "Latest in Engineering" notes in your issue of August 22nd, 1907.

The method of fixing the arms away from, and raising them so that they stand parallel with, post is very crude and quite unnecessary. The more usual method—adopted by English railways—of arranging for the arms to stand out at right angles for "line blocked" and at an angle of 45 degs. with post for "line clear" leaves nothing to be desired on the score of appearance, and, what is of much more importance, a clear signal to the driver.

Fixing one light over another on the same post was abandoned by English railways more than 20 years ago, owing to serious mistakes made by

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drivers. It is apparent that should one or more of the lights be out the driver would be misled; and even though all the lights are alight, it is very easy to mistake one for another. When there is more than one signal on a post applicable to more than one line, they should be placed side by side, so that they can be easily understood, and this is the rule on English railways.

Also the "caution" signal is quite unnecessary. The line is either clear or blocked to the next signal, and only two signals are necessary. A white light for "line clear" was abandoned by English railways owing to there being so many white lights to be seen, and the consequent confusion, also there is the possibility of the red spectacle glass being broken and a white light shown, which would probably lead to disaster.—Yours truly,

A. Green.

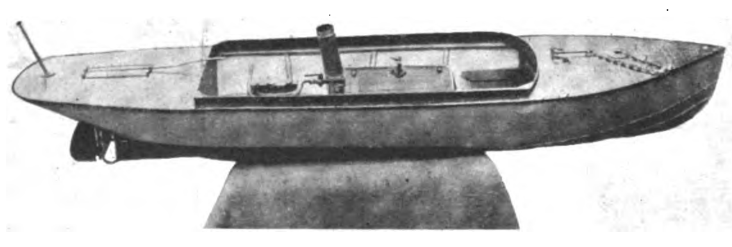
Leyton.

A Schoolboy's Model Steam Launch.

To the Editor of *The Model Engineer*.

Dear Sir,—I have enclosed two photographs of a steam launch, as I thought they might interest your readers.

The engine is compound (with cylinders made of brass tube, with flanges soldered on, ⅞ in. and 1¼ in. bore by 1 in. stroke), and has a feed pump (driven off L.P. crosshead by a rocking beam) of 9-64ths in. bore and ½ in. stroke. The crankshaft is built up and soldered together, and valve-chests are soldered on to sides of cylinders.

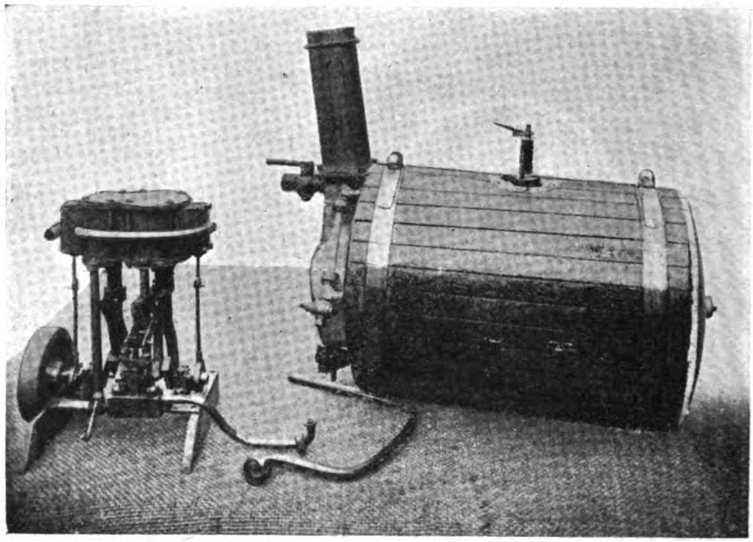


Mr. J. Anthony's Model Steam Launch.

The boiler has a return tube, but a furnace for half the distance and tubes for the rest was made of sheet copper and measured 5½ ins. diameter by 8½ ins. long, lagged with cedar, french polished, and fired by a blowlamp—not shown in photographs.

The boat is built of tin strips soldered together, and has a ball-bearing thrust to the propeller shaft and a clutch worked by a small lever. The whole of the turning was done on a 2½ in. centre ordinary lathe, and was made when at the age of fourteen.—Yours truly,

King's Lynn. J. Anthony.



Machinery of Model Steam Launch.

A Strange Occurrence.

To the Editor of *The Model Engineer*.

Dear Sir,—With reference to the "strange occurrence" noticed by "R. N." and published on August 15th in The Model Engineer. Your correspondent gives no particulars as to the rest of the circuit, but suppose there were motors, or anything with large electro-magnets, it will be easy to understand that a very high E.M.F. would be produced when the circuit is opened by the breaking of the filament—due to self-induction.

Having the necessary high voltage, the lamp would behave as a vacuum tube and exhibit all the phenomena mentioned. The change observed when polarity of lamp is reversed is due to the fact that it is at the negative pole that the discharge is given off. The four other lamps would not show any visible signs of current, since they are merely acting as conductors.—Yours truly,

E. C. H.

Iron, it is stated, may be coppered by dipping it into melted copper, the surface of which is protected by a melted layer of cryolite and phosphoric acid, the articles thus treated being heated to the same temperature as the melted copper.

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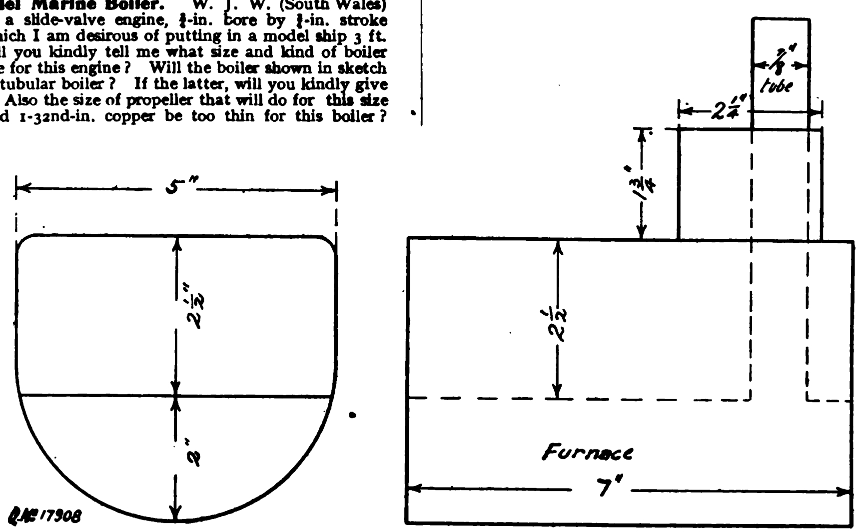
Queries and Replies.

[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:—

[17,908] **Model Marine Boiler.** W. J. W. (South Wales) writes: I have a slide-valve engine, ¾-in. bore by ¾-in. stroke (marine type) which I am desirous of putting in a model ship 3 ft. 6 ins. long. Will you kindly tell me what size and kind of boiler would be suitable for this engine? Will the boiler shown in sketch be suitable, or a tubular boiler? If the latter, will you kindly give a rough sketch. Also the size of propeller that will do for this size of vessel. Would 1-32nd-in. copper be too thin for this boiler?



A READER'S DESIGN FOR MODEL MARINE BOILER.

The type of boiler you have chosen is all right for low pressures, but we cannot recommend anything less than 3-64ths-in. copper for the plates. In addition, you must stay the boiler well, as recommended in our hand-book "Model Boiler Making," see Figs. 12 and 12A, page 40, of new edition (price 6d. net, 7d. post free) The water space might be 2½ ins. instead of 3 ins. (as we have altered your figures on the sketch), and the height of the furnace increased to 2 ins. Water-tubes might, of course, be added with advantage. The propeller may be 2¼ or 2½ ins. diameter by about 3½-in. pitch.

[17,985] **Telephony.** B. C. (Hellifield) writes: One of the questions given at this year's examination for the City and Guilds' Ordinary Grade certificate in telegraphy and telephony related to the construction of lines where iron poles had of necessity to be used. Will you kindly tell me how this kind of pole is placed in the ground, how stayed, etc., and how arms and insulators are attached? Are the arms of wood or iron? Kindly send me drawing of one of these poles carrying ten lines. I have three text-books on Telegraphy, but they contain no mention of this. I should also be very pleased if you would send me diagram with explanation of parts of the electrical apparatus used in railway block signalling—I mean the bell and needle system. Kindly give interlocking and other systems. Will you also please give me diagrams of microphone and ringing circuits, in the cases where Blake & Hunnings' transmitters are used. I have your book, "Telephones and Microphones," but should like the full connections of the circuits between two points, with each of these transmitters and ringing circuits complete.

You will find illustrations of iron poles, with methods of fixing them in the ground and fitting the arms in pages 294–298 of Preece and Sivewright's "Telegraphy," eighteenth edition, 1905. Another form of iron arm is illustrated in Poole's "Practical Telephone Handbook," on page 349. For diagrams of block signalling apparatus consult J. Pigg's "Block Signalling." There is no difference between the transmitter circuit of either of the transmitters mentioned by you, and the information you require is given in the latest edition of our Handbook, "Telephones and Microphones." To have supplied all the drawings you asked for would have completely filled our correspondence columns, and we think you will see on reflection that you are hardly reasonable in your demands.

[18,026] **Windings for 500-watt Manchester Type Dynamo.** P. A. McF. (Glasgow) writes: I would feel much obliged if you could tell me if the following amounts and sizes of wires are about correct for a 500-watt Manchester type dynamo: Armature, 4 ins. × 4 ins., plain drum, wound with single layer No. 13 S.W.G.; 108 conductors in all, divided into twelve sections. Fields wound with 11 lbs. No. 14 S.W.G., 5½ lbs. on each limb, connected in shunt; 2,400 r.p.m. Output—40 amps. at 10 volts; fields, 10 amps.; total amps., 50 × 10 volts—500. Am I correct in allowing 20 per cent. of total current generated in armature for fields? The machine is intended to supply current to a large electro-magnet, which has to attract an armature 200 times per minute. Shall I require a condenser for this; and if so, could you give me an idea what size I should require? Where can I obtain mica for insulation of commutator?

Without a dimensioned sketch of the dynamo we cannot say if your quantities of wire are likely to give the voltage required. The gauges are suitable to carry the currents mentioned, and the weight for field-magnet is a good proportion for a machine of this size. If you do not obtain 10 volts at 2,400 r.p.m., the speed can be raised to some extent. Should the dynamo fail to maintain its magnetism owing to the resistance of the electro-magnet winding, we advise you to try a series winding in addition to the shunt, say a single layer of No. 10 gauge D.C.C. copper wire on each limb over the shunt winding, the two layers to be connected in parallel with each other and in series with the armature. There are several methods of dealing with the spark—a condenser can be used, or a high resistance across the break, but the size must be determined by trial. Another method is to break circuit under a liquid such as oil. Another method is to wind the electro-magnet with two sets of coils, differential, that is, one set of coils opposes the other. Current is normally on to both coils, and, as they are in opposition, no magnetism is produced in the core. Upon breaking the circuit of either, the remaining coil at once produces magnetism; when the broken circuit is re-made, its action destroys the magnetism. There should be no spark at all with this method, and it would suit a shunt-wound dynamo provided the resistance of the two coils was not too low to prevent the machine exciting its field. Your electro-magnet will respond more readily to the charges of magnetism if its core is laminated or made of wires in the form of a bundle. A 500-watt dynamo of good design ought to work with 50 watts

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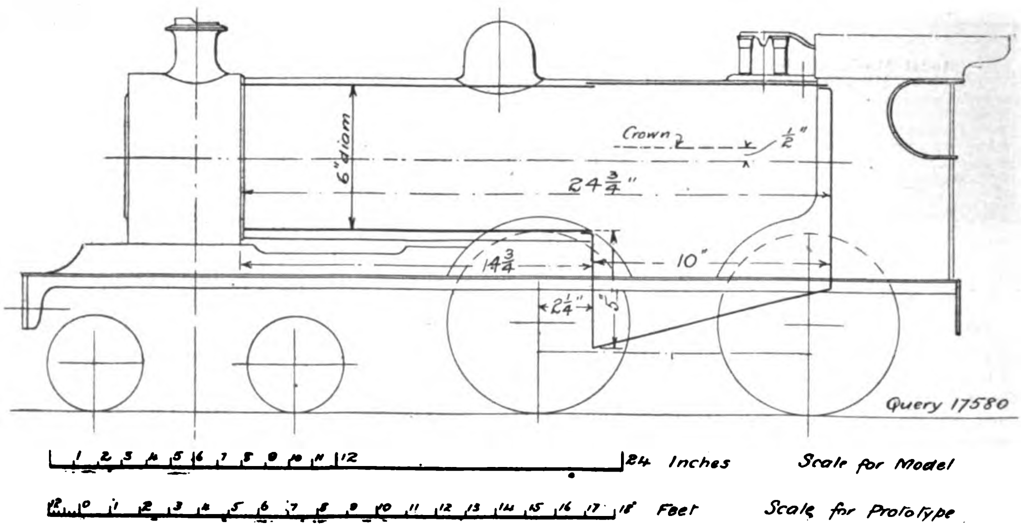
approximate excitation; under the circumstances, however, you are erring on the right side in allowing 10 amps. exciting current. For commutator mica, try Mr. Avery, Fulmen Works, Tunbridge Wells.

[17,580] **Boiler for Model Midland Locomotive.** L. S. (Ilkeston) writes: I should be very much obliged if you would assist me with a little information as regards a locomotive I am now building. It is a Midland type having four wheels coupled, 7½ ins. diameter, and cylinders are 1¾ ins. by 2 ins. (1) Would the following boiler dimensions be suitable for the above? Length. 24 ins.; diameter, 6 ins.; firebox, copper, 10 ins. by 8 ins. by 4½ ins., having about nine ⅝-in. tubes. (2) Would steel be more suitable than copper, as I want the working pressure 100 lbs.? Also what thickness should I require the plates and rivets? (3) Could you give me a little sketch to that size with particulars?

From what we can gather, the engine you are building will represent either a modern engine of Mr. Deeley's design or one of the re-builds. The general outline of the design illustrated herewith follows the latest class of 4—4—0 expresses. The scale, we presume, is 1½ ins. to the foot. (1) The dimensions of the most suitable boiler tally in almost every particular with that you propose. We should, however, employ a larger number of tubes of smaller diameter, say, 9-16ths or ½-in. You ought to be able to get in sixteen tubes ½ in. diameter quite easily. (2) A steel boiler of this size is very clumsy if allowances are made in the plate thickness for corrosion. We could not recommend less than ⅛ in. or 9-64ths in. steel plate; this would mean that ¼-in. rivets would have to be employed. If you can make a copper boiler, use a piece of 6-in. tube for the barrel. The thickness of the barrel tube may be 5-64ths in. This will give a factor of safety of 6 at 100 lbs. pressure; 3-32nds in. tube would, however, not be too thick, but if the barrel is riveted up not less than 3-32nds in. copper plate should be employed. This thickness should be used or the firebox wrapper and inside firebox plates, except tube plate, which should be ⅛ in. Screw the tubes into the tube plate, expanding them in at the smokebox end.



BOILER FOR MODEL MIDLAND LOCOMOTIVE.

[17,688] **Apprenticeship.** C. P. H. G. (Keighley) writes: For the last two years I have been serving my time as a premium apprentice at a small electrical engineering shop, and during that time have been through the winding, testing, starter, and switch-making departments. I have only another eighteen months to serve, and as yet I have done no iron or brass turning, neither have I worked in the drawing office. (1) Would you please advise me as to how long I ought to be in the drawing office? I might mention that I have attended evening classes in machine drawing for the last two winters, and have passed first class in the South Kensington (Stage I) examination. (2) Which should I give most time to, iron or brass turning? (3) What position would you advise me to try for when I have finished my apprenticeship?

(1) We should recommend you to obtain permission to work at the turning for at least a few months, and also to make inquiries as regards getting some time in the drawing office. It is often arranged that the last year of a four years' apprenticeship is spent in the drawing office; but this is a matter to be arranged with the firm you are serving. After you have got a good all-round knowledge of the work the firm does you should specialise in some particular direction if there is scope for this. Perhaps the firm would be glad to keep you on when you are out of your time, and put you in a more responsible position. Much depends on the particular circumstances of your case of which we have no particulars. But if you are in any special difficulty, we should be glad to advise you further if you send us details. Recent query replies on this subject may possibly assist you.

[18,015] **Wiring for 4-pole Dynamo.** W. H. H. (Broken Hill, Australia) writes: I am building the 4-pole dynamo the diagrams of which were given some time ago. As I am constantly on the move from one city to another, I find a difficulty in obtaining my MODEL ENGINEER regularly. I would be greatly obliged if you could let me have the wiring for same, as I am unable to obtain the missing copies. I have the drawings for it, but not the wiring. The questions I would like answered are: (1) What amount and what gauge on armature? (2) What amount and what gauge on field?—the 750-watt direct-coupled engine and dynamo. Please give diameter of wire (bare), also in millimetres, as I have a micrometer and will be able to check wire in event of mistakes.

(1) Armature winding, No. 18 B.W.G. D.S.C. copper wire, fifteen turns in each coil, two coils per slot, making thirty turns per slot; about 4 lbs. is required. (2) The shunt winding is to be 810 turns of No. 22 gauge B.W.G. s.c.c. copper wire per pole—about 9½ lbs. total for the machine. The series winding to be twenty-four turns of No. 13 B.W.G. s.c.c. copper wire per pole; about 4 lbs. total will be required for the machine. The authors state that the machine will not be self-regulating, that is, the volts will not automatically keep constant with this winding, and give alternative field-magnet winding as follows: No. 24 B.W.G. for the shunt winding and thirty-six turns per pole of No. 13 B.W.G. for the series winding. In each case the coils of each winding are to be all joined in series with one another. The windings are for an output of 50 volts 15 amps. Diameters of wires: No. 18, ·049 in., 1·245 mm.; No. 22, ·028 in., ·7112 mm.; No. 24, ·022 in., ·558 mm.; No. 13, ·095 in., 2·413 mm.

[18,017] **Small Voltmeters.** W. M. G. (Glasgow) writes: Recently I purchased a watch voltmeter, and on opening the back found a small notice, "Avoir soin de s'abattre le couvert sur le boîtier, une fois le fil sorti, pour effectuer une mesure." This I take to mean that the lid at the back must be shut before a correct measurement can be taken. Why is this? Then there is no groove for the connecting wire from inside to be carried through, so that the lid cannot be shut. Would I be warranted in filing a small groove? The effect of the lid being shut while using the meter is to make the index pointer rise to a higher value.

The directions appear to mean that you should be careful to pull down the lid or cover of the case when making a measurement. Presumably, the lid produces some effect upon the needle movement; perhaps the instrument has been calibrated with the lid wide open, or perhaps it presses against a control spring, which locks the needle when lid is closed. If it was intended that the

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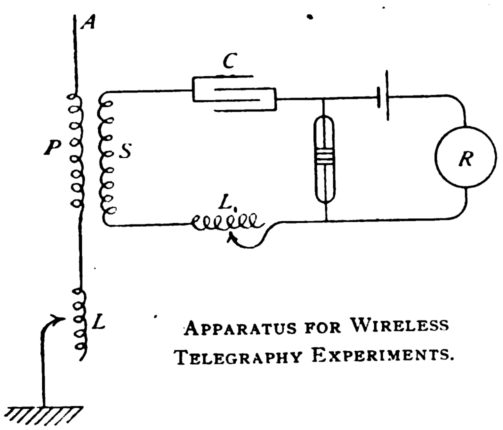
lid should be shut, some provision would surely have been made for the connecting wire to pass. A translation of the directions, however, indicates that the lid should be wide open.

[17,913] **Wireless Telegraphy Apparatus.** I. W. P. (Nottingham) writes: A friend has fitted up a wireless telegraphy set, with the object of signalling half-a-mile at least, and if possible a mile. The coil gives a 2-in. spark with ordinary break, and 3-in. to 4-in. with mercury break. The transmitter has one 2½-in. ball between two 1¼ ins. diameter Receiver has filings, tube, coherer, and 1,000-ohm relay. The apparatus answers perfectly over a distance of about 40 yards, but not over a distance of half-a-mile. An aerial wire ending in a network of copper wire, about 3 ft. × 1½ ft., is mounted on a pole 35 ft. high at sending and receiving stations, and one terminal of spark gap connected to earth by means of a wire to water tap. When the earth wire is connected, the coil will not spark unless the balls are moved very near together, about 1-16th in. Can you explain this? Also about the tuning. I have your book by Howgrave-Graham and Bottone's. Neither explain exactly what is to be done to put transmitter and receiver in tune.

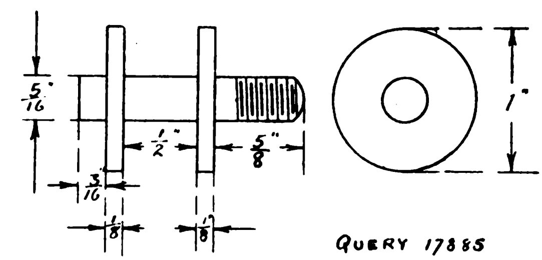
The dimensions of the spark-balls do not greatly affect the efficiency of the transmitter, and we doubt whether anything is gained by the use of three balls instead of two. We think that the explanations given in Mr. Howgrave-Graham's book should give sufficient indication of the possible reasons for the shortness of the spark which you obtain. On page 58 it is clearly shown how the length of the spark at the gap depends on the amount of energy delivered by the coil secondary and on the capacity of the aerial; a sufficiently large aerial would easily reduce a 2-in. spark to 1-16th in., especially if the spark of the coil by itself is thin and only represents a transfer of a small quantity of energy. However, as your aerial is not large it is more probable that it is insufficiently insulated from earth, or that the spark-coil secondary is insufficiently insulated from the primary. If the latter, the spark will be reduced on earthing the one ball, whether or not the other ball is connected with the aerial. If the trouble is due to badly insulated aerial, the spark will be feeble in colour and sound. If the spark-length is simply reduced by the normal capacity-effect of the aerial the spark will be bright blue and somewhat noisy. On page 22 of Mr. Howgrave-Graham's book reasons are given for the avoidance of any descriptions of tuning apparatus. Unless you have a current-operated detector of the Fessenden type, you will



APPARATUS FOR WIRELESS TELEGRAPHY EXPERIMENTS.

have to introduce an oscillation transformer primary P between the receiving aerial and earth, connecting the secondary S through a condenser C to the coherer. An inductance coil L must be placed in series with the primary P and adjusted until the aerial and P and L are together in tune with transmitter; the condenser and S and a second variable induction L, must also be made of suitable dimensions, and must be tuned like the primary. We have no dimensions or particulars available, and the adjustments required are somewhat complex, and require time, patience, and some considerable skill. If you wish to tune, it would be better to use a current-operated detector with a simple variable impedance coil between it and earth. If your transmitting apparatus is in order, you should be able to signal over a mile. Probably your receiver is not sufficiently sensitive. We do not recommend the filings-tube type.

[17,885] **Windings for Telegraph Instruments.** P. R. T. (Kenilworth) writes: Enclosed please find dimensioned sketch of single magnet bobbin, turned from solid soft iron bar. Will you kindly answer the following question? I am making up two sets of post office pattern telegraph instruments (lever-key and sounder), and wish to utilise these bobbins. The base is drilled and magnets placed either side the sounding lever, being connected together by a piece of soft iron strip. I have wound two of the bobbins with No. 24 gauge s.s.c. wire, and same work well with a four-volt accumulator, but refuse to do so with four Daniell cells. I should



SINGLE MAGNET BOBBIN FOR P.O. TELEGRAPH INSTRUMENTS.

be very glad if you would give me the exact quantity and gauge of wire with which to wind them. I have tested the current taken by these coils from a four-volt accumulator, and it is, roughly, 3 amps.

Your bobbins should each be wound to 10 ohms with 0·0136 silk-covered wire. This will require 120 yards.

[17,989] **Four-pole Motor Windings.** A. H. M. (Erith) writes: Please will you kindly answer the following questions: (1) I have a four-pole motor, as described in THE MODEL ENGINEER Handbook, "Small Electric Motors"; it is the smallest size (A), with armature 1½ ins. diameter by ¾ in., eight-slot drum. What size and quantity of wire shall I require to wind motor for 100 volts, to be connected in series? (2) I have a No. 2 Avery dynamo (60-watt), armature twelve-slot drum. I want to know size and quantity of wire to shunt-wind for 100 volts? How many turns per slot of armature? (3) Is it possible to wave wind an armature for four-pole field with even number of slots?

(1) This motor is too small for use with so high a pressure as 100 volts. If you care to try it, wind the armature with No. 40 gauge s.s.c. copper wire and field-magnet with No. 32 s.c.c. copper wire, connected in series; get on as much wire as you can; for method of winding armature, see Handbook No. 10, page 36, diagram 49. The best way to use this motor with a 100-volt circuit would be to run it through a 100-volt lamp as a resistance, winding the armature with No. 30 gauge s.s.c. copper wire and field-magnet with No. 24 gauge s.c.c. copper wire as a series winding. (2) Armature, No. 34 s.s.c. copper wire; get on as much as you can; probably about 6 ozs. will be required. Field-magnet, No. 34 gauge s.c.c. copper wire; about 2 lbs. should be the weight, but we cannot say exactly, as you do not send sketch of machine. (3) It may be possible, but an odd number is generally necessary. You could leave one slot out as a dummy. The number of indicators, that is, wire or groups of wire, in each slot, must equal the number of magnet poles by any odd number + or − 2.

[18,025A] **Table of Steam Pressures and Volumes.** N. G. writes: Boyle's law says that the volume of a given amount of gas is inversely proportional to the pressure. The table of volumes of Saturated Steam at various pressures in THE MODEL ENGINEER, May 3rd, 1906, does not seem to correspond at all with Boyle's law. I shall be much obliged if you will explain this to me

In dealing with the steam pressures and volumes, the fact that steam is not a perfect gas must not be forgotten. In addition, Boyle's law (P V = C) is true only when the temperature of the gas being dealt with remains quite constant and does not vary. This circumstance is not obtained in a steam boiler, and as the pressure rises the temperature rises also. P × V = C is, therefore, not exactly true. The tables of pressures given in the issues of May 3rd, 1906, and January 1st, 1902, are *gauge* pressures, or pressures above the atmosphere. Calculations under Boyle's law must be made with *absolute* pressures, which can be obtained by adding 15 lbs. (14·7 lbs., to be more accurate) to the *gauge* pressures. Adding 15 lbs. to the pressures given in the table, and considering also that Boyle's law is only correct when the temperatures are constant, you will find that there is not much for a model engineer to bother about in the tables given in the issues mentioned. For instance, at 10 lbs. gauge pressure, or, to deal with the problem in round figures, the absolute pressure of 10 + 15 lbs. = 25 lbs. pressure, the volume given is 1,000 cubic ins. Now at three times this pressure 25 × 3 = 75 lbs. pressure absolute, which is, of course, 75 − 15 = 60 lbs. *gauge* pressure, the volume which, according to Boyle's law, should vary inversely as the pressure—ought to be one-third of 1,000 cubic ins., viz., 1,000 ÷ 3 = 333 cubic ins. The table gives it as 355 cubic ins., which we submit is near enough for all practical purposes when we consider that steam is not a perfect gas, that we have neglected the temperature rise, and that round figures only have been employed.

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The Editor's Page.

WE have been pleased to hear from a number of readers in the Provinces that they intend to make a special journey to London to visit THE MODEL ENGINEER Exhibition. We have been in correspondence with the various railway companies with regard to excursion tickets, and have particulars of a number of special trips which will be run during that week of which our readers can take advantage. We shall publish particulars of these in an early issue. One of our correspondents, in expressing his intention of coming up to the Exhibition, suggests that the occasion will form an excellent opportunity for readers making the acquaintance of contributors and other fellow readers, who may be known to them by name but not personally. He adds that some sort of a reception or meeting room at the Exhibition where model engineers could meet might facilitate the gathering together of kindred spirits, to their mutual pleasure and advantage. The idea seems a good one, and providing space permits, we will endeavour to carry it into effect.

* * *

A pleasing indication of the way interest in model making is taking root in the Colonies is the news that a Society of Model Engineers has just been established in Cape Town. The entrance-fee is 2s. 6d., and the annual subscription is 7s. 6d. We hear that the Society has started under very favourable conditions, and that quite a number of enthusiastic members have already been enrolled. The Secretary, Mr. S. E. Anderson, Chester House, Rondebosch, Cape Town, is himself an amateur mechanic of considerable ability, and has contributed some interesting matter more than once to our pages. He will be pleased to hear from any readers in the Colony who would like to join, and would also be glad to receive from manufacturers at home catalogues of models, castings, electrical apparatus, tools, and materials, for the information of the members.

* * *

We are informed that the governing body of Battersea Polytechnic have appointed Mr. Sidney G. Rawson, D.Sc. (Lond.), F.I.C., Assc. Univ. Coll. (Liverpool), as principal. The appointment is in consequence of the resignation of Mr. Sidney H. Wells, who has been principal of the Polytechnic since its foundation in 1893, upon his acceptance of the position of Director-General of the Department of Agriculture and Technical Education for Egypt. Dr. Rawson is at present Director of Education for Worcester, a position he has held for 3½ years. Prior to this, he was principal of the Technical College, Huddersfield, for eight years.

Answers to Correspondents.

L. P. (Hither Green, S.E.)—The particular information you require is given in THE MODEL ENGINEER Table of Screw and Wire Gauges, price 3d. post free from our publishing department.

E. J. O. (Chatham).—We do not think the paper ebonite discs would be a success. However, you could try the experiment. We do not quite follow your plan of making holes in glass plates, A fuller explanation would be welcome.

B. W. (Ohio).—Outsiders can sit for most of the examinations held in England, and you could make arrangements a few weeks before you wished to sit. Certain forms have to be filled in, etc. If you require further details, write to the Secretary, City and Guilds of London Institute, Gresham College, London, E.C.

F. K. (Rhodesia).—We have an article in hand on the matter you write about which will be published very 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, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

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

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THE

Model Engineer

And Electrician.

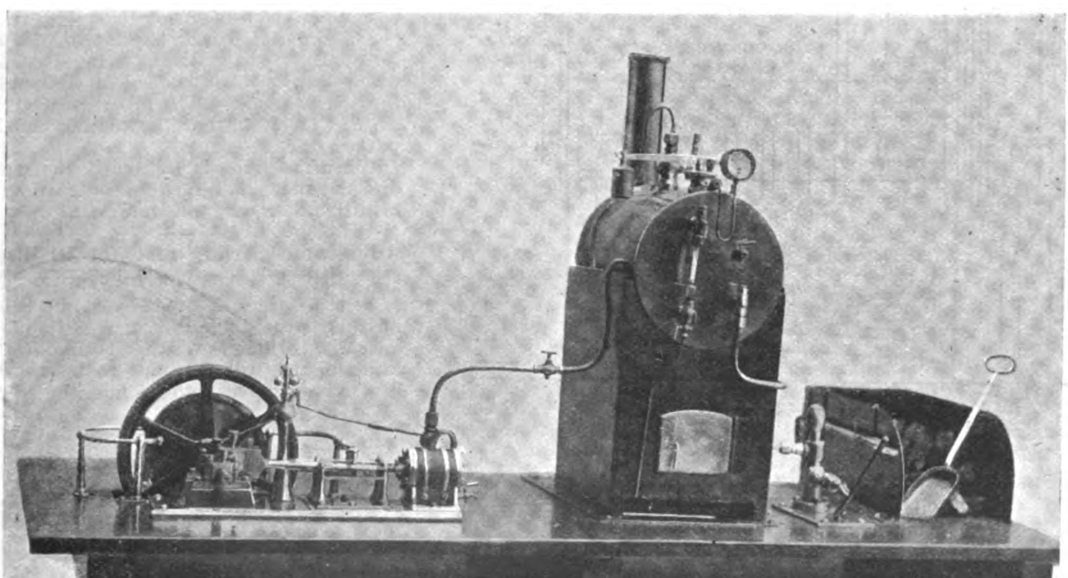
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 334. SEPTEMBER 19, 1907. PUBLISHED WEEKLY

An Amateur's Model Steam Plant.

By F. HABBISHAW.



MR. F. HABBISHAW'S MODEL STEAM PLANT.

THE following is a description of my engine and boiler. The cylinder is ¾-in. bore and 1-in. stroke, and is made of gun-metal; it is fitted with two rings and is lagged with mahogany with two brass bands round. The guide bars are mild steel, as are also crosshead slide blocks and pin. The connecting-rod is mild steel fitted with split brasses, steel strap, gib and cotter. The crank-shaft was made from a solid piece of mild steel and is 5-16ths in. diameter, and runs in three bearings of mild steel fitted with adjustable brasses, two bearings being close to the crank webs. The eccentric sheaf is also mild steel with brass straps and silver steel rod. The flywheel is 5½ ins. diameter and ⅝ in. wide; the driving wheel is steel. They are keyed on the shaft, the third bearing being outside the driving wheel. The governors are brass throughout. Bevelled wheels were turned out of ⅜-in. brass rod marked with a milling tool and the teeth filed out. The brass balls are ¼ in. diameter. The wheels are completely cased in and run in oil. All wearing parts are fitted with brass oil cups with lids turned from ¼-in. brass rod. The throttle valve is connected to the governors with levers and connecting-rod 1-16th in. diameter, and is fitted with adjusting nut. The bedplate is 9 ins.

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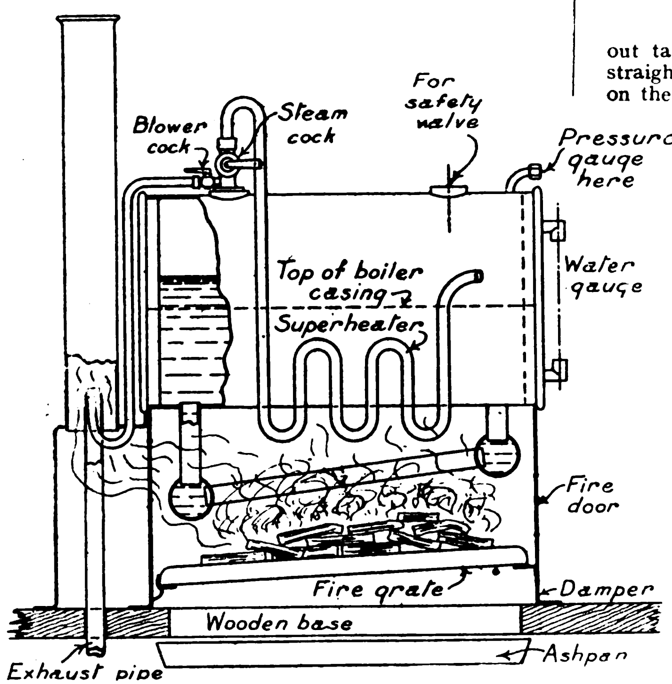
long and 2½ ins. wide and is brass. Hexagon steel nuts and bolts are used for all parts. The boiler is made of solid drawn copper tube 4½ ins. diameter and 8 ins. long with gun-metal ends which were bored a good fit for the tube and contracted on the end of tube, being tight up to the face. Each end is fastened on with twelve 3-16ths-in. studs, which were screwed tight in and filed flush. It is of the water-tube type, having a row of five tubes, as shown in sketch. It is fitted with a steam blower, which is also shown in sketch. All the fittings on the boiler were made by me with the exception of the steam gauge. It is fired with charcoal, with which I can make plenty of steam to keep the engine going at a fairly good rate, gaining more steam with the blower on. I have had 30 lbs. pressure on. The pump is fitted with ball valves, which work



SKETCH SHOWING ARRANGEMENT OF MR. F. HABBISHAW'S MODEL BOILER.

splendidly, water being drawn through tube under the base. The exhaust is carried up the chimney in the same manner. The fire irons are made of steel. The coal bunker is sheet iron. The board is mahogany polished.

A CONTEMPORARY gives some interesting figures obtained in a census of the motor-cars of the United Kingdom. The total number of motor vehicles of all kinds, including cycles, which are licensed in the United Kingdom, is 119,618, of which 61,617 are pleasure cars, 4,124 are commercial and heavy motors, and 53,877 are motor cycles. These figures show that nearly 16,000 more pleasure cars were registered in 1907 than in 1906. There are altogether 205,606 driving licenses in operation.

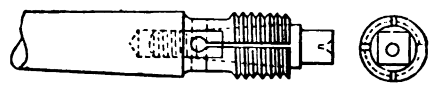
Workshop Notes and Notions.

[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 Mandrel for Facing Nuts.

By F. C. S. STUDENT.

The shank of this mandrel is turned taper to fit the lathe spindle; then a hole is drilled, and turned



MANDREL FOR FACING NUTS.

out taper, the bottom part of the hole being left straight and tapped out. Then the thread is cut on the outside to fit the nut.

At back of the thread, two holes are drilled crosswise and slots cut into the holes. The screw is turned to fit the taper hole, and the end is squared to apply a wrench. The end of the screw may be centred and hardened so that the tailstock centre may be brought up to support it.

This kind of mandrel can also be used for turning small castings having a reamed hole. In that case, instead of the thread on the outside, the end is turned to fit the hole, so that the casting can be pushed on.

When the screw is tightened, the mandrel expands, and the nut or casting is held tight.—*American Machinist.*

Adjustable Steady-rest for Drilling.

By T. GOLDSWORTHY-CRUMP.

At some time or other every mechanic has experienced the difficulty and annoyance when drilling, or rather boring, in the lathe, of the drill declining to follow the centre-punched or other guide, the result

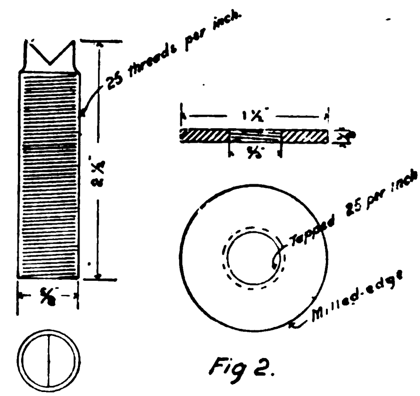


Fig 1. *Fig 2.*

being either an eccentric hole, with probably a broken drill, or otherwise loss of labour in correcting the error by "drawing" at its initial stage.

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The little fitment shown in Figs. 1, 2, and 3 has overcome all chance of mistake in this respect—presuming, of course, that the drills are properly ground.

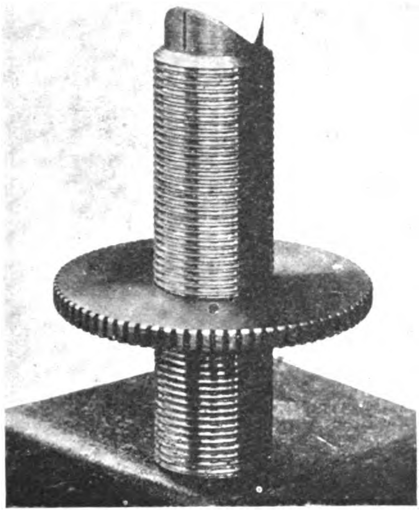


Fig. 3.—Adjustable Steady for Drilling, Etc.

The part shown in Fig. 1 should be a sliding fit in the socket of the hand-rest (the dimensions shown are for Drummond's 3½-in. lathe), and may be made of brass and threaded twenty-five per inch, the top being filed to the shape shown. Fig. 2 is a brass disc turned, bored, and threaded twenty-five per inch to fit Fig. 1, and should be deeply milled on the edge.

The work having been centred and the drill selected, the back poppet is brought up so that the drill is supported as shown in Fig. 4. The fitment is slipped into the socket of the hand-rest and brought under end of drill close to the work, and is then carefully adjusted for height by means of the threaded disc, care being taken to see that the centre of support is in alignment with centres of lathe. This being satisfactory, the nuts holding steady and hand-rest can be tightened and the work proceeded with, the drill being held down firmly in the V with every confidence of a true hole.

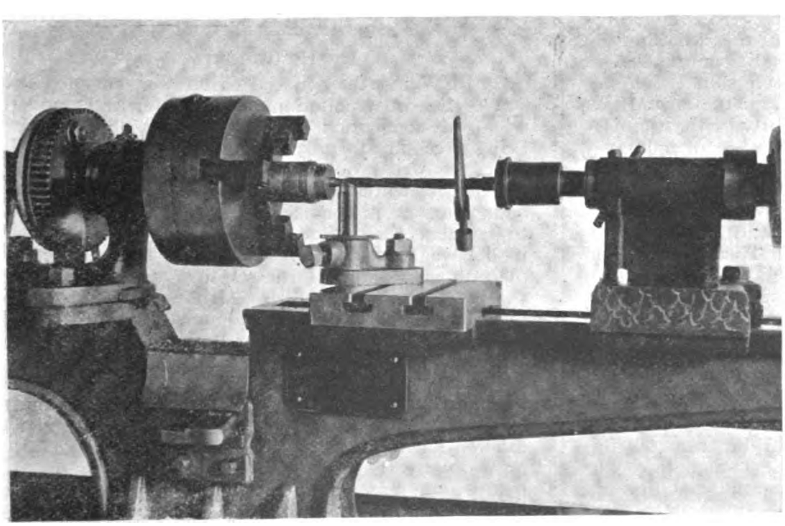
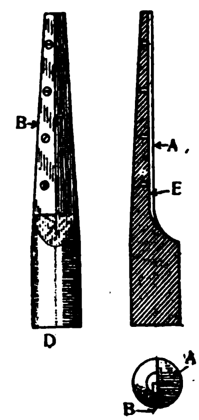


Fig. 4.—Showing Support in Use.

A Taper Reamer for Roughing Out Holes.

The drawing herewith reproduced shows a first-class reamer for roughing out all kinds of tapered holes for valves and pet cocks. The shank and



A Taper Reamer.

cutter holder D is turned from tool steel to within 1-32nd in. of the size wanted, then milled as shown at A. A second cut is taken on the milling machine as shown at E, leaving a recess to take the cutter blade B. The screwholes in blade should be a little large to allow adjustment for wear, which can be taken up with strips of paper inserted behind it. The holder and blade must be hardened and ground to size.

The Board of Trade is shortly to prepare a return of the total number of persons injured by the "live rail" on railways in the years 1904, 1905, 1906, and the first eight months of 1907, defining in the return the number of fatal accidents and on what railway they took place.

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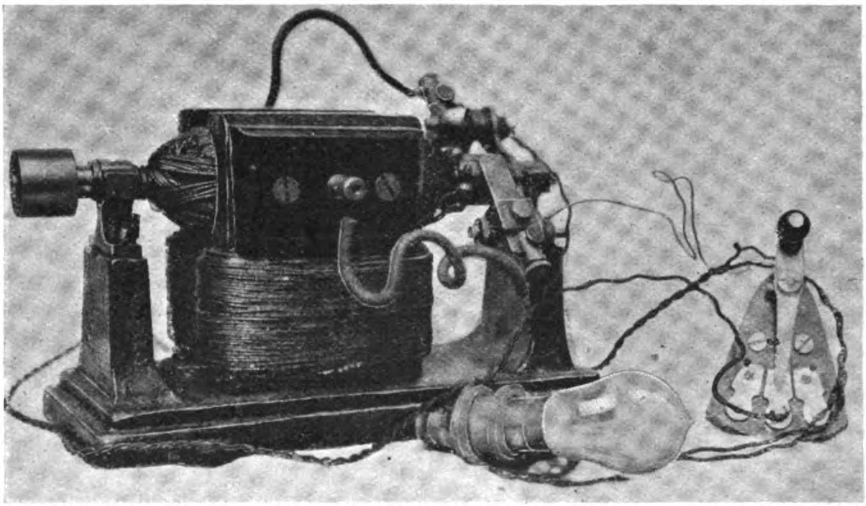
A Small Overtype Dynamo.

By P. J. Mullen.

THE illustration herewith is of a small Kapp type dynamo I have constructed from castings bought. My first job was the armature. At this point I met with my first disaster, for the bindings round the armature conductors did not prove sufficiently strong to withstand centrifugal force, with the result that the wires flew out, got hopelessly mutilated, and jammed the armature in the tunnel. I rewound the top sections of conductors and magnetised the fields by joining up through a lamp resistance to lighting mains, and



A Small Overtype Dynamo, Constructed by Mr. P. J. Mullen.

As the hole in the stampings is much larger than the diameter of the shaft, a core of hardwood was driven on, afterwards the stampings, which are 2 ins. diameter, and have eight slots, and then backed up at each end by a hardwood disc slotted same as laminations. The commutator, which is an eight-section one, made in the ordinary manner from brass tube, with hardwood core, each bar being secured by two screws along with connecting screw, was now driven on, and the winding of armature done; there are forty-eight conductors of No. 22 gauge copper wire in each slot. I next aligned the bearings by wrapping the armature with paper so as to fit rather tightly in the tunnel, then slipped on bearings, marked holes for holding-down bolts, and got the boring and tapping done. The winding of the magnets, although entailing no very great amount of skill, was a very tedious job, as the carcase is all in one piece, and I had to put on about 450 turns on each limb. The trouble with this form of magnet is well repaid, as one has not to bother about magnetic resistance due to badly-fitting joints. The brush gear presented no special difficulty. The brushes are copper gauze stiffened by a strip of light brass on top to get the necessary pressure on the commutator, and secured to adjustable brush rocker in the usual way. On assembling the parts, and connecting up in shunt, I tried to magnetise the magnets with four bichromates in series, but could not get machine to generate. I think this must have been due to the inability of the residual magnetism left by this small magnetising current to bridge the slightly excessive air-gap. on the next trial the machine lit a 20-volt lamp very brightly. It gives about 5 amps at 20 volts, and also runs very well as a motor.

An Electrical Differential for Model Motor-cars.

By H. Greenly.

A FEW months ago the writer was engaged in the construction of an experimental model in connection with road traction, and it being necessary to provide some form of differential gear, the writer devised a means of accomplishing the object electrically without the use of additional spur gears or pinions over those actually required to connect the motor to the road wheels. The model was electrically driven from a set of cells placed near the model, the "leads" trailing behind the model as it travelled. Although the arrangement is not perhaps new, it may be new to some readers of The Model Engineer, and where any such readers are prospective builders of electrically propelled models of road vehicles, it may save them the trouble of cutting very small gear wheels and pinions, as would be required if the orthodox differential were fitted. In the case in point it proved perfectly efficient, and I think not only saved money, but gave a more reliable job than would have been obtained if the usual type of differential gear-box had been modelled.

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The problem was a commonplace one. It was proposed to employ only one electro-motor, both for cheapness and simplicity's sake, more especially as it was desirable that the motor might be readily removed from the frame of the vehicle. The armature shaft *had* to be placed longitudinally with the centre line of the vehicle, and it was at first proposed that it should drive a countershaft through a differential-box, this countershaft having pinion working into gear wheels fixed to the road wheels, as indicated in Fig. 1.

As most readers know, the function of the differential is to provide a method of equally distributing the power over the two wheels and at the same time to allow of one wheel to travel faster (or slower) than the other, according to the path traversed by the vehicle. In turning a corner, therefore, it should be possible for one wheel to be standing still and the other moving rapidly over the surface of the ground.

This was done in the model by the use of a motor with one field-magnet coil and two armatures, as shown in Fig. 2. The centres of the armature spindle were set out so that the pinions in the ends engaged directly on to the gears fixed on to the road wheels. This rendered any countershaft unnecessary. The motor was made specially by Messrs. T. W. Thompson & Co., Greenwich, and although one or two electrical friends averred that the device would not work, when the motor came home it was found to fulfil its purpose admirably. The fields were connected in shunt and the two armatures placed in series, the latter being connected so that they both ran in opposite directions, in forward and reverse gear. The four wires were bound up into a single flexible cord and led to the

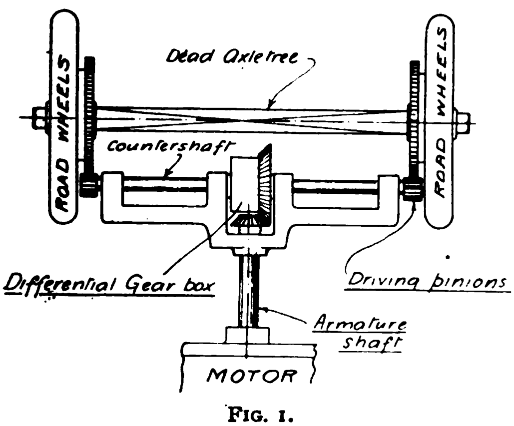

FIG. 1.

switchboard, the armature current being intercepted by a reversing switch. The fields were therefore excited by a constant current, but there seems to be no reason why the arrangement should not have worked if it had been wired up with the field coil in series with the armatures.

On trying the motor out of the machine it was possible to exemplify the differential action perfectly. With the current on it was possible to brake or even hold one spindle quite still, the effect being to make the other one run faster. The reason of this is that the back E.M.F. in the spindle which is held is reduced (to *nil* if the armature is stopped) and therefore the moving spindle is impressed with a higher voltage and runs faster. A current which would endanger the braked armature cannot pass as the amperage is regulated by the running armature. It was found, however, that it was impossible to hold both spindles at once. A sort of balance was effected : when one spindle met with greater resistance and slowed down, the other

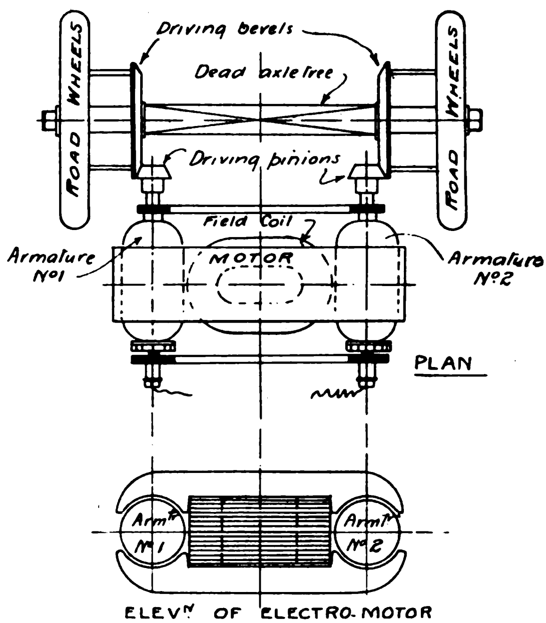

FIG. 2.

automatically took more work on its shoulders. With the motor fitted to the road wheels the same thing was observed, and the whole arrangement giving no trouble whatever. The type of motor might be fitted to other models, say, twin-screw model launches; but, of course, its special use is to provide a simple differential gear for models of road vehicles where the wheels cannot be coupled rigidly together.

The sketches reproduced herewith are not to scale, and as the actual model is of an invention not yet completely patented, the general features are purposely disguised. In setting out any particular arrangement the speed ratios must be properly proportioned according to the exigencies of the work to be accomplished by the model.

THE RAPID COALING OF LOCOMOTIVES.—The Pennsylvania Railroad have adopted a method for filling the tenders of locomotives with coal and water in five minutes' time, as against half-an-hour under the old system. A bridge is built across the tracks, fitted with coal-shoots and water-pipes. The coal-wagons discharge their contents directly into the tender from above, while the tanks are filled at the same time with water delivered at high pressure, the result being a net saving of five-and-twenty minutes for every engine so supplied.

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Design for a Model Water-tube Marine Boiler.

By A. Peddie, Jun.

THE following is a description of a model boiler, constructed on the semi-water-tube principle, for a model racing boat, 5 ft. 6 ins. long by 7⅝ ins. beam by 6¼ ins. deep at centre of deck. The drawing will, I hope, explain itself. There is not much work in it, although it may look a lot. The shell is made of sheet steel, No. 18 B.W.G., treble riveted and flanged outwards for the end plates, which are 1-16th in. thick, this being much easier than flanging the ends, also the rivets

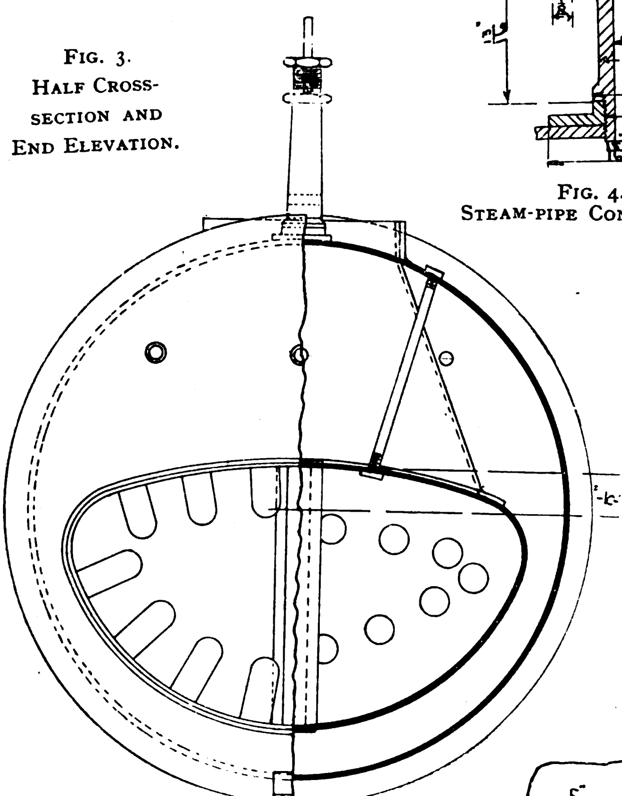

FIG. 3.
HALF CROSS-SECTION AND END ELEVATION.

are easier to get in. The rivets are 5-32nds in. diameter steel. The stays, too, are 5-32nds in. diameter. The furnace and uptake are 18 B.W.G. riveted and stayed to shell, with 5-32nds in. stays and nuts. The shell, ends, and furnace joints were tinned, and after riveting they were sweated together. The boiler was tested to 80 lbs. pressure with cold water, but is only worked at 25 lbs., this being found sufficient to drive a two-cylinder, double-acting engine, ⅞-in. bore by ⅞-in. stroke, and two three-bladed propellers 4 ins. diameter by 9-in. pitch at a good speed. The steam is superheated by passing the steam pipe down the uptake and up to the engine. The long horizontal tubes are 5-16ths in. external diameter, No. 28 B.W.G.

(*Full size.*)

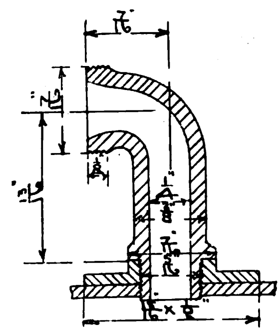

FIG. 4.
STEAM-PIPE CONNECTION.

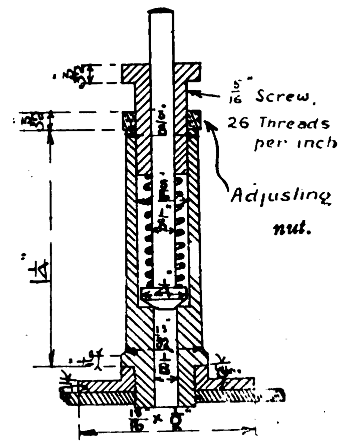

FIG. 5.
RELIEF VALVE.

It will be seen by the drawing that the top ones are dropped ¼ in. one end, and the bottom ones raised the same amount at the same end. This arrangement is to allow the water to circulate. The short vertical tubes are ⅜ in. external diameter, and are No. 24 B.W.G.; these also help the water to circulate. All the tubes are brazed in. A relief valve is fitted which blows off at a pressure of 25 lbs. A nut is also provided for adjusting the spring for any required pressure. It is fired with two Ætna burners, fixed together to an oil tank, with 15 lbs. pressure on tank. Steam can be had in 2½ minutes from the burners being started. The weight of boiler with all connections is 8 lbs. 1 oz.

WHAT is said to be the largest photograph ever made is a print 12 ft. by 15 ft., being made as an enlargement from an 8 in. by 10 in. negative of President Roosevelt in an

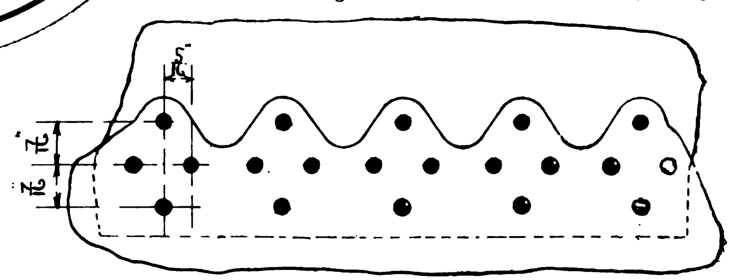

FIG. 6.—SHOWING METHOD OF RIVETING BOILER SHELL.

Oldsmobile car at Lansing, Mich. The big plate was obtained by successive enlargements, and the print will be made in a series of strips 60 ins. wide.

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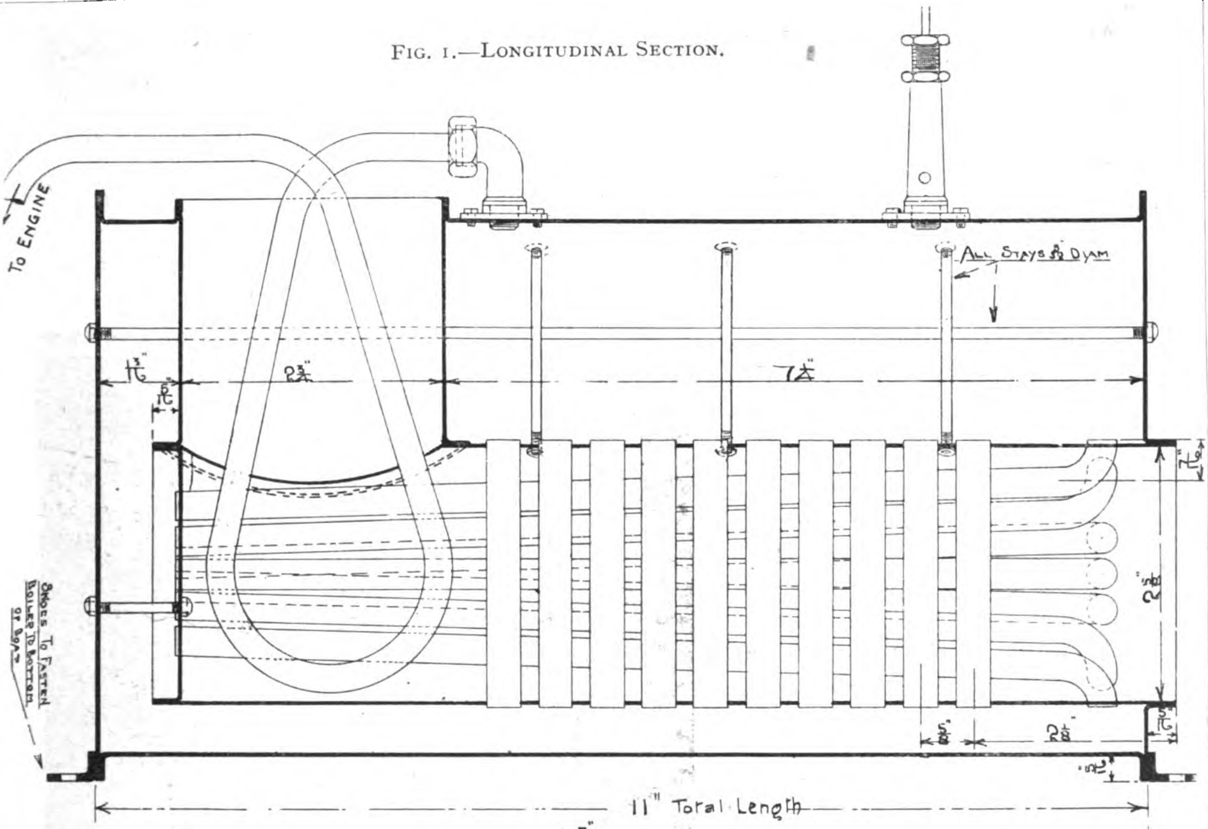
FIG. 1.—LONGITUDINAL SECTION.



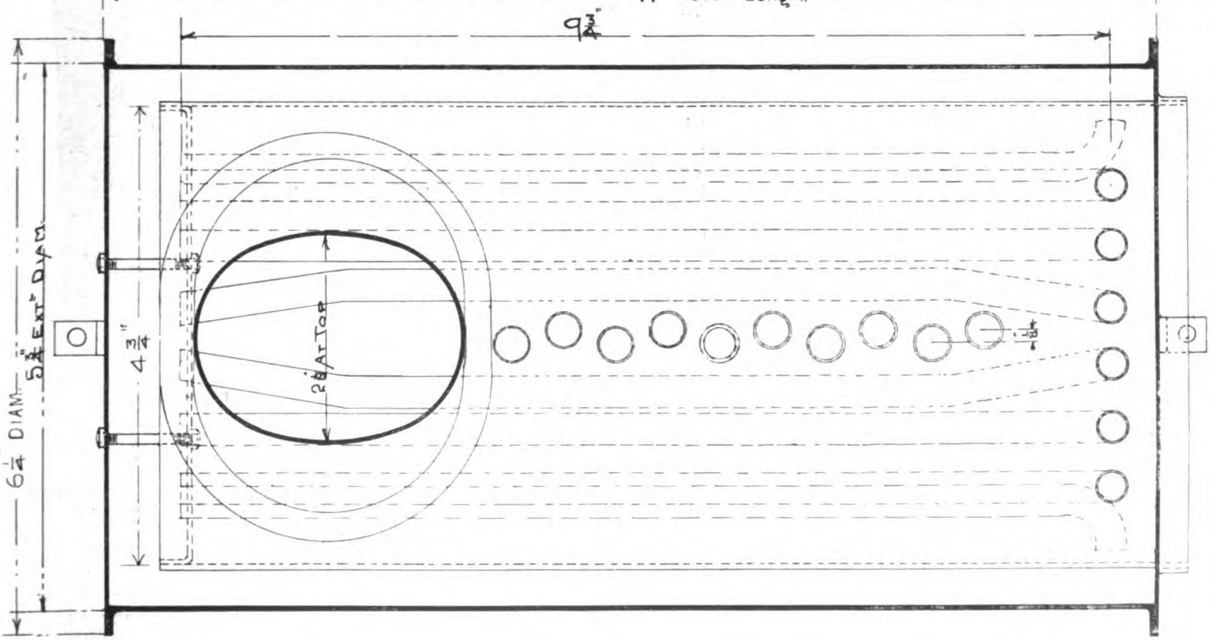


FIG. 2.—PLAN.

DESIGN FOR MODEL WATER-TUBE MARINE BOILER. (*Scale: Half full size.*)

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A Model Railway Signalling System.

By W. E. Webb.

THE three photographs herewith are of my model railway track. A plan and explanation of the signalling and electric control was given in The Model Engineer for September 28th, October 19th, and November 9th, 1905. It will be noticed that one or two slight modifications in the signalling have been made, and when all is complete and in working order, with the Editor's permission I hope to describe the signalling and box, etc., more fully. Owing to change of locality the railway has had to be largely rebuilt, so causing delay.

The line is only 53 ft. 4 ins. long, about the same length as the old one, and is quite straight. The old one was largely on a curve, which necessitated considerable relaying.

One end of the line has four roads. This is called the terminus end, and reading from the fence, the roads are—No. 1, main departure; No. 2, through road for arrival or departure; No. 3, main arrival; No. 4, carriage road.

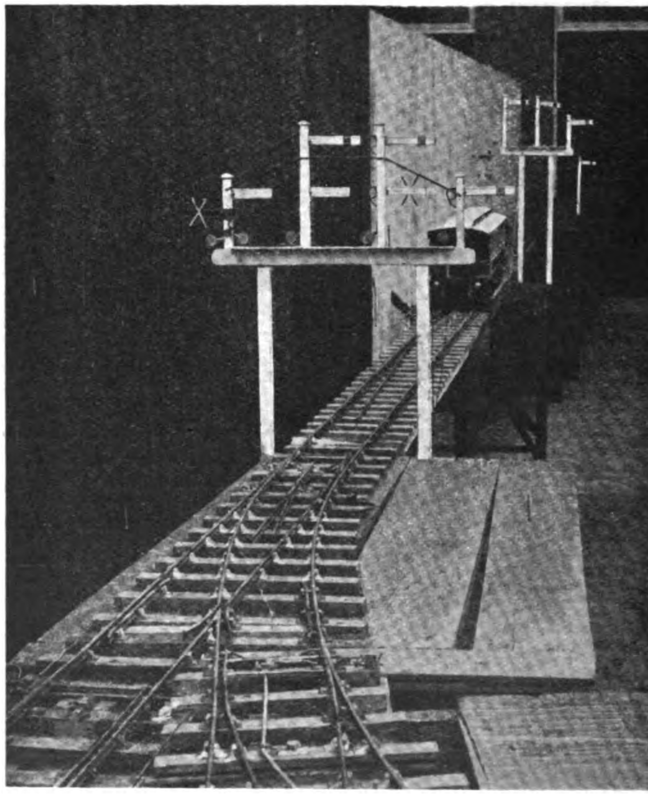
Between the fence and line 1 will be a platform 11½ ins. wide, 11 ft. long, and between lines 2 and 3 will be an island platform 10½ ins. wide and 10 ft. long. The whole terminus (4 ft. 4 ins. wide) will be covered by a double-span roof supported on Whipple-Murphy girders, so giving a clear opening the full width of the terminus. The bottom flange of the span girders will be 2 ft. from the rail level. The tops of the platforms will lift off, and when any repairs to track are required, the platelayer will just take off the platform and will then be able to walk on the ground between the lines and not be unduly cramped when working under the covered roof.

In the original plan (September 28th, 1905) the second road was a through road for engines, etc., there being no island platform, and No. 4 road was a siding to the goods. This is now a carriage siding under the cover of the roof, and will one day—when the line is converted to a double track — be the shunting neck for the goods sidings, which will be three in number and extend down to the 26-ft. mile post, which is between the home and distant gantrys.

The conversion to double track and the laying of the goods sidings can be carried out without in any way interfering with the present arranged track, with the exception of three extra pairs of points being inserted.

The signal-box of twenty-eight levers is so arranged that the twelve extra levers that will be necessary, with their interlocking, can readily be put in. The home gantry will, of course, require enlarging by the addition of another post and being widened to span the up-and-down road. The four lines converge on a turntable, so permitting an engine to be readily changed from any one line to any other. This turntable is locked in position by locking-bolts worked from the signal-box, the locking-bolt levers being interlocked with the signal levers. The other end of the line has just two roads for reversing the engine end for end of the train.

The signal-box at this end of the line is being rebuilt with twelve levers, the old box only having five levers. From the distant gantry to this small end of the line is all old track, and was put down straight away. Some parts of this track have been laid nearly three years, and are practically as good as the first day they were made. The double line at this end of the track will hold two carriages not exceeding 6 ft. 3 ins. the two (over buffers). This then permits the engine to pass on the adjacent line for attaching itself to the other end of the train.



Terminus Points and View down the Line.

The whole of the track has been tarred since the photographs were taken. It was not contemplated that photographs were to be taken of the railway, it being still unfinished; otherwise, the starting signals at the terminus would have been put out in position, also on the other side of the track to the distant gantry will be a post carrying the advance starter signal and the distant signal to the home signal at small end of track. This advance starter signal is the most interesting on the railway. It is worked from the large box A,

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and, further, by a solenoid at the base of the post. The pulling over of the lever by A raises the weight, but does not lower the signal, it being still kept at danger by the weight actuated by the solenoid. The pulling over of the lever, however, in addition to raising the weight, worked the switch which put current into third rail between the home gantry and advance starter signal. This further gave current to work the solenoid, which then let the arm lower. The distant signal-arm is worked and controlled by A and B, as is the usual practice.

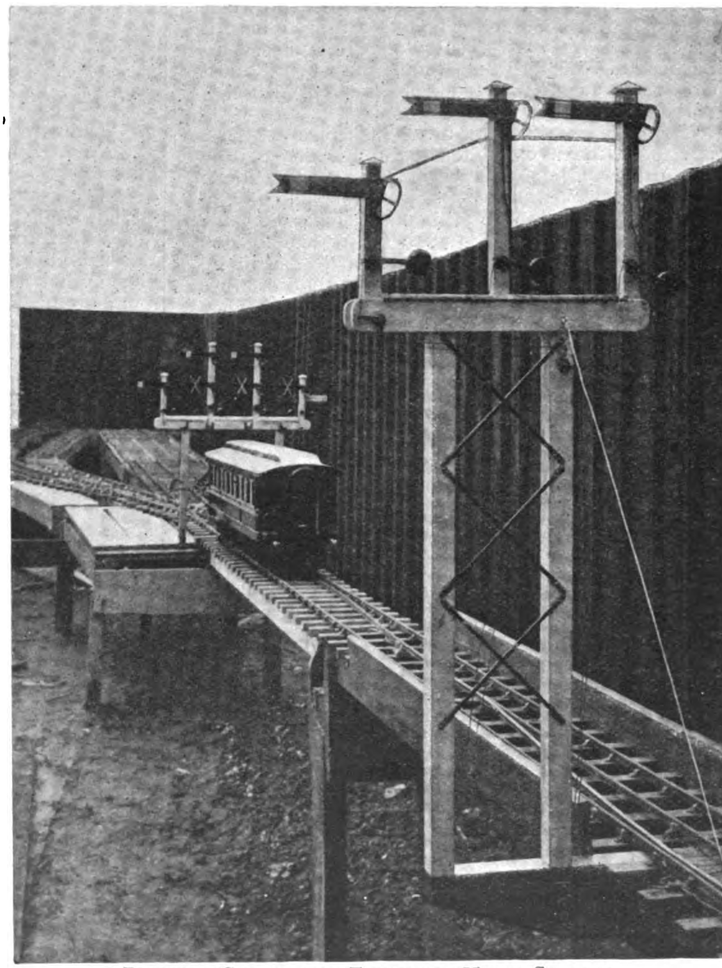
When the train passes the advance starter signal it breaks the circuit to the solenoid, and so puts the signal to danger again. It also, in accordance with the requirements of real practice, puts the distant arm to danger at the same time.

This signal cannot be worked again until the train has passed out of B's block section, that is, until it has passed its home signal, in doing which it actuates a treadle which releases B's block instrument. B can then give A permission to send another train, and not before. It is impossible to properly explain in this short space the absolute block working adopted and the interlocking of block instruments with levers, etc. I hope to do this fully if I give working drawings and description of signal-box. Everything on the line is made by ourselves, the rails being our own, the chairs being a L. & N.W. Ry. pattern without the bosses for bolts; only the new part of track is laid with our own chairs.

The spectacles, small rollers to guide point rods, pivot castings for the angles, guiding point rods, etc., these being required in quantities and to look like the real thing, and be all the same, were made in metal dies. The arms of signals are of thin sheet iron, the ribs being formed in a cast-iron block made for the purpose. The ribbed arms are as adopted on the L. & N.W. Ry. The arms are pivoted on brackets fixed to the side of posts, so following this Company's rule. The turned spindle has long bearings and free movement, so is never liable to bind. Where the rod moving arm is attached to arm a thick boss is fixed; this prevents rod rubbing the rib at back of arm.

As will be seen by the photographs, locking-bolts are fitted to all the points; the locking-bars are not yet finished. These latter, owing to the confined position of the points, will have to be attached to each point, there being no room in front of the points for them. This sometimes occurs on the real railway.

In the photograph looking from the terminus end to the other end of line, in the front, will be seen the points, and the left-hand point of the pair giving access to the carriage siding looks bent; this is due to the photograph, as it is not actually bent. In this photograph—in the left-hand corner—may be seen a signal detector uncovered on the outside of the line. The third rail may also be seen laid from the small end as far as the distant gantry; the bare boards to right hand of point are in preparation for the double track. The terminus end will be boarded in down to the ground and covered with rough cast, the track being edged in all along by boarding 2½ ins. deep coming 1½ ins. above rail level. When a train is standing on any one of the four lines at the terminus it works a treadle, which works a block instrument in the signal-box which shows line blocked, and also locks at danger the home signal giving access to that road.



DISTANT GANTRY TO TERMINUS HOME SIGNALS.

A NEGRO clergyman of Virginia has been granted a patent for a whistling piano, his own invention. It is capable of whistling the most difficult notes, and the inventor is confident that his device will become very popular with his own race throughout the world.

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A Design for a Small Model Undertype Engine.

By Henry Greenly.

(*Continued from page* 226.)

IX.—The Alternative High-pressure Simple Cylinders.

As mentioned in the article of July 25th (page 84), a reader who intends building this model as a twin-cylinder high-pressure engine instead of a compound has asked that drawings should be included for cylinders arranged in this way. Figs. 53, 54, and 55 give the necessary particulars, and all other details may be obtained from the drawings inserted in the issues of May 2nd, 16th, and 30th last.

The cylinders are ⅝ in. by 1¼ ins., placed 1¼ ins. apart, so that except for main cylinder casting no further patterns will be necessary. The steam chests are identical with the L.-P. steam chest of the compound engine, and the pistons may be made from castings supplied for the H.-P. side of the original engine. The covers are made 1-16th in. larger in diameter, but most probably castings for the H.-P. covers of the compound cylinders will be found to turn up to the enlarged diameter. By increasing the diameter of the covers a better lap is obtained, and the studs can be placed on a slightly larger pitch circle (15-16ths in. instead of 29-32nds in.).

The steam ports should be the same as the H.-P. ports of the compound model, viz. :—Steam ports, ⅜ by 3-32nds in. ; exhaust port, ⅜ by 3-16ths in. ; port bar, 3-32nds in. wide. ; and the valves may be made from the H.-P. valve drawings (Fig. 19, May 16th issue), the cavity being made ⅜ in. (bare), and the angle of advance of the eccentric increased slightly, so that the engine will work more economically. The length of the valve may be on the full size of ⅝ in., rather than be ⅝ in. bare.

To reduce the number of connecting pipes to the minimum, only one steam pipe is used. This is screwed into the cylinder casting in the left-hand front corner, as in the compound engine, and the two steam chests are connected by a ⅛-in. horizontal passage, drilled right through the main casting from valve face to valve face. A channel connecting the ends of this passage with steam chest may be chipped in the valve face, or the walls of steam chests may be cut away in the manner shown in the drawing (Fig. 53), to allow the steam a free passage. The two exhaust pipes should be beat and joined together at their upper extremities, so that they form a breeches or Y-pipe. The joint should be made with silver-solder, and the upper part—where the two pipes merge into one—screwed for a nozzle which should not be larger than ⅛ in. diameter. If the pipes fit well, there is no need to make them a permanent fixture in the cylinder casting. They may be prevented from serious leakage by a little red lead. The union for the steam pipe should, of course, be inside the smokebox.

Of course, the boiler pressure maintained will be lower with an equally well-made compound engine, but it should not fall below 40 lbs., and, as a simple high-pressure engine, the model should be found more suitable than the compound for use as a model winding engine, or for any purpose requiring a more even turning movement. The steam should, of course, be superheated, as in the case of the original engine.

The next article will conclude the series, and will deal with the pump and fittings and include drawings of the spirit lamp.

(*To be concluded.*)

Locomotive Notes.

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

Another "Largest Locomotive in the World."

Quite recently there appeared in these columns an illustrated description of a huge "Pacific," or 4—6—2 type, express passenger locomotive, built by the American Locomotive Company for the Pennsylvania Railroad, and rightly claimed by them to be the heaviest and most powerful passenger locomotive in the world. The same Company has now beaten its own short-standing record by producing at its Schenectady Works an enormous Mallet compound locomotive, with sixteen wheels, all coupled and arranged in two independently driven groups of eight wheels each. The weight in working order of this monster locomotive is, roughly speaking, 184 tons, and it has H.-P. cylinders 25 ins. in diameter by 28-in. stroke, and L.-P. cylinders 39 ins. in diameter by 28-in. stroke. The fitting of L.-P. cylinders nearly 40 ins. in diameter to a locomotive is in itself a remarkable achievement. An illustrated description of this engine will shortly appear with these notes, and attention can then be more easily directed to the remarkable features of the design.

Good Locomotive Work on the Midland Railway.

Returning quite recently from the North by one of the principal expresses of the Midland Railway the writer noted a very good performance on the part of a single locomotive of the last series built by Mr. Johnson, having 19½ by 26-in. cylinders and 7 ft. 9 in. diameter driving wheels. The engine was attached to the up "Scotchman," due in St. Pancras at 8.5 p.m., at Leicester, the train having been brought from Leeds by a rebuilt 4—4—0 type engine, and the arrival being eight minutes late. The "single" had rather more than 100 minutes in which to cover the 99¼ miles between Leicester and London, the load being equal to thirteen-and-a-half coaches, and the conditions on the whole favourable for fast running. After speed had been gathered the engine gave a splendid exhibition of fast running, passing Bedford within forty-nine minutes of leaving Leicester, thus giving about fifty-two minutes for the 50½ mile run to St. Pancras. Slacks at Luton and Hendon rendered the accomplishment of this out of the question apart from everything else ; but the arrival in London was only five minutes late, so that the average speed on the Bedford-St. Pancras section was not less than 56½ miles per hour.

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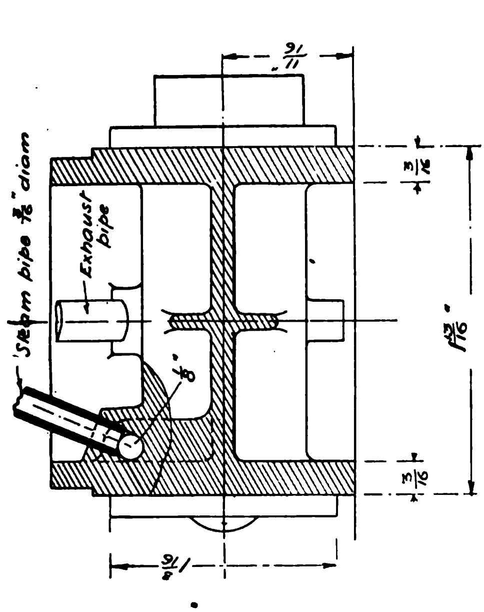

FIG. 54.—LONGITUDINAL SECTION, SHOWING THE CONNECTING LIVE STEAM PASSAGE.

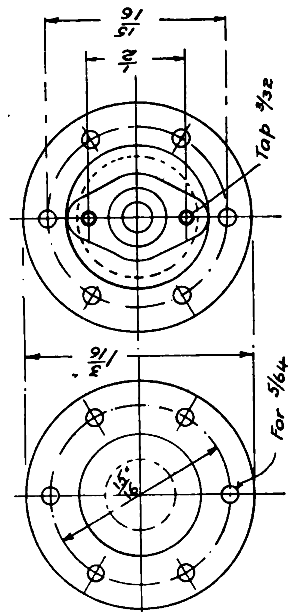

FIG. 55.—COVERS FOR TWIN HIGH-SPEED CYLINDERS.

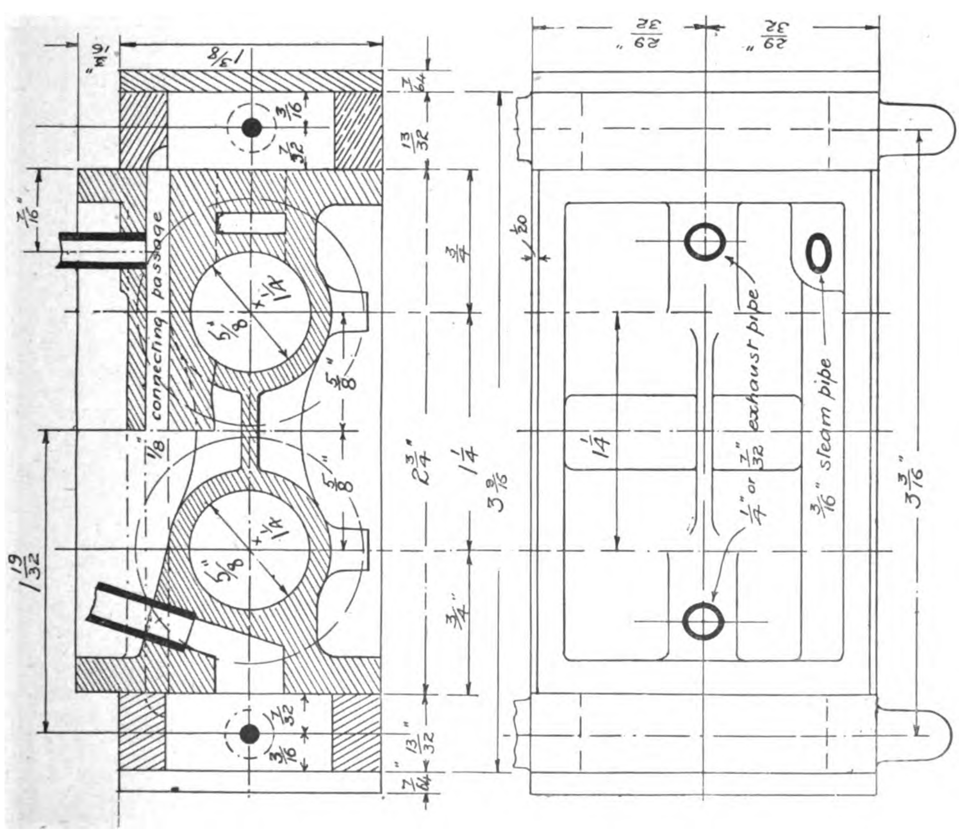

FIG 53.—CROSS-SECTION AND PLAN OF ALTERNATIVE TWIN HIGH-PRESSURE CYLINDERS FOR SMALL MODEL UNDERTYPE ENGINE.

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An Interesting Tank Locomotive.

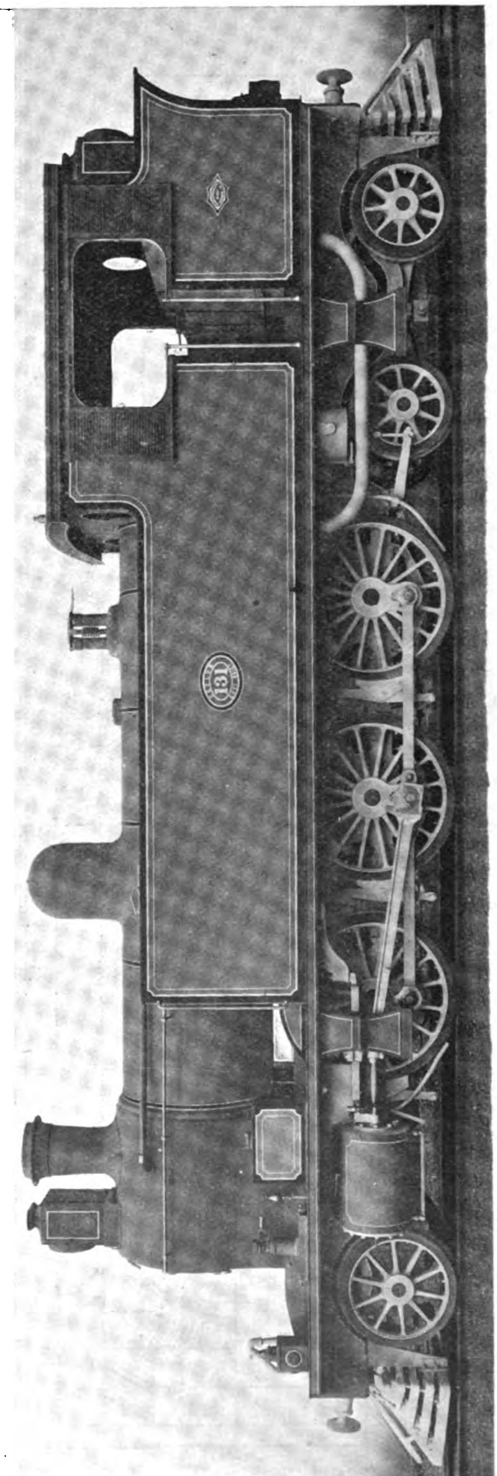
Among other noteworthy locomotives designed and built in this country during the present year for service abroad, the one illustrated on this page is specially interesting. The wheel arrangement is 2—6—4—a very uncommon one—and the cylinders are placed outside the frames, with the middle pair of coupled wheels as drivers. The two ends of the locomotive are supported on bogie trucks, of which the front one is of the two-wheeled "pony" type and the rear one of the ordinary four-wheeled variety. The valve gear is Stephenson's link motion, and the slide-valves are of the balanced pattern, working at the sides of the cylinders. The coupled wheel springs are equalised throughout. The boiler is of large dimensions, and is fitted with a firebox of the ordinary round-topped description. The smokebox, which is much extended, contains a spark-arresting device. A comfortable cab is provided. It is fitted with a double ventilated roof, and two sliding shutters are fitted on each side. The engine is equipped with sanding gear, sight-feed lubricators, and the automatic vacuum brake. It, and others, of the same design comprised in the order are intended for service on the Ceylon Government Railways, which have the 5-ft. 6-in. gauge. They are among the largest and most powerful locomotives yet exported to the island. The writer is indebted to the builders—Messrs. Robert Stephenson & Co., Ltd., of Darlington—for the photograph of the engine and also for the particulars which follow :—

Cylinders : Diameter, 19 ins. ; stroke, 26 ins.
Coupled wheels diameter, 5 ft.
Total wheelbase, 32 ft. 6 ins.
Total heating surface, 1,323 sq. ft.
Grate area, 23·5 sq. ft.
Working pressure, 160 lbs. per sq. in.
Total weight in working order, 71 tons.
Tank capacity, 1,750 gallons.
Bunker capacity, 2¾ tons.

Cowcatchers are fitted to each of the buffer beams, and the coupling arrangements are similar to the ordinary patterns. Altogether, this is a well-designed and powerful type of engine.

New Compound Express Locomotives—Saxon State Railways.

Quite recently a new series of compound express locomotives has been turned out of the works of the Sächsische Maschinenfabrik, of Chemnitz, for the Saxon State Railways. The cylinders (four in number) are arranged in line below the smokebox and all drive the leading pair of coupled wheels, the wheel arrangement in this case being 4—6—0. The cylinder and valve gear arrangement is that now referred to as the "Central European" system, in which only two sets of gear are employed for actuating the four valves. The L.-P. cylinders are placed outside the frames and the H.-P. inside, the latter driving the crank axle of the foremost coupled wheels, while the outside connecting-rods drive by means of crank-pins in the same wheels. The slide-valves are of the piston type, working above the cylinders. The boiler contains a superheater of the well-known Schmidt smoke-tube type, and the piston valves and pistons are likewise of the same inventor's design, being specially formed to work in conjunction with highly



2—6—4 Type Tank Locomotive: Ceylon Government Railways.

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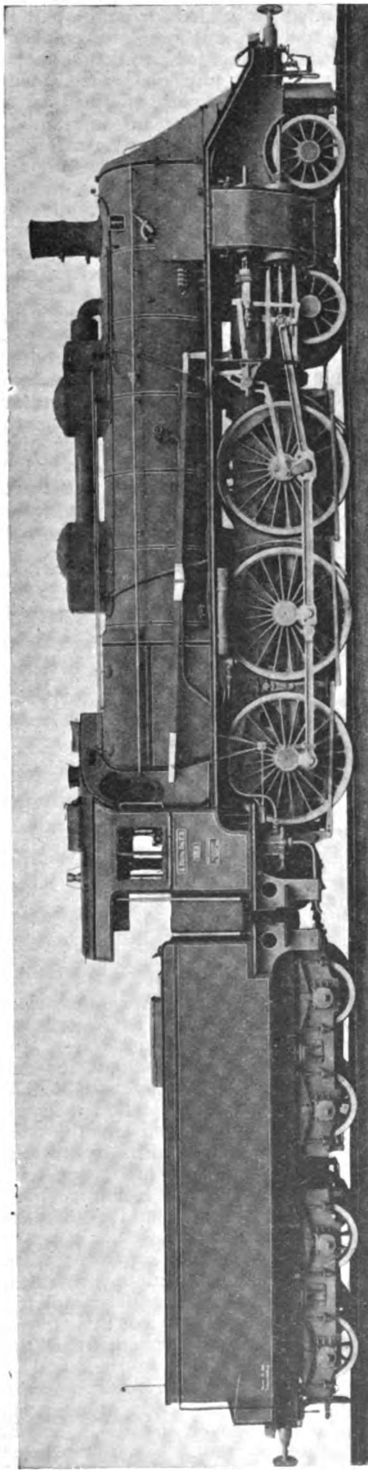

NEW 4—6—0 TYPE COMPOUND EXPRESS LOCOMOTIVE WITH SCHMIDT'S SUPERHEATER: SAXON STATE RAILWAYS.

superheated steam. The valve gearing is of the Heusinger type—a modification of the Walschaerts motion. The two gears are supplied to the outside L.-P. cylinders direct, and motion is conveyed to the H.-P. valve spindles by cross connecting levers at the rear of the cylinders. The boiler is fitted with a Belpaire firebox and extended smokebox, The front of the latter is of conical formation. and the cab is similarly arranged to reduce air-friction. The superheater consists of twenty-four tubes of $4\frac{5}{8}$ ins. to 5 ins. diameter and 144 tubes of $1\frac{3}{4}$ ins. to 2 ins. diameter.

The leading dimensions of the locomotive are given below :—

Cylinders : H.-P. (two), 16·9 ins. in diameter ; L.-P. (two), 24·8 ins. in diameter.
Bogie wheels diameter, 3 ft. 5 ins.
Coupled wheels diameter, 6 ft. $2\frac{3}{4}$ ins.
Boiler pressure, 213 lbs. per sq. in.
Heating surface : Firebox, 138 sq. ft. ; tubes, 1432·7 sq. ft. ; superheater, 441·2 sq. ft. : total, 2012·9 sq. ft.
Grate area, 29·5 sq. ft.
Weight for adhesion, 47 tons.
Weight in working order, $72\frac{3}{4}$ tons.

Mechanical, Electrical, and Other Aids for the Deaf.

By JOHN PIKE.

(*Continued from page* 255.)

THE apparatus is easily tested at every stage in its construction, first one, then two, three, and four microphones being brought into circuit. A suitable test is one of the smallest electric bells made operated by a single cell. The deaf person will probably not hear this at all, but on applying the receiver to his ear, with the bell and receiver on the bench in front of him, and the whole properly connected, he hears the tinkle very clearly. With the apparatus shown, the very deaf person will probably hear music very clearly ; he may sit at one end of the room with the apparatus at his side and the receiver to his ear, and the performer will be heard with more or less distinctness. "In all loud speaking electrical instruments"—says one writer—"the sounds received through them, to ordinary hearing, appear altered in *timbre*, but these differences are not perceived by those who are deaf." A statement easily made, but one in which the deaf person is not likely to acquiesce ! The strength of the above apparatus may be increased by the addition of a small induction coil such as would be fitted to a telephone. One may be easily made in an hour or two with a few pieces of soft iron wire (22 gauge), a piece of thin brass tube $\frac{1}{4}$ in. or $\frac{3}{8}$ in. diameter, a piece of thin sheet zinc or brass, some cotton-covered wire 24 B.W.G., and an ounce or so of 36 B.W.G. wire. Pack the brass tube—two inches long—with iron wire ; cut out two bobbin ends from the sheet zinc or brass (shaped as Fig. 3) and solder these on to each end of the tube : cover the tube and inside of ends with paper, and wind on four layers of the No. 24 wire, bringing the commencing and finishing ends out through holes drilled for the purpose ; put a layer or two of waxed

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paper over this primary, and then run in the fine wire—previously well soaked in hot wax—in as even layers as possible. This induction coil will also find a place inside the box, and if used is in series with microphones and battery, the receiver being connected to secondary winding on the coil.

Trials may be made with the microphones otherwise connected, *i.e.*, all the carbons to one terminal and all the casings to the other, as Fig. 4.

The constructon of the box may also be varied with advantage. Made square with a microphone on each face is a convenient arrangement, and suits some cases. In this case the writer uses

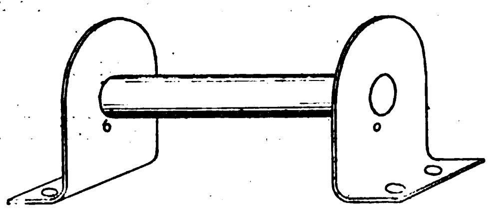

FIG. 3.

very fine thin pine wood—four pieces of equal size, and each secured to its neighbour with small hinges at the extreme top and bottom; three pairs of hinges will be put on in their usual form; the fourth pair have their pins removed, fixing one half to the first, and the other to the fourth side. These being brought together—forming the square—a suitable hat pin passed through secures the whole. The advantage is that the hinged boards may be laid flat and have the 'phones properly fitted and joined, then the arrangement is placed on end and squared. The corners are left open, and a top and bottom fitted, the whole being finished in any fanciful design which may be thought fit—with mouldings and so on; the batteries are placed inside and a brass handle on the top completes the apparatus.

It is fairly evident that a good percentage of

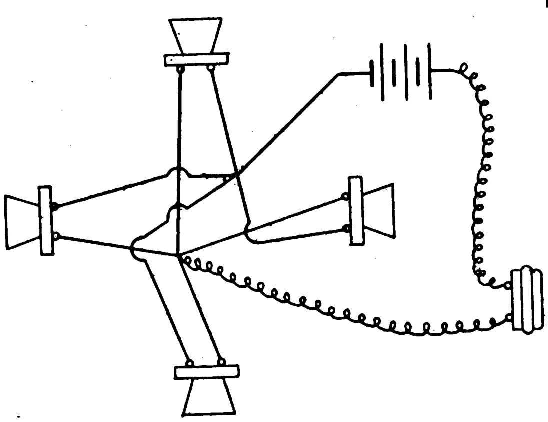

FIG. 4.

deaf persons obtain relief from the use of certain electrical apparatus, which, however highly extolled and exaggerated, contain in themselves nothing elaborate or novel. Electro-therapeutics is a specialised branch, and so far as the ear is concerned, one must be guided by competent medical advice. The use of unauthorised internal remedies is to be distinctly avoided, and the deaf person should never attempt any quack treatment. On the other hand, many properly qualified ear specialists will say that such treatment as a mild direct current—Faradisation—will do no harm, and may do good as a mild stimulant to the auditory nerve; and they will also say, with similar qualification, that massage as applied to the middle ear may also be indulged in. The deaf person is no doubt justified in trying certain remedies, but they should have the sanction of his medical adviser, and must always be on the side of mildness.

Now a course of continuous current as a remedial agent may be applied by anyone with the assistance of two dry cells and a couple of electrodes. The apparatus may be rigged up for a few shillings, and will often prove beneficial. Select *two* electrodes of the pattern figured (E, Fig. 5); the disc at the end is fitted with a small piece of sponge and covered with linen; the handles, of course, are of hard wood or otherwise insulated. The

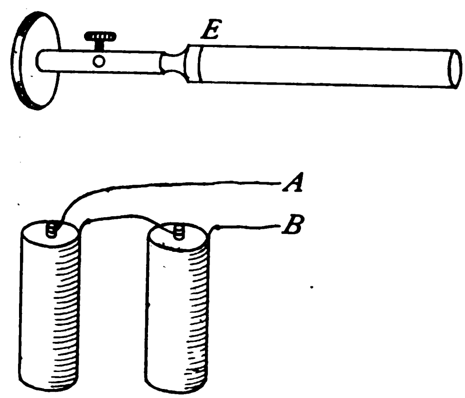

FIG. 5.

cells being connected in series, the electrodes are attached to flexible wires, as A and B. The pads are moistened with warm water, and the electrodes then held to the back of the ears. A very mild sensation of prickling will be felt from one terminal, and after an application of ten minutes or so the electrodes are reversed and the treatment continued for a like period. Firstly one cell only should be tried, then two or three; but the latter may be too much, causing a feeling of giddiness, which however soon passes off, but it is to be avoided. The perfect apparatus consists of several small cells with a switch, so that so many volts may be used as prescribed—voltmeter, rheostat, and milliamperemeter, and so on, all complete; but no one will go far wrong with two or three dry cells.

The drawback to this arrangement is that the electrodes require to be held in the hands, but a simple adjustment may be easily made and similarly shaped pads fitted to the ends of a spring just long enough to pass over the head, leaving the pads in the right position. Fig. 6 represents the idea. We first ascertain approximately the length required by measurement, and then to "A"

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(in the figure) which is a piece of ebonite, attach by means of terminals a couple of short springs, BB. Two discs, CC, of sheet copper or brass and about the size of penny pieces, are soldered to the ends of the springs; by means of a slot cut in the springs and a nut on the threaded pin (through

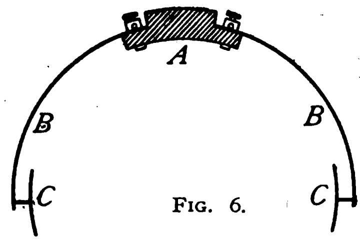

FIG. 6.

C) the apparatus will be finely adjusted to fit the head. The small battery will then be connected to the terminals, and the discs, being padded and covered with linen (and moistened with water, as before), placed comfortably behind the ears, the current passes. After the few minutes' application all that is necessary is to lift off the spring and reverse it. The addition of a reversing switch to the battery would, of course, save this slight trouble.

The application of massage is carried out in a simple manner by using a small pneumatic pump

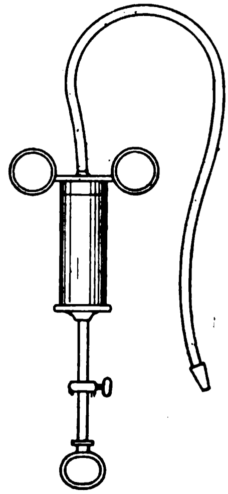

FIG. 7.

of the shape figured (Fig. 7). The nozzle is inserted into the ear, and by working the pistons—the length of which may be regulated—little puffs of air impinge upon the tympanic membrane, producing gentle oscillations which are transmitted to the inner ear. Such apparatus is fitted for electrical adaptation, if any reader cares to go to the trouble and expense of a small motor with which to make the necessary movement of the piston. As, however, the instrument would be used probably only once a week, and for a minute or two at a time, it is scarcely worth the trouble.

In conclusion of these short notes, it must be confessed that the deaf person falls an easy prey—apparently—to many an advertiser. He is anxious to try this, that, and the other highly-lauded remedy, and in the vast majority of cases he had better keep his money for better purposes. Particularly is this so with regard to so-called invisible sound magnifiers—inventions which purport to do for the ear that which glasses achieve for the eye. The problem still remains for the future. It is certainly not to be done by the small, invisible—as worn in the auditory canal—appliances, some of which are mixed up with electrical terms, and thrust before the notice of a trusting public.

A Design for a Handy Lathe.

By W. MUNCASTER.

(*Continued from page* 233.)

SOMETIMES in small work a cut less than 1-100th in. seems desirable. We can get this by adding a wheel which is attached to the side of the intermediate wheel, and gearing into the wheel on the lathe spindle.

As an example, if we put fifteen teeth on the lathe spindle, ninety teeth on the leading screw, with a simple intermediate gear we get a ratio of $\frac{1}{6}$, which, with $\frac{1}{6}$ in. pitch screw, gives us a feed of 1-36th. Suppose this to be too coarse for our requirements—the largest wheel available has, say, 100 teeth only, we therefore put a compound of eighty teeth and twenty teeth on the intermediate stud sleeve, the larger gearing into the spindle wheel, the smaller into the leading screw-wheel; the ratio then becomes

$$\frac{15}{80} \times \frac{20}{90} \times \frac{1}{6} = \frac{1}{144},$$

which may suit our requirements better.

Rule:—Multiply the drivers together for a numerator and the driven together for a denominator, and the resulting fraction by the pitch of the leading screw. Any wheel gearing into two wheels in the train may be neglected as regards pitch (or speed) but not as regards direction.

The change wheels generally supplied will be twenty-two in number, with 15, 20, 21, 22, 23, 25, 30, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, and 100 teeth, No. 14 pitch, $\frac{1}{2}$ in. wide bored to $\frac{1}{2}$ in., a keyway cut in each.

For reference in screw-cutting, tables are given on the next page, which the reader is recommended to keep for reference.

A suitable slide-rest is shown in Figs. 43, 44, and 45.

This is to be bolted to the surface of the lathe saddle by means of bolts pushed into the grooves. The slide is made up of three castings—(*a*) a longitudinal slide bolted to the saddle; (*b*) a transverse slide; (*c*) a rest to which the tools are attached; arrangement by which we secure a compound movement will be readily understood by a reference to the drawing. The bottom surface should be carefully faced to rest on the saddle, the surfaces that slide on each other, machined and scraped to a dead fit. The angle of the dovetails will be 60° to 65°, the corner at the outer angle should be taken off so as not to make a sharp edge. In this case about 1-16th in. will be about right. This not only dispenses with the necessity

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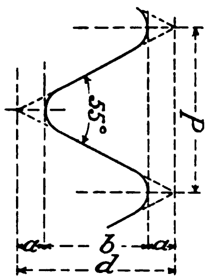
WHITWORTH STANDARD.

$$a = \frac{d}{6}$$

$$b = \frac{2d}{3}$$

LIST OF BOLT THREADS IN INCHES.

Dia. of Bolt.	No of Threads.	Dia. of Bolt.	No. of Threads.
1/8	40	9/16	12
3/16	24	5/8	11
1/4	20	11/16	11
5/16	18	3/4	10
3/8	16	13/16	10
7/16	14	7/8	9
1/2	12	15/16	9
		1	8



CYCLE ENGINEERS' STANDARD.

$$a = \frac{p}{6}$$

$$b = 0{\cdot}533 \times p$$

$$c = \frac{p}{6}$$

LIST OF BOLT THREADS IN INCHES.

Dia. of Bolt.	No. of Threads.	Dia. of Bolt.	No. of Threads.
·064 (1/16)	62	3/16	32
·092 (3/32)	56	1/4	26
·125 (1/8)	40	5/16	26
·175	32	3/8	26

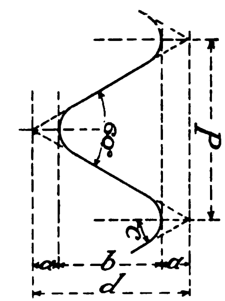
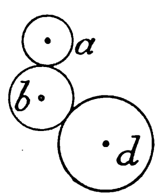


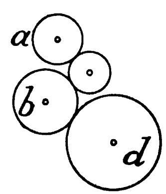
TABLE OF CHANGE WHEELS FOR 1/8-IN. PITCH LEADING SCREW.

Threads per inch	190	180	170	160	150	144	140	128	120	112	108	100	96	90	84	80	76	70	64	60	56	52	48	44
Spindle (*a*)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Stud (*b*)	95	90	85	80	75	80	70	80	70	70	60	50	60	60	60	60	60	70	40	35	40	40	40	40
Pinion (*c*)	20	20	20	20	20	20	20	25	21	20	20	20	20	20	20	30	30	30	20	21	20	20	20	20
Screws (*d*)	100	100	100	100	100	90	100	100	90	80	90	100	80	75	70	100	95	75	80	90	70	65	60	55

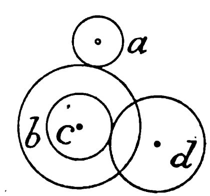
Threads per inch	40	36	32	30	28	26	24	22	20	18	16	14	12	11	10	9	8	7	6	5	4	3	2	1
Spindle (*a*)	15	15	15	15	15	15	15	15	15	30	30	30	30	30	30	30	30	60	30	60	60	60	90	100
Stud (*b*)	*Any Convenient Size.*																							
Screw (*d*)	100	90	80	75	70	65	60	55	50	90	80	70	60	55	50	45	40	70	30	50	40	30	30	20



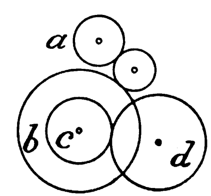
R.H. Thread.



L.H. Thread.



R.H. Thread.



L.H. Thread.

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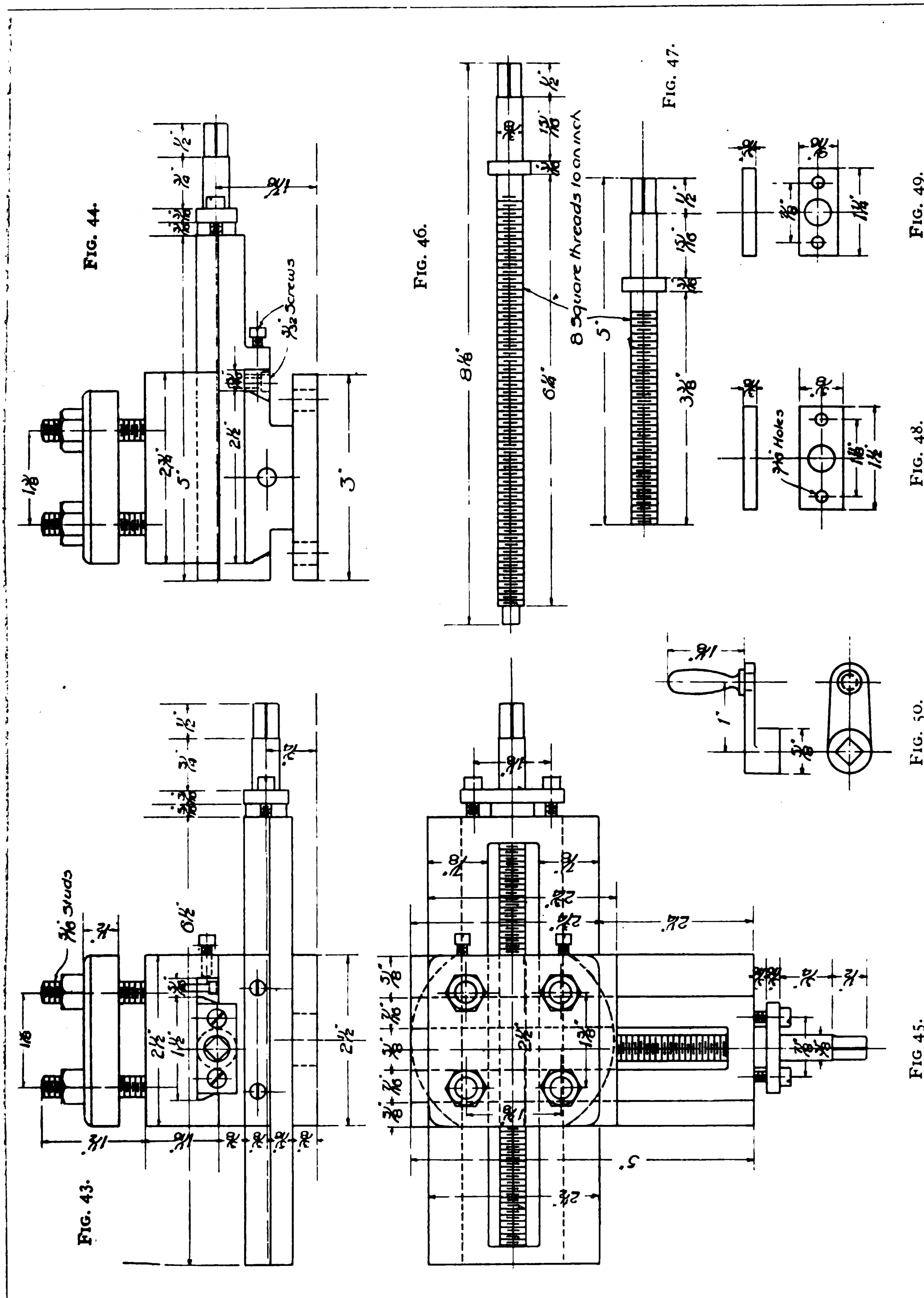

FIG. 43. FIG. 44. FIG. 45. FIG. 46. FIG. 47. FIG. 48. FIG. 49. FIG. 50.

GENERAL ARRANGEMENT AND DETAILS OF SLIDE-REST FOR 4½-IN. CENTRE LATHE.

of undercutting in the interior angle, but lessens the risk of the corners being knocked off when anything happens to strike them.

Figs. 46 and 47 show the details of the screws. These are held in position by glands (Figs. 48 and 49).

To make the construction more easily understood, the castings are shown separately, Figs. 51 to 56, together with the nut to suit the screws.

The rest is bolted to the saddle by bolts through the curved slots, so that it may be set at any angle when it is required to turn any conical or tapered object in the lathe.

(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.

THE first indoor meeting of the new Session will be held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., when the locomotive testing stand now under construction will be inaugurated. It is requested that all members owning locomotives will bring them to this meeting and run them either on the stand or track. Readers of this Journal who are thinking of joining the Society should apply to the Secretary at once to ensure their being elected at the above meeting; the payment of a year's subscription will cover the period from September 25th, 1907, to October 31st, 1908. Full particulars and forms of application may be obtained from—HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

Portsmouth Model Yacht Club.

AN open race for 10-rater model yachts was held on Wednesday afternoon, on the Canoe Lake, under the auspices of the Portsmouth Model Yacht Club, the yachts being started with a very light breeze blowing, which remained fluky all the afternoon. The Club was again honoured by two London competitors—Rev. — Newton, London Model Yacht Club (*Scout*), and Mr. Johnson, Alexandra Model Yacht Club (*Togo*). The final scores were: First, Rev. — Newton's *Scout*, 20 points; second, Mr. Coxon's *Saucy Sally*, 14 points (P.M.Y.C.); third, Mr. Brown's *Dorothy*, 12 points (P.M.Y.C.); Mr. Johnson's *Togo* securing fourth place, and Mr. Clive Wilson's *Florence* fifth (P.M.Y.C.).—Hon. Secretary, CLIVE WILSON, 343, Fawcett Road, Southsea.

A FIRM in Munich has built for the Bavarian State Railways a locomotive capable of hauling a train weighing 165 tons at a speed of 93 miles an hour. This engine was tested on July 1st and 2nd, and, it is said, maintained for a prolonged time a speed of 96 miles an hour, which is declared to be the greatest speed ever made in Europe by a steam locomotive. It is a four-cylinder compound with 6-ft. drivers, and fitted with a superheater.

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.]*

Facing Points for Model Railways.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Mr. W. J. Ward's letter *re* mechanical contrivance for moving facing points for model railways is a very good one, as I can testify from nearly three years' use with the same, and the efficiency of the arrangement for holding the points firmly in position leaves nothing to be desired.

But there are two considerations against its use in practice: first, there is much friction, which throws great strain on the pivot pins of the bell cranks guiding the point rods; and, secondly, the movement required is rather a long one. In my case, with ¼-in. opening of the points, a movement of 11-16ths in. was found necessary. The curved part of the slot was made ½ in. long, the straights each end ⅛ in.

These straights permit a slight movement of the point rods, due (in real practice) to variance in the temperature, and yet do not cause any movement of the points themselves; in model work they take up any lost movement due to slack in the pins.

It is advisable to fit signal detectors to this arrangement.

My points failed to close properly on two occasions only, and each time the defect was immediately discovered through the detectors not acting; but the attempt to pull over the signal being prevented by the detector, put such a strain on the signal wire that caused it to break. Rods were consequently used as far as the detectors; this also did away with the heavy counterweights necessary to ensure the bars coming out of the slots of the detector when the signals were put back to danger. I now have four pairs of points, each fitted with a locking bolt, actuated by a separate lever to the point lever, as is the usual practice in this country, and from three months' use I prefer them to the old arrangement.

In the device used by Messrs. Bassett-Lowke and Co., the lever is part of the apparatus and fixed close to the points; the defects I mention above do not then occur. The arrangement shown by Mr. Ward will be found in Sir J. Wolfe Barry's book, "Railway Appliances."—Yours truly,

New Bushey, Herts. WILLIAM E. WEBB.

Oil Engine Troubles.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—If you will permit me the use of your valuable pages, I should like to inform "Puzzled" (Cockermouth), Query No. 17,636, that he is not alone in his troubles with small oil engine. His experience has been mine also. After trying several methods without success, I concluded I should do no good with paraffin oil, so I have now converted it into a petrol engine.

I first made a surface carburettor, after Mr. Percy Briggs' design, which I find gives a very rich gas; I put an air-port in feed-pipe, which

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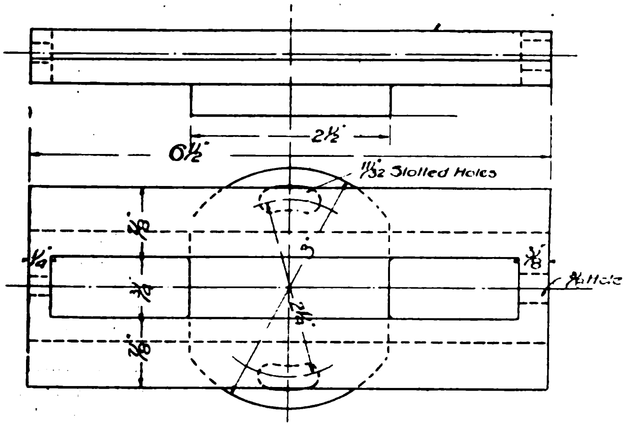
FIG. 51.



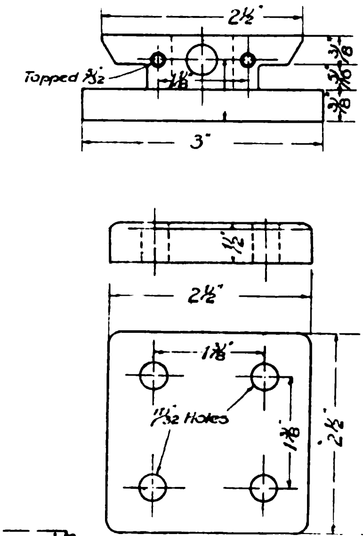
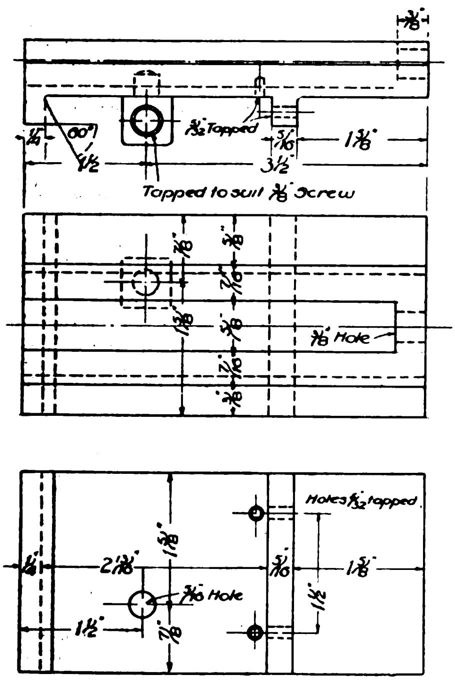


FIG. 54.

FIG. 52.



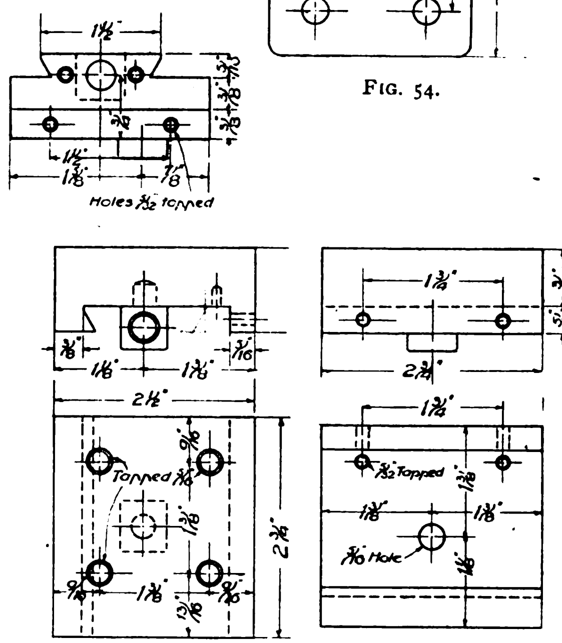
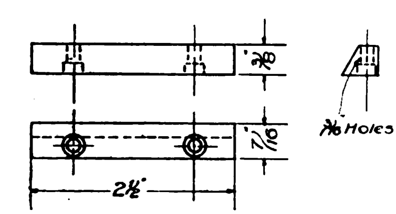


FIG. 53.



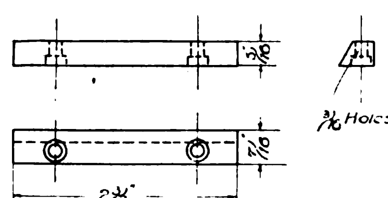


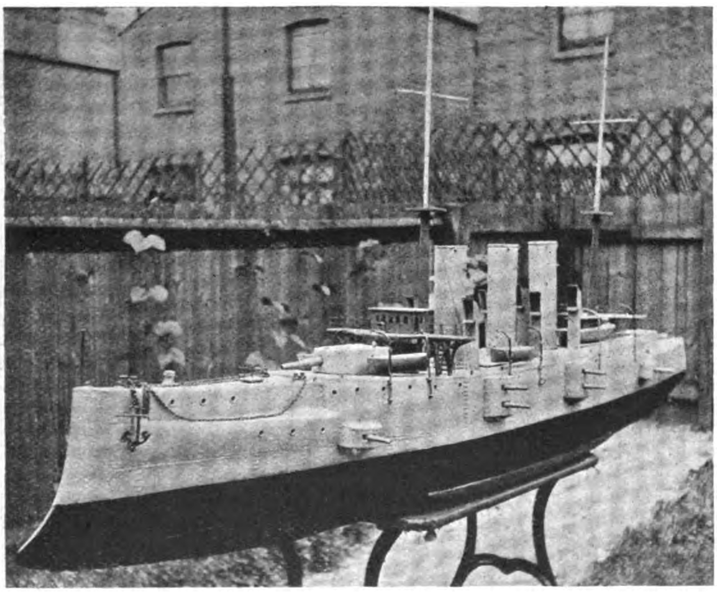
FIG. 55. FIG. 56.

DETAILS OF SLIDE-REST FOR 3½ IN. CENTRE LATHE.

can be regulated, and I find I get a very explosive mixture. In place of tube ignition, I have fitted a spark plug, with "make-and-break" contact on side shaft which works exhaust. This, I find, gives a very wide range of timing, and also, if set properly, does away with danger of back-firing, which I found very pronounced with tube ignition.

It was only after completing these alterations that I succeeded in running. I am now fitting another pair of timing wheels to work inlet valve mechanically, and also intend filing a shallow groove round piston block exactly where piston stops under lubricator, as I find oil is not carried into cylinder, but is swept out and compression lost. "Puzzled" will do well to look to his compression. If particulars of any alteration I have made to my engine would be of advantage to "Puzzled" or any other reader, I shall be pleased to supply them.—Yours faithfully, FRANK HOLMES.

Cheadle, Staffs.



MR. G. V. S. ROBINS' MODEL CRUISER.

A Model Cruiser.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The above cruiser is made from descriptions given some time back in THE MODEL ENGINEER. The hull is built of strips of wood and afterwards covered with strips of sheet zinc riveted on to the wood, which gives the hull a very realistic appearance. The ventilators are made of sheet zinc, with all joints soldered. The bridge is built up of brass tubing and rod and sheet zinc. There are twelve small and two large guns. There is also a steam pinnace behind the funnels. Electricity comprises the motive power. The motor is an H type armature, made from castings supplied by the Clyde Model Dockyard. It is driven by a 6-volt accumulator placed under the funnels where there is an opening made for same. The length of the model is 63 ins. over all, and it is painted the latest war colour. The model took over two years to make.—Yours truly,

G. V. S. ROBINS.

Croydon.

Proportions of Steam Pipes.

To THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In your issue for December 27th, 1906, I notice on page 618 a reply to a question asked by W. S. *re* the proper proportions of steam pipes.

You give a formula for determining these proportions, together with an example worked out for a cylinder 2 ins. by 2 ins. The example ends with the astonishing statement that: $\sqrt{\cdot 4} = \cdot 2$,, and that the size of pipe is, in round numbers 3-16ths-in. bore. As a matter of fact, $\sqrt{\cdot 4} = \cdot 632$; therefore, by your formula, the steam pipe should be ·632-in. bore, or approximately ⅝ in.

Now I think you will admit that a steam pipe ⅝-in. bore is a bit too large for a 2-in. cylinder, therefore there must be a weak point in your formula. I think that this weak spot lies in the fact that a velocity of 30 ft. per sec. is too low; 100 ft. per sec. would be more in accordance with the usual practice. The actual velocity of the steam in the example you give, with a 3-16ths-in. steam pipe, would be about 340 ft. per sec.

As this subject is of importance to your readers, I trust you will pardon my calling your attention to the error.—Yours sincerely,

STEPHEN COULSON.

Auckland, N.Z.

A NEW EITHER-SIDE BRAKE FOR RAILWAY WAGONS.—A new brake for railway wagons, designed to fulfil the Board of Trade requirements, has recently been patented by Mr. Thomas Dawber, of Wigan, and it is said that it will be likely to create considerable interest in railway circles, because it complies with all the conditions published by the Safety Appliances Committee. In Mr. Dawber's arrangement the hand-levers are of similar pattern on both sides of the wagon, and the method of operating both levers is identical. By pulling one hand-lever out of the lever-rest, the other hand-lever is also pulled out automatically, and then by pressing one lever down, the other lever is by an ingenious arrangement also pressed down, and both pairs of brake blocks are applied to the wheels. This is just what is required, and it would appear, therefore, that Mr. Dawber has successfully solved a difficult problem. Being an engineer of an inventive turn of mind, and having had a training in practical mechanics, he has been able to produce a brake that fulfils the necessary conditions, where many other inventors have failed.

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Queries and Replies.

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

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

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

[18,067] **Accumulator Making.** R. C. (Bristol) writes: I should feel greatly obliged if you would answer for me the following. I wish to make an accumulator, about 6 volts, as a friend gave me nine lead grids, 4 ins. by 4 ins. I propose making them up for a 6-volt battery, one positive and two negative in each cell, pasted with red lead and litharge. (1) When pasting grids, what strength acid solution should I use? (2) What strength acid solution for cell when made up? (3) Would a case made of wood coated with marine glue be suitable? (4) About what amperage can I expect to get from battery when fully charged? (5) What would be about the charging rate? (6) Also highest rate of discharge?

(1) Concentrated acid 1 part, water 1 part. (2) Concentrated acid 5 parts, water 21 parts. Specific gravity = 1·184. (3) Possibly, but this is apt to give trouble some time or another. (4) If well made and in good condition you can reckon about 15 amps. per sq. ft. of + plate surface. (5) Discharge rate not to exceed 5 amps. per sq. ft. of + plate. (6) Charge at about the same rate.

[18,065] **Speeds for Driving Emery Wheels.** O. I. H. (High Wycombe) writes: Will you kindly give me information regarding the following. I have a 15-in. flywheel, which I propose to use to drive a 5-in. emery wheel mounted on a polishing head, size of pulley 1¾ ins. diameter. Shall I obtain sufficient speed to make emery wheel cut efficiently?

The speed of emery wheels varies from 4,000 to 6,000 ft. per minute, according to their manufacture. If a vegetable binder is used, the maximum of 100 ft. per second is allowable. If you drive from the 15-in. flywheel on to a 1¾-in. pulley, the speed of driver being, say, 100 r.p.m., the emery wheel will be running at, approximately, 850 r.p.m. Its diameter being 5 ins., this gives an approximate circumferential speed of

$$\frac{850 \times 5 \times 3{\cdot}14}{12} = 1114 \text{ ft. per min.}$$

Hence to run at anything near the most efficient speed, either the driver must be increased in diameter, or its speed increased threefold. Of course, grinding of a kind can be done at very low speeds.

[18,073] **Building Small Oil Engine from Castings.** R. B. (Leicester) writes: Could you kindly help me in the following queries? I have got a machined set of oil engine castings, size, 2¼-in. bore, 3-in. stroke, but cannot get it to work properly, the vaporiser especially giving no good results at all. I wrote to the makers, and can get no satisfactory answer. I therefore intend fitting a new back cover, as per sketch (not reproduced), and running it as a gas engine. There is about 1 in. of space at back of piston. Will this be enough now that the old vaporiser is gone? Of course, I can alter it if you think it is not enough for compression. I should like you to give an opinion on the arrangement of valves in the back cover; also give suitable sizes for same. I intend running it on petrol gas, and should like you to tell me which you think the best carburettor of the three following: the one shown on page 141 of THE MODEL ENGINEER for August 8th, 1907, or the one shown on page 281, Vol. VI, of THE MODEL ENGINEER, or the one shown in your handbook on "Acetylene Gas." Personally I think the first-mentioned the best, but was afraid engine would suck petrol instead of drawing the air through: what do you think? What size should ignition tube be? It is to be heated by a benzoline blowlamp. Only the exhaust valve is opened mechanically; the gas and air valves are by suction. Would it be advisable to have a tap in air pipe to cut down supply of air if needed? I might say engine is water-cooled; also I have your handbook on "Gas and Oil Engines."

We regret to hear that you have obtained no good results with this engine. However, a great deal depends on the nicety of adjustment and fitting. Your new design for the back end will do very well, but we should make the gas valve a bit smaller, and the air and exhaust larger—as large as space will allow. The carburettor shown on page 159, October 1st, 1902, issue, is most suitable. Yes, insert an adjustable check in the air pipe to regulate the supply; make all exhaust passages as large as possible, and with as few bends as possible, too. Although it is quite possible that the engine castings, etc., are perfectly sound and good, yet you must not expect to obtain a first-class set of engine parts at a very low price. We have seen engines of this make running, and, considering their price, they run very well. But we can never advise a low-priced engine.

[18,071] **Small Lighting Plant for a Workroom.** W. B (Nelson) writes: I wish you to answer me the following questions:—(1) What size of dynamo (in volts and amps.) would you use to light a cellar used as a workshop, which is 13 ft. by 13 ft. by 6 ft. high? (2) Would a water-motor with 10-in. wheel and buckets made of ⅜-in. brass tube cut in half drive the above dynamo? If not, give size of water-motor which would drive the dynamo. The motor has to be run from cellar tap.

This depends upon the supply of water available. Two 8 c.-p. lamps would be needed, and for this a dynamo of 150 watts would do. A water motor of ¼ h.-p. would just be able to cope with the load with both lamps burning. The design given in December 15th, 1901, issue, page 269–271, would meet your requirements, provided your water supply is good enough.

[18,070] **Construction of Large Induction Coils.** B. H. (Oldham) writes: The following are some queries that I should be glad if you could answer: (1) Would hard black fibre tubes and blocks be satisfactory instead of ebonite for a large spark coil such as described below? (2) I am thinking of building a large spark coil (having successfully made a 4-in. one). The following are the proposed dimensions: Core—1·1 in. gross diameter, 18 ins. long; iron wire, No. 22 S.W.G. Primary—wound on about 16½ ins. No. 12 S.W.G. D.S.C.; total, 446 turns. Primary tube—hard black fibre ⅛ in. thick, 1¾ ins. internal and 2 ins. external diameter; 24 ins. long. Secondary tube—over the primary tube is the secondary tube of similar material, 2 ins. internal diameter, 2¼ ins. external diameter—*i.e.*, ⅛ in. walls, 18 ins. long. The ends of this tube will be screwed to take nuts to clamp the ½-in. block fibre and pieces. Distance between insides of end pieces, 15 ins. There will be one ½-in. piece in the middle to act as a support. From the above it will be seen that 14½ ins. is the gross available winding length, and allowing 25 per cent. for insulation between sections (found from experience to be about correct), we get net length available for wire 10·875 ins. What I want to know now is about what weight of No. 36 S.W.G. s.c.c. will be needed, taking for easy calculation (net) 11 ins. winding length, 2½ ins. internal diameter of sections, 5½ ins. external diameter of sections. (3) I should like you to make any suggestions as to better proportions for this coil. (4) About what spark length should I get at full power? (5) About what would be the most suitable voltage to use, and the maximum current needed at that voltage to give normal spark? The object in having two tubes is two-fold: first, that in case of being punctured (very unlikely), by turning the inner one half round the fault would be practically mended. Secondly, that the whole primary coil and tube can be withdrawn without any trouble to assist cooling after a long run or for examination, and to permit of ready disconnection from the base for such withdrawal. I propose to have each coil of the primary brought to a separate terminal mounted on a block in the end of the tube which is very long, in order to keep the primary terminals out of range of the secondary ones. These separate terminals of primary coils will allow of the latter being used in series or parallel—wires being led from them to terminals and switches permanently fixed upon the base-board, for convenience and safety of such manipulations.

Your data appears to be all right, but ebonite is, of course, the more suitable insulating material, and we should recommend it in preference to any other. The arrangement of tubes is useful, inasmuch as breakdowns can be temporarily put right, but, on the other hand, you increase the distance of primary from secondary windings. The weight of primary will be approximately 6 lbs., and of secondary about 19 lbs. You will find it profitable to read Hare's "Large Induction Coils," 7s. 10d. post free, before attempting this job. The cost of construction will also be an item worth consideration, viz., the matter of £10 or £12.

[18,025B] **Heating Surface of Locomotive Boilers.** N. G. writes: Are the large boilers fitted on our modern locomotives for the purpose of increasing the heating surface, or are there other reasons for using such boilers?

With increases in over-all dimensions, of course larger heating surfaces and fire-grate areas are obtained; this, in turn, means a greater evaporative power, and although the cylinders themselves may not be increased in capacity, an increased i.h.-p. is obtained where the larger boiler is employed, and the tendency to prime is also reduced. Compare the G.N.R. 8-ft. singles with the latest "Atlantic" engines as regards boiler and cylinder proportions.

[17,852] **Miniature Locomotive Details.** B. F. (Birmingham) writes: I have built a model locomotive as per the rough drawing (outline diagram only reproduced). I have

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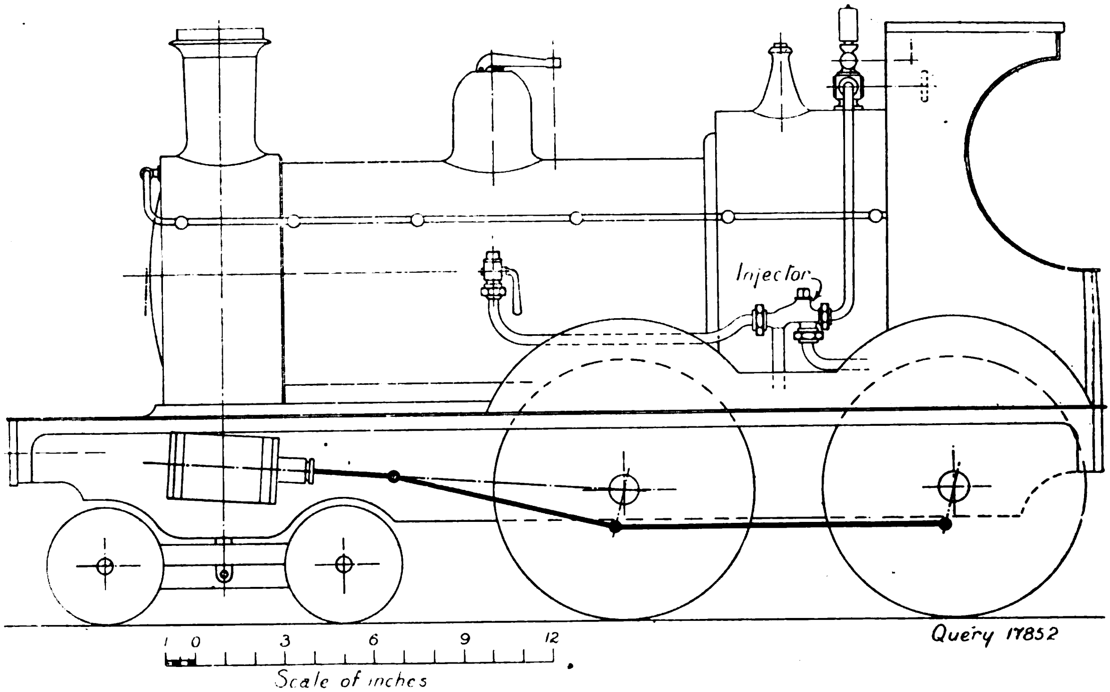
had her at work on a short track, and she has pulled a load of nine people; but she does not seem to make steam quick enough, as the pressure quickly falls after working for a few minutes, and I am writing to ask if you will be kind enough to advise me on the following points: (1) The steam, you will notice, is taken from boiler dome by a short tube in smokebox direct to cylinders, and I propose to lengthen this tube and give it five turns in the smokebox to superheat the steam; will this be a correct thing to do? Of course, when the engine is stationary and steam up, this tube will become very hot; is there any danger when the steam is turned on into this tube to start the engine? I mean, I use a coal fire, which burns exceedingly well through the seven 1-in. diameter tubes, and with the blower on I can get an almost white-hot fire. (2) The feed-water to boiler is supplied by a ½-in. by 9-16ths-in. pump, working between frames from eccentric on driving axle, but it does not seem to keep the water level up in boiler. So I have fitted an auxiliary pump in tender to work by hand; but this seems a lot of trouble, and I propose making a new pump to work from driving axle. Will you kindly say what diameter plunger this should have, with a 9-16ths-in. stroke, to keep the boiler well supplied when the engine is running; at present the pump delivers the water through a back-pressure valve in the centre of barrel in the same position as the one shown working by injector, but on opposite side of barrel. Now I propose altering this arrangement and fixing a back-pressure valve in the bottom of smokebox tube plate—just below the bottom row of tubes—and I propose to give this feed-tube a couple of coils in the smokebox, to warm up the water before it passes the back-pressure valve into the boiler. I have a Vic injector fixed to one side, but this will not work at all at any pressure. I have not interfered with it since I bought it some five or six years ago; it was guaranteed to work at any pressure up to 100 lbs., and to start to work directly steam was turned on, but it does not; can you kindly explain why? What will be the highest safe working pressure this boiler will stand? It is made entirely of copper, the barrel being a solid-drawn copper tube 3-16ths in. thick, 7 ins. diameter, and the plates are 3-16ths in. thick; also there are seven solid-drawn brass tubes, No. 14 wire gauge thick; the plates, etc., are all riveted together with ⅛-in. copper rivets, ⅞ in. apart. I have pumped up to 200 lbs. pressure with water. I sweated the whole of the seams together with soft solder, and although she leaked under water pressure (over 50 lbs.), she was perfectly steamtight at 100 lbs. Of course, I have not tested her with water since sweating her up, but I am not afraid of her leaking now. What I wish to know is—What is the highest steam pressure she will stand considering this soft soldering? She is well stayed all round—firebox with ⅛-in. fine thread copper stays and two longitudinal stays above tubes through barrel.

(1) The provision of the superheater is, of course, a help, and you will have no trouble with regard to the heat to which the tube in the smokebox is subjected. If you are not experienced in coppersmith's work, do not go in for a gridiron type of superheater, but a plain tube coiled in the smokebox, without joint. This is what is used in "The Little Giant," and has never given any trouble. Your drawing does not give the size of the cylinder, but we may say that the heating surface is insufficient, and the firebox is about half the size we would have advised it to have been made. (2) Not having the consumption of steam stated we cannot give you the proper size of pump, but you would do well to make it somewhat larger, say, about 1 inch, and return the surplus water to the tender by a by-pass pipe from the delivery. See recent articles on "Model Making Wrinkles." (3) Except that the check valve will be in a dirty place and be awkward to get at, there is no objection to the scheme. (4) From our experience we think that the back-pressure valve is quite unsuitable. The passage-way in the cock is much too small. We have an article in hand in our "Chats on Locomotives" series dealing with this question. The area of the hole through the cock should not be less than that of the pipe, otherwise the injector will not work. (5) We must have a drawing showing stays before we can give the maximum working pressure to which you can safely press the boiler. From what we can see, however, we should say that 80 to 100 lbs. is quite a reasonable pressure to work at. Soft solder will commence to get plastic at over 100 lbs. steam pressure, and may then blow out of any joint which is at all open.



OUTLINE DIAGRAM OF MINIATURE LOCOMOTIVE.

[18,064] **Accumulators.** S. C. (Todmorden) writes: I shall be grateful if you will answer me the following:—(1) Is it only the positive plates that require putting into the concentrated solution of chloride of lime? Will you tell me what strength the solution is about, and how long it usually takes to form? The plates are 8 ins. by 6¼ ins. by 3-16ths in. (300 holes, ¼ in. square). (2) Is it possible to buy moulds for casting accumulator plates? I have your book, "Small Accumulators." I have begun cutting grooves in the plaster, and find it a rather tedious task. (3) I am making the 12-volt 32-amp. accumulator, as in your handbook. It does not give the size of wood case in the book, but I have had made an oak case which has six partitions, of course each measuring 11 ins. high, 7 ins. long, and 4 ins. wide (inside). I suppose this will do. The box has a sliding lid like a chalk box. When I take the accumulator to the charging station, should there be a piece of glass between the lid and the top of the cells, to prevent the acid splashing against the wood lid? The box is very strongly made, the wood being ⅜ in. and

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¼ in. for the partition pieces, with dovetailed corners. The book says the discharge should not be above 8 amps. Will you please tell me how many 12-volt 16-c.-p. lamps I can light with the above discharge? I am an apprentice plumber by trade, and as this is my first attempt at anything in the accumulator line, I have had little experience in these things. I have been a reader of your journal for about four months, but I have never noticed any replies to the above questions.

(1) Yes. Use a concentrated solution, and the action will not take long to complete. The paste should go a dark brown (chocolate) colour. (2) Yes. Whitney's would supply you. (3) So long as the case holds the plates easily that is all that is required. Yes, of course, protect the wood from the action of the acid as much as possible. (4) Reckon 3½ watts per c.-p. At 12 volts a 16-c.-p. lamp would take 4 or 5 amps., which is about as heavy a discharge as your cells will stand. We should advise using lower c.-p. lamps, and run a few in parallel. You should obtain back volumes of this journal, and read up the subject.

shaft and its reversing arm is that shown on the accompanying drawing; the eccentric sheave is placed in the other quarter of the crank-pin circle. The gear as depicted is, therefore, in back gear. To provide a proper bearing for the pivot pin, the piece of brass plate which should be used to thicken up the frame for the driving coupled axles is carried forward as shown in the two views. The back plate of the link is also provided with a boss into which the shouldered pivot screws. The eccentric-rod should be arranged with a 7-64ths-in. steel pin projecting inwards through the slot. The steam ports should measure 5-64ths by ⅜ in., and exhaust ⅛ by ⅜ in. Practically no lap should be given to the valve, and best results will be obtained if the gear is truly in line, and none of the rods set out of the straight. The main dimensions will vary according to those of the locomotive being modelled.

[18,095] **Small Ring Armature Winding.** L. P. (Falmouth) writes: I should be very grateful if you would give me the following information. I have a set of dynamo parts, and wish to wind it to give me at least 12 volts and as heavy a current as I can below a maximum of 6 or 7 amps. The armature has eight slots, and I have a commutator built up of sixteen sections. If I wind two separate coils in each slot and connected in series on the commutator, will the commutator act as well as if I wound one coil on each slot and connected every two segments on the commutator and used it with larger brushes as an eight-segment commutator? Kindly give the amount of wire and gauge I must use on armature and field-magnets. Armature (ring), eight slots: outer diameter, 3¼ ins., 1¼ ins. long; inner diameter, 2¼ ins.; slots, triangular shape.

You can treat the windings in one slot as two coils, and then connect up as a sixteen-section winding. Wind armature with No. 20 S.W.G. full, and field-magnets with about 2½ lbs. No. 22 in shunt to brushes.

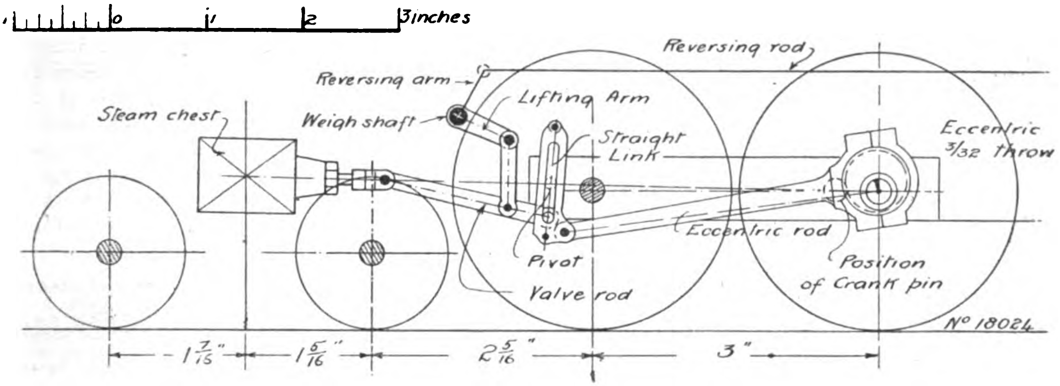

Fig. 1.—Single Eccentric Valve Motion for 2-in. Gauge "Atlantic" Locomotive.

[18,024] **Single Eccentric Valve Gear for Small Model Locomotive.** F. A. S. (Detroit, Mich., U.S.A.) writes: Will you kindly publish drawing, with dimensions, of *outside* valve motion for ⅜ in. or 7-16ths in. scale outside cylinder "Atlantic" (4—4—2) type locomotive? See "The Model Locomotive," Fig. 176, page 154.

The drawing on page 154 of "The Model Locomotive" is arranged more particularly for an inside cylinder model. We therefore

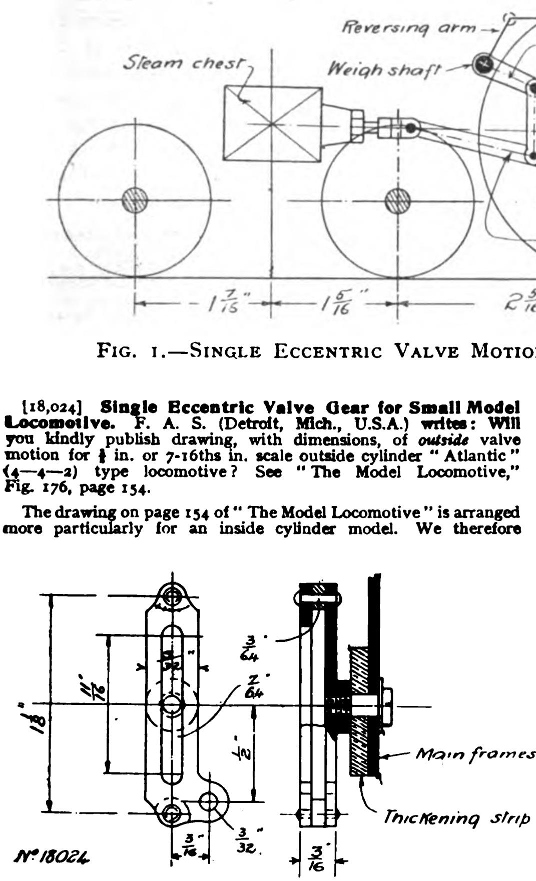

Fig. 2.—Full Size Detail of the Link.

publish herewith two sketches, showing a method of applying the gear to an outside cylinder "Atlantic" express engine. There are two positions in which the link may be placed: (1) behind the leading coupled axle, and (2) in front of the coupled axle, as shown. With the G.N.R. wheelbase dimensions (see drawing) we tried the first method, and even with the eccentric rod very short we found that the cranking of the valve rod to clear the coupled axle works out rather excessive, therefore we recommend the arrangement shown in Fig. 1. The link, as will be seen, is straight, and is built up on a back plate similar to that for the gear shown on the next page (p. 155) of "The Model Locomotive." There is no necessity to make the link curved, as linking up in such a small model locomotive is never resorted to. The most convenient position of the weigh-

[18,093] **Speeds for Driving Small Lighting Sets.** G. C. M. (Sunderland) writes: I am writing to ask your advice. I have a small novelty dynamo, which is supposed to light a 6-volt lamp with very little power and at a low speed. Now a competent engineer has made me a steam engine (twin-cylinder slide-valve) of ¼ h.-p., and we have had engine running at 700; then on to a small gear at the rate of 10 to 1, making 7,000 revolutions; then same is doubled, and then run on to dynamo; this is 1,400 revolutions, but as there was a loss of power—as we were using tape belts—we only got a little over 7,000 revolutions; at this rate we got a red glow. Now I, being dissatisfied with this, drive off small 1 h.-p. gas engine, diameter of flywheel being 13 ins. and the diameter of pulley on dynamo 7-16ths in.; this is 26 to 1. We had engine going at 400 per min.; this makes 1,600 rev., but afterwards this was reduced to 9,000, as we would burn out lamp. Can you advise me what to do, as the small twin-cylinder steam engine does not get such a tremendous speed as 9,000, which, however, is called low speed and low power. By sight alone, not counting gearing, we could see dynamo was going well over 9,000.

We are afraid both your figures and reasoning are at fault. To begin with, you do not mention the size of your lamp (*i.e.*, wattage or candle-power), and, secondly, it is quite impossible to "see" and say whether the dynamo is running at 2,000 or 10,000 r.p.m. As you have based your calculations on purely estimated speeds, we are inclined to think that in this your error lies. Besides this, belt slipping not only reduces the speed of the driven pulley, but absorbs more power than would be taken in the ordinary way were it driving properly. Then, again, your small pulleys are too small, *i.e.*, the surface contact for the power to be transmitted is far too small. If the same ratio is to be kept, make both the driving and the driven pulleys larger.

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The Editor's Page.

WE have been asked by two intending entrants for the Open Competition at our forthcoming Exhibition whether they would be eligible or not, in view of the fact that the models they proposed entering were the originals of descriptions in THE MODEL ENGINEER, or, in other words, because their models happen to have been made before their descriptions and drawings appeared in our pages. At first sight this appears to contravene the regulations of the competition, of which No. 3 states that the competing models "must be the result of instructions given in the pages of this Journal." On giving the matter further thought, however, it is clear that the original model is the result of the design and ideas of the author, and the fact that this design and these ideas are imparted to other readers puts both the originator and the reproducers of the model on the same footing so far as knowledge is concerned, while in the matter of constructional skill the originator has not necessarily any advantage at all. Apart from this, however, the underlying idea of the competition, as we have previously pointed out, is to enable us to put in front of visitors to the exhibition a display of models which have been fully described in our Journal, and which anyone who is sufficiently interested can make for himself by following the instructions given. Under these circumstances we see no objection to accepting entries of the original models of the various articles. There are many cases where no actual model has been built prior to the appearance of the design in our pages, and then, of course, the point raised above does not enter into consideration at all.

* * *

Another correspondent has asked whether we shall give any preference to purely amateur work as against that of professional mechanics. We would repeat, in regard to this, our remarks of last week—that the competition is open to all, and that no distinction will be made. Each model will be judged entirely on its merits as a piece of work. Although this may perhaps put beginners out of the running for a prize, we do not think it will operate unduly against many of the competitors, for we have often seen amateur work which is quite equal to anything turned out by a professional model maker, and the amateur who does score over his professional brethren will have an additional reason for feeling proud of his success. Still another question has been put to us, asking whether, provided the published design is followed, the use of a different material would disqualify, the case in point being a cardboard model of a locomotive built to some drawings intended for a working model in metal. Our reply is that such a model would be quite eligible to compete. We may perhaps say that, in the event of there being models in any of the classes which, while they do not gain a medal are still of considerable excellence, extra certificates of merit will be awarded.

* * *

No exhibition is considered quite a success without sweet music's soothing charms, and in this respect there will be no fault to find at the Royal Horticultural Hall, for we have been fortunate in securing at considerable expense the exclusive services of Herr Ph. Meny's White Viennese Band for the week. This celebrated band, which has been such an acceptable feature of many recent exhibitions, will give three performances a day under the personal leadership of Herr Meny, and will, we are sure, prove a charming addition to the many other attractions we are providing.

Notices.

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

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Contents.

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

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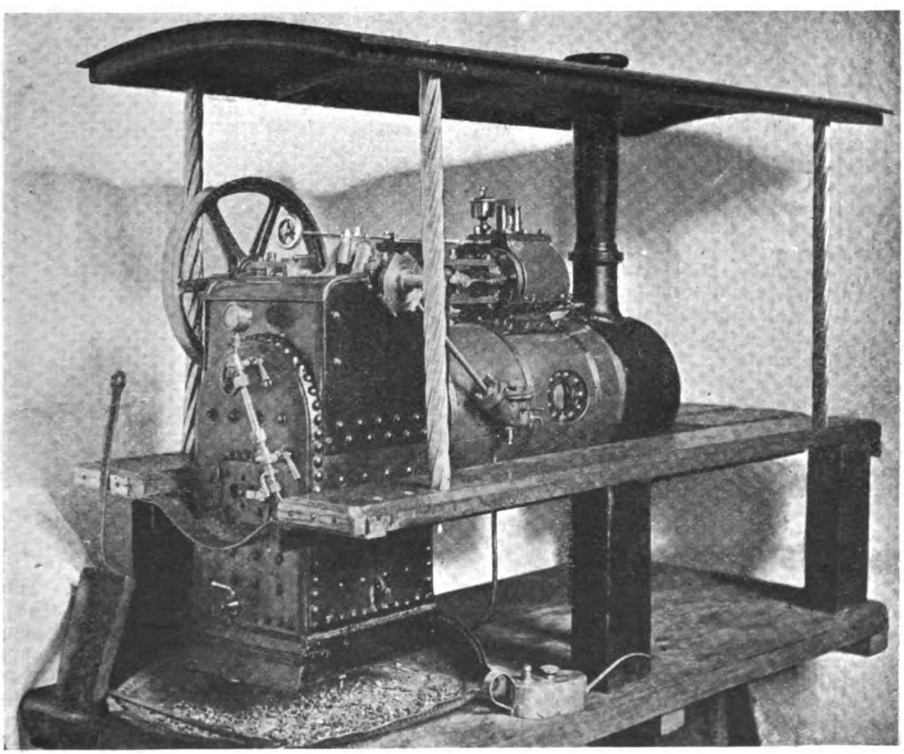
A Portable Electric Light Engine.

By F. PHAREZ.



A PORTABLE ELECTRIC LIGHT ENGINE.

THE following is a short description of an electric light engine that I have just built, with the idea of making a model electric light plant such as is used by travelling showmen. In building this type of engine my aim was to have a plant that would be very compact, but at the same time powerful enough to drive a 150-watt dynamo for charging accumulators and lighting.

Having decided on what I thought would be suitable dimensions, I prepared some rough working drawings full size. I then made patterns for foundation and fire-hole rings, also front and back

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tube plates, which I had cast in gun-metal. The front tube plate I turned to 6 ins. diameter, but the other castings were finished with the file. The rings were made ⅜ in. thick to give me plenty of water around the firebox. I then commenced on the boiler proper, and soon found out that boiler-making of this size was by no means light work. The plate I had to cut to shape with the chisel, while my only means of bending and flanging the boiler plates were a hammer and an iron block (the latter I had cast from a pattern I made). But I managed very well with these.

The following are the principal dimensions of the boiler :—Over-all length, 24 ins.; barrel, 12 ins. long and 6 ins. inside diameter; firebox casing, 7½ ins. long and 10 ins. high. Both these plates are of mild steel 1-14th in. thick. The longitudinal seam of the barrel is double riveted with 3-16ths-in. copper rivets, and all the other seams are single riveted.

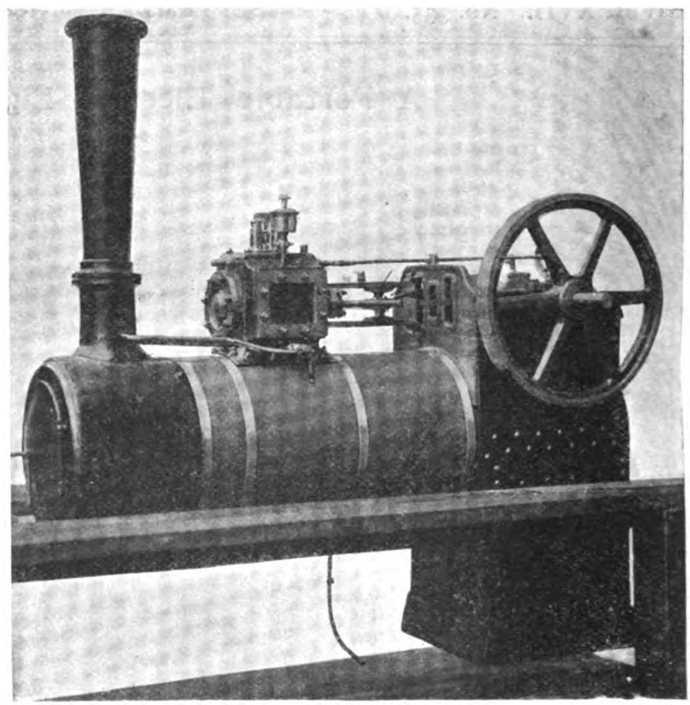
The firebox is made of 1-14th-in. copper with the exception of tube plate, which, as mentioned before, is a casting 5-32nds in. thick at the bottom and ¼ in. thick at the tube holes. The inside measurements of firebox are: height, 7 ins.; width, 4¾ ins.; length, 5¾ ins. There are twelve ⅜-in. brass fire tubes, 12½ ins., expanded into the gun-metal tube plates, with a small expander which I made (the triple roller type). The throat and back plates are of 1-12th-in. copper, as I was not certain I could make a neat job of them in steel without the use of proper dies.

The firebox is stayed with forty-four 3-16ths-in. copper stays 1¼-in. pitch, screwed and riveted over. Nine roof stays are fitted, and six 3-16ths-in. longitudinal steel stays, nutted each end. All the seams are caulked, no solder being used whatever in the construction of boiler or engine. The smokebox is 4½ ins. long, 6½ ins. diameter, fitted with door for cleaning purposes. This is of the locomotive type, and has the usual dart rod and bar. The funnel base is an iron casting cored out 1¾ ins. The boiler is lagged with 3-16ths-in. asbestos board, and covered with thin sheet iron enamelled green and kept in position by four ⅜-in. brass bands drawn tight with bolts. The working pressure of boiler is 50 lbs.

The cylinder, slide, and stop valve chests are three separate gun-metal castings bolted together with fourteen 5-32nds-in. steel studs and nuts, six being used for the top and eight for the slide-valve chest. The cylinder is also cored out for the governor throttle and steam ways to the steam chest. The cylinder is bored out to 1⅞ ins. diameter by 3 ins. long, and the piston is cast iron and has two rings. These are made of ⅛-in. square tool steel bent to shape and carefully turned on a mandrel. I took great care to make the rings a good fit in their grooves. The piston-rod is of silver steel, ¼ in. diameter, turned taper each end, secured to piston with a nut, and the crosshead secured with a taper cotter.

The cover plates of cylinder and valve chest are iron castings, and the crosshead a gun-metal casting. The slide bars are made of ½-in. by ¼-in. tool steel firmly bolted to a substantial cast-iron motion plate, which in turn is bolted to the bearing plate, so that the boiler is relieved of the strain of the engine. The crankshaft I had forged solid, and pieces on the ends for centreing the dip, which was cut out after I had roughed the shaft all over. The journals are ½-in. diameter, and the other parts ⅝-in.

The connecting-rod is a mild steel forging 6 ins. between centres, and is fitted with a steel draw-wedge and split brasses to take up wear. The force-pump is a gun-metal casting, and has a hollow ram with the gudgeon-pin fitted about half-way down to do away with side rock. This pump I



Another View of Portable Electric Light Engine constructed by Mr. F. Pharez.

specially designed for high speed. The stroke is only 5-16ths in. and bored out to 7-16ths in., and it will feed well at almost any speed. The valves are ¼-in. bronze balls. Both eccentrics are made of iron castings. The engine has only one eccentric at present, but I am now working on the governor and reversing gear.

The engine (as will be seen from the photographs) is mounted something after the style of a travelling showman's electric light plant, except that it has no wheels. The frame is made of 1-in. by ¾-in. angle steel, riveted up. The platform is oak, 3 ft. long and 1 in. thick by 15 ins. wide, and will be supported by angle iron when finished in place of the wooden legs seen in the photograph. The top covering is made of ¼-in. mahogany, varnished, and supported by four iron rods covered with hexagon tubing twisted.

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I have had the engine running several times, and she behaves splendidly; the fire burns perfectly, and, using coal and coke for fuel, I can raise steam in fifteen minutes from cold water, lighting up in the ordinary manner with wood and coal. The speed of engine will be 500 r.p.m.

The model has taken me so far 2½ years of my spare time to build, that is making everything except nuts and steam gauge. The patterns took a long time to make and design, the entire work being purely amateur, and, of course, my own design. With the Editor's permission, I intend to send a photograph of the engine and dynamo complete when finished.

A Simplified Potentiometer.

By H. S. Manisty.

As probably most of The Model Engineer readers already know, with a potentiometer and its accessories many things can be done. For example:—

Small and also very large voltages can be measured, though in the present case the range will only be from 0 to about 30 volts, reading to about ·1 per cent. Small resistances, such as armature coils and also large ones, can also be accurately measured. An ammeter is necessary for this, as a piece of extra apparatus. Small and large currents also come within its range with great accuracy. It is specially useful for graduating volt and ammeters.

I will now try and make clear the principle of this apparatus. It is based on Ohm's law, which shows that the fall in potential down a uniform wire carrying a current varies directly as the length of the wire, and also that when two equal and opposite potentials are present in a circuit no current flows in that circuit.

The instrument consists of five parallel wires of No. 30 S.W.G. manganin, and 1 metre long, connected at their ends to heavy brass bars, slit, as seen in the plan, Fig. 1. These bars are considered to have no resistance compared to the wires, and the arrangement is virtually one wire 5 metres long. A constant current is passed through this (about ⅛ amp.) from two accumulator cells. This current is regulated (by cutting out more or less of the last two wires with a piece of thick flexible wire) till the drop down 1 metre length is exactly 1 volt, then the drop down the 3 metres is 3 volts. The so-called setting is done by comparison with a standard cell.

The first thing to describe will be the potentiometer proper. The base is a board 3 ft. 9 ins. long and 10 ins. broad, cut from well-dried ½-in. pine. It has three stiffening pieces at the back, 1½ ins. by ½ in. This must be of dry wood, planed smooth, and then it is given a couple of coats of shellac varnish and allowed to dry while the other parts are being got ready. The wires, as mentioned, are No. 30 S.W.G. manganin; five pieces 41 ins. long will be wanted. It can be bought from advertisers in this Journal; 20 ft. cost about 1s. Cut off two pieces of strip brass ½ in. by 3-32nds in., or a little thicker; draw-file this all over. Drill six countersunk holes for ½-in. brass screws in the position shown on plan. On the underside scratch five shallow slots to fit the wires; these are to be spaced as drawn. Fix the two strips down temporarily on a board, their inside edges exactly 1 metre apart (1 metre = 39·3708 ins., or about 3 ft. 3⅜ ins.) Solder the ends of the wires carefully to the brass strips for the full length of the brass, and then carefully stretch and solder the other five ends, so that each wire has 1 metre free length and all are stretched alike. Trim off the odd ends and unscrew from the board, and screw down right side up to the final base, still keeping the brass exactly 1 metre

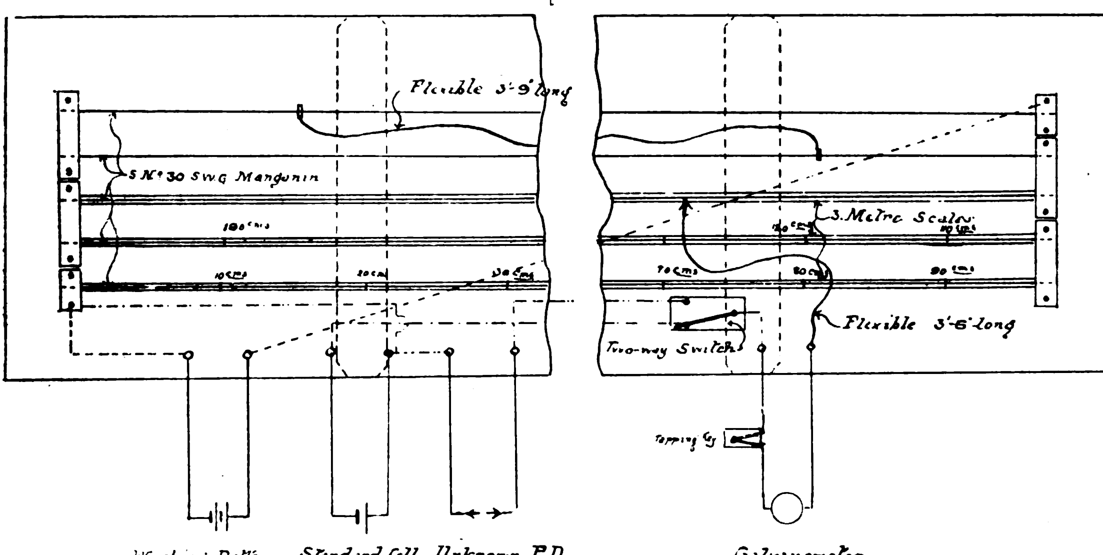

Fig. 1. —Plan of Potentiometer, showing Connections. (*Scale: 2¼ ins. to 1 foot.*)

apart. Three paper scales 1 metre long and divided into centimetres are to be fixed under the first three wires; it would be safer to fix these scales before the brass, as they should have a coat of varnish, and the wires must be left clean. Six terminals are to be fixed, spaced evenly in pairs along one side. The connections can be easily followed from the plan.

A standard cell is the next thing to make. For all work not requiring very great accuracy a Calomel cell is the best, as its variation with temperature is very slight; but for more accurate work a Clark Standard should be used, made up to Board of Trade specification, as described in S. P. Thompson's "Electricity and Magnetism." In this case the

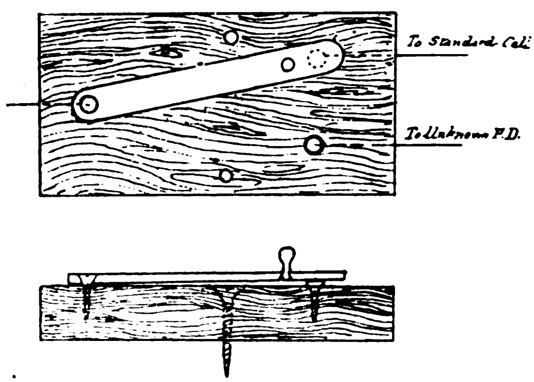

FIG. 3.—TWO-WAY SWITCH.

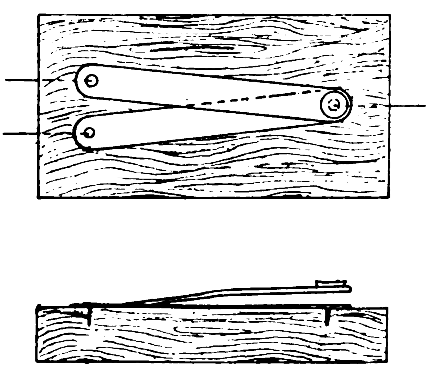

FIG. 4.—TAPPING KEY.

temperature must be taken into account. I will here describe the Calomel cell. All chemicals must be bought as "pure."

The cell (Fig. 2) is set up in a wide test tube about 1 in. diameter and 4½ to 5 ins. long. In the bottom of the test tube is poured about 1 in. of mercury, and dipping into this is a fine platinum wire, enclosed till it reaches the mercury in a fine glass tube. The tube is drawn out to a blunt point and the wire passed through. The tube is then heated till the glass flows round the wire and seals it in. A short length of platinum wire, say 2 ins., need only be used, and a thicker copper wire soldered to the end, which also forms one terminal. Above the mercury is ¾ in. to 1 in. of mercurous chloride (*Note*—this is very poisonous). On the top of this again is poured a saturated solution of zinc chloride. A cork is fitted, and passing through this is a small rod of pure zinc; this forms the other terminal. The cork is sealed with paraffin wax, and the whole arranged in some form of stand to keep it upright. This cell gives a voltage of very nearly 1 volt; to be exactly 1 volt, the specific gravity of the zinc chloride must be 1·38. Two or three cells should be made up, so that they can be checked against each other.

A galvanometer is essential, but I will not describe one here, as nearly every amateur has one, and if not, very good descriptions will be found in back numbers. The galvanometer must be sensitive and also have a high resistance; if not, some high resistance must be inserted in its circuit. The

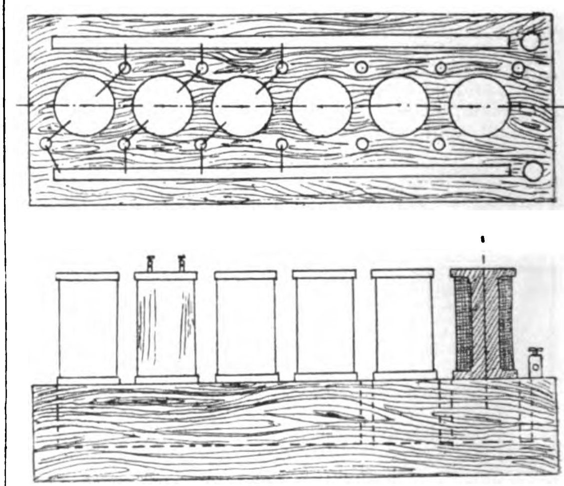

FIG. 6.—RESISTANCE COILS AND STAND.
(*One-third full size.*)

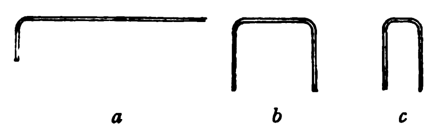

FIG. 7.—CONNECTORS. (*One-third full size.*)

accuracy of the results depend largely on the sensitiveness of the galvanometer and the correctness of the standard cell. There is one other small thing to be made before any readings can be taken, that is, a flexible connection to cut-out part of the last two wires.

Cut out from springy copper or brass four pieces, 1 in. by ¼ in. by 1-32nd in.; file one edge of each to a slight bevel. Turn bevels inwards and solder the opposite edge, and also solder one end of a piece of flexible to each pair, so as to form a clip. Now each end can nip the fine wire at any part, and so vary the resistance. This will give a variation of about 12 ohms.

Two switches will be needed—one a two-way switch to switch from the standard cell to the unknown P.D., and a small tapping key to connect up

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the galvanometer. The two-way switch (Fig. 3) consists of a base of well-dried and varnished wood, 2¼ ins. long by 1½ ins. wide, of about ⅜-in. or ½-in. wood. A strip of springy brass 2 ins. long and of a section ¼ in. by 1-16th in. This must have a hole drilled at one end and a small knob at the other, so that one end can be screwed down and still free to move sideways. Two brass screws are screwed in, as shown, and their heads left about 1-16th in. above the level of the base. To these the wires from "Standard Cell" and "Unknown P.D." are fixed on the under side, and the galvanometer wire to the fixed end of the brass strip. The general idea will be seen from the drawing. The strip must have a downward set, so as to make good contact. The tapping key (Fig. 4) is made by fixing two pieces of brass strips (2 ins. by ¼ in. by 1-32nd in.) to a small base (2¼ ins. by 1½ ins.), so that when the top one is pressed down it makes contact on the one beneath. This can be seen clearly in the drawing also. An ordinary bell push will serve as an excellent tapping key.

I will now describe the method of measuring the P.D. of a dry cell of about 1·4 volts. Connect up as shown in the plan using a two-cell accumulator as the source of current. Its voltage should be between 4·5 and 3·6; if too high, a little use will soon lower it; and if below 3·6 volts, it is time it was re-charged. Connect up the battery and put the two-way switch to standard cell. Take the wire from the galvanometer marked "flexible," and touch the manganin wire at one metre; with the other hand depress the galvanometer tapping key,

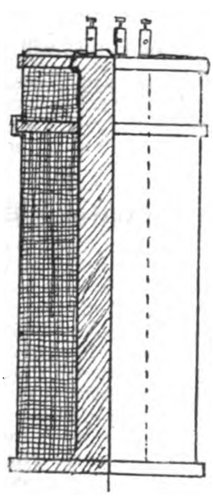

Fig. 5.—Bobbin.

and if there is any deflection alter the double-ended flexible connection till there is no deflection. Be careful that the standard cell and battery P.D. oppose each other, or they cannot be balanced. Then the instrument is said to be "set," because the drop down 1 metre = 1 volt; therefore, the drop down the 3 metres = 3 volts. Of course, if a Clark cell is being used, the manganin wire must be touched at 1·434, the voltage of a Clark at 15° C. Now put over the two-way switch to unknown P.D., and find the point on the manganin wire, where, when it is touched with the galvanometer flexible, there is no deflection on depressing the tapping key. This shows that the drop P.D. and the unknown P.D. are balanced, so read the distance, say 1·421 metres, and this corresponds to 1·421 volts, the P.D. of the cell. Again switch back to standard P.D., and check the setting of the instrument. This, of course, should not have altered; but if it has, the trial must be repeated. For higher P.D.'s up to, say, 30 volts, a voltbox must be used. This consists of two coils of high resistance, and the smaller coil has a resistance of

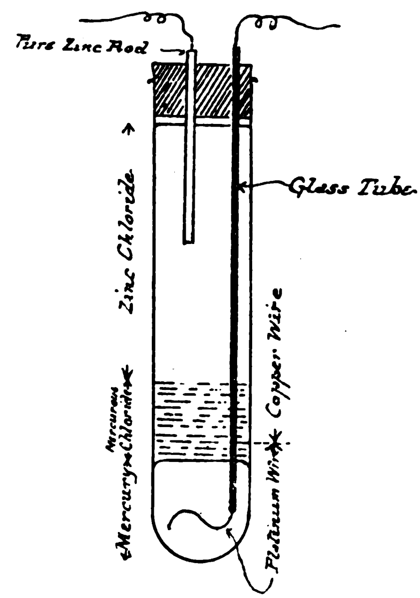

Fig. 2.—A Calomel Cell.

one-tenth the total, so that the P.D. across the smaller is one-tenth the total P.D.

Make a bobbin 4 ins. long between the cheeks, 2 ins. diameter, and ¾-in. core, of hardwood (see Fig. 5), and fix between the cheeks and a flange, so as to divide the two parts in the ratio of 10 to 1. Boil the whole in paraffin wax, and wind on layers of fine uncovered flower wire in a way that each turn does not touch its neighbour, and over each layer wrap some writing-paper, and after every three layers soak in paraffin wax. It is difficult to give the actual quantities of wire, but the resistance of a short length can be measured, as will be described, and from that enough wound on to make the larger coil have a resistance of about 900 watts, and the smaller 100 watts, but the chief thing is to have one nine times as great as the other. For the final adjustment of length apply a P.D. of from 2½ to 3 volts over the two, and measure on the potentiometer the P.D. across the whole and also across the smaller one. Then the first must equal ten times the second. To use this the unknown P.D. is applied across the two coils in series and the P.D. across the smaller measured; then total = 10 times this amount. It would make a better job, but more expensive, if the coils were wound with cotton-

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covered resistance wire, such as iron or manganin of about No. 36 gauge.

The next step will be the measurement of currents, and for this some extra resistances must be made. A standard ohm coil must be bought or made to start with. There is no trouble in the making, provided there is something to compare it with, as it must be accurate. The checking can be done with the potentiometer if the reader has a reliable ammeter reading to about 2 amps. Pass a current of about 2 amps. through the ammeter and coil, and simultaneously read the potential drop across the coil and the ammeter; then the resistance $= \frac{v}{c}$. This must be adjusted to 1 ohm. On the whole it would be better, if possible, to buy a standard coil, or at least get the loan of one for comparison.

The reader will now need six such coils, made of iron or, far better, of manganin of No. 20 S.W.G. These will enable him to read currents up to 15 amps. If he requires a larger range, more resistances will be needed. For small currents a resistance-box will do away with all this trouble. For a 1 ohm coil 10 ft. of manganin will be needed—No. 20 S.W.G. cotton-covered. Turn up six bobbins 1½ ins. long between cheeks, and the core ½ in. diameter, and cheeks 1 in. diameter, and boil in paraffin wax. Double the wire, and start winding by putting the doubled end through a hole in one cheek; wind on the whole length double, and fix the two ends to two terminals. Now bare a short length of the doubled end, and twist this up till the resistance is exactly 1 by comparison with the standard; solder up this end and tuck it away. Definite lengths cannot be given, as manganin varies in composition and resistance; but the resistance of a length, say 10 ft., can be measured, as will be described, and this will give a good base to calculate from. To each terminal of each coil must be soldered a stout piece of copper wire (No. 12 or 14) bent into an L, so that each coil can be connected with a mercury cup.

A stand must be made for these coils, so that they can be connected in series or parallel, or any other combination, at will, and have a negligible resistance at the contacts. Cut out from a board 1½ ins. thick a piece 8 ins. by 3 ins., and drill in this twelve clean holes ½ in. diameter and 1 in. deep; the positions are marked on the drawing (Fig. 6). Cut also a slot 6½ ins. by ½ in. by 1 in., as shown. Then boil the whole in paraffin wax. Cut from No. 14 copper wire six pieces as (*a*) in the drawing, six as (*b*), and six as (*c*) (Fig. 7). With these any combination of the six coils can be made. For example—for a resistance of ½ ohm to carry a current of 9 amps., connect up as is done in the drawing of stand for resistance.

Now the measurement of any current from 0 to 15 can be made. Suppose the reader wants to graduate or check an ammeter, divided into tenths, from 0 to 5. Connect up all the resistance coils in series, and connect the set and the ammeter in series, and pass a current through the whole of about 1-10th amp.; connect the resistance coils by fine wires to the unknown P.D., and read the P.D., then the actual current flowing $= \frac{v}{r} = \frac{v}{6}$. Gradually increase the current till about ·4 is reached, taking reading at intervals of both unknown P.D. and ammeter scale. At ·4 cut out one coil of resistance then current $= \frac{v}{5}$. Keep on in this way, altering the coils so as to keep the P.D. reading about 2 volts to 2½ volts, and never having more than 2½ amps. to any one resistance coil. For example—at 5 amps. two coils must be in parallel. From this, I think, the reader will follow the method of manipulating the resistance coils.

Measurements of resistances can be done in two ways—by direct comparison, or by absolute measurement; this second method necessitates the use of an accurate ammeter; but as any ammeter can be checked as just described, this is not a great drawback, and the method is very convenient, so I will describe it first. Suppose the resistance of an armature coil has to be measured, the resistance will be somewhere about 0·08. Connect an ammeter in series with the coil, and pass 5 amps. or 10 amps.—if the armature will stand it—through the two. Measure with the potentiometer the P.D. across the armature, and read the current passing; then the resistance $= \frac{v}{c}$, if the P.D. $= ·794$ and the current $= 9·6$, resistance $= \frac{·794}{9·6} = ·083$.

To measure the resistance by comparison. Connect five resistance coils in parallel; this gives ·2 watt to pass about the same current as before through both, but there is no need to know the actual current. Measure first the P.D. across the known resistances, and then across the unknown; if the P.D. across known resistance $= 2·014$ volts, and that across unknown $= ·836$ volt, then resistance $= \frac{·836 \times ·2}{2·014} = ·083$. I think this will show the great usefulness of this simple apparatus, and the reader will very soon find how very accurate it is. What always strikes me is the very large range and at the same time great accuracy over that range.

The Junior Institution of Engineers.

A CONSIDERABLE number of members of this Institution paid a visit on September 7th to the Hampton Works of the Metropolitan Water Board through arrangements kindly made by the president, Mr. William B. Bryan, M.Inst.C.E., chief engineer to the Board. Under the guidance of Mr. Walter Hunter, Assoc.M.Inst.C.E., assistant engineer of the Western District and member of the Institution, they were shown over the extensive works on the north bank of the Thames, comprising intakes, reservoirs, filter beds, and pumping machinery for the supply of the Western and Southern districts, the former previously being the old West Middlesex and Grand Junction Works, and the latter the Southwark and Vauxhall. The fine series of pumping engines of various types, probably the most varied to be seen collectively anywhere, were examined with very great interest. At the conclusion the party, assembling in one of the engine houses, were entertained to tea by Mr. Bryan, and a vote of thanks was passed to him on the proposal of Mr. Lewis H. Rugg, Chairman of the Institution. On Thursday, September 26th, an official visit of the Institution will be paid to the Engineering and Machinery Exhibition at Olympia.

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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.]

Setting Slide-rest at any Angle.

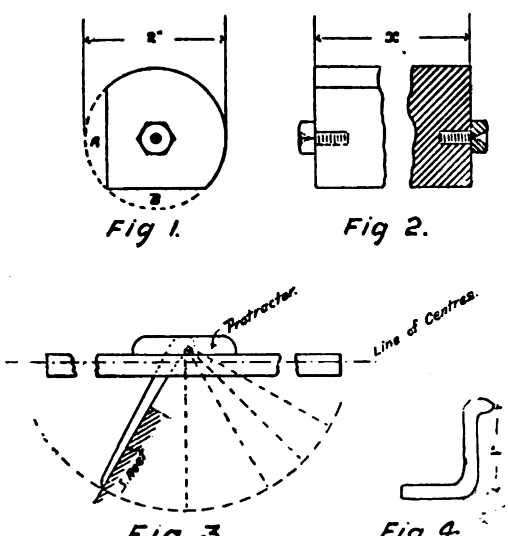
By T. Goldsworthy-Crump.

The top slide of most rests is made to swivel for the purpose of turning tapers and cones, and is often provided with a scale of degrees, generally too minute for accurate adjusting.

The following method provides a means of *accurately* setting the rest at any angle and *replacing* the rest at any future time to the same position.

Figs. 1 and 2 show end and side views of a wooden mandrel, which should be of thoroughly well-seasoned straight-grained hardwood, and not less than 2 ins. diameter. The length will be governed by length between centres "X," or say not less than 15 ins. Previous to turning, metal centres should be inserted, as shown. The mandrel should be turned perfectly parallel and allowed to remain a few weeks before proceeding further, so that any warping may manifest itself. On resuming work, a light cut should be taken to make sure that mandrel is parallel.

The next step is to remove the portions marked A and B (Fig. 1). The easiest and most satisfactory way to do this is by means of the overhead and eccentric cutter; but, failing the latter, a drill spindle and cranked drill, as shown in Fig. 4, will do all that is required.



Setting Slide-rest at any Angle.

The cutter can be made out of a bit of round tool steel of a size to fit drill spindle, and the end flattened while hot with one blow of the hammer, and then filed to shape, hardened, and ground.

The drill spindle is adjusted at right angles to the lathe centres, and is traversed from end to end by lead screw, the feed being given by the cross-slide.

If a division-plate is available, it should be used to set out the faces A and B at 90 degs., or the spur wheel of the back-gear on headstock can be utilised for this purpose. It is necessary that the mandrel be held perfectly immovable during the cutting.

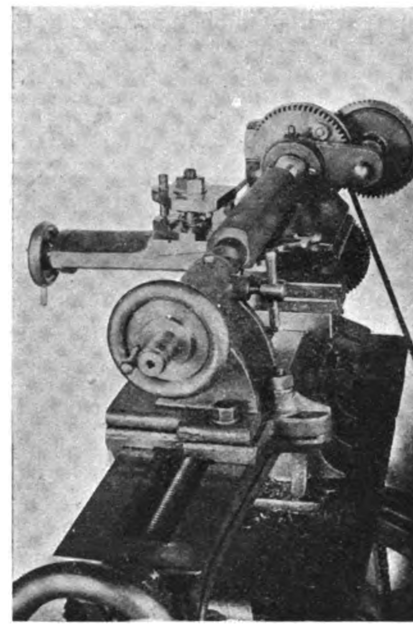


Fig. 5.—Showing Position in Use.

Everything now being ready, the drill spindle is driven as fast as possible, and the cross-slide slowly advanced until the cutter makes a slight penetration, say 1-16th in. The lead screw is now brought into use, and the cutter caused to slowly traverse the whole length of the mandrel, thus removing a small portion and leaving a perfectly flat, even, parallel face.

The cross-slide is again advanced and a further traverse made, and so on, until the necessary amount has been removed.

The mandrel is then revolved 90 degs., and the second face cut in exactly the same manner, and when completed the line of intersection should be perfectly straight and parallel and the faces A and B at right angles to each other.

After a time the bar should be again carefully tested and a slight cut taken off each face, as the success of the arrangement depends on these faces being true.

If preferred, the bar can be made of brass, when the dimensions could be greatly reduced, but the wood has proved quite satisfactory.

The method of using this bar is shown in Figs. 3 and 5, and is extremely simple. The bar is placed between centres, with one of the flat faces downwards and the other away from the operator. A protractor set to the angle required is held or fastened to the bar, one edge being in contact with one face of the bar, the other projecting underneath, to which the slide-rest is adjusted.

There are various ways of accomplishing the same thing, but this method is simple and certain.

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Experiments on Electric Oscillations and Waves.

By R. P. HOWGRAVE-GRAHAM, A.M.I.E.E.

FURTHER EXPERIMENTS ON INDUCTION OF HEAVY HIGH-FREQUENCY CURRENTS.

(*Continued from page* 208.)

THE last article dealt with the induction of heavy currents in a single turn of broad brass strip, and demonstrated the very great expenditure of energy in an iron core within a coil carrying high-frequency currents.

The following experiments give further illustration of the magnitude of the effects produced by eddy-currents in short-circuited turns and sheets of metal without the aid of hysteresis, the action of which is, of course, confined to iron.

Fig. 53 shows a coil of fourteen turns wound to a diameter of about 5 ins. from copper wire about ¼ in. in diameter. The coil was roughly wound, and has been roughly used, but answers the purpose perfectly so long as any two adjacent turns do not get near enough together to spark. To the right of the coil stands a cylinder of tinfoil, made by bending it to the required shape and folding the meeting edges over two or three times to make the best possible electrical joint. If the contact is not good, the resistance introduced considerably lessens the short-circuit currents, as the voltage driving them is somewhat low.

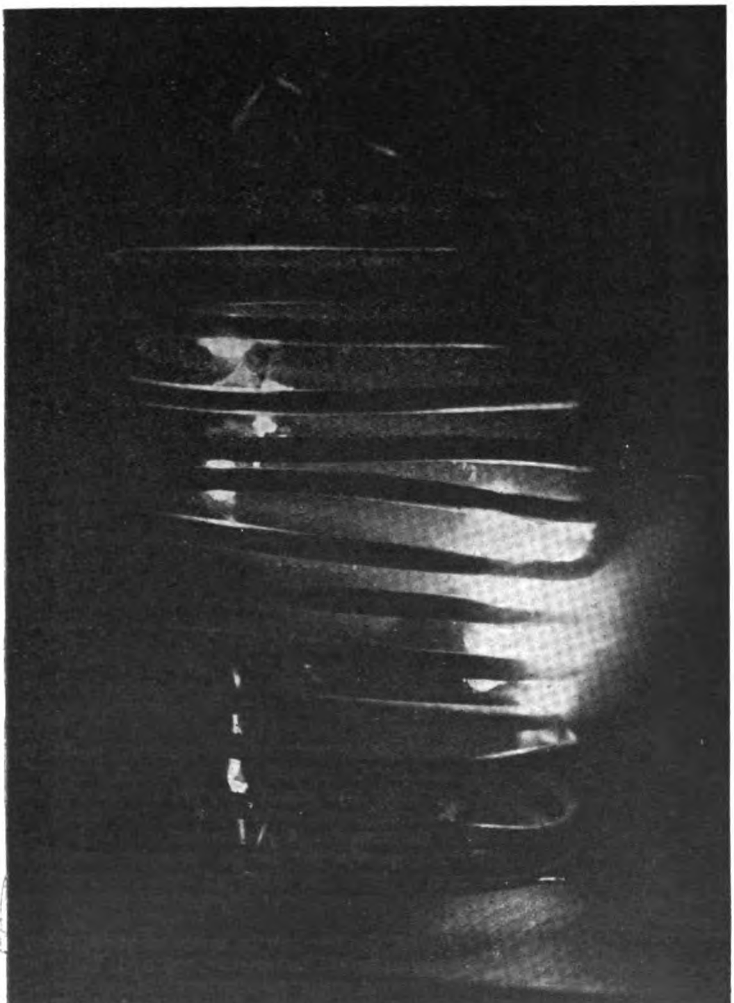

FIG. 54.—DISINTEGRATION OF TINFOIL CYLINDER BY INDUCED EDDY-CURRENTS. (*About half actual size.*)

After the photograph had been taken the coil was lifted up and let down so as to enclose the cylinder of tinfoil concentrically; then the oscillatory discharge was passed through the coil, the room being darkened completely.

Fig. 54 is the result of an exposure made immediately after the current was started. The heat generated in the tinfoil by the induced eddy-currents caused red-hot spots and lines to appear and spread at various parts of the cylinder, until it was so far disintegrated that the upper portion collapsed, pieces leaning over against the inside of the coil or falling off and lodging on its turns. This resulted in a general short-circuiting between various adjacent turns; the vigorous combustion and sparking within the coil were the sole sources of light by which the photograph was taken.

When all action had ceased, the discharge was stopped, the coil lifted off, and a third photograph taken, showing (Fig. 55) the state of tinfoil after the experiment was over.

A very convenient form of coil for experiments of this nature is made in the following way: A piece of stout board about 9 ins. square and ¾ in. thick is cut and planed, and a small boss of wood or ebonite about ½ in. in diameter is screwed to the centre. At a point close to the circumference of the boss a hole is drilled through the board large enough to pass ordinary lighting wire, say, 3/20, or, if a large Leyden jar capacity is used, 7/22. When one end of the winding has been pushed through from the front so that 3 or 4 ins. project behind, the wire is wound tightly round the boss in a flat spiral of only one layer, the turns being temporarily secured by ordinary bell-staples where necessary.

In this way the diameter of the spiral increases until it is nearly equal to the width of the board when a hole is made at a point where it is decided

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to finish off, the wire being cut with a spare end of 3 or 4 ins. and thrust through the hole so as to project behind like the other end. The whole coil should now be cast into a solid mass with some good insulating material, preferably a substance with a rather high melting point. Paraffin wax would to be an excellent insulator for the purpose. Perhaps it is preferable to adopt the first method, as the working up can be done in sections; this makes it possible to remove the staples in one part of the coil while the wire is held in place by the hardened wax in other parts.

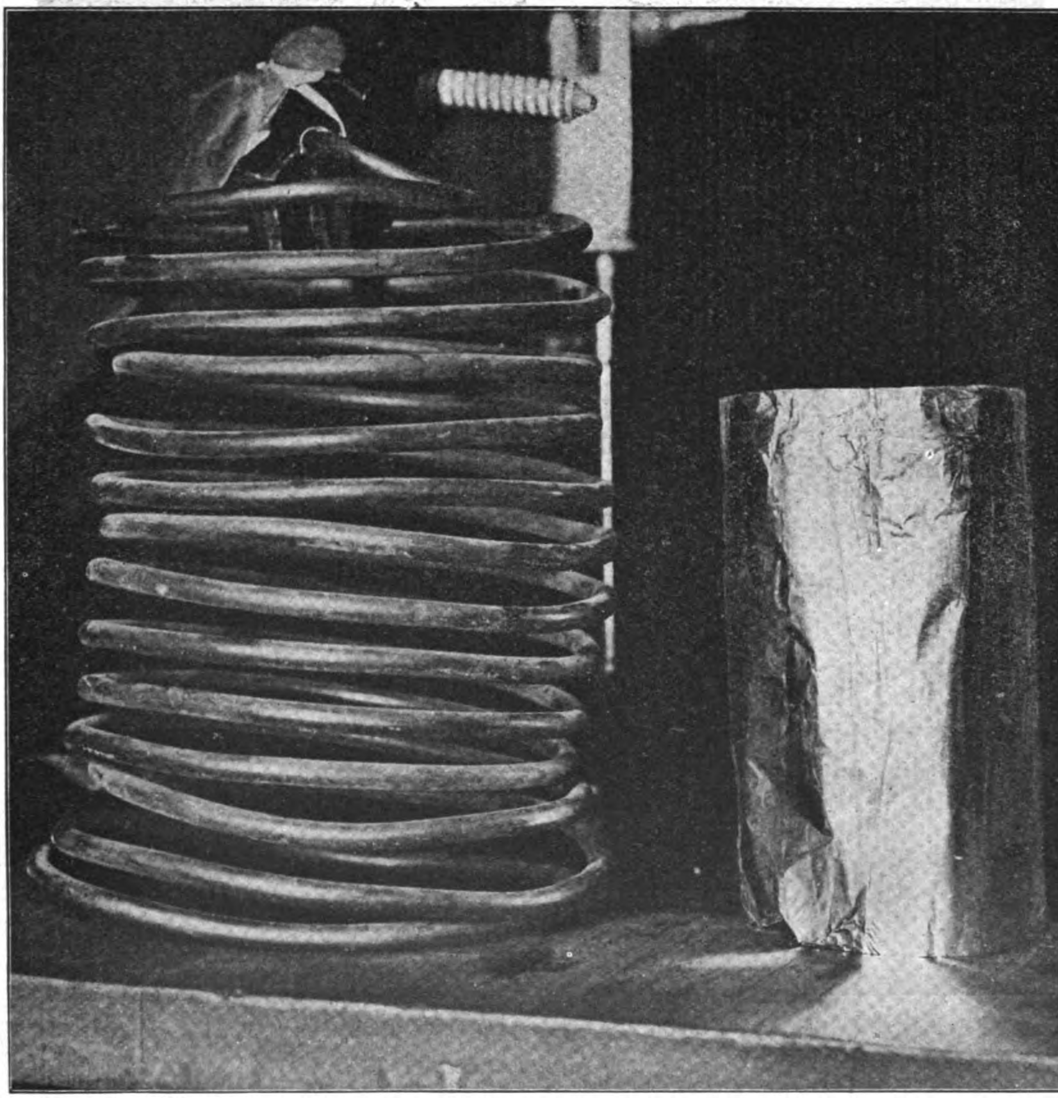

FIG. 53.—CYLINDER OF TINFOIL AND INDUCING COIL.

(*About half actual size.*)

do, though its melting point is rather low. A composition of bee's-wax, resin, and red ochre is fairly suitable, and can be worked up with hot irons until the wire is well bedded. An alternative way is to pour it over the coil, after surrounding the latter with a raised ring of cardboard, or, better still, of modelling clay. Sulphur would probably prove

When finished, the coil should present the appearance of a smooth circular cake of insulating material fixed to one side of a board. As it is desirable to bring the sheets of metal, etc., as close to the coil as possible, the wire should not be more than about 8 ins. below the surface of the wax. The ends which project at the back may be attached to

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properly insulated terminals, or may be soldered or screwed to ordinary barrel connectors. When the oscillatory discharge is sent through such a coil the field close to it is peculiarly suitable for

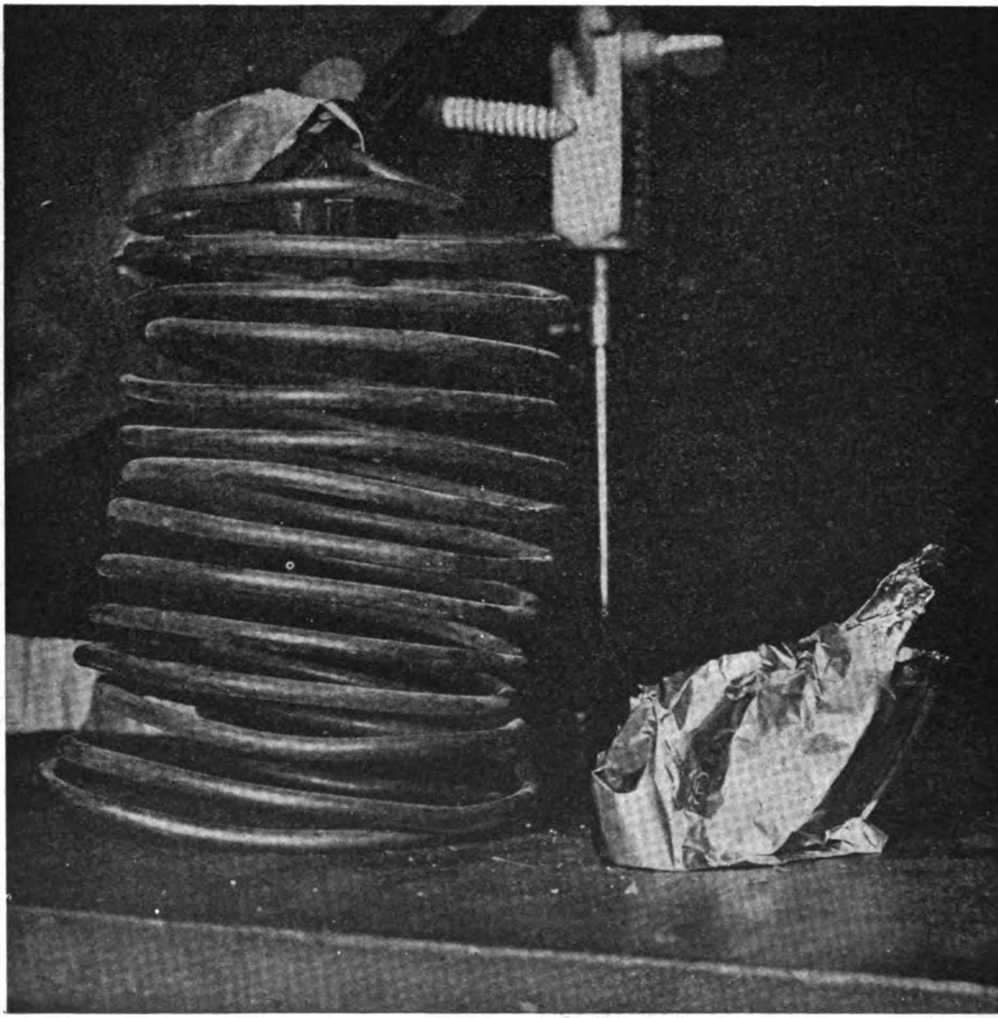

FIG. 55.—TINFOIL CYLINDER AFTER THE EXPERIMENT.

(*About half actual size.*)

inducing currents in sheets or annular pieces of metal brought up parallel to its surface.

In the next article some experiments which can be made with this coil will be described.

(*To be continued.*)

WITH a view to ensuring that all the senior stoker petty officers gain the knowledge and the experience necessary to enable them to perform the duty of taking charge in small boiler rooms, the Admiralty have directed that the first increase of pay laid down for a stoker petty officer after three years' service in that rating is only to be granted to men who have been examined and found qualified to take charge of a stokehold when steaming. This examination is to be instituted forthwith, and is to be held by the engineer officer of the ship. No stoker petty officer is to be advanced to chief stoker until he has passed two examinations.

MUCH trouble is caused in brazing, says the *Engineer*, by not using thoroughly fused borax. Dry borax does not answer, as it swells while brazing, and makes the joint porous. The borax should be melted in a clay or iron crucible to a clear liquid, so as to drive off all water. Such borax will not swell when used for brazing.

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Chats on Model Locomotives.

By Henry Greenly.

(*Continued from page* 253.)

The L.N.W.R. Tanks as Prototype for Models.

An interesting constructive alteration has occurred in connection with the very fine passenger tank engines designed by Mr. G. Whale for the local and suburban services of the London & North-Western Railway, which, although it has not been considered worthy of notice by those more particularly concerned with actual locomotive development, is very important from a model locomotive builder's point of view. excessively sharp curves in several of the engine-shed yards on the system. This was no doubt due to the long wheelbase and small lateral play with which the engines were provided, and to the fact that these roads were in many cases laid long before such large engines were even dreamt of.

To allow of a reasonable amount of side play in the leading bogie (or radial truck, to give it its proper name), the main frames of the first engine, which I will call for convenience sake the No. 528 class, were built-up in two parts, in the same manner as in the "Precursor" and "Experiment" express engines. I show a sketch of this construction in Fig. 4, and, as will be seen, it renders the bending of the main frames unnecessary. The two plates are riveted together, the lap of the joint

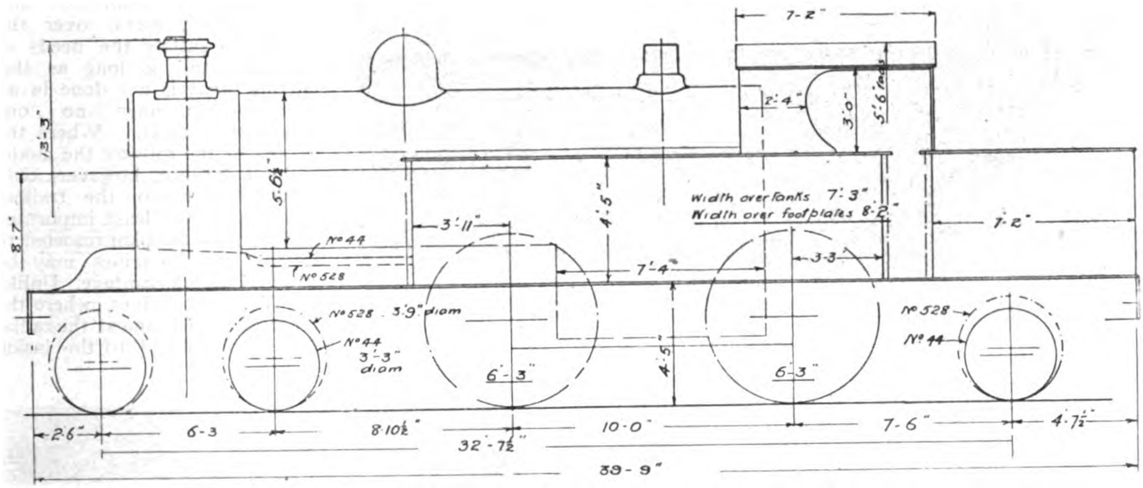

Fig. 1.—Diagram of 4—4—2 Type Tank Engine, L.N.W.R., giving Leading Dimensions of the Two Classes, No. 44 and 528.

This being the case, I take the present opportunity of making a special reference to it in submitting the long-promised outline drawing of the type, and also show by means of photographs (which I have specially taken for this article) and diagrams the difference between the two classes now running. being very large, so that the maximum strength is obtained. The device, of course, gives an extra amount of lateral play to the bogie equal to the thickness of the frames. To render the wheelbase of the engine still more flexible, the frames

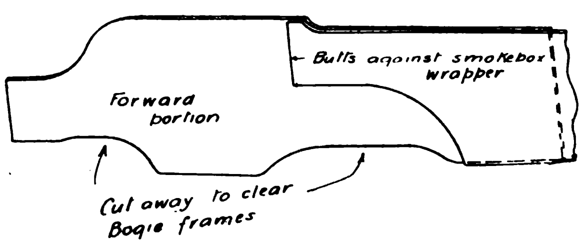

Fig. 4.—System of Frames at Leading End, L.N.W.R. "Precursor," "Experiment," and No. 528 Class Engines.

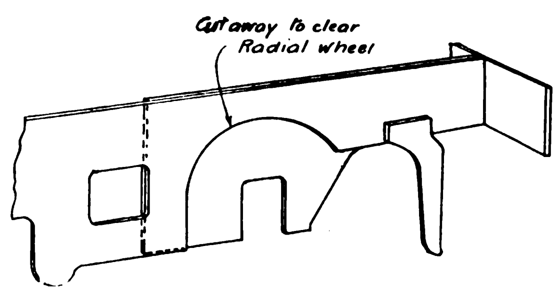

Fig. 5.—Frames of No. 528 Class Tank Engine at Trailing Wheel.

Not that it matters very much to model makers what was the exact reason for the change, I understand that some trouble was occasioned with the first locomotives of the type in traversing certain at the trailing wheel were subsequently dealt with in a similar way, the radial axle-box guides being fitted to the inner plates. (See Fig. 5.)

In building new engines, however, Mr. Whale

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dealt with the problem in a more drastic manner, and in a fashion which, I am sure, will be appreciated by all readers who have had experience in making and running model locomotives. Under ordinary circumstances—such as would obtain in the building of, say, a 7-16ths-in. scale model of No. 528—the builder has the choice of two evils. He has either to model the engine correctly and forgo any but the easiest curves on the model railway, points and crossings being out of the question; or he has to make such alterations as in some enthusiasts' eyes ruins the realistic appearance of the model, to enable a radius of curves common to model railway practice and points and crossings of normal construction, to be negotiated.

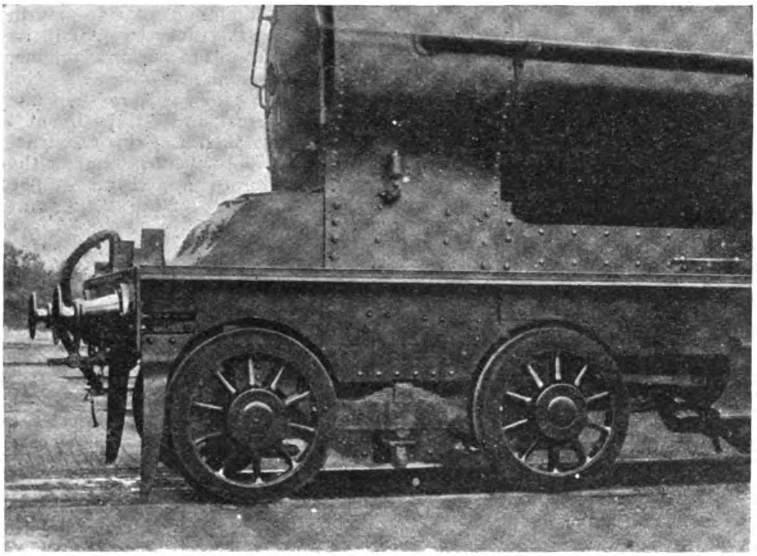

FIG. 6.—VIEW SHOWING BOGIE WHEELS.

But with the later engines, which may be termed the No. 44 class, the prototype may be closely followed, and at the same time the locomotive will be able to traverse the normal model railway curve.

The No. 528 class engines were built with 3-ft. 9-in. bogie and trailing wheels, and any attempt to model these to correct size to a small scale and also to cut away the main frames to allow the wheels to swing right under them, means that there would be very little framing left over the wheels; indeed, it is almost impossible, and it will be found that the wheels must be reduced in diameter. In the new engines of the No. 44 class, the frames are cut away, as the accompanying drawings and photograph (Figs. 2 and 6) show. These engines have 3-ft. 3-in. bogie wheels, the leading truck being similar, if not identical, with that fitted to the 4—6—0 goods engine recently turned out of Crewe shops. Therefore, by adopting this class of engine as a prototype in preference to the No. 528 class, the exigencies of model making are satisfied and a very flexible wheelbase may be provided without departing in any way from the original—in form or scale dimensions. This applies, however, in the case of the bogie. The trailing wheels of the No. 44 class locomotives are also reduced from 3 ft. 9 ins. to 3 ft. 3 ins.; but the frames are not cut clear away, as at the leading end. The fact that the wheels are reduced in size, however, enables the builder of the model to cut away the main frame and leave enough metal over the wheels to satisfy the needs of strength, and so long as this cutting away is not done in an obtrusive manner no one should cavil at it. Where the curves of the railway the model is built for are, however, only moderately sharp, the trailing end—being the least important of the two—the plan resorted to in the actual engines may be adopted with advantage. Unlike the No. 528 engines, where the inner piece of frame at the radial wheel is fastened to the inside face of the main frames (Fig. 5), which are cut away in the form of an arch to allow the wheel to move laterally, the rear portion of the frames behind the axle-boxes of the coupled wheels is an entirely separate plate, and is riveted on to the inside of the main frame plates with a piece of packing intervening. The packing being about 1 in. thick, and the two frames being of the same dimension as regards thickness, this provides an extra 2 ins. of side play, instead of the 1 in. provided in No. 528 for the radial truck, over that which would be

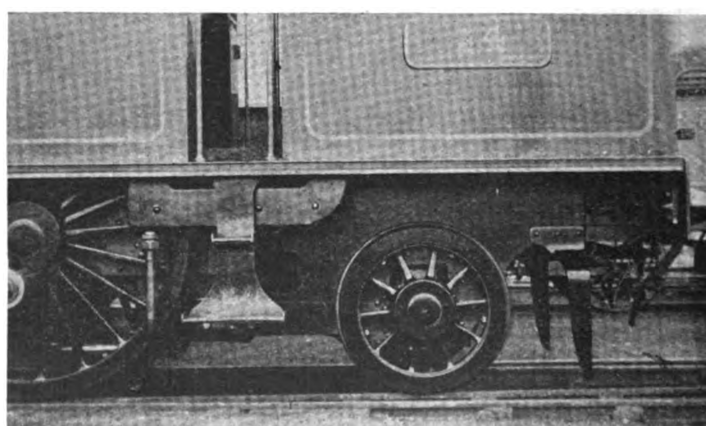

FIG. 7.—SHOWING TRAILING OR RADIAL WHEELS.

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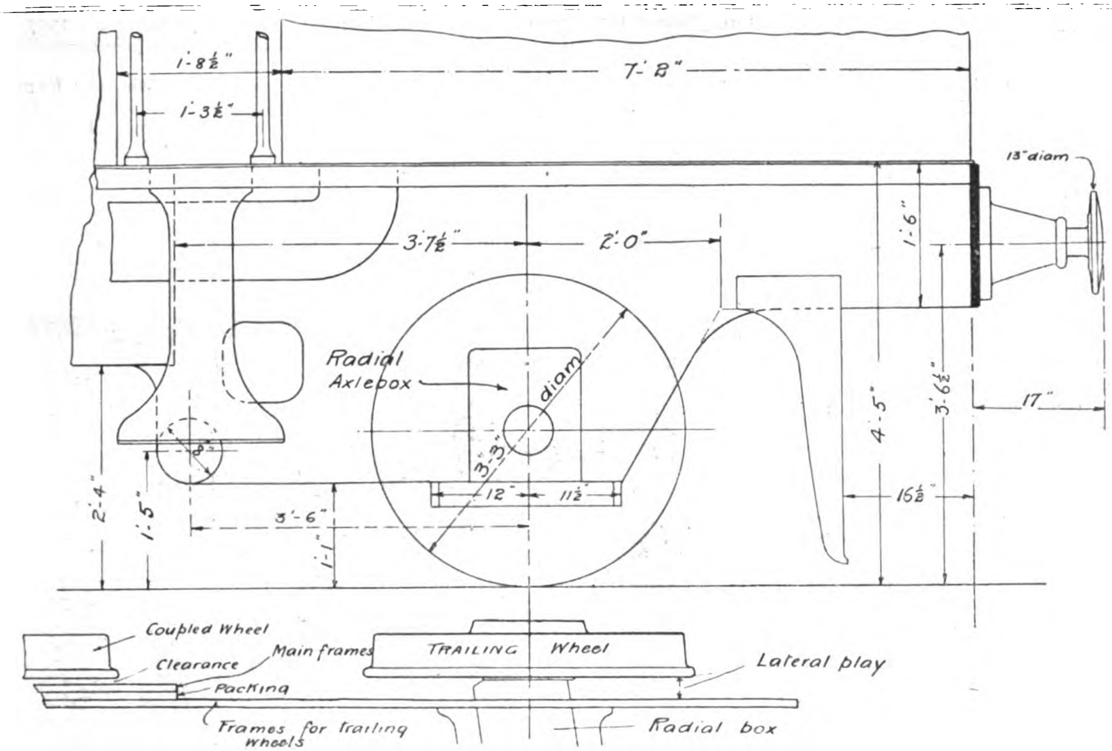

FIG. 3.—TRAILING RADIAL WHEELS AS FITTED TO LATER 4—4—2 TYPE TANKS ON THE L.N.W.R.
(This drawing shows how the frames are arranged to obtain sufficient lateral play for the radial wheels.)

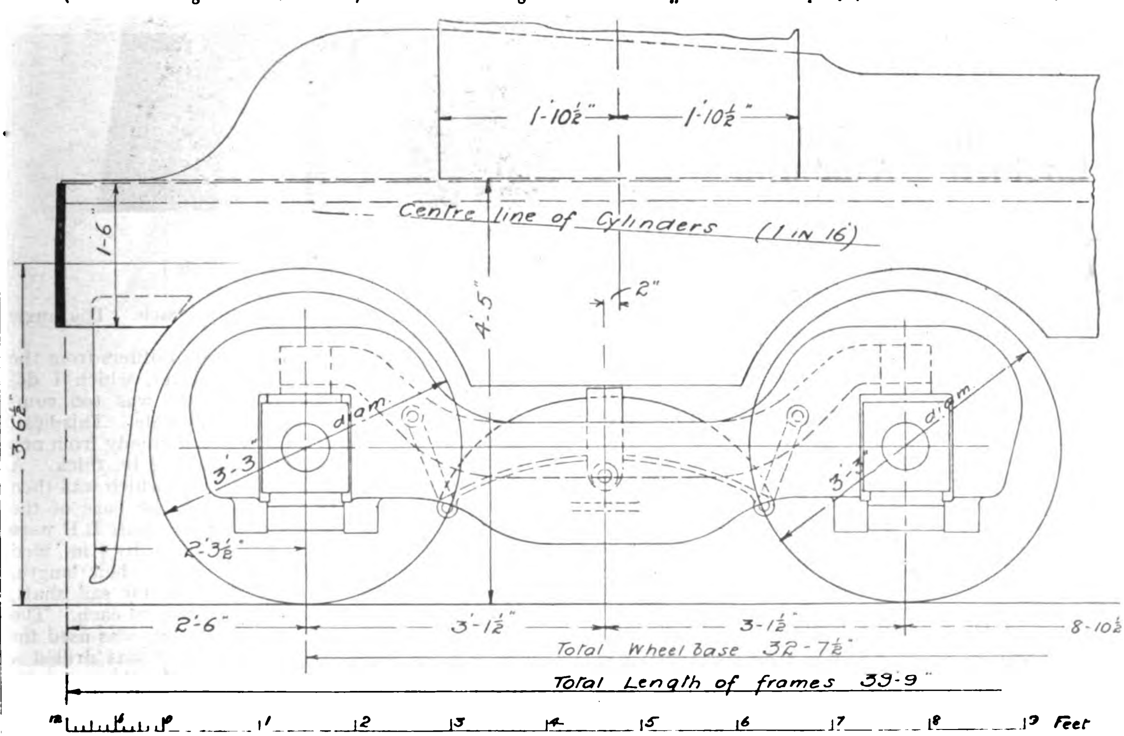

FIG. 2.—BOGIE WITH SMALL WHEELS (3 FT. 3 IN. DIAM.) AS FITTED TO THE LATER 4—4—2 TYPE TANKS, L.N.W.R.
(Note the main frames are cut away entirely to clear bogie wheels.)

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possible with continuous straight frames. In the model, with slightly thicker frames than a mere scale reduction would show necessary, and a more formidable packing-piece between the fore and aft frame plates, quite a respectable amount of side play may be obtained.

Another slight difference in the two classes, which I did not at first notice and which is due to the alteration in the diameter of the bogie wheels, is to be seen on the level of the top of the frames just behind the smokebox. In No. 44 the frames are higher, owing to the cutting away at the rear bogie wheel, the chain dotted line in Fig. 1 representing the profile in the main frames of the earlier (No. 528) engines. A photograph of the first engines of the type was published in the issue of Sept. 6th, 1906, and may be compared with the pictures included herewith.

The subject of this article may appear trivial at first glance, but those who have had experience in model locomotive design will, I think, endorse that the alteration is really a great, if unintentional, concession to model locomotive builders on the part of the London & North Western locomotive superintendent. Contrary to most other prototypes, there does not now appear to be a single drawback to this type of engine as regards its suitability for model purposes, and that the new L.N.W.R. tanks rank among the handsomest engines in the country will be generally conceded.

(To be continued.)

A Small "Model Engineer" Windmill.

By W. S. Farren.

THE accompanying illustrations show a 1-in. scale model of the 20-ft. windmill, the designs for which were given in the early part of Vol. XVI. The woodwork is very similar to that recommended for the full-size mill. The main timbers are square in cross section, ½ in. by ½ in., tapering to ⅜ in. by ⅜ in., 24 ins. long, all four cut from a piece of crate wood. I choose this shape on account of the greater facility which it offers for fixing the other stays. The main timbers are spaced 7¼ ins. at the bottom, 2 ins. at the top. The stays are ⅛ in. by ⅛ in., eight round sides of frame, crossing one another, and four in the middle, fixed horizontally, for platform to rest on. There are "beams" at the bottom, ½ in. by ⅜ in. to strengthen the fastenings of main timbers. The platform is 7 ins. by 5½ ins., in two pieces for convenience in fixing; it is zinc-covered and slots are cut in it for standards and ladder. The top of the framework is strengthened by four pieces of sheet brass, 1 in. broad, and a piece of ⅜-in. oak, 2⅜ ins. square. The whole is mounted on a baseboard, 18 ins. by 9 ins. by ½ in. thick. This framework is very strong and firm; I found I could sit on it without any breaking.

The sails and wind vane are to scale, the former being made of cigar boxwood; the latter of thin oak to make the head balance better. I did not attempt to make the sails tilt at the proper angle,

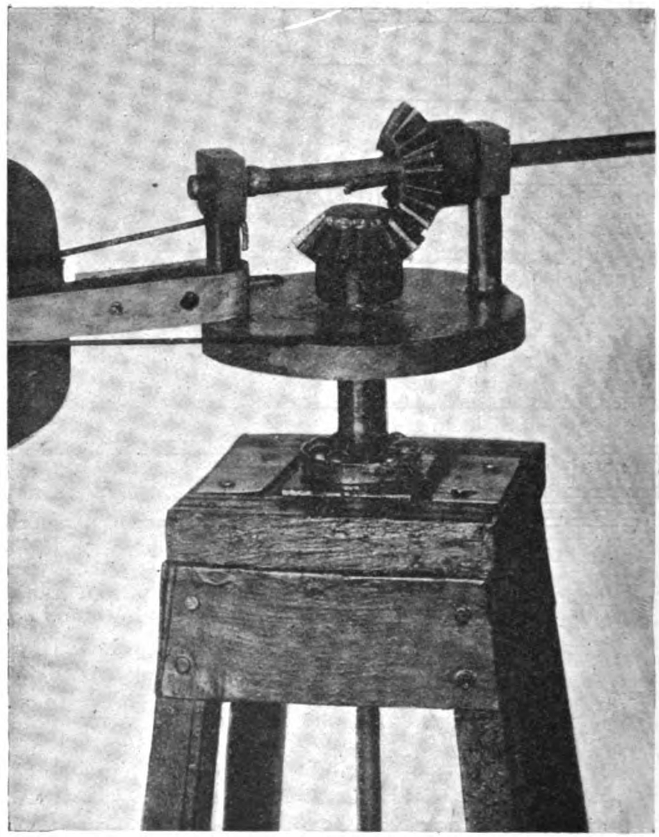

Fig. 2.—Windmill Head.
(Note the head is raised to show balls.)

as they were made in one piece each. The angle is about 20 degs.

The chief point in which this mill differs from the full-sized one is the revolving head, which I designed myself, as the correct one was too complicated to reduce to such a small scale. This head is seen in Figs. 2 and 3. I made it chiefly from one piece of brass, 2½ ins. by 3½ ins. by ¼ in. thick. A piece was cut off 2½ ins. by 2½ ins., which was then marked and filed round to form the base of the head A. The standards for the sail shaft B B were made from two pieces, 1½ ins. by ½ in. by ¼ in., filed down to ¼ in. diameter for 1 in. of their length. They were then drilled 3-16ths in. for sail shaft, and an oil hole was drilled in the top of each. The remaining piece of brass, 1 in. square, was used for the bearing piece C, and through it was drilled a ⅜-in. clearing hole for the rod D. In the centre of the base piece A a ⅜-in. hole was drilled, in which was soldered rod D, which is 1¼ ins. long. Through it a 3-16ths in. clearing hole was drilled for main shaft. I had to get a friend to do this, as I have no lathe, and it had to be quite true or the whole

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head would rock when working. This was the only part for which a lathe was used in the whole mill. The standards were soldered in ¼-in. holes 1-16th from edge. When they were in I found that the centre of sail shaft was about 3-64ths in. out of true. This, however, was neutralised by the size of the teeth on the bevel wheels.

I fitted 3-16ths cycle balls between A and C, keeping them in by a brass ring E. The shafting is 3-16ths in. steel. The bearings for the main shaft were made from some pieces of brass which I had (see Fig. 4). I filled the middle one up with solder, as the hole was too big, and drilled it out for the shaft.

The bevel wheels are 1 in. in diameter, fourteen teeth. I bought them from an advertiser in the Sale and Exchange columns. As they had 5-16ths in. holes through, I melted down an old broken candlestick and poured the metal (I think it was some kind of type metal; it had too low a melting temperature to solder), in the holes, using the shafts as cores.

The "spider" was cut from sheet zinc, a circle being cut out and divided and bent to form the arms. Another circular piece was soldered on in front to strengthen it. A piece of brass tube which I made from sheet metal was soldered through the middle of both discs to fix the spider to the sail shaft. This was afterwards soldered on the shaft, centre of spider being 3¼ ins. from centre of mill, 1⅜ ins. from end of shaft. I soldered a small disc of brass ½ in. in diameter on the end of the shaft,

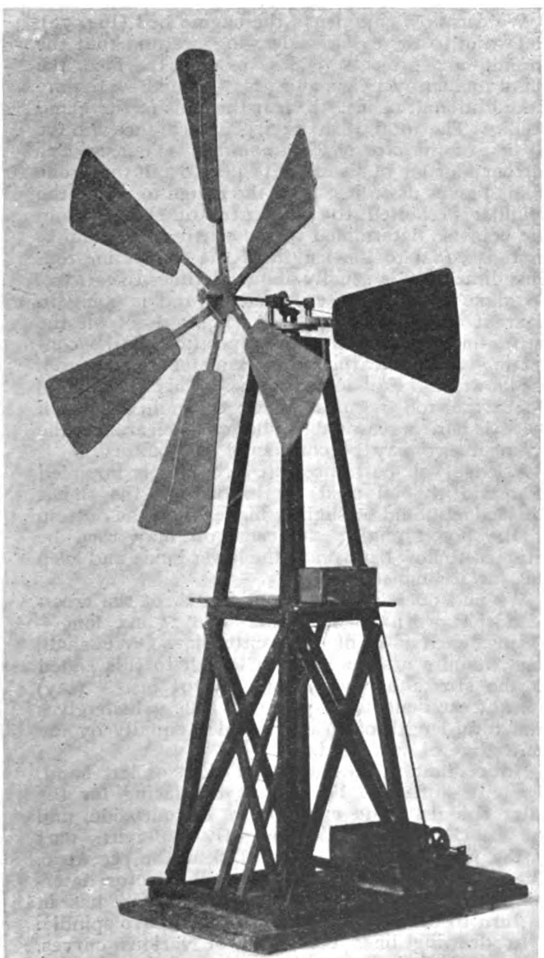

Fig. 1.—General View of Model Windmill.

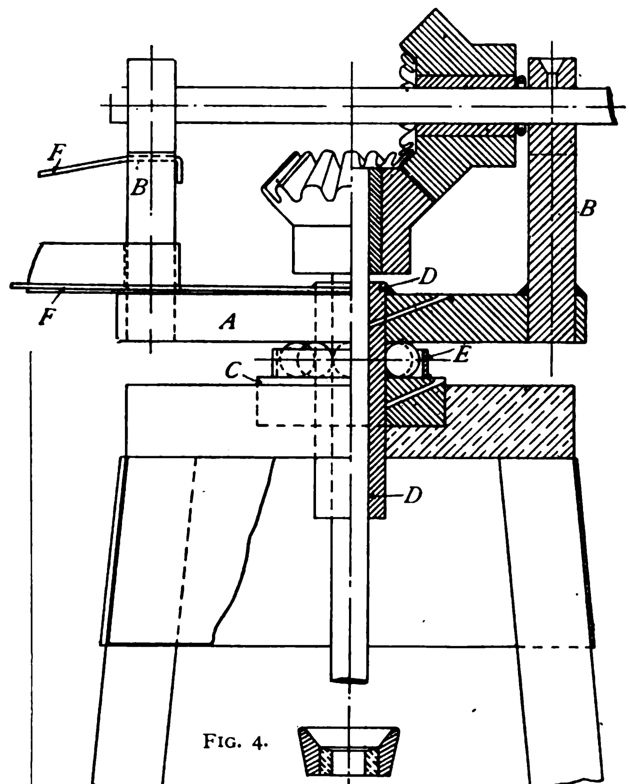

Fig. 4.

Fig. 3.—Part-section of Model Windmill Head. (*Full size.*)

with six 1-16th in. holes drilled through for the straining wires.

The sails were fixed to their respective arms, and these to the spider arms, by brass pins. The wind vane is fixed on tight with three wires F to support it. I did not attempt to copy the regulating gear.

A small two-speed pulley is fixed near bottom of main shaft. It drives a small pump I have made out of a S.A.O. cylinder, ¼-in. bore, ¾-in. stroke. It is not a success, as it leaks. I shall make a pump with clack valves some time and hope to get it to work better.

The mill goes (as nearly as I can judge) about 350 revolutions per minute in a fairly strong wind, when I cannot stop it by holding the shaft with the thumb and two fingers. It is painted: sails, drab (three coats); timber, Indian red (two coats); base, green (two coats).

This model has taken me about ten weeks on and off to make, and I am very pleased with the ease of its running, which I think is largely due to the size of the teeth on the bevel wheels.

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The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length. and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows :—

- SILVER MEDAL to the fastest boat in Class A beating previous records.
- BRONZE MEDAL in Class A to all other boats beating previous records.
- SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.
- BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.
- SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.
- BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour ; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

IT is said that the "electrobus" which has been running in London during the past six weeks has proved very successful, and that the number of these cars in use will soon be increased to forty, the first instalment towards the 300 which are promised.

Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page* 130.)

BEFORE commencing the engine bed it will be desirable to set out roughly the crosshead, to be sure of what amount of clearance we require, and also the small end of the connecting-rod. These drawings need not be furnished at this stage, but may be left to take their turn ; both should be set out full size. The completed drawings are shown (Figs. 71 and 72), to which we need not again refer. The reason for setting out the end of connecting-rod first will be evident by a study of Fig. 72.

We find on setting out these that we need 6¼ ins. allowance from the centres of the crosshead pin to the face of the boss. Assuming we require ½-in. clearance between this and the ends of the studs of the gland, we can then find how far we shall show the centre of the guides from the flange to which the cylinder is bolted.

We can now commence the engine bed (Fig. 72). Referring to the cylinder drawing, we find that the stuffing-box projects 3½ ins. beyond the face, the gland further by 1½ ins. and ¾ in., to which we require an additional 1½ ins. to clear the ends of the gland studs. The total, with, say, ½-in. clearance and the 6¼ ins. of the crosshead, amounts to 14 ins. The further addition of an amount equal to half the stroke (6 ins.) gives us 20 ins. from the flange to which the cylinder is bolted to the centre of slide. From the point so determined to the centre of the crankshaft is equal to the length of the connecting-rod. This dimension is usually about 2¼ times the stroke. To make sure that the connecting-rod is going to clear at the point marked A (Fig. 73) set off the centre-line, showing the lower position of the connecting-rod, indicating the diameter of the rod, as shown by the dotted lines. This position is where the rod is most likely to foul, so that if there is here a reasonable amount of clearance, the arrangement may be considered satisfactory.

A ledge will be noticed at A. This is intended to retain the oil used for lubricating the slides. This ledge should be slightly higher than the bottom of the bored guide ; sufficient oil may then be retained to flow back on to the lower guide and keep the surface moist.

We find on reference to our sketch of the crosshead that we have made the slide 7½ ins. long—3¾ ins. each side of the centre-line. We shall, then, require a slide equal in length to this added to the stroke of the piston : = 19½ ins. – (say) ¼ in. at each end for overrun of slide, which gives us a total length of 19 ins., divided equally by the centre-line of crosshead.

Notice that the bed is either right or left hand, the only difference being that the facing for the valve spindle guide only occurs on one side, and the bearing brasses are slightly different, part of the face being cut away to clear the eccentric. The eccentric is, to some extent the factor determining the width between bearings, and has in its turn to take a position to suit the valve spindle.

In drawing lines composed of various curves, as from B to C, always draw a pencil line through the centres of each circle, so as to determine how

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ENGINEERING DRAWING FOR BEGINNERS.

By H. Muncaster.

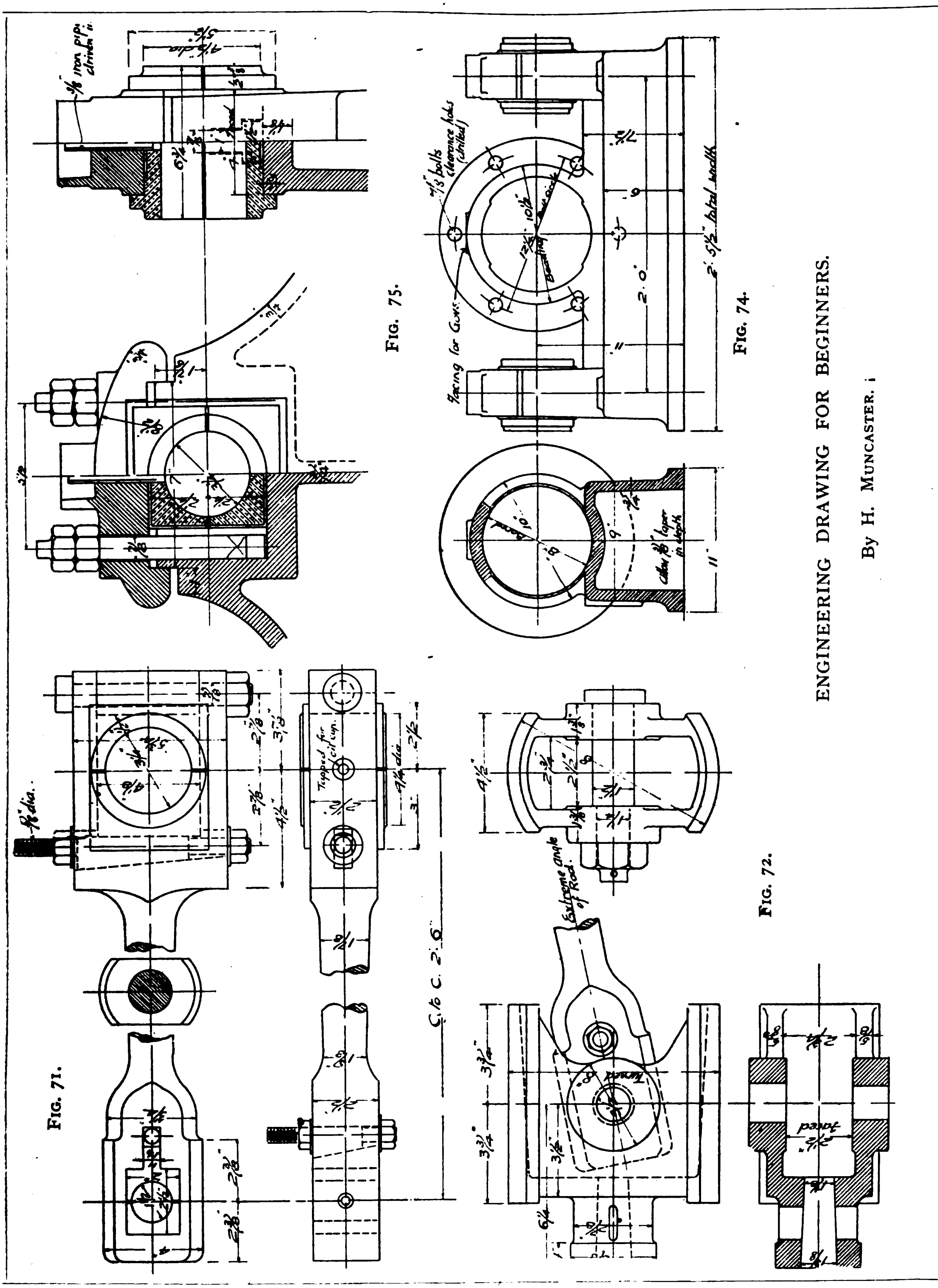

Fig. 71. Fig. 72. Fig. 74. Fig. 75.

far to draw each arc. In this case the arcs B and C would join at D, and E and F at G; draw the larger radius first. If any adjustment is required, it is generally easily done with the smaller radius. Great care should always be exercised in this respect, as an extremely small error in joining arcs is noticeable.

Details of the bearings to a larger scale should be given—for a small bearing like this "full size" is handy. In addition to the plan and elevation an end view, also a section through the slides will be necessary, as shown in Fig. 74.

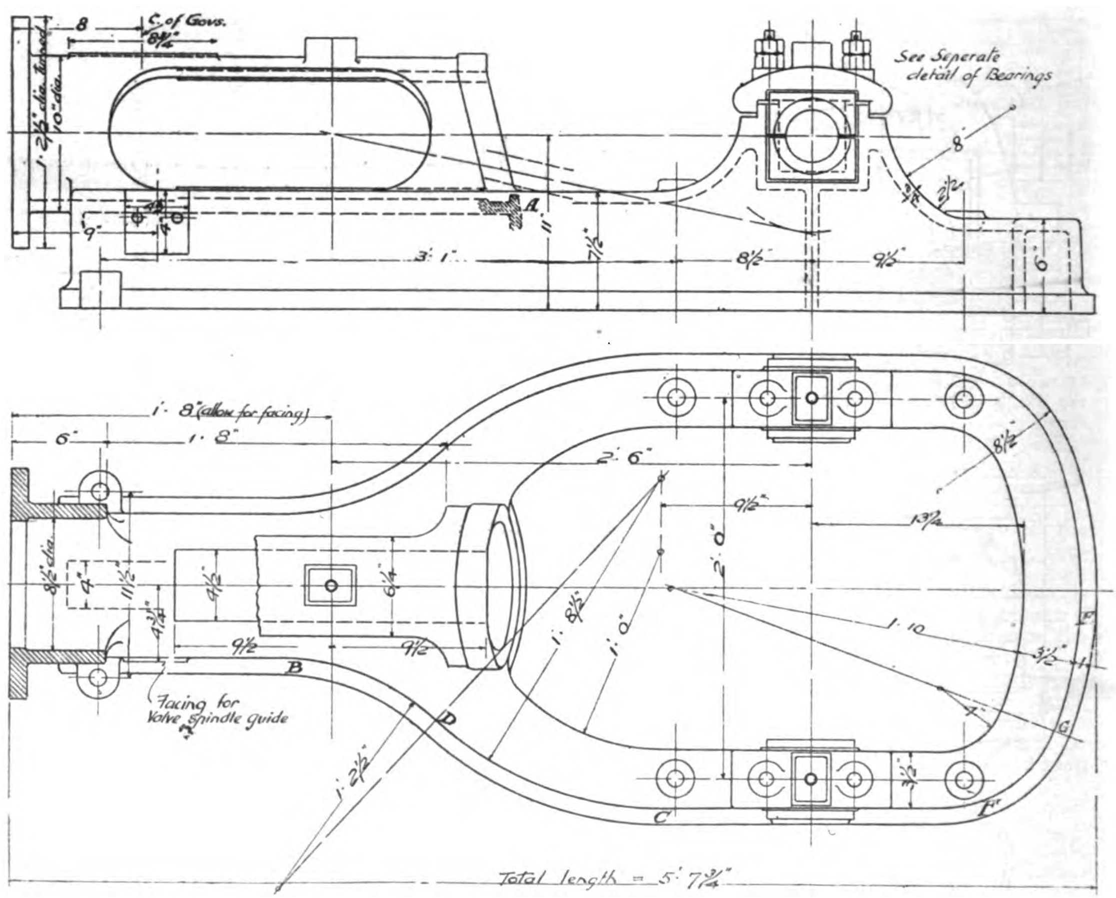

FIG. 73.—PLAN AND ELEVATION OF ENGINE BEDPLATE.

In designing engine beds of this description care should be taken to have the metal of a fairly even thickness; at the same time the plinth along the bottom edge should be substantial, to prevent the metal in the upper surface "drawing" the bed and making it hollow as the metal cools after being cast in the mould.

(*To be concluded.*)

The Society of Model Engineers.

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

London.

ON Saturday, August 31st, a party of twenty-six of the members of the Society visited Mr. Louis Brennan's residence at New Brompton, Kent, and there spent a most enjoyable afternoon witnessing experiments with his model gyroscopic mono-rail motor coach, which has recently excited so much interest and attention, and an illustrated article dealing with his invention appeared in the pages of this Journal on May 23rd last. The workmanship of the model, which was constructed in Mr. Brennan's own workshops,

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elicited much admiration from the members. It is driven by two electric motors, one at each end, geared to the wheels of the two bogies and deriving current from a battery of accumulators carried on the car. The gyroscopes are also driven electrically and, of course, run continuously whether the model is travelling or at rest. The stability of the model, whether loaded with human freight or otherwise, was remarkable, no side blows nor sudden shifting of weight from one side to the other appearing to affect it in the least. There being practically no fixed wheelbase, the coach is able to negotiate the most tortuous and ill-laid track conceivable. A length of iron gas barrel, bent and twisted to all shapes, both vertically and horizontally, was laid on the lawn without fixing of any kind, and the model being placed upon it ran the whole length without any difficulty. It is safe to say that no other vehicle of any description could have proceeded more than 6 ins. without being derailed. The model came through another involuntary test with flying colours. A length of ⅛-in. steel wire cable having fouled the circular track on which the model was running at high speed, the model pushed this ahead for a considerable distance without derailment and until the cable was removed by an attendant.

On the conclusion of the experiments, the party were most hospitably entertained by Mr. Brennan to tea, and a vote of thanks having been proposed by the Secretary and heartily accorded, the party took their departure to the station, everyone expressing themselves as greatly interested. The tedium of the journey home was relieved by Mr. J. C. Taylor, who kindly produced a simple gyroscope he had recently constructed, and a lively discussion arose on the curious behaviour of this scientific marvel.

FUTURE MEETINGS.—Friday, October 18th: The Annual Sale of Models, Tools, Parts, Materials, etc., the property of members, will be held at the Cripplegate Institute, Golden Lane, E.C., at 7 p.m. New members who have not yet had an opportunity of attending one of these Sales will be well advised to do so, as model making apparatus of all kinds is generally to be obtained on very advantageous terms. The Secretary will be pleased to answer any enquiries respecting the inclusion of goods in the sale, etc. — Wednesday, November 13th: The Annual General Meeting. Any member wishing to move an alteration or addition to the Society's rules at this meeting is invited to write to the Secretary on the matter, who will also be pleased to receive any suggestions for the increased usefulness of the Society to its members for consideration and discussion at that meeting.—HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

Provincial Society.

Tyneside.—The members of this Society propose to commence the indoor meetings of the Winter Session on Saturday, Sept. 28th. The meeting will be held at the Society's workshop, 2, Princess Street, commencing at 7 p.m. An invitation is given to prospective members to attend, and anyone joining now will have no subscription to pay till November. To the tools already installed it is hoped to shortly add a hand planing machine.—Full particulars as to subscrption, etc., may be had at the meeting or from the Hon. Sec., THOS. BOYD, 128, Dilston Road, Newcastle-on-Tyne.

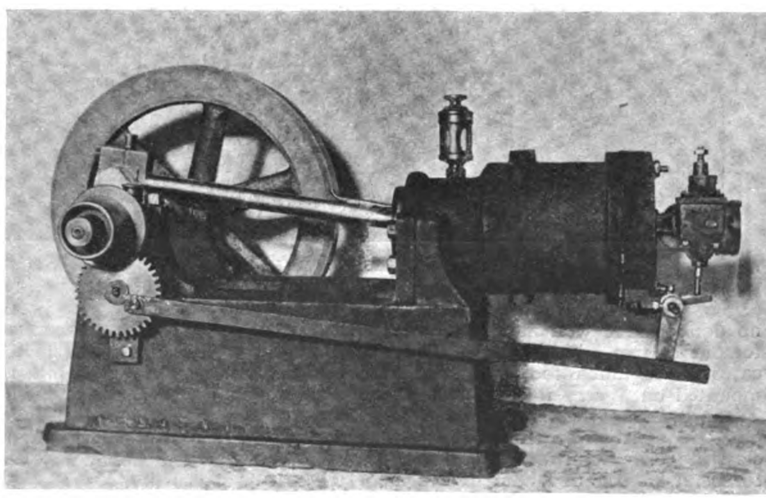
Practical Letters from our Readers.

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

A Small Gas Engine.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The accompanying photograph shows a small gas engine that I have recently made. The castings were bought second-hand through the "Sale and Exchange" column. The principal dimensions are:—Bore of cylinder 2¼ ins., stroke 4 ins., crankshaft 1 in. diameter, square webbs, crank pin ⅞ in. The flywheel is 12 ins. diameter, 1 in. broad, and has two rings of lead cast on and afterwards turned, making it very heavy. Screw grease cups are fitted to crankshaft brasses, and sight-feed oil cup to cylinder. The piston is fitted with three rings ⅛ in. broad. I have tried engine once or twice, but as I have not a blowlamp to heat tube hot enough I have not obtained satisfactory results. I have been trying an iron tube with gas burner playing on it. I intend fitting



A SMALL GAS ENGINE, CONSTRUCTED BY MR. A. MORRISON.

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electric ignition, and hope to get better results.—Yours truly,
Kintore. A. MORRISON.

A Double-cylinder Prize Model.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The photograph and description are of a model horizontal engine recently advertised in THE MODEL ENGINEER and purchased by me. The cylinders are 1-in. bore and 2-in. stroke, lagged with sheet brass. All the castings are of brass very highly polished, no part being painted. The flywheel (7½ ins. by ¾ in.) is polished all over, with very fine effect. The two separate brass bedplates are each 13 ins. long, 2⅜ ins. wide, and ⅜ in. thick. They are of framework section, with two crossbars, on which the piston guide-bars rest. There are fourteen lubricators and two drain cocks.

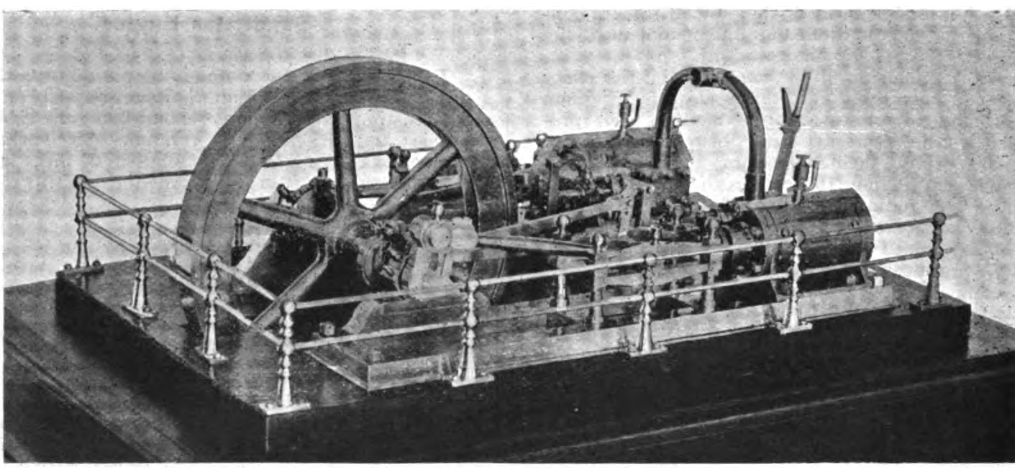
This model is the winner of several prizes, and judging from the design and workmanship would, no doubt, have won many more had it not been for one or two minor defects. The cylinder lubricators were much too large, and the model was mounted on a very inferior bed—too small for it. These defects have been removed by myself. I have frequently seen similar defects in other high-class models. It always seems to me to be a pity to spend months of labour over a model and then to spoil its appearance by a few disproportionate details, which a little thought would have rejected.

Having purchased the model, I took it to pieces and re-polished every part. Then I took it off the deal bed and put it on a new oak one. It may interest some readers to know that this bed is built up of four separate sections made from oak picture framing, and forms a hollow box with top and sides without bottom.

The top is made from oak ⅜ in. thick, with holes cut for the flywheel and reversing gear. Beneath this is the overhanging upper framework, screwed to a second or inner frame, to which the vertical side and end pieces are screwed from the inside. The lower carved moulding is again a separate framework. This was not such a great undertaking as might be imagined, as it was all cut from ready-made picture framing material, with the exception of the two upper pieces. The oak is stained and polished black to give effect to the brasswork of the engines.

In order to still further improve the appearance of the model, before fixing the bedplates to the oak bed I procured two pieces of sheet copper, polished them, and laid one piece under each bedplate. The copper being seen between the framework of the brass bedplates gives a very nice contrast, and forms a kind of tray for oil droppings. The arched steam pipes—put on by myself—are of copper, and the union and sockets are of brass.

I should like to mention that in re-mounting this model I have avoided a mistake which is so frequently (almost always) made—of hiding the bedplate and often other lower portions beneath the framework of the glass case. To prevent this I have placed the engine on a separate board raised above the box-bed, while the glass case rests upon the box itself, so that the upper part of the lower frame of the case is level with the upper side of the wood to which the engine is bolted. In this way the whole of the model is in sight when the case is on.—Yours truly, (Rev.) J. SHORES.
Darlington.



REV. J. SHORES' MODEL DOUBLE-CYLINDER STEAM ENGINE.

A STRAW CLOCK.—An extraordinary addition has been made to the exhibition of inventions now being held in Berlin. A shoemaker, named Wegner, living in Strasburg, has sent in a clock of the grandfather shape, nearly 6 ft. high, made entirely of straw. The wheels, pointers, case, and every detail are exclusively of straw. Wegner has taken fifteen years to construct this strange piece of mechanism. It keeps perfect time, but under the most favourable conditions cannot last longer than two years.

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Queries and Replies.

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

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

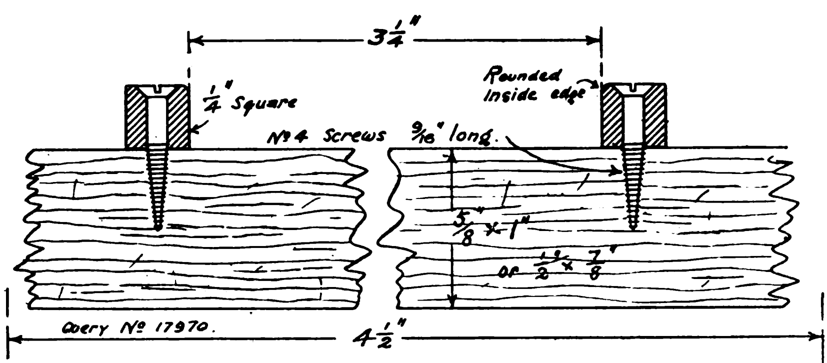
The following are selected from the Queries which have been replied to recently:—

[18,082] **Small Primary Batteries, Lamps, and Accumulators.** T. B. (Coventry) writes: I shall be glad if you will please answer the following questions at your earliest convenience. (1) Is a single fluid bichromate battery, with three cells, ½ pint each capacity, sufficient to light a 5-volt lamp for two hours at a run; if not, please say how long it will go; and then, when light fails, would it recover itself for the next night? (2) Could I fully charge a 4-volt accumulator (10 amp.-hour capacity) with this same battery; if not, how many amp.-hours could be put in the accumulator with one charge? (3) What is the correct amount of chromic acid for this size battery, *i.e.*, three ½ pints? (4) What is the correct amount of bichromate of potash for this size battery? (5) Does either charge want sulphuric acid adding; if so, how much? (6) Zincs in this battery; will they work as well without being amalgamated as they do with being so? (7) When exciting fluid is spent out, which is best, *i.e.*, to add new bichromate of potash, or chromic acid, whichever you recommend, to old solution, or to make up a new lot with water? (8) If battery gives 5 volts, will it light a 4-volt lamp at 10 yards away; if not, what voltage lamp would it light at that distance? (9) Is there any battery suitable for electric driving where the zincs may remain in solution always? (10) Will four ordinary pint size Leclanché batteries fully charge a 4-volt accumulator of 10 amp.-hour capacity with one charge of sal-ammoniac? (11) Will a 4-volt accumulator light two lamps together, and would it be best to connect lamps in series or parallel? (12) How long will a battery, as in question No. 1, drive a motor advertised as wanting 4 volts? (13) Do cells connected in series double the voltage, or is there not a small loss of E.M.F. in connecting a lot of jars together?

(1) Yes, provided the lamp does not take much more than ½ amp. (2) At a slow rate of charge, say ½ amp., you could just about charge this accumulator. (3) Use 11 pints of water to 12 ozs. chromic acid, and add 1 pint concentrated sulphuric acid. Then fill cells with this. Any quantity can be made, of course, by keeping the proportions the same. (4) See above. (5) See above. (6 and 7) Usually more acid is required, as the solution turns blue. See handbook "Electric Batteries," 7d. post free; also read up query replies on this subject in back numbers. (8) Yes, provided about No. 20 or 22 S.W.G. wire is used. (9) Sac Leclanché cells are very good, but only for *very small* lamps. (10) Scarcely. (11) Depends on voltage of lamps used. For 4-volt supply connect 2-volt lamps in series, or 4-volt ones in parallel. (12) This also depends on the current motor takes. It is best found by trial. (13) Yes.

[17,970] **Model Railway Material.** "CALEDONIAN" writes: I am in some doubt as to what sort of permanent way I should use for a 3½-in. gauge railway I am thinking of making out of doors. I can get T-iron fairly cheaply from a wholesale place here in lengths of 22 ft., costing 1s. But from THE MODEL ENGINEER I understand this not only deteriorates rapidly, but is also very difficult to make into points, etc. Proper permanent way comes in rather expensive for a track of any length—especially if one wants some points as well. (1) Is T-iron made in brass? (2) If so, what difference is there in price? (3) If not, what does rod brass similar to that proposed by Mr. Greenly in THE MODEL ENGINEER for April 1st, 1901, cost? (4) I am aware, of course, that there is rod iron, like Mr. Rompler's track is made of, but then the everlasting rust is brought in again. Besides that, one would have to have chairs or else mill grooves in the sleepers—rather a lengthy business. (5) Can you suggest any other methods? I naturally want something fairly cheap, yet that will last a reasonable time. (6) If T-brass is not made, does any firm stock a Vignoles section rail of brass?

(1) We think that it can be obtained. Angle stuff we know is a stock article, and unequal angle, say ⅜ in. and ¼ in., should make a fairly good track. The cost of brass is now about 1s. 1d. per lb. The weight per yard of ⅜-in. and ¼-in. angle, 3-32nds in. thick, would be just over ½ lb. ⅜-in. by ¼-in. by 3-32nds-in. T-brass would be about ⅜ lb. for same length. Try Messrs. H. Rollett and Co., 13, Coldbath Square, London, E.C. The track would therefore cost quite 1s. 9d. a yard with the sleepers and screws, without reckoning the drilling for the screws or spikes. (2) You should be able to get small T-iron at about 3d. per lb., and it would weigh quite 1 lb. to the yard in the smaller size. Square iron (steel) can be made into a very good track if laid on a permanent base. Use ¼-in. manganese steel. (3 and 4) Brass and copper are very dear at the moment. Without the chairs the rail for this track would work out at about the same price as the angle brass above referred to. (5) If you use your line fairly often, and can keep it greased, use ¼-in. square steel, before mentioned, laid on to cross sleepers. You will find square stuff make up into points very readily. (6) No, not that we know of.



MODEL PERMANENT WAY LAID WITH SQUARE STEEL.

[18,098] **Small Dynamo Failure.** J. T. B. (Walthamstow) writes: *Re* Query 17,977. I have wound field-magnets with as much wire as I can get on, making up to 3 lbs., but the output is still low. I have tested for insulation, and with a 4-volt ignition accumulator I get through fields ¼ amp., thus making, I believe, 16 ohms resistance, which, I think, is correct for the amount of wire. I have also tested the armature coils, with same accumulator, and each coil gives 6 amps. reading, so that it, I think, works out at 2-3rds ohms each coil, making for eight coils 5⅓ ohms, or about 1 lb. of wire on armature. Will you kindly let me know if I am correct in the working out of the resistance of both sets of wires? Is there sufficient wire on armature? Could I wind another layer on armature, as I have just room for it, and would it make any improvement in current should the ends be connected in series or parallel with existing coils? After winding fields with extra wire, on testing the dynamo I got from 15 to 18 volts, which is about half the rated current. I wrote to makers, as suggested, and they replied there was no mistake, and that if I had fitted the machine together properly it would give full output easily. All fitting was done by them, as it was a fitted and wound set. The only thing I had done was to have armature tunnel bored out and wind wire on magnets. As they suggested I might have a leakage in the insulation, but I cannot find any leakage or yet any coils of armature connected wrong, can you tell me if I am getting all current possible from machine with existing windings, or what should I expect to get? One thing I omitted to state in last query was—that I had the armature tunnel bored rather too large, and had to wind some iron wire over armature to make up for it. It was only one layer of iron wire, about 22 gauge I think, so that taking into consideration that the wires do not quite fill out armature cogs, there would seem to be a great air-gap. Should this

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make the difference or half the output? If I can only get machine to give 20 volts, I should be satisfied, though I would much rather get the full output, if possible.

There appears to be nothing for it but to go on improving things bit by bit until you get the maximum possible output under prevailing conditions. Another ounce or two on armature would increase the voltage, and to a small extent the output, but we think you could get this equally well by increasing the speed. This is a very important factor, and requires very careful watching. Your large air-gap, too, will account for a good deal. Again, the quality of iron may not be such as to give the best results. All these things are matters for trial, and we can only suggest that you continue making trials until you appear to have reached the maximum efficiency. We do not remember what your driving power is, but it is essential that you should have ample power, and also remember that a drive may be quite efficient and satisfactory at half-load, and yet when the load is increased, the belt may easily slip without it being very noticeable, and cause not only loss of volts, but loss of power, *i.e.*, waste of power. We trust these few hints will assist you, and that you will succeed in getting at least a better output than heretofore.

[17,988] **Riveted Joints for Model Boilers.** S. H. A. (Bilston) writes: Having read your most valuable and interesting paper for the past two years, I beg leave to ask if you could kindly supply me with an answer to the following queries *re* riveted joints for boilers: The quickest and best way to determine the diameter and pitch of rivets in circular and longitudinal seams? The distance between the centres of rivets? Distance from centre of rivets to edge of plate? Take any size boiler to suit your own convenience.

Intricate formulæ are not required for model work. We therefore giving the following simple rules:—

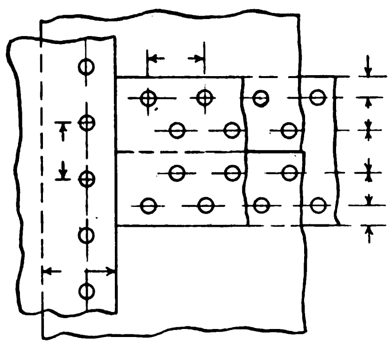

FIG. 1.—THE REQUIRED PROPORTIONATE DIMENSIONS.

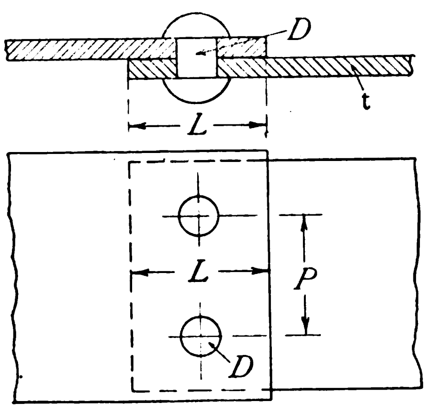

FIG. 2.—SINGLE RIVETED LAP JOINT.

t — plate thickness.
D — 2 t.
L — 3½ D.
P — 3 D.
BS— 2 L.

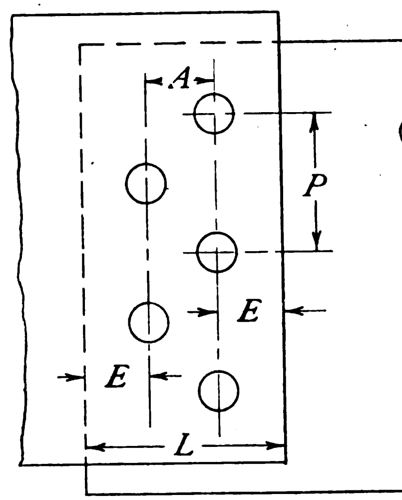

FIG. 4.—DOUBLE RIVETED LAP JOINT.

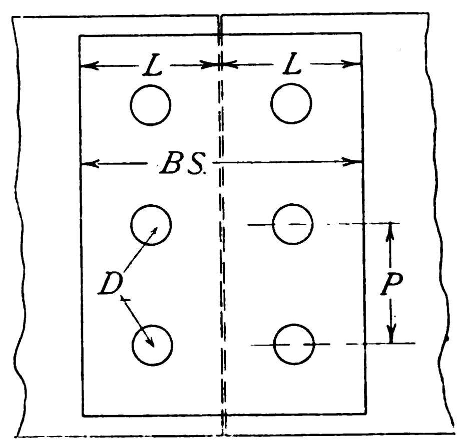

FIG. 3.—SINGLE RIVETED BUTT JOINT.

D — 2t.
P — 3½ D.
A — 1½ D.
L — 5 D.
E — 1½ D.

RIVETED JOINTS FOR MODEL BOILERS.

Diameter of rivets — twice the plate thickness.

Pitch of rivets — three times the diameter of rivets used.

For single riveted lap joints (see Fig. 1) make the lap of the plates 3½ times the diameter of rivets (or seven times the plate thickness). For single riveted butt joints the same rules apply. The width of the butt strip (BS) should be twice the lap (L), see Fig. 2. Where a single butt strip is employed, make butt strip 1¼ times thickness of plate. Where two strips are used they should be each ⅝ of plate thickness. For double riveted lap joints the total lap should be five times the diameter of the rivet, and the distance apart of the two rows of rivets (A) should be 1½ times D. The greatest pitch should be 3½ times D, as shown in Fig. 3. Butt joints will obey the same rules.

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[18,086] **Engineering as a Profession.** W. P. (Liverpool) writes: I should be obliged for your advice on entering the engineering profession. I am nearly 22 years of age. I have been up to the present engaged in a business quite unconnected with engineering. It is uncongenial to my tastes. I have been interested in engineering all my life, though I have practically no knowledge of it, either theoretical or practical, except what I have picked up from THE MODEL ENGINEER. (I have taken it in since January, 1901.) I am waiting daily for the result of a competition for a scholarship to Liverpool University for three years. Were I successful, I would take the engineering course. I would be 25 on completing that. I do not know whether I would take up civil, mechanical, or electrical. In any case, I suppose it would be necessary to serve some time. Considering general probabilities—(1) Would I have to serve as apprentice or pupil? (2) How many years? (3) Could I expect a nominal salary during the two or three years which I suppose I should have to serve? Would I have to pay a premium? I would want to go to a firm where I should get experience, not caring whether firm was large or small. (4) Would I be likely to have much difficulty in finding a place as apprentice or pupil on account of my age, providing I were willing to be unpaid for? (5) What would be my course of action and prospects after this? It is the question of age which troubles me most; if I thought I could be earning £100 by the age of 30, I would take the scholarship were it to be offered me. Otherwise, I would keep on in my present occupation, but engineering is the thing I think I am best fitted for. I have been interested in things mechanical all my life. I have occupied much space in putting my queries, but since they all bear on the one question I hope you will be able to reply. I expect to hear result daily.

After a three years' course at Liverpool University you would still be well advised to go through the shops for a year or two, to become thoroughly familiar with the ways and organisation of commercial engineering, as distinct from the kind taught in colleges and technical institutes. Age would bar you from going as an ordinary apprentice, but with the advantage of a three years' course you might have rather less than ordinary trouble in obtaining a post as improver or assistant in some small concern, yet doing a good business. However, in this matter you will have to act for yourself. Salary, again, would depend on ability, and the firm you got with. With ordinary perseverance and ability you should be making the sum you mention at the age of 30, *i.e.*, five years after finishing the course, and say allowing for 2½ or 3 years at a very low wage—a matter of 10s. a week probably.

[18,069] **Telephones.** S. M. F. (Hatch End) writes: I am putting up a telephone between a private house and stable, and I want to make an extension to a third instrument. My idea is as shown (sketch not reproduced). I particularly do not want to use a third wire, as the distance is about 300 yards from A to C, and I have bought all the wire (using water-pipes for return earth). The result of present arrangement would be that if A pressed ringing key, B and C would both ring; similarly, if B or C rang up, the other two would both ring. Usually, it would be A ringing B (stable) or C (cottage), in which case a signal could be arranged—one long for B and two long for C, etc. What I would like to know is—(1) Would A ring B and C, both being in parallel, or would B take all the current, being the nearest? (2) If A were talking to C, would the fact that the bell at B was in circuit with megaphone at A interrupt conversation; or, similarly, if A were talking to B. B and C are never likely to be in conversation together. (3) Would the batteries have to be extra powerful to ring the two bells in parallel of the other instruments? (4) Is there any other method of connections with only *two* wires, one aerial and the other earthed, which would obviate any of the faults mentioned?

Your underground wire should be protected by wooden troughing and bitumen run in. We cannot advise the wire being run in the surface-water drainpipes, as the lead covering would probably be attacked in a very short time. You will have no difficulty with either speaking or ringing on the plan proposed by you. We should, however, advise induction coils, as the speaking will be much better and extra expense is trifling. Two cells at each end ought to be sufficient.

[18,078] **Electrical Engineering and Central Station Work.** W. R. C. (Kent) writes: Will you kindly answer me the following: I am 17 years of age, and have been employed in the instrument testing-room of a well-known electrical firm for about a year, having been introduced by a friend. The work I have to do is to test and calibrate volt- and ammeters, make and stamp the scales for them, etc. I am not certain what I ought to aim at becoming eventually. I am rather good at my work, taking a great interest in all I do. I should like to get into some electric light power station, but have recently been told that there are no prospects whatever, and that you cannot rise to a position commanding more than about £3 a week. Is this so? If it is, what would you advise me to aim at, also what departments ought I to try and go through? I was told that for a power station you have to know a good bit about steam engines. Is this right? The firm I am with make, besides instruments, dynamos, motors, switch gear, cables, arc lamps, etc. Ought I to go through the drawing office? I intend to go to classes of practical electrical engineering and theory, magnetism, and electricity this winter at Goldsmith's College, New Cross. I should like your opinion as to the power station. Would you tell me what kind of work it is at one at the start, with what wages, and the different stages of the work? Do you know anything of Hove (Sussex) electric lighting station? I should like, if possible, to get there, as my parents are likely to move to Hove. How could I get into a station later on—by applying some time beforehand, or what? This is, if the prospects are any good. I shall esteem it a great favour if you will let me have your advice upon the above.

We suggest that you make enquiries at the works you are at at present and find out from your foreman whether there is not a possibility of your being moved to some other department of the same works. No doubt your firm have a generating plant of their own, and perhaps you could gain some experience at this work before you make a move. Generating station work is no great catch, and most junior positions are very much underpaid. We suggest that you learn all you can where you are, and try to get put on to more advanced work, or even into the drawing office. A good knowledge of steam engines and boilers is necessary, even for a switchboard job at a generating station, as the drivers are not always to be depended upon. As regards the Hove station, all you can do is to apply to the chief engineer there, and ask if there is any likelihood of a vacancy occurring shortly, and to have your name put on their list. More than this we cannot say, as much depends on what personal efforts you can make and what your firm are willing to give you in the way of opportunities for gaining experience.

[18,068] **Induction Coil Making.** W. B. (Beith) writes: I intend making an induction coil to give ½-in. spark. I have THE MODEL ENGINEER Handbook on "Coils," but should like you to answer a few questions for me, as follows—(1) I enclose you three samples of paper. Please say if any one of these will do for using in the condenser of coil, and if so, which one? (2) Can you tell me the voltage of a ½-in. spark coil? (3) Is there any danger in working an induction coil? For instance, would touching the terminals or wires of the primary or secondary produce any serious effect on the person touching them? (4) Can you tell me what effect would result if I connected up a new 100-volt 16 c.-p. incandescent electric lamp to the ends of the secondary? (5) Can you tell me what height to centre of contact-breaker should be? Would a fretsaw lathe do for turning dynamo or engine castings?

(1) No. 3 paper would be preferable, if you can obtain it without the ruled lines; otherwise, we advise you to try No. 1 sample. Two sheets should be used between each pair of tinfoil plates to guard against the possibility of microscopic holes being in either sheet. It is exceedingly improbable that two such holes would come in line with each other—a hole in one sheet would be likely to come opposite to a sound place in the second sheet, and so on. (2) Cannot be stated accurately, and depends to some extent upon the shape of the discharger rods. Possibly about 12,000 volts. (3) Not in the same sense as a shock taken from a 12,000-volt power main, as the actual energy given by the coil is small. The effect is, however, severe as a shock, and might produce an injurious result. It is a good plan to keep one hand behind your back when manipulating an induction coil in action, so that any shock will be likely to miss a vital part of your body. (4) You may obtain some brush discharge and perhaps some sparks; try the experiment. (5) A matter of convenience; a good idea of the proportions of a contact-breaker is given on page 40 of our Handbook.

[18,087] **400-watt Dynamo.** S. P. (Douglas) writes: I have a dynamo, magnet wound with the thin wire enclosed (about 9 lbs. in weight, weighed by myself). It is cast iron, Kapp type, with cores 4 ins. by 2½ ins., with the wire 3 ins. deep on them, with 2 ins. wire room between poles. The armature tunnel is bored 4 ins. by 4 ins., and I want to know if it is possible to obtain 100 volts 4 amps. from it, and would 2 lbs. weight of thick wire (enclosed) be suitable to wind the armature with?

Yes. Should give about 400 watts. Wind armature with 2 lbs. No. 22 (*i.e.*, the thicker of the wires you sent) and connect the field in shunt. The fine wire is No. 25 S.W.G.

Further Replies from Readers.

[18,023] **Capacity of Accumulator.** In your issue of the 5th inst. R. L. (Stanwell Moor) asks: "If an accumulator of 20 amps. is being charged, and is fully charged, by a 25-amp. dynamo, would the ammeter only show 5 amps. as the output of the dynamo under a full load?" I think I understand what he wants to know, and my reply is: No; the ammeter will show 20 amps. when the cells are fully charged. The fact of the cells being fully charged by their charging current of 20 amps. does not stop the flow of current, viz., 20 amps., through them, provided that the applied pressure is in excess of the B.B.M.F. of cells. What I think our friend has in his mind is: That when the cells are fully charged—charging current 20 amps.—for (number of hours not mentioned) with a machine capable of giving 25 amps. at (voltage not mentioned), the 20-amp. reading on ammeter somehow disappears, and as this machine is a 25-amp. one, all the ammeter shows is 5 amps., because the cells are fully charged, and that the charged cells are having 5 amps. pumped through them, and this is all the work the machine is doing. Of course, this is not so; 20 amps. will continue to flow as long as the machine is kept running. I hope this will be clear to him.—H. ANDREWS.

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The Editor's Page.

We would remind intending competitors that all entries for the Open Competition at the forthcoming Exhibition must be sent in by Tuesday next, October 1st. Judging from the entries and correspondence already received, this competition is arousing a good deal of interest, and we hope a thoroughly representative display of readers' work will result.

* * *

As announced in our last issue, we have decided to arrange for a Sale Section in the Exhibition, where models, etc., may be exhibited with a view to their being disposed of. There will be such a large attendance of the model-loving public at the Exhibition, that the opportunity for finding purchasers for models and scientific apparatus of all kinds will be unique. The exhibits in this section will be numbered, and a register of the owner's name and address and the sale price will be kept in the office of the Exhibition management, where it can at all times be consulted by intending purchasers. A registration fee of 2s. 6d. will be charged for each exhibit in this section, and a commission of 5 per cent. on the purchase price will be payable if a sale is effected. The delivery and removal of the model must be made by the owner, who must also take all risk while the model is on show.

* * *

Most of the space available for trade exhibits has now been let, but one or two positions are still open at the moment of going to press. If there are any of our trade friends who are still undecided whether to show or not, we would advise them to send in an application for space without delay if they wish to secure a position. We may say that the whole of the Exhibition arrangements are being organised on a thoroughly first-class scale, and both the show and the attendance will be unique in the history of model engineering. We have been told by those who have had considerable experience in exhibition management, and who know our plans, that our greatest difficulty will be to provide sufficient space for the visitors!

Answers to Correspondents.

G. W. (St. Arnaud).—You are quite correct as to the horse-power of the dynamo. The output of the machine is found by multiplying the volts and the amperes together and dividing by 746. The figure—14 h.-p.—marked on the plate is the horse-power required to drive the machine to give the required output.

W. S. (Leeds).—Try Messrs. Bassett-Lowke and Co., Northampton, for the castings you require.

M. P. T. (Eden View).—A petrol engine is, perhaps, more reliable and starts more easily. About 2 h.-p. would be required. Use a reversible propeller. The makers would advise as to size when you settle on the engine to be used. An Otto cycle type is to be preferred, and get a *written guarantee* as to b.h.-p., no matter who you buy from.

"Several Querists."—We have the matter of the M.R. bogie single express locomotives in hand, and as soon as space permits we will insert a drawing of No. 2,601 with tender.

H. G. B. (Woodford Green).—We do not know of any firm supplying castings for this boiler. Try Stuart Turner, Ltd., or W. J. Bassett-Lowke and Co.

R. Moxon.—Thanks for letter and photograph of your work. We shall be pleased to insert them in our "Practical Letters" columns if you can send us a better print for reproduction.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

How to Address Letters.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

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Contents.

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

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THE

Model Engineer

And Electrician.

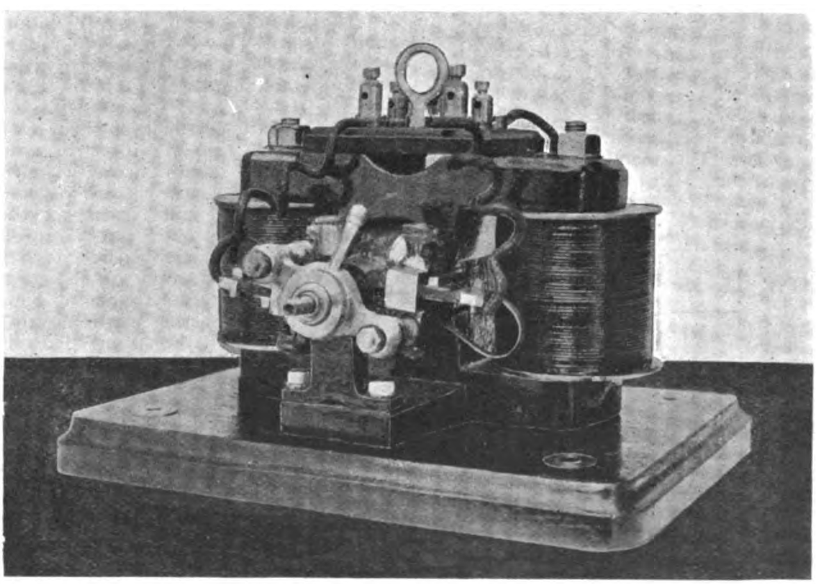
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

Vol. XVII. No. 336. OCTOBER 3, 1907. PUBLISHED WEEKLY

A 40-watt Manchester Type Dynamo.

By E. J. Szlumper.



Mr. E. J. Szlumper's Small Dynamo.

THE above photograph depicts a 40-watt Manchester type dynamo I have constructed during nine months of my spare time. The armature is a 2-in. by 2-in. laminated eight-slot drum, wound in eight sections. The worst piece of work in the whole machine was the commutator. This is a built-up one, turned and bored from a solid piece of brass, and insulated with red fibre, except round the end washers; here the insulation is formed of linen soaked in shellac varnish. I used this because the end clamps of the commutator cut through other substances and shorted the segments. I made six of these commutators before I had one successful. The size of it is 1 in. long by ⅞ in. diameter. The shaft is mild steel 7¼ ins. long, and ¼ in. at bearings.

The bearings are cast from my own patterns, those sent with the castings being ¼ in. too low. I sent them back, thinking that I had been sent the wrong ones, but they were returned to me with the advice to pack them up with hardwood.

The brush gear that was sent did not please me, so I made a pattern for the rocker and had it cast in gun-metal. The handle which is fitted on it is polished steel.

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The brush-boxes are cut from the solid. The springs are adjustable, and are of unusual design. A piece of flat spring steel is bent to a horseshoe and screwed to a collar, which is fitted with a knurled headscrew and placed beside the brush-box on the arm of the rocker. The free end of the spring engages with a brass plate which is screwed in with the brush. The tension of the spring can be altered by moving the collar round the rocker arm and securing it.

The brushes are of copper gauze, with a brass cap on the outer end for connection to the leads.

There are two oil cups fitted on the bearings. They are provided with tight-fitting covers, the edges of which are knurled.

The terminal board is a piece of ebonite, and is fitted with five terminals, two long and three short. The two long ones are connected to the brushes and the other three, short, to the field coils, so that the machine can be connected up in any way desired, although it is generally run shunt-connected.

The eyebolt is turned and filed from a mild steel forging, and is highly polished.

Before the terminal board was screwed in position a piece of paper was slipped underneath to prevent accidental shorts through the field-magnets.

All the knurled headscrews, terminals, etc., were turned from brass rod. All steel work is highly polished. The belt wheel, which is turned from a piece of 1¾-in. mild steel and polished, looks particularly fine. All brasswork is polished and lacquered, and the iron and bearing pedestals are enamelled dark green. The machine is mounted on a polished teak base, with brass bolt-holes let in each corner. I have driven it off a lathe, and it works very satisfactorily.

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.]

Making an Eccentric.

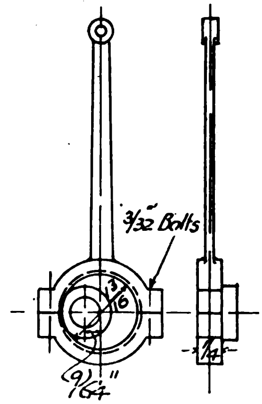
By H. MUNCASTER.

THE right and the wrong way of doing a job is often merely a question of appliances. Before commencing we usually consider what we have to do it with. Even with a choice of means, different individuals will do the work better in different ways, and a resourceful man will get through a job successfully with appliances that the average man would not think of using. Generally speaking, however, the right way is the one that will ensure accuracy with the least expenditure of time and material, and this in a great measure depends on one's skill in manipulation.

We may take it for granted that an amateur may not require to rig up any elaborate appliances such as would be demanded where a great deal of repetition work has to be done. In purely amateur work one rarely does exactly the same thing more than once, except perhaps in a few minor details. For this reason it is not desirable to go to any great trouble in supplying what may be considered adequate means if possessed of sufficient skill to accomplish the work with what appliances may be at hand.

Some little time ago the writer required three eccentrics which were to be practically the same in every respect; instead, however, of making them all in the same manner, he determined to try a different method for each, using the same care, and afterwards make a test to see which was the most successful as regards accuracy.

FIG. 1.



The sketch (Fig. 1) gives details of eccentric and strap. The castings for the straps were of brass, and were cast in a piece with the rod. The diameter of sheaf was 13-16ths in., and the length of the rod—C to C—about 3 ins.

In the case of the first sheaf to be turned the eccentric was simply gripped in a Cushman chuck by means of a piece cast for the purpose, as shown (Fig. 2), the eccentric turned to size with the bead, as required, a small cutting-off tool being used having a narrow but flat face. This tool also was used for facing the side at *a*; a small ring was turned on the boss, as shown at *b*, to enable the centre of shaft *c* to be set off at the correct distance. The casting was removed, the chucking-piece cut off, and the stump filed off level with the face *a*. The centre *c* was next marked with the

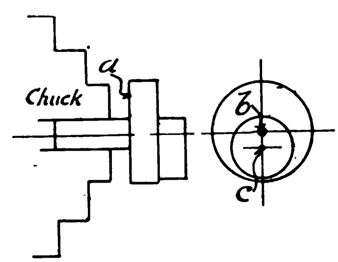


FIG. 2.

punch 9-64ths in. from the centre of sheaf. The sheaf was then mounted on the faceplate, as shown in Fig. 3, by means of a 5-16ths-in. bolt *b*, and a piece of 1¼-in. by ⅜-in. flat bar *c*, a piece of stout sheet brass being placed over the centre opening to form a flat surface for the shaft to lie against. A 5-16ths-in. drill was put against the back centre and the hole drilled, the drill, of, course being prevented from revolving. The eccentric was then mounted on a mandrel and the boss turned to size and finished, also the adjacent face of the sheaf.

A small template *a* was made, as shown (Fig. 4), to fit the eccentric, also a corresponding one to

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turn the strap to (*b*). The strap was then fixed to the faceplate and held in a manner similar to the sheaf, using two bolts *b b* (as shown in Fig. 5) and two pieces of 1-in. by ¼-in. flat. A special tool was prepared for the boring of the straps, as shown in Fig. 6, the width of the cutting edge being only 1-16th in. This tool will do all the necessary work —boring the hole and cutting the groove, the latter being made to suit the template *b*. There is no need to use calipers, as the hole may be bored to allow the eccentric to enter, and there is no difficulty in getting an exact fit.

The amount of facing that can be done on the side of the eccentric is very limited on account of

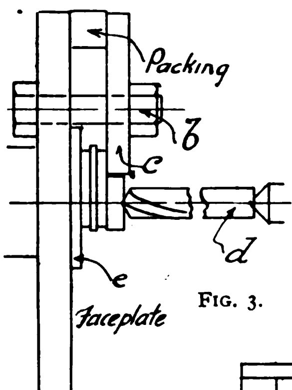

FIG. 3.

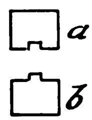

FIG. 4.

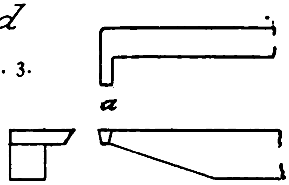

FIG. 6.

the clamps holding it, but if a small portion be trued to the bore, it will serve as a guide, and the rest can be filed up.

Having removed the strap from the lathe the bolt holes were marked off and drilled. This is a very simple matter, a piece of bar being clamped

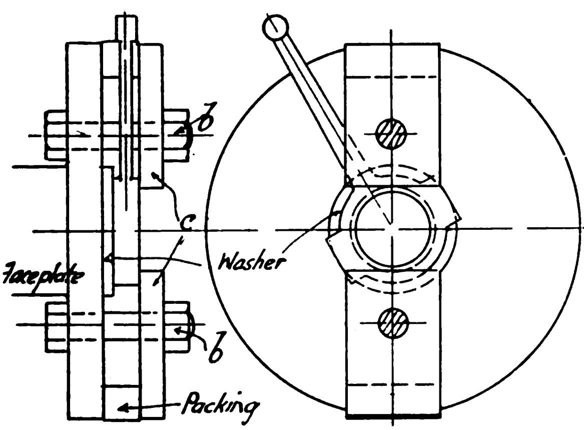

FIG. 5.

by means of two plates and packing to the rod by a ¼-in. bolt, as shown in Fig. 7, the bar having a V-cut in one end and a centre-mark on the other. The whole can easily be held in the (left) hand and drilled in the lathe. The strap was now split by means of a saw made out of an old table-knife, the cut being extremely thin. The writer has for years used with success a table-knife that has been worn thin as a saw for cutting brass. The teeth are formed by striking the sharp edge of the knife

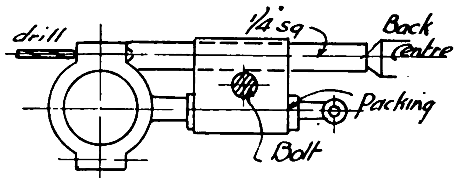

FIG. 7.

across a rough file; a few blows, not too hard, will give a serrated edge that will cut ordinary brass and gun-metal easily, an occasional blow or two across the file being all that is necessary to renew the cutting edge.

After cutting, the joints were levelled with a file and a thin brass liner fitted, the cutting and subsequent levelling not exceeding a total of 1-32nd in., taken from the joint. Bolts were then fitted and

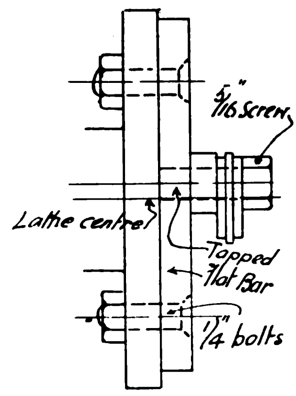

FIG. 8.

the eccentric finished off. In one case the holes were drilled, the straps split and bolted up before being bored, no liners thus being fitted to the joints. In the case of the third strap the bore was rather full, and after drilling and splitting, the parts were bolted up without any liners, a light blow across the joint serving to close the strap slightly, which was then a splendid fit.

In the case of the second sheaf the chucking-piece was cut off the casting first of all, and the back of the eccentric roughly filed to a fair surface. The boss centre was punched and drilled for the shaft, the drill being in the chuck and the sheaf held against the end of the tailstock spindle. After drilling, it was mounted on a mandrel; the boss and both sides turned. No trouble was taken to set-off the centre of the eccentric; there was plenty of metal to spare. An arrangement was rigged up, as shown in Fig. 8. The exact throw of the eccentric was determined by noting the greatest and least distances of the boss from the tool held in the slide-rest (the throw, of course, being equal to the differences), a few taps on the

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flat bar serving to adjust to a nicety before finally screwing up. The sheaf was then turned true to the given diameter and template.

The third sheaf was cut and drilled in precisely the same way as the second, no great care being bestowed on the operation. A mandrel was found

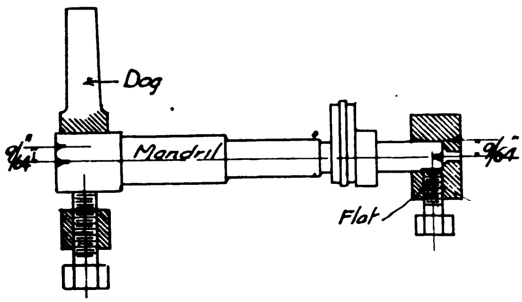

FIG. 9.

with four diameters, the smallest being 5-16ths in. diameter, and rigged up, as in Fig. 9; an odd piece of iron about ½ in. thick and 1-in. square was picked out of scrap, a 3-32nds-in. hole drilled through it, and a 5-16ths-in. drill made to follow not quite through; a ¼-in. set screw was fitted, a small flat filed on the end of the mandrel, and the iron piece put on and screwed up, the flat being to ensure the piece being put back to the same position when removed.

By means of the scribing block a line was drawn across each end, passing through the centre of the mandrel; on this line new centres were marked off 9-64ths in. from the old ones, and a hole run in with a 3-32nds-in. drill some 3-16ths in. or so.

The sheaf was mounted on this mandrel, care being taken that the eccentric was in the right direction for the new centres. The boss and the

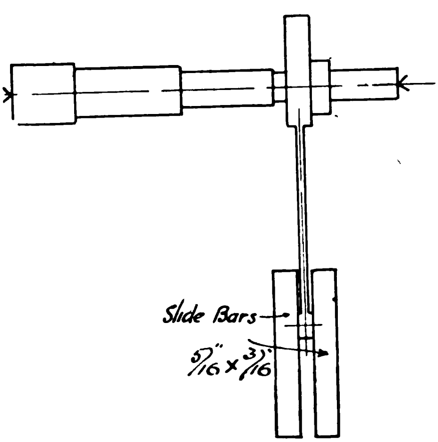

FIG. 10.

sides of the eccentric were first turned on the original centres; then the mandrel mounted on the new centres and the work finished, the actual operation of turning not occupying more than (say) ten minutes.

The three eccentrics were then put together and tested to see if the axes of the sheaves were parallel to the shaft. To this end each was mounted on a mandrel fixed in the lathe centre, and the slide-rest brought up so that the end of the rod rested on the flat surface, and two light bars arranged so that the boss on the eccentric rod worked between, the bars touching the boss so that any side-movement due to the eccentric being out of truth would spread them when the mandrel was turned. In the two latter eccentrics no appreciable movement was apparent, and in the first it would not be quite 1-32nd in., the stroke in all cases being 9-32nds in. exactly.

The writer's conclusion is that of the three ways of turning an eccentric the last-named (shown in Fig. 9) is preferable, most easily prepared, and, when the work is finished, more likely to be accurate than by the other methods. The same rig may be made to suit several sizes of eccentric, while still retaining its usefulness as a mandrel.

It is difficult to fix securely a small eccentric to a faceplate, and when drilling a hole for the shaft—which is by far the heaviest operation—the work is rather liable to be shifted. There is also a lot of trouble in setting, besides the work of marking out the centre every time and changing the faceplate for the chuck and again for a mandrel.

The Latest in Engineering.

A Large Mooring Buoy.—The largest mooring buoy ever laid down has just been put in position in the Mersey for the use of the Cunard liners *Lusitania* and *Mauretania*. The buoy is pear-shaped, and is also a gas buoy, the lamp being carried on a tripod on the top, which is removed when the buoy is in use. It weighs about 17 tons, and is moored in 10 fathoms at low water, the depth at high water being nearly 15 fathoms. The mooring cables are of square section with stud links, and these, together with the anchors and shackles, aggregate 230 tons 13 cwt. The two shackles at the top of the buoy weigh 11½ cwt.

Motor Lifeboat for the Tees.—The third motor lifeboat to be brought into service by the National Lifeboat Institution is practically ready for its station on the Tees. She will be the only vessel of her kind on the North-East Coast, and will be stationed near Seaton Carew, always afloat in the shelter of Greatham Creek, and thus ready at a moment's notice when her services are required. The new lifeboat has been built by the Thames Shipbuilding Company, and fitted with engines of 40 h.-p., by Messrs. Tyler & Co., of London, the accommodation being for fifty persons in addition to the crew.

Experimental Tank for Japan.—The very special equipment of machinery and apparatus which the firm of M. Kelso and Company, mechanicians and model makers, of Glasgow, have been engaged upon for some time for the Mitsu Bishi Company, of Nagasaki, Japan, to be fitted in the experimental tank which that shipbuilding concern is establishing for its own use, is shortly to be despatched to the East, according to the *Engineer*. The tank is 400 ft. in length by 20 ft. in width, and about 10 ft. in depth, and the machines and recording apparatus, as well as the machinery for moulding and shaping the models to be tried for speed, has

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been based on the previous experience of Kelso and Company with the special work in the case of the Clydebank tank and those at St. Petersburg and at Spezzia, all of which, of course, were based on the study of the original tank of Mr. Froude, of Torquay and Gosport, and of the succeeding one at the shipyard of William Denny & Brothers, Dumbarton. A mechanician from the latter place has been engaged to proceed to Japan in connection with the preliminary laying down of the tank, and Mr. Kelso is shortly to follow, and will see to the complete installation of the varied and delicate apparatus. A native naval architect was for a considerable time, by the courtesy of our Admiralty and the firms of Wm. Denny & Brothers, Dumbarton, and John Brown & Co., of Clydebank, granted a period of study in their several experimental departments.

A Stranding Buoy.—Following the terrible disaster last winter at the Hook of Holland, Mr. Bredsdorff, a director of the Flensburger Shipbuilding Company, of Flensburg, has invented what he terms a stranding buoy. The idea is that when a ship is on the lee shore communication can be set up between the ship and the shore by means of a buoy fitted with a small sail and having the end of a fine line attached to it. When the buoy is thrown overboard it is blown to the shore and brings with it the line from the ship to the life-saving crew, and enables them to bring a heavier rope from the ship to the shore or *vice versa*. The buoy is made of yellow metal and measures about 36 ins. in length, and is made boat shape and fitted with a mast, sail, and four handles. The weight is about 25 lbs., and immediately the buoy enters the water the ballast keeps it upright. In the upper part a watertight aperture is provided, so that the buoy can serve as a receptacle for important documents, and may be provided with a store of provisions within its body. In case of foundering in the open sea such a buoy has a better chance of being picked up than the old-fashioned bottle. The stranding buoy is also a lifebuoy fairly able to support two or three persons in the water.

Notes on Wireless Telegraphy Apparatus.

By V. W. Delves-Broughton.

A Sensitive Non-polarised Relay.

In the article which appeared in the issue for July 4th, I described a polarised relay suitable for radio-telegraphy, which has been constructed and tried with great success. An amateur instrument-maker may, however, be frightened at the amount of work entailed in its construction. I therefore propose describing in the present article a simpler form of relay, which should give fairly good results; but it must be remembered that the residual magnetism in the iron cores, which with the utmost care cannot be avoided, is bound to render any type of non-polarised relay less sensitive to feeble currents than a properly constructed polarised relay. This non-polarised relay should work freely with one milliampere, and can therefore be used with several types of coherer, although it may not be sensitive enough for the so-called Marconi type, where extremely feeble rays are to be entrapped.

The cores of the relay are formed out of bundles of iron wire (about No. 22 gauge) welded into a solid yoke formed out of a piece of Swedish iron.

If the wires are fitted tightly into the yoke-piece, leaving about 1-16th in. projecting at the back, Messrs. Thorn & Hoddle will weld them in for a trifling sum—(address, 151, Victoria Street, Westminster)—with their acetylene welding process.

The yoke can be filed off flush on the back, and will be found to show no indication of having had any core passed through it.

Next the bobbins for the coils should be made, the flanges being formed out of brass castings, neatly filed up, and the tubes soldered into position. Each bobbin should be split down one side through both the flanges and tube. Now temporarily slip the bobbins on the cores, and secure the yoke Y to the flanges with a couple of brass screws and fit the pole-pieces B, which are also secured to the flanges by two brass screws (see Fig. 4).

The loose ends of the core wires should now be wedged tight with a few pointed sprigs (but not so tight that the pole-pieces cannot be pulled off), and the ends of the core filed off flush with the pole-pieces.

Now dismount again, and after wrapping a piece of iron wire round the wire forming the cores (to prevent their being distorted during the process), anneal all the iron-work, including the pole-pieces B and armature W, which is formed out of a small piece of sheet iron (about No. 26 gauge) bent round into a tube, but with the joint not absolutely touching. Slots should be cut in W for X to pass through previously to bending it round, as it can then be cut comparatively easily with a fretsaw.

After being annealed, none of the iron work must be touched with any tool, and even cleaning up with emery cloth should be avoided.

Next the coils C can be wound in the same manner as described for the polarised relay, only using No. 40 wire instead of 42, the outer layer being of No. 30 D.S.C. wire, to give a good finish. The coils, after being boiled in wax and resin, may be mounted on the cores after removing the wrapping wire, and the pole-pieces fixed in place, a few pieces of pointed iron wire being *pushed*, not hammered, in to make a good magnetic contact. Of course, these pieces of wire must be carefully annealed, and care must be taken not to put any in near the slit in the tube, or they will be sure to find their way through and break the fine wire wound on the bobbin or do some other damage. The contact-screw P, regulating screw S, and clamping screws A, mounted on a Z-pillar, are clearly shown in the drawings, and call for no special remark.

The suspension bar X is formed of a piece of light brass or German silver, and should be, like the rest of the brass work, neatly finished and lacquered. A small button of platinum is soldered to the under-side of X in such a manner that it exactly opposes itself to the platinum point of the contact-screw P.

X rests on a knife edge formed on the top of the pillar N, which is also provided with a pin projection which passes through a hole in X, which is quite slack on the pin, and only serves to prevent X from shifting. X is carried out beyond N, and a spring R is fixed in such a manner that

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W is kept away from the pole-pieces B. The tension of R is regulated by a hook K made to slide up and down a slot formed in the pillar N and secured by a small nut.

D and D are two posts which are bored out at the top, and small plugs with knurled heads are fitted; these plugs are slit down with a fretsaw to ensure a spring fit in the posts D. Through these same slots pass a short piece of silk thead (that obtained from unravelling a piece of Tussore silk is excellent for the purpose), and attached to the suspension bar X in such a manner that it cannot slip sideways; the silk must be quite slack, however.

The silk threads are indicated by the letter L in Figs. 2 and 3.

H indicates the base, which may be of slate, ebonite, or even wood.

T and T are the distant or coherer terminals, and T1 and T1 are the local or recorder terminals. These are connected to the coils, etc., by stout copper wire run in grooves cut in the under-side of the base.

X is attached to N by a small spiral of very flexible wire; this should either be fixed with very small screws or by a touch of solder.

The construction of the Z pillar can be simplified from that shown in the drawing by fixing an ivory point to the screw G instead of insulating the block in which it is fitted.

The central part of the knife edge on the top of N is filed out to make a convenient place to bore a hole for the pin, which has already been mentioned. It is advisable to make N of steel and to harden and temper it, as it is important that the knife edge should be ground up sharp and smooth, and it is difficult to prevent a wire "edge" forming in anything softer than tempered steel.

The spring R can be formed by wrapping some No. 30 copper wire round a bit of silver steel, soldering one end, and running it round in the lathe whilst the whole contrivance is clamped tightly between two strips of hardwood held in the hands. This soon hardens the wire, and a spring made in this way is very good where quite light springs are required. German silver or phosphor bronze treated in the same way are better, but it is sometimes difficult to pick up the gauge required.

All light springs should be protected with a coating of lacquer, care being taken to apply the latter very lightly and to keep the convolutions apart during the process by suspending a light weight from the spring.

In all types of relays plenty of wire should be used if they are required to work with small currents, as it is preferable to cut down the current in this manner to splitting up the current by a "potential divider." On a long telegraph line it is advisable to make the resistance of the relay eqnal to about five-eighths of that of the line; and, if either of the relays is used for that purpose it is advisable to wind the bobbins full and regulate the resistance by choosing the wire with a suitable gauge.

This relay is distinctly easier to construct than the relay described in the previous article, because it is wound on a round bobbin and also because it is wound with thicker wire. I do not think it would be advisable to try winding with thinner wire than No. 40, for, as already explained, owing to the residual magnetism, a certain amount of energy is bound to be lost; and then, again, the spring, however finely it is adjusted, will take a certain pull to stretch it, whereas in the polarised relay the attractive force of the negative pole disappears on the current flowing through the coils.

Neither of these relays will work very fast, *i.e.*, they could not be used to record a message despatched by an automatic sender, as their self-inductance would be too great, and some such instrument as a syphon recorder or a moving coil instrument (as described in Mr. Howgrave Graham's book on "Wireless Telegraphy") would have to be used; but these instruments are quite quick enough to take any message sent by an ordinary Morse key, either by wire or "wireless."

When used for wireless telegraphy both these relays should be provided with a non-inductive resistance across the platinum contacts or between the terminals, which is practically the same thing. This resistance should be about six to eight times that of the recorder or other instrument used with the relay. As a further precaution a sheet metal shield should be placed between the relay and the coherer and the wires leading thereto. A sheet-metal screen should be fitted across the front flanges of the relay bobbins to protect the leads to the coherer from the influence of the spark.

The spark due to the "extra current" produced by breaking contact in apparatus is very peculiar in its action, and if provided with a non-inductive resistance across the break, will generally disappear, but periodically will occur without any apparent cause or alteration in the prevailing conditions.

I have never seen this phenomena noticed nor explained in any way, and only discovered it quite accidentally when experimenting some years ago with a new coherer, which, by the way, was not a success.

The relay would work for hours perfectly without any trouble; then five or six sparks would occur, and then again it would work perfectly. Altering the resistance across the break had no effect, and periodically the coherer and relay started off in the most erratic manner, each acting on the other at a most alarming pace! On fitting sheet-metal screens, however, this effect was obliterated.

If these relays are used with a recorder or other instrument taking a very heavy current, it may be found necessary to interpose a second relay wound with thicker wire between the two, as if the current passed is too strong, the magnetism in the polarised relay and the spring in the non-polarised relay may not be powerful enough to separate the platinum contacts, if these instruments are at all finely adjusted.

(*To be continued.*)

A Novel Plating Process.—In a novel electroplating process recently developed in France, the solution—which may be of any of the usual plating baths—is contained in a brush, which is connected to the positive pole of the electric circuit, while the object to be plated is connected to the negative pole, and simply brushing the well-cleaned object gives a regular and adherent deposit. The thickness of the layer formed depends on the duration of the brushing, and the number of applications to each spot. Larger objects than usual can be covered, and a surface may be plated with several different metals, thus giving a varied decoration.

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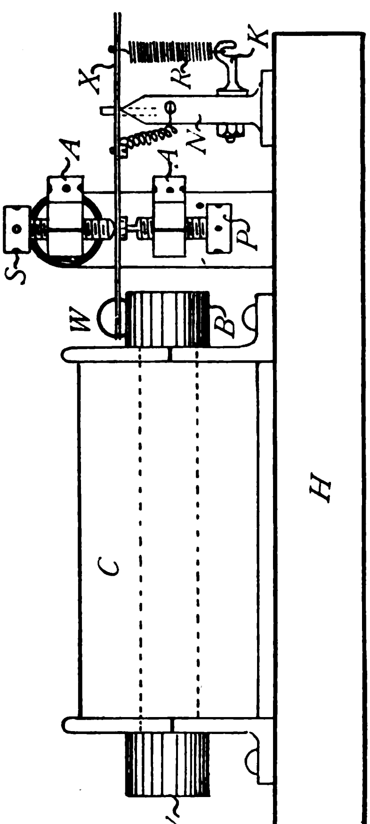

Fig. 1.—Side Elevation.

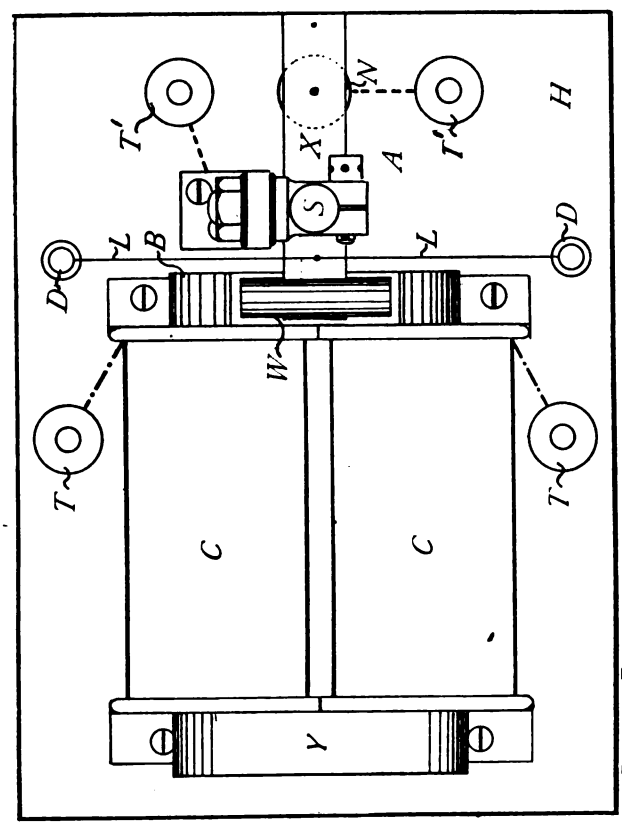

Fig. 2.—Plan.

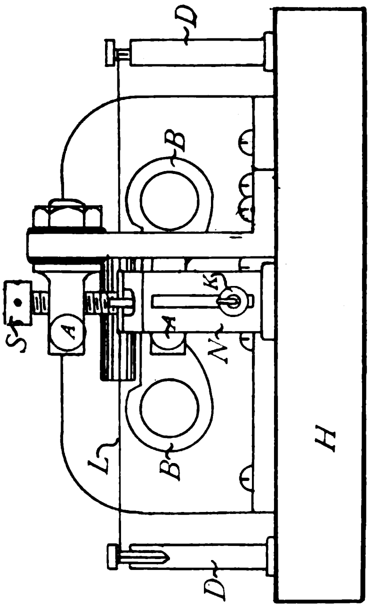

Fig. 3.—End Elevation.

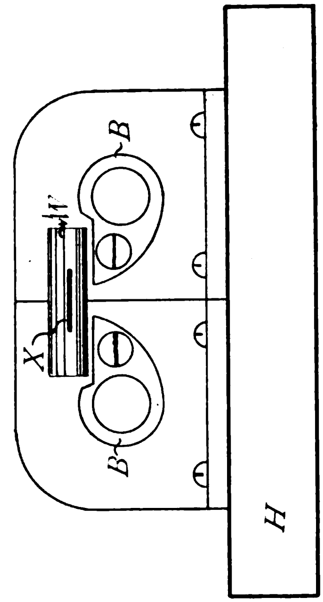

Fig. 4.—End Elevation, with Contact Pillar, Etc., Removed.

A SENSITIVE NON-POLARIZED RELAY.

Chats on Model Locomotives.

By Henry Greenly.

(Continued from page 302.)

Locomotives and Railway Curves.

For a considerable time past there appears to have been some doubt among Model Engineer readers and others as to the "curve-negotiating" properties of model locomotives and railway vehicles. Statements have been made on the subject—possibly I have been responsible for some of them—which tend to show differences of opinion as to the minimum curve round which a given engine will travel, and although not the result of sheer perversity, they are apt to mislead the unsophisticated. For instance, it was said that the smallest curve over which a ½-in. scale express engine of maximum proportions in all directions should run at top speed was 20-ft. radius. Then somebody interpolates with the remark that a similar engine would traverse a curve of 6-ft. radius. Both statements may be quite true, and also the one that a ½-in. scale 4—4—0 type engine could be made to run round a 2-ft. 4-in. radius curve. But the beginner requires to know why there is such a difference apparent in the three statements. Like in everything else, it depends on the point of view which is taken. In the first case, the speed very largely governed the choice of curve; in the second and third, speed evidently did not enter the question to any extent, but upon how flexible—I was going to say "ramshackley"—the running gear of the model was made. A perfect scale model is the worst possible type of engine for negotiating curves.

The two main considerations which present themselves are, therefore—

(1) The flexibility of the wheelbase;

(2) The speed of the locomotive round the curves.

Both headings are respectively modified by the design and scale accuracy of the model locomotive and the amount of superelevation which is given to the outer rail of the track.

Although, in dealing with this subject as fully as time and space will admit, I will formulate some simple arithmetic rules for finding the minimum curves and settling the amount of superelevation, I shall endeavour to refrain from belabouring the mathematical drum as much as possible—some people object to such music. To commence operations, therefore, I include the following observations, which have come within my personal experience in practical model railway work, and which, I think, may be cited with advantage:—

(1) Light model locomotives made of tinplate stampings, ½-in. scale, with more or less unlimited play in the bogie and 3-16ths-in. total clearance between flange and rails will traverse curves of only 2-ft. 4-in. radius. Above speeds of more than 2 miles per hour there is a tendency to overturn and derail, owing to centrifugal force. Superelevation of the outer rail, ¼ in.

(2) A 3½-in. gauge locomotive of rather small proportions, but having a rather high-pitched boiler (5¼ ins. above rail level, boiler diameter outside 3¼ ins.), the total wheelbase being 12 ins., of which 4½ ins. was fixed. The engine was very flexible in the matter of wheelbase, and would traverse a 5-ft. radius without undue "grind." It overturned or run off the track, owing to wheels lifting, at speeds over 3½ miles per hour. Superelevation, 3-16ths in. to ¼ in. maximum.

(3) A large 4—4—0 type ⅝ in. scale express engine, fixed wheelbase 5⅞ ins., total 15¼ ins., with a Bissel bogie, would traverse a 7-ft. 6-in. curve.

(4) A ¾-in. scale express engine of normal proportions will traverse a 20-ft. radius curve quite safely at 8 miles per hour. Gauge, 3½ ins.; superelevation, 5-16ths in.

(5) On a 7-ft. radius curve a ¾-in. scale 4—4—2 outside cylinder tank engine, which would traverse the curve quite easily and safely at 3 or 4 miles, overturned (without thinking twice about it) at a speed of 7 to 8 miles per hour.

(6) By allowing the maximum amount of side play possible in the bogie, and also side play in the trailing wheels, and by taking out the centre pair of wheels of the tender, a 1¼-in. bogie single-driver engine was just able to run over a 12-ft. 6-in. radius curve at low speeds. Without superelevation, the engine derailed at speeds over about 3½ to 4 miles per hour.

(7) A ⅞-in. scale locomotive, with low centre of gravity, proved quite safe on a track 40 ft. in diameter at 8 miles per hour. Superelevation, 5-16ths in. to ⅜ in.

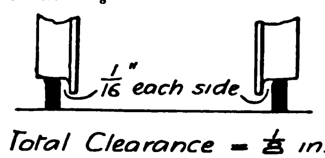

Fig. 1. Showing Clearance between Wheel and Rail.

(8) A 3-in. scale locomotive traverses a 105-ft. radius curve with ease at 7 to 8 miles per hour. Superelevation of outer rail, 2 ins. Speed on 150-ft. radius curve, 10 to 12 miles per hour. Superelevation of track (15-in. gauge), 2½ ins.

The above, I think, covers the ground sufficiently for the purpose of showing that while a comparatively very small radius may be adopted as the minimum curve if speed is left out of the question (as on siding and points and crossings) where full speeds are attained, the radius must be made larger, with given conditions the radius varying more or less as the square of the speed at which it is intended to run. If the curve is 7-ft. radius for 4 miles per hour, then 28-ft. would be required for 8 miles per hour. This rule, however, is subject to the amount of superelevation allowed, as with a greater superelevation of the outer rail the radius of the curve may be safely reduced.

Examples (1) and (6) show the great reduction in the diameter of the curve which can be obtained by arranging all the running parts very slack, providing the bogies and other wheels with a large amount of lateral play and by increasing side-clearance between rail and wheel flanges. Of course, this is done at the expense of speed and entails great superelevation at a given speed, to say nothing of its effect on the design and appearance of the bogie.

One of the first points to be dealt with in approaching any particular example is the fundamental principles governing the construction of wheel and rail. Following this, the design of the vehicle must be considered.

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If it were not for the clearance between rail and wheel flange (see Fig. 1) a rigidly built vehicle would not go round a curve at all. Sufficient clearance is necessary to prevent undue grinding of the flanges and consequent increase in train resistance, as well as to allow the vehicle to traverse a curve.

In model practice this clearance varies from 3-32nds in. total in a small model to ⅜ in. in the largest model engine (*i.e.*, a 3-in. scale locomotive). A four-wheeled engine or truck is, of course, the best sort of rigid vehicle for passing round a curve, as the only limit to the cutting down of the radius is the angle the clearance will allow the flange to make with the rail (see Fig. 3).

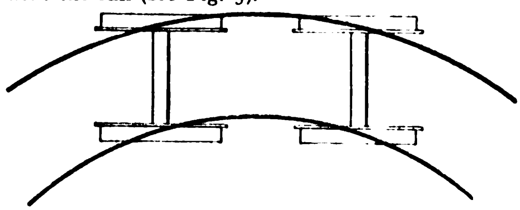

Fig. 2.—Showing a Four-wheel Vehicle on a Curve.

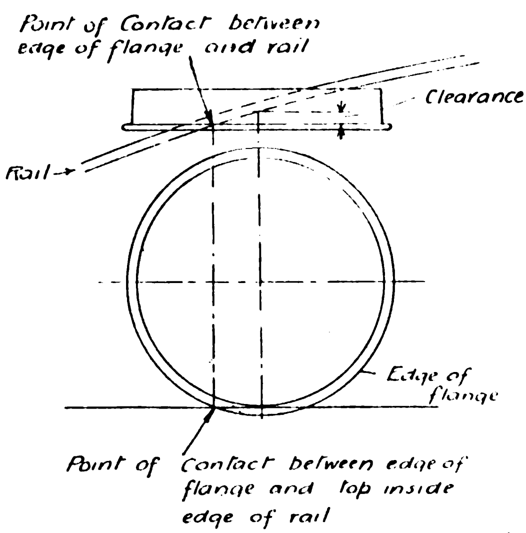

Fig. 3.—Diagram showing how not only the Clearance, but the Diameter of Wheel and Size and Shape of Flange affects the Radius of Curve.

In the case of a six-wheeled vehicle this is still true, but another factor is introduced owing to the presence of the centre pair of wheels. This makes clearance absolutely necessary and also brings in additional features of railway practice, viz., the provision of side play in rigid (*i.e.*, non-radial) axles, as shown in the accompanying figure 5, and the increase of clearance by widening the gauge on curves.

The problem that usually faces the model maker is—What is the minimum curve around which a given locomotive will pass? rather than—What type of engine will be the best for a curve of stated radius? The latter question would always be answered in the same way: a four-wheeled engine or other vehicle of the shortest possible wheelbase will prove preferable to any other type. This being so, I propose, in exemplifying, to adopt the former course and to calculate from the basis of a given locomotive.

Imagine, for instance, that we have a locomotive running on six wheels, the three axles being quite rigid and having no appreciable side play. The scale of the model is 7-16ths in. to the foot (standard 2-in. gauge), and the total wheelbase is 6 ins. We proceed to measure the clearance between the wheel flange and the rail, and find it to be 3-32nds in. total, as shown in Fig. 7, the measurements being made on a straight piece of track laid to correct gauge. Add to this the already referred to extra allowance in gauge on curves* (if any), taking this as 1-32nd in. This makes a total of ⅛ in. exactly.

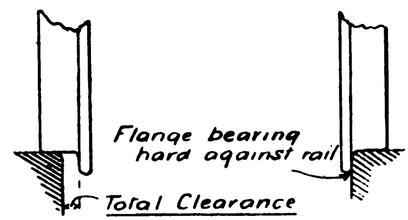

Fig. 7.—How to Measure Total Clearance.

(*Never on any account over-estimate this clearance.*)

The following rule can then be employed to find the minimum curve:—

$$R = \frac{\frac{1}{2}W \times \frac{1}{2}W}{TC + GA}$$

where R = Radius of minimum curve in inches.
½W = Half the total wheelbase.
TC = Total clearance.
GA = Extra allowance in gauge on curves.

Put into other language, the radius in inches of the minimum curve will be equal to the half the wheelbase multiplied by half the wheelbase, the result being divided by the sum of total clearance and the gauge allowance.

Therefore, with 6-in. wheelbase and a total clearance of ⅛ in., we get:—

$$R = \frac{3 \times 3}{\frac{3}{32} + \frac{1}{32}} = \frac{3 \times 3}{\frac{1}{8}} = 3 \times 3 \times \frac{8}{1}$$

$R = 9 \times 8 = 72$ ins. = 6-ft. radius;

which from my own observation is within the range of possibility.

The effect of the slightest difference in the clearance must, however, be observed. Supposing the extra allowance in the matter of rail gauge is not allowed, then the minimum radius is:—

$$R = \frac{\frac{1}{2}W \times \frac{1}{2}W}{TC} = \frac{3 \times 3}{\frac{3}{32}}$$

$$R = \frac{3 \times 3 \times 32}{3} = 96'' = 8'$$

Where the centre axle is allowed side play, however, the minimum radius will be larger, as the amount of the side play can be added to the total clearance, and the radius is thereby reduced. Supposing that the side play is 1-16th in. *on each side of the centre* (not the total), then add this to the total clearance

* The extra clearance obtained on curves by increasing the gauge is not always obtainable at points and crossings, and therefore should not be added in every case.

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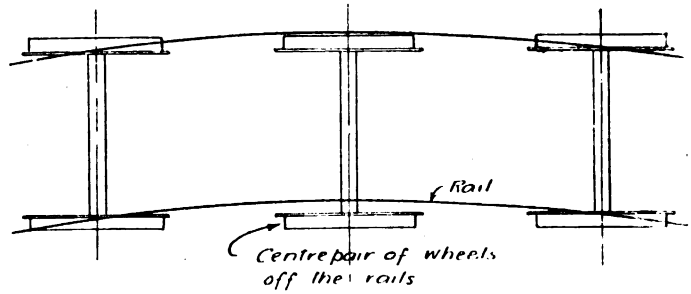

FIG. 4.—SHOWING THAT A PERFECTLY RIGID SIX-WHEELED VEHICLE CANNOT BE MADE TO TRAVERSE A CURVE WHERE THERE IS NO CLEARANCE BETWEEN RAIL AND WHEEL-FLANGE AND NO LATERAL MOVEMENT OF THE MIDDLE AXLE.

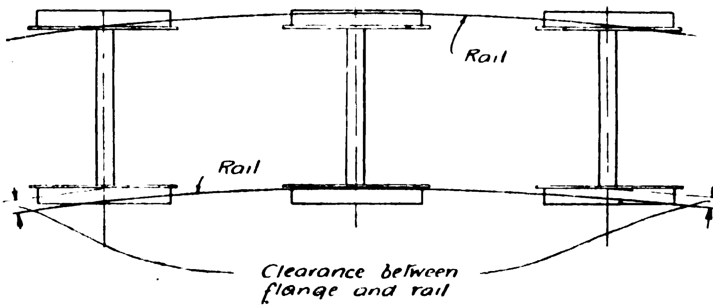

FIG. 5.—SHOWING THAT THE SAME VEHICLE WILL TRAVERSE A CURVE WHERE THERE IS CLEARANCE BETWEEN RAIL AND WHEEL, THE CURVE DEPENDING UPON THE AMOUNT OF CLEARANCE.

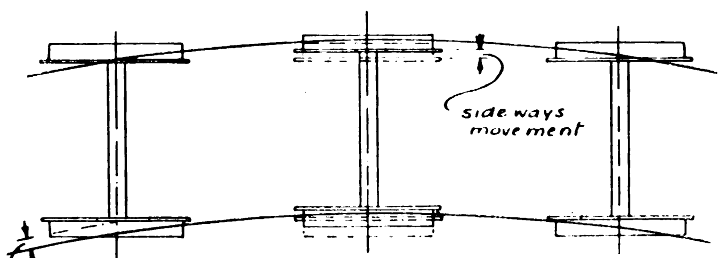

FIG. 6.—SHOWING THAT WITH LATERAL PLAY IN THE MIDDLE AXLE THE CURVE MAY BE MADE MUCH SHARPER.

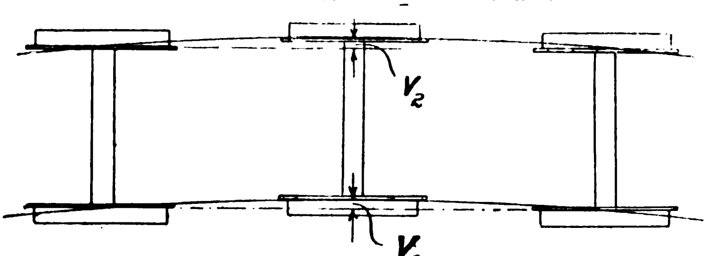

FIG. 8.—WHERE THE CENTRAL AXLE OF A SIX-WHEELED VEHICLE HAS A LATERAL MOVEMENT THE FACTOR IN THE FORMULA "V" IS ESTIMATED BY PLACING THE WHEELS WITH CENTRE AXLE PUSHED OVER AS FAR AS IT WILL GO, AND MEASURING THE DISTANCE (V_1) IT MOVES FROM ITS NORMAL POSITION, OR, WHICH IS THE SAME, MEASURING THE VERSED SINE OF THE CURVE FORMED, THE CHORD BEING EQUAL TO THE TOTAL WHEELBASE, AS AT V_2.

(T C) in the formula above. The resulting radius advised will then be :—

$$R = \frac{\frac{1}{2}W \times \frac{1}{2}W}{TC \times V}$$

V being the versed sine formed by a curve passing through the three wheels when the latter are set as shown in Fig. 8, or as represented in the present case by the side play of the centre wheel on each side of the centre (not the total).

Working the problem out :—

$$R = \frac{3 \times 3}{\frac{1}{8} + \frac{1}{16}} = \frac{9}{\frac{3}{16}} = \frac{9 \times 16}{3}$$

$$R = 3 \times 16 = 48'' = 4'$$

The only question in dealing with this rule is the advisability of taking any notice of the increased gauge on curves. Personally, I do not advise that it should be considered, as at points and crossings it is doubtful whether any such allowance can be made. Therefore, unless the addition to the gauge is large, and where the engine has side play in the axles, radial wheels, or a bogie, it is not recommended to be allowed to enter into the formula, more especially as there are few absolutely rigid vehicles, and the flexibility of wheelbase provided by radial axle-boxes and bogies is a more important factor. Wherever it is possible, the additional rail gauge on curves should be thrown in to the advantage of the locomotive as a sort of contingency fund, and instead of dividing the $\frac{1}{2}W \times \frac{1}{2}W$ by $TC + GA$ (total clearance plus gauge allowance), it should be T C only, that is, the total clearance between rail and wheel flanges, and, of course, the "V" allowance where the model has a flexible wheelbase.

For rigid vehicles* the formula should be :—

$$R = \frac{\frac{1}{2}W \times \frac{1}{2}W}{TC}$$

Where TC = total clearance between rail and wheel flange, R = the minimum radius and $\frac{1}{2}W$ = the half total wheelbase.†

For engines with side play in the axles, bogies, or radial axle-boxes :

$$R = \frac{\frac{1}{2}W \times \frac{1}{2}W}{TC + V}$$

---

* No rule can be formulated for four-wheeled vehicles, as the shape of flange enters into the question.

† The formula reads $R = \frac{\frac{1}{2}W \times \frac{1}{2}W}{TC}$ This, of course, may be stated : $R = \frac{1}{2}W$ squared $\div TC$, or $R = \frac{\frac{1}{4}W^2}{TC}$.

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V, as before explained, being the versed sine of the curve which the wheels follow when set over to the maximum the construction of the locomotive will allow. How to do this correctly will be shown in a later article. Fig. 8 shows a six-wheeled vehicle with the wheel set over—it is presumed to the maximum. The dimensions V_1 and V_2 are to all intents and purposes the same. V_1 can, of course, be measured by placing a straight edge against the flanges of the two end wheels and moving the centre wheel outwards away from the straight-edge. With a pocket rule then measure the amount of the side play V_1. The measurement of V_2 requires a curved straight-edge (this is not a speciality of an Irishman's tool bag), which shall just fit the wheels with the centre one hard over. But this means practically making a sample curve, which we wish to avoid.

(*To be continued.*)

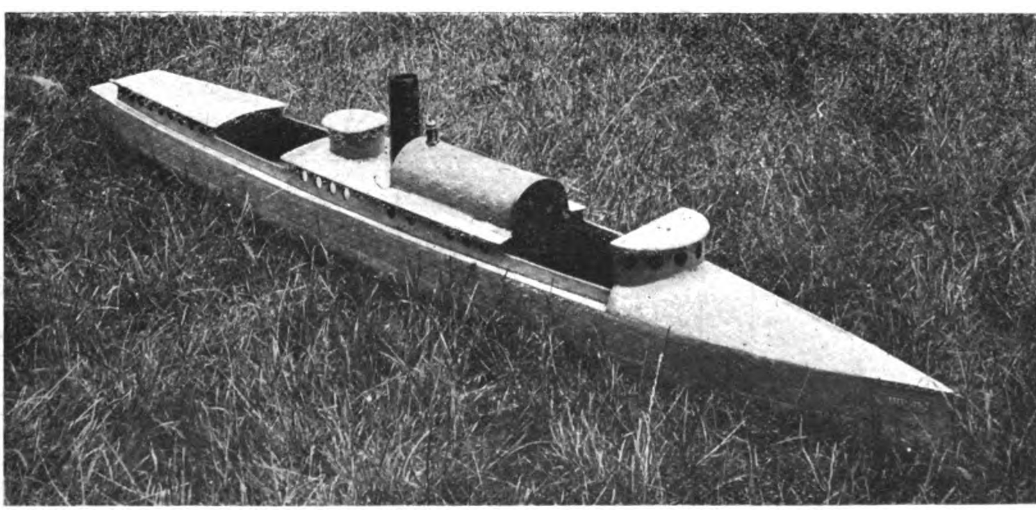
Two Interesting Boats.

By "The Carpenter's Mate."

In order to redeem my promise to give some further particulars of interesting boats and people I have met, I have secured the skipper's permission to appear above deck again for a short spell with that object in view. So while the "old man" (to give him his correct nautical *nom de plume*) is below, I will get on with a description of the *Messenger* and the *Misery*.

The *Messenger*, as will be seen from the photograph reproduced, is (above the water-line) a correct model of a steam cruising launch. The prototype of this model is a class of vessel usually employed on coastal pleasure cruises, and might be said to take the middle position between an ocean-going steam yacht and a river launch; being too large for the river and too small for a protracted cruise at sea. It offers many attractions to model marine engineers, as the deck fittings are simple in character and, if well done, look very effective. The next best thing to owning an actual sea launch is to own a good model of one; for it is not given to all of us to enjoy the keen delights of playing swings and roundabouts in a cockle-shell, with the English Channel as "bunker up." So in the hope that model mariners may get some inspiration from the *Messenger*, I have obtained the permission of her genial owner and builder, Mr. T. Rose, to set forth the novelties in her design and construction.

To begin with the hull itself, it will be seen from the accompanying lines that the bow is extremely bluff, running into a perfectly flat floor at the first section and continuing so right to the stern. At first sight it would appear that such a form of bow would be detrimental to speed, and no doubt this would be the case if the water line was much higher up; but the *Messenger* is essentially a light boat, and her motion through the water is almost hydroplanic. Just a short curly wave is noticeable each side of her nose, and then perfectly smooth water all along her length, broken only by the vortex from the screw—one of the cleanest running boats I have seen, in fact. The boiler is of a somewhat unique design. This is arranged with steam drum and two water or mud drums connected by thirty-two small diameter water tubes; the general arrangement bearing some resemblance to a Thornycroft type, but there the resemblance ends, for the water tubes are only heated on one side, acting, in fact, as a wet firebox to surround the fire. They are spaced apart about $\frac{1}{8}$ in., and this might perhaps give the impression that some means of protecting the boat from the leakage of heat would be necessary, but in practice it has been found that no such provision is needed. The tin casing is brought close up to the tubes, and the paint on it does not even blister off. This condition of affairs is, perhaps, to be accounted for by the fact that as the casing is close on the tubes there is no circulation of gases between them. The one great advantage of this system, however, is that an almost perfect circulation of water is obtained in the boiler, as



The Model Steam Launch "Messenger."

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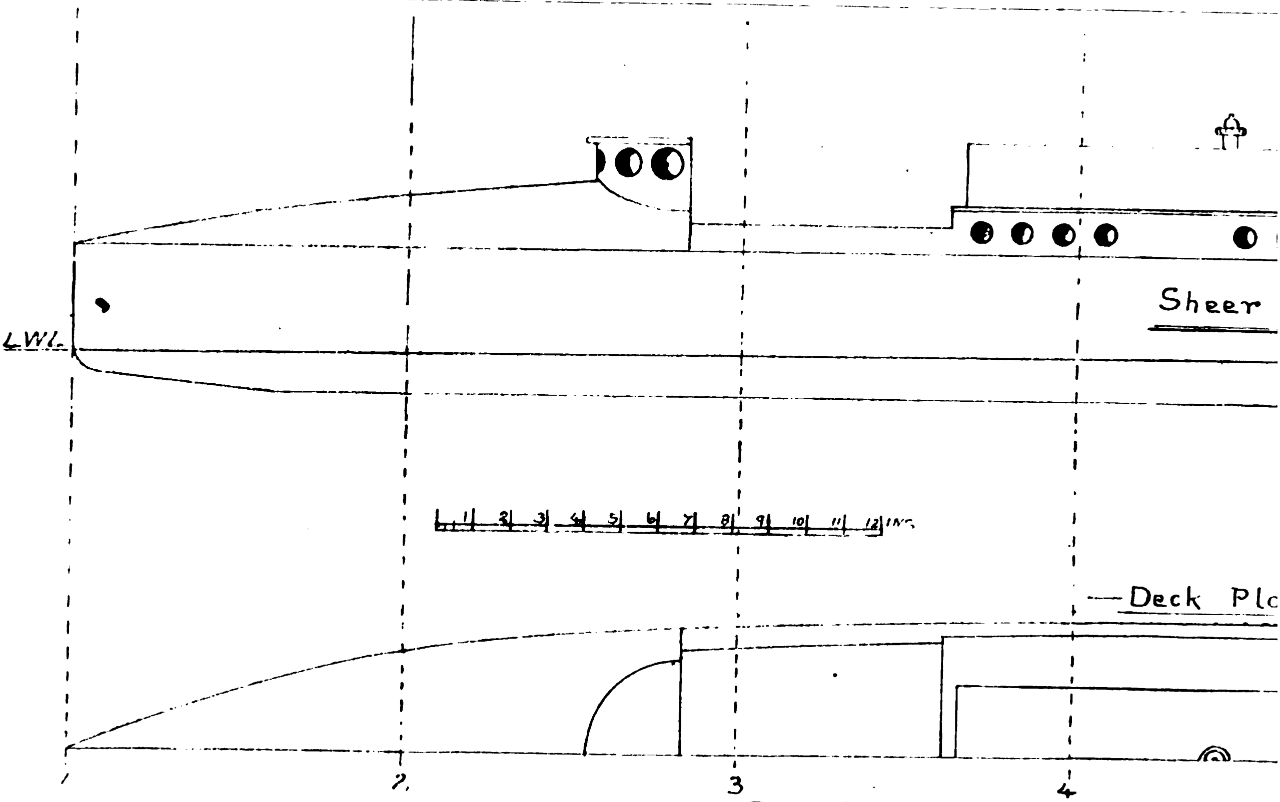
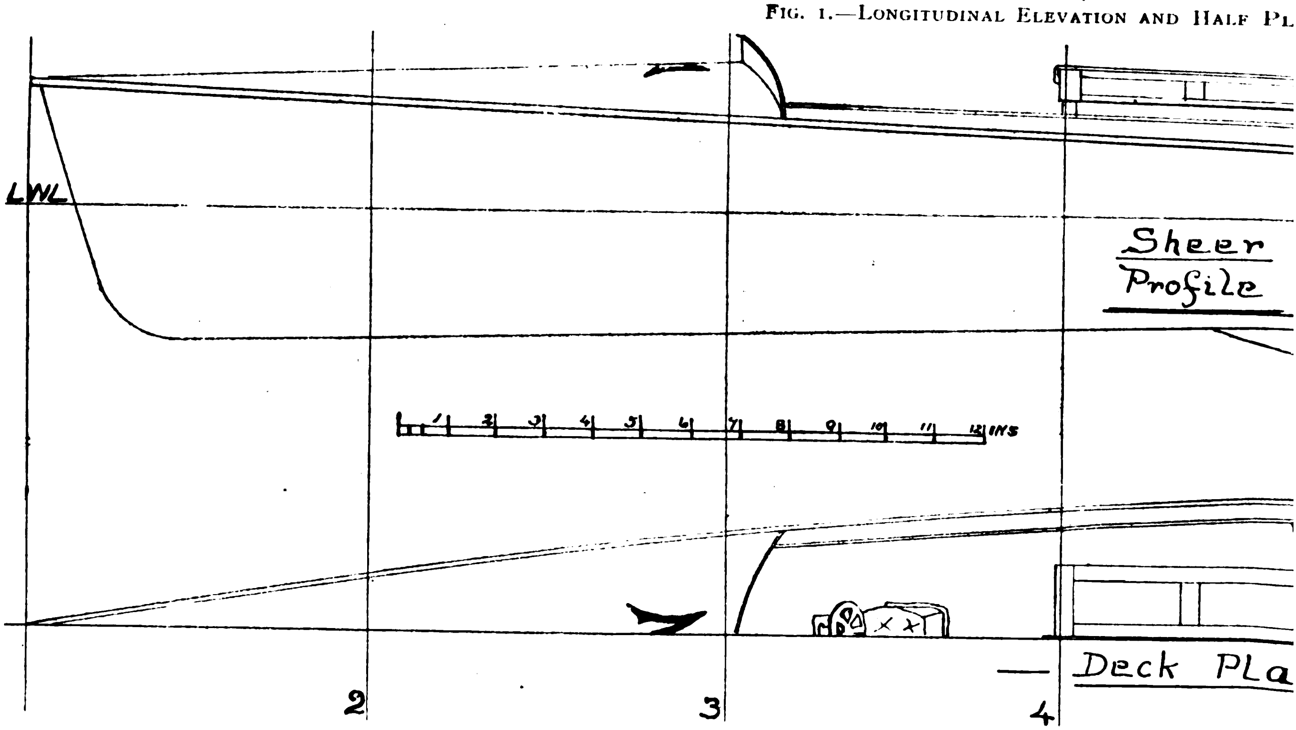


FIG. 1.—LONGITUDINAL ELEVATION AND HALF PL



For description]

FIG. 2.—LONGITUDINAL ELEVATION AND HALF PLAN OF THE

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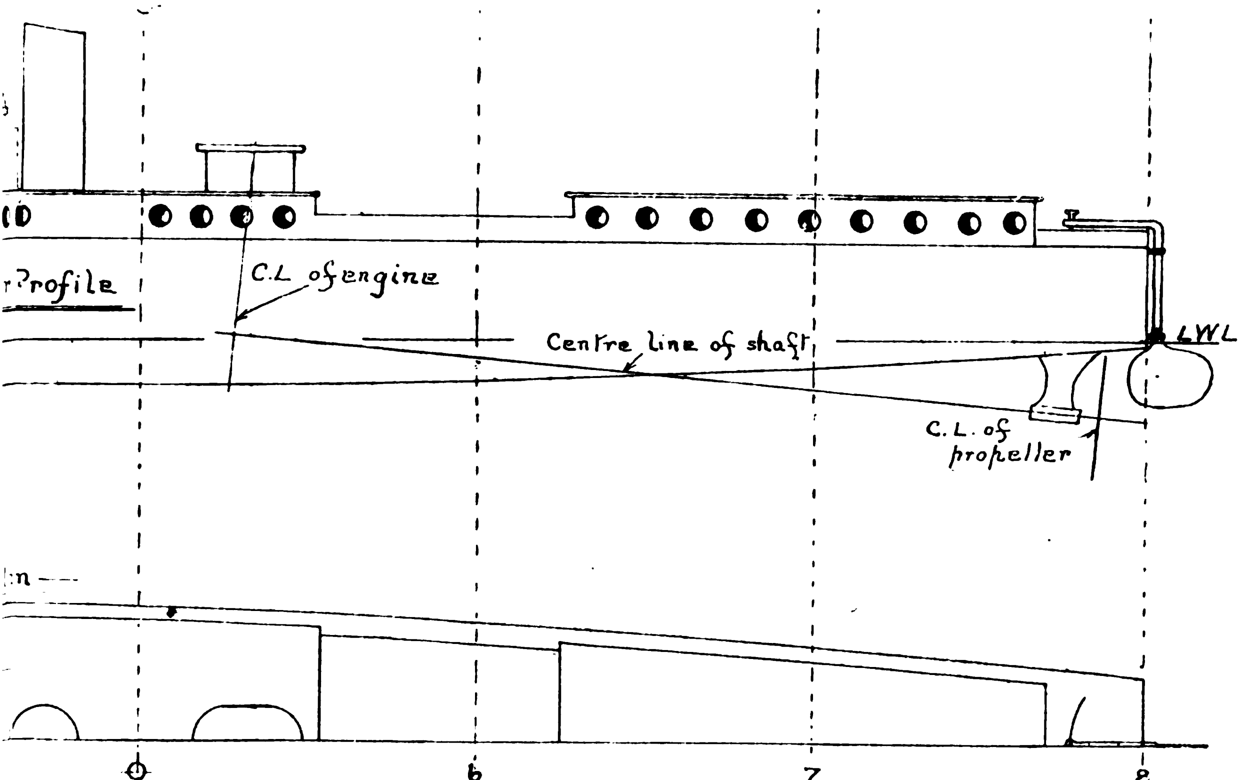
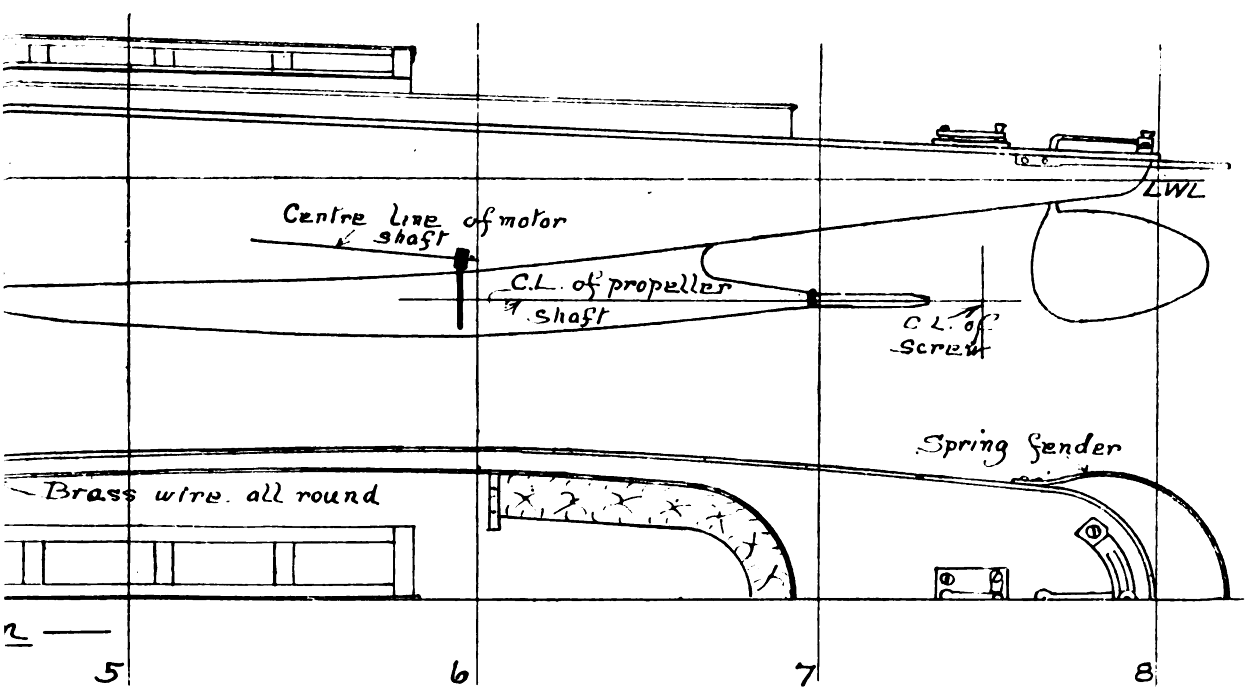


AN OF THE MODEL STEAM LAUNCH "MESSENGER."



MODEL ELECTRIC RIVER LAUNCH "MISERY."

TING BOATS.

[See pages 323—327.

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one side of the tubes is always cool for the returning flow.

It will be seen from the drawing that a very large grate area is employed, and this of course makes the maintaining of an efficient solid fuel fire a fairly easy matter. There are two "J" tubes at the smokebox end, and these, together with a good length of superheater coil, help to augment the efficiency of the whole. The engine, which is of the ordinary slide-valve vertical type, 1-in. bore by 1-in. stroke, does not call for any special mention, except that the crosshead slide is unusually large in order to reduce the trouble of wear and tear that so many model engines suffer from. The one great point about this boat, however (and one that has set all its beholders to work duplicating), is a simple insignificant looking little ejector bilge pump. Anyone who possesses a model boat knows that however much the deck is cased in there is always an accumulation of water in the hold, and in the case of a racing steamer that hops and lops about in the slightest sea(?)-way this is sometimes a distinct nuisance necessitating troublesome delays for sponging out. The ejector bilge pump gets over that in once. All that is necessary is to turn on a tap arranged somewhere handy on the deck, and out comes all the bilge water while you are saying "Jack Robinson" or any other expletive you may personally favour.

Referring to the sketch Fig. 5, it will be seen that two cones are arranged in opposition within a tube placed horizontally in the boat, this tube being connected to the lowest part of the hold by means of a pipe fitted with a gauze strainer. In the case of the one in question, the cones are made out of such uncompromising materials as penny oil-can spouts; but it will work perfectly if the dimensions shown are kept to. It would, of course, be better if the cones were made of brass or some other non-rusting material. Should it fail to draw at any time (which means that the gauze strainer is choked up), a finger tip placed over the overboard pipe will send the steam down and clear out the obstruction. Unlike nearly every model *injector* that I have had the misfortune to meet, this little device does not get fits of the sulks.

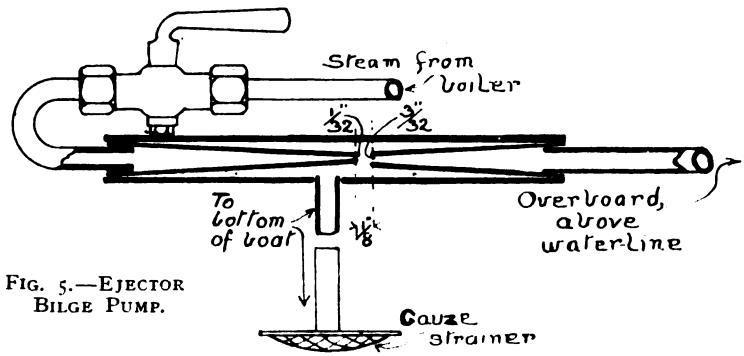

Fig. 5.—Ejector Bilge Pump.

The deck fittings are not very elaborate, the spray deck and conning-tower being very similar to those used on a torpedo-boat destroyer, without, of course, the armaments. This form of fore deck is an essential feature of all low-lying and fast-moving craft of small tonnage that ply on the open sea, and here a word to budding marine model engineers. If you are modelling a T.B.D., arm it by all means; but if you are modelling a sea launch (except it be a vedette boat or naval service launch), don't! oh, don't! put guns aboard. The days of privateering are passed, so if you do not wish to have the facetious comments of other and older model mariners, forgo the pleasure of fitting those awful indica ions of aggressiveness made out of cork and kni ting needles. What would our model locomotive friends say if one of their number were to produce his latest creation with a G.N.R. chimney, automobile wheels, and an American cowcatcher? Ponder on it and consider that some day, not very far distant, the model steamboat will be as perfect and subject to the same laws of etiquette as the modern model locomotive.

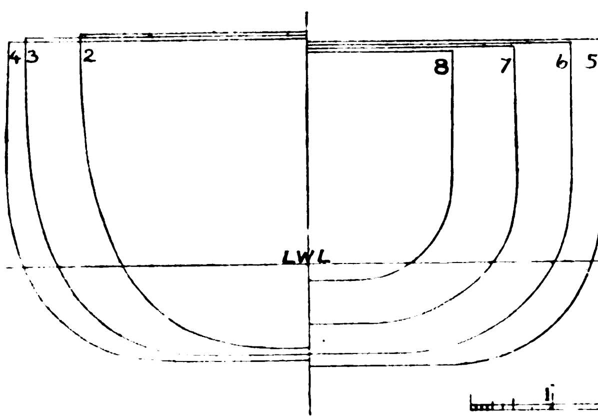

Fig. 3.—Body Plan of the "Messenger."

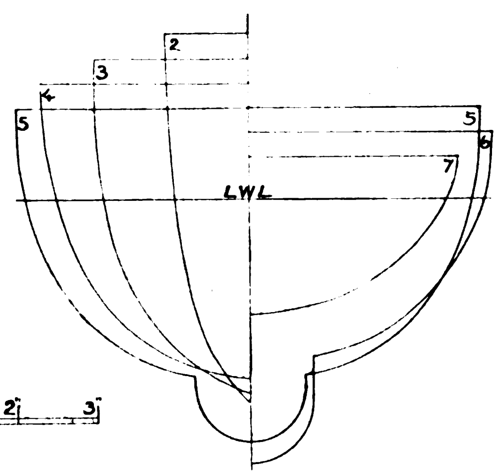

Fig. 4.—Body Plan of the "Misery."

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To return to our deck fittings. The portholes in the original are glazed with plate-glass or "bull's-eyes" ringed with brass; these can be simulated in a model with talc or mica, but in the case of the *Messenger* they are left open. The hull is painted a pale pink below the water-line, and a very light blue above, finished with a matt surface. The whole of the deck is painted a light stone colour with the exception of the boiler casing, which is a darker shade of stone, and the roof of the conning-tower, which is finished white; all painted surfaces above the water-line being finished matt surface. The funnel and safety valve are polished brass. The boiler at its best maintains a pressure of 40 lbs. to the square inch, the shaft speed being about 1,000 r.p.m. The *Messenger* has approached a speed of six miles per hour for short distances,

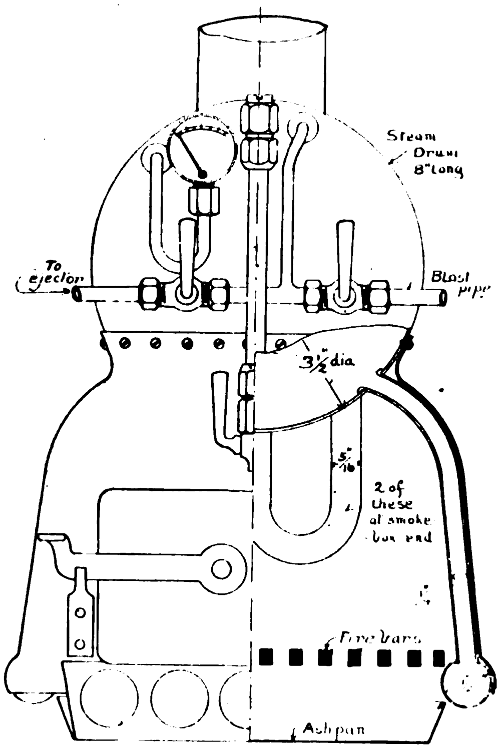

FIG. 6.—PART SECTION OF THE "MESSENGER'S" BOILER (*Half full size*).

which is not bad for her size; her only fault being, perhaps, that she requires rather frequent stoking.

The *Misery* is, as far as internal fittings go, a model of an up-river launch. The spray deck and coaming are more suggestive of estuary work though, where something is needed to keep out the lumps of water that get knocked off the tops of the rolling billows by the swift ploughing stem. I have noticed several motor boats up the river lately (principally those fitted with about a 2 h.-p. engine) which sport a spray deck big enough for a T.B.D. It undoubtedly improves the appearance of any launch by giving it a rakish suggestion of latent speed. It is a pleasant little silent fabrication, and it gets its precedent from the early users of motor-cars, who used to fit a 50 h.-p. bonnet over a 5 h.-p. engine until the police started assessing the speed limit by the size of the bonnet. The spray deck and coaming are very necessary for all open-well models, because what is only a ripple to a 15-ft. dinghy is a tremendous breaker to a model, and any water inside soon messes up the upholstery.

(*To be continued.*)

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length. and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows:—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

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How It Works.

XII.—The Howden System of Forced Draught.

By CHAS. S. LAKE, A.M.I.Mech.E.

IT is necessary in order to obtain the best results from marine and certain other condensing types of engines to employ apparatus for creating the draught required to ensure the proper combustion of fuel used in the furnaces, as the natural draught caused by directly exhausting into the atmosphere as in railway locomotives is not obtainable under the conditions of working which apply. The majority of steamships, both large and small, are nowadays equipped with forced draught apparatus, and in most cases this is arranged on Howden's patent system, with the name of which readers of THE MODEL ENGINEER interested in marine engineering are doubtless well acquainted, although they may not all be clear as to the details and working of the appliance. The brief description which follows, read in conjunction with the accompanying drawings, will, it is hoped, explain how the Howden patent system of forced draught operates and what its advantages are.

The air for combustion is supplied by a fan driven either directly or by belt by a steam engine or electric motor. The air passes from the fan, which can, of course, be placed in any convenient position, generally in the engine room, through a conduit into an air heating chamber above the smokebox, circulating in this chamber round a series of tubes through which the waste gases pass upwards from the smokeboxes into the uptake and funnel. Part of the heat of the waste gases is thereby transmitted to the air, which then passes down passages at the sides of or between the smokeboxes into an airtight reservoir or chamber surrounding the furnaces. From this chamber it is passed through furnace fronts by valves into the ashpits and over the fires through air distributing boxes in proportions exactly suited to the kind of fuel used and the rate of combustion required, thus ensuring the most perfect combustion of fuel yet attained under any system.

The Howden system of forced draught has been extensively adopted by mercantile steamships and mill owners in preference to other methods after extended trial. The advantages claimed for the apparatus may be summarised as follows:—

(1) Great increase of power over natural draught.
(2) Much reduced size and weight of boiler for a given power.
(3) Unequalled economy in fuel.
(4) Preservation of boilers and consequent lengthening of their existence.
(5) Perfectly cool stokeholds.
(6) Complete control of combustion and steam supply under all conditions of atmosphere.

The highest evaporative power, combined with the highest economy, are obtained with the least labour when using forced draught by maintaining the coal nearly level across the furnace and always a good height at the bridge. The coal must not be heaped up in front, as is usual in natural draught boilers, or lie against the cast-iron air-boxes inside the furnace fronts. When the fire is too high in front the air from the cast-iron boxes at the sides of the furnace, and from the box on the inside of the furnace door, is prevented from striking over the surface of the fuel and effecting its proper combustion. Heaping coal up near the furnace door also destroys the air boxes, and consequently causes the admission of too much air to the furnace without increasing the combustion. All unnecessary use of air in the furnace wastes fuel. The fires must never be so thin as to allow air to pass up too freely with the fuel, nor should they be too thick to prevent the thorough ignition of the fuel. When a high rate of combustion is being used the fires must be somewhat heavier, and their depth should also be in proportion to the diameter of the furnaces; the rule being the larger the diameter the deeper the fire. As the fire burns more quickly at the sides and back, care has to be taken to lay the coal well in at the sides in firing and pushed back when levelling before firing.

In working the air valves used with the Howden system, the air pressure in the main discharge pipe from the fan must not be under 2 ins., and it may rise to 4 ins. if the quality of the fuel or rate of combustion require it. If the pressure in the air pipe is too much for the requirements in the furnace with both ashpit valves open, the right-hand valve is shut entirely and the left-hand valve only worked. If this is still too much, with an air pressure not less than 2 ins. or 2½ ins. in the fan discharge pipe, then the left-hand valve is only opened so far as is necessary to give the required combustion. The top air valve, which is for the purpose of consuming the gases and reducing smoke, should never be shut when firing or even in cleaning fires. It should be set by the engineer to suit the kind of coal being used when starting, and never moved during the voyage unless to prevent steam blowing off when the engines are stopped, and even then not entirely closed. With the best coal one-third to one-half open is sufficient, but a greater opening is required for highly bituminous smoky coal. Opening of this valve beyond what is necessary tends to reduce economy.

Before opening the furnace doors for firing, it is necessary to close the ashpit valves, and they are opened again whenever the door is shut. When steam is rising faster than it is wanted, one of the ashpit valves is first closed, and if that is not sufficient to effect the desired purpose, both valves are closed. It is never necessary to open the furnace or smokebox doors to keep down steam, as the combustion is perfectly controlled by the air valves.

Cleaning fires with this forced draught should in no case cause any drop in steam pressure. Though one fire in each boiler was being cleaned simultaneously, the steam pressure should be fully maintained. This is easily accomplished by observing the simple rule that no fireman begins to clean a fire until the other fires under his care are put in good condition with a proper charge of coal on each and full air pressure below bars. Following this course in some steamers with single boilers having threee furnaces only, the engines are maintained at full speed and the safety valves made to blow off while cleaning fires. An equal effect should be aimed at also in high-powered steamers with many boilers.

Attempts to establish the use of forced combustion in boilers began very early in the history of steam production in the United Kingdom,

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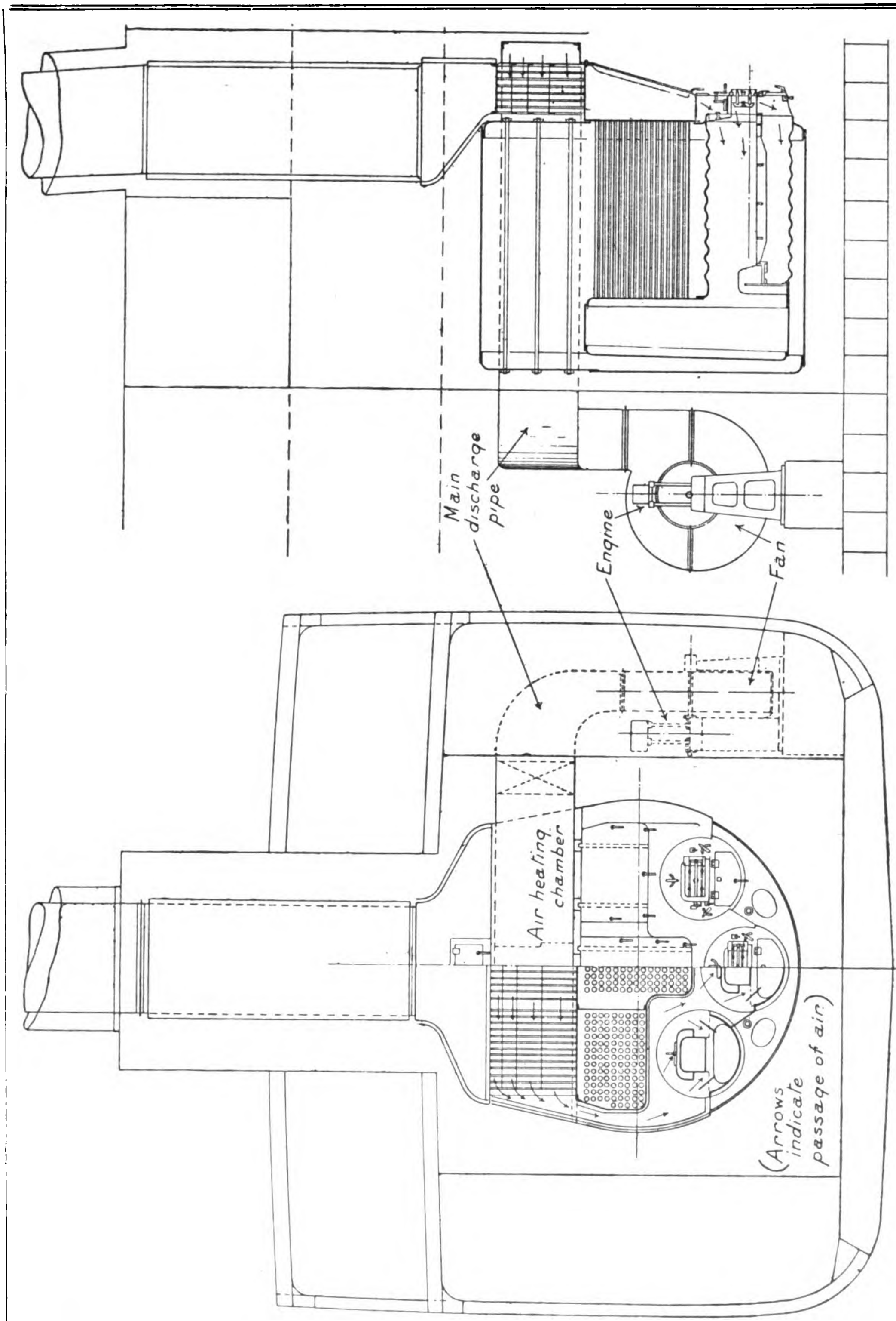


GENERAL ARRANGEMENT OF HOWDEN'S FORCED DRAUGHT APPARATUS APPLIED TO STEAMSHIP BOILERS.

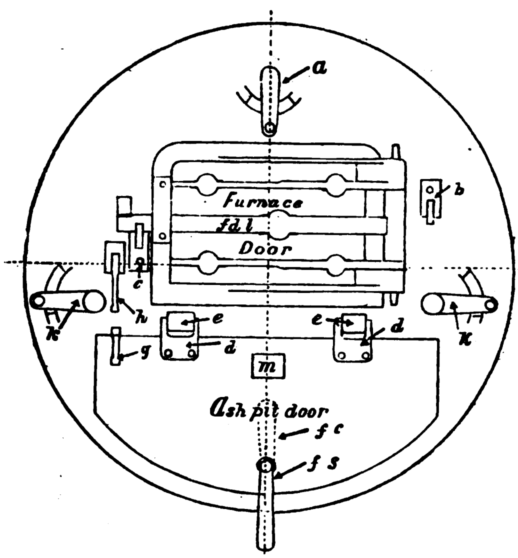
Holland, and America, but chiefly in the last named. There the system of forcing air directly into closed ashpits, also of exhausting the gases by means of a fan at the base of the funnel, and the use of compressed air in airtight fire-rooms (or the closed stokehold system), were all tried time after time from 1828 to 1864 in steamers and on land boilers, but were all eventually given up owing to various serious disadvantages attending their use, including wastefulness of fuel. The successful use of forced draught as an established mode of working boilers dates from the introduction of the Howden system in 1884. At that time there was not a single seagoing or land boiler in the United Kingdom, America or elsewhere fitted or being fitted with forced draught of any kind, nor had there been any trials of forced combustion made in such steamers or land boilers for many years prior to that period.

The system applied to water-tube boilers removes some of the objectionable features in their working, reduces considerably their expenditure of coal per indicated horse-power, and also the heat in the stokeholds and uptakes.

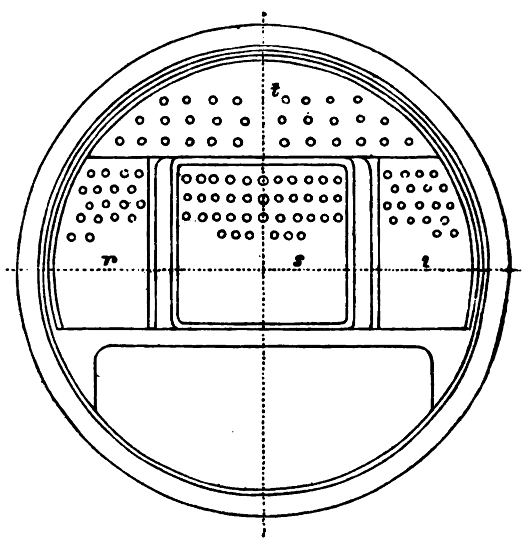
Among the latest and most important steamers fitted with Howden's system of forced draught are the two mammoth turbine-driven express Cunarders, the *Lusitania* and *Mauretania*.

The drawings accompanying this article, as well as particulars incorporated in it, were kindly supplied by the Howden Forced Draught Company, Ltd.

A SUBSTITUTE for mica for commutator insulation has just been patented. In order to render the insulation softer than the softest obtainable mica, the inventor employs hard mica, calcined under pressure. The mica is crushed between two plates of suitable material, which are placed in a calcining furnace. The internal structure of the mica is said to be so altered that it becomes equally as soft as the segments of a commutator.



FRONT VIEW.



BACK VIEW.

FIG. 1.—FURNACE MOUNTINGS: HOWDEN'S FORCED DRAUGHT SYSTEM.

a. Top Valve Handle.
b. Back Catch.
c. Front Catch.
d. Hinge Flat.
e. Hinge Centre.
fc. Ashpit Door Handle for Centre Front.
fs. Ashpit Door Handle for Side Front.
g. Catch for Ashpit Door.
h. Hanger for Ashpit Door.
k. Side Valve Handle.
l. Left Hand Baffle Plate (or Air Box).
m. Mica Plate.
r. Right Hand Baffle Plate (or Air Box).
s. Door Baffle Plate (or Air Box).
t. Top Baffle Plate (or Air Box).
u. Furnace Door.
x. Ashpit Door.

At the present moment there are over 2,300 large seagoing steamers fitted with the Howden system, and the number is rapidly increasing every year. The aggregate indicated horse-power of these installations is 7,550,000. They comprise steamers for almost all the principal steamship companies of the world. Some of the vessels are also fitted with Messrs. Howden & Co.'s patent oil burning system, which is worked in conjunction with their forced draught system. The results of this combination have been exceedingly favourable in every respect. Modifications of the Howden system for application to water-tube boilers have also been successfully applied to many warships of the British, Dutch, Austrian, and other Navies.

IT is reported that in 1908 Canada will make all her own coinage, amounting to 16,000,000 or 20,000,000 pieces annually. The Royal Mint in London now coins 16,000,000 pieces for Canada per annum. When the new Canadian Mint opens, probably in December next, one or more new coins will be issued. A new piece of the value of 2 cents will be coined in nickel. This will be the first time that nickel has been used in Canadian coinage, although nickel is one of Canada's most largely produced minerals.

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Practical Letters from our Readers.

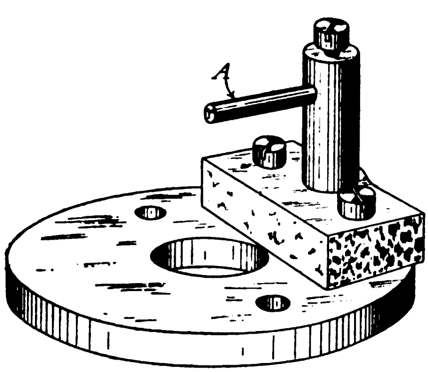
[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.]*

A Tool-holder for Intricate Turning.

To the Editor of *The Model Engineer*.

Dear Sir,—In reference to examples of intricate turning in The Model Engineer, pages 150–3, for August 15th last. In my mind the internal ball work can be done in a rather simpler way, and possibly with greater precision. As shown in The Model Engineer, for each size ball one wishes to turn out, a special boxwood holder to carry ball, and a special tool-holder to carry tool, has to be made. With my idea (perhaps it is not new), you avoid both of these items. I have enclosed same herewith, thinking perhaps it might interest readers of The Model Engineer.

The appliance is made (of materials I had on hand) to fit a bottom slide of compound rest of my lathe, and swivels completely round as top slide of rest does. The ¼-in. piece of steel A represents the tool, the top of which is at exact height of lathe centres. With this appliance any size ball or round rim wheel (up to capacity of lathe over carriage) can be turned, and the internal ball turning carried out with absolute mechanical precision, a great advantage, I think, in the matter being, you can tackle brass balls as easily as softer materials, the balls themselves, when turned and taper holes bored, being held direct in a four-jawed (a three-jaw can't be used for the job) self-centreing chuck



Tool-holder for Intricate Turning.

on nose of mandrel. The tools themselves have, of course, to be same shape as shown in Figs. 7 and 8, in the description.

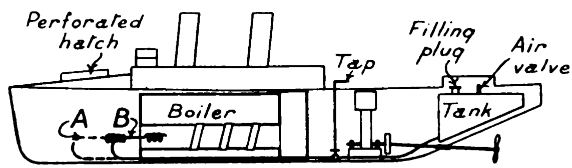
I trust I have made matters quite clear, and that it may be of some service to readers of The Model Engineer. As you will see, the appliance can be made by anyone with a lathe with compound rest, and fitted to lathe at very little cost indeed, and it well repays time spent on it.—Yours truly,

Reading. A. Berry.

Firing Model Horizontal Marine Boiler.

To the Editor of *The Model Engineer*.

Dear Sir,—I enclose herewith rough sketch of steamer, showing present position of coil burner in firebox, marked B, and also former position of burner outside firebox, marked A. My difficulty is this. When the burner was in position A, I used to place a small tray filled with cotton wool and covered with wire gauze and saturated with methylated spirit, to heat up the burner before turning on the benzoline, but found before the burner was properly heated that the heat from spirit burnt the wooden deck overhead. I tried a tin deck also, but found it melted the solder around the hatch, etc., and blistered the paint on deck. I have now



Firing Model Horizontal Marine Boiler.

moved burner into firebox, as shown at B, which partly gets over the trouble, but find that the burner fires back and lights at the air holes, and also that the spirit blows back out of firebox mouth (when heating up burner), and does nearly as much damage as before.

I find, on looking up The Model Engineer, that my boat is arranged almost precisely the same as Messrs. H. G. and F. L. Wearn's, in March 21st issue, where I see they have their burner arranged outside the firebox tube, and shall be pleased to know how they get over this difficulty. Unfortunately, my business during the day here prevents me coming in contact with anybody who takes much interest in this sort of thing, and consequently I have to poke along the best I can myself, with the invaluable help of The Model Engineer. If any reader can give me a wrinkle or two I shall be much obliged.—Yours truly,

Dublin. J. Skelton.

The Society of Model Engineers

Future Meetings.—Friday, October 18th: The Annual Sale of Models, Tools, Parts, Materials, etc., the property of members, will be held at the Cripplegate Institute, Golden Lane, E.C., at 7 p.m New members who have not yet had an opportunity of attending one of these Sales will be well advised to do so, as model making apparatus of all kinds is generally to be obtained on very advantageous terms. The Secretary will be pleased to answer any enquiries respecting the inclusion of goods in the sale, etc.—Wednesday, November 13th: The Annual General Meeting. Any member wishing to move an alteration or addition to the Society's rules at this meeting is invited to write to the Secretary on the matter, who will also be pleased to receive any suggestions for the increased usefulness of the Society to its members for consideration and discussion at that meeting.—Herbert G. Riddle, Hon. Sec., 37, Minard Road, Hither Green, S.E.

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Queries and Replies.

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

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

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

[18,052] **Steam Engine for Workroom.** W. E. W. (Nelson) writes: My workroom is on the second floor of an ordinary house, in a bedroom (disused, of course). I have a ½ h.-p. gas engine (built from Leek Company's castings), but the noise which it makes puts it out of the question for regular work. Would it not be possible to build a small steam engine (say a double-cylinder, high-speed, or a compound) driven by a flash boiler heated by gas from the ordinary house supply, to drive a 3½-in. lathe, back geared? I should be extremely obliged if you would give me dimensions of a suitable engine, and of a suitable boiler for same (coil type).

We have even heard of a workroom which *is* used as a bedroom. Model engineers are nothing, if not enthusiastic. However, this is, like the gas engine, beside the point. Although we do not wish to appear to discourage research, we think you would be well advised to use an ordinary boiler. The only objection to the ordinary boiler is that it must be large for its power to give reasonable satisfaction as regards attention. Presumably you do not want to employ a small boy as a stoker. Therefore, if you can afford it, and also afford the space, we would recommend, among others, a 16-in. by 24-in. single-flue boiler with the flue connected in an air-tight manner to the chimney of the room. The boiler could be made by yourself from standard flanged plates, as supplied by J. Goodhand. We should advise 3-16ths-in. plates (not ¼ in.), the seams being double riveted. According to the price list we have, a 16-in. by 30-in. centre-flue boiler, with ¼-in. plate tested to 170 lbs., costs £8 12s., while a 16-in. by 24-in. multitubular boiler with 3-16ths-in. shell and fourteen 1½-in. tubes costs only £5 15s. If you are buying a boiler, then have the more powerful multitubular one at less money. Of course, the 16-in. by 24-in. vertical centre flue boiler with 3-16ths-in. plates would no doubt cost less than the 16-in. by 30-in. generator with ¼-in. plates, listed as above. Such boilers, of course, require solid fuel. If you wish to have gas, then adopt the type of boiler shown on page 32 of the new edition of "Model Boiler Making." The shell could be made about 15-ins. by 20 ins., and have about thirty-five tubes ⅜ in. diameter expanded into it. The plate should be of steel 5-32nds in. thick, *double riveted* with 9-32nds-in. or 5-16ths-in. rivets. If you have the water supply handy, then couple the L.-P. exhaust of your compound engine to a jet condenser and endeavour to arrange the starting handle to turn on the jet condenser water and the steam to the engine at the same time. If a two-cylinder compound engine be adopted, you will require some sort of a lever to work a by-pass to the receiver in case the H.-P. cylinder stopped on dead centre. We suggest that all levers be made to work with the foot. This would be the most convenient for lathe work. Of course, you would have to lag the boiler to prevent the room becoming too stuffy. We think that a flash boiler in a room would remind you too much of a ship's stokehold in full working order, if nothing worse. Everything, however, depends on the fireplace in the room. If you are not anxious to do a lot of pattern-making, go in for a Stuart No. 3 (1¼ ins. and 2¼ ins. by 1¼-in. stroke) compound engine set of castings.

[17,582] **Train Resistance and Tractive Power of Locomotive.** H. R. H. (Walmley) writes: If you would oblige me with a reply to the attached query I should esteem it a great favour. What horse-power must a locomotive exert to draw a train of 200 tons under the conditions stated below:—(*a*) At 30 miles per hour on grade 1 in 80; (*b*) at 45 miles per hour on grade 1 in 80; (*c*) at 30 miles per hour on grade 1 in 40? Could you give me the formula for working this out? I am not very good at figures, so should be much obliged if you would put it as plain as possible.

As a certain amount of the horse-power developed in the cylinder of the locomotive is absorbed in driving the locomotive itself, therefore we must reckon the horse-power at the drawbar of the tender. Of course, we could assume the weight of the engine at 100 tons and estimate its rolling resistance under the same formula as that used to arrive at the resistance of the train at various speeds. Taking the formula—

$$\text{Resistance in lbs. per ton load} = 9 + {\cdot}0072V^2.$$

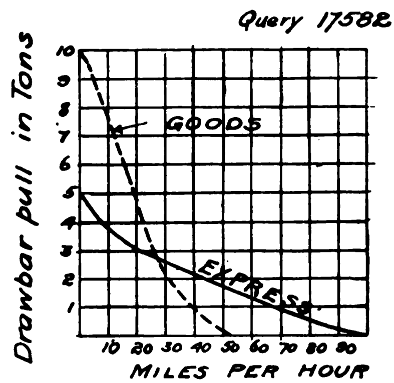
Where V is the velocity of the train in miles per hour, the drawbar pull in lbs. required to pull a train of 200 tons at 30 miles per hour, omitting the power absorbed by the locomotive, would be—

$$R = 9 + {\cdot}007 \times 30^2.$$
$$R = 15{\cdot}3 \text{ lbs. per ton.}$$
$$R \times 200 = \text{Drawbar pull.}$$
$$15{\cdot}3 \times 200 = 3{,}060 \text{ lbs.}$$

$$\text{The horse-power required would be } \frac{\text{drawbar pull} \times \text{feet per min.}}{33{,}000}$$

$$= \frac{306}{33{,}000} \times \frac{30 \times 5280}{60} = 489 \text{ h.-p.}$$

You can work out the other examples in the same way. The above, however, does not take into account the gradient, and the horse-power required for this work must be added on. There are 5,280 ft. in a mile, and at 30 miles per hour half a mile will be traversed in a minute. Therefore, on a gradient of 1 in 80, in this time the train will be *lifted* half of 1-80th of 5,280 ft. =



(Diagram showing results of Mr. H. A. Ivatt's experiments on the comparative tractive power of a G.N.R. single express and an eight-coupled goods locomotive at various speeds.)

33 ft. per minute. The foot lbs. of work done per minute will be, of course, with a 200-ton train,

$$33 \times 200 \times 2{,}240 \text{ ft. lbs.}$$

Therefore the horse-power will be

$$\frac{33 \times 200 \times 2{,}240}{33{,}000} = 448 \text{ h.-p.}$$

The total horse-power required will be that due to train resistance + gravity = 489+448 = 946 h.-p. at the drawbar. Please check the calculations, and if we have put the solution to the problem clearly enough work out the other conditions in the same manner. In connection with the tractive power of locomotives the results of experiments in the matter of internal resistances and drawbar-pull of various types of locomotives published by Mr. H. A. Ivatt of the G.N. Railway are very interesting. On testing one of his 7-ft. 7-in. bogie single express engines in comparison with an eight-coupled goods engines, he found that the average drawbar pull of the express engine was only *one-half* that of the goods engine up to speeds of 10 miles per hour. At 27 miles per hour the draw bar pulls of the two engines were identical, as shown on the diagram, viz., 2¾ tons. At 40 miles per hour the ratios of that up to 10 miles per hour were reversed, the express engine exerting twice the drawbar pull of the goods engine. At 52 miles per hour the internal and rolling resistances absorbed all the power of the goods engine (which state of things was not reached in the express engine at 90 miles per hour), leaving practically nothing which could be used to haul a train.

[18,113] **Running Gas Engine on Petrol and Oil.** G. E. M. (Keighley) writes: I should be pleased it you would give me some information on the following, viz., I have bought a second-hand gas engine (2-in. bore and 3-in. stroke) giving about ¼ b.h.-p.. I have fitted this up to run with petrol, using a surface carburettor. Shall I get as much power out of the engine with petrol as

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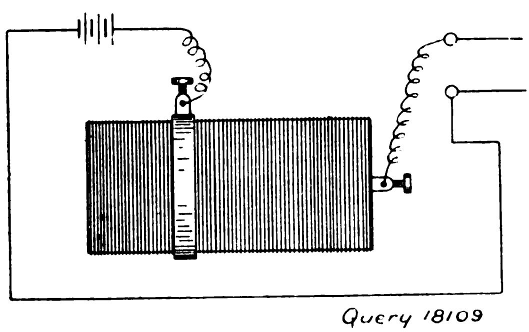
if fitted with gas? Also, would it run with petroleum if the carburettor was fitted with a pipe or pipes to carry the exhaust through the carburettor? I enclose a rough sketch of a surface carburettor. Is this method right? If not, could you give me a sketch of one that would do for this engine?

Provided everything is in order, you should get quite as much power from it running on petrol as gas. But adjustments will have to be made when running on trial. You cannot vaporise paraffin as you propose, as it takes a much higher temperature than would be got in that manner. Besides this, only a limited quantity should be vaporised at a time, and it will not readily mix with the air drawn over the surface, or even through the liquid, as petrol does. For petrol, any of the arrangements that have been described in these pages will answer, and for paraffin we refer you to the "Oil Engine" articles by Runciman, in Vol. XIV.

[18,053] **Feed Pump Proportions.** J. E. B. (Wimbledon) writes: I have a compound engine with cylinders 1¼ ins. by 2¼ ins. by 1½ ins., which is driven by steam from a boiler 11½ ins. by 24 ins., with twelve ⅜-in. tubes in it. At 50 lbs. pressure in the boiler the engine makes from 800 to 1,000 revolutions per minute. I wish to make a pump to be driven by gearing of the shaft of the engine. Kindly inform me the dimensions of the pump valves and piston, etc., necessary to supply water to the boiler.

The pump should be geared 3 to 1, and the plunger should measure ⅜ in. diameter, and should have ⅜ in. stroke. Of course, the pump, if suitably designed and made, could be run direct, but you would perhaps do better to gear it as recommended above. The diameter of the suction and delivery valves should be 5-16ths in. at least. For construction see the article in the issue of June 13th, 1907, "Some Wrinkles in Model Making." Do not forget to fit the by-pass piping so that you can regulate the feed-water.

[18,109] **Induction Coil Queries.** G. T. W. writes: I have a small induction coil and three bichromate cells. I want to connect them so that I may get the most varying degrees of strength from one cell with draw tube in, right up to tube out with one cell, tube in and out two cells, tube in and out three cells. If I connect them in series, the whole three cells going, it is too strong to start with. I have tried connecting all three carbons to one terminal, and only one zinc to the other, and then switching the other zincs



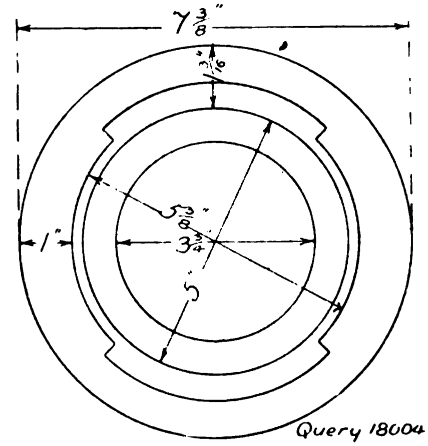
A Small Resistance.

on one after the other until all three zincs were connected to the other terminal. This does not seem to work well. Can you please tell me the best way to connect up to get the best results as mentioned above? If you can oblige me I should esteem it a favour. I enclose a rough sketch, which may illustrate better what I mean.

You will find a small resistance more convenient. Wind a hardwood cylinder or some insulating material with about 2 or 3 ozs. of No. 28 German silver wire, and arrange a sliding ring as shown. When ring is at extreme right hand end all resistance is cut out, and coil works at full power as far as battery is concerned.

[18,004] **Small Alternating Current Motor.** A. H. (Tunbridge Wells) writes: I am thinking of building an alternating current single-phase commutator motor, to run on 220-volt 70-cycle supply, and to give not less than ¼ h.-p. I have laminations for field-magnet and armature, a dimensioned sketch of which is enclosed. I should feel greatly obliged if you would help me with the following:—How many turns and what gauge of wire must I have on field and armature, and how many sections in the commutator? I have 7 lbs. of 20 s.c.c.; could I use that?

You will find this to require some experimenting, and we cannot say that you will be successful in obtaining the power you state from the motor, or making it to run without considerable sparking. Try a winding of No. 18 gauge D.C.C. copper wire for the armature, and No. 14 gauge D.C.C. for the field-magnet, connect in series with armature. Armature to be cut with 24 slots each, 5-16ths-in. deep × ⅜ in. wide, commutator to have 24 sections; use carbon brushes. You could try the No. 20 gauge wire for the armature. Fill the winding spaces on both armature and field-magnet. When trying the machine you will find it necessary to adjust the brushes to various positions to get the place for best effect; you should there-



Small Alternating Current Motor.

fore provide a brush rocker. We expect you will scarcely get ¼ h.-p. from this motor at 70 periods frequency. Sparking would be reduced by having a 48-section commutator and winding two coils per slot in the armature.

[18,032] **Small Boat and Motor for same.** L. K. A. (Bristol) writes: The following is a description of an electric motor I have built: Type—single-coil "Simplex," built to scale two-thirds the size of the 10-watt model described in Handbook No. 10; fields have a wrought-iron core, and are wound with 4½ ozs. s.c.c. wire, No. 24 gauge; armature is eight-slot cogged drum, wound in four sections with rather more than 1 oz. of No. 24 gauge s.c.c. wire, size 1 in. by 1 in.; weight of whole, 21½ ozs. I should feel much obliged for information to the following queries: What length boat (torpedo-boat destroyer, dug-out type) would carry motor and suitable accumulators to the best advantage, so as to give the greatest speed? I want the boat as small as possible. Using twin-screws, what diameter ought they to be? What pace ought the propellers to be driven at? What size and voltage accumulators ought to be used to drive the motor and proposed boat? Ought any resistance to be used; and, if so, how much? The motor will, I think, want gearing down; what gear ought to be used? The motor runs excellently when connected in shunt, but will not move when connected in series; can you tell me why this is?

We have no data concerning a craft with so small a motor, but would suggest one of about 2 ft. 6 ins. by 4½ ins. by 3½ ins. draught. The hull itself must be *very* light, as you will only have about 2 lbs. displacement to work upon. One of Thompson's horizontal accumulators, weighing not more than 1½ lbs., should be used. We do not advise twin screws. This will add useless weight and friction. Let motor run at as high a speed as possible and use a fine pitch propeller (about 1 in. diameter and 2-in. pitch). Speed is purely a matter for trial. The field coils are of too high a resistance to be run in series.

[18,013] **Model Steamer Machinery.** C. M. (New Cross) writes: I should esteem it a favour if you would answer the following questions for me. I intend making a boiler of the same pattern as enclosed sketch, to drive a ¾-in. by ¾-in. marine slide-valve engine (single cylinder), the barrel to be of solid drawn copper tube and the ends cast brass. (1) What would the dimensions of the boiler be (fired with spirit lamp) to drive above engine at a fair rate of speed? (2) What size and pitch of propeller would proposed boiler and engine drive? (3) How many burners should the spirit lamp have (I do not want a blowlamp), and of what diameter? (4) How many water-tubes shall I have to put into boiler, and of what diameter? (5) What would internal diameter of steam pipe have to be? I do not want barrel to be more than 3 ins. diameter, but the length does not matter much.

(1) The barrel should be about 2 ins. diameter by 6 or 7 ins. long, and have three or four water-tubes. Do not use heavy cast brass ends. (2) The propeller should be about 2½ ins. diameter and 3-in. pitch. (3) A tray burner may be employed in preference to one with vertical wick holders. Make two trays, 6 ins. long by ¾ ins. wide by ½ in. deep, and fill same with asbestos yarn. Feed the spirit near the centres. (4) Four water-tubes should suffice.

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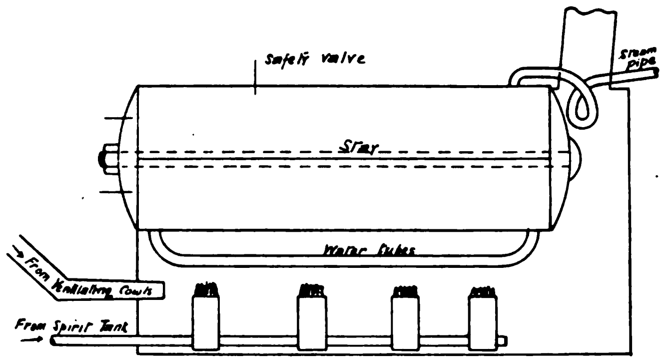
Diameter, 7-32nds in. outside; they should be inclined, and not quite horizontal, as shown. (5) Steam pipe ¼ in. internal diameter. With regard to the general design, the boiler requires to be as low down as possible, and yet the furnace room must be ample, to secure the proper ventilation of the same. If the boat is very stable, then the diameter of the boiler barrel may be increased to 3 ins., but we cannot say anything definite, as you do not state the proportions of the hull. The tube from the ventilating cowl



Query № 18313.

PROPOSED BOILER FOR MODEL STEAMER.

is of no use. A large open space must be provided at the end of the boiler to allow air to get at the flame. The steam pipe should pass *through* the flame of the lamp and the funnel should be larger.

[17,941] **Valve Gearing.** F. K. (Rhodesia) writes: On page 143 of "The Model Locomotive," in dealing with valve gearing, it says: "Reversing gears which do not allow of an angular advanced lap cannot be added to the valve." Can you let me know what is meant by the above? Would you kindly also let me know what is meant by "open" and "crossed" eccentric rods, mentioned on page 151 of above book? Could you let me have a sketch showing a piston valve as fitted to model cylinders worked by means of a reversing plate on the side; these are shown in "The Model Locomotive," but no diagram of the valve is given. I have not drawn the cylinder, as doubtless you are very familiar with it; it is fitted to Bassett-Lowke's and other makers' model locomotives, and shown on page 154 of above book.

Study diagrams (Figs. 157 and 159 and 160 to 165), and you will see that the converse is also true—" that if lap is added to the valve, the eccentric must have an additional advance beyond the 90 degs. given to it, otherwise the admission of steam will be late." Compare Figs. 160 and 161, and above all make the simple model shown in Fig. 158 either in wood or cardboard, and all will be clear to you. The above being true, then if the extra advance cannot be added in fixing the eccentric, then the valve cannot be provided with lap, otherwise the circumstance shown by Fig. 160 would result. This figure is entitled: "Late admission due to the addition of lap only, without advancing the eccentric." Most single eccentric valve gears without additional features which provide for the advance (as in Walschaerts valve gear) require valves without appreciable lap. In Fig. 173 (see diagram 1) the rods are open. If the forward rod was connected to the bottom of the link and the backward rod to the top, this would be crossed rods. See the book by the same author, "Model Steam Engines," price 6d. net, 7d. post free.

[18,022] **Small Oil Engine Troubles.** H. O. (Chichester) writes: I have a ¼ h.-p. oil engine of good make, with needle valve oil supply. Exhaust worked from second motion shaft; other two valves work automatically by suction. The trouble seems to be that the compression escapes into the oil tank which forms the base of the engine through the copper tube at side of vaporiser. When the flywheel is turned and the piston compresses, the vapour comes out of oil tank filler in puffs. Kindly state if this should be. All the valves have been ground in with emery powder and appear to be air-tight. Engine pumps up oil into vaporising chamber, and there is a cotton-wool filter in suction pipe. This engine used to be used for pumping, but has not been working for some time. Could you give me the probable cause of trouble?

It is difficult to say from any description what the actual remedy would be, as you are uncertain of the cause. Thorough grinding in is the only cure for valve leaks, provided they are not too badly worn. If that is the case, then a cutter will have to be used to true up the seat, a new bush fitted, and the spindle re-turned. The most likely cause is that although they do not seat badly, yet they stick up at times, but this can only be ascertained by personal inspection.

[18,080] **Rotary Converters.** W. M. (Blyth) writes: Being an old reader of THE MODEL ENGINEER I beg to ask the following question concerning a rotary converter, 300 kw., 600 volts, six-phase, 40 per second, compound wound, 600 revolutions. They say we have 11,000 volts at this station. Does this 11,000 volts go in the first instance to the machine, or through a transformer? There is also a series-wound mid-wire booster connected on the same shaft on the D.C. end. Is this for running the machine up to speed? What is meant by mid-wire? I don't understand the voltage on booster; it has 0·25 volt 85 amps. Does this mean ·25 volt only that it takes? Also, what is a series-diverter? I shall be very pleased if you will let me know this as soon as possible.

It would be better for you to address your queries to someone in charge of the machinery as power station arrangements vary according to local circumstances and the plans of the designer. If the machine is really a converter, that is, having the alternating and continuous current parts combined, a step-down transformer will be necessary, as the continuous current voltage produced is always greater than the voltage applied to the alternating side of the machine. The booster appears to be intended to boost up a drop of 0 to 25 volts in the middle wire of a three-wire system; it will certainly not be used to start the converter or run it up to synchronous speed. This will probably be done by continuous current applied to that side of the machine from the network of mains, but with six phases it is possible that the starting may be done from the alternating side.

[18,120] **Cells and "Motors" for Model Launch.** G. P. (Liverpool) writes: Being a reader of your valuable paper I wish to know if you will give me a little information. I am constructing a boat 8 ft. long, and for ease and cleanliness wish to drive it by electricity. There are four screws and I want each driven by a separate motor. Could you tell me what size would be suitable for four motors to drive at high speed, and how many accumulators would be required and voltage? Could I buy stampings and wind myself, or do you recommend buying them ready?

This will be a very inefficient way of driving her, as four small motors will waste a lot of power—much more than one of four times the size. However, regarding it as an experiment, your first step will be to find by trial exactly what weight the hull will carry. Then presuming you are using four 10-watt motors, weighing about 2¼ lbs. each, you can utilise the remaining available weight for accumulators. You can group these so that motors can run in parallel from the cells. The motors can be had from Thompson, of Greenwich, and should be as light as possible, and run at a high speed. Reserve as much weight as possible for the cells. The maker would also supply suitable accumulators for motors.

[17,945] **Model Steamer Boiler.** J. H. C. (Shettleston) writes: I have a compound launch engine, H.-P. ¾ by 1-in. stroke, L.-P. 1 by 1-in. stroke. Boat, 39 ins. by 8-in. beam, 3-in. propeller. Kindly refer me to design for best type of boiler, taking into consideration ease of construction and cost. I can spare about 9 ins. long by 6 ins. wide in space, and about 6½ lbs. in weight for boiler filled and complete with lamp.

We would advise a 9-in. by 5½-in. single flue marine boiler, as recommended on pages 46 and 47 of our handbook—" Model Boiler Making." As the furnace tube will be large, we should adopt the "D" flue, but, of course, it will require ample staying by water tubes and by direct crown stays near the entrance of the furnace where the tubes are omitted. The tubes should, of course, be silver-soldered in. The stays should be screwed into the plates, the threads fitting tightly and the extremities of the stays being back nutted. The shell of the boiler should be of solid-drawn tube, 5-64ths in. thick for a compound engine.

[17,942] **Mercury Break for Coil.** A. M. (Plumstead) writes: As I am thinking of making a mercury break for a 2½-in. spark coil, I should be obliged if you will give me your kind advice. I made the one described in your handbook, "Induction Coils," but failed to get it to work satisfactorily. I am now about to make the one as described in THE MODEL ENGINEER by Mr. Pike (No. 275, Vol. XV, page 113), and should be obliged if you would send me particulars of dimensions, etc. (1) What size wire and what quantity for magnet? (2) What size bracket (A) would be suitable? (3) About what thickness iron for armature. Would ¼-in. thick be too heavy? (4) How long the armature spring and how wide? (5) About what width shall I use for "D." Will a piece of phonograph spring do, about ¼ in. wide?

(1) We cannot say quantity; there is no definite size for this magnet, and weight of wire will be in proportion to size. You must judge proportions from the sketch. There is no particular size. Better err upon the side of too large than too small. Probably No. 28 s.c.c. copper wire will do for the winding, as it is to be worked from separate cells, such as two dry or Leclanché pattern. (2) The spreader B is given as 3 ins. from end to end; this will guide you as to proportions. (3) No, judging from Mr. Pike's remarks. (4) Anything in proportion to sketch. (5) The spring you mention would probably do very well.

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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 T. B. D. Fittings.

We have received for inspection from the Machine Carved Model Company a complete set of castings for fitting up the fast model torpedo boat destroyers as shown in the illustration (Fig. 1) —the machine carved hulls for which we referred to in these pages some time ago. The castings of the conning-tower and turtle deck, funnels, ventilators, and anchor are in aluminium, and those of the propeller, rudder, bearings, &c., in gunmetal—these are shown in Fig. 2. All appear to be of good quality, clean, and free from blow-holes. The sheet of detail drawings supplied with the castings will help the amateur considerably in the work of fitting up this boat. We may add that separate parts can be purchased either in the rough or finished state, and can be adapted to model hulls other than those supplied by this Company. We notice that the price of both the first and ordinary quality hulls have been greatly reduced. A complete list, including prices for machinery for electrically driving, may be had on application to the above at 11, Balmoral Road, Watford.

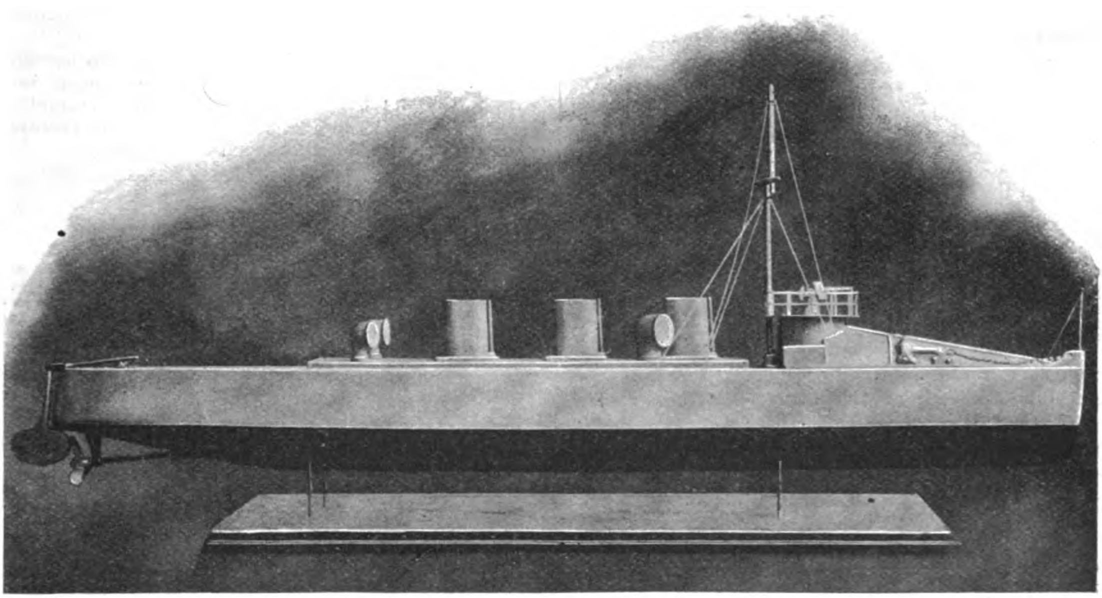

Fig. 1.—A Complete Model Torpedo Boat Destroyer.

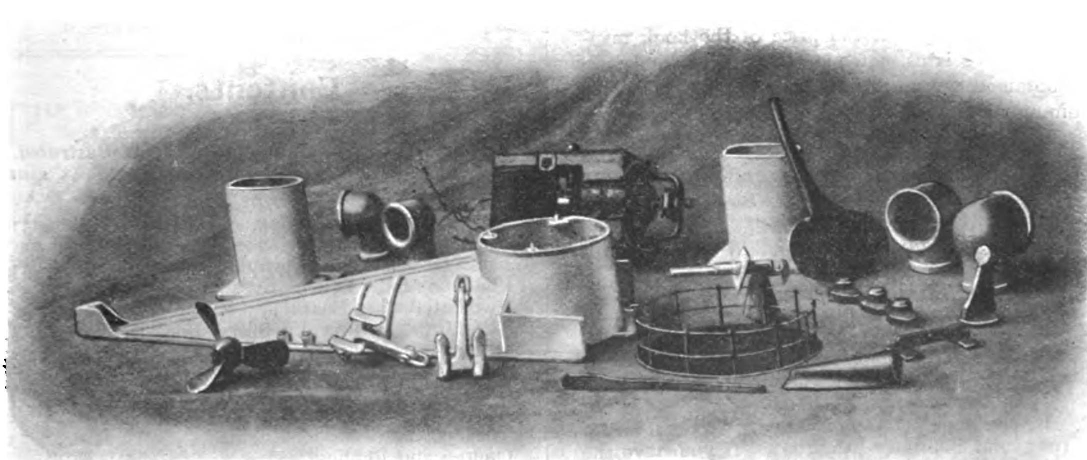

Fig. 2.—A Group of Castings and Fittings for the Model Torpedo Boat Destroyer.

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The Editor's Page.

NO doubt a number of our readers, particularly those in the London district, will wish to make several visits to THE MODEL ENGINEER Exhibition, and for the convenience of those who have intentions of this kind, we have decided to issue non-transferable season tickets available for the whole period during which the Exhibition is open, at the price of 3s. each. These are now ready and may be obtained at our office post free at the price named. There will be so much to be seen at the Exhibition, and the lectures and demonstrations are so varied, that we are sure this is a privilege which will be a convenience to many. Ordinary tickets at 1s. and 6d. each respectively are also now ready and may be had from our office or through many of the agents for THE MODEL ENGINEER. The 1s. tickets are available on any day, and the 6d. tickets after 4 p.m. on Wednesday and Saturday. We hope next week to be able to give further particulars of the interesting programme of lectures and demonstrations which have been arranged.

* * *

The attention of our readers who are particularly interested in the subject of wireless telegraphy is especially directed to the series of articles commencing on page 317 of this issue, from the pen of Mr. V. W. Delves-Broughton. We wish to point out to readers that the articles are not intended in any way to trespass on the ground already so ably covered in Mr. R. P. Howgrave-Graham's book "Wireless Telegraphy for Amateurs," but that they will be found to supplement the information contained therein. Students should study these notes in conjunction with the respective chapters in the book. For the benefit of readers who are just commencing to interest themselves in the subject, we may mention that the price of the book mentioned above is 2s. net, post free 2s. 3d., and may be obtained from our publishing department or from any of our agents.

Answers to Correspondents.

J. McI. (Kilmarnock).—We will attend to the matter as soon as we can obtain the necessary particulars.

A. H. F. (Brighton).—See *Railway Engineer* for June 10th, 1904, for drawings of G.C.R. "Atlantic" locomotives, price 1s. 2d., post free, from this office. Also see issues of THE MODEL ENGINEER for August 25th, September 1st, 8th, and 15th, 1904, price 1s., post free.

C. B. (Northwich).—See issues for February 9th, 1905, and February 7th, 1907. If you have the back volumes you will find numerous examples of our readers' work in this direction from which you could gather all the help you require.

J. D. H. (Horwich).—Your letter *re* steam engine is having our attention, and we will deal with it at the earliest possible moment.

H. B. (Tailsworth).—We have not yet published an end view of the N.E.R. express locomotive you refer to, but will take an early opportunity of inserting same in our pages. To drive a 1½-in. scale model by clockwork would be impracticable. You had better try a smaller scale—⅜ or ½-in. For "Dunalastair" details, see issues of February 1st, March 1st, April 1st, May 1st, June 1st, July 1st, August 1st, September 1st, October 1st, and November 1st, 1901.

B. L. K. (Sunderland).—The engine is much too large for the boiler. You require a 11½-in. by 24-in. boiler. Briquettes are not now obtainable in this country.

A. O. G. (Wimbledon).—We advise you to use an ordinary electric bell, with the bell itself removed, and a somewhat lighter piece of metal for the striking hammer. Allow it to vibrate against a thin piece of wood or stiff fibre.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

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

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Contents.

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

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THE

Model Engineer

And Electrician.

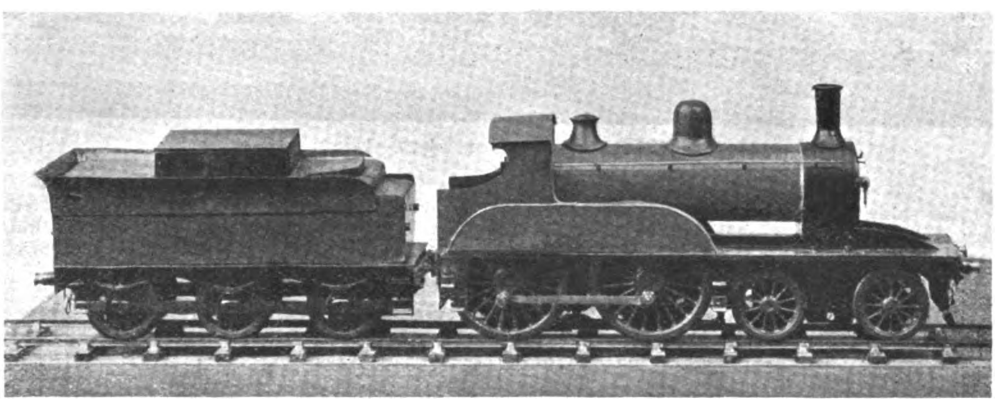
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 337. OCTOBER 10, 1907. PUBLISHED WEEKLY

A Reader's Model Locomotive.

By A. C. WATKINS.



MR. A. C. WATKINS' ELECTRICALLY-DRIVEN MODEL LOCOMOTIVE.

THE models shown here were made without the use of a lathe. The first is an electric (steam) locomotive. The frames are 1-16th-in. sheet brass cut out with treadle fretsaw; the wheels were bought as castings, a 3-16ths-in. hole being bored in them. I then filed and glass-papered them quite smooth. They were driven tight on to steel axles, and run perfectly true. Coupling-rods are filed out of ⅛-in. flat steel rod; crank-pins are ⅛-in. steel rod screwed into wheels tapped on the outside down to shoulder; a nut and washer holds side rods in place. Dummy laminated springs are fitted inside frames, these being made of short strips of zinc bolted together in the middle, the ends being drilled and screwed to hangers attached to frames. Brakes are also fitted to coupled wheels, the blocks being cut out of oak. The boiler is a piece of 1-16th-in. brass tubing split at both ends to form the smokebox and firebox respectively. Bogie frame has equalising rods pivoted at centre, the axle boxes being sweated on each end. I have departed from the usual method of fixing motor on engine, it being placed in tender and geared on to centre axle. The motor I purchased ready-made, being one of Whitney's Triplex, and I must say for its size it is very powerful. The engine picks up current on third rail principle, the collecting shoe being made from a piece of clock spring. She will pull, inclusive of her own weight, 30 lbs. on 6 volts. The reversing switch, which is also in tender, was made according to instructions given in THE MODEL ENGINEER for March 31st, 1904. The engine is painted light green, the framing arab brown. I may add that before starting any part of engine I made card board templates for everything. It is ½-in. scale, 2½-in. gauge.

The second photograph represents two N.E.R.

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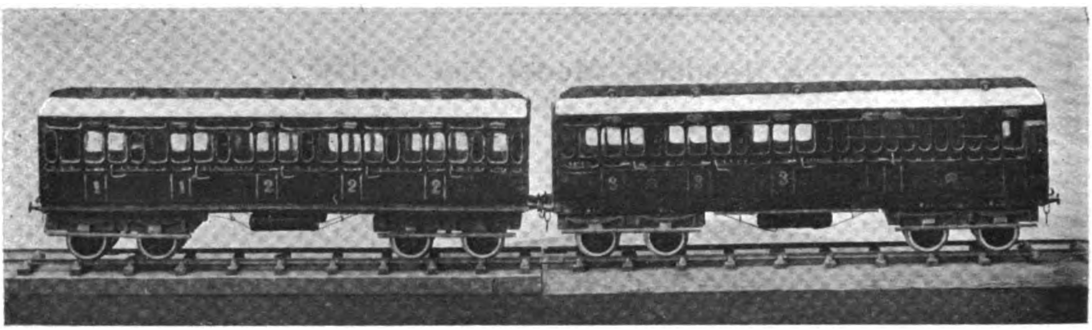
bogie carriages—one a brake-van with three third-class compartments, the other being first and second class. They are constructed entirely out of ⅜-in. wood, and in the simplest manner possible. I first cut out the sides, and finished them off in the following manner. Having cut them to exact size, I cut out all spaces for windows, the top half being recessed to allow for glass and overlay piece, the overlay being cut from 1-16th-in. whitewood to exactly match the carriage side; it was then glued and screwed on after glass was put in, making a fine job of it. The handles and guard rails were then put in position, being made from 1-16th-in. brass wire. The curved side was obtained by merely planing down the under-half, there being plenty of wood left for the purpose. The same was done to the roof, the clerestory being another piece of the same stuff bevelled at the ends and screwed on to the roof proper After the floor, partitions, and ends were cut out the whole was firmly screwed together and given two coats of dark oak varnish stain, the tops being enamelled white. The bogies were made from 1-16th-in. sheet brass (the wheels, which are lead, being forced on to steel axles). They were then pivoted at each end of carriage body with ¼-in. bolts. The wheels, bogie-frame, and imitation gas tanks are painted black, and the rims of wheels white. After carriage bodies were dry I lined them with gold.



TWO MODEL N.E.R. COACHES FOR 2½-IN. GAUGE RAILWAY.

AN invention lately patented by the Deutsche Gasglühlicht Aktiengesellschaft relates to tungsten filament glow lamps, and consists in employing carbon suspenders in place of the suspenders of metal or the refractory metallic oxides which have hitherto been generally used for this purpose. As carbon possesses the property of good radiation for heat rays, this support remains comparatively cool, even near the point of contact, and can, therefore, be made very thin. Carbon suspenders have been found to be unsatisfactory for osmium lamps, owing to the formation of osmium carbon compounds; but this objection is not present when tungsten is used. The suspender is attached to the filament by means of a suitable cement, the carbon being made of such thinness that it will allow sufficient movement in the lamp filament when switching on and off, and rupture of the filaments is thus prevented.

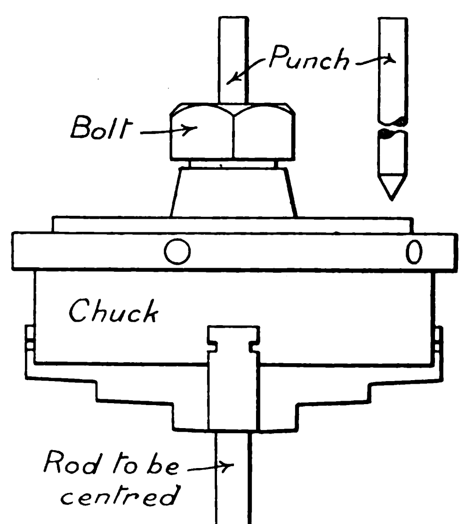
Workshop Notes and Notions.

[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 Centreing Device.

By "Locos."

By means of this tool, ends, discs, etc., may be centred with great ease and despatch. A special feature is that small or bent rods, which could not be centred in the lathe, are just as easy to centre. A bolt, screwed the same thread as chuck, is drilled most carefully, centrally. A piece of steel rod (about ¼-in.) is made up as a punch and fitted carefully to the hole, in which it must slide; it must not be slack, however. In use, the bolt is screwed into



the back of the chuck. The disc or rod is placed in the chuck as usual. It is then punched as shown in the drawing.

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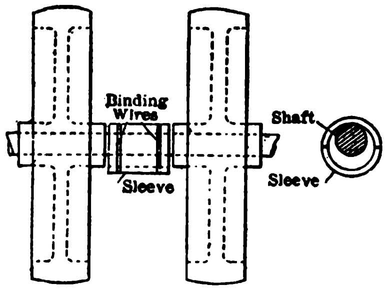
To Save Belt Wear.

A writer to the *American Machinist* gives the following hint for avoiding the undesirability of an idle belt hanging loose on a revolving shaft. Take two wood bushings a little larger than the shaft,



How to Save Wear of Belt when Idle.

and bind them on with soft wire at the place where the belt will rest when idle. The sketch herewith shows the device.

A Method of Securing Crank-pins, etc.

By Clive Nicholson.

The following is a modification of a well-known method of fixing crank-pins, axles, etc., which I find very useful. The drawings are self-explanatory, the shape of the component pieces being clearly shown. The threads on the reduced portion of A and on the outside of B may be cut with Whitworth standard dies, though A need not be so much reduced if a gas thread is used on B, and a stronger job results. In putting together, B is first screwed into C as far as it will go ; the threaded shank of A is then screwed into B till the collar (or cone) is fairly home ; B is then turned back so as to screw it *out* of C. The result is that as B, owing to its coarser thread, tends to leave C faster than it pushes A away from itself, A is drawn on to its seating by an amount due to the difference in the pitches of the two threads. When tightened up, everything is very firmly locked. The usual method of making such a joint is to put the fine thread on B and the coarse thread on the reduced portion of A, and the joint is tightened by screwing B into C instead of out of it. Besides the obvious advantage of having the fine thread on the smaller part of the work, bringing in standard taps and dies, the very awkward calculation is avoided with reference to the length of the screw threads required on A and B to bring everything into position when tightened up.

Fig. 2 shows a method of making the joint with a head on the pin and everything else flush. Though not so strong a job as that shown in Fig. 1, it has its advantages.

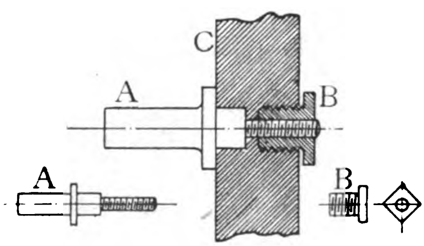


Fig. 1.

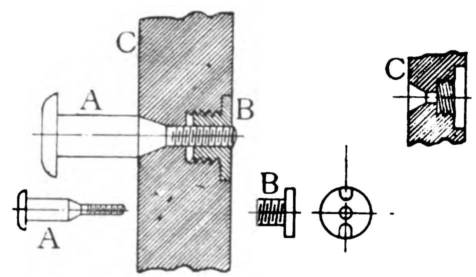


Fig. 2.

Showing Method of Securing Crank pins, Axles, etc., by Means of Differential Threads.

The Latest in Engineering.

Telegraph Construction across the Sahara.—Some interesting particulars of telegraph construction in the Sahara Desert are given in a Canadian paper, the *Victoria Times*. In order to avoid interference with camel caravans, the wires have to be supported at a height of 15 ft. from the ground, and are carried on hollow steel poles 18 ft. long. As the latter have to be transported on the backs of camels, they are made telescopic, so as to close up to a length of 5 ft., and are extended and locked when erected. The line already constructed extends through Algeria to Beni Abbes, a distance of 150 miles. Thence it will be carried to Adrar, 800 miles south of the Mediterranean in the heart of the desert, and finally the Burem on the Niger, a stretch of 860 miles.

Relative Cost of Steam and Gas Power.—In a recent issue of the *Railway Gazette* Mr. A. Stucki presented some very interesting data on the relative costs of steam and gas power, basing his estimates on conditions obtaining in Pittsburg, and assuming a plant of 1,000 h.-p. He stated that the cost of 1,000 h.-p. per year would be £2,625, a high-speed non-condensing engine being used, and £1,725 in the case of a triple-expansion condensing engine. The cost of the coal used was taken at 10s. per ton. With natural gas at 15 cents per 1,000 cubic ft., 1,000 h.-p. per year would cost £900, while if producer gas made from Pittsburg coal were used, the cost of the same amount of power would be £735.

A New Racing Launch.—We are indebted to the Editor of the *Engineer* for the illustration herewith of the little boat recently launched at the Beilvaire Works, near Nantes. It has been built to the designs of M. André Gambin, by M. Beilvaire, with the assistance of M. Chauvelon, who have striven to produce a good racing launch of the torpedo-

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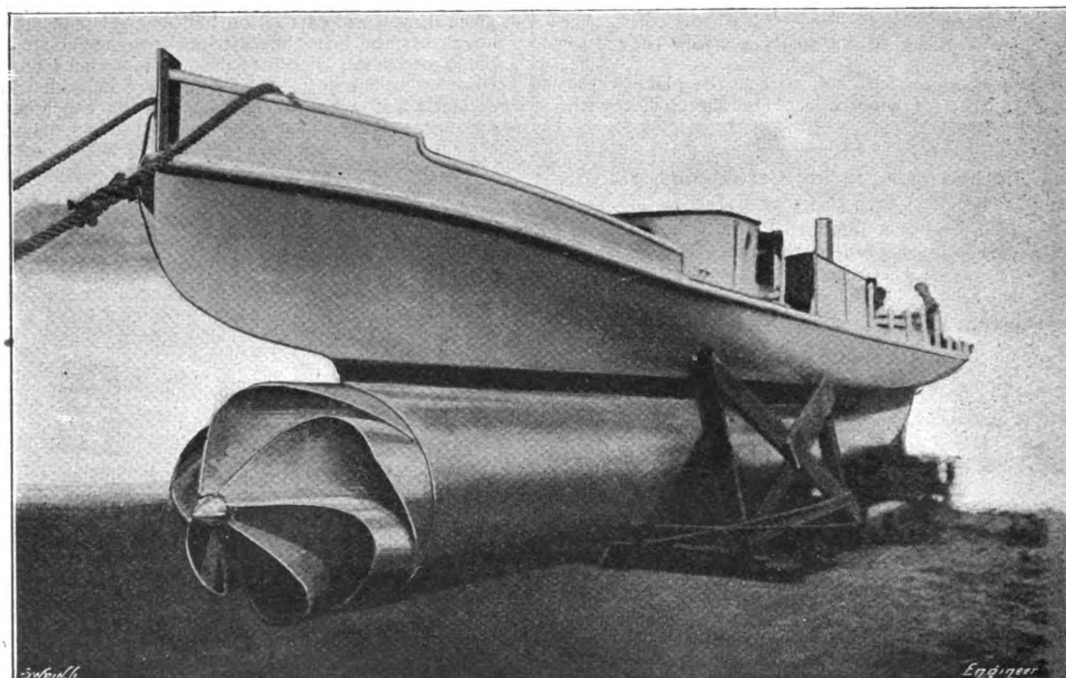
boat type—light and strong. The principal dimensions are—length over-all, 17·90 mm.; length along water line, 16 mm.; breadth across deck, 1·60 mm.; breadth at water line, 1·40 mm.; height from keel to deck, 1·34 mm.; draught, 0·80 mm. When in the water the launch has a neat appearance, and there is nothing which would lead one to suspect the peculiar construction at the keel. According to M. Chauvelon, the boat cannot capsize, unless, perhaps, when attempting to turn at a high speed. The propelling machinery consists of two sets of internal combustion engines, each capable of developing 60 i.h.-p., and driving on to the same main shaft. There are four cylinders, and these are cast in pairs, the valves being arranged on both sides. Both accumulator and magneto ignition have been fitted.

boat. It consists of vanes attached to a central shaft. These vanes extend spirally from the apex of the shaft to the circumference, finally developing into a cylinder. The construction will be more readily gathered from the engraving. Each vane has two faces, one being spiral in form, the convexity of which produces the centrifugal action. The other is concave and spiral, and extends from the apex of the first face and along and against the cylindrical face of the next vane. This face produces the suction action. The inventor is naturally very sanguine regarding the ultimate success of his invention, and he is said to have guaranteed a speed of 100 kiloms. per hour, or 54·5 knots. Two years ago some very interesting trials were made near Bordeaux by M. Gambin, with the object of demon-



The Typhonoide Racing Boat.

The boat is propelled by what the inventor calls a "Typhonoide," 80 cm. diameter. This is an apparatus designed to be placed at the fore end of the boat, as shown in the engraving. It is claimed that as the typhonoide revolves at a high rate of speed it reduces the resistance in front of the boat—in fact, opening, as it were, a passage for the boat to pass through. The state of equilibrium of the atmospheric and hydrostatic pressures on the fore and aft ends of the boat is disturbed, and a kind of pneumatic suction being set up, the typhonoide, and with it the boat, is drawn along. This suction lasts as long as the typhonoide rotates. The typhonoide is really nothing more than a centrifugal pump, the blades being so arranged that in combination with the motion of the launch they throw the water backwards along the sides of the

strating that higher speeds could be obtained with the typhonoide than with the screw. For this purpose he constructed two models, 2·40 mm. in length, and propelled the typhonoide by clockwork, with the result that a speed of 60 kiloms. per hour was, it is said, attained—a speed which is approximately equal to 32·73 knots. Last May further trials were conducted in Paris by the French Committee of Study. In these trials the inventor's object was to demonstrate the tractive power of his propeller, and the minimum power required by it to set large volumes and weights of water into motion. A propeller of 5 cm. diameter was used. It is said to have been proved that the typhonoide gave a maximum speed with a power which is much below that which would be required in the case of ordinary screw propulsion.

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Chats on Model Locomotives.

By Henry Greenly.

Locomotives and Railway Curves.

(*Continued from page* 323.)

THE last article on this subject concluded with a few cursory notes on locomotives with bogies and other forms of radial axles, and gave the rule applicable to such vehicles, but did not describe the method of finding the factor "V" in the formula. This factor varies in every particular example according to the amount of lateral play in the radial or bogie axles and the disposition of these axles.

Before going into the matter very deeply, it will be as well to mention that there are right and wrong ways in designing bogies. The use of the plain bogie pin without any sideways movement is useless on a vehicle which has more than one pair of fixed or rigid wheels. I hope to demonstrate this fully in a later article, and for the moment, therefore, this statement, together with the more or less summarised remarks in my book (see pages 75 to 86 of "The Model Locomotive"), may, perhaps, be allowed to suffice. Furthermore, there is practically no limit to the curve a long double-bogie vehicle, with a short bogie wheelbase and unlimited movement in the bogie trucks, will traverse. This type of vehicle is governed by the same circumstances as a four-wheeled vehicle of the same dimensions as those of the individual bogie trucks. Therefore we can leave ordinary bogie carriages out of the question, as in nearly all cases they will negotiate a curve which would be quite unsafe at the even normal speed of a model express train.

In the case of model electric locomotives having double bogies other conditions are usually present, and these render it necessary for the model engineer to deal with their abilities for curve negotiating in the same way as would be done in an ordinary steam locomotive. The bogies seldom have unlimited movement, and the wheelbase of the bogie trucks is usually large in proportion to the total wheelbase of the model. In addition, some margin over the absolute minimum curve over which it would be possible to take the engine is required, and it is to provide a "safe" or "satisfactory" minimum radius that I have designed the present formula.

As in previous examples, the factors required are the "V" vertical height of the triangle formed at a given point (the centre of the wheelbase) by the wheels when set over to the maximum amount the frames or other parts of the fixed structure will allow; the clearance between rail and wheel flange which we designate "C" in the formula; and the total wheelbase of the engine. The clearance may be obtained as shown in Fig. 7 in last article, and only where abnormal circumstances obtain should it be augmented by the extra allowance of gauge on curves.

The "V" factor is readily measured whether the engine exists or no. If the model has not progressed farther than the paper stage, then the amount of side play may be set out in any simple manner; but where the model is in the flesh, it may be placed on a piece of paper with the bogies moved over as far as they will go. Taking into consideration the outer wheels, they will, of course, stand like diagram (Fig. 9). This position being obtained, with a pencil mark the points of contact of the flanges on the paper as shown in Fig. 10 (points 1, 2, 3, and 4). Remove the model and then draw two lines, one through the points 1 and 2, and the other through 3 and 4 in the manner indicated by the dotted lines. Join by another line points 1 and 4 as shown, and the vertical height of the apex of the triangle formed by the three lines will be the dimension "V" required for the formula—

$$\text{Radius} = \frac{\frac{1}{2}W \times \frac{1}{2}W}{C+V.}$$

Taking The Model Engineer Electric Locomotive as an example, I find that the swing of the bogies makes "V" equal 9-32nds into 5-16ths in. Allowing the smaller dimension, the result obtained, with the usual 3-32nds in. rail and flange clearance, is—

$$\text{Radius} = \frac{\frac{1}{2}W \times \frac{1}{2}W}{C+V.}$$

$$\text{Radius} = \frac{7\frac{3}{4} \times 7\frac{3}{4}}{\frac{3}{32} + \frac{9}{32}} = 160 \text{ ins.}$$

Minimum radius in feet therefore equals 13 ft. 4 ins., which is, I should say from past experience only, a very suitable one.

The next type of locomotive which may be dealt with is that with rigid and radial wheels combined. The 2—4—0 and 0—4—2 types are, or used to be, well-known examples, and taking one of the former class of locomotive, we will presume that the model

Fig. 9.—Diagram of Wheels of a Double Bogie Electric Locomotive, showing Position when on a Curve.

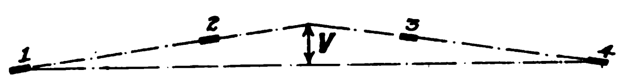

Fig. 10.—Finding the Factor "V" for an Electric Locomotive, as Fig. 9.

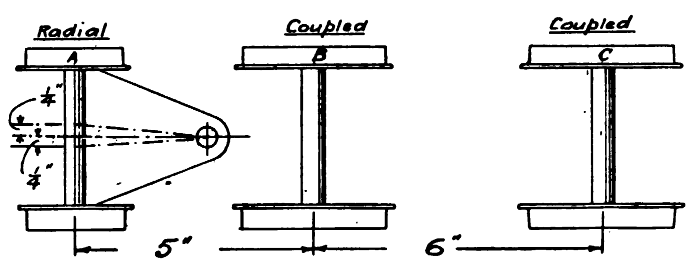

Fig. 11.—The Wheel Arrangement of a 2—4—0 Type Locomotive.

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is a $3\frac{1}{2}$-in. gauge engine with a total wheelbase of 11 ins., the wheelbase at the leading end being 5 ins. and between the coupled wheels 6 ins., as depicted in Fig. 11. The method of marking out the plan of the wheels with the radial wheel pushed over as far as it will go, already described, may be adopted where the actual model is being dealt with; otherwise make a drawing like Fig. 11, but with the frames or other features which limit the lateral movement of the bogie shown in correct relation to the wheels. Prepare a tracing of the radial truck and wheels, and pinning down the tracing through the pivot pin of the truck, swing it till the wheels would, if the engine were in existence, be on the point of rubbing against the frames or fouling any other part of the fixed structure. Fasten the tracing in this position, or prick through so that three points A, B, C, representing the points of contact of the three wheels on the rails, are obtained. Draw dotted lines AB, BC, and AC; divide AC into two, and at the bisecting line measure off the "V" or vertical height of the triangle at this point.

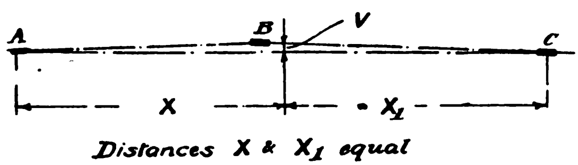

FIG. 12.—SHOWING THH SETTING-OUT FOR FINDING THH FACTOR "V" IN LOCOMOTIVE, AS FIG. 11.

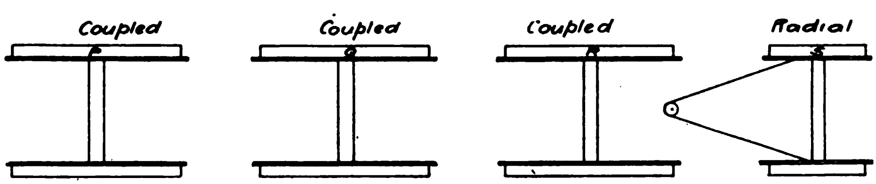

FIG. 13.—THE WHEEL ARRANGEMENT OF A SIX-COUPLED RADIAL ENGINE, 0—6—2 TYPE.

Of course, where the wheelbase is equally divided, the vertical height can be immediately taken at centre pair of wheels, or roughly estimated as one-quarter the total side play of the radial truck; or, which is the same thing, one-half of the side play on each side of the centre line. This is $\frac{1}{8}$ in. in the present case. On measuring "V" in the diagram (Fig. 12) this will be found to be barely $\frac{1}{8}$ in. The difference is immaterial, and the formula works out as follows:—

$$\text{Radius} = \frac{5\frac{1}{2} \times 5\frac{1}{2}}{\frac{3}{32} + \frac{1}{8}} = 138 \text{ ins.}$$

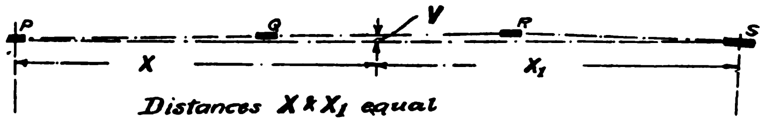

FIG. 14.—SHOWING THE SETTING-OUT FOR FINDING THE FACTOR "V" IN LOCOMOTIVE, AS FIG. 13, WHERE THE RADIAL WHEEL HAS ONLY LIMITED SIDE PLAY.

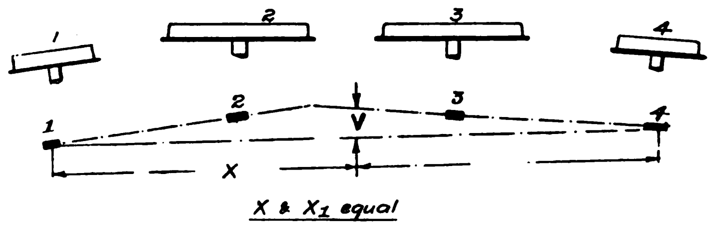

FIG. 15.—SETTING-OUT FOR A 2—4—2 TYPE DOUBLE-ENDED RADIAL LOCOMOTIVE, WITH ONE RADIAL AXLE HAVING MORE MOVEMENT THAN THE OTHER

Radius in feet therefore equals 11 ft. approximately.

For all normal examples of the 2—4—0 type radial engine there is no need to make a diagram. The "V" is obtained by the simple method indicated above. It is only when there is a great disparity between the two wheelbases (between leading and driving that of the coupled wheels) that a drawing is essential.

With engines of the 0—6—2 or 2—6—0 types a diagram is necessary, as will be seen by Figs. 13 and 14. Here the measuring of the "V" factor at the *centre* of *total wheelbase* may make a considerable difference. Where the movement of radial wheel is practically unlimited, the diagram may also be omitted, as the effect is to leave simply a six-coupled rigid engine, the curve-traversing propensities of which must be considered in another way, as described in last issue. The formula for rigid vehicles must be used in place of that for flexible structures. In case of doubt, estimate with both formulas and average the results.

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The double-ended or 2—4—2 type locomotive does not present any difficulties. The four points of contact are obtained, and where the movements of the leading and trailing trucks are identical, the "structure" will be the same as in Fig. 10. The factor "V" must always be measured at the *middle* of the total wheelbase, and in this any difference in the lateral movements of the fore and aft radial trucks will be allowed for. Fig. 15 shows this in an exaggerated form.

In the case of bogie engines which have more than one pair of fixed or rigid wheels, the method remains the same as for 2—6—0 or 0—6—2 type engines (see Figs. 13 and 14), but where the bogie is used in conjunction with six or eight-coupled wheels and has *unlimited* movement*, as already mentioned, the rigid vehicle formula should be applied, as it is the rigid wheels that are of paramount importance. Wherever they will go, the radial truck, like the lamb in the nursery rhyme, is sure to follow.

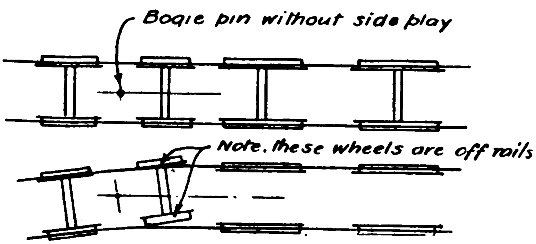

Fig. 16.—A Four-coupled Bogie Locomotive with incorrectly-designed Bogie. Engine shown on a Straight and Curved Track.

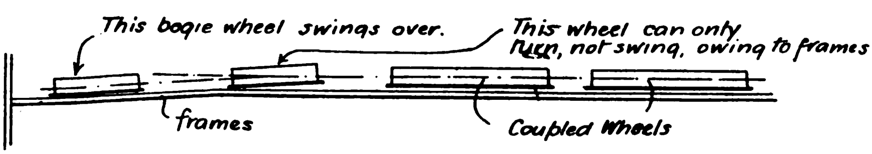

Fig. 17.—Showing a Bogie which has no Side Play in the Inner Bogie Wheel owing to the Main Frames of Locomotive.

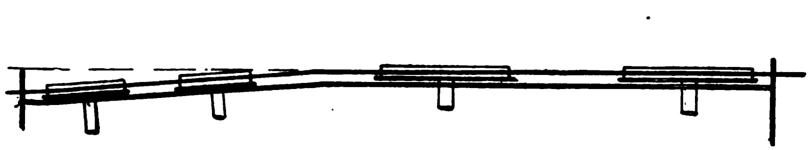

Fig. 18.—How a Bogie should Swing over when the Vehicle has more than One Pair of Rigid Wheels.

Exemplifying the rule, in connection with The Model Engineer steam locomotive (coloured plate 1904), the total wheelbase is 15⅜ ins., say, 15¼ ins. to reduce the labour of working out. The frames and bogie construction allow the truck to swing over properly, not like Fig. 16 or Fig. 17*, but bodily as in Fig. 18. At the centre of the wheelbase the vertical height of the triangle equals ⅛ in. Therefore, the minimum safe radius would appear to be with 3-32nds in. clearance.

$$R = \frac{7\frac{5}{8} \times 7\frac{5}{8}}{\frac{3}{32} + \frac{1}{8}} = 265 \text{ ins.}$$

R in feet = 21 ft.

I believe I gave 20 ft. as the proper radius for this engine, although, of course, as in all other examples, the presence of an abnormal gauge allowance will moderate this. However, 20 ft. is a safe radius from all points of view (see practical example, No. 4, which I cited in last article), and although the scale is different, is a fair comparison. The Caledonian "Dunalastair," which was described in Volumes IV and V of The Model Engineer, according to this rule, requires over 30 ft. radius. The "Little Giant" has a wheelbase of 6 ft. 3 ins. The factor "V" = ⅞ in., and with a clearance of ⅜ in. the rule recommends a minimum radius of about 106 ft. The minimum radius I used in connection with this engine was 105 ft. This, I think, shows that the rule may be used without fear. At any rate, it will, as far as I can discover, always be found to err on the right side.

So much for the minimum safe radius of model railway curves. We have now to consider the question of speeds on these curves and the amount of superelevation required for various speeds. After considerable experiment and trial on various known examples of actual model practice, I have evolved the following formula :—

$$\text{Superelevation in inches} = 2 \times \frac{V^2 \times S \times (H - G)}{R}$$

Where

- G = the gauge of the railway in inches
- S = scale of the model in inches to the foot.
- V^2 = velocity in miles per hour squared.
- R = radius of curve in inches.
- H = ⅞ height of boiler centre in inches for small models; ¾ height of boiler centre in inches for large models.

Previous to accepting this formula, let us see whether it bears minute inspection. The velocity (V) it will be noticed varies the amount of superelevation not directly but as the square. Within ordinary limits this is as it should be, doubling the velocity resulting in four times the superelevation. The size or weight of the model is represented by the factor S, the scale. Therefore, doubling the scale will double the superelevation. This, however, in itself is not enough, and therefore the factors H and G

* This is a state of things seldom present in any model of decent design. To allow unlimited side play generally means sacrificing something of importance to the appearance or working of the model.

* Where this obtains the engine is provided with about the same facilities for traversing a curve as a 2—6—0 engine instead of a true 4—4—0 engine.

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are introduced. If the height of the boiler is increased the superelevation is also increased, which is reasonable. The widening of the gauge decreases the amount of the superelevation as the product of H – G is thereby lessened. The variation in the factor H (⅞ of boiler height in small models, and ¾ boiler height in large models, say, under ⅝ in. scale) is recommended, because the boilers of small models are heavier in proportion to those of larger ones, and, furthermore, an increase in the boiler height does not mean that the centre of gravity of the whole engine is raised to a corresponding degree.

Taking three examples, we get for a 3-in. scale model where the radius of curves is 100 ft. (1,200 ins.); velocity, 8 miles per hour; height of boiler, 2 ft. 2 ins.; gauge, 15 ins.—

$$\text{Superelevation} = 2 \times \frac{8 \times 8 \times 3 \times (19\tfrac{1}{2} - 15)}{1{,}200} =$$

$$\text{Superelevation} = \frac{36}{25} = 1\tfrac{1}{2} \text{ ins.}$$

For a ¾-in. scale model like Mr. Henry Lea's, boiler centre, 5¾ ins.; speed, 8½ miles per hour; radius of curve, 20 ft. (240 ins.); gauge, 3⅝ ins., the result is—

$$\text{Superelevation} = 2\,\frac{8\tfrac{1}{2} \times 8\tfrac{1}{2} \times 3 \times (4\tfrac{3}{8} - 3\tfrac{5}{8})}{240 \times 4} =$$

$$\text{Superelevation} = \frac{27}{80} = \frac{1}{3} = \text{5-16ths in. approx.,}$$

and, on reference to the back issues of THE MODEL ENGINEER, we find that this is exactly the amount of superelevation adopted by Mr. Henry Lea on the 20-ft. radius curves of his railway.

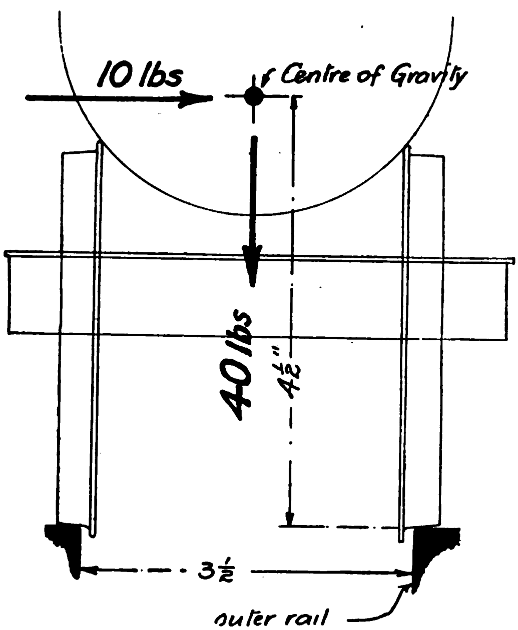

FIG. 19.—THE FORCES ACTING ON A GIVEN MODEL LOCOMOTIVE AT ITS CENTRE OF GRAVITY WHEN RUNNING ROUND A CURVE, NO SUPERELEVATION BEING ALLOWED.

For a small ⅝-in. scale engine with boiler centre 5¼ ins. above rail level, gauge, 3¼ ins.; radius of curves, 60 ins.; speed, 3½ miles per hour, the formula gives—

Superelevation = 5-16ths in. full with H = ⅞ boiler centre (as for small models).

Superelevation = 3-16ths in. with H = ¾ boiler centre (for larger models).

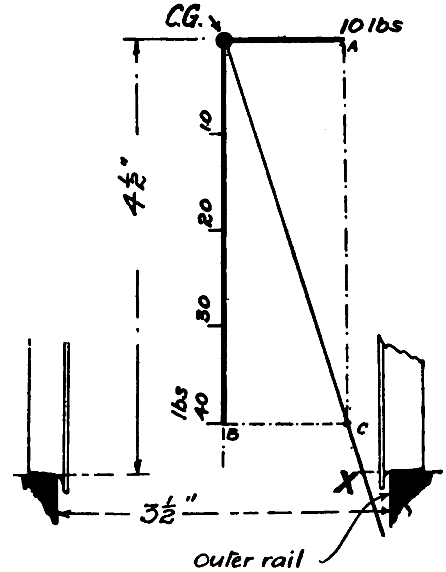

FIG. 20.—STABILITY DIAGRAM OF LOCOMOTIVE IN FIG. 19.

And as this engine is more or less on the borderland I would recommend averaging the results, which will give ¼ in. as the most suitable superelevation.

As most readers know, railway carriages and wagons often have a higher centre of gravity than a locomotive, especially when laden, and therefore in establishing any rate care must be taken that it allows an ample margin. The fact that model boilers and boiler mountings are much heavier than they would be if reduced exactly to scale also requires consideration. Most probably the scale equivalent of 6 ft. (that is, 6 ins. in a 1-in. scale model, 4½ ins. in a ¾-in. scale, and 3 ins. in a ½-in. scale engine) represents the average height of the centre of gravity. Assuming this to be the case, we will examine the stability of a locomotive of ¾-in. scale which weighs loaded, say, 40 lbs., and which is traversing a 20-ft. radius curve on a track 3½-in. gauge at 8½ miles per hour. Now, the centrifugal force on a body travelling through a circular path is represented by—

$$M \times V^2 \div R.$$

Where M is the *mass* (weight divided by the force of gravity), V^2 the velocity in feet per second squared, and R the radius of the path or track in feet. To simplify matters we find the mass (M) by dividing the weight by 32* and the velocity in feet per second by estimating it at 1½ ft. per second†

* The factor g should, of course, be 32·2.

† 60 miles per hour equals 88 ft. per second.

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per mile an hour. In the present case the weight is 40 lbs., therefore the mass is $\frac{40}{32}$. The speed is $8\frac{1}{2}$ miles per hour, therefore per second the locomotive travels $1\frac{1}{2} \times 8\frac{1}{2}$ ft. = $12\frac{3}{4}$ ft. per second. The formula then reads :—

$$CF = M \times \frac{V^2}{R}$$

$$CF = \frac{40}{32} \times \frac{12\frac{3}{4} \times 12\frac{3}{4}}{20}$$

$$CF = \frac{40 \times 162}{32 \times 20} = 10 \text{ lbs. approximately.}$$

Having obtained this result, we will prepare a diagram showing the two forces which are acting on the locomotive, viz., the horizontal centrifugal force tending to overturn the locomotive and the vertical force of gravity or weight of the engine. The engine has a gauge of $3\frac{1}{2}$ ins., and centre of

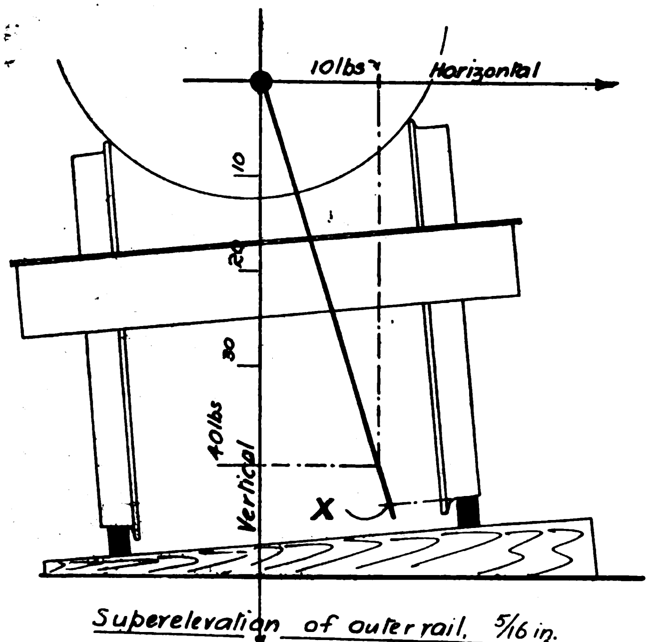

Fig. 21.—Showing the Increased Stability where Locomotive in Fig. 19 is running on a Super-elevated Track.

weight on centre of gravity is supposed to be the scale equivalent of 6 ft. above rail level ; that is, $4\frac{1}{2}$ ins. in the model.

Fig. 19 shows the two forces and their direction when the locomotive is on a piece of track without superelevation, the 10 lbs. centrifugal force acting in a truly horizontal direction, and the weight, of course, in a truly vertical direction. To find the stability of the engine from the point indicating the centre of gravity (CG in Fig. 20) draw a line to a suitable scale representing 10 lbs. horizontally, as shown. In the diagram 1-16th in. equals 1 lb., therefore the line measures ten-sixteenths or $\frac{5}{8}$ in. On the line of the vertical force draw another representing 40 lbs., the weight of the locomotive. Construct a parallelogram by drawing lines BC parallel to CG – A, and A – C parallel to CG – B. From CG run a diagonal to point C, extending it until it cuts the level of the rails at point X. If X falls inside the rails then the locomotive is stable and will not overturn. In diagram Fig. 20 it will be seen that it does so, but there is no margin of safety. Indeed, if the speed were increased another one mile per hour the locomotive would certainly overturn. Therefore, superelevation of the outer rail is more or less imperative. The proposed rule gives 5-16ths as a suitable degree of superelevation, and I therefore show diagrammatically in Fig. 21 the position of the engine with this elevation of the outer rail added. In proceeding to test for stability, it must be borne in mind that the weight still acts vertically and the centrifugal horizontally. The effect of this is, owing to the movement towards the inner rail of the centre of gravity and the vertical component of weight, to throw the diagonal well within the gauge and to indicate a greater degree of stability. This measure of stability should be the miniumm allowed for any model.

This, I think, completes the interpretation of the various formulæ I have proposed for dealing with locomotives traversing model railway curves. Any of the practical examples quoted in the last article may be tried by the diagrams, and it will be found that from a scientific point of view it was inevitable that those referred to as overturning at the speeds mentioned would become unstable. In some cases allowance must be made for the passenger on board the locomotive.

The formula included herewith will, I think, be found to give sufficiently accurate results for all ordinary models. Abnormal examples must be dealt with specially, and in every case the figures should not be allowed to obtain mastery. If the result does not appear reasonable, go over the working again, and always mix the formula with an equal amount of common-sense.

(To be continued.)

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particu-

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lars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signatures of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows :—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as tc the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

A YEAR'S SUPPLY OF METHYLATED SPIRIT.—From the report of the principal chemist upon the work of the Government laboratory during the year ended March 31st, 1907, it appears that, out of a total quantity of 2,468,619 gallons of industrial methylated spirit used in the financial year, 10,800 gallons were employed in connection with the manufacture of electric lamp filaments, 2,042 gallons in respect of the making of electric cables, etc., and 13,269 gallons in regard to the output of incandescent gas mantles.

Experiments on Electric Oscillations and Waves.

By R. P. HOWGRAVE-GRAHAM, A.M.I.E.E.

FURTHER EXPERIMENTS ON INDUCTION OF HEAVY HIGH-FREQUENCY CURRENTS.

(*Continued from page* 298.)

VARIOUS striking experiments with the coil described in the previous article will suggest themselves, but two of the simplest are shown by the photographs reproduced in Figs. 56 and 57.

The coil was set on edge in a vertical plane, and a carefully smoothed and flattened sheet of tinfoil was hung parallel and quite close to its surface. When the discharge was started the eddy-currents induced in the tinfoil raised its temperature sufficiently to cause it to melt in places; little red-hot lines and patches enlarged and advanced in the manner described above, and small sparks passed between the disintegrating fragments of the metal. All this took place within ten seconds, after which the tinfoil collapsed and tore away from its supports. When it was in this condition, the photograph (Fig. 56) was taken.

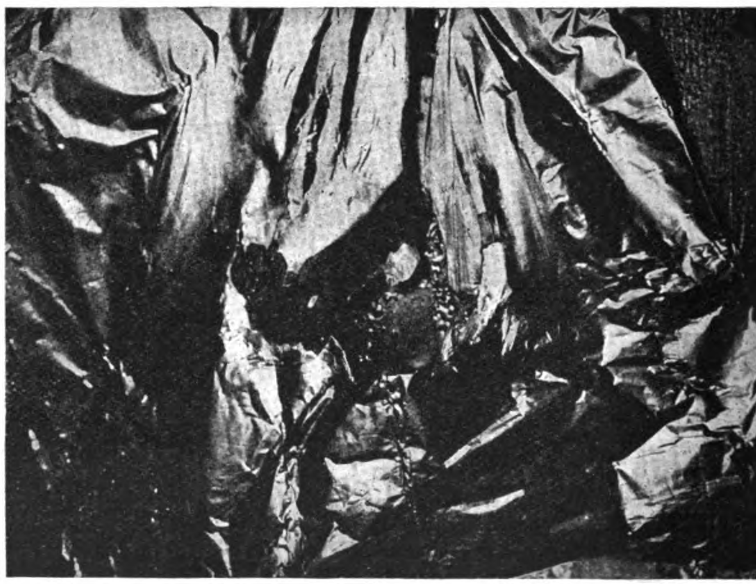

FIG. 56.—TINFOIL SHEET AFTER BEING MELTED BY INDUCED EDDY-CURRENTS. (*About half actual size.*)

Fig. 57 illustrates the following remarkable experiment: A piece of iron wire (about No. 20) was bent into a circle 3 or 4 ins. in diameter, the end being twisted and soldered (as shown in the photograph) so as to make an electrically good joint. The short-circuited circle thus made was held by a wooden clip, so that it was close to, and centrally parallel with, the surface of the coil.

When the discharge was started the iron rapidly rose to white heat and before long fused at one

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point, where a small ball of melted iron was formed and emitted characteristic scintillations. At the moment of rupture one of the fused ends sprung inwards towards the centre, and then moved back again a short distance. Thus a curved and blurred streak of light was recorded on the photographic plate by the little globule of white-hot iron, though it eventually stopped in the midway position shown by the extra bright line and spot in the middle of the streak. The circle of light is the photographic record of the white-hot wire before it broke. As an exposure was made with a small quantity of magnesium, before the discharge was started, the outline of the wire ring when cold can be traced wherever it moved on getting hot. Various irregularities on the shining surface of the wax caught the somewhat undiffused magnesium light in such a way as to render some retouching necessary, but the image of the wire itself has not been interfered with in any way. It is noteworthy that the rate of heating round the circle of wire is often very unequal—possibly because irregularities of field-distribution cause unequal generation of heat by hysteresis up to recalescence point, thus getting some portions of the wire ahead of others in their temperature to rise.

(*To be continued.*)

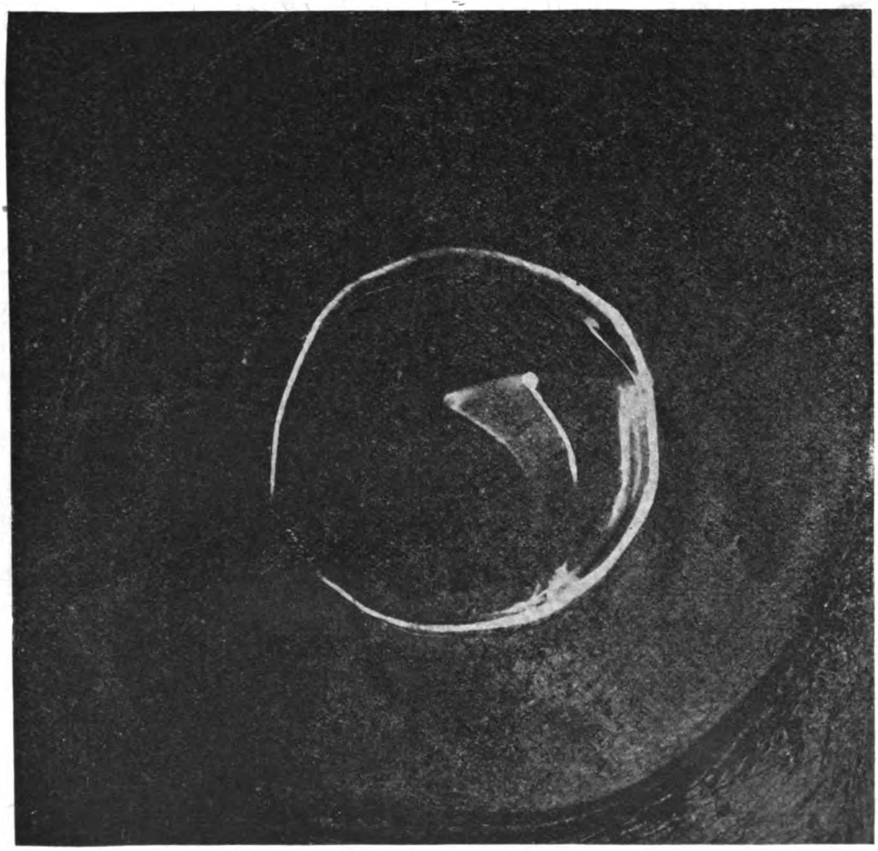

Fig. 57.—Iron Ring Fused by Eddy-currents. (*About half actual size.*)

Two Interesting Boats.

By "The Carpenter's Mate."

(*Continued from page 327.*)

Before describing the internal fittings in detail, we will examine the somewhat peculiar hull lines. It will be seen from these that the shaft line is almost parallel with the water-line; this is effected by what purports to be a "Saunders" bulb keel. There is a slight difference though, for the correct "Saunders" keel forms an integral part of the hull lines, starting right from the stem post and gradually widening until at the point where the motors are placed it is sufficiently wide for the engines to drop down into. From thence it tapers off to the propeller much the same as the stern of a torpedo. In the case of the *Misery*, the bulb starts from about the midship section and approaches its maximum width just below the motor driving wheel. A larger gear wheel fixed on the tail shaft meshes with this and gives a reduction of speed of $3\frac{1}{2}$ to 1, the section of the bulb at this point being just sufficient for the larger gear wheel to revolve within it. The experience of the owner of this boat led him to fit this arrangement in preference

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to driving direct, for it was found that, apart from the great frictional losses that a high-speed tail shaft sets up, it was impossible to get the best work out of any propeller revolving at the normal

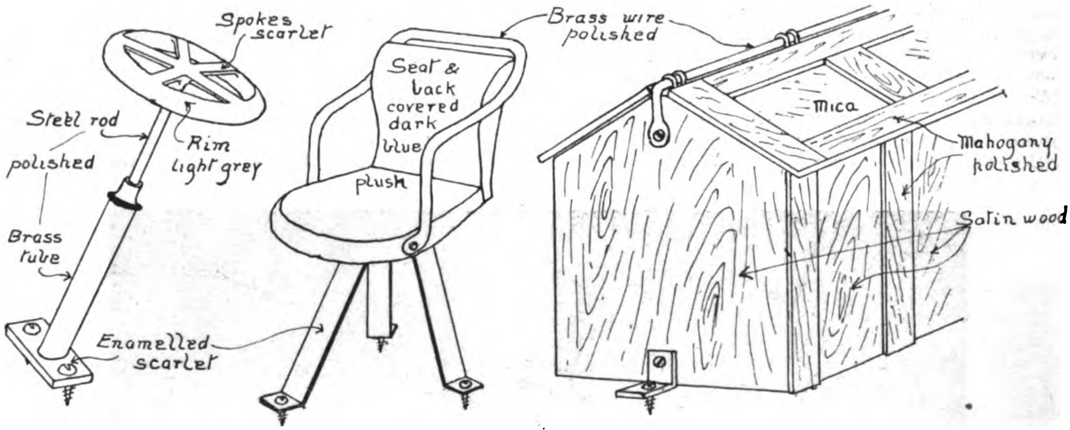

FIG. 10.—STEERING WHEEL, HELMSMAN'S SEAT, AND ENGINE COVER OF THE "MISERY."

rate of revolution of the motor. The arrangement shown gets over the difficulty very well, as, of course, a larger screw is used giving about the same thrust at its lower rate of revolution as the smaller direct-driven screw should theoretically give, but does not owing to the cavitation losses. The hull is Carvel

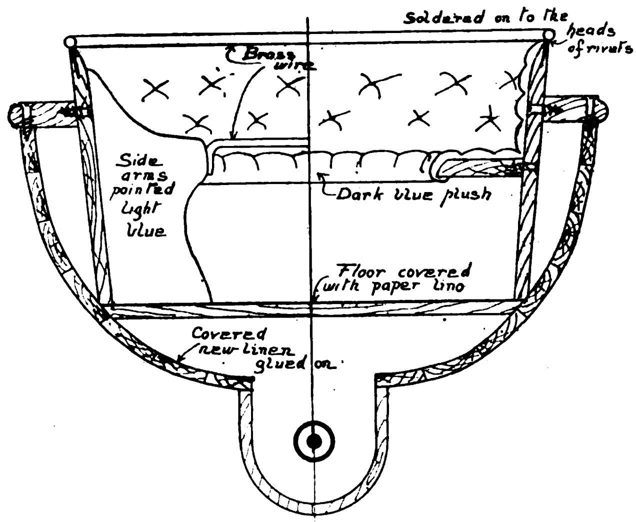

FIG. 7.—SECTION 6 (FIG. 2) LOOKING AFT.

built of yellow pine. There are no ribs, moulds, or stringers in the finished hull, which accounts for the extremely light weight. Before painting, this was only 1 lb. 9 ozs. It may, perhaps, be of interest to describe the method of procedure in the building, as it is slightly different from accepted practice. The materials required are: A board of flawless yellow pine, ⅛ in. thick (what is known in the trade

as "nine cut"), a piece of 1-in. by 1-in. ditto, sufficient to make the keel, a few odd pieces to make the stem post, moulds, and building board, these latter being independent of quality; a few remnants of *new* linen, some very small brass screws, a pot of properly made honest Scotch glue, and—yes, a little more than "Hedge Carpenter's" skill in the use of woodworking tools. Commencing with the stem post and keel, these are shaped up and joined together as shown in sketch, Fig. 9, the joint being

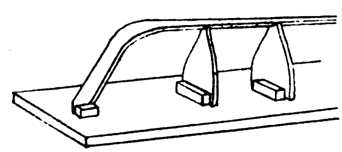

FIG. 8.
METHOD OF FIXING MOULDS TO MOULDING BOARD.

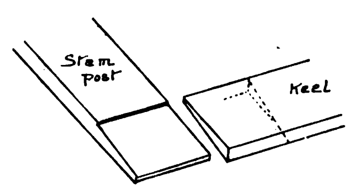

FIG. 9.—SHOWING METHOD OF FITTING KEEL TO STEM POST.

thoroughly warmed before glueing and pressed together with a clamp until quite dry. The building board is then taken in hand and one side planed quite flat and straight. Upon this the deck line is drawn out. The moulds (six in number) are got out true to the lines, allowance being made for the thickness of the planking, as the drawings, of course, indicate the form of the boat outside

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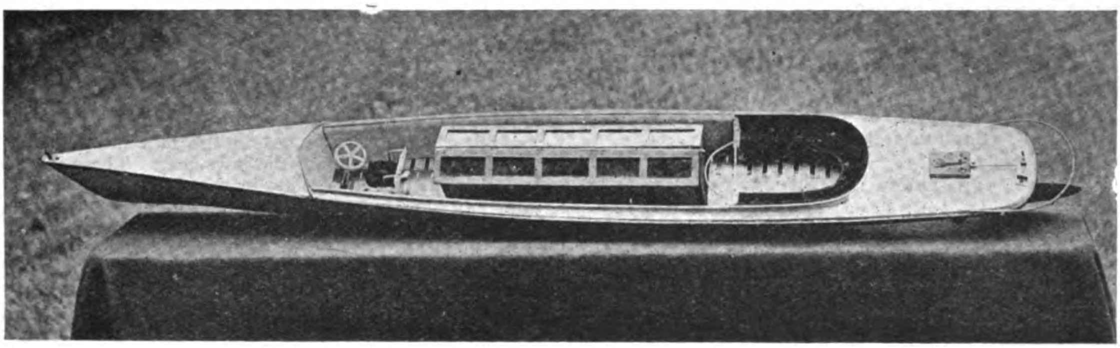
the planking. The moulds are left with an inch of additional length on the top edge for fixing to the moulding board, the stem post being left that much longer for the same purpose. They are fixed on with a glued block—no nails here, please, as we want them exactly in their right place. Just put some glue (not too much of it) on two adjacent sides of a squared block. Support the mould exactly in its place (on the drawing on the moulding board) with one hand, using the third and fourth fingers to support a small try-square at the back, and rub the block gently into its place with the other hand until it "bites" (that is, it sticks). Retain the support for a few seconds to let it set, and then proceed with the next one. When all the moulds are fixed and quite dry, we can fix on the keel and stem post, using glue to make a simple contact joint and retaining it in position by a carefully driven brad into each mould. The stern piece (which is cut to shape from the solid, as is also the bulb keel, and hollowed out until it is as thin as the planking), is then fixed in position in a similar way. The part where the planking and keel join into this stern piece must, of course, be is then made a perfect joint and glued on. When dry, some narrow strips of glued linen are placed along the joint outside the hull, half on the bulb and half on the hull. The outside can now be cleaned up with glass-paper and the end joints of the planking further fortified with the small brass screws let in flush. The resultant hull, if properly made, is a triumph. It has the resiliency of whalebone with the dimensional recuperative powers of a rubber ball. It will stand any amount of reasonable rough handling and a surprising amount of unreasonable ditto. The total weight compares favourably even with aluminium, which has to be strengthened with stringers and moulds. As a little practical example of its strength, I may mention that once upon a time (two years ago) the *Misery* came into ignominious contact with a large sailing cutter when going full speed, and her heavy electrical equipment promptly took her to the bottom of 6 ft. of water. She remained there for four hours and a half, to the disgust of her owner and his friend, who rowed around in a leaky dinghy trying to locate her, while the crowd smiled and tendered suitable but unwelcome advice. I do not



THE MODEL ELECTRIC LAUNCH, "MISERY."

left thick enough to take the rebate. Everything is now ready for the planking, and here the special skill required comes in, for, to realise the virtue of the system, the jointing of planks one upon another must be perfect. There are only two results to expect: perfect success or perfect failure. We must wait for the glue to dry on each successive plank before proceeding to the next, so it is of necessity a prolonged job calling for a good deal of patience, but it is worth doing the right way. When the planks are all fixed, the hull is cut away from the moulding board and the inside lined with the new linen. The pieces, of a suitable size to go in between the moulds, are dipped bodily into thin hot glue and then placed in position and rubbed into a close contact all over. When this is dry, the moulds, which, of course, are firmly glued in position, are carefully cut right away and this calls for some skill with the chisel, the places they have occupied being covered with bands of glued linen like the rest. The bulb is put on last of all and is finished with a coat of priming inside and the stern tube and shaft fitted before being attached. A small slot is pierced in the hull for the gear wheel to poke through to engage with the motor, and the bulb think a more severe test of the method of construction could have been made, for she only had one coat of red lead priming inside and three coats of paint outside. She was ultimately recovered with the aid of a claw drag, and it must be remembered that there were two heavy accumulators and the motor to raise, in addition to being filled with water, yet careful examinations have failed to find anything amiss with the hull either then or since. While it answers so admirably for a cold driving plant, I should not attempt to put a steam set into such a hull. I have reason to have the greatest faith in Scotch glue, but the celebrated adhesive forgets all its responsibilities when it comes in contact with warm water and steam.

The internal fitments of the *Misery* belies her title, for it unconsciously calls up memories of that delightful sunny July day when our friend proffered us the use of his launch for a trip up to Boulter's Lock. The construction of the fitments can be easily followed from the sketches, which is, perhaps, after all the best way to describe these things. The motive power consists of two accumulators of 10 amp.-hour capacity and an 8-volt drum armature motor using $3\frac{1}{2}$ amps.;

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rather a heavy rate of discharge, but they stand up to it with careful watching. The driving plant is completely enclosed under the "engine" casing and the gearing is under the floor. The switch is placed on deck just in front of the steering gear, and all the connecting wires are out of sight, which is where they should be in an electric launch. The hull is enamelled a light cream colour all over, only relieved by a black line round the rubbing strake. The coaming is edged all round with ⅛-in. bright brass wire and a spring fender is fitted on the stern, also of brass wire. All the metal work in sight is kept bright polished, and it has a very pleasing effect. Owing to the lugubrious title of this craft, the owner decided to put only the initial letter on for a name-plate. This is cut out of thin sheet brass with a pair of scissors and pressed in place while the enamel was tacky. It is possible that some influence was brought to bear upon the selection of the name for this boat by the miserable hours the owner and builder has spent waiting for those accumulators to be charged, but of that I am unable to speak. Suffice it to say that although he has been sometimes guilty of allowing his feelings to regulate his actions, he must not "sentimentalise" THE MODEL ENGINEER by allowing his heart to stray into his pen.

A Design for a Handy Lathe.

By W. MUNCASTER.

(*Continued from page* 282.)

A Three-jaw Chuck.

ONE of the most useful accessories to a lathe is a good chuck for holding the work to be turned or for taking drills, reamers, and mandrels. In the illustrations herewith, such a chuck is shown; this is a 4-in. three-jaw "Cushman,"

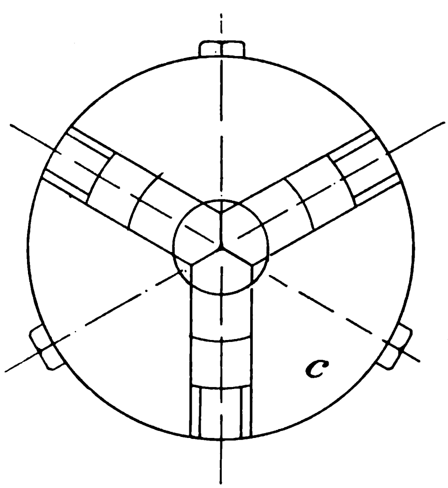

Fig. 1.—Front View.

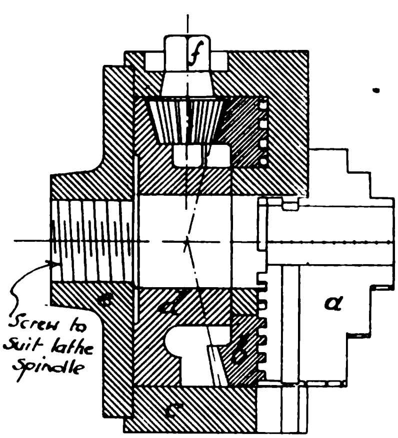

Fig. 2.—Section of Chuck.

one of the most popular of all forms of chucks, and quite deserving the high reputation it has amongst users of lathes and other machine tools for boring, turning, etc.

The accompanying sketches—drawn carefully to scale—illustrate this chuck, showing each part in detail, and indicated by corresponding letters giving information sufficient to enable one to be constructed.

Referring to Figs. 1 and 2, which show a section and a front view of the complete chuck, there are

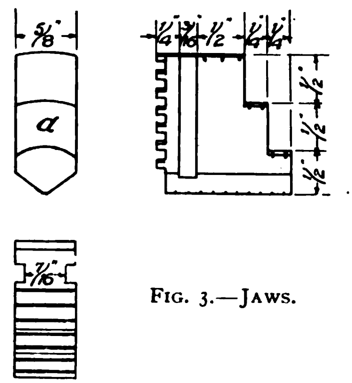

Fig. 3.—Jaws.

three hardened steel jaws *a* working in radial slots in the end of a cylindrical shell; these jaws are adjusted by means of a disc *b* inside the shell, having a spiral thread cut in the face into which the teeth on the back of the jaws gear. These jaws are carefully fitted to slide in the slots in the shell, and can only move in a radial direction, a strip at each side of each slot in the shell engaging into corresponding grooves in each jaw. If the disc *b* be revolved in either direction, the jaws must either approach the centre or recede from it. To revolve the disc three small spindles are fitted, on each of which is wrought a bevel pinion to gear into suitable teeth on the back of the disc. The spiral on the disc is about 3-16ths-in. pitch, and will be cut in a surfacing lathe geared to cut five threads per inch. It is evident that the three jaws will not be exactly alike as regards the position of the teeth working into the spiral, because each jaw engages the spiral at a different place. This matter will, however, right itself if the jaws be--when the teeth are being cut—arranged on the faceplate in proper order at the same angular distance as they will eventually be fitted and the teeth cut by the surfacing arrangement giving five threads per inch,

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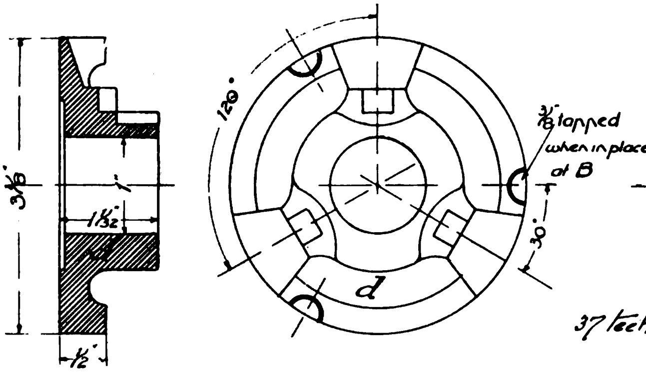


Fig. 4.—Collar in which are Bearings for Bevel Wheel Spindles.

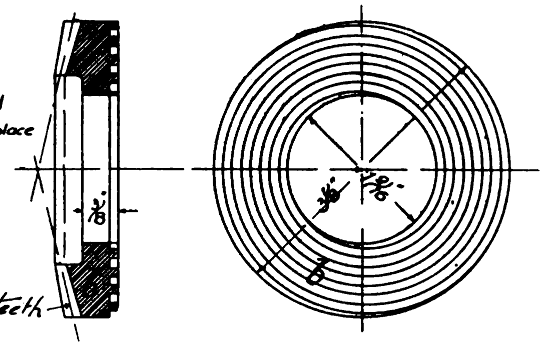


Fig. 5.—Disc for Operating Jaws.

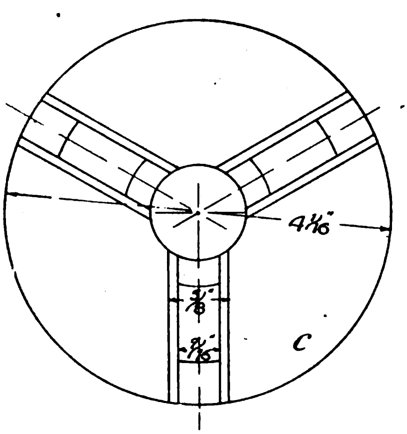


Fig. 6.—Front View of Shell.

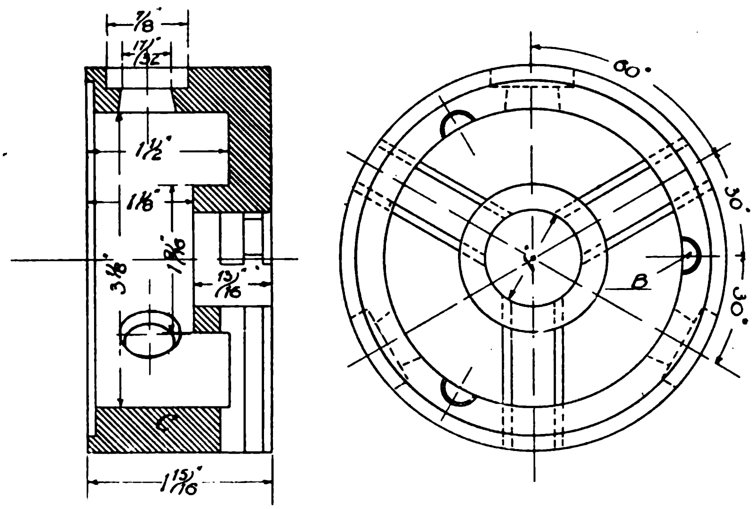
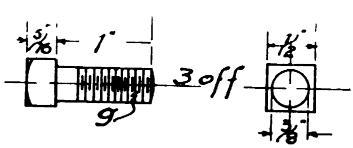


Fig. 7.—Section and Rear View of Body or Shell of Chuck.

Fig. 10.—Fixing Screws.



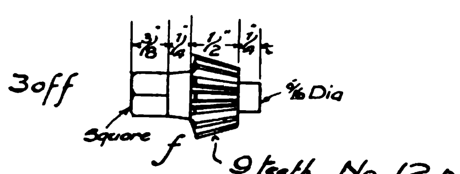


Fig. 8.—Bevel Pinion.

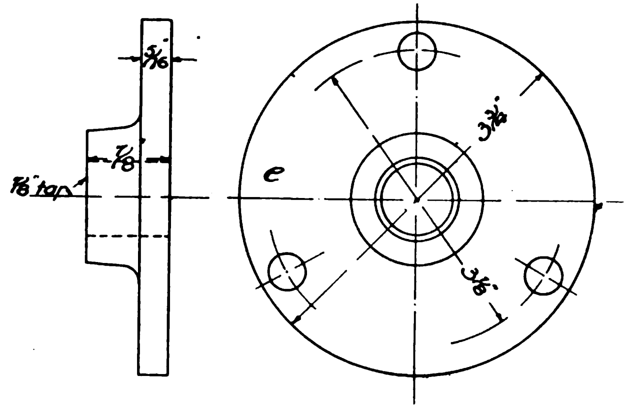


Fig. 9.—Backplate.

DETAILS OF A 4-IN. THREE-JAW "CUSHMAN" CHUCK.

(*Scale: Half full size*)

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except that the direction must be reversed, that is, in cutting the thread in the disc the slide-rest would travel towards the centre of the lathe; whereas, in cutting the teeth in the jaws, the slide-rest must travel from the centre outwards.

There is another point that requires attention. A spiral *may* be of constant pitch, but it *must* be of varying diameter; each tooth will require to be cut to suit the largest as well as the smallest diameter of the thread in which it has to engage.

To keep the spiral disc exactly central it is carefully bored to fit over a turned boss in the inside of the shell. The depth of the boss is the same as the thickness of the shell, a piece *d* being arranged to form a collar, so as to keep the spiral up to its work. This piece also forms a bearing for the ends of the spindles of the small bevel wheels. When every part is in place the back faces are turned true and recessed, as shown; three holes are drilled and tapped for $\frac{3}{8}$-in. screws, half into *d* and half into *c*.

To mount the clutch to the lathe a small faceplate is prepared and tapped to screw on to the lathe spindle. When in place the plate is turned and truly faced to fit in the recess of the shell *c*, which serves to centre the chuck. Three $\frac{3}{8}$-in. diameter holes are drilled in the faceplate to secure the chuck by means of three $\frac{3}{8}$-in. screws *g* into the tapped holes already mentioned.

Two sets of jaws should be fitted, one set as shown in Fig. 3, the other having the steps in the opposite direction.

The capacity of the chuck is enormous, and gives facilities for such a variety of work that it seems almost a necessity to those who have been accustomed to its use. This size will hold a drill 1-16th-in. diameter, and will take anything up to $4\frac{1}{2}$ ins. diameter, or having a hole from 1 in. to $5\frac{1}{2}$ ins. diameter.

As the arrangement is self-centreing, any piece that has once been turned is mounted exactly true when the jaws are screwed home. The power is ample; it may safely be relied on to hold anything that can be turned in a foot lathe.

(*To be continued.*)

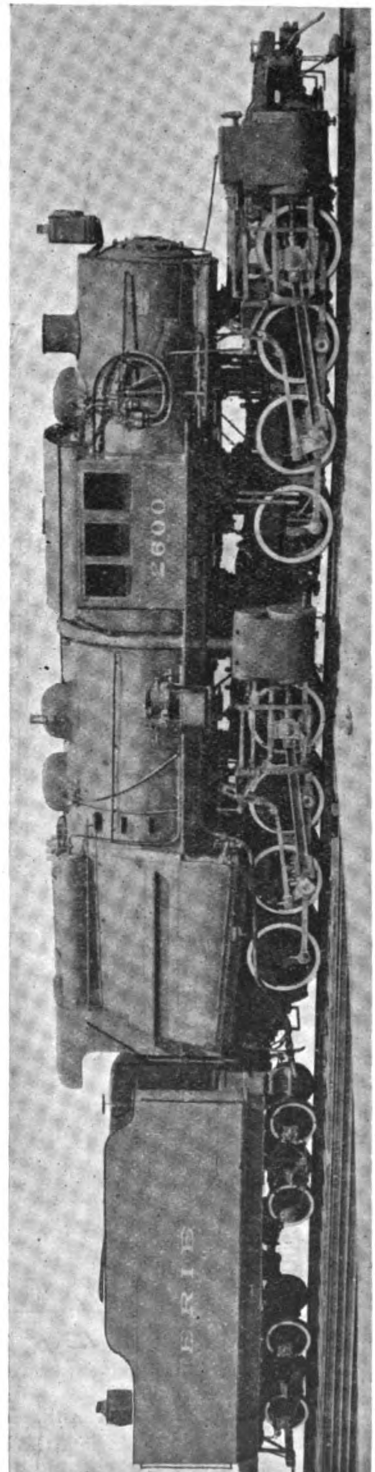
Locomotive Notes.

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

Articulated Locomotives for the Erie Railroad.

What ranks for the moment as the largest and most powerful locomotive in the world was recently completed by the American Locomotive Company, at their Schenectady Works, for the Erie Railroad. This is one of three immense articulated compound locomotives intended for heavy banking service on steep inclines, and a photographic reproduction of the engine is, by courtesy of the builders, given on this page.

From this it will be seen that there are two groups of wheels comprising eight coupled wheels in each, and the cylinder arrangement adopted is that usually employed in locomotives of this description; that is to say, the low-pressure cylinders drive the forward group of wheels, and the high-pressure cylinders the hind one. Walschaerts valve gearing is employed throughout for actuating the slide-valves, which for the high-pressure



The World's Most Powerful Locomotive.

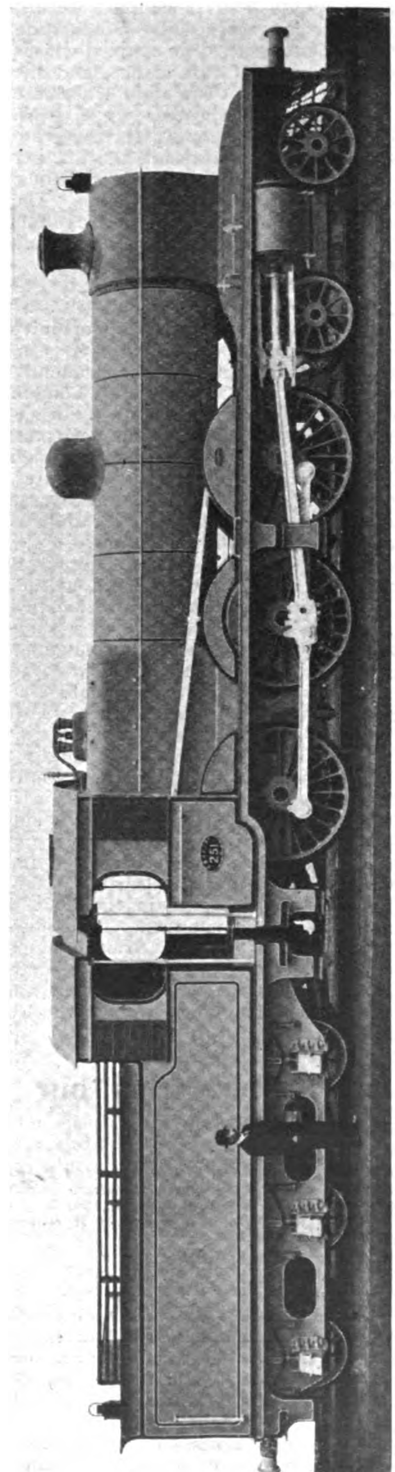
cylinders are of the piston type, and for the low-pressure balanced slide-valves of the Richardson pattern. The engine is compounded on the Mellin system, the intercepting valve being located in the upper part of the left cylinder casting. Steam from the H.-P. cylinders passes into a 9-in. receiver pipe extending forward from the centre of the cylinder saddle, to which it is connected by means of a ball joint. Steam from the L.-P. cylinders, which are located considerably ahead of the front end of the boiler, exhausts back through a flexible pipe connection to the exhaust pipe in the smoke-box. By an ingenious arrangement of the reversing gear the weights of the valve motions of the front and rear engines counterbalance each other. As the H.-P. valves are internal admission and the L.-P. external admission, it was possible, with this arrangement of reversing gear, to obtain a most satisfactory valve motion with both eccentric cranks leading the pin, the rear engines taking the forward motion from the top of the link and the front engines from the bottom of the link. The operation of the engine is rendered easier than it would otherwise be by the application of pneumatic reversing cylinders to the ordinary gear with positive automatic locking in any desired position.

The wheels of the forward group are equalised together on each side and, in addition, they are cross-equalised in front of the leading wheels, making the system equivalent to a single supporting point. The rear engine, on the other hand, is equalised throughout on each side only, without cross-equalisation. This forms a complete three point suspended engine or the best obtainable condition for flexibility and ease on the track. The leading dimensions of this record locomotive are as follows:—

Cylinders: H.-P., 25 ins. by 28 ins.; L.-P., 39 ins. by 28 ins.
Wheels, 4 ft. 3 ins. diameter.
Wheelbase: Rigid, 14 ft. 3 ins.; total, 39 ft. 2 ins.
Steam pressure, 215 lbs. per sq. in.
Total heating surface, 5313·7 sq. ft.
Grate area, 100 sq. ft.
Total weight in lbs., 410,000.
Tractive effort (working simple), 94,800 lbs.

New Express Locomotives for India.

Of late years Indian locomotive engineering has been remarkable for the strides which have been made in connection with it in the direction of increasing the sizes of the dimensions, and the tendency has been towards the adoption of standards common in this country. Of course, this is attributable in great measure to the work of the Engineering Standards (Locomotive) Committee, which has prepared designs comprising nearly all of the more advanced types of engines. Thus, there are now working in India locomotives of the "Atlantic," 4—6—0, and other types in passenger service, while "Consolidation" or 4—8—0 engines are being regularly employed for working heavy goods traffic. Quite recently the Vulcan Foundry Co., Ltd., of Newton-le-Willows, Lancashire, sent out to India a number of large and powerful express passenger locomotives of the 4—6—0 type for service on the Bombay, Baroda and Central India Railway. One of the engines is illustrated herewith. It has outside cylinders, 20 ins. diameter by 26 ins.



New Six-coupled Express Locomotive: Bombay, Baroda, and Central India Railway.

(Vulcan Foundry Co., Ltd., Builders.)

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stroke driving the middle pair of coupled wheels, and the slide-valves are worked by Stephenson link-motion inside the frames. The coupled wheels have a diameter on tread of 6 ft. 2 ins., and the bogie wheels of 3 ft. 7 ins. The rigid wheelbase is 14 ft. 3 ins., and the total wheelbase 27 ft. 3 ins. The total heating surface is 2,037 sq. ft., the grate area 32 sq. ft., and the boiler pressure 180 lbs. per sq. in. The weight on coupled wheels is 49¾ tons, and of the engine in working order 67½ tons. The tender carries 4,000 gallons of water and 7½ tons of coal. Engine and tender together in working order weigh 113¾ tons.

Fast Run on the North-Western.

The writer recently was afforded an opportunity of noting the performance of one of the 6-ft. 3-in. six-coupled express engines, of the "Experiment" class, when returning from Crewe by the London and North-Western Railway. The engine, "Sarmatian," built in 1905, was attached to the 6.20 p.m. train from Crewe, which is booked to run through to Euston without a stop in 2 hours 55 minutes. On the occasion noted, the start from Crewe was made 3 minutes late, and on nearing Stafford a prolonged slackening of speed was followed by a virtual stop, just north of the station. Again, a few miles further on, the train was slowed up and appeared likely to stop again, but this was avoided and the obstruction passed in the shape of a goods train shunted into a siding on the left of the main line. From this point onwards to Euston there were no reductions of speed except the usual slight one through Rugby, that station being cleared with 89 minutes remaining in which to reach London.

At Bletchley the driver had exactly 47 minutes in hand and 46¾ miles to go. With the 15-mile climb to Tring in front this might appear to be a task of considerable difficulty, because, although it is down grade practically the whole way from Tring to London, there has to be considered the fact of approaching the terminus, clearing Willesden, etc., and, after all, 60 miles in the hour is good work under any circumstances. This, however, is what "Sarmatian" did, the train arriving alongside No. 8 platform Euston a few seconds before 9.15 p.m., the booked time. The load was equal to 16½ coaches, including two 12-wheeled dining-cars.

Practical Letters from our Readers.

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

Model Railway Material.

To the Editor of *The Model Engineer.*

Dear Sir,—I notice in your September 26th issue another query regarding the best form of model railway track. "Caledonian" asks: "Can you suggest any other methods?" and wants "something fairly cheap yet that will last a reasonable time."

If "Caledonian" can get T-iron so cheaply, surely it would pay him to use it, even if he had to renew his rails every two or three years, especially as, if he uses cross sleepers, the wood will be decayed by the end of that time. It is a pretty tedious job cutting out cross sleepers, to say nothing of the drilling and counter-sinking of the holes in square rails. A tremendous amount of labour would be saved if "Caledonian" laid his sleepers longitudinally. Light stuff, however, will not do, for the track will not be sufficiently strong, and it will be liable to wind.

Really the building of substantial longitudinal track is the simplest way possible of laying a railway. Obtain from a builder's yard some laths 11 ft. long 3 ins. deep by ⅞-in. wide. They

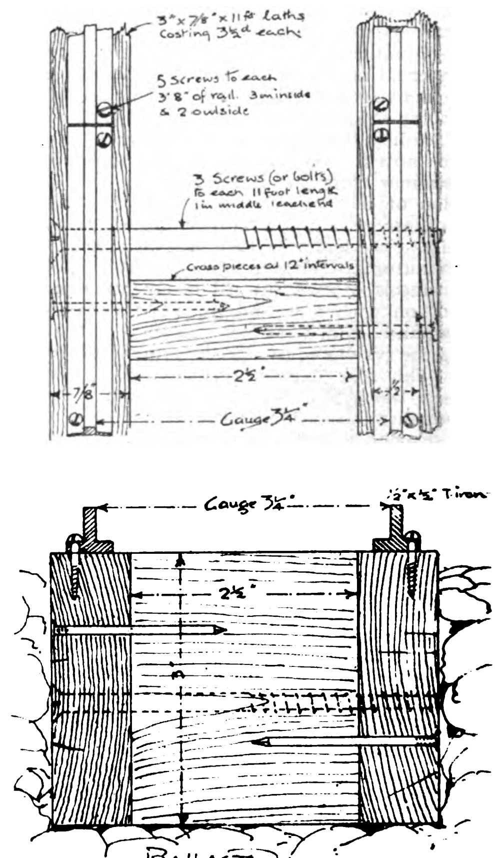

Fig. 1.—Model Permanent Way on Longitudinal Sleepers.

are kept in stock to this size, and cost a penny per 3 ft. run. Plane up one edge on each, take two of them for each 11 ft. of track, lay side by side, cut another one up for distance pieces, and nail these between about a foot apart. Right through from one side to the other put three large screws or bolts, one at each end and one in the middle. Then cut the T-iron (one of the 22-ft. lengths referred to by "Caledonian" will just do a length of track); cut each 11-ft. piece into three, making the rails 3 ft. 8 ins. long each. Screw these down on the planed edge of the longitudinal with round-headed brass screws, leaving an allowance of 1-32nd in. to 1-16th in. for expansion; five screws to each rail will be

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sufficient. The lengths can be made up in the workshop, and when all are ready, lay them in a trench previously prepared for them. The wood must be well tarred, likewise the rails except the running edge. The lengths being laid end to end, should be levelled by packing ballast or removing same underneath. When true, screw wooden straps about 2 ft. long one on each side overlapping the ends of consecutive lengths. Fig. 1 shows all these details in section and plan, and Fig. 2 gives a perspective view of same, showing the bonding straps.

Mr. Henry Lea, in a letter to THE MODEL ENGINEER, page 42, January 10th, 1907, states that the running surface of the rails may be preserved by rubbing with polishing felt served with graphite, which, he says, rain does not wash off. I have not tried this, but have used tallow with success. No support or base is required for this form of track as with cross sleepers, and yet it is capable of carrying very heavy weights, as my own 3½-in. gauge track has done, having borne without deflection a friend weighing 12 stone.

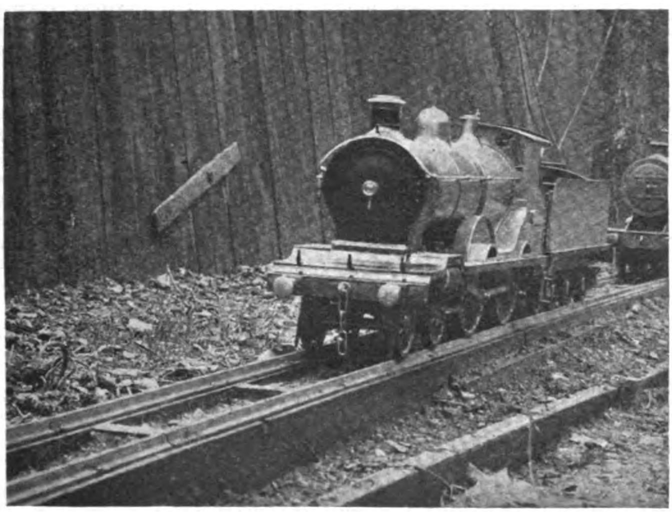

FIG. 2.—PERSPECTIVE VIEW OF TRACK.

I propose shortly to contribute a description of this form of track, dealing with the question of points, curves, crossings, etc.

There is one claim that ought not to be omitted—that this longitudinal system has the merit of appearing almost a fac-simile of that employed in actual practice on the Great Western Railway throughout the West of England, on the Central London Railway, and on several other tube railways. In fact, it is a nearer approach to actual practice than anything else, except "Scale Model Permanent Way."—Yours truly,

Hanwell. E. W. TWINING.

A Strange Occurrence.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Seeing your reader E. C. H.'s answer to my article "A Strange Occurrence," the lamps were not in circuit with a motor, etc., so no high E.M.F. could be generated; his likeness of it to a vacuum tube accurately describes the appearance of the effect. The peculiar part about it is that, although I have shown it to a dozen or more people, the effect still appears the same; putting the lamp in circuit and taking it out again does not alter the discharge in the slightest; a discharge of some sort I suppose it must be.—Yours truly,

R. N.

Correct Scale Model "Dunalastair" Loco. Wheels.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—*Re* Mr. W. Ballantyne's letter in your issue of September 5th, I have been asked by Messrs. W. J. Bassett-Lowke & Co., to report on enclosed wheels and send same on to you for inspection. As far as I can see they accord in every particular with the working drawings published in your paper. The balance weights are correct, also number of spokes, and diameter on tread when finished. Furthermore, the character of the wheels is exactly what it should be for a scale model of a Caledonian Railway locomotive. — Yours faithfully,

HENRY GREENLY.

Watford.

[We have inspected the wheels in question, and they appear to correspond exactly to the requirements of our correspondent.—ED. *M.E. & E.*]

Oil Engine Troubles.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I was pleased to see that the publication of my query *re* above elicited a reply in your issue of September 19th from another reader. I notice in the same issue a query (R. B., Leicester, No. 18,073) which indicates that this reader has had exactly similar troubles. The frequency with which questions on this subject have appeared leads one to think that there are many who have made up their small oil engines only to meet with disappointment at finding they will not work. I think, therefore, that Mr. Frank Holmes' kind offer to give further particulars of the conversion he has carried out on his engine from paraffin to petrol would be appreciated by many besides myself.

I should be glad to know (supposing Mr. Holmes' engine to be made from the same castings as mine—the British Electrical Company's, Leek) whether in making his alterations he removed the vaporiser, and, if so, what method he adopted in fitting the valves. I should also like details of electric ignition, and how this is worked from the existing 2-to-1 gear.

If the Editor would give the space, and Mr. Holmes is willing, I am sure that illustrated details of his petrol driven engine would be of interest and helpful to many.—Yours truly,

Cockermouth. "PUZZLED."

Re Six-coupled Locos.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Last month's issue of the *Railway Magazine* contains an article on the rolling-stock

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of the Caledonian Railway, by Mr. M'Intosh, in which the heating surface of the "Cardean" class is given as 2,400 sq. ft., and the cylinder dimensions as 20 ins. by 26 ins., thus bearing out "Model Compound Locomotive's" statements. An article by Mr. Chas. Rous-Marten (whose reputation for extreme accuracy is well known) which appears side by side with the above, contains the following statement regarding Nos. 49 and 50, the two 4—6—0 express engines to be first built for this line:—They are "driven by inside cylinders 21 ins. by 26 ins. nominally, but in reality, I believe, of 20 ins. in diameter, it being intended to bore out the additional inch should practice prove this desirable, which, so far, I believe has not been the case."—Yours truly,

Bradford. HAROLD SMITH.

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 of Model Engineers was held on Wednesday, September 25th, at the Cripplegate Institute, Golden Lane, E.C., Mr. Herbert Sanderson taking the chair at 7.30, and upwards of eighty members and visitors being present.

The Secretary having read the minutes of the last meeting, and six new members having been elected, the Chairman drew the attention of the members to the new locomotive testing stand constructed by Mr. Hildersley for the testing under steam of ¾-in. scale models and under, and adjustable to all wheelbases and gauges. Mr. Greenly shortly explained the working of the stand and the means by which the draw-bar pull and speed were taken, and later in the evening Mr. C. S. Barrett's fine ¾-in. scale six-coupled locomotive (fitted with Joy's valve gear) gave an exhibition of her running powers.

The chief event of the evening was the running under steam on the track of Mr. J. C. Taylor's beautiful model of the old engine "Agenoria," now in the South Kensington Museum. Despite the complicated mechanism in the model, which in all respects is a faithful copy of the prototype, the model ran very satisfactorily, both at high and low speeds, and its performance was greatly applauded by the members. Amongst other exhibits were an electric locomotive, shown by Mr. F. H. J. Bunt, at work on a special track, and Mr. Dawson exhibited and worked by compressed air a very small pair of steam winch engines fitted with link reversing gear, the cylinders being ¼ in. bore by ⅜-in. stroke. A visitor also exhibited and ran on the track a simple single-cylinder locomotive which performed remarkably well. The meeting adjourned at 10 p.m.

FUTURE MEETINGS.—Friday, October 18th: The Annual Sale of Models, Tools, Parts, Materials, etc., the property of members, will be held at the Cripplegate Institute, Golden Lane, E.C., at 7 p.m. New members who have not yet had an opportunity of attending one of these Sales will be well advised to do so, as model making apparatus of all kinds is generally to be obtained on very advantageous terms. The Secretary will be pleased to answer any enquiries respecting the inclusion of goods in the sale, etc.—Wednesday, November 13th: The Annual General Meeting. Any member wishing to move an alteration or addition to the Society's rules at this meeting is invited to write to the Secretary on the matter, who will also be pleased to receive any suggestions for the increased usefulness of the Society to its members for consideration and discussion at that meeting.—HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

Leeds Model Yacht Club.

THE racing for the fine silver challenge shield presented by the late Alderman North is one of the principal annual events of the club. It was sailed for on Saturday, September 21st, at Harold Park, Low Moor, when a number of members and their friends went over from Leeds. Harold Park has a very fine lake in an exposed position, and very suitable for model yacht racing. Sixteen yachts were entered for the race, which was sailed in a very strong wind, the yachts carrying short sail. Owing to the direction of the wind, it was advisable to sail a "reach" across the lake, as a beat to windward with such a large entry could not have been finished in one afternoon. The yachts had each and all a fair opportunity of showing their individual qualities. The race was principally confined to 10-raters and 10-tonners. There was also a 5½-rater and a 36 linear rater entered, the latter proving more than equal for some of the largest boats, winning two heats and getting third place in the final. The result of the racing, which was sailed in heats, was as follows:—

Maud (10-rater), Mr. McCaw: 3 heats, first and Shield.
Doris (10-rater), Mr. Mason: 2 heats, second.
Muriel (36 linear rater), Mr. North: 2 heats, third.
Ruby (10-rater), Mr. Wilkinson: 1 heat.
Iris (10-tonner), Mr. Flatow: 1 heat.

The distance raced was 151 yards, and the timing was:—

Maud, 1 minute 55 seconds.
Doris, 2 minutes 5 seconds.
Muriel, 2 minutes, 15 seconds.

The winning yacht was designed and built by the owner, is 42 ins. L.W.L., 57 ins. over-all, 10·5 ins. beam, and 8·75 ins. draft. She is a built boat, planked with cedar and varnished, showing the natural colour of the wood and screws. She is not a fin-keeler, but more of the linear-rater style. It would be interesting to know how the speed compares with other clubs.—M. J. MCCAW, Hon. Secretary, L.M.Y.C., 24, Dorset Terrace, Harehills Lane, Leeds.

THE EDINBURGH AND MIDLOTHIAN HOME-WORKERS' ELEVENTH ANNUAL INDUSTRIAL EXHIBITION, which, as already announced, is to be held in the Waverley Market, Edinburgh, this month, will be opened on Wednesday, the 16th inst., by Dr. Andrew Carnegie, at 6 p.m., and will remain open until the 26th inst.

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Queries and Replies.

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

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

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

[18,101] **Facing Oscillating Cylinder.** R. B. (Streatham) writes: I am making up a small marine engine from castings bought, and am unable to get the two steam faces true (double-action oscillating cylinder). Have tried by rubbing with emery on flat glass, but they do not seem to get steamtight. Is it necessary to have a lathe?

A skilled mechanic could make a fairly good job of the cylinder without a lathe, but of course this tool would enable any workman to produce a better job than by hand. You must see that centre

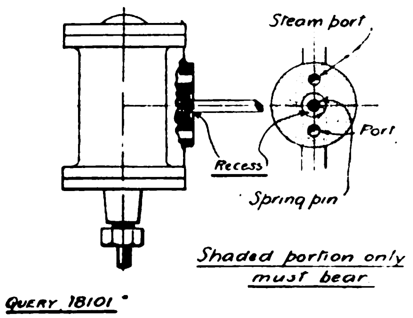

DIAGRAM SHOWING THE PORT FACE FOR OSCILLATING CYLINDER.

portion does not bear, otherwise the steam faces will never be steamtight. You should recess the metal round the spring pivot pin slightly with the point of a large drill or by a specially made tool, and then facing the cylinder and steam block as well as you can with a file and rubbing down on a piece of plate-glass, finish them by grinding the two surfaces together in position, using grindstone dust and water or pumice powder as an abrasive. Do not use emery for the purpose.

[18,046] **Tools for Model Engineering; the Apprenticeship Question.** K. R. D. (North Wales) writes: Wishing to begin model locomotive engineering as a hobby, will you kindly answer the following. What tools, etc., will be required for a beginner besides the underwritten which I possess: small bench vice, hacksaw, soldering bit, and files (triangular and right angled). Will you also quote any books that will be any guidance in these matters? Can a model locomotive be made respectable without a lathe? Would you oblige me with a sketch of a ½-in. scale locomotive (2½-in. gauge) which would be very simple to construct, and also will you refer me to any back numbers of THE MODEL ENGINEER containing any information on 2½-in. gauge locomotives, rolling-stock, accessories, etc.? I am anxious of following the profession of locomotive engineering on some railway. Being a reader of your interesting journal, would you kindly answer the following questions. What posts are young men likely to command if, when having satisfactorily served their time as a premium apprentice, and obtained their B.Sc., they go abroad? Also will you kindly quote salaries given. Better posts and salaries are obtainable abroad, are they not? Can one depend upon obtaining a post without much trouble when qualified as above? Do non-premium apprentices stand any chance for those posts if they have their B.Sc. degree?

You should obtain "Metal Working Tools and Their Uses," 7d. post free. Besides various kinds of chisels, hammers, files, stocks and dies for screw-cutting, a paraffin blowlamp (or a spirit one is just as good), pincers, screwdrivers, calipers, foot rule, try squares, centre-punches, etc., you should obtain a good, if small, lathe. You cannot do very much without one. We advise you to obtain back numbers of this journal and read up the various articles on these subjects. See "The Model Locomotive," 6s. 4d. post free—you will get all the information you require from it. As regards your second inquiry, we can only reply generally to it. Without a full knowledge of the circumstances of the case we can only say that the whole matter depends largely on the ability and determination of the apprentice. Most of the good jobs abroad are advertised in the home papers. A thorough practical training is the first essential. Salaries depend entirely on ability and the standing of the firm you go to. No fixed scale can be given. Good posts are always difficult to obtain unless you are pitchforked into one. Non-premium apprentices are every bit as good, and in some of the best and largest modern engineering works, premiums are being done away with and entrance examinations taking their place. In the old days premium apprentices were regarded as fairly remunerative. Now-a-days engineers are finding that a sufficiently substantial return for training is obtainable from the work a good apprentice will do during his last year or two; and bad ones are not required or indeed kept, by firms of any reputation. With the old premium system it was a less easy matter to get rid of undesirable apprentices, for frequently when the foremen would have been glad to see him go, the "office" factor in the concern deemed the premium useful.

[18,050] **Machinery for Small River Launch.** G. H. D. (Kensington) writes: I have an ordinary Thames river skiff, and I wish to fit in it a small engine to drive the boat with the current just as auxiliary power. I am now in a difficulty to know what is the minimum power I should be able to employ to drive this boat at just a slight speed with the current, about as fast as she could be paddled with a couple of canoe paddles. I would rather use a small steam engine in preference to a petrol engine, as I understand the former and am afraid I am a novice as regards the latter. I should also like to know from you whether there are any hot-air engines made that would be powerful enough to do this work, and could you also tell me what is the smallest size of boiler I should require to efficiently drive the engine you suggest?

At the outset, we may mention that a hot-air engine is of no use for the purpose. A ½ h.-p. hot-air engine would nearly, if not quite, sink the boat, so you may leave it out of the question altogether. Yes, you will find a small model steam engine do all you require, and to save yourself the bother of designing, pattern-making, and getting castings, you can obtain either Messrs. Stuart Turner's 2-in. by 2-in. vertical engine castings, or their No. 3 compound engine 1¼ in. by 2¼ ins. by 1¼ ins. The latter engine will require a stronger boiler; but, of course, you may gain some advantage by fitting condensing apparatus to the compound engine. The condenser could take the form of a single pipe placed outside the skin of a boat. An air pump would be the only other fitting required. We recommend a tubular boiler with a steel shell. The boiler should be about 11½ ins. in diameter and 10 ins. in height, the smokebox and furnace being extra, of course. See "Model Boiler Making," page 32, for general design. The shell may be made of 5-32nds-in. plate (mild steel), riveted together with 9-32nds-in. or 5-16ths-in. rivets. Longitudinal seams double riveted. Thirty tubes at least should be used. These should be ⅝ in. or 11-16ths in. diameter, according to convenience of arranging. This number will provide sufficient heating surface to drive the boat at about three miles per hour maximum. The steam should be superheated. Use a battery of eight "Intensive" burners fed by a separate tank through flexible tube. Of course, you may adopt the two tanks described in a recent article by H. Greenly, under the heading of "Locomotive Chat," and in this way have a better control over the fire. Use a 9-in. propeller with a 15-in. pitch. Do not bother to fit link reversing gear. It is not worth it unless all the motion is made of case-hardened steel. Employ a fairly large flywheel, and when it is required to reverse the engine, shut off steam, give the flywheel a start in the opposite direction, and turn on steam again. The boiler should have a blower and the usual fittings. Fit a ball-bearing thrust block, using a cycle hub if it is possible to work the same in.

[18,019] **Engine and Pump Proportions.** G. C. O. (Somerset) writes: Will you kindly oblige by informing me in your next issue, if possible, whether a locomotive boiler which will evaporate 7½ ozs. of water in five minutes would be sufficient to supply two cylinders ⅝ in. diameter and 1-in. stroke keeping up a fair pressure, say, about 35 lbs. per in. Would a small feed pump, ¼-in. bore and ⅜-in. stroke, be likely to work at all if going about 500 or 550 strokes per minute?

One pound of water contains 27·75 cub. ins. and 1 cub. in. of water equals 3-100ths of a pound, therefore reckoning the evaporation you have obtained at barely ½ lb. in five minutes, we may estimate the evaporation as 1-5th of ½ or 27 — 2·7 or 2½ cub. ins. per minute. It would, therefore, appear, presuming you have

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measured the evaporation correctly (was there any diminution in pressure during the period mentioned?) that the boiler will run the two cylinders mentioned faster than will be required in actual practice. Yes, if the passages, and valves are properly designed. See our issue of June 13th last, "Some Wrinkles in Model Making."

[18,062] **Running Motor from Cells, and Lamps and Motor from Mains.** J. W. J. (Milkwall) writes: I made a dynamo, 60 watts, same as in your Handbook No. 10, Manchester type. (1) I tried to run it with a four-cell bichromate battery, but could not get it to run. Is there enough battery power? The armature is 2 ins. diameter, and the tunnel 2 3-16ths bore. Is this air space too much and what should it be? Could iron wire be wound round it to reduce space as I have fields nicely fitted up? (2) Where is the approximate position for the brushes of any dynamo? (3) Is it safe to connect my dynamo in series with a 220-volt 32 c.-p. lamp to run it as a motor, and would this current be most suitable? (4) How is the horse-power of a dynamo or a motor calculated? (5) Do lamps of the same candle-power take the same amount of current in amperes when connected in series as when in parallel?

(1) The cells are not anything like large enough to drive the machine as a motor. Assuming motor to be wound for 8 volts, you would need to supply it with at least 6 or 7 amps. (2) The brushes are arranged so as to tap the current at the maximum voltage or pressure. (3) Yes. Probably more than one 32 c.-p. lamp will be needed. If so, try several in parallel and the whole lot in series with the motor. (4) 746 watts = 1 electrical h.-p. (5) No, unless the supply voltage be raised proportionally. Connected in series their resistances are added, but when in parallel the resistance of the group is inversely proportional. That is, with two in parallel the resistance is half of that of a single lamp, and with four in parallel quarter, and so on. See query replies on this subject in back numbers of this Journal.

[17,997] **Electric Bell Wiring.** R. J. D. (Tooting Common) writes: I am requiring a little information which I have quite failed to procure. It relates to the connecting of two electric bells. I have searched all my electrical books, including "Electric Bells and Alarms," but without effect. The point is this: a friend of mine and I want to have an electric bell system between each other's houses. They are a fair way apart, and we especially want to have only two wires because of extra expenses incurred in other wires, and also other reasons. He is to have a bell and a push, and I am to have a bell, a push, and two dry cells. Well, I cannot find out how to connect up all these things with only two wires. You would oblige me greatly by giving me the required information, and, if possible, a little plan.

You must have two batteries, one at each station. The person ringing will ring his own bell as well as that at the distant station, but that should not matter. If he does not wish his own bell to

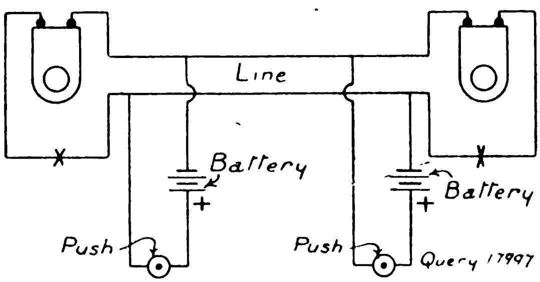

DIAGRAM OF ELECTRIC BELL WIRING.

ring, it can be cut off by means of a switch placed at the points marked **X** in the sketch. He would open the switch when ringing and then replace it to receive the answer. Both switches would be normally in the "on" position. Use large size cells and add more if ringing is not loud enough.

[17,930] **Nodon Valve.** T. B. (Gildersome) writes: Could you please let me know what the area of the plates for a Nodon valve should be to pass about 15 amps. at 100 volts? The alternating current pressure is about 105 volts. I understand one plate should be lead and the other aluminium, and phosphate of soda is used for the electrolyte. It is my intention to make lead-lined boxes to hold the solution. Should the aluminium be in a solid block, or would sheet aluminium do?

Try plates having an area of 70 to 100 sq. ins. each, reckoning one side only. Solution should be ammonium phosphate, saturated. Plates to be lead and aluminium. If you use lead-lined cells the lining could form one plate; aluminium can be sheet with cells of flat shape to suit. Current will flow from lead to aluminium, but not from aluminium to lead. A resistance should be used in series with the cells and main supply, and when they are first switched on this resistance can be cut out as soon as the cells start working. See THE MODEL ENGINEER for September 27th, 1906, page 303.

[18,011] **Fitting Bush for Drilling Machine Spindle.** A. N. (Whitefield) writes: I am making a drilling machine, and in drilling the holes for the drill spindle through the casting have got the holes a little out of line with each other. The top hole is ½ in. diameter and the lower one ¾ in. diameter. I suggest drilling the bottom hole out to 1 in. diameter and filling it with anti-friction metal while the spindle is in its place. (1) Do you think this would act? (2) And will you tell me how to proceed and what kind of metal to use? I have some new type metal if that would do. I have all the volumes of THE MODEL ENGINEER and have looked through but cannot find anything to guide me.

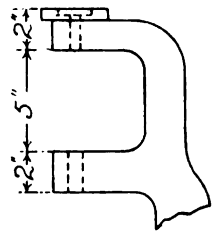

FIG. 1.

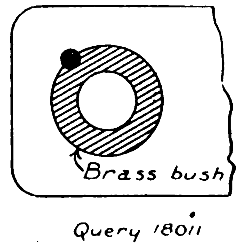

FIG. 2.

FITTING DRILLING MACHINE BUSH.

The lower part of spindle, which revolves in the lower bearing, will have a keyway cut in it when finished. (3) Will this tend to tear the anti-friction metal? (4) Can you suggest a better way of overcoming the difficulty? The job was rather too big for my drilling tackle.

We would suggest that you bore out bottom hole large enough to take a brass bush. The latter would be first fitted solid to the hole, then marked off and centre popped truly in line with top hole, and then taken out and bored carefully. Bush should be an easy driving fit, and could be held from turning by a steady pin (as sketch) screwed in with head a little below the surface. A keyway in the spindle, if properly finished off at the edges, will not tear nor bite the bush.

[17,936] **Manchester Dynamo.** T. H. H. (Monkton-on-Tyne) writes: I have a dynamo (Manchester type), armature 6 ins. long by 3 ins. diameter. I wish to wind the armature to give 260 or 270 volts at about 1,000 r.p.m. The fields are now wound with 1-18th D.C.C. Could I connect them in series with armature and run as series machine? What size wire should I use for armature? It has 8-section commutator.

We can only answer your queries approximately without you send a dimensioned sketch of the dynamo. Probable wire for armature No. 28 D.S.C. copper wire. A series winding is not convenient for the field unless you adjust the external circuit to take sufficient current to produce excitation. The No. 18 gauge is probably too large, but you can make a trial. You may have trouble with the commutator. The number of sections is scarcely sufficient for so high a voltage, and there will be a liability to spark across from brush to brush unless the gaps between the sections are fairly wide. This can be decided by trial.

[17,991] **Electrical Engineering Correspondence Tuition.** W. B. R. (Kinsley) writes: I shall be greatly obliged if you can answer me the following. I am at present in charge of an engine and dynamo used for lighting purposes at a colliery. I am midway between the ages of 18 and 19, and up to four or five months ago had had absolutely nothing to do with electricity, although I have worked among engines practically since I started work at the age of 14. However, I have taken a great liking to the subject and would like to follow it up. I should very much like to enter some large electrical works, but am afraid I am too old; also, as I am entirely dependent upon myself I am afraid the wage I should be likely to receive would not suffice to keep me. Do you think that would be the case? If not, could you give me the name of any firm to apply to? On the other hand, if I remain in my present position would it be possible for me to learn enough in my spare time to pass any examinations which would help me to better my position, and what would be the best way to do so? Also which would be the most useful books to purchase? I may say that I am unable to attend a technical class as I am compelled to work a good deal on night shift, and the nearest institution of that kind is some seven or eight miles away. I have received some pamphlets, lists, etc., from the International Correspondence School of 59-60, Chancery Lane. Their courses in electricity, taught by post, run from £10 upwards, payable in instalments. Do you think such methods would be any good to me, and are they

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really genuine, as it seems a lot of money to expend? Although, if it really is a good thing I would not mind the outlay.

We much regret we can only say to you as to many other correspondents who seek advice on this matter, that if it is possible by making personal enquiries or calls to get into touch with some electrical firm, do so by all means. On the other hand, if you make the most of the opportunity, you could obtain a very fair experience with the plant you at present have charge of. You might either attend evening classes or take a correspondence course in electrical work, which, with a few good works on electrical machinery, should put you on the right track. We doubt if you would make enough in a manufacturing electrical works to pay your way for the first year or two. We have sent a list of books in which we have marked those that will be of most use to you. The correspondence tuition is good if you are *already doing* practical work in the same line, but it will never do for you what actual working experiences will. We could recommend you to try it and see how you get on for a bit.

[17,982] ***Re* 220-volt Motor.** C. B. (Oldham) writes: Referring to my query of December 31st, 1906, and your reply of January 24th, 1907, No. 17,152, *re* dynamo windings for 110-volt 2 amps., I have now built the 200-watt machine and have run it as a motor on 110-volt circuit, and I find it runs very satisfactorily. I now intend putting it into regular use for driving a centrifugal pump instead of using it as a dynamo. The circuit on which I shall use it is 220 volts, so shall rewind the machine for the new voltage. The dynamo windings you gave me for 110 volts 2 amps. were: Armature, 26's S.W.G. D.C.C. wire, and fields 2 lbs. each 28's S.W.G. s.c.c. wire. You will see from the rough tracing enclosed that there is not much room for the field coils, and I did not succeed in getting more than 1½ lbs. 28's on each pole, so that this must be considered when calculating the field winding. These coils, on the machine at present, appear to get rather warmer than they should do, so I conclude that the coils have not as much resistance as they should have. The speed, I believe, is about 2,000 r.p.m. with the present windings. What I wish to know is amount and gauge of wire, both for field coils and armature, and whether single or double cotton-covered. I require particulars of field coils both for shunt and series machines. I enclose rough tracing with particulars. I require this motor to drive a small centrifugal pump, and as it would start with a load on, would use the series coils on the fields. My reason for requiring a pair of shunt coils is to use it for another experiment, for which I require a uniform speed at all loads. Can you suggest an easier way of winding armature than winding in diametrically opposite slots with one complete coil at the top and another at the bottom of the slot, as the wires at the ends of the slots do not retain their position very well during winding. I think Mr. Avery winds in one less than diametrically opposite slots. I still wish to wind armature in eighteen sections as the commutator has eighteen bars. In order to give you some idea of what the present 100-volt winding consists of, I may say there are forty-two convols. per coil; that is, eighty-four active conductors per slot arranged in six layers of seven convols. each (No. 26 S.W.G.). My particulars may appear to be somewhat lengthy, but I cannot get particulars from any of THE MODEL ENGINEER handbooks for 220-volt windings for drum armatures. Please say what thickness of leatheroid, approximately, should be used to insulate armature slots for 220 volts. Will ·015 be sufficient, the same size as I have used for 110 volts?

Wind armature with No. 30 gauge double silk-covered copper wire and field-magnet with No. 34 gauge s.c.c. copper wire for shunt winding, and No. 23 gauge (or No. 22 if you cannot get No. 23) s.c.c. copper wire for a series winding. Get on as much wire as you can. The armature ought to have twice as many turns as used for the 100-volt winding, but it is difficult to get them on as insulation and covering take up more space for the higher voltage, but as the present wire is cotton-covered and the new winding will be silk-covered, you may be able to put on the double number of turns. Silk covering is more compact than cotton. If you do not get on double the number of turns the armature will have to run at a correspondingly higher speed. Regarding the method of winding armature, if you wind the coils over one another in the slots you should wind into diametrically opposite slots one coil at a time. Go directly round the core winding into successive slots. You will find the lower coils are thus wound in first and the upper coils will come in when you get half-way round the core. Each coil can be entirely wound to one side of the shaft or divided across it. An alternative way is to wind the coils in pairs side by side as indicated by Figs. 43 to 46, pages 34 and 35 of our handbook, "Small Dynamos and Motors." Taking Fig. 46 as example, you wind coil 1, 1A, then turn the armature over and wind coil 9, 9A; then wind coil 2, 2A, turn again and wind coil 10, 10A, and so on. We advise you to use two thicknesses of the ·015 leatheroid. A double layer of insulation is better than one of double thickness; 220 volts requires better insulation than 110 volts.

[18,088] **Curves for ½-in. Scale Locomotive.** J. L. C. (Bickley) writes: I anticipate building a small model railway in a room, dimensions of which are shown on the accompanying drawing (not reproduced). As I already have a ½-in. scale locomotive (Bassett-Lowke & Co.'s N.E. Express 1,619), I am anxious to use same, therefore my gauge being fixed at 2½ ins. I should esteem it a favour if you consider that the track as shown within the room is at all practicable. If not, can you say what is the smallest radius I can lay track to suit the above-mentioned engine?

We do not think that the room is sufficiently large. The minimum radius we would advise would be about 4 ft. 9 ins. to 5 ft. A maximum radius of 34 ins. will not do; 1¾-in. gauge or 2-in. gauge with small type locomotives is the largest railway we would advise in a 10-ft. by 10-ft. room.

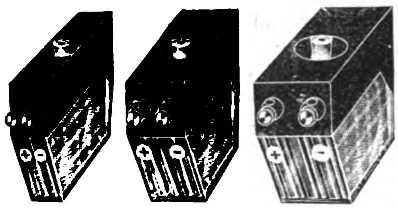
The News of the Trade.

[*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.*

* New Horizontal Boat Accumulators.

We have received a number of samples of the latest type of transparent celluloid horizontal boat accumulators which are manufactured by Messrs. Armstrong & Co., Twickenham, and are specially suitable for driving small motors for model boats, launches, model motor cars, etc. The accompanying illustration shows how they are tapered down towards the bottom, which enables them to be placed athwart-ships or packed round the boat's side or other available position. These accumulators can be obtained in twenty



MESSRS. ARMSTRONG & CO.'S NEW HORIZONTAL BOAT ACCUMULATORS.

different sizes, ranging from 2 to 10 volts, the uniform height being 2½ inches. Each accumulator is fitted with celluloid lid at top of plates underneath cement. The latter is also keyed to the sides of the case on the inside, ensuring perfect sealing and adhesion to the celluloid. Acid proof protected terminals are fitted. We can recommend these accumulators to our readers who may be requiring reliable goods of this kind. Further particulars and prices will be forwarded upon application.

A Change of Management.

To those of our readers whom it may interest we have been asked to state that Mr. John Bing, the manager of the English sales department of the firm of Messrs. Bing Bros., of Nuremberg and London, is shortly handing over the position to the joint management of Messrs. Seelig & Stein.

New Catalogues and Lists.

The Economic Electric Co., Twickenham, London, S.W.—According to the list prepared by the above firm, there is not much that the average amateur electrician requires that cannot be obtained from them. The list includes accumulators, coils, small dynamos and motors, incandescent lamps, testing lamps, electric cycle lanterns, microscopes, Morse telegraph instruments, Geisler tubes and rotators, wireless telegraph apparatus, switchboards, charging boards, sparking plugs, small incandescent lamps, and numerous accessories and novelties. Readers should mention THE MODEL ENGINEER when writing for the list.

The Universal Electric Supply Co., 60, Brook Street, C.-on-M., Manchester.—The illustrated list, comprising nearly 90 pages, sent to us by this firm, describes numerous electrical apparatus, such as bells, bell sets, alarms, telephones, indicators, pushes, batteries, galvanometers, terminals, coils, magneto machines, experimental apparatus, small dynamos, voltmeters, amperemeters, electro-motors and sets of parts, incandescent lamps, and every accessory required by the amateur or student. We have also received a descriptive pamphlet, giving prices, of the "Ready" gas and oil engines, which are made in sizes to develop respectively ¼, ½, 1, 1½ and 2 h.-p. Lists will be sent to readers of this Journal upon application.

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The Editor's Page.

A READER has made a rather interesting suggestion in connection with our Speed Boat Competition. It is that as there are doubtless many readers who are not within reach of a sheet of water where the straight run of 100 yards can be obtained, but who can have the use of a smaller lake or pond, the trial might be run on a circular course, the boat being tethered to a centre post by a light wire or cord with a swivel joint at the end. In this way a trip of 100 yards can be run over a circular course of a little over 30 yards diameter, or by making two trips over a course of a little over 15 yards in diameter. Obviously such a trial would not be so favourable to the boat as a clear straight run, but our correspondent suggests that there may be some readers who would like to compete even at this disadvantage. Possibly there might be difficulties in keeping the boat properly on its course, but it would be interesting to know whether any of our readers have ever tried to run a boat under these conditions, or whether any would be prepared to make a trial and report the results. We should like to hear from owners of model steamers on the subject.

* * *

Another suggestion, of a different nature, which has recently been made to us, is that we should make a point of stating the prices of all goods reviewed in our "News of the Trade" column. We have hitherto abstained from so doing because we have felt that the inclusion of prices in these notices would tend to give our remarks the savour of an advertisement for the particular articles described, and as such notices are in no sense intended as advertisements, but merely as items of news for our readers, we have considered a description of the articles and an expression of our opinion on their quality as sufficient for the purpose. This, we may say, is the general practice of technical journals in such matters, except so far as books are concerned, when the prices are almost invariably mentioned. It is argued in favour of the insertion of prices, however, that if the price of an article were stated it would save a good deal of fruitless correspondence, both on the part of the reader and of the trade, for the former would not write for particulars of anything he felt he could not afford to buy, or felt was priced at too high a figure, while the latter would not have to reply to a large number of enquiries of which possibly only a small proportion would result in business. In the case of foreign and colonial readers, the saving of time in ascertaining price would also be a consideration. We should like to know what our readers and what the trade think of the suggestion.

Answers to Correspondents.

J. T. H. (Anglesey).—Thanks for your entry for competition, which has been accepted.

H. B. (Dublin).—We regret being unable at the moment to say definitely the use of the instrument of which you send us a sketch. We will, however, retain the sketch, and endeavour to ascertain as opportunity occurs.

H. M. W. (Kilmarnock, N.B.).—An article was published in *The Woodworker* for July 15th, August 1st and 15th, 1903. These can be obtained from the Handicrafts Press, Ltd., 33, Furnival Street, Holborn, London, E.C. We have not published anything on the subject in question.

A. T. (Stanningly).—This is a matter for our Expert Service Department. If you will enclose a stamped addressed envelope, we shall be pleased to quote for the drawings you require.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

How to Address Letters.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

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Contents.

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

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THE

Model Engineer

And Electrician.

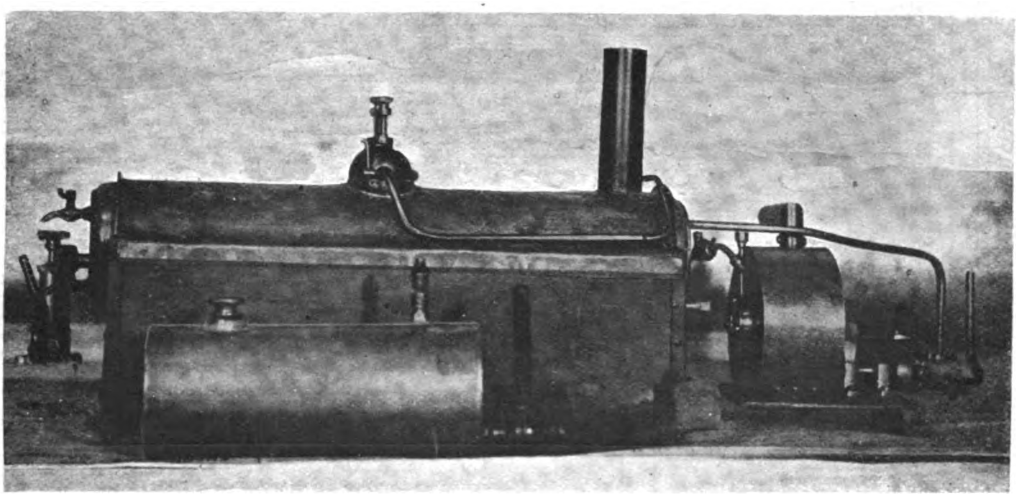
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 338. OCTOBER 17, 1907. PUBLISHED WEEKLY

A Model Turbine Speed Launch.

By A. E. HARBORD.



MACHINERY FOR THE MODEL TURBINE SPEED LAUNCH.

WHEN this boat was first planned it was to be a T.B.D. The upper works were all made and fitted, and altogether she looked very business-like. When she was tried, however, nothing would induce her to keep an even keel without overloading with ballast, which, of course, does not agree with a speed boat, so I was compelled to adopt the form of deck seen in the photograph. The lines of the hull resemble very closely a design of a motor launch I have in my possession.

The building has taken me eighteen months of my spare time. The hull is 4 ft. 6 ins. long, with a maximum beam of 6½ ins., average depth 5¾ ins. It is constructed on the layer principle, the layers being held together with marine glue and screws. When this was set the hull was finished with glass-paper and scraping, and then brown paper of a tough variety was marine-glued on. After drying, it was well primed with good white paint, glass-papered, and then two coats of aluminium paint applied. A band of black was put round the top. This process gives the boat a very smart appearance. The fore and aft turtle decks are made of stout cardboard, this being light, easy to fit, and when enamelled quite as strong and serviceable as wood, perhaps better, as it will not split. These decks are fastened to the hull by large pins, cut off ½ in. from the head, spaced ⅜ in. apart. They have all the appearance of rivets. The boiler cover is constructed of ⅛-in. satin walnut, as used for fretwork. It is 14 ins. long and 1¾ ins. high. The ports are painted drawing pins. I have made the funnel of tinplate, fitting in a brass square base, which is screwed to the deck. The flagstaff is of

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brass and screws into the bow of the boat. The wording on the flag is *Lady Jennie III.*

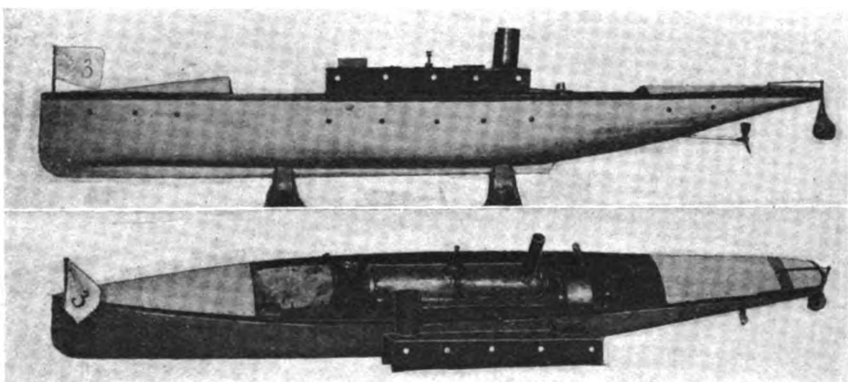
As will be seen the rudder is of the T.B.D. type. It is held in position by a knob on the tiller springing into corresponding holes in a brass plate and serves splendidly.

The boiler is a Yarrow type, 12 ins. long. Top drum 2½ ins. diameter, two drums at the bottom corners 1 in. diameter. These drums are connected by thirty ⅜-in. tubes and sixteen ¼-in., with one ⅝-in. downcomer tube at each end to keep up the circulation. The boiler is a modification of the design in "Model Boiler Making." Steam is taken through the firebox and boiler from a dome. The uptake is 1 in. diameter. All the parts are brass, the drums tube, with ends flanged and screwed on. The casing is iron plate, very light, and so fastened that it comes off in a minute in case of a breakdown in the tubes. I have used asbestos covered with copper for the lagging. When getting steam up, the flame comes back through the firedoor, so it takes rather a time to steam. However, when it does start, I have a jet in the funnel which soon draws the flame in. All the usual boiler fittings are employed. The pump is worked by hand. I did have a pump on the turbine shaft, but it was more trouble than it was worth. The water in the boiler will give a twenty-minute run in safety. There is one great disadvantage to this type of boiler on narrow-beamed model work—that is, the high centre of gravity; it is generally above the water-line, and has to be put right by more keel weight, bringing more work for the engine.

Firing arrangements consist of a benzoline blowlamp with a container made of 2½-in. brass tube 9 ins. long, worked under air pressure in the ordinary way. It gives a flame about 10 ins. long.

The engine is a de Laval turbine with a 3-in. rotor, geared down 8-to-1 on to the driving shaft. Ordinary spur gearing is employed. Connection is made between the driving shaft and propeller shaft by a stout steel spiral spring, as I find this gives far less friction than the carrier type of union. The thrust is taken on the end of the propeller shaft tube. When the turbine runs at 2,000 r.p.m., as it does when running light, it sounds like an electric motor humming. This takes 40 lbs. on the boiler. If a reader contemplates making a turbine of this description, get the rotor well balanced, otherwise there will be trouble at 16,000 r.p.m. To use a common expression, "I've had some." In my case the shaft broke. I have now got it running in hardened centres with a *very* small amount of end lash; this seems to give a flexibility to it. Needless to say, I put the balancing right previously. The rotor has twenty-four blades soldered to a centre casting and bound with an outside ring of brass tube; it is ½ in. wide on the rim. This method of construction gives a very light and, at the same time, strong rotor. The exhaust steam is led over the side of the boat, as I do not think it is much advantage to put a ½-in. tube in the funnel. I keep all the motion parts of the turbine well oiled. My vote is in favour of turbines for model boats, provided you have plenty of steam to spare. I have tried both styles of engine, and if there is only one advantage, it is that there is no complicated gear valve work to get out of order. It may amuse the crowd to see a boat stuck fast in the middle of a pond blowing off steam and not moving—but the owner! I have given the boat one run with a 3-in. propeller under rather adverse conditions, and if I say four miles per hour I shall be well within the limit.

In conclusion, I must say that I have derived many hours of amusement from the construction of the model, and hope to pass many more in the sailing of it.



Two Views of Mr. A. E. Harbord's Model Turbine Speed Launch.

In consideration of the extra work entailed by the introduction of the premium system and the increase of piecework generally in the Government Dockyards, the Admiralty have decided to increase the pay of leading recorders and measurers by 6s. per week. The new rates of pay will be from 9s. to 11s. per day instead of from 8s. to 10s.

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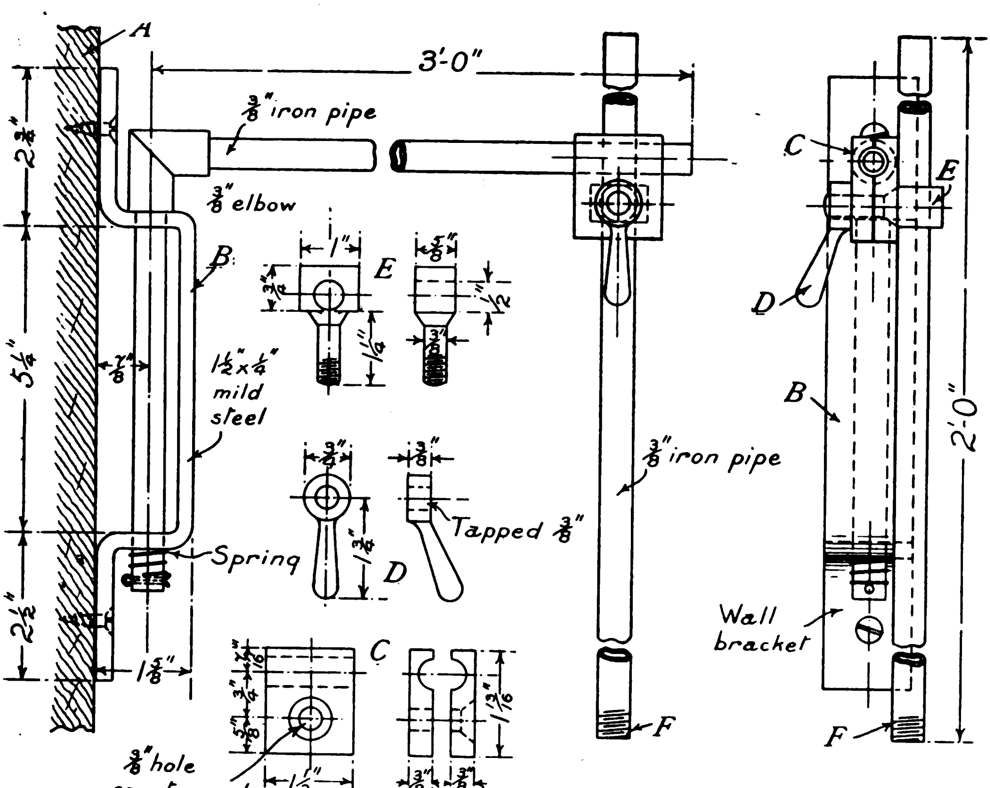
Workshop Notes and Notions.

[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 Electric Light Bracket for the Bench.

By " SPARKS."

The following is a description of a handy electric light bracket made to be fixed to the wall at the back of the bench which is capable of movements to allow the light to be turned to any required position. The shaded part A represents the wall to which the bracket B is fixed. This bracket consists of a piece of 1½-in. by ¼-in. mild steel, bent to the shape shown, screwed to the wall and drilled to allow a piece of ⅜-in. iron tube to go through; the tube is prevented from slipping through by an iron elbow, and is kept firm by a spring which is slipped on the bottom and is kept in its place by a cotter put through the tube. Fixed in to the other end of the elbow is a piece of ⅜-in. iron tube 3 ft. long, which is thus able to swing from the wall on the right to the wall on the left. On this tube is a combination clamp C, made of brass, which can be made to slide from the elbow to the end of the tube, which it can be made to grip by a turn of the handle D. This movement also tightens another clamp, E, which grips another length of ⅜-in. tubing, 2 ft. long, the end, F, of which is screwed so that a bayonet lampholder can be screwed on, the flexible wires from the lampholder passing up the 2-ft. tube to a plug and socket (or its equivalent) on the wall. Thus, by loosening the clamp the tubes will be free to slide into the required position and tightened again by a turn of the handle.



DETAILS OF A SIMPLE ELECTRIC LIGHT BRACKET FOR THE WORKSHOP BENCH.

A Simple Milling and Drilling Attachment for the Lathe.

By W. GOSLING.

The attachment to be described is fitted to a Holmes' New Century lathe with slide-rest. The top of the rest is used for the drilling table, and the fact of the rest being capable of movement in almost any horizontal direction renders the machine capable of use for almost any light milling work—in fact, by a little rig up, I have cut teeth on plain wheels.

The machine consists of an upright piece of polished steel A, on which the body of the machine slides up and down for adjustment of height, and two castings in iron, one (B) which slides up and down the steel pillar, and the other (C) which holds the running parts. A, the steel pillar, is a piece of $1\frac{1}{4}$-in. round bright steel, bought of the advertisers in THE MODEL ENGINEER, turned down to $\frac{5}{8}$ in. one end, and screwed Whitworth. This is firmly clamped to the bed of the lathe by two clamping plates. B is the casting which slides up and down the pillar, and has a keyway $\frac{1}{4}$ in. wide by $\frac{1}{8}$ in., filed throughout the $1\frac{1}{4}$-in. hole, which, with the $\frac{5}{8}$-in. bolt, serves to keep the casting clamped rigidly in any position on the pillar.

C is the casting which contains all the running parts. First of all there is the turntable portion, which fits to turntable on B; the turntable on B being drilled with two $\frac{3}{8}$-in. clearing holes, as Fig. 1, while the turntable on C is drilled out in the manner shown in Fig. 3. This allows the machine to be adjusted to any angle by tightening the two $\frac{3}{8}$-in. bolts. The feed-screw is of $\frac{1}{2}$-in. steel screwed Whitworth, and is turned down one end to $\frac{1}{4}$ in., for reception of the feed-wheel. This feed-wheel is kept in position by $\frac{1}{4}$-in. nut, as Fig. 1. The other end has a groove turned in it. This end fits into a $\frac{1}{2}$-in. hole drilled down the spindle, and a slightly tapered pin is driven through a hole drilled in the side of the spindle

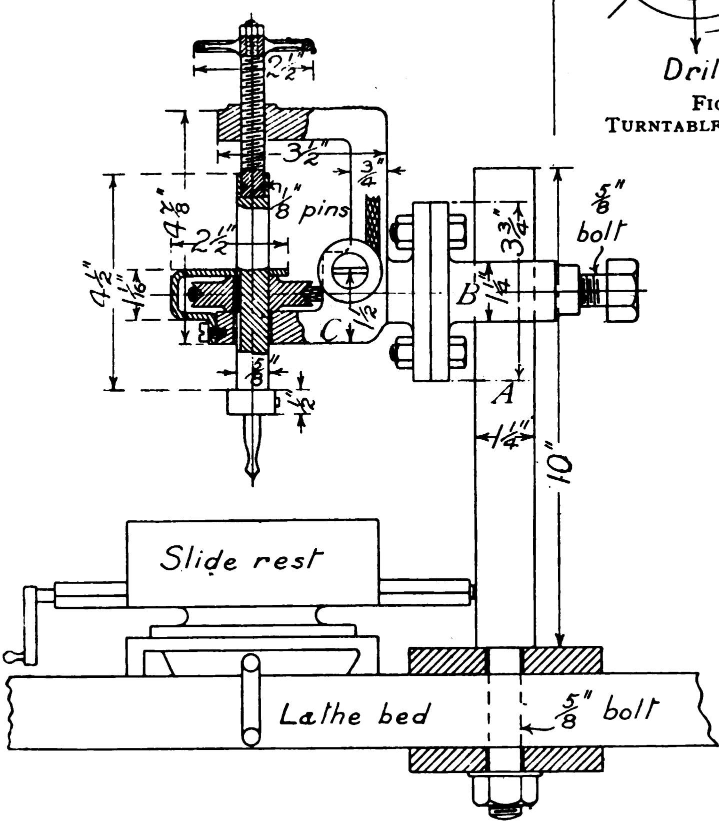


FIG. 1.—SECTIONAL ELEVATION OF MILLING AND DRILLING ATTACHMENT FOR THE LATHE. (*Scale: Quarter full size.*)

and engages in the groove (darkened in Fig. 1), and permits of the drill being raised or lowered. The large and two small side pulleys are brass castings.

The main pulley has a keyway filed in it $\frac{1}{8}$ in. wide by 3-32nds in. deep, to engage with the one in the spindle, which is cut also $\frac{1}{8}$ in. by 3-32nds in.

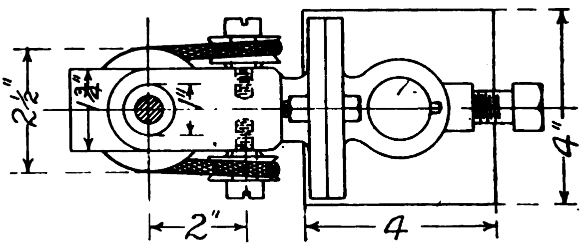


FIG. 2.—PLAN OF DRILLING MACHINE.

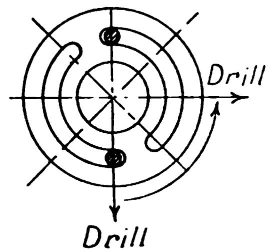


FIG. 3.
TURNTABLE AND SLOTS.

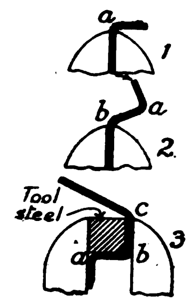


FIG. 4.—SHOWING METHOD OF FLANGING PLATE.

The key that fits should be a nice easy fit, so as not to bind when the drill is raised.

The spindle is a forging of $1\frac{1}{4}$-in. steel swaged down and turned to size shown in figure. The keyway is cut to within $\frac{3}{8}$ in. of the top. The bottom part runs on a brass bush sweated in. The pulley is kept in position on spindle by a piece of $\frac{1}{8}$-in. steel plate flanged as shown. I have shown the method of getting it into shape in Fig. 4. In making the second flange care should be taken to strike it exactly where I have indicated by the arrow. The hole for the spindle is drilled in after the flanging is completed. It is fastened by two 3-16ths-in. screws. The chuck is an ordinary one with set screw, and takes $\frac{3}{8}$ in. round. The spindle is made heavier altogether than the ordinary, for milling purposes. The two side pulleys are fitted to the casting by special screws turned as shown. The machine is run from an overhead gear, and milling cutters are mounted on a spindle and run the same way as a drill. Its drilling capacity is up to $\frac{3}{8}$ in. The drawings are all to a scale of $\frac{1}{4}$ in. = 1 in., but measurements are inserted. The feed-wheel is omitted in the plan.

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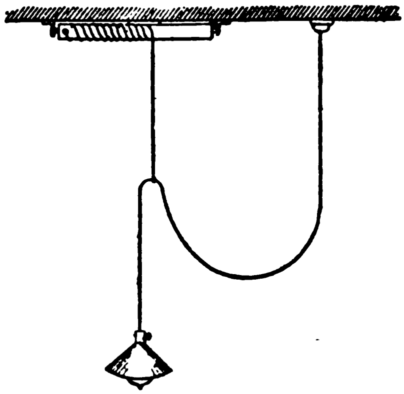
A Workshop Lighting Hint.

A correspondent of the *American Machinist* says: "I find that there is no handier way of hanging an incandescent lamp, either for use on a machine or vice, than the one shown in the accompanying



Method of Hanging an Incandescent Lamp in Workshop.

sketch. Simply take the stick of an old spring window blind, cut it to a suitable length, and attach it to the ceiling or any place directly above the spot where the lamp is to be used. Attach it to a stout cord, as shown in the sketch. Tie this cord to the lamp cord, and you have your light just where you want it when in use, and out of the way when not in use."

Hints on Belt Driving for Lathes, etc.

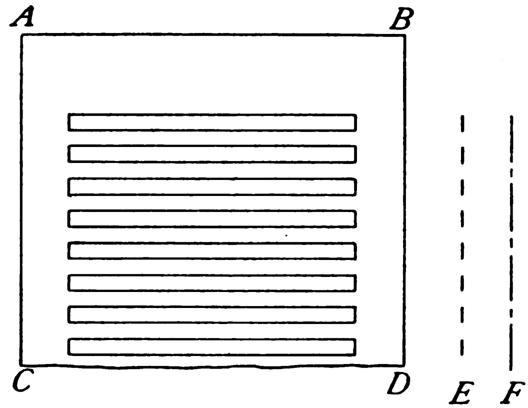
By Bridge.

It very often happens that when driving small grinding and polishing heads, etc., the driving pulley is very much bigger than the driven pulley. This difference in the diameters causes the belt to have a larger arc of contact on bigger pulleys than on the lesser one, and results in slip, and loss of speed and power. One way of getting over the difficulty is to tighten the belt, but this increases the wear on the bearings, and causes a lot of friction, especially at high speeds. Quite recently the writer, in making some experiments, which necessitated a high speed and a slack belt, found this trouble crop up as usual. However, the difficulty was got over in a simple way, viz., by placing on the small pulley a couple of rubber bands, such as stationers use, the bands being so chosen that they were fairly well stretched when on the pulley. In the case just mentioned the pulley was 1½ ins. wide on face, and two bands ¼ in. wide were used; the results were splendid, little or no slip taking place at all. A single ½-in. wide band would give the same result. Of course, when there is a fair amount of power to be transmitted, the stouter the bands are the better; but for general light work two small ones are sufficient. This idea may be carried further and applied to small iron turning lathes, with no doubt as to the success. Care must be taken to clean any grease off the pulley face. Canvas belt sewn double does splendidly in connection with the above.

A Useful Stencil.

By Edgar C. Hartridge.

Most amateur draughtsmen are aware that the drawing of dotted lines is a rather long job, especially if they are to be of regular thickness, etc. A



A Stencil for Drawing Dotted Lines.

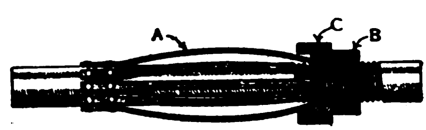
great saving of time may be effected by adopting the following simple device:—

Take a strip of rather stout cartridge paper about 3 ins. wide and of any length; rule parallel lines about ⅛ in. apart, as in Fig. 1, so that their ends are about ½ in. from the edge of the paper, A B C D being the strip of cartridge paper. With a sharp knife cut along these lines, and then remove every alternate strip, as shown in Fig. 1, and you have a stencil which can be placed under the T-square and dotted lines be drawn with one fell swoop. The strips need not be of all the same width, but can be arranged to give a line like F. The stencil described above will produce a line similar to E.

How to Wind Irregular-shaped Springs.

A writer in *Popular Mechanics* gives the following method of winding springs shaped like those on stove lifter handles, stove doors, etc., having made a tool as shown in the illustration and used it in his lathe with good results.

Each piece A is made of spring steel and riveted to a shaft with two rivets on one end, while the other end fits into an individual notch in the



collar C. This collar is kept from turning on the shaft by a key. Turning nut B up against the collar pushes on the ends of the springs, causing them to bulge outward in the middle. When the proper size is secured on these springs one end of the wire is fastened to it and the coil is wound. When through winding, loosen the nut and slip the finished coil over the opposite end of the shaft from the collar.

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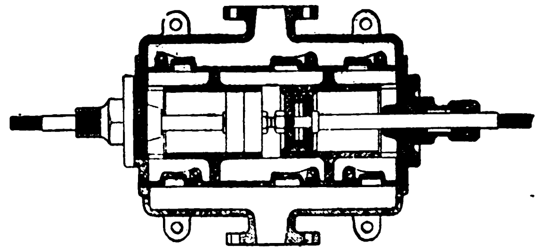
The Latest in Engineering.

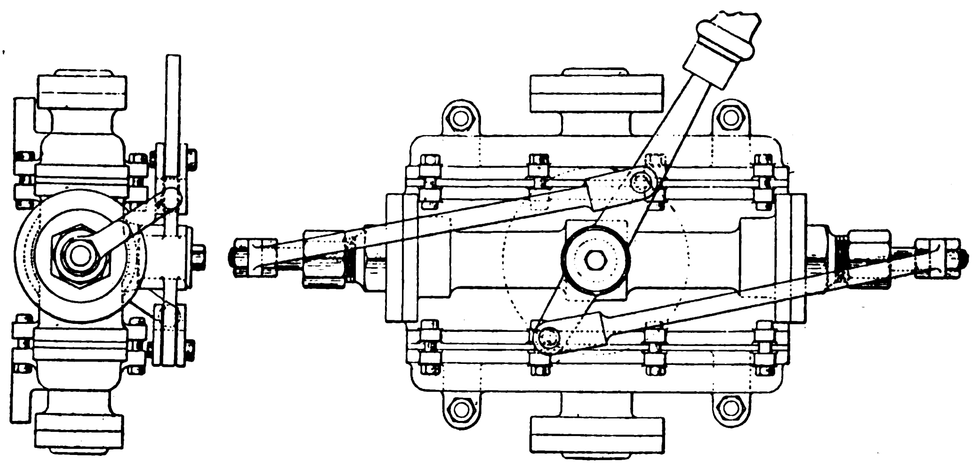
Locomotives for the Simplon.—The Simplon tunnel has had to fall back upon steam locomotives fitted with smoke-consumers, as a new difficulty has been experienced upon the introduction of three-phase electric locomotives lent by the Valtellina Railway. It appears that these engines, which take up with their cross-section almost the entire available section of the tunnel, act much like a projectile, in that they push large quantities of air before them, with consequent great consumption of power and diminution of speed. Also, in going from the cool outside air into the tunnel atmosphere, which is warm and moist, they become covered with a profuse condensation. Some of the motors have broken down because, it is supposed, of moisture penetrating the insulation. Modifications are being made with a view to adapting the motors to the new conditions with which they have to deal. —*Engineering.*

A High Duty Plunger Pump.—We illustrate from the *Engineer* a new type of plunger pump recently put upon the market by Messrs. W. H. Wilcox & Co., 23, Southwark Street, S.E. It is claimed to be capable of a higher capacity than any other plunger pump occupying the same space. It will be seen from the sectional view that there are delivery sides are self-contained, and we understand that in the case of damage they can be replaced by any unskilled man, as can also the leathers, and, in fact, all other parts. Another point claimed as an advantage is that when in operation



Section through Cylinders.

the pump is always sucking and delivering in equal quantities, thus ensuring an even strain on all the parts. The inlet and outlet ports of the centre chamber are double the area of the end ports, the former having twice the quantity of liquid to contend with. With the use of a foot valve the makers state that the pump will suck vertically from a depth of 25 ft., and will force to a height of 100 ft. and upwards. To prevent damage in frosty weather the cylinder is provided with two small drain cocks, one at the top of the cylinder and the other at the



A High Duty Plunger Pump.

two independent pistons which are operated by crank levers connected to the handle. When the handle is moved to the left the pistons separate, thereby delivering the water through the ports at the ends of the cylinder, and at the same time the space between the two pistons is filled. Conversely, when the handle is moved to the right, the water is discharged from between the pistons through the centre port, and the two end spaces are filled. Each piston is provided with two cup leathers fitted back to back, one of which is always forcing. The cylinder of the pump, in accordance with the usual practice, is fitted with a brass liner, and, consequently, there is no scoring or sticking of the leathers caused by rust. The valve plates on both the suction and bottom. The former may also be used for priming in the event of the leathers becoming dry. It is stated that these pumps are also supplied for hot water and other liquids, and they are also constructed with suitable gearing for driving by means of a windmill or other mechanical source of power. The hand-operated pumps are provided with four cast lugs, by means of which they may be bolted to the wall.

While common glass will crumble when exposed to great heat, experiments show that when mixed with hydeslite it will bend or roll hot, neither breaking nor crumbling.

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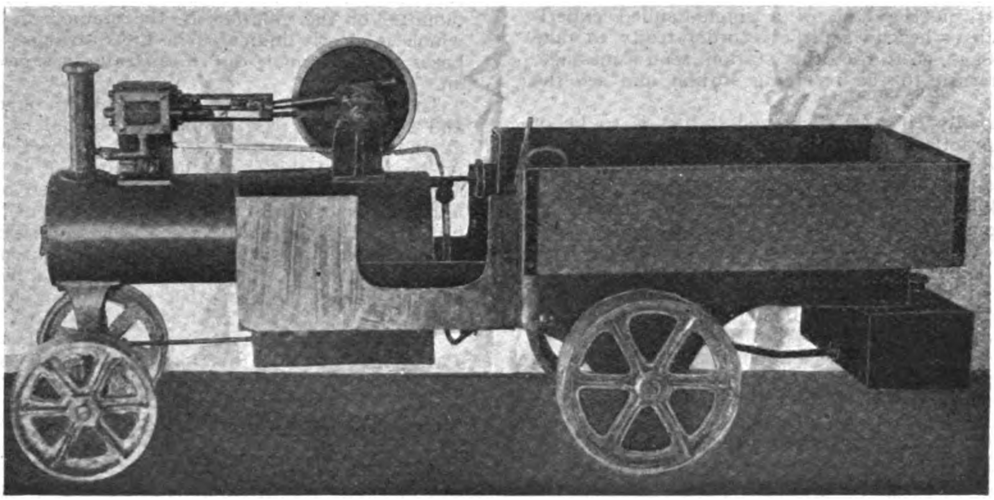
A Model Steam Wagon.

By S. K.

THE photograph represents a steam wagon made according to the drawings and instructions which appeared in THE MODEL ENGINEER (August, 1906). It is made exactly to drawings, excepting the reversing gear. I have made a slip eccentric (being easier), also the wagon body is made shorter than the one in the instructions, as the smaller size makes it less bulky. I got the castings from an advertiser in THE MODEL ENGINEER. I started with the cylinder by fixing it in a screw-cutting chuck, and bored it ⅝ in., and turned the end which was to be the end for cover with guide, as this was most likely to be square with the bore; then, reversing, turned the other end. Next came the cover and guide. This was put in the chuck, guide outwards to run as true as possible, and bored out for crosshead. Then a hole was drilled for piston-rod, enlarged sufficiently deep to form stuffing-box, and threaded thirty-two to the inch with a long tool in slide-rest. It was then taken out of chuck and a piece of round steel pushed tightly into guide as far as it could go, the other end of steel put in chuck, and the back-centre put in hole that was drilled for piston-rod. The end of cover was turned and spigot made to fit tightly in cylinder. This method seemed to answer well, as when I put cylinder together, and fitted crosshead and piston to rod, they worked very smoothly, not binding in the least. The facing on cylinder support (where it fits boiler barrel) was done in this manner. A piece of tube the diameter of boiler was procured, and a piece of No. 2 emery cloth glued round with a butt joint, well pressed down and left for a day. I then put a round piece of wood in one end for back centre and the other end in chuck, turned the lathe as fast as possible, and held the semi-circular seating on it for a few minutes, when it had smoothed it beautifully, and it fitted on boiler barrel perfectly. When grinding this I found it best to hold casting as low down as possible and firmly. The front wheels bracket was faced the same way, also crankshaft bearings seat where it fixes to boiler. The latter was made exactly to instructions, and steams splendidly, supplying more than sufficient steam to drive engine. The tank under wagon end is for boiler feed-water, which is fed in by a pump (the handle of same can be seen in photograph in fore part of wagon body). The water gauge was made as large as possible for this size engine, so that it should be quite reliable. Tubes in boiler are screwed in front plate; they were all threaded in the lathe thirty-two to inch, very slightly tapered. Not having a tap the right size or a piece of tool steel to make one, I cut a thread same as on tubes on a piece of mild steel rod same diameter as tubes, and filed it square and tapered towards the end to give it a start. This makeshift was nearly worn out by the time all the holes were tapped; but it finished the job, and tubes screwed in and were quite steam-tight without solder.



A MODEL STEAM WAGON.

I decided to make this engine as it was out of the common, and it well repaid me for the time spent on it. As it appears in the photograph it is not quite finished, being minus the lamp for firing, gear shaft and painting; but at every opportunity I do a bit to it. I shall be pleased to give a fellow reader any information concerning it at any time.

PARTICULARS of the coal consumption of the turbine steamer *Virginian*, running between Liverpool and Montreal, have recently been published. In a series of voyages the boat has averaged 17·2 to 17·65 knots at an estimated power of 12,700 i.h.-p. The average coal consumption for the propelling machinery only was 1·30 lbs. per i.h.p. Including the auxiliary machinery it was 1·2 lbs., and including electric light also, 1·507 lbs.

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Notes on Wireless Telegraphy Apparatus.

By V. W. Delves-Broughton.

(*Continued from page* 318.)

A Simple Recorder.

In the book, "Wireless Telegraphy for Amateurs," the author does not mention a recorder in conjunction with the Lodge-Muirhead coherer, beyond saying (page 81) that the use of this coherer much simplifies the adjustment by eliminating the relay and recorder; but the use of these instruments is distinctly useful in certain instances, and if there is nothing beyond the above-mentioned adjustments to preclude their use, I, for one, would prefer a Morse type recorder to a moving coil instrument.

First, in the case of a single-handed experimentalist—he can set the recorder ready to take a message, go to the other station, send a message, and return to the receiving station and see the result.

Secondly, if a wireless installation is to be of any practical use between two friends' houses (I do not mean commercially), it seems to me that some recording apparatus is necessary, capable of taking down a message during the absence of the operator.

Now anyone who has had any experience with a syphon recorder will have noticed that it takes considerable skill to decipher the record; and, secondly, that it cannot be depended upon to start working when required without attention. A syphon in skilled hands and with constant attention is a splendid instrument; but it is far too delicate for ordinary every-day use, more especially if only to be used at spasmodic intervals. As for adjustments, a relay, once adjusted, should work for months without trouble. A recorder constructed according to my present description should not require adjusting more than once a month, except that, if much used, the ink will require renewing at most once every three days—a matter of one minute. Again, three Leclanché cells (one for the relay and two for the recorder) will work for a year without attention, if the water evaporated is made up.

As an example of the rough treatment that a recorder will stand, I remember once packing one up, shipping it, leaving it packed for some months, and, taking it out, found it in working order, not even requiring the spring to be adjusted. This recorder was an old pattern Post Office instrument, reconstructed on the lines indicated in the present article.

A good recorder will work freely with 5 milliamperes, and will work equally well with 20, so that the state of the battery is not very important, and any deterioration is quickly noticed by the absence of the sharp click given when the instrument is working properly.

To proceed to the construction of the instrument.

The yoke and cores of the magnet are made up in the manner already described for the non-polarised relay, the wire cores being very easy to construct, and having the advantage that they interrupt the eddy currents set up in the core.

The coils A are made of brass, and split, as usual; they are then carefully insulated with waxed paper, attached by heating with a hot iron, and the first layer wound with thick wire and the bobbin filled with No. 36 s.s.c. copper wire. Cotton-covered wire will do, however, if economy is necessary. Finish off the outside with thick wire, and lead each end to one of the terminals T, of which four are provided; in this manner the coils can be connected in series or parallel, giving respectively about 500 and 125 ohms resistance. Care should be taken to get exactly the same number of turns on each bobbin and to make the resistance as nearly equal as possible, otherwise the attraction of the two pole-pieces will not be quite equal, and there will be a tendency to cant the armature F, especially when the coils are connected in parallel.

The base B may be made out of any good hardwood, which it is advisable to boil in wax to remove any tendency to warp. To this the coils and terminals are attached and the brass plate C mounted on the columns N, the manner of fixing which is clearly indicated in the drawings. The bases of N are made out of separate discs sweated on.

The lever V is made of magnalium or brass, and is the only part requiring a special casting; all the rest can be made from rod or sheet metal. At one end of this lever the armature F is fixed, as shown in the drawing. This is formed out of fairly thick sheet iron (about 20 gauge), bent round into the form of a nearly closed tube and fixed into position, as shown, the screw passing through a clearing hole in the top side of the tube and bearing on the inside. At the other end a hook for the spring is filed out and a piece of fairly stout clock spring bent in the shape shown in Figs. 1 and 2. Two screws to hold this spring are shown, and a third adjusting screw is shown underneath, to regulate the bend of the spring; this is very convenient, but not absolutely necessary. The lever V is pivoted on a short piece of knitting-needle—(this should be ground off to sharp points at each end without softening)—driven tightly through a hole bored in V.

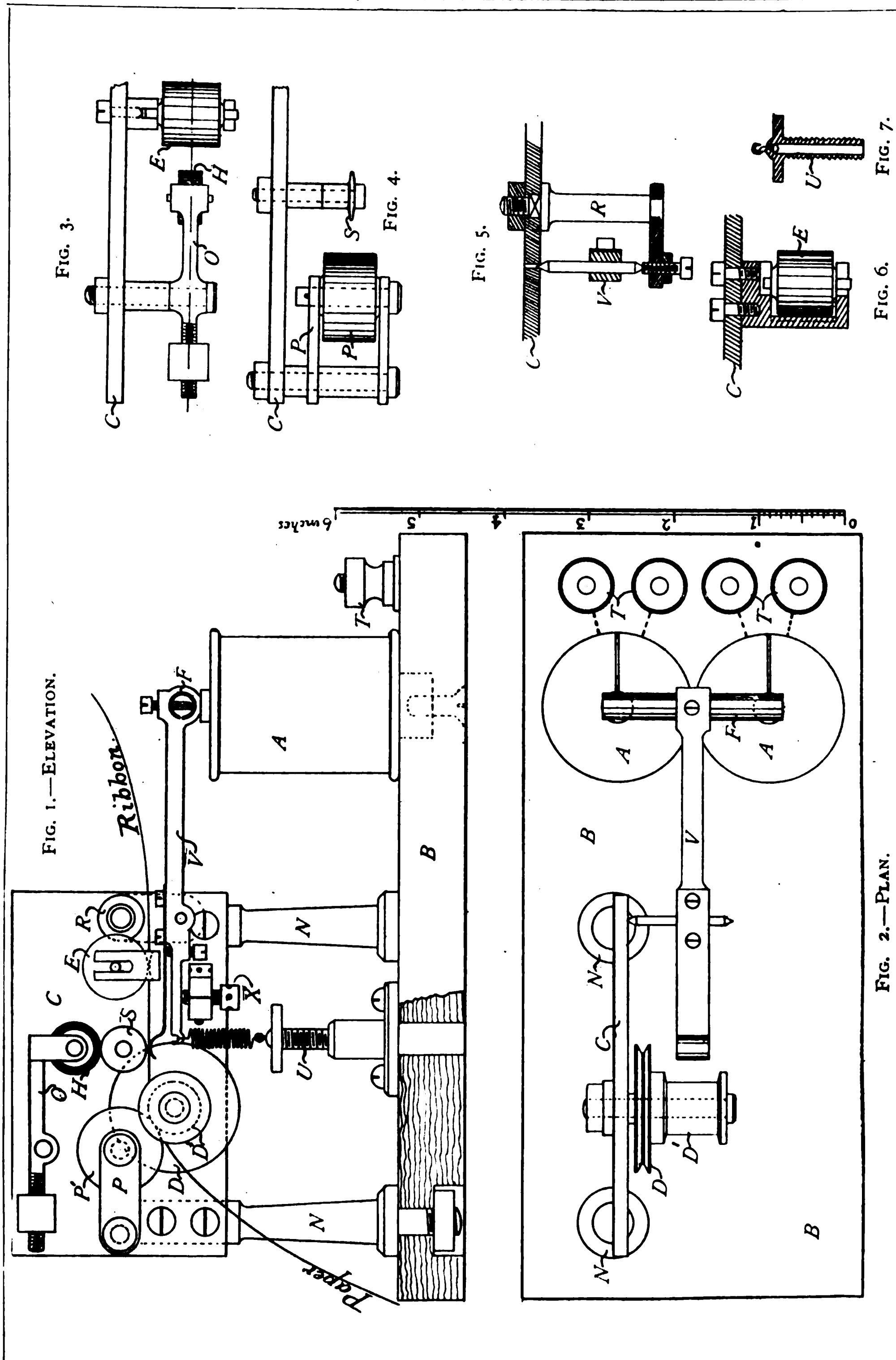
V is suspended by the bracket R, shown partly by dotted lines in Fig. 1 and in section in Fig. 5.

S is the pen disc, made to revolve freely on a pivot (see Figs. 1 and 4).

H (Figs. 1 and 3) is a small roller made of wood covered with a short piece of soft rubber tube hung in the bridle O, which is pivoted and balanced so as to rest very lightly on the pen disc S, an adjustable balance-weight being provided to regulate the pressure. This ink roller is charged by lifting the roller off S, and a microscope slide charged with a few drops of rubber-stamp ink pressed against the roller and worked up and down till the ink becomes equally distributed.

D and D1 (Figs. 1 and 2) are respectively the driving pulley and paper wheel. D, by preference, is formed out of ebonite. D1 is brass, and is attached to D by small countersunk screws before finally finishing. The cylindrical part of D1 should be about 1-32nd in. wider than the paper tape used, and should be slightly roughened by being mounted on a steel spindle, so as to be free to revolve whilst the edge of a fine flat file is drawn backwards and forwards under considerable pressure.

P1 is a weight roller hung in the cradle P in such a manner that the paper ribbon is gripped between P1 and D1. P1 should be turned slightly concave,



GENERAL ARRANGEMENT AND DETAILS OF A SIMPLE RECORDER FOR WIRELESS TELEGRAPHY.

so that it does not touch the paper in the centre, but only bears on the two outside edges; this is to avoid smudging the fresh ink.

E (Figs. 1 and 4) is another small weight roller to put a slight tension on the paper. This is made to work in a slotted cradle in such a manner that it can rise and fall to allow for any inequalities in the paper.

X (Fig. 1) is a device to regulate the stroke of the armature F, and calls for no description.

U (Figs. 1 and 6) is a screw to regulate the armature spring, and, as shown in Fig. 7, a hole is bored right through it, the hole at the top being very small, and a swivel hook is formed at the top out of an ordinary lady's pin.

The armature F—if thought advisable—may consist of a flat piece of soft iron. As a matter of fact I believe a flat armature is preferable to the tubular form, as the attraction is greater. High-class instruments are generally made with a tubular armature, so I have shown one in my design.

No paper reel has been shown in the drawings. I have found the best system to be to lay the coil of paper flat on the table and uncoil a little, as required. In the drawings the width of the paper used is shown at ⅝ in., instead of ⅜ in., as is usual in Morse instruments. This is due to the fact that I had a stock of this paper to hand when I made the design, but, of course, this dimension could easily be varied to suit the paper available. My paper was obtained originally for a syphon recorder, but this instrument was discarded for the reasons given at the beginning of this article.

(*To be continued.*)

Locomotive Notes

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

New American Locomotives.

The American Locomotive Company recently delivered to the National Railway of Mexico a "Pacific" type locomotive which they have built at their Schenectady works. The engine is a four-cylinder compound, with cylinders arranged on the Cole system, which has already been explained in the pages of The Model Engineer. A photographic reproduction of the locomotive appears on this page. Only in one other case has this system of compounding been applied to a locomotive of the "Pacific" type, and that was when the same company built some locomotives for the Northern Pacific Railway last year, having the 4—6—2 wheel arrangement and the Cole system of compound cylinders. The present design is, however, unique in that one of its features has not been tried before under the same circumstances. The high- and low-pressure cylinders have different lengths of stroke, that of the high-pressure being 26 ins., and that of the low-pressure 28 ins. The result of this arrangement is to make the angularity of the H.-P. and L.-P. connecting-rods more nearly even. Only two valve gears are employed in these engines to actuate the four slide-valves, which latter are of the piston type with a travel of 6 ins.; steam lap, 1 in.; exhaust lap—H.P. 5-16ths in., L.P., ⅜ in., and ¼-in. lead when cutting off at 11 ins. of the stroke. The right-hand crank leads. The leading bogie is of the swing centre bearing type, and a single pair of

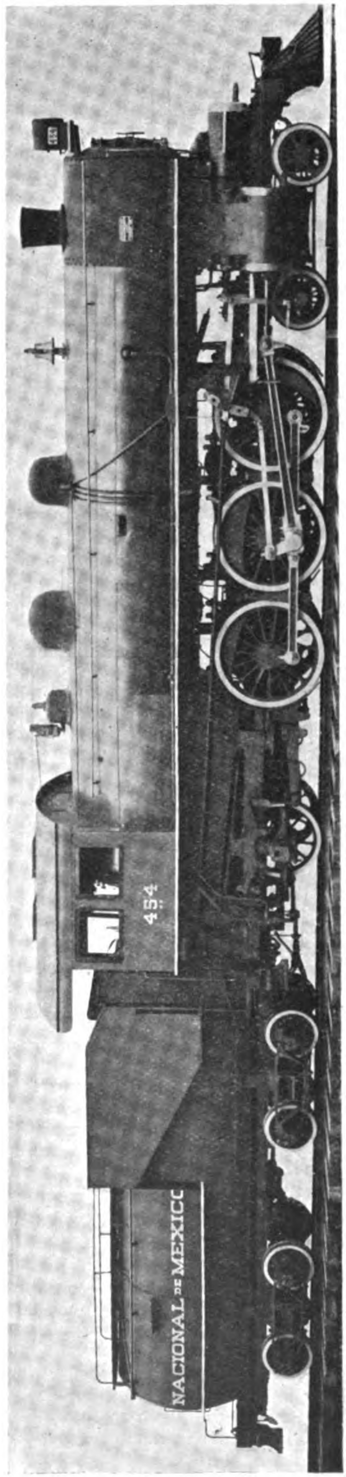


Fig. 1.—Four-cylinder Compound "Pacific" Type Locomotive: Mexican National Railway.

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radial wheels is used to support the trailing end of the locomotive. The boiler is of the straight pattern with barrel comprised of three telescopic rings, the smallest having an internal diameter of 6 ft. 1 in. The length of the boiler between tube plates is 18 ft. 11 ins., and there are 306 steel tubes, each of 2¼ ins. diameter outside.

The coupled axles are provided with long bearings for the journals, the dimensions being 12 ins. by 10 ins.; the leading bogie has journals 6 ins. by 12 ins., and the radial wheels 8 ins. by 14 ins.

The springs of the coupled wheels are connected to those of the trailing wheels by equalising levers, as is usual in American locomotive practice.

The tender is of the Vanderbilt cylindrical pattern, with a water capacity of 7,500 gallons, and which drive the leading pair of coupled wheels. The valve gearing is that known as Heusinger's, which is substantially the same in principle, if not in all its details, as the famous Walschaerts motion. The slide valves, of the piston type, work above the cylinders, and both they and the pistons are fitted with tail or extension rods working through covers. The coupled axles are placed clcse in on each side of the firebox, which latter is of the ordinary round-topped pattern with a deep ashpan. The boiler is of large size with ample steam and water circulating space. Lubrication of the working parts of the engine, and especially of those parts coming in direct contact with the highly superheated steam, is very adequately provided for, forced lubrication with a special oil being resorted to. The bearings

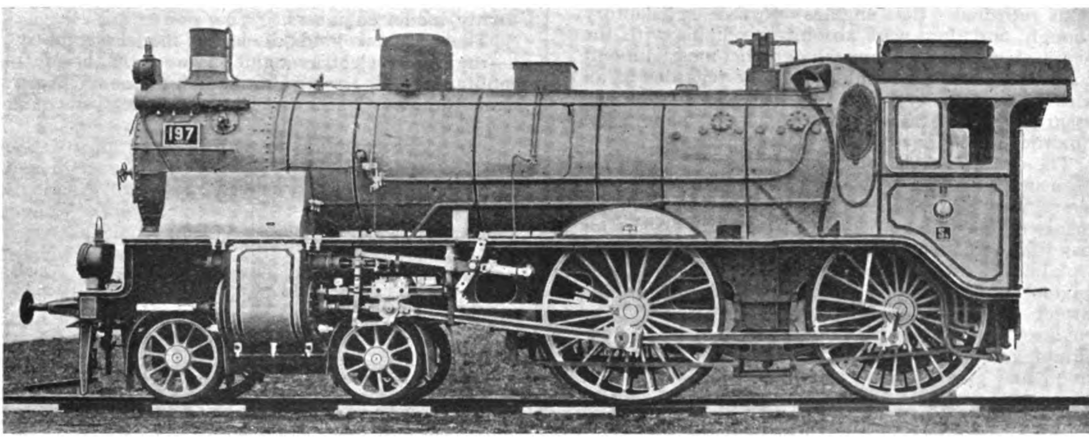

Fig. 2.—Latest Design of 4—4—0 Type Locomotive: Prussian State Railways.
(*Fitted with Schmidt Smokebox Superheater.*)

a coal space of 12 tons. Below are given the leading dimensions :—

- Cylinders: H.P., 5½ ins. by 26 ins.; L.-P., 27 ins. by 28 ins.
- Wheels, diameter: Bogie, 2 ft. 9 ins.; coupled, 5 ft. 7 ins.; trailing, 4 ft. 2 ins.
- Wheelbase: Rigid, 12 ft.; engine, 34 ft.; engine and tender, 64 ft. 3¼ ins.
- Heating surface: Tubes, 3,588 sq. ft.; firebox, 210·3 sq. ft.: total, 3,798·3 sq. ft.
- Grate area, 51·6 sq. ft.
- Boiler pressure, 220 lbs. per sq. in.
- Adhesion weight, 60 tons 14 cwts.
- Weight of engine in working order, 107 tons 12 cwts.
- Weight of engine and tender in working order, 170 tons.

New Express Locomotives, Prussian State Railways.

The latest four-coupled express locomotives of the Prussian State Railways are of the design illustrated on this page. They represent a considerable advance upon all previous engines of the 4—4—0 type in use on this great German railway system, and are of large size and considerable power. The boilers are fitted with Schmidt's superheaters, of the smokebox type, and there are two outside cylinders of the driving axles have been made as large as possible, and, in fact, everything possible has been done to provide for maximum efficiency.

The engines are working in the Breslau district, and have been built by the Breslauer Maschinenbau Company from designs prepared by the State Railways Engineering Department, under the direction of Professor Garbe, acting in conjunction with Mr. Wilhelm Schmidt, the originator of the well-known superheating system of that name, and also with the builders.

The leading particulars are as follows :—

- Cylinders diameter, 21·3 ins.
- Stroke of pistons, 23·6 ins.
- Coupled wheels diameter, 6 ft. 6 ins.
- Heating surface: Tubes and firebox, 1,095 sq. ft.; superheater, 331 sq. ft.: total, 1,426 sq. ft.
- Grate area, 24·4 sq. ft.
- Boiler pressure, 170 lbs. per sq. in.
- Weight of locomotive, 54·5 tons.

In a long communication to the writer on the subject of these engines, Mr. Schmidt states that when tested against an "Atlantic" type "saturated" compound, with identical loads and conditions absolutely the same in both cases, the economy of the superheated steam locomotive, based on 1,000 ton-miles, was :—(*a*) With nine coaches,

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25 per cent. in coal and 41 per cent. in water; (*b*) with eleven coaches, 27·8 per cent. in coal and 40·5 per cent. in water; (*c*) with thirteen coaches, 33·3 per cent. in coal and 36·7 per cent. in water.

Great Northern Tank Locomotives.

The withdrawal of the powerful eight-wheels coupled radial tank engines from the London district on the Great Northern Railway and the placing of the engines on coal traffic in the north, is a matter of interest to those who concern themselves with the suburban traffic problem in the Metropolitan area. When the engines first made their appearance they proved too heavy for the track, or some portions of it, and smaller boilers and shorter side tanks had to be fitted before they could be placed in regular working. These alterations effected, the engines proved satisfactory enough, and they were absolutely reliable with the heaviest suburban trains under the most difficult conditions, but they could hardly be regarded as an ideal passenger type at any time, and they will assuredly find greater scope for their many good qualities in the new field they are entering upon.

The 0—6—2 type tank engine, No. 190, has now been in service for some months, and is proving in every way well adapted to the particular requirements of the London suburban traffic. The writer has had frequent opportunities of gauging the capabilities of No. 190, and has always found the engine perform good work. On the Moorgate Street to High Barnet service of the G.N.R. the engines have ample play for their abilities in hill-climbing, and it is on this traffic that No. 190 has so frequently given such a good account of itself. The number of engines built to this design will shortly be considerably augmented.

Chats on Model Locomotives.

By Henry Greenly.

Electric Locomotives.

For some two or three years past my attention has been directed towards the development of the model electric locomotive, and as there is every reason to believe that the small electrically driven engine with steam locomotive outline has come to stay, I venture to suggest that the sooner the design and arrangements of the motors and other fittings are brought into line with the accessories used in steam work the more popular will this particular branch of model engineering become.

As far as I can make out, those who have already built model electric railways are more than pleased with the genuine fun they afford, and the way they can be manipulated. There is no need to look for the reason of this. To combine the small working steam locomotive with a perfect model railway system having all the refinements of signal and interlocking gear is a difficult problem. That controlled steam locomotives can be made is well known, but a considerable amount of skill and patient experiment is necessary to produce an entirely satisfactory model of this character; furthermore, it is not every amateur that is the happy possessor of appliances for making the requisite delicate control apparatus.

Where ordinary steam locomotives are used in conjunction with more or less complete railway systems, the varying moods of the engine prevent the operator dividing his attention between locomotive and railway in the proper relative proportion according to their respective importance. Should he attempt a set programme of working, he will find that the locomotive is seldom ready for the railway when some important evolution is to be be performed, and when the signals and points are properly set and the disposition of the rolling-stock is favourable to the particular manœuvre, the locomotive either lacks steam, water, or fuel, or requires some adjustment which completely stops progress according to time-table.

The above may be an exaggerated statement, but it is a rough outline of what generally does happen. This being so, it is not to be wondered at that the electric railway in which perfect control is obtained from any given point has such a fascination for many model engineers.

There are two kinds of electric model locomotives —the purely electric engine, as used on the Metropolitan, North Eastern, and some Swiss and American Railways; and the electrically driven model

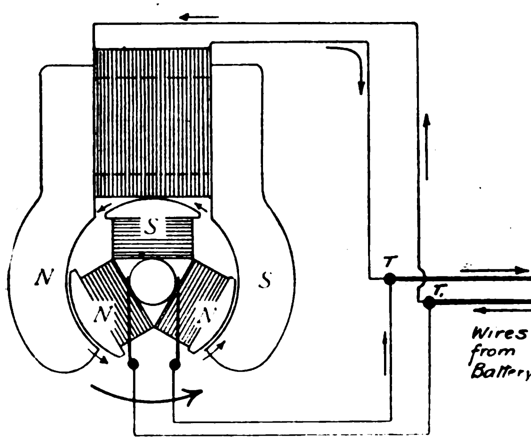

Fig. 1.—Showing Connection of an Electro-motor and the Mutual Attraction and Repulsion of Adjacent Unlike and Like Poles of the Magnet and Armature respectively.

of the ordinary steam locomotive. We are not yet familiar with the purely electric locomotive coupled to express trains, and it is likely that for long distance trains it will be many years before the steam locomotive disappears; therefore, there is much to say for the model with steam locomotive outline which is propelled by electrical machinery, for use on model railway systems where the owner is more particularly interested in signalling and the operations of railway working.

While I intend sooner or later to deal with the construction of the ordinary electric locomotive, for the present I shall address myself to those to whom railway work in miniature is of paramount importance, and the locomotive itself only a means to an end. To this class the advantages of model electric traction are many, although it may be considered by some to be rank heresy to fit an electro-motor into a model of a steam locomotive, but I venture to think that such practice may be justified by the results which are obtained.

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The points in favour of electrically driven model locomotives for complete railway systems may be enumerated as follows :—

(1) Perfect control in starting, stopping, regulating speed, and reversing may be obtained with the least possible complication, and realistic railway working rendered quite easy.

(2) The operation of signalling and engine driving may be combined so that accidents due to errors of judgment cannot occur.

(3) The appearance of the locomotive does not deteriorate with continued working.

(4) The hauling power is only limited by the adhesion of the locomotive.

(5) The locomotives require less looking after, and therefore a greater amount of attention may be bestowed on the working of points, signals, and marshalling of trains.

(6) A successful railway may be made to a much smaller scale.

The only objections I have heard advanced by model railway enthusiasts to the adoption of electric traction is the fact that their locomotive experience has been entirely connected with steam engines. They complain that they know nothing of electrical science, and are therefore afraid to tackle an electric engine. No fears, however, should be entertained on this score, as the literature of this branch of model work, and the accessories and appliances obtainable, are being daily augmented. As may be imagined, makers of electrical appliances in the past have not, as a whole, been sufficiently familiar with the exigencies of model railway

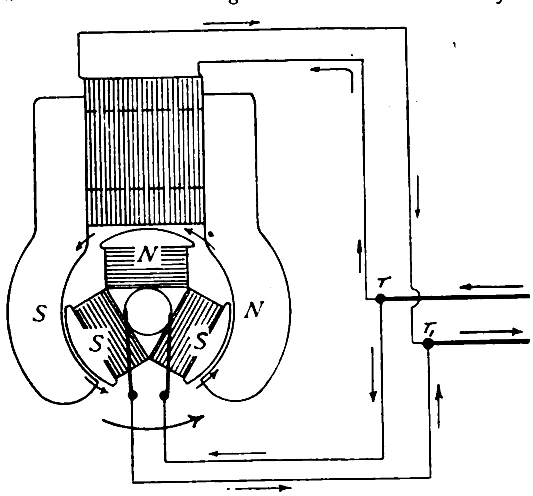

Fig. 2.—Showing that a Simple Reversal of the Supply Current does not Change the Direction of Rotation, as all the Poles are Changed and the Relative Attraction and Repulsion remains the same.

practice, and therefore motors, switches, and other appliances, although they may be good in other respects, not being designed for locomotive work, are found difficult of application ; and while they may suit one particular style of engine, are useless for another.

I wish, therefore, to submit various designs of model electrically driven locomotives, in the hope that the component parts used in their construction may reach the degree of standardisation which obtains in model steam engine work.

One of the chief items in the programme is the consideration of the arrangements which may be used for reversing electric locomotives from the track. There are several methods of accomplishing

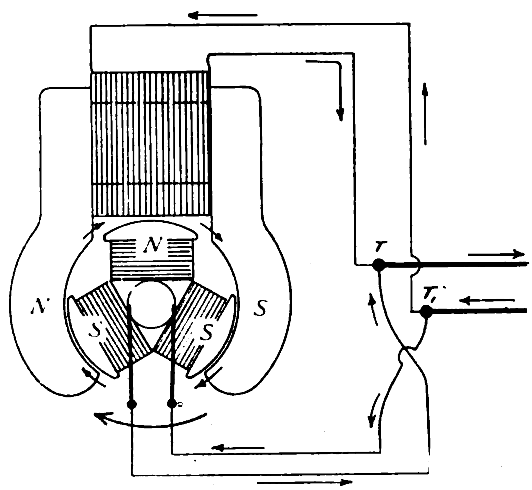

Fig. 3.—Showing that the Reversal of the Current in the Armature alone Changes the Polarity in the Armature, gives Attraction where Repulsion took place before, and Reverses the Motion of the Armature. (Compare with Fig. 1.)

this object, all of which have been described in the columns of The Model Engineer, but not in a connected form :—

(1) By using permanent magnet motors, a method which is suitable for small models and light loads.

(2) By using ordinary electro-motors, the field-magnets of which are separately excited by independent battery or accumulator carried on the engine.

(3) By using two conductors (one of which may be formed by the two running rails, *i.e.*, what is known as the third rail system), and an automatic polarised switch for reversing the motor on the locomotive.

(4) By using four conductor rails—two for the fields and two for the armature—an ordinary motor-reversing switch being used at any convenient position on the track.

In the latter system the two running rails are generally arranged to form the flow and return for either the field or armature circuits, and therefore have to be insulated from one another. The axles and frames also have to be so made that there can be no flow of current through the engine from one rail to the other, and, as may be imagined, that while it is comparatively easy to do this in tiny models, it is very difficult to provide against short-circuits in engines of any size. The method,

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therefore, has serious drawbacks, and is not generally to be recommended.

In dealing with the electro-motors, those who have not had much to do with them before may consider them to work by mutual attraction and repulsion of the fixed and moving poles of the field-magnet and armature respectively, and where further knowledge of the principles upon which they work is required, reference may be made to the lucid explanations given by "A. W. M." in the "How It Works" column some time ago.* In model locomotive work, supposing the motor to be provided, the only point which requires careful attention is in the connecting up of the fields and armature to make the motors reverse properly, according to system employed.

Experiments with a motor will soon prove that the reversal of the current of supply does not affect direction of rotation of an electro-motor connected up in the ordinary wav. It is of no avail to simply change the wires to the positive and negative terminals, as the motor will continue to run the same way as before. The relations of the currents in the armature and field-magnets must be altered, and either leaving the field-magnet current as it was, the armature current must be reversed, or, with the armature current running in the given direction, the field-magnet circuit must be changed over, to obtain motion in the opposite direction. The reason of this is shown in the accompanying sketches, Figs. 1, 2, and 3. Like poles, of course, repel, and unlike poles attract, and it is the direction of the current which decides which is the N. and S. poles respectively in any given position of armature and field-magnets. Accepting these simple facts, examine Fig. 1. It will be seen that the main source of supply branches out at the terminals T and T1, one pair of wires going to the field-magnet and the other pair to the armature (*via* the brushes). With the current travelling in the supply wires in the direction indicated by the arrows, the polarity of the field-magnet and armature are as shown by the letters N. and S. (north and south). Now, considering the upper limb of the tripolar armature, this is seen to be a S. pole, and is, therefore, being attracted by the left-hand N. (or unlike) pole of the field-magnet, and being repelled by the "like" (S.) field-magnet pole on the left-hand side of the drawing. The two lower poles of the armature are respectively north and north, and the attractive and repulsive forces acting in the same direction as regards the rotation of the armature, we get the combined efforts turning the armature shaft and doing the work required of it.

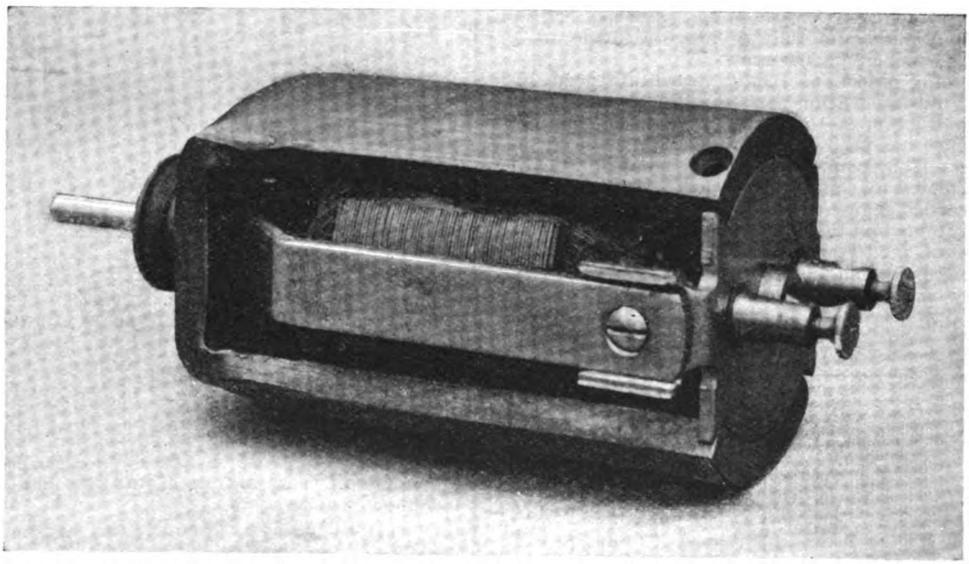

Fig. 4.—Permanent Magnet Motor for Model Locomotive.

Supposing the supply current is reversed—what happens? As depicted in Fig. 2, all the polarity of all parts are changed, but, as further examination will show, that the direction of the forces remains as before. Take the top pole of the armature: the reversal of the current changes this from a S. to a N. pole. The current, however, simultaneously reverses the polarity of the field-magnets, and we have a S. pole to the left and a N. pole to the right. Therefore, the pole of the armature we are considering is repelled by the right-hand pole of the field-magnet, and attracted by the left-hand pole, the motion being in the direction of the arrow—*i.e.*, the same as before.

This shows that reversing the source of supply is not enough. The fields must be kept constant in polarity and that of the armature reversed (or *vice versa*). This is shown in Fig. 3, the leads to the armature being crossed so that the field current remains the same as in Fig. 1, and the armature currents are reversed. In this way the polarity

* See issues for Jan. 4th to Feb. 15th, 1906, inclusive.

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of the three limbs of the armature are changed, and, as will be seen, the attraction and repulsion effects are exactly opposite to that in Fig. 1 (see arrows).

It being possible to reverse a motor in this way, it stands to reason that so long as means are provided for keeping the polarity of the field-magnet fixed, the reversal of the electricity in the armature circuit by a simple switch will cause the locomotive to travel backwards or forwards, the three popular methods being those mentioned in the above paragraphs 1, 2 and 3.

Permanent magnet motors are obtainable, and one which is most applicable to model locomotive work is shown in Fig. 4. This motor is circular, and fits the barrel of a small 1¾-in. or 2-in. locomotive perfectly. Although not exceptionally powerful, I found on fitting one to a six-wheeled single express locomotive it was sufficiently powerful to run the model up a bank 1 in 25 with the

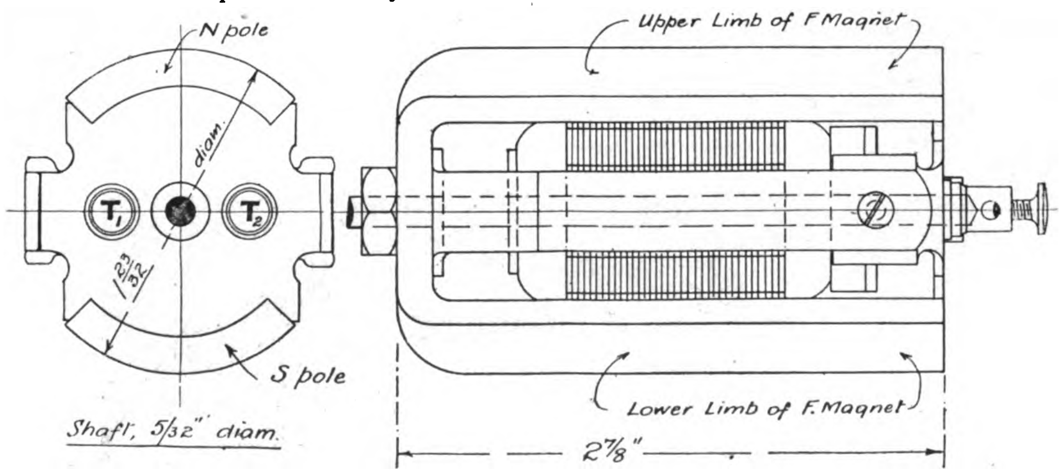

FIG. 5.—FULL-SIZE DRAWING OF CYLINDRICAL PERMANENT MAGNET MOTORS FOR MODEL LOCOMOTIVE WORK.
(T1 and T2, Terminals for armature current to brushes.)

accumulator on board the engine, the consumption of current being only 1½ to 2 amps. at 4 volts. The motor is entirely self-contained, and has no projecting brushes, and all that is necessary is to connect the two terminals—one to the collectors, and the other to the frame of the engine—to obtain, by a simple rheostat reversing switch on the side of the line, perfect control over the engine. The armature is made up of 12-slot iron stampings, and during the whole time I have used the motor I have not experienced the slightest hitch with it in the matter of starting. As many readers may desire to build locomotives to suit these motors, I include full-size drawing of the one I have, and in the next article will show the various methods by which I geared it to the model single-wheel locomotive already mentioned, and submit a complete design for a suitable 1¾-in. gauge engine which may be driven by this neat, compact electro-motor.

(To be continued.)

EARLY in 1908 electric trains will be seen running experimentally on the London, Brighton, and South Coast Railway between London Bridge and Victoria Stations, says the *Engineer*, and a regular passenger service is promised next summer.

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prizewinners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows:—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

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Silver Medal in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

Bronze Medal in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

The *Engineer* states that the French Navy Department is entering upon a general overhaul of the boilers of all warships fitted with vertical tubes. Several accidents to boilers of this type have rendered the step necessary. The jointing of the tubes is the source of weakness, danger beginning as soon as the temperature exceeds 600 or 650°.

The short ends of arc lamp carbons, says a contemporary, may be joined together and utilised again. They should be cut square, and the ends should be coated with a cement formed of a mixture to a pasty consistency of potassium silicate and carbon dust, and then pressed together by hand. Carbon rods made in this way of a number of pieces are said to burn well on continuous or alternating current, and to be no more brittle than ordinary carbons.

A Practical Tesla Coil.

By J. Pike.

Many readers of The Model Engineer and possessors of spark coils may be interested in a Tesla coil which I have made recently on a larger scale than the one I described four years ago, and to which frequent allusion has been made in these pages (May 28th, 1903, The Model Engineer).

The coil is for the purpose of producing high-frequency effluxes and various experiments for the amusement of one's friends—after the manner dear to the heart of the amateur electrician. For reasons stated further on, no photograph has been made of the completed coil, but details of the construction are here given.

The coil consists of a primary of a few turns of thick wire, or, in this case, of copper *strip*, 3-32nds in. section and ⅜ in. wide, and a secondary of a few hundred turns of fine wire placed inside the primary, the whole immersed in boiled oil, therefore enclosed within a box, which must, of course, be quite oil-tight.

In the first figure will be seen the method of building up the primary, and here I may say that an endeavour has been made to utilise material which is at hand, or at the least readily obtainable. For instance, the secondary is wound upon a cylinder which may be glass or ebonite. Now a perfectly straight-sided glass jar (about 4 ins. diameter and 8 or 9 ins. long) can be got anywhere, and serves the purpose. For this coil I used a glass chimney such as is supplied for use with enclosed arc lamps; it measures 7 ins. × 4¾ ins., and the diameter of the primary was arrived at by taking, approximately, 3 to 2 as the ratio to determine the amount of insulation between the one coil and the other. The glass chimney being nearly 4½ ins. diameter, I

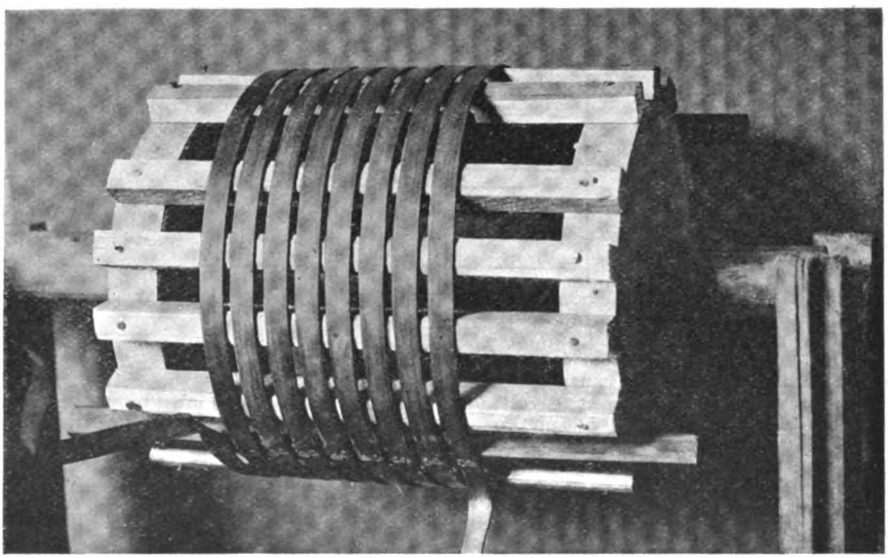

Fig. 1.—Showing Method of Building up the Primary.

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thought 6½ ins. would be a suitable diameter for the primary, therefore had turned two wood discs 1 in. thick and 5½ ins. diameter, and these, being properly centred, were then drilled through to a size equivalent to a stout broom shank. The two discs being placed parallel and about 6 ins. apart, strips of wood, ⅛-in. section and about 6 ins. in length, were nailed to the edges, as seen in the figure; these ½-in. strips, plus the diameter of the discs, bring the turns of copper to an even 6½ ins. At two opposite sides are two ebonite or *vulcanised fibre* rods, 9 ins. × ½-in. section, the wood rods being spaced between them, all being rather lightly attached with screws, or nails partially put in, to facilitate removal after the winding.

The skeleton drum or cage is then set up on two strong supports, as shown in the figure.

As it is requisite that the winding should be centrally over the secondary, we must measure carefully the starting-point from which to lay down the strip. The eight turns take up about 4 ins.; therefore, if we place a foot-rule over one of the *fibre* supports and make a mark at 2½ ins., and at each ½ in. until we arrive at 2½ ins. from the further end, the spaces will be about right. Then upon the opposite *fibre* support we make similar marks, but start at 2¾ ins. This is, of course, essential, because the primary is wound as a spiral, with ⅛-in. space between each turn, and this result is achieved by fastening the commencing end (leaving 8 ins. or so free) at the side of the 2½-in. mark, then at the 2¾-in. mark on the opposite fibre rod, when, arriving at the full turn, we find the strip falls naturally at the 3-in. mark. The copper must be secured to the fibre supports with brass screws, and, for the most part, two will be required in each case. With a little assistance the copper is easily pressed and bent into place, and screws may be put in as the work proceeds.

The eight turns having been put down, we finish by leaving a spare 8 ins. or so for connections, and proceed to—if this has not been done before—put in the *two* screws requisite to properly secure the turns. These screwheads should be neatly flush with the copper or filed smooth, and the part then covered with, say, Chatterton's cement, this merely to cover over any sharp edges or points left in the filing, which otherwise might facilitate sparking between the primary and secondary. This done, the wood and fibre supports may be unscrewed or the nails withdrawn, so that the frame may be detached, leaving the spiral properly shaped, as in the figure. If necessary, and to strengthen the structure, shorter (4-in.) pieces of ebonite or fibre may be put on at additional points—one may be seen in the photograph.

To wind the secondary, the glass chimney is first fitted with two hardwood caps or plugs, with a neat rounded flange, which should come close up to the glass. These plugs are also to be carefully centred and an ebonite rod passed through them (9 ins. in length, but any convenient size). Before fixing the plugs the latter should have holes made in them in at least two places, so that the oil may find easy access to the interior. This done, the plugs may be put in position with seccotine, the ebonite rod inserted and fixed in like manner.

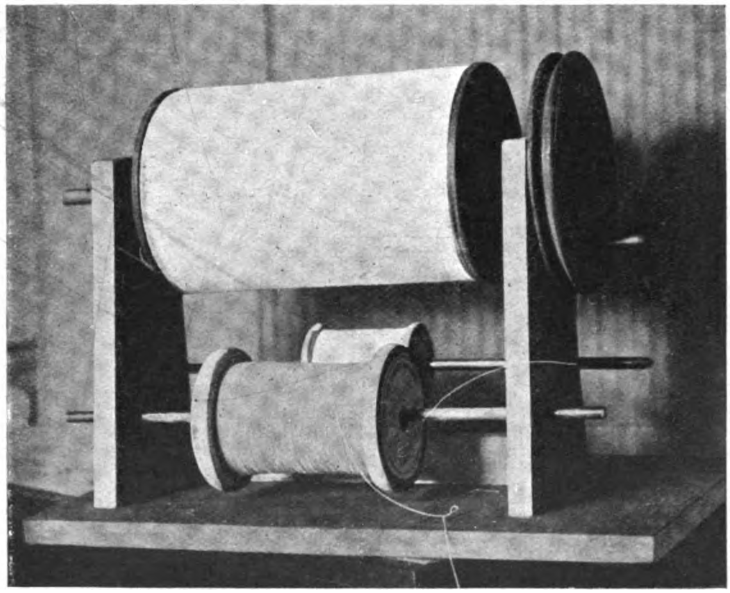

FIG. 2.—SHOWING METHOD OF WINDING THE SECONDARY.

We require now to mount the cylinder—for winding—in another stand, which should be just high enough for comfortable working and to admit of a reel of cotton and a bobbin of wire (No. 38 S.W.G. cotton-covered) being placed beneath. Fig. 2 is a photograph of the secondary on completion of the winding. One layer only is put on, and each turn is spaced from its neighbour by a turn of the cotton. The figure shows an extemporised driving wheel at the side, but this is not much use in practice, it being better and much easier to pay out the wire and cotton with one hand and to revolve the drum with the other hand, which also will be required to properly align the turns. The turns should be fairly tight, and, of course, even and close. At the commencing and finishing ends of the drum at least a foot of spare wire should be left, secured temporarily by insertion into a small cut into the wood flange; then a little hot wax secures it permanently.

(*To be continued.*)

THE Great Western Railway Company claims the credit of having produced the first complete corridor train, combining the privacy of separate compartments with the advantages of through communication from end to end and access to toilet rooms.

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Practical Letters from our Readers.

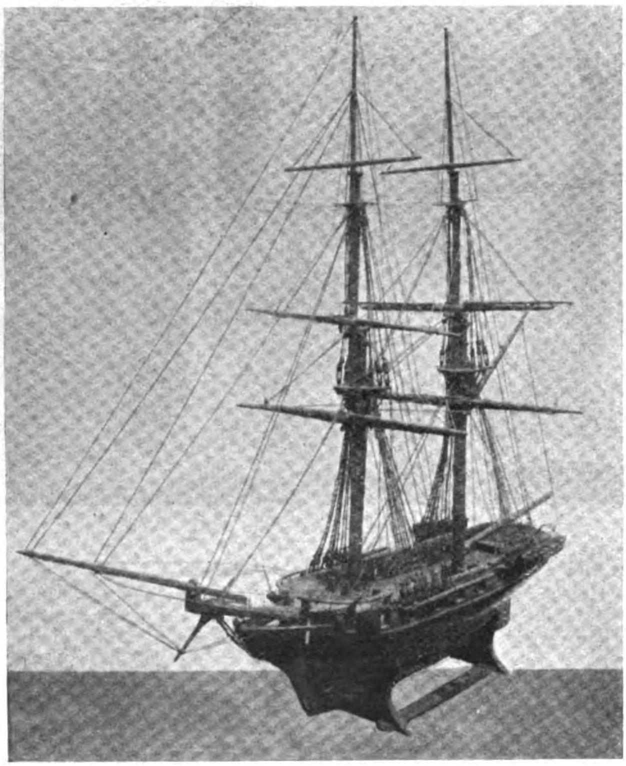
[*The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a* nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.*]

A Model War Brig.

To the Editor of *The Model Engineer.*

Dear Sir,—The photograph I send you is of my model brig, which I hope may be of interest to your readers. It is a model of the old-time war brig, sometimes called "sea coffins" (owing to the number which foundered). It is, I think, one of the most perfectly rigged models I have come across. She is 15 ins. long by 4½ ins. beam and 31 ins. overall. The height of the foremast from the deck is 21 ins., and the other ½ in. less. The hull is of the "dug-out" pattern: it would be difficult to make so small a model in the authentic manner. The hull is pine and the masts lance wood. She has seven portholes each side, and the fittings include three hatchways, two boats slung on davits, and a couple of long booms to fasten boats from when at anchor. The blocks are all solid, as it would be almost impossible to make them with proper wheels. All the yards can be squared as in a real boat. The rigging is as near to scale as possible. She is painted black above the water-line and bronze below.—Yours truly,

Preston Park. S. S. Willis.



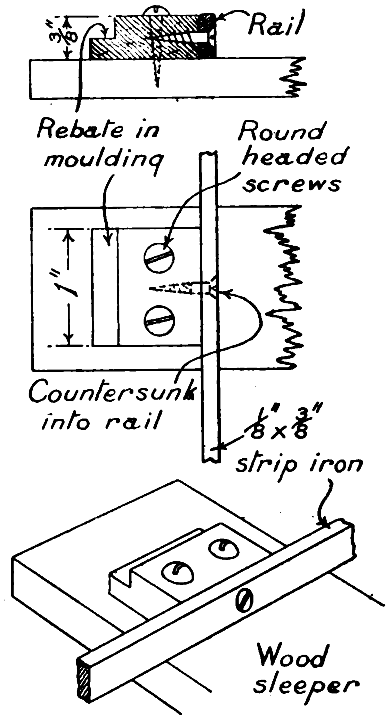
Mr. S. S. Willis's Model War Brig.

Model Railway Material.

To the Editor of *The Model Engineer.*

Dear Sir,—I notice in your issue of Sept. 26th an enquiry from "Caledonian" *re* a suitable cheap form of model permanent way. Perhaps the accompanying diagrams, which illustrate a method I am adopting in the construotion of a small track (2¾-in. gauge), may be of interest. The diagrams are almost self-explanatory. The rails are of strip iron ⅜-in. by ⅛-in., fixed, as shown, to chairs made of small pieces of ordinary oak picture frame moulding, some short lengths of this material which I had by me suggesting the idea. The rebate might, of course, be cut away, but, if anything, its retention adds to the appearance of the track. The strip iron is very cheap, easily worked, and makes up splendidly into points. I find that with the sleepers 7 ins. apart from centres I get all the required rigidity. One advantage of this form of construction is that it obviates having heads of screws along the top of the rails.—Yours truly,

Tufnell Park, N. Louis A. Dessurne.



A Suggestion for Model Railway Track Chairs.

A Reader's Useful Model Vertical Engine.

To the Editor of *The Model Engineer.*

Dear Sir,—The following description of my vertical engine may be of interest. The engine was designed for a light 12-ft. boat. I have been using it for driving a dynamo, with very satisfactory results. The cylinder is a brass casting, 2-in. bore

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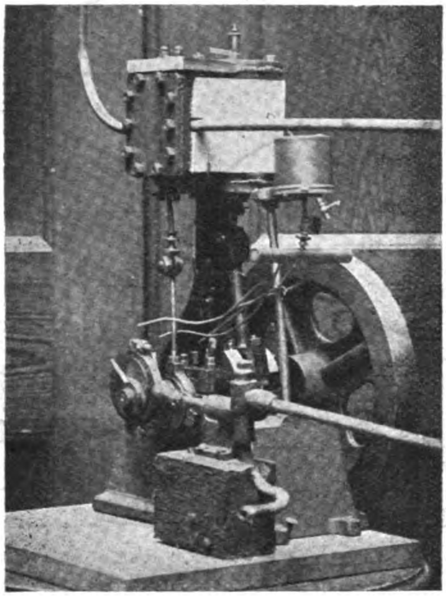
3-in. stroke, with ports cast. The column and bottom cylinder cover are cast in one piece. The valve cuts off at $\frac{5}{8}$-in. stroke. The piston has two brass rings, 3-16ths in. thick, and the piston-rod is $\frac{3}{8}$ in. diameter; connecting-rod a steel forging $\frac{1}{2}$ in. by $\frac{5}{8}$ in. diameter, and case-hardened at the small end. The cross-head and gudgeon pin are



MR. RICHARD LUMB'S SMALL POWER ENGINE.

also steel and case-hardened. The crankshaft is $\frac{5}{8}$ in. diameter, and was built up. The webs and balance weights are cut out in one piece. The flywheel is 8 ins. diameter, 1-in. face. I also made the pump myself: it is a brass casting, $\frac{3}{4}$-in. ram, $\frac{5}{8}$-in. stroke, with ball valves.—Yours truly,

Leeds. RICHARD LUMB.

ACCOUNTS have recently been published of a gasworks in Switzerland which is in the happy position of being able to sell more gas than it makes. This apparent anomaly is explained by the circumstance that the factory is situated about 820 ft. below the holder and the place where the gas is consumed. The rise in level causes the gas to expand, and increases the pressure in the main by some 6 ins. The town served by the undertaking is St. Gall, and the factory is on the shore of Lake Constance, six miles away.

ABERDEEN INVENTOR'S SUCCESS.—According to the daily Press, Mr. George L. Smith, a draughtsman of the Bon-Accord Granite Works, Aberdeen, and the inventor of the "Aero Fire Alarm," has concluded a bargain with an American firm by which he will receive £50,000 for the rights of the invention in that country, while the British rights have been secured for £10,000. The fire alarm is to be exploited in both countries by syndicates. It may be mentioned that, in addition to his good fortune in disposing of the British and American rights, Mr. Smith retains the Continental rights, which may be disposed of for a further considerable sum.

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.—Friday, October 18th: The Annual Sale of Models, Tools, Parts, Materials, etc., the property of members, will be held at the Cripplegate Institute, Golden Lane, E.C., at 7 p.m. New members who have not yet had an opportunity of attending one of these Sales will be well advised to do so, as model making apparatus of all kinds is generally to be obtained on very advantageous terms.—Wednesday, November 13th: The Annual General Meeting. Any member wishing to move an alteration or addition to the Society's rules at this meetiug is invited to write to the Secretary on the matter, who will also be pleased to receive any suggestions for the increased usefulness of the Society to its members for consideration and discussion at that meeting.—HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

Liverpool and District Electrical Association.

ON Saturday, the 5th inst., the members of the above Association paid a visit to the Widnes and Runcorn Transporter Bridge. The party left by train from Lime Street Station, and on arrival at the bridge were met by Mr. John Henderson, the general manager. The bridge being worked by electrical energy, an inspection was first made of the generating station. This consists of a gas engine, 70 b.h.-p., dynamo, booster, and accumulator battery of about 246 cells, with a well-fitted switchboard. There is also a duplicate 70 b.h.-p. gas engine and dynamo. The party then proceeded for a detailed round of examination of the construction of the bridge proper, ascending into the towers, and also on to the girders. A trip was then made across the river and back by the transporter car, when it was apparent to all how well the car was under control, thus ensuring the safety of the public. It might be mentioned the car is capable of carrying at one time four two-horse loaded wagons and 300 passengers, and the platform is suspended from the girders by a trolley, driven by two electro-motors of about 35 b.h.-p., being provided with efficient automatic and hand brakes, and runs beautifully smooth. The party then dispersed after a most pleasant and interesting afternoon, the very best thanks being due to Mr. John Henderson, the genial general manager, and his able assistants for the most kindly manner in which they had entertained the party and also supplied so much interesting information, and the best thanks of the Association and wishes for the prosperity of the bridge, were conveyed to that gentleman by the Hon. Secretary, Samuel Frith, Bootle.

ACCORDING to a contemporary, carborundum has proved to be a satisfactory material for classes of work other than an abrasive, for which it was originally intended. It is so satisfactory as a grinding material that it is not surprising that equally as good uses may be found for it in other lines. One of the recent uses for it is in moulds for casting aluminium.

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Queries and Replies.

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

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

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

[18,089] **Spirit Lamp for Model Steamer.** F. B. (Bury) writes: I have made a model paddle boat, 3 ft. long. It has a boiler like the one on page 40, Fig. 12, of "Model Boiler Making." I should use an ordinary spirit lamp with six wicks, but the difficult part about it is that there is only about 7 ins. between the end of the boiler and the end of the boat, so you see there is not much space for drawing the lamp in and out.

If you use asbestos wicks and have a separate spirit container with a drip or automatic feed, you should have no trouble in firing the boiler with a plain lamp—that is, providing the boiler has sufficient heating surface for the cylinders.

[18,106] **Marine Engine Failure.** R. A. K. (Paisley) writes: I have just completed a model marine engine and boiler. The engine goes very well when I blow into it, but does not answer under steam. The boiler, though fitted with a superheater, does not produce dry steam, and the water clogs up the steam ports of the cylinder. The boiler, which is 7 ins. long and 3 ins. diameter, and has a centre flue 1¼ ins. diameter, is fired by means of a small blowlamp, which is not powerful enough to give satisfactory results.

Presuming that the engine and boiler are of suitable proportions, we should say that the reason of the priming is the want of packing in the pistons. Leakage occurs and the demand on the boiler becomes excessive; as a result the latter primes. See that piston and all glands are steamtight. Also look to the valves, which should be correctly set and bed properly on their faces. Test again, and then if the boiler does not steam make a new blowlamp. It is always worth bearing in mind that models waste more steam than they use. To obtain success, the thing to do is to check all sources of leakage and heat loss. You will find a drawing of a suitable benzoline lamp in our book, "Machinery for Model Steamers," price 6d. net, or post free 7d. from this office.

[18,100] **Compressed Air Engine.** L. J. (Yorks) writes: As an old reader I venture to write to you for information concerning an engine to be driven by compressed air, to run for about ten minutes, and to develop ¼ h.-p. The engine: What size of cylinder and length of stroke? What size of portholes? What size of feed pipe? I want to get about 1,500 r.p.m. The air reservoir: Can you tell me what size air reservoir? The drawing (not reproduced) enclosed will give you an idea of what I want it to be. How thick should it be if made of steel or copper? What pressure per sq. in.? What kind of pump should I need to inflate?

To develop ¼ h.-p. for ten minutes you will require a reservoir holding about 6,000 to 8,000 cub. ins. of air at 200 lbs. pressure. A cylinder 1¼in. by 1¼-in. would work well with a reduced pressure of 50 lbs. per sq. in. in the valve chest. Of course, a re-heater and a good reducing valve will also be necessary. It would take at least one hour steady pumping by hand to inflate the reservoir—that is, allowing for losses—and a two-stage pump would be essential. The reservoir you have sketched will only hold 4 cub. ins. of air, and would only be sufficient for a fraction of a second even if pumped to a much higher pressure. You do not give us any idea as to the purpose of the plant, therefore we cannot recommend an alternative.

[18,008] **British Standard Permanent Way.** E. E (Carlton) writes: Being engaged in model locomotive building, and a subscriber from the commencement, I venture to ask your help as follows. Living in a country village I am unable to get the measurements myself. (1) What size is an ordinary sleeper—length, width, and thickness? What space is given between each sleeper when laid? (2) What is the size of an ordinary steel rail—length, weight, etc.? A fully dimensioned sketch of cross section would be most useful. What size are the cast-iron chairs which hold the steel rails? What size are the oak wedges used in the chairs? (4) What size is a fishplate—length, width, and thickness? What size are the bolts for same?

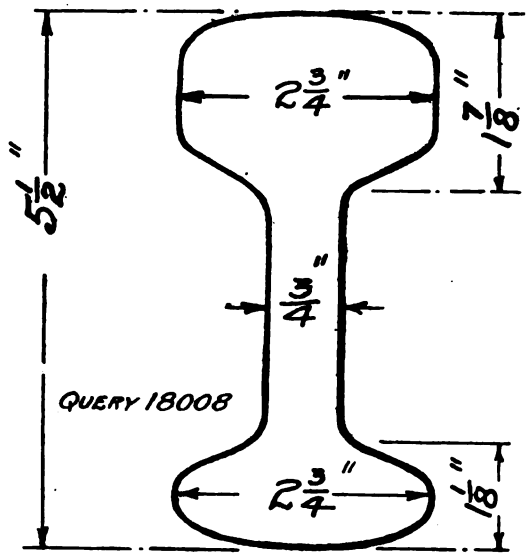

FIG. 1.—STANDARD L.N.W.R. RAIL. A SKETCH TAKEN FROM A RUBBING OBTAINED AT THE END OF A NEW CHECK RAIL. *(Sketch half full size.)*

(1) A railway sleeper usually measures 9 ft. in length and 10 ins. in width, the thickness being 5 ins. The average distance apart is 2 ft. 9 ins. In special positions, such as points, sleepers are much longer and are made out of 12 · 6 timber. The fishplate bolts are, in some places, square-necked roundheaded bolts, ⅞ in. or 1 in. diameter. Some companies use clip fishplates which clasp the bottom bulb of the rail, and are intended to provide a better

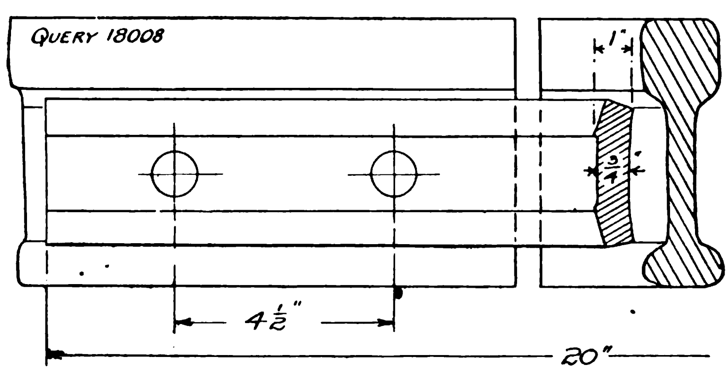

FIG. 3.—L.N.W.R. PATTERN FISHPLATE. *(Quarter full size.)*

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vertical support to the joint. The fastenings of the chairs used on the L. & N.W.R. are, as far as we can judge, a screw and a spike. In some cases we noted a treenail instead of the spike, and somewhere—we forget where—we have seen a hollow treenail used with a spike driven through it. (2) We append a sketch of the L. & N.W.R. bull-headed rail which, we believe, weighs somewhere about 90 lbs. per yard. The section was obtained from the rail itself and, therefore, we cannot give you the standard dimensions in micrometer sizes. You will find further particulars of rail sections in the "British Standard Specifications and Sections of Bull-headed Rails," a report issued by the Engineering Standards Committee (L. S. Robertson, secretary). London: Crosby Lockwood & Son, Stationers' Hall Court, E.C. (3) The drawing (Fig. 2) shows the L. & N.W.R. pattern chair and key. Chairs, as far as we remember, weigh from 38 to 40 lbs. each. You will note that the *support* for the rail projects beyond the jaws, being practically 8 ins. long—that is slightly longer than the width of the chair. The oak keys measure 3¼ by 2¼ by 6 ins. long, and are pressed to shape under great pressure. (4) The fishplates measure 20 ins. in length and bear on the two heads when screwed up, the sides not touching the webs of the rails.

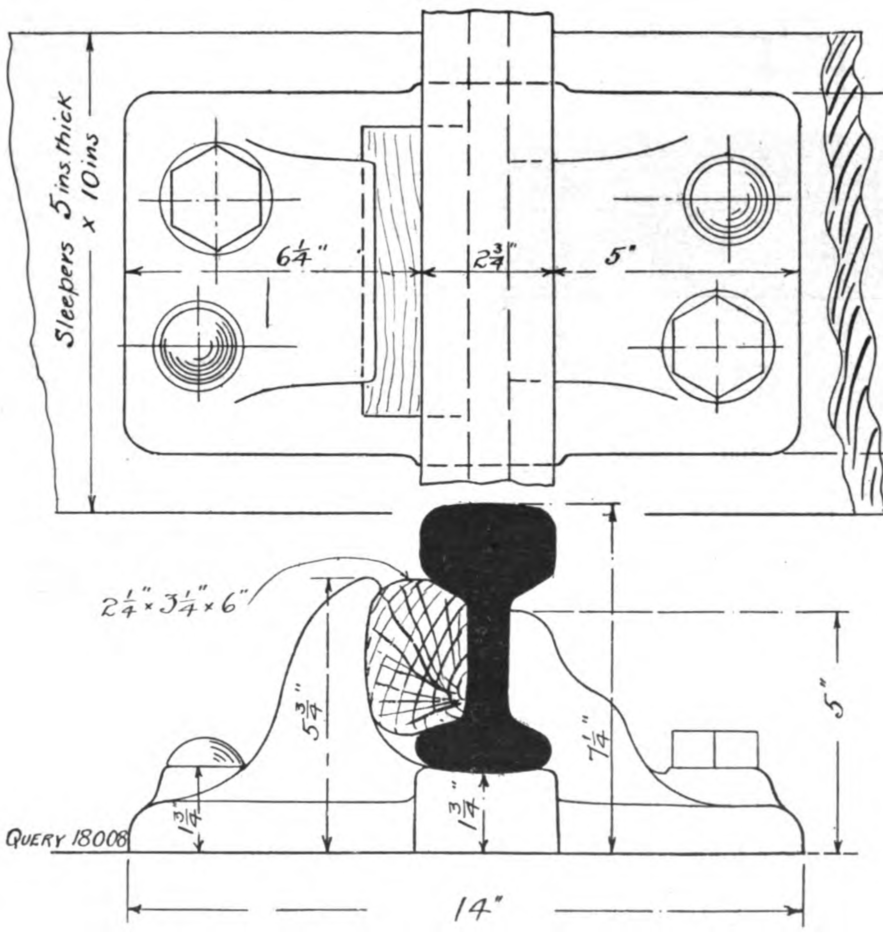

FIG. 2.—L.N.W.R. CHAIR, SHOWING RAIL KEY AND FASTENINGS IN POSITION.

(*Quarter full size.*)

[17,881] **Motor Liner and its Machinery.** W. P. (Bedford) writes: I am about to make a model Atlantic liner, 6 ft. long by 11 ins. beam by 9½ ins. deep, so I would be glad if you would assist me by answering the following questions. (1) Are the above good measurements? (2) What size boiler should be used for a boat like this, without tubes if possible? Could a satisfactory boiler be made out of steel? If so, what thickness of steel? (3) Should a large spirit or blowlamp be used? (4) What size engine ought I to use to drive the boat at a moderate speed? Would an engine 1-in. bore by 1-in. stroke be large enough? What diameter should the propeller be? I am only going to use one. (6) What is basswood mentioned by R. H. Collet in the recent article on the construction of a model Atlantic liner hull?

(1) The usual proportions of beam and length are about 1 to 10, but, of course, in a model, owing to the different disposition of weights an adherence to exact proportions is impossible. (2) See "Model Boiler Making." The difficulty in making a respectable model of a liner to work by steam lies in the fact that the top hamper will be found very much in the way. You must use copper or brass. A steel boiler, which would be safe, and allow for the effects of corrosion, would be too heavy. (3) The most *convenient* form should be used. (4) A ⅝ by 1¼ by 1-in. compound would do very well, working at about 70 lbs. pressure, and an engine with a single cylinder 1 × 1-in. would do just as well, but, of course, a compound engine looks better in a liner. The propeller may be 3½ or 3¾ ins. diameter and 6-in. pitch. (6) *American Linden or Lime*, sometimes confused with American whitewood, which is really tulip tree.

[18,079] **Engine for Steam Launch.** R. H. M. (Brighton) writes: I am about to make engines for a steam launch 35 ft. long which I want to run at about 12 miles an hour. What class of engine do you advise—compound or a two-cylinder simple? What bore and stroke?

If you adopt a boiler which requires only natural draught, then by all means employ a compound condensing engine. The matter of designing the engine for the given speed is beyond our scope entirely.

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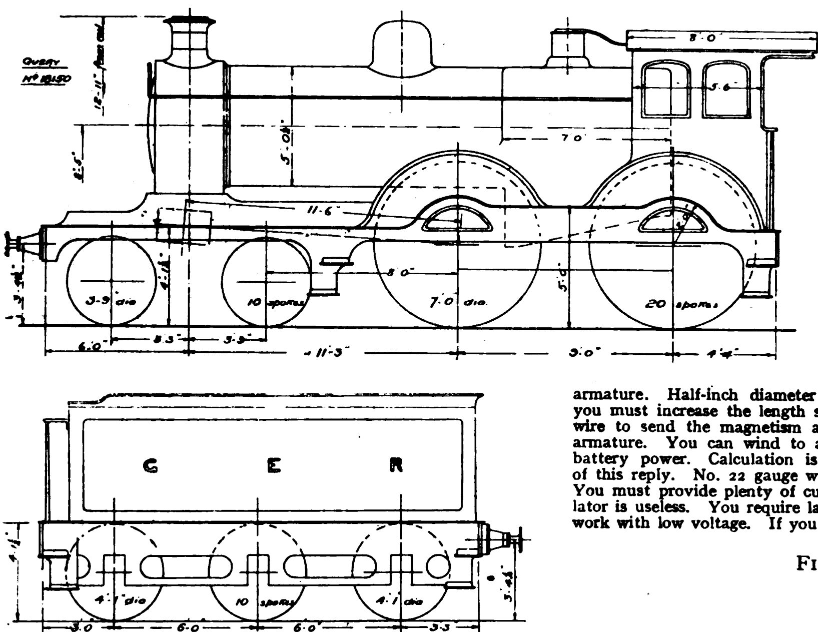
[18,150] **The "Claud Hamilton" and the Newer "Belpaire" Express Engines.** SEVERAL READERS write asking for drawings of the "Claud Hamilton" and the newer "Belpaire" express engines now running on the Great Eastern Railway. We may mention that although the plates of working drawings of the "Claud Hamilton," of which we had a limited stock, are quite exhausted, we are still able to supply copies of *The Railway Engineer* for May, 1901, containing the drawings of this engine. The price is 1s. 6d. net, or 1s. 8d. post free. We reproduce a diagram herewith, taken from an official drawing of the later 4—4—0 type engines with "Belpaire" boilers. The diagram we have shows the engine with the ordinary pattern dome, but, as



THE G.E.R. 4—4—0 TYPE ENGINES WITH "BELPAIRE" BOILERS.

will be seen by the photograph of No. 1,855, reproduced in the "The World's Locomotives," the engines have flat-topped domes. It will also be noticed that the sandbox is not placed as in the "Claud Hamilton" in front of the driving splasher, above footplate level, but is behind the front step, the position of which has also been altered. Apart from these details, the builder of a model of the later engines may follow the dimensions given on the above-mentioned working drawings. The exact curvature of the roof is not at the moment obtainable, but if you make the height in the centre about 8 ft. 9 ins. from footplate level and the edge 7 ft. 6 ins. you will not be far out.

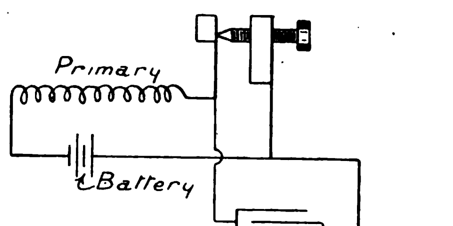
[18,028] **Boiler for Model Turbine Boat.** A. H. B. M. writes: I want the boiler to drive a turbine (*Re* Query 17,975). for a boat. The boiler must evaporate 2 cub. ins. of water a minute; the exhaust steam could easily be used to induce draught. Small coal or charcoal would be used to fire the boiler. I suppose it is not much use using anything except superheated steam for the turbine?

We would recommend a boiler which requires very little external aid in the matter of draught. You might try the design shown on page 50 of "Model Boiler Making," or the "Yarrow" type on page 48 (new edition). The heating surface of the tubes should be about 130 to 160 sq. ins. To prevent priming, which will occur if the steam is drawn off too rapidly, see that the nozzle of the turbine is of such a size that it will not pass a greater quantity of steam than the boiler can supply. It is not wise to check the exhaust of a turbine; the efficiency largely depends on the lowness of pressure on the exhaust side. Otherwise, you would do better with a reciprocating engine,

[18,016] **Electro-Magnet to Lift 10 lbs. at 1 in.** R. B. A. (Lochgelly) writes: I have made an electro-magnet which can lift 28 lbs. coupled to a 4-volt accumulator. I intended using it to work a little model, having a resistance of about 10 lbs., armature requiring to be attracted from about 1 in. away; but on fitting up this magnet, I found that it would only draw it a fraction of an inch. Would you kindly let me know how to make a magnet to work the above model? The core I have is ½ in., Lowmoor iron, wound with No. 22 D.C.C. I have a plain spark coil for a motor cycle which is giving a large spark at the primary "make-and-break," and a very weak and thin spark at the secondary terminals. When taken out condenser was fitted one end to T for "make-and-break," and one end to M (secondary). I have put on a new primary (two layers) and have rewound the secondary and connected condenser as at first, but the result is the same. I have now converted it into a trembler coil and can get about ⅛-in. spark at secondary terminals, but there is still excessive sparking at primary contacts. The condenser was also altered thus—one end to contact pillar and other end to armature spring. Could you please give me an idea as to what is wrong with it?

You will require to make a much more powerful magnet to pull a distance of 10 lbs. at 1 in. See THE MODEL ENGINEER for June 1st, 1901, page 243. The power falls off enormously as the distance of the armatures from the magnet poles is increased. The magnet should be horseshoe pattern so that the two poles pull upon the armature. Half-inch diameter iron is quite large enough, but you must increase the length so as to get on a great deal more wire to send the magnetism across the gap between poles and armature. You can wind to a depth equal to ½ in. Also add battery power. Calculation is intricate and beyond the scope of this reply. No. 22 gauge wire is too thin; try No. 16 gauge. You must provide plenty of current. A pocket pattern accumulator is useless. You require large size cells if you are obliged to work with low voltage. If you work from electric light supply or

FIG. 2.



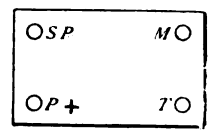


FIG. 1.

similar voltages the magnet should be wound with fine wire. *Re* spark coil. The condenser should be connected across the break. Motor cycle circuits are arranged to use the frame of cycle as a part of the system, but the condenser must be connected on this principle. If you trace out circuits you will find where the break is. Perhaps your condenser does not suit the coil. Try a condenser of larger capacity. You could make a second one and try it in parallel with that at present in use.

[18,092] **1½-in. Scale Locomotive with Water-tube Boiler.** A. J. G. (Bradford) writes: I am starting to make a four-wheeled tank engine for a 1½-in. scale railway (7¼-in. gauge), and should be greatly obliged if you would give me a little help and advice. Are the following dimensions suitable for such an engine:—Cylinders, 1¼-in. bore and 2¼-in. stroke (outside); wheels (coupled), 5 ins. diameter on tread; axles, ⅞ in. diameter; boiler (water-tube), similar to design to one given on page 192 of "The

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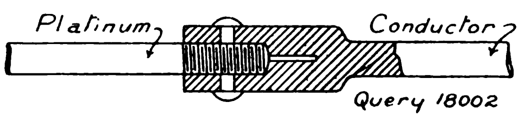
Model Locomotive," by Henry Greenly, 5 ins. diameter and 24 ins. long, made of copper 3-32nds in. thick, outside diameter 7½ ins.; frames (steel), 36 ins. long, ¼ in. thick; wheelbase, 10 ins.; pressure, say, 50 lbs.? Please say how many Primus burners would be needed to heat the boiler. I want the locomotive to pull two adults and truck to ride on (say, 350–400 lbs.), and should be glad if you could tell me whether the above dimensions are unnecessarily large or not, as I wish to keep the cylinders and boiler as small as would be compatible with the power required.

The proportions you have chosen are good and no doubt you can arrange the firebox to extend over the driving wheels and at the same time clear the eccentrics. Maximum width of firebox is not required in the boiler mentioned. As you will see by the recent article (issue of September 12th) the boiler has proved a success, and where you wish to use oil fuel we can advise its adoption. The Primus silent burners are very good and four should work the engine well, but the non-silent pattern stand rougher usage, and six of such burners should give excellent results. These burners are made by the same people and are called the "Intensive." Four burners would do, but you would have to "push" them and then they would be rather noisy. Therefore, you had better use six burners and not work them so hard. There will not be room for more than four silent Primus burners. You can obtain good castings for a 5½-in. driving wheel, therefore you can save the trouble of making a pattern by adopting this size. Send us your general arrangement drawing when completed for our perusal and criticism. Of course, you will get a greater evaporative power from a coal-fired boiler of good design on a continuous track owing to the efficacy of the blast, but there is not much room for a firebox of ample dimensions on a four-wheeled locomotive without excessive overhang at each end.

[18,002] **Specific Resistance of Platinum.** G. B. W. (Oakham) writes: I should esteem it a great favour if you will reply to the following questions. (1) What is the specific resistance of platinum? (2) What would be the price of a piece of No. 14 S.W.G. and 1½ ins. long? (3) What current would be required to maintain a piece of above dimensions at a bright red heat? (4) What is the best method of jointing same to a pair of rigid conductors, allowing as little as possible of the platinum to be taken up in the joint but at the same time making a sound mechanical connection?

(1) According to Matthiessen, specific resistance of annealed platinum is 8·98 microhms per cubic centimetre at 0° C., it has approximately six times the resistance of copper. (2) Apply to



METHOD OF JOINTING PLATINUM TO CONDUCTORS.

Messrs. Johnson and Matthey, platinum refiners, Hatton Garden, London, E.C. (3) Cannot be stated as the influence of connections and surrounding air require to be taken into account. You may determine it approximately from Preece's formula for passing current C in amperes = $a\,d\,3/2$. Where a has a value of 5172 for platinum, when d the diameter of the wire is taken in inches. It will be a comparatively heavy current perhaps, 30 amps. or more. (4) We suggest a screwed joint; that part forming the socket being split and a rivet put through to clamp the platinum tightly as sketch.

[18,083] **Converting Small Motor to Alternator.** H. H. C. (Guildford) writes: I have just bought a small electric motor and I wish to convert it into a small alternator to be used with small steam engine, the current going throuhg a step-up transformer and then to ordinary handles for shocking purposes. The motor is like those sold by Marshall & Woods, and has a tripolar armature 1¾ in. long by 1½ ins. diameter, and a single field coil. Could you put me on the right track to make a "bit" of it? I intend to excite it with the current from a bichromate battery. I am under the impression that I could get sufficient current more easily like this than with a continuous current dynamo.

You will not obtain much effect by a simple arrangement of alternating current and transformer. To convert your motor into an alternator for this purpose, you should fit a Siemens H pattern armature instead of the tripolar armature. In place of a commutator the two ends of the coil are to be connected to two insulated contact rings as sketch. We think you will have more chance of success by using the armature as it is, but the commutator slots cut much under so that the brushes break contact as they pass over the slots. If you fail to get a strong shock, make an induction coil as described in our Handbook No. 11 with reference to Fig. 7, page 19. Try it without a contact-breaker and connect the wires from brushes to W and S in the figure referred to. The idea is that the commutator with widened slots takes the place of the contact-breaker. Your machine is, however, so small that you may not obtain very powerful shocks.

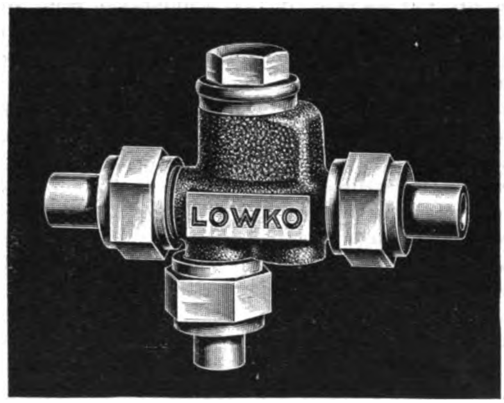
The News of the Trade.

[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 New Model Injector.

We call the attention of our readers who are constructing small-power boilers or large scale model locomotives to the new and neatly designed injector which Messrs. W. J. Bassett-Lowke and Co. are now manufacturing. We understand that the No. 1 size (3-16ths-in. diam. pipe) which has been sent to us has put 5 pints of water into a boiler in 8 minutes at 30 lbs. pressure under a



W. J. BASSETT-LOWKE & CO'S NEW MODEL INJECTOR.

recent test, being nearly 20 cubic inches per minute. This fitting should meet with a large sale, judging from the many enquiries we receive as to where a reliable injector can be obtained at a reasonable price. A proper check valve should be used, and particulars of these, together with prices of injectors, which are made in four sizes, and suitable for work up to ¼-h.-p., can be had from the above firm.

* Small Dynamos and Motors.

Mr. H. Smyth, of 37, Ravenscourt Gardens, London, W., is now making a speciality of small electro-motors and dynamos. Specimens have been sent to us for inspection of a small 6-volt 3-amp. dynamo, with an 8-part commutator suitable for charging accumulators. The machine, which is illustrated in our advertisement pages, is substantially made, and we consider the price is very reasonable. Another specimen we have before us is a novelty in the form of a small electro-motor suitable for driving a model tram-car, etc., or a small fan may be attached to the spindle. Special terms to the trade may be had upon application, enclosing trade card.

New Catalogues and Lists.

W. Canning & Co., Birmingham, and at 18-20, St. John's Square, Clerkenwell, E.C.—The general catalogue we have received from this firm has reference to numerous appliances which are frequently required by readers of this journal, comprising electro-plating machinery, appliances, chemicals, and materials; outfits for nickel-plating, silver-plating, gilding, copper- or brass-plating, electro-tinning, and the "Canning Amateur Plating Outfit," which contains everything necessary for the work in an experimental way. The lists also include polishing, burnishing, and bronzing apparatus and materials.

H. Wilton & Co., Lockerley, Romsey, Hants.—We have received from the above, lists giving prices of castings and parts, also of finished petrol motors for attachment to bicycles. Also a special clearance price list of outer covers (puncture proof and ordinary). We notice a substantial reduction in the usual prices. The lists will be sent to any reader making application and enclosing a stamped addressed envelope.

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The Editor's Page.

THE day for the opening of THE MODEL ENGINEER Exhibition is close at hand, and by the time our next issue is published the gathering at the Royal Horticultural Hall will be in full swing. That it will be a wonderful show will have been expected from the various announcements which have been made in these pages from time to time, but its full importance and exceptional interest to the model engineering world will only be realised by an actual inspection of the exhibits. We are not yet at liberty to disclose any secrets with regard to the various trade arrangements, but we may say that a number of firms are preparing displays of an exceptionally attractive character. Many novelties of great interest to model makers will be shown for the first time, as well as a thoroughly representative collection of lines which have become more or less standard articles of trade. The Society of Model Engineers will be represented in strong force by some of the best examples of their members' work, while they will show their new locomotive testing-stand in operation, and several model locomotives at work on their track. The Victoria Model Steamer Club will have some twenty or so of their model fleet in evidence, and will welcome all marine modellers at their stand. An excellent show of readers' work will be made in connection with our Competition, and in the private loan section some magnificent examples of model engineering of all periods from the days of Trevithick will be seen. Fascinating lectures and demonstrations will be kept going from early afternoon till late at night, and the whole show will be a modern scientific wonderland.

* * *

THE MODEL ENGINEER will, of course, have a stand, where books and papers and other things wherewith to gladden the heart and enlighten the mind of the model enthusiast will be on sale. Adjoining this will be a cosy little reception-room, where we shall be glad to see as many of our readers as may like to look in. An appointment register will be kept, so that readers or contributors who may wish to meet one another may be brought into touch, and we hope the Exhibition may be made the means of creating many new friendships and cementing many old ones.

* * *

Don't forget—the Exhibition opens on Tuesday next at 11 a.m. Come early, and come often—there will be lots to see.

Answers to Correspondents.

W. J. K. (Dublin).—Please conform to the rules of our query department.

G. H. (Clifton).—There is a note on page 243 of issue for March 15th, 1906, which may help you. See also the articles on "Metal Finishing, Polishing, Colouring, and Lacquering" in issues for May 18th, 1905; September 28th, 1905, and

F. D. (Berks).—The recent replies *re* conversion of small gas engine to run on oil and petrol apply to your case also. You do not need a large mixing chamber, but otherwise your arrangement should work. We have an article in hand on this subject, and will deal with the governing of small engines also at the same time. You could get a good idea of what is required in the way of governing from the articles on "THE MODEL ENGINEER Gas Engine," which commenced at the beginning of Vol. XIV.

"PERPLEXED."—1¾ b.h.-p. would be required to drive your machine.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

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Contents.

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

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THE

Model Engineer

And Electrician.

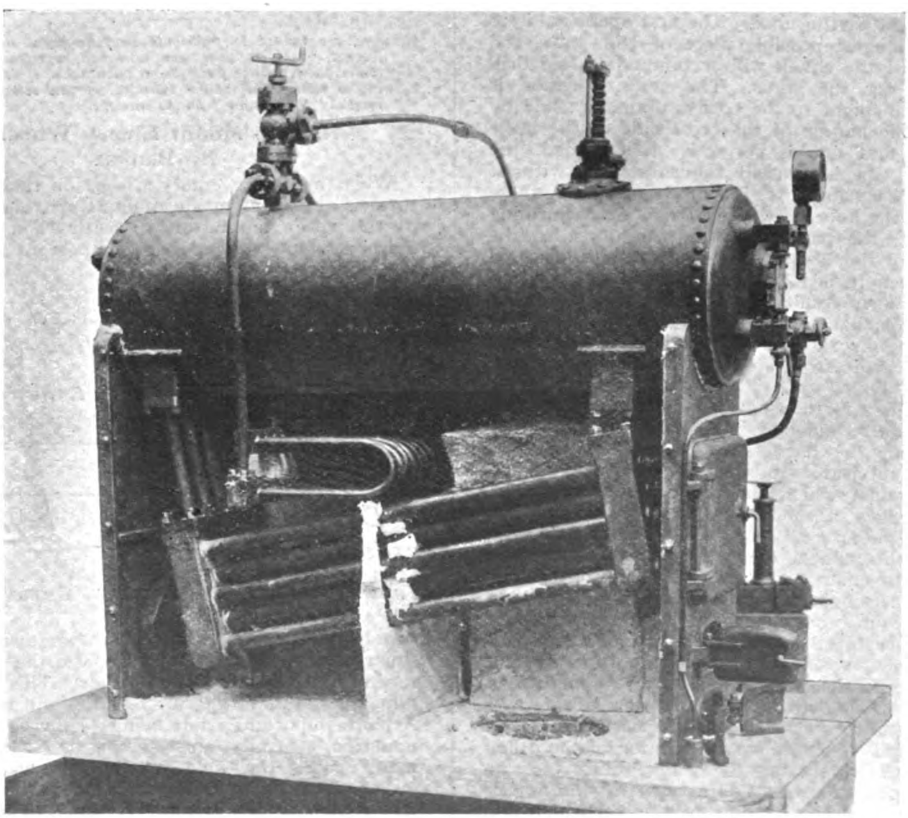
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 339. OCTOBER 24, 1907. PUBLISHED WEEKLY.

Model Babcock and Wilcox Type Water-tube Boiler.

By W. G. CORNER.



VIEW OF MODEL WATER-TUBE BOILER, SHOWING SIDE CASING REMOVED.

(*For detail drawings see pages 396—397.*)

THE accompanying drawings and photograph illustrate a model water-tube boiler recently completed. This, it will be seen, is on the lines of the Babcock & Wilcox boiler, but is not a scale production. The boiler has been designed entirely with the idea of providing a satisfactory working model and one which, while retaining a reasonably "scale" appearance, shall be as simple as

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possible to construct. The design is of ample strength for a working pressure of 75 lbs. per sq. in., and the boiler shown in the photograph has been tested to 160 lbs. per sq. in. The shell is formed of 4-in. seamless copper tubing, No. 16 W.G. thick and 14 ins. long. Gun-metal castings are used for the ends, headers, and saddles, and the total effective heating surface is 326 sq. ins., with a superheater surface of 37 sq. ins. A boiler of this design has the great advantage of containing a considerable amount of water in proportion to its heating surface, and it also has ample steam space. It will evaporate 5½ cubic ins. of water per minute, with one No. 5 Primus burner. All parts, it will be noticed, are easily accessible for cleaning or inspection, should this at any time be necessary.

Although, perhaps, at first sight it may appear that there is a considerable amount of work in the boiler, it is all of the simplest character, and can be undertaken with quite a moderate equipment of tools. A few notes on the method of construction may perhaps be useful to some.

The caps for the water tubes (46 in number) may appear rather a tedious job, but these are all made with a parting tool. The first operation is to take the longest possible piece of ½-in. brass rod which the lathe chuck will accommodate and drill this ⅛-in. for the stays. The next operation is to turn the spigot to the correct diameter: and by marking the handle of the cross-slide of the lathe after the first one is correctly dimensioned, the remainder can be turned the same size without further measuring. It is important that these should fit the holes in the headers. After finishing the spigot, the parting tool is run down to the diameter of the boss for the nut, and the curved portion then turned away. This will not produce such a uniform result as a forming cutter, but for work of this character absolute uniformity scarcely seems necessary. The joints under these covers should be made from stout unglazed brown paper soaked in boiled oil. The easiest way to make these washers is to use two hollow punches—one ½ in. diameter, and one ⅜ in. diameter.

In drilling the headers for the water tubes it would be advisable to first plane or file up the surface against which the cover joints are made, also the edges of the flanges, and solder the two castings together. A ⅜-in. twist drill can then be put right through the four surfaces, and there is no necessity to enlarge any of the holes for passing the tubes through, as by first entering the whole of the tubes into one header they can subsequently be pressed into the second by the use of a steel rod to guide the tube ends into position. In fitting the water-tube portion to the shell the best method is to assemble the two headers, water tubes, and flanges, then to secure one saddle permanently to the shell and locate the exact position of the other on the shell by placing the water tubes, etc., in position. Any necessary adjustment of the angles of the flanges or the bending of the vertical water tubes can be then made. If the two saddles were first fixed according to the actual dimensions on the drawing some little difficulty might be experienced in getting the correct angle of the water tubes and flanges.

For riveting the gun-metal ends in position it will be necessary to use a piece of ⅜-in. square iron, with one end bent at right-angles and passed through the manhole to form a holder-up. The rivets can also be placed in position through this same hole with a bent piece of tin forked at one end.

It is recommended that the ½-in. vertical water tubes, at the front end at least, be silver-soldered to their flanges, as, owing to the short length and curvature, it is difficult to get these thoroughly expanded into the flanges. The twenty-three ⅜-in. water tubes can be kept satisfactorily tight by expanding them with a hardened taper drift, the taper being as small as possible.

The eight screwed stays in each header may at first sight appear unnecessary, in view of the number of longitudinal stays which pass through the tubes, but the former are required to resist the pressure put upon the header in tightening up the covers, and they should not be omitted.

I should mention that the steam pipe shown in the photograph is temporary for testing, 5-16ths being the proper size. The asbestos baffle shown has been displaced by the removal of casing.

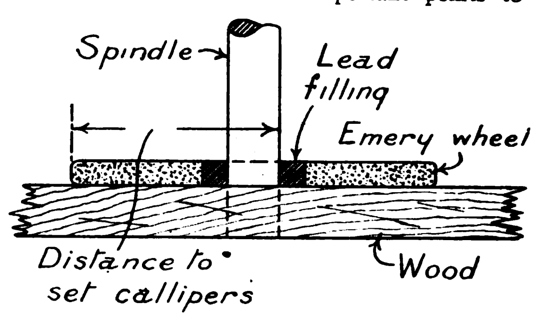
Workshop Notes and Notions.

[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.]

How to Mount Emery Wheels.

By Bridge.

When mounting emery wheels on their spindles, there is always a certain amount of trouble caused by the wheel running out of truth when the job is finished. One of the most important points to



Showing Method of Mounting Emery Wheels.

watch is that the faces of clamping washers are square with the axis of spindle, also the same with regard to the nut and washer. This is easily remedied by mounting in the lathe and trueing up. A more important point being—How is the wheel mounted centrally on the spindle? In a great many cases the hole in the emery wheel is larger than the spindle, and the position of the wheel on spindle is guessed, and tightened up, when it runs fairly true. The objection to this method is obvious, viz., that when pressing fairly hard on the wheel, it at once shifts, and generally plays havoc.

A much better plan is to turn a piece of steel the exact diameter of spindle on which the wheel is to be mounted, and place it into a piece of wood, as shown in sketch, and place the emery wheel on the wood. Care must be taken to get the spindle

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set square in relation to the wood. Place the wheel as central as possible, and measure carefully from the outside edge of wheel to the opposite side of shaft, continuing all the way round. The distance at which to set the callipers is easily calculated from the diameter of the wheel and spindle. When all is carefully adjusted, pour with lead, filling up the space between the spindle and the hole in the wheel. This method will be found to give excellent results, and there is nothing to be afraid of in buying a wheel with a larger hole than the size of spindle. When clamping up the wheel a couple of cardboard discs inserted between the clamping washers and the wheel will increase the driving friction without tightening up so much as to risk cracking the wheel.

How to Make Screw Pitch Gauges.

By T. Goldsworthy-Crump.

A set of screw pitch gauges should find a place in every workshop, and the following method, if carefully carried out, will produce a set which will meet all amateur requirements. There are many variations of shape which may be adopted, but for simplicity perhaps the "key-ring" pattern is preferable, a minor advantage being that additions can be made at any time of any odd or particular pitch.

Having obtained some thin rolled brass, say

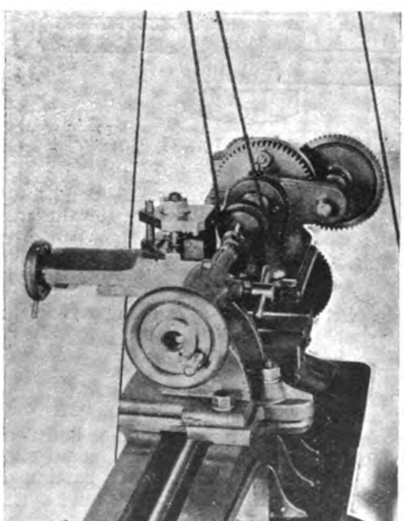

Fig. 1.—General Arrangement.

1-64th in. thick, it should be cut into strips of a size sufficient to allow for finishing to dimensions shown in Figs. 2 and 3. The strips should now be filed smooth—if required—and well polished.

The general arrangement for cutting the teeth is shown in Fig. 1. The spindle, taken from a vertical cutting frame, is placed between centres and driven by the overhead, the cutter being formed as shown in Fig. 5. If such spindle is not available, a substitute can easily be made, as shown in Fig. 6. The strips of brass are held in a block of hardwood, slotted with a sawcut at centre height, as shown in Fig. 4, which slot is closed on the strip by the tool clamp of slide-rest, thus holding all firm.

The foregoing having been rigged up, a strip of brass is taken and placed in slot of wood block,

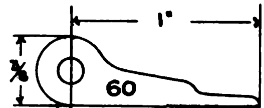

Fig 2.

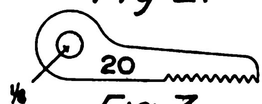

Fig 3.

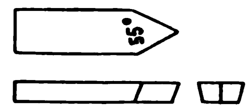

Fig 5.

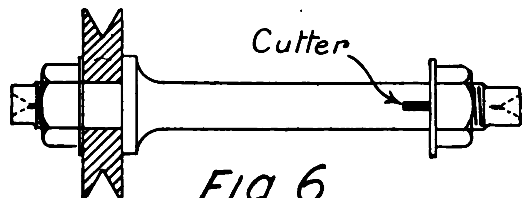

Fig 6

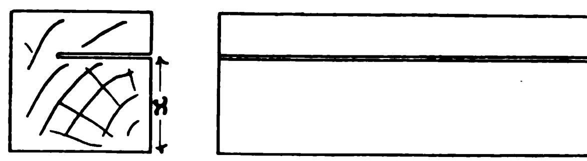

Fig 4.

Showing how to Make a Screw Pitch Gauge. (*Not to scale.*)

and roughly adjusted parallel to lathe centres and the clamping nut tightened. The cutter is then revolved at a high rate, and just the edge of the brass brought into penetration, the slide then being traversed so that a perfectly straight edge is produced.

As it is desirable to commence with the finest pitches, the change wheels are arranged to cut sixty teeth per inch. The slide-rest is adjusted so that cutter comes opposite one end of brass strip and the lead screw brought into engagement. The mandrel head is now revolved either forwards or backwards until all slack or back-lash is eliminated and the nut controlling the back-gear is at its highest point. The cutter is then put in motion and driven as fast as possible, and the cross-slide advanced so that a small V is cut in edge. A stop should now be fixed, so as to give the same penetration for each cut.

The cross-slide having been withdrawn, the mandrel head is given one revolution by hand in the same direction as at commencement, the nut being brought vertically as before and the cross-slide advanced and withdrawn. This process is repeated thirty times, and will produce a gauge ½ in. in length.

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A fresh strip is now placed in holder and change wheels arranged for cutting 48 teeth per inch, the same procedure being followed with the exception that only twenty-four teeth are required. The remainder are produced in a similar manner, the number of teeth being reduced so as to only occupy ½ in. in length.

A fairly complete set of gauges for amateur use would contain the following numbers—60, 48, 40, 38, 36, 34, 32, 30, 28, 26, 25, 24, 22, 20, 19, 18, 16, 14, 13, 12, 11, 10, 9, 8, and the change wheels required for these thread rates, with eight-thread guide-screw, are as follows :—

Threads per in.	No. of Teeth on Mandrel Wheel.	No. of Teeth on Guide Screw Wheel.	Intermediate. No. of Teeth Driven.	No. of Teeth Driver.
60	20	50	60	20
48	20	60	40	20
40	20	50	60	30
38	20	50	38	20
36	20	45	40	20
34	20	85	—	—
32	20	40	60	30
30	20	50	30	20
28	20	35	60	30
26	20	65	—	—
25	20	50	25	20
24	20	60	—	—
22	22	55	—	—
20	20	50	—	—
19	40	50	38	20
18	20	45	—	—
16	20	40	—	—
14	20	35	—	—
13	40	65	—	—
12	20	30	—	—
11	40	55	—	—
10	40	50	—	—
9	40	30	30	20
8	30	30	—	—

If it be desired to cut a set for metric pitches, the following table will give the thread rates :—

Pitch in M.MS.	Wheel on Mandrel.	Wheel on Screw.	Intermediate. Driven.	Driver.
·50	20	63	60	30
·75	20	63	40	30
1·00	20	63	—	—
1·25	50	63	40	20
1·50	30	63	—	—
1·60	20	63	30	50
1·75	35	63	—	—
2·00	40	63	—	—
2·25	45	63	—	—
2·50	50	63	—	—
2·75	55	63	—	—
3·00	60	63	—	—
3·50	35	63	20	40
4·00	40	63	30	60
4·50	40	63	20	45
5·00	40	63	20	50

The cutting of the teeth having been completed, the strips should be assembled and clamped together with their serrated edges and ends in line. The hole for the split ring should then be drilled and the curved ends filed to shape.

The plates containing the fine pitches should be cut or filed as shown in Fig. 2, so that nuts and internal threads may be measured.

It is necessary that each gauge be numbered with its thread rate, and as a set of small figures may not be available, the following plan should be adopted.

A small quantity of beeswax or composite candle is melted in a metal ladle or pot, and each plate is dipped, withdrawn, and allowed to cool. An etching needle or similar instrument is used to scratch the figures through the wax, after which a drop of nitric acid (*aqua fortis*) is applied and allowed to act for a few minutes. The acid is then washed off and the wax removed by heating or dissolved with benzoline or petrol.

The gauges are now complete, and may be finally polished and lac- quered. Care must be taken that there is no back-lash any where and that the brass strips do not project more than the depth of the tooth. The cutter must be driven at a high speed and kept sharp. If it is wished to cut the gauges in steel, a V-shaped milling cutter should be used in the same manner as the fly cutter, except as regards speed.

A Non-slipping Hinge Joint.

To make a hinge joint that will not slip, yet must be adjustable (a contributor to *Popular Mechanics* says), use round stock and cut threads

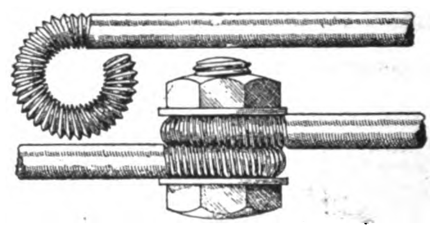

FIG. 1.

FIG. 2.

A NON-SLIPPING HINGE JOINT.

on one end of each of two pieces. Bend an eye in the end, as shown in Fig. 1, where the threads have been cut. Clamp the two ends thus bent together with a bolt, as shown in Fig. 2.

Simple Nut and Screw-making Attachment for a Lathe.

By A. P. WHITE.

Following is a description of my nut and screw-making attachment for a small lathe :—

Referring to the drawings, the body of the attachment is a casting. A is the small slide-rest which actuates the parting tool for parting off the bolts. B is a circular disc of ¼-in. mild steel case-hardened, drilled with various size holes corresponding to size of hexagon bars, etc., being used. This acts as a stay while bolts are being turned or parted. C is a mild steel block drilled as in Figs. 1 and 4, which are sectional plan and side elevation, respectively. The hexagon or round bar revolves in the tapered portion, while the drill, which is made of ¼-in. steel (round) is fed up by back centre, as shown in Fig. 1. Since the ¼-in. hole at the opposite end of block is drilled central with the taper hole, it follows that the hole drilled in the hexagon bar must be central.

The stay B is fastened to a bracket on the casting and is adjustable. It is set by a ¼-in. bolt. The steel block C is also adjustable crosswise, and is held in the centre of the casting, which is raised,

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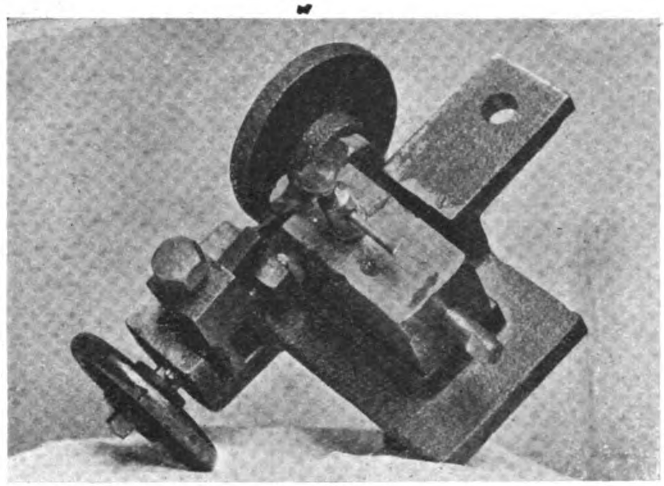
to fetch the centre of the tapered hole in line with lathe centres. This block is cast steel and hardened, and is fastened to the casting by two 5-16ths-in. studs.

The method of using is to chuck a piece of hexagon rod in a suitable self-centreing chuck, adjust the stay to suit the size of the rod, and advance the *compound slide-rest* till the rod is through the stay and hard home in the tapered hole in the block. The drill is then fed in by the back centre till the tapping hole is drilled to the desired depth. The *compound slide-rest* is then run back from the rod. Meanwhile the gauge on the top of the block is set to the desired thickness of nut and the nut parted off by the small rest on the casting.

For screw-making or bolt-making the tool in small rest is set half-way across the stay hole corresponding to the diameter of the desired screw. The rod is then fed through the stay hole by the *compound slide-rest* until the length of the screw is cut. This method is also used for making the drills for use with the machine, which are turned down to size of drill and filed flat for cuttings to clear.



General View of Nut and Screw-making Attachment for a 3½-in. Lathe.

In the drawings Fig. 1 shows a general plan with the block in section. Fig. 2 shows front elevation, with bracket for clamping to slide-rest, the disc being cut away to show this. Fig. 3 shows view with the disc removed, and the bracket to which the disc is clamped is shown with the elongated hole for adjustment. Fig. 4 is a sectional side elevation of the block showing method of fastening to the casting, also the adjustment gauge for thickness of the nut. All the drawings are full size, and are fully dimensioned.

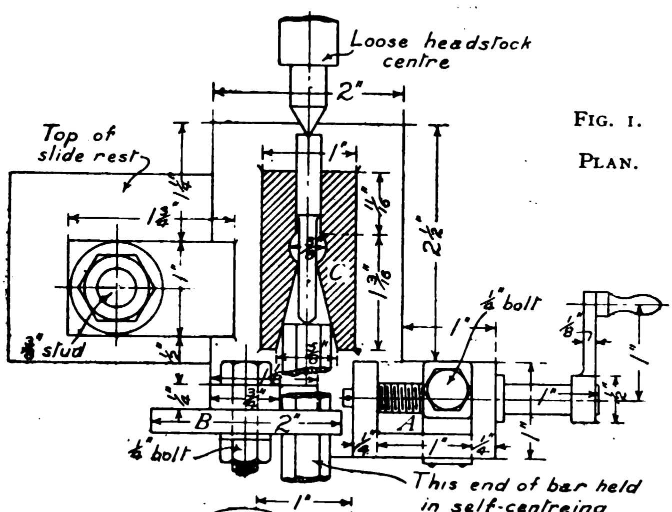


Fig. 1.

Plan.

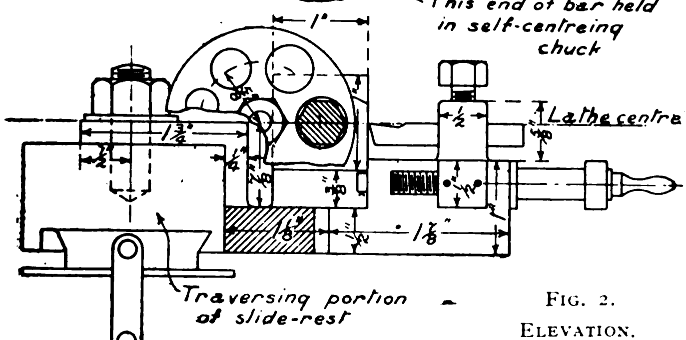


Fig. 2.

Elevation.

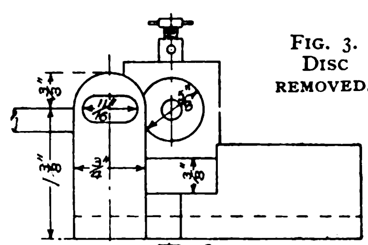


Fig. 3.
Disc removed.

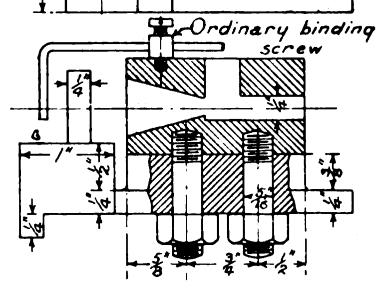
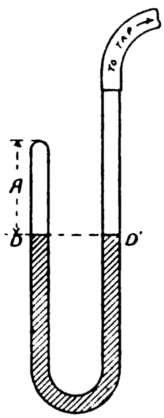


Fig. 4.—Section of Block.

A Simple Method of Finding the Water Pressure of a Tap.

By E. W.

The following method of finding the water-pressure of a tap is based upon Boyle's law, which is as follows: "The volume of a gas varies inversely as the pressure, the temperature being constant," and as the temperature will be constant, this part of the law need not be taken into account. Get a glass tube of about ¼-in. bore and a foot in length. Close one end by heating in a blowpipe or Bunsen, and blow gently down the tube to get a nice symmetrical end. Then bend to shape shown in figure, by heating in the ordinary luminous flame. To facilitate matters it had now best be mounted on a small wooden stand. Pour a little mercury into the tube up to a level, D (holding the tube sideways to let the requisite amount of air escape from the closed end), so that we have a certain volume of gas (air) enclosed in the tube. As everyone knows, the atmospheric pressure is approximately 14 lbs. per sq. in., and as this pressure acts in all directions, it follows that there is a force equal to 14 lbs. per sq. in. acting on the surface of the mercury at D′, and therefore acting on the surface D, so that we have a quantity of air (A) under a pressure of 14 lbs. per square inch.



Now connect on to the tap, as shown, by a piece of rubber tubing and turn on the water. Suppose the air A now occupies only a third of its former volume. By the law it is evident that the total pressure (water plus atmosphere) on D1 is equal to three times the atmospheric pressure = 3 × 14 = 42 lbs. per sq. in., since the air at A occupies only a third of its former volume, so that the water pressure = 42 – 1 atmosphere = 28 lbs. per sq. in.

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. — Wednesday, November 13th: The Annual General Meeting will be held at the Cripplegate Institute, Golden Lane, E.C., at 7 p.m. Any member wishing to move an alteration or addition to the Society's rules at this meeting is invited to write to the Secretary on the matter, who will also be pleased to receive any suggestions for the increased usefulness of the Society to its members for consideration and discussion at that meeting.—HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

G.W.R. ELECTRICAL EQUIPMENT.—The electrical arrangements in connection with the working of traffic on the Great Western Railway necessitate the use of some 135,000 primary battery cells, 30,000 block and other telegraphic instruments, 4,500 telephones, and 19,000 miles of wire.

Engineering Works and Accessories for Model Railways.

By E. W. TWINING.

WHEN, a little more than two years ago, I wrote for "Ours" an article entitled "Picturesqueness in Model Railways," I was strongly of the opinion that the modelling of railway stations—and, in fact, of anything which it is usual to make of light woodwork—was a useless practice where such stations, etc., were required to be placed permanently out-of-doors. It is a fact that small wooden structures will *not* stand the weather when placed on the ground level or partly buried in the ground. It was principally this idea, which I have since proved to be well founded, which caused me to discredit the model station.

When, therefore, the Editor, a little while ago asked me if I would treat on the subject of model stations in these pages and give some designs for same, I was in somewhat of a dilemma, and, to use a common expression, had to put on my thinking cap. At last, after some thought and a little experiment, I arrived at a method by which all the structures on a miniature railway—not only station buildings and platforms, but bridges and tunnel fronts—can be made quite permanent, in fact, absolutely so, as regards being weatherproof, and practically indestructible, except perhaps by earthquake.

Having found a way to the making of permanent stations, I felt quite willing to waive the other two objections to them which I raised in my former article. These were the lack of miniature passengers, making the stations from a practical point of view objectless, and the difficulty of stopping the trains neatly at the platform except by hand, which method is, to say the least, undignified.

Well, the first, *re* passengers, must go to the wall entirely, and if we *must* have our line complete with stations, we must put up with their uselessness.

The question of regulating the trains at stations without handling the engine, *i.e.*, working from a signal cabin, or some other point on the line, is one which I have not seen dealt with yet, but it seems to me to be an ideal way in which to work the miniature traffic, and I will as I proceed offer a few suggestions regarding this.

Before giving designs and drawings of station buildings, I might mention that not long ago I had occasion to make scale elevations of some of the tunnel fronts on the Great Western Railway main line, of some of which I gave photographs in my former articles, and now, in the hope that these may be of use to my fellow-readers, I am reproducing them here, together with one or two on other lines, with the recommendation that in large sizes only for out-of-door use and for indoor railways they be modelled in wood according to the directions I previously gave. I mention this because the two wooden Gothic tunnel fronts illustrated in the issue of February 1st, 1906, which were on a ⅜-in. scale railway laid in my garden were found to be quite rotted away

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FIG. 1.—WESTERN FACE OF THE ORIGINAL NO. 1 TUNNEL NEAR BRISTOL, G.W.R.

For description] [*see page* 390.

when I had occasion to move them recently: they had been in place less than two years. So it will be well to abolish all small woodwork, not only in stations, but in tunnel fronts, bridges, and everything else of a structural nature, except where such woodwork can be well tarred or creosoted, as in the case of sleepers. Hence my reasons for to a certain extent recapitulating my former articles.

The tunnel fronts and bridges, of which I gave original designs, can be modelled in the way I shall describe, but should the model engineer prefer to copy to scale in miniature some work in

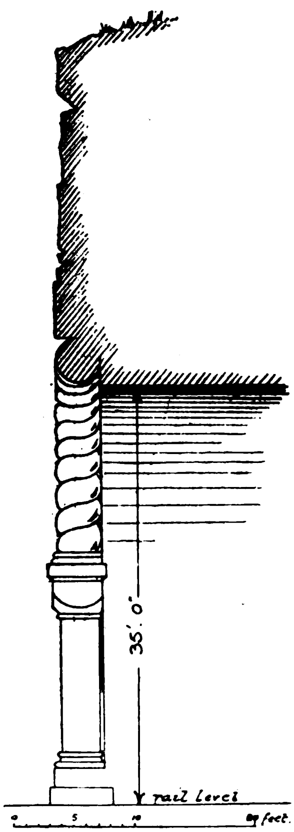

FIG. 1*a*.

actual existence on one of our railways, then I hope that the drawings I now give will provide a sufficient variety of architectural style to enable him to make a choice. Although not absolutely essential, I think that, should his locomotive be, say, a L. & N.W.R. "Precursor," then he ought to model a North Western tunnel, such as Primrose Hill, Watford, or Kilsby; and if he possesses a G.W.R. engine, let it be Box Tunnel, or one of the Gothic or Norman ones down Bristol way, so that not only his engine and rolling-stock, but his whole railway, will be a copy, so far as is possible within the limits of a garden, of some great prototype.

The illustration (Fig. 1) on previous page is a drawing of the western end of the old "Number One" tunnel on the Great Western Railway, near Bristol. This was cut through new red sandstone, and the pennant rock of the coal formation, and was, in the broad gauge days, the first tunnel to be encountered in coming up from Bristol. It was removed and made into an open cutting with vertical sides some two or three years before the abolition of the broad gauge, in 1892. Difficult it now is to conceive that a tunnel was ever there, for the whole of the new red sandstone at the western end has been removed from over a very large area, and the site is now occupied by extensive sidings.

The dimensions of this tunnel were: length, 990 feet; width or span of the arch, 30 ft.; height from rail level to crown at each entrance, 35 ft.; greatest depth rail level to surface, 76 ft. The front here shown is in the Norman style, of simple but bold design. A vertical section is given in Fig. 1A. Of the style of the eastern end I have no record, but it was probably of much more simple design without the rope ornament and flanking columns.

It may be as well to state here, with regard to the accompanying drawings of tunnel fronts, that although they appear to be, and perhaps are, to a certain extent, perspective pictures, containing landscape, etc., the actual masonry of the tunnel is not in any of the views in perspective but is strictly in elevation, and, more, is drawn to scale, which scale I have inserted at the foot of each drawing. Even the height of the hill in the background is to scale in most of them. The foreground, rails, and sides of the cuttings, are in perspective. No doubt plain line drawings would have served the purpose almost as well, but the shaded pictures by means of the shadows and high lights enable one to see clearly what parts are recessed and what are in relief, as well as giving a far better idea of the exact form of mouldings towers, cornices, etc., than could be conveyed by outlines only; further, by means of these drawings I have endeavoured to show how even a tunnel entrance well designed adds a point of interest and charm to a landscape. The moral is obvious: if they do this in already beautiful nature, they are still more likely to enhance the beauty of our garden railway tracks.

Regarding the practical use of the drawings as I give them, it will only be necessary to, by means of the scale, take off all measurements of the tunnel front in the same way as if the drawings were outlines, and preferably make an elevation of the model full size to whatever scale the railway is built to for which it is intended. Thus, taking Fig. 1 as an example, with a pair of dividers placed across the opening of the tunnel, and then transferred to the scale below, we get a measurement of 30 ft. This will, for a $\frac{3}{4}$-in. railway, mean a width of thirty times $\frac{3}{4}$ in., or $22\frac{1}{2}$ ins., and so on over all the masonry of the front. The scale on the drawings will, of course, give the dimensions of the real tunnel, and not of a scale model, as did the drawings given in the "Picturesque" article.

(*To be continued*).

A 24,000 H.-P. TURBINE.—Messrs. Brown, Boveri are constructing a steam turbine of 24,000 h.-p., to work at the steel works of Messrs. Krupp.

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A Practical Tesla Coil.

By J. Pike.

(*Continued from page 377.*)

SOME writers advocate the removal of the cotton turns after winding on the wire, and also the brushing over with shellac varnish of the complete layer; neither is necessary, and, above all, I should not again shellac varnish the wire turns of a coil which is intended to work in oil; the varnish prevents the oil penetrating the covering of wire, and numberless small air-spaces may thus be left, to be easily perceived under certain circumstances when the coil is worked in the dark.

In Fig. 3 we have the two coils (primary and secondary) mounted permanently in a hardwood stand, ready to be placed in the box. Very little description is necessary here. The wood is teak, and the stand —put together without any nails or screws—is just big enough to fit the retaining vessel. When making the stand, one of the sides, after careful measuring, etc., is fixed and the coils put in place; then the other side support is put in, being secured with seccotine or glue. The fibre supports of the primary and the ebonite rod passing through the secondary being of equal length require no further alteration, but may be secured tightly by means of small wedges of wood, if necessary. No difficulty should be experienced in getting the secondary in a central position.

The box to hold this should be very neatly made of teak and the corners dovetailed; it must, of course, be water- or oil-tight, and for this size (10 × 8 × 9 ins. inside) be an inch thick. The box, being guaranteed tight, is improved by a thorough basting inside with hot paraffin wax; in this way we may line the box out with a layer of wax ¼ in. thick or so, and be quite safe against leakage.

The ends of the primary are brought to one side and secured there with binding-screw terminals. For the secondary I find nothing better than two stout ebonite pillars about 5 ins. long, solid or built-up with ebonite tubing; they should be at least 1 in. in diameter, and at the top I find it convenient to fit a piece of brass tubing capped at one end to form a cup, into which—on completion of the coil—various accessories can be placed, *e.g.*, brass balls, terminals, straight brass rods, etc.. Fig. 4 shows what is intended. A piece of No. 14 copper wire is soldered to the bottom of the cup after drilling a hole to take one end, and, before fitting on the lid or cover, the fine wires from the secondary are soldered each to one of the wires depending from the pillars.

Two Leyden jars are provided, and they measure 9½ ins. × 4 ins., coated inside and out to a height of about three-fourths with tinfoil, care being taken to get an even coating, *i.e.*, to have the foil in optical contact with the glass. If possible, the inside coating—with the exception of the bottom—should be in only two pieces, these overlapping; but, if necessary, three may be used. I presume all our readers know how to make a Leyden jar, so that no words need be spent over the matter beyond stating that the desiderata are the even coating inside and out, the foil being put on with glue—thin, hot, well made, clean, and applied with a fine brush, so that it is no more than a smear of glue. Being placed in a warm, dry atmosphere—more dry than warm—the jars will be ready for use in a week. The brasswork in use with them is for each—a stout brass rod, ¼ in. diameter, terminating in a large brass ball (1½ ins.); this ball is carefully drilled horizontally to take a smaller rod (fitted with short ebonite handles), which in turn terminates in a smaller brass rod (1 in.). As these balls form the spark gap, they should be arranged so that the height is the same in each case, and the rods should make a good fit, without being tight. In place of the usual caps or lids I use ebonite discs—1-16th in. thick, cut with dividers to make a good fit inside the jars (top end). These discs, being drilled through their centres, are pushed on to the upright rods so that the latter are kept in a vertical position. The discs should be within an inch or two of the top in each jar. The simplest way to secure them in position is to cut out of brass tubing collars to make a good fit on the rods—two for each. These little collars are sawn through on one side and given

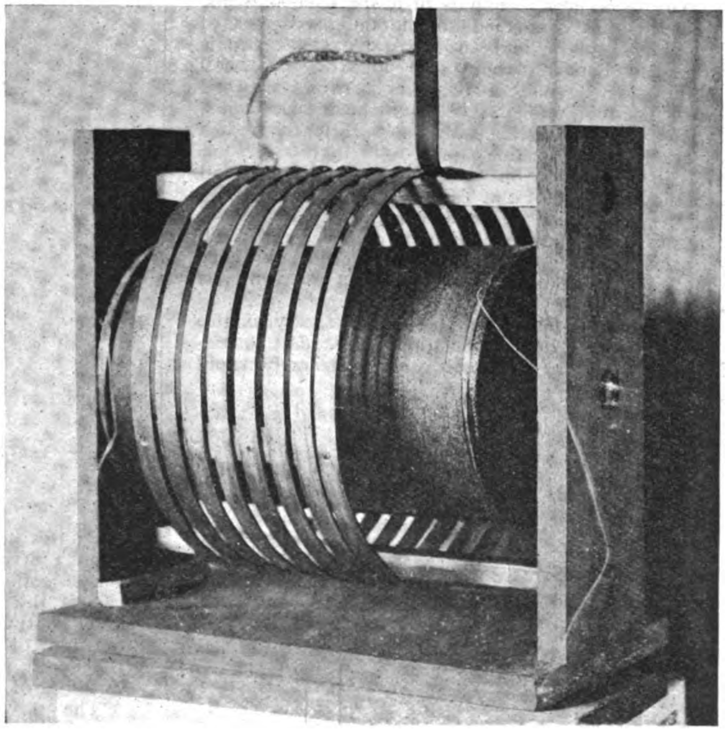

Fig. 3.—Showing the Primary and Secondary Coils Mounted in Hardwood Stand.

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a slight grip between pliers to ensure a tight fit. One is pushed over the rod to the height requisite, the disc is put in place, and the second then secures it in position. The rods, balls, collars, etc., should all be highly polished and free of sharp edges, and so on. At the bottom of each rod is fitted with solder a piece of thin sheet brass, cut cross-wise and bent to fit the bottom of the jar. The arms of the cross are about ½ in. longer than necessary to fit, to make room for a small tuft of fine wire (a piece of the best silk-covered flexible lamp wire will supply this). (See Fig. 5.) Lengths of 1 in. are denuded of covering, placed at right angles at each end of the cross, the ends then bent over and pressed tightly. We get in this way four excellent contacts in the bottom of each jar.

The secondary terminals of a spark coil—6 ins. at least—are connected to the inner coatings of the Leyden jars, and an adjustable spark gap is arranged between them (see Fig. 6). The coil being started, one of the jars becomes charged with positive and the other with negative electricity, and when the E.M.F. is sufficiently high a spark leaps across the gap.

The outside coatings of the jars are connected to the primary (of the Tesla coil), and the E.M.F. of the oscillating currents is raised by induction, by providing the secondary coil of fine wire, which in this case is placed inside the primary. Very fine brush discharges are produced at the terminals of this secondary.

The discharge between the balls of the spark gap appears to the eye as one single spark, but it consists actually of a succession of extremely rapid

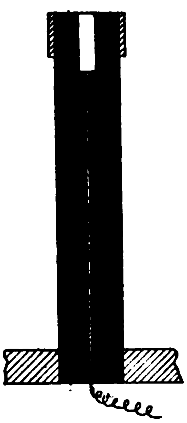

Fig. 4.

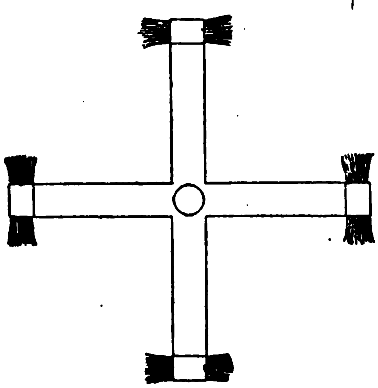

Fig. 5.

electrical oscillations or waves. As long as the inner coating of the jar is charged with positive electricity the outer coating must be charged with a similar quantity of negative electricity. As soon as the spark leaps over the charge disappears, but on account of the change the outer coating becomes positively charged, and this again induces a negative charge on the inner coating. It has been calculated that the sparks follow one another in an opposite direction with an interval of about one-millionth part of a second, and on account of their rapidly oscillating character comes the term—"high-frequency" currents. Every change of potential taking place on the inside coatings induces a similar change of the same intensity, but in an opposite direction, on the outer coatings, and these latter are connected to the Tesla in the manner indicated.

Another way is to provide a separate and adjustable spark gap, and to use either one jar only or the two in parallel (see Fig. 7). In this case

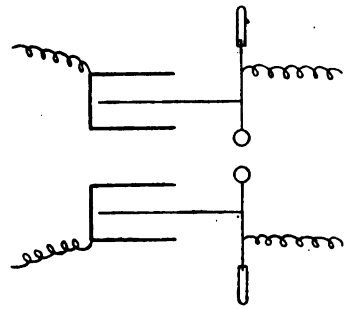

Fig. 6.

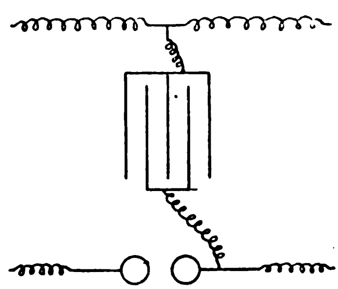

Fig. 7.

the outer coatings of the jars—which may stand upon a strip of tinfoil—are connected to one of the secondary terminals of the spark coil and to one of the primary terminals of the Tesla. The inner coatings are connected to the other secondary terminal of spark coil and to one of the balls of the spark gap, thence to the remaining primary terminal of the Tesla.

The physiological effects from the secondary terminals of the Tesla coil will be found entirely different to those from the spark coil. The latter must always be treated with the greatest respect, and no one is likely to forget a shock from a large coil. Referring to Fig. 7 we may say roughly that all that part of the apparatus to the right hand must not on any account be touched while the "spark coil" is at work; *always* switch off the current before attempting any adjustment of the apparatus. With regard to the Tesla coil, however, one need not be so particular with the apparatus arranged as Fig. 6, as it should be in the usual orthodox way for medical use. We may take sparks from the Tesla secondary with impunity; that is to say, there is no shock whatever. Arranged as in Fig. 7, we do experience slight shocks if the finger is approached hesitatingly to either of the Tesla secondary pillars; but if we take a brass rod in the hand and approach it to the pillar, we may take big sparks therefrom and feel nothing.

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The current should, however, be *always switched off* before making any fresh adjustment of the jars or spark-gap.

One important modification remains to be mentioned, and this is a simple method of tuning the apparatus. The primary coil (Fig. 3) is made with eight turns of copper strip, and, other things being equal, this may be, for the size, correct; but it is well to have an arrangement whereby we may cut out two or three of the turns, and this may be done by proceeding as follows:

Premising that the finished coil in its case is not particularly ornamental, and is therefore not pictured, and nothing would be shown thereby to be of any value, the reader will imagine a cube of about 11 ins. each way. The two terminals of the primary will be on one side and those from the secondary on the other, taken up through ebonite pillars, as described. Now before placing the lid or cover in position, the position of the primary turns should be carefully measured, so that if we drill two, three, or more holes in the lid, a copper or brass rod thrust through one or other of them will make contact with a turn of the copper strip. Now imagine one of the wires from the outside coatings to be fitted with a short piece of brass rod, and instead of inserting into the binder provided for it, push it through one of the holes in the lid, so that seven, six, or five only of the turns are used. The rod should make a decent fit in the lid, as it is required simply to make contact by touch. It is not possible in this apparatus to move the primary, otherwise the turns in use should be fairly central to the secondary winding, but this difficulty may be overcome by making holes for each turn and using a similar rod for the other wire. In this way we could cut out the two end turns, at any rate, and thus use six turns, all placed centrally over the secondary. Another point is to drill these holes diagonally, so that the pins or rods may be as far away as possible from the secondary pillars. Testing the apparatus figured, I found no essential difference using six turns or eight, as sparks were emitted in profusion between the secondary pillars, 8 ins. apart.

The results will largely depend upon the efficiency of the induction coil used; a coil which gives a long, thin spark, even if continuous, is not so good as one which gives "fat" sparks. The Leyden jars also will modify the results. Carefully made and equal to professional work, the output will be very gratifying.

A NEW type of current insulator for high-tension transmission lines was suggested by Mr. H. W. Buck at the recent meeting of the American Institute of Electrical Engineers. It consists of a simple form of unreinforced strain insulator with wide flaring petticoats, which are linked in series to support the line wires by a swinging suspension at each pole. At intervals of about every ten poles, the line is anchored in either direction by the strain links similarly arranged. It is claimed that but ten towers or poles need be used per mile with this construction, and that the voltage carried is limited only by the number of insulators inserted in the links, only four of the insulators in series being needed for a 100,000-volt line.

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows:—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

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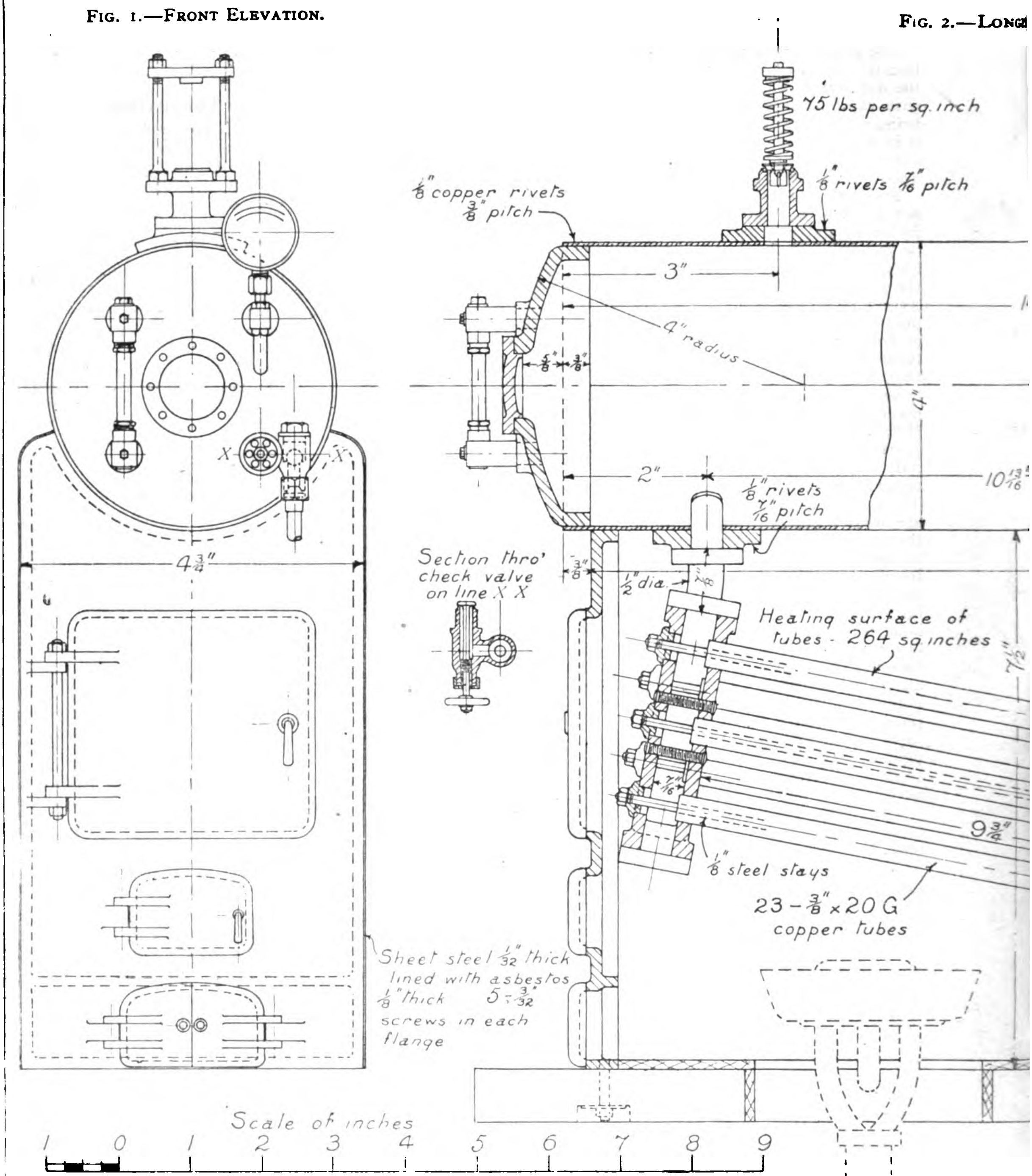


GENERAL ARRANGEMENT OF WORKING MODEL WAT

For photograph and description]

NAL SECTION.

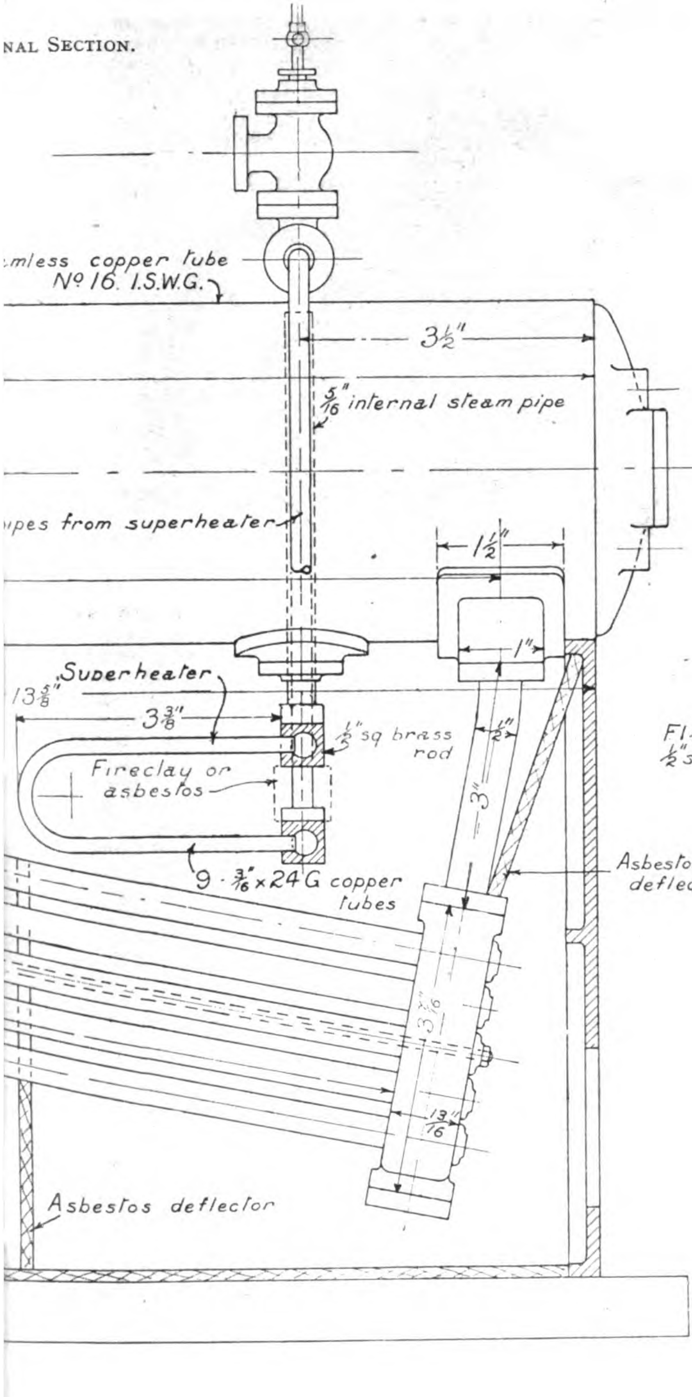
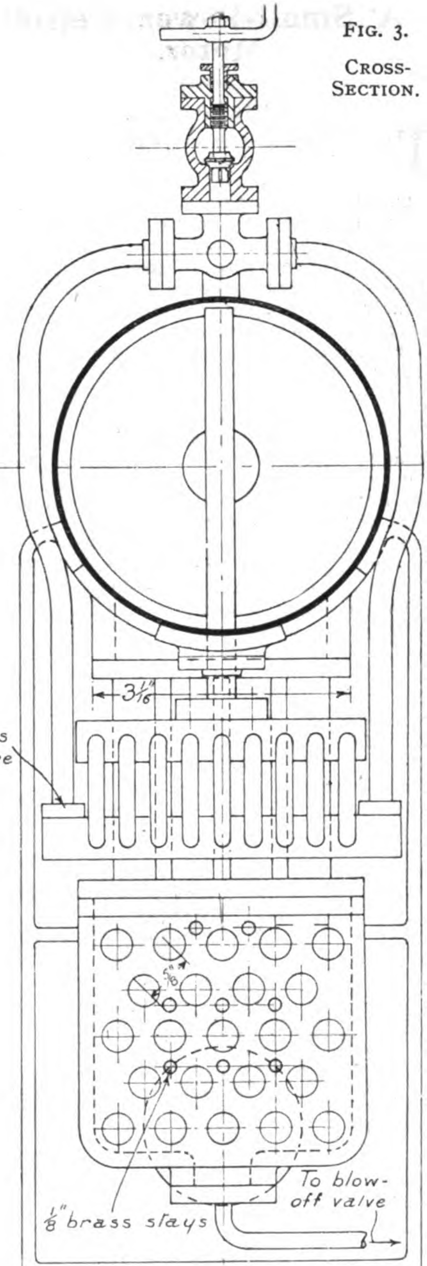


FIG. 3.

CROSS-SECTION.



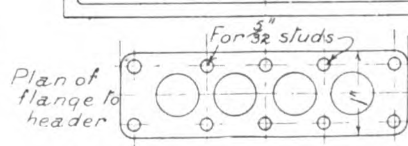


FIG. 4.—PLAN OF FLANGE TO HEADER.

TUBE BOILER. (*Effective heating surface, 326 square inches.*)

[*see front page.*

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A Small-Power Petrol Motor.

By H. Stevens.

THE following is a description of a small petrol motor which I have made from the cylinder and piston of a cycle engine. The cylinder (air-cooled) is 2½-in. bore by 2¾-in. stroke, the head of which has a valve-box on both sides, one for admission, and, of course, the other for exhaust. Having made patterns for the various parts—namely, the bedplate, crank case, bearing crank disc, connecting-rod, etc.—I proceeded to obtain castings from the same. These having been obtained, I first turned up the crank disc and shrunk and keyed it on the shaft and screwed in the crank-pin with a ¼-in. gas thread, and burred the end over to ensure keeping it tight (after the lock-nut had been screwed up). The crankshaft and pin were turned from 1-in. steel shafting, while the castings were being done. The crank case was next bored to receive shaft, cylinder, etc., and afterwards secured to the bedplate. The connecting-rod was next taken in hand, bored to receive gudgeon-pin, crank-pin, etc., and cut at big end, and fitted with 5-16ths-in. steel bolts and lock-nuts. The other parts, such as the 2-to-1 gear, tappet rods, and levers being finished, the whole engine was assembled.

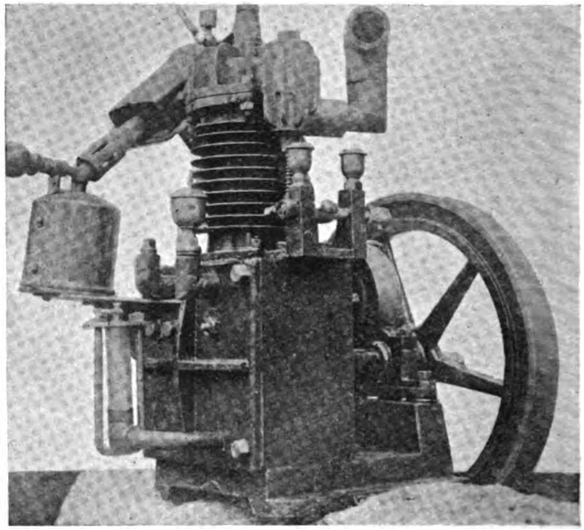

Fig. 2.—Another View of Petrol Motor.

The flywheel (12 ins. diameter and 1¼-in. face) was keyed on, and lubricators screwed into the bearings. The carburettor, which is a Longuemare gravity feed, is secured by the lug to the right-hand stud which holds the plummer-block to the bedplate, an extra nut being employed for this purpose. A home-made oil gauge, which, as described, may be of interest, was made out of a ¼-in. gas elbow, as shown in Fig. 3, the tap on top only being opened when quantity of oil is required to be seen. The ignition is by blowlamp and porcelain tube, the latter being fitted in a stuffing-box, made from an old

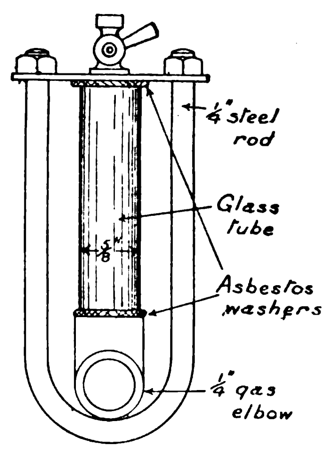

Fig. 3.—An Oil Gauge.

sparking plug. A vacuum valve, made from a lubricator, is also of good service. With a well-heated tube, and the air supply properly regulated, the engine will develop 1,000

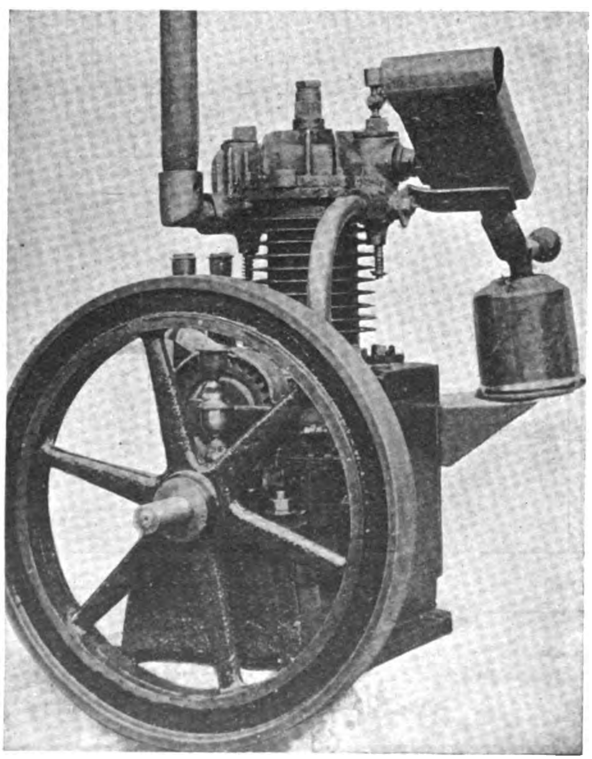

Fig. 1.—Mr. H. Stevens' Small-Power Petrol Motor.

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r.p.m., and maintain a good speed loaded without any signs of overheating, although no fan is fitted, or water used for cooling.

Portsmouth Model Yacht Club.

THE Portsmouth Model Yacht Club held a very successful race at the Canoe Lake on Wednesday afternoon, October 8th. The boats were set going, with a strong southerly wind blowing, at 3 o'clock, by F. Johnson, Esq. The several heats proved most interesting, owing to the very close finishes. Prizes were given by Harcombe Cuff, Esq. (first prize), Captain Brown (second prize), and Mr. Clive Wilson (third prize), the first prize being won by Mr. Taclack's *Sport*, 18 points; second prize by Mr. Clive Wilson's *Florence*, 12 points. Three boats tied with 10 points each for third prize—Mr. Howard's *Dorothy*, Mr. Coxon's *Saucy Sally*, and Mr. Bignall's *Foam*; Mr. Howard's *Dorothy* proving herself the winner of the third prize after a closely-contested final.—Hon. Sec., CLIVE WILSON, 343, Fawcett Road, Southsea.

GYROSCOPE TRAIN FOR INDIA.—Mr. Louis Brennan, the inventor of the mono-rail gyroscopic carriage, some particulars of which were given in these pages for May 23rd last, has just been granted the sum of £6,000 by the Indian Government towards the cost of his experiments in connection with the design of the full-sized mono-rail vehicle which he is building for that Government. The War Office is also assisting Mr. Brennan in connection with the experiments by giving him the use of the Brennan Torpedo Factory.

Chats on Model Locomotives.

By HENRY GREENLY.

ELECTRIC LOCOMOTIVES.

(*Continued from page* 375.)

IN all electric model locomotive work the chief problem is the satisfactory gearing of the motor to the driving wheels. It is not difficult to do this if no regard is given to the hauling capabilities of the model and the current consumption of the electro-motor, and, in addition, as the ratio of gearing adopted will very largely govern both of the above features, care must be taken to obtain the best proportions. If the gearing and countershafts are not nicely made, and the bearings out of alignment, there will be a considerable amount of power wasted by way of friction. The ratio of gearing should bear a proper proportion to both the weight of the locomotive and the load it has to haul and the power of the motor. If not geared down sufficiently, the motor will run too slow and absorb more current than it should under normal circumstances.

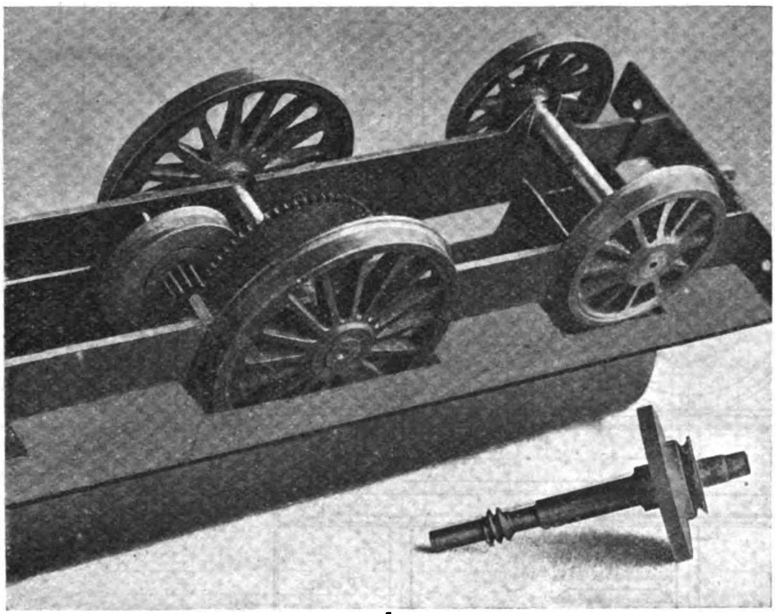

FIG. 6*a*.—PHOTOGRAPH OF GEAR OF EXPERIMENTAL ELECTRICALLY-DRIVEN LOCOMOTIVE.

With the permanent magnet motors described in the last issue the question of gearing is of the utmost importance, as the fields of the permanent magnet are comparatively weak. This being so, the armature speed is fairly high, and the torque less than a series-wound motor of the same size. The motor I possessed was rated for 6 to 8 volts, but I found it worked very well on 4½ volts (from a fully charged accumulator), the speed being about 2,500 r.p.m.

Having used the well-known spiral spring band for high-speed transmission gearing in another field of model work, I thought of applying it to the experimental electric locomotive I made to suit the motor already described. It proved very successful, and formed a very convenient and reliable method of connecting the armature shaft in the centre of the boiler barrel with the countershaft below. The countershaft was made of a piece of silver steel wire 1-16th in. diameter, running in holes in the main frames. The pulley wheel was made of type-metal cast on the spindle. The pinion* was taken from

* "Pinion wire" is obtained in lengths of about 1 ft., and in various pitches. It is rather hard, and should be softened in the usual way before turning down the ends.

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a clockwork engine, likewise the gear-wheel, the latter having 64 teeth and measuring 1 9-16ths ins. diameter on the pitch line, and the pinion eight teeth. The ratio between the countershaft and the driving axle was, therefore, 64 to 8, or, which is the same thing, 8 to 1. With a velocity ratio of the belt drive of about 2 to 1, this gave a total ratio between the motor and driving axle of 2 × 8 ins. = 16 to 1. With the motor running at 2,500 revolutions, the speed of the engine would, therefore, be $\frac{2,500}{16}$ = 156 r.p.m., and the driving wheels, being 2 5-16ths ins. diameter, or 6-10ths (·6) of a foot in

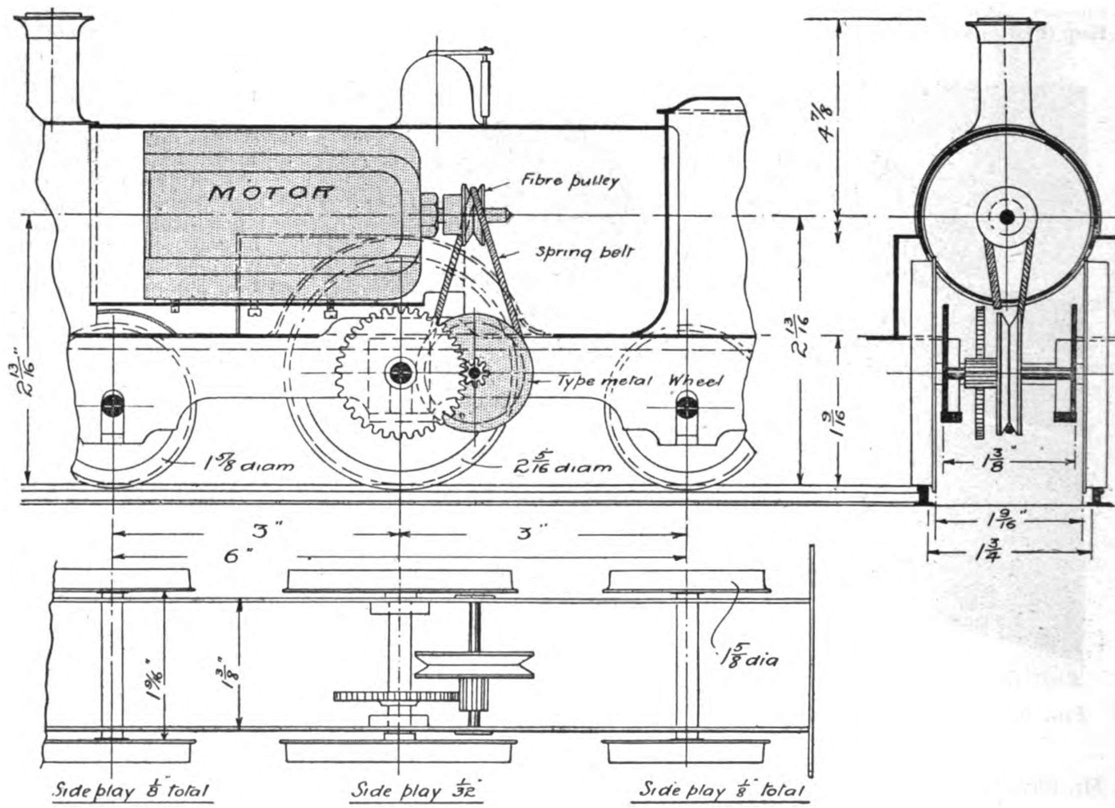

Fig. 6.—A Cylindrical Permanent Magnet Motor applied to a Model ⅜-in. Scale Single Wheel L.B. & S.C.R. Engine with Belt and Plain Spur Gearing.

(*Scale: Half full size.*)

circumference, the distance travelled will be ·6 × 156 ft. = 93½ ft. per minute. Now 88 ft. per minute is 1 mile per hour, so that at the estimated normal speed of the motor the engine ran just over one mile per hour. This was quite fast enough, and, as mentioned, the engine would run up a bank 1 in 25 with the accumulator aboard without difficulty. No doubt with a lighter voltage a greater speed would have been obtained. At any rate, I can recommend the above speed ratio with confidence, and also the use of the crossed belt shown in Fig. 6. Fig. 6A is a photograph of the actual model on which the system was tried. The spring belting (small size) is obtainable at about 2d. per foot, and is readily connected by means of a small pair of pliers, loops being formed at each end of the belt and hooked together. The belt should be provided with a good tension, and with a fibre pulley will not slip to an appreciable degree.

In making the pinion on the countershaft I only had a piece of about ¼ in. long, and had to drill it for the spindle. Pinions cannot very well be held in the ordinary three-jaw chuck, and, therefore, if the lathe is not fitted with spring collets, the best way of dealing with pinion wire is to obtain a piece of brass tube which will just fit over the pinion, and to saw it down longitudinally. Push the pinion into this and grip in the self-centreing chuck. Where sufficient length of wire is to hand the ends may be turned down to form the bearings, as indicated in the sketch, a lead or type-metal pulley wheel being cast on in the required position.

The reason a crossed belt was adopted in Figs. 6 and 6A was simply because I happened to have the gear-wheel and pinion, and although I did not altogether fancy the arrangement, the crossing of the belt seemed to lessen the tendency to slip when the engine was heavily loaded. If I had set myself out to make or have made all the parts, I should have gone about it in the manner shown in Fig. 7. Here it will be seen the plain spur-wheel is replaced by

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a "crown" wheel. A crown wheel is a spur gear-wheel with the teeth cut in the side of the flanged portion of the blank as shown in the sketch, and is practically the same as the bevel wheel. Crown wheels are only used in light work; really the teeth

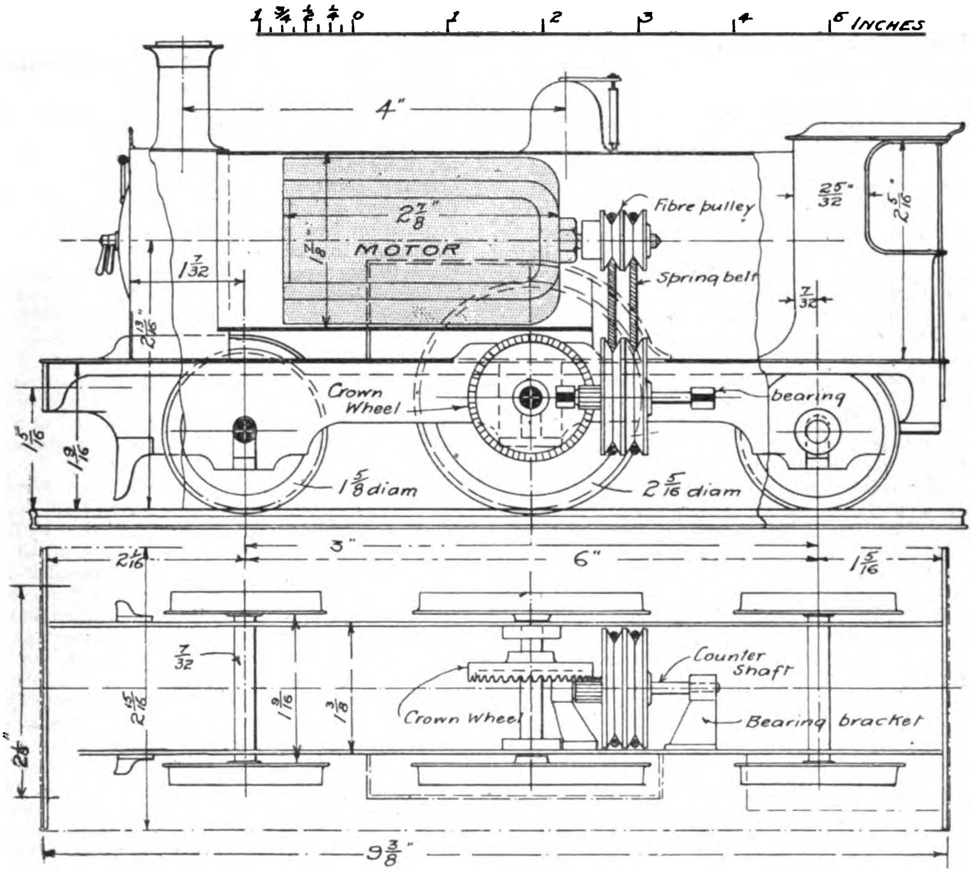


FIG. 7.—CYLINDRICAL PERMANENT MAGNET MOTORS APPLIED TO ⅜-IN. SCALE L.B. & S.C.R. LOCOMOTIVE WITH CROWN GEARING AND DOUBLE BELT.

of both the wheel and pinion should be cut at an angle, but crown wheel teeth being so narrow, and the ratio of the gearing large, this refinement is dispensed with.

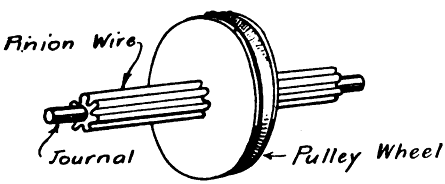
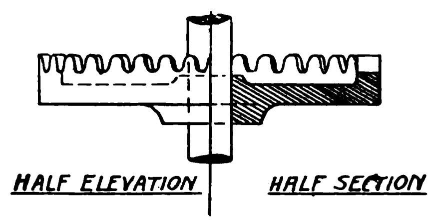


FIG. 9.—PIECE OF PINION WIRE TURNED DOWN AT EACH END TO FORM JOURNALS AND TYPE METAL GROOVED PULLEY WHEEL CAST ON.

The countershaft, of course, lies parallel to the armature shaft, and may be connected by more than one driving belt, as indicated in the drawing, Fig. 7. While one pair of pulleys would, no doubt, be successful, the duplicating of the transmission arrangements is advised because it will certainly tend to prevent any slip, and should one belt break (I have not experienced this) the engine would



A FIG. 10.—CROWN WHEEL.

continue to run. With parallel countershafts larger pulley wheels can be used. This will increase the belt speed, which is always desirable.

(To be continued.)

WORLD'S LARGEST WAGON.—This has been shipped to Alaska. It is over 26 ft. long, and 7 ft. high from the axle. The wheels are 10 ft. in diameter, and have iron tyres 1½ ft. in width.

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Practical Letters from our Readers.

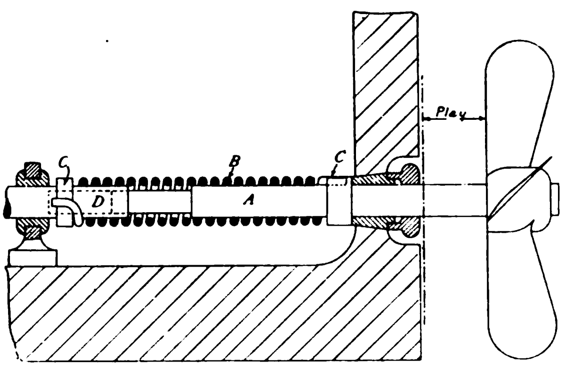
[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached, though not necessarily for publication.]*

A Suggestion for Model Power-Driven Boats.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Your readers may be interested in the suggestion I make for an improvement in the model power-driven boat. I have never had experience of the working of model boats, but it appears to me that in a craft such as these the engine must be greatly distressed while in action with the sudden accession of pressure every time the vessel sinks in the water from a high to a low level with the motion of the waves. The illustration is of a device for taking up gradually these otherwise sudden loads so as to ensure uniform running of the engine.

In the illustration, A is the propeller shaft, and B is a spring fitting it exactly and fixed at its ends in the flanges C C. The tail shaft is free to move in the circular hole D in the engine shaft, the two pieces being connected by the spring only. When the propeller is revolving clear of the water the position is as shown; when it enters the water the resistance causes it to forge ahead, compressing the spring to a certain extent, and so transmitting the load without shock to the engine. Also the engine shaft will be a little in advance of the tail shaft, owing to the slight uncoiling of the spring, probably half the circumference. This cushion is more sensitive than the compression cushion and accordingly quicker in action. The amount of play should be less than the total of the spaces between the coils of the spring, say one-fifth. For a 5-ft. boat



with fine lines a tough steel spring, 4 ins. long, of 1-16th-in. diameter metal, and with the coils spaced 1-32nd in. apart, would answer well, and ½-in. play would be sufficient. The right-hand side of the flange at the stuffing-box should be unbroken, so as to take the thrust when the engine is reversed, and the bearing at the engine-bed should take the forward thrust. In order that the thinned part of the tail shaft will not entirely leave the hole in the engine shaft, about ⅛-in. should be added to the length of each. A pin-hole should be made at the further end of the hole to let the air escape when the spring is compressed. This last provision suggests the air cushion, which is better than the spring, but it requires extremely accurate work if the complication of packing would be avoided.—Yours truly,

Glasgow. SCOTT CRONE.

The "America" Yacht: A Reminiscence of 1849.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—It may be of interest at this period to recall the circumstances connected with the original contest for the much-coveted trophy, the America Cup. The Americans looked upon its acquisition as a national victory, and many thousands of pounds have been spent on the hitherto unsuccessful attempts for its recovery.

The *America* yacht was built in the year 1849, by Mr. George Steers, the celebrated shipbuilder, of Williamsburg, Long Island, and would now-a-days have been considered very plain, and her equipments classed among the simplest and cheapest variety. She was, in fact, built with one end in view, namely, to "whip the Britishers," and it was stipulated with the builder that she should beat anything of her size in England.

There had previously been some attempts at improvement in ship-construction in England. It had been suggested that vessels, with their bluff bows and fine runs, were being sailed wrong end foremost, and the *Mosquito*, a small iron-built cutter, had been constructed on the "wave line" theory; but these new ideas had gained but slight recognition, and their general acceptance was undoubtedly due to the complete success of the American schooner.

The *America* differed considerably from the prevailing style of vessel. A well-known yachtsman, in comparing her with an English schooner, said: "Her displacement, area of load-water line, and area of midship sections, are remarkably small in relation to the circumscribing dimensions. She was, in fact, a vessel with a small hull in proportion to her dimensions, and therefore she was able to avail herself of much sharper water-lines than had hitherto been attempted; consequently the small amount of resistance to progressive motion in proportion to the lateral resistance, admitted of her being sailed very near to the wind without her speed being materially diminished."

The arrival of the *America* at Cowes in July, 1851, caused an amount of interest and excitement which has rarely, if ever, been equalled in the yachting world. Such flat standing sails had never been seen before, and the late Marquess of Anglesea, on witnessing her performances, said, "If she is right, we must be all wrong."

The Regatta of the Royal Yacht Squadron took place on August 22nd, and was a match for all rigs, round the Isle of Wight, for a cup presented by the members of the R.Y.S., time allowance being waived in order to induce the *America* to enter. Other well-known competing yachts were the *Arrow*, *Volante*, *Alarm*, and *Aurora*, and several schooners, all more or less on the "cod's head and mackerel's tail" principle. The wind being light, the contest was to some extent unsatisfactory; nevertheless, the *America* made such a display when there was any wind that her superiority to the

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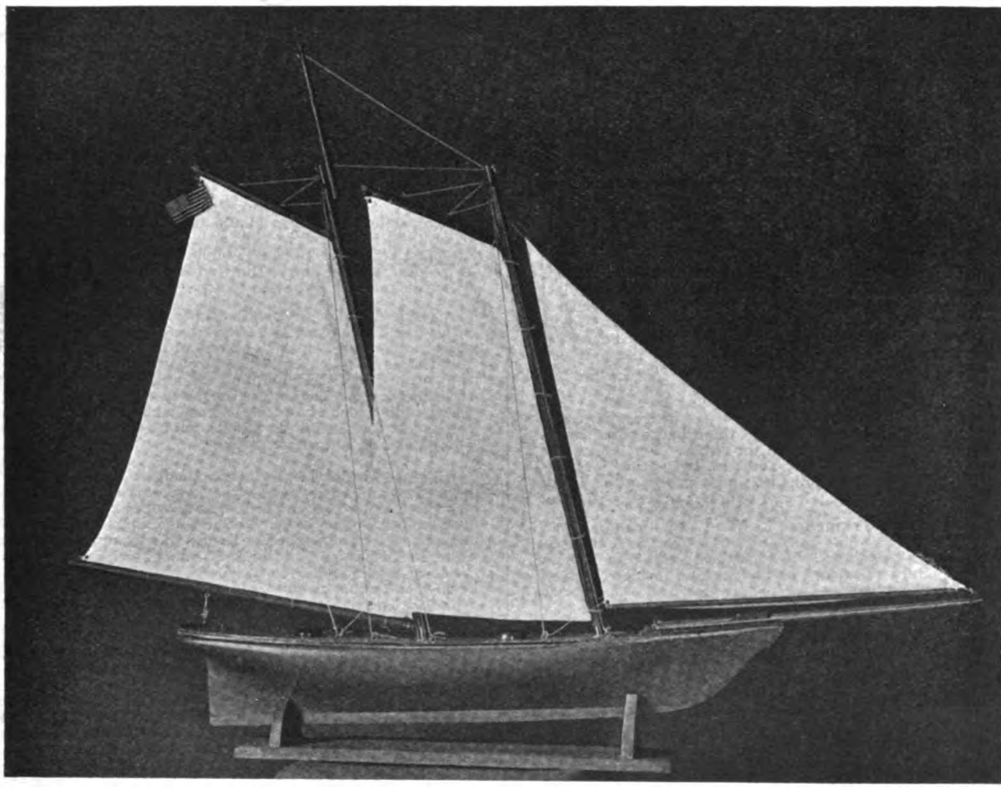
English yachts was placed beyond all question, and she reached the flagship twenty minutes in advance of her nearest competitor. Shortly afterwards she sailed a match against Mr. G. Stephenson's schooner yacht *Titania*. Running twenty miles before the wind the *America* only beat the *Titania* by five minutes, but thrashing back, she had to make less than two boards to the other's three, and won by 52 minutes. These made the *America's* fame, and not another yacht-owner could be found who would venture to match his vessel against her. The *America* was subsequently defeated by the *Arrow* and *Mosquito*, but she had then lost her American crew, and was consequently not handled as she was on the occasion of her previous victories, and it was noticed that her sails had lost something of their original set. The last race of importance in which the *America* took part was in the schooner match of the Eastern Yacht Club in 1887, and although more lead had been fastened to her keel, she found herself unable to compete with the more modern craft, having a greater displacement and a larger sail area in proportion to their size.

The accompanying photograph is that of a model of the *America* built by the writer, and measuring 36 ins. L.O.A. It is made to scale in the hull and rigging, but not in minor details. The displacement is 8 lbs., and sail area 762 sq. ins. A corresponding model of a modern yacht would have a displacement of about 10 lbs. and sail area of about 820 sq. ins. It is said that the *America* was put in the scales and actually weighed, and that her tonnage was found to be considerably less than by the English rule of measurement.—Yours truly,

(REV.) A. WILLAN.

Copmanthorpe Vicarage, York.



MODEL OF THE "AMERICA" RACING YACHT OF 1849, CONSTRUCTED BY REV. A. WILLAN.

Re A Strange Occurrence.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Although electro-magnets in circuit with the lamp will be the means of obtaining a very high E.M.F., they are not an absolute necessity—in fact, they only serve to heighten the effects mentioned. If the experiment is continually being repeated, the vacuum in the lamp will be spoilt and the phenomenon will cease. By the latter part of "R. N.'s" letter, one is rather led to suppose the discharge to be continually taking place, irrespective of the lamp being in or out of circuit. If this is so, I am afraid such commonplace explanations as I can offer will be entirely inadequate.—Yours truly,

E. C. H.

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Queries and Replies.

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

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

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

[18,192] **Locomotive Type Boiler.** J. K. (Grantham) writes: I beg to ask the following queries—Would a boiler, as per tracing (not reproduced), drive an engine with cylinder 1¼ ins. by 2 ins., firing it with Welsh coal or charcoal. I make the heating surface about 256 sq. ins. What would be the proper size for steam ports in engine? Would ¼ in. by ⅛ in. do for steam, and ¼ in. by ⅛ in. for exhaust? If it will not drive this engine, what size engine will it drive? Also, what size dynamo will it drive properly?

The boiler is a trifle small. We should have preferred a 5-in. diameter barrel, twelve tubes, firebox 7½ ins. by 5 3-16ths ins. wide, and a length between tube-plates of about 10 ins. Such a boiler would do much better with the engine mentioned. Unless you have some special reason for it, do not make the firebox narrower than the diameter of the barrel at the foundation ring. If you do not care to alter the size of the boiler, use an engine 1⅛-in. bore by 1½-in. stroke. The boiler is sufficiently powerful to run a 15 to 20-watt dynamo. Make the firebox 4⅛ ins. wide, not 3½ ins. The steam ports should be half the bore of the cylinder in length and one-sixteenth the stroke in width; the exhaust ports should be double the width, viz., one-eighth the stroke. For the smaller engine this means—steam ports, 9-16ths in. by 3-32nds in.; exhaust ports, 9-16ths in. by 3-16ths in.; port bars, 3-32nds in. or ⅛ in.; lap of valve, 1-16th in.; lead, 1-64th in.; travel, 5-16ths in.

[18,308] **Electric Tramcars.** W. J. B. (Southminster) writes: Could you tell me how many different systems there are upon which electric trams are run, and which are chiefly used at the present time? Are the tube railways run the same as the new trams of the L.C.C.? I should like, if you could give me, a drawing of each

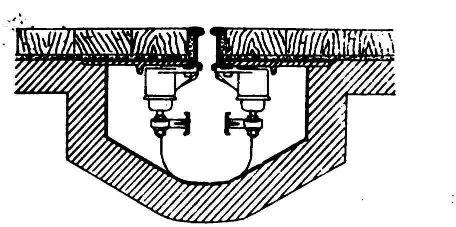

FIG. 1.

way of working. Also, could you explain what kind of brake is used? It seems very powerful, yet works so smoothly.

In reply to your enquiry *re* systems of electric traction, we may say there are practically only three in general use now, viz., the overhead trolley system, the conduit system, and the surface-contact system. The accumulator system was at one time used, particularly on the Continent, but was found inefficient and expensive, and was used only for short distance lines. The third-rail system is useless in towns and cities, of course, on account of the danger to the public. A surface-contact system was illustrated on p. 130 of February 11th, 1904, issue of this Journal; and some miles of track will, we believe, shortly be in working order in the north-east of London. We give a diagram of the slot conduit system herewith, and also a diagram of the circuit of the overhead trolley system, showing the path of the current from the generator, along the overhead wires, through the motors, and back to the negative pole of the dynamo. Besides various mechanical brakes, a very powerful braking effect is obtained by connecting the motors so

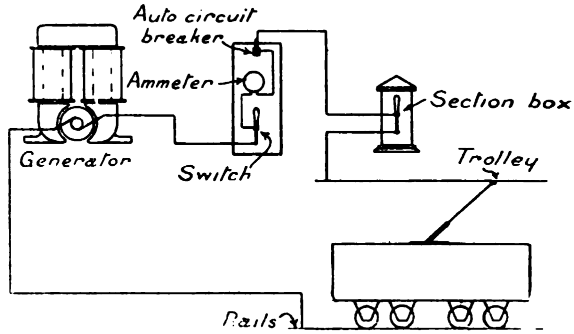

FIG. 2.

that they generate current, *i.e.*, act as dynamos for the time being. This connection is made by the special controller in charge of the driver. The tube railways can use the "third rail" system, as the public are not allowed to be in close contact with the lines, of course.

[18,149] **Steam Engine Pump.** "ENGINEMAN" (Cockermouth) writes: Will you kindly tell me what size pump I shall require to feed a 24-in. by 12-in. central flue vertical boiler driving a horizontal engine (2-in. bore, 4-in. stroke) at from 20 to 30 lbs. per sq. in. The engine is used for driving small dynamo, and it is proposed to drive pump by eccentric.

A 12-in. by 24-in. central flue boiler has only about 440 sq. ins. of heating surface, and is hardly large enough for a 2-in. by 4-in. engine. You might make a success of the combination if you use the exhaust to induce a draught and superheat the steam by passing the steam pipe (steel pipe must be used) down the uptake and through the fire. The water evaporated will be about 4½ to 5 ins. per minute under favourable circumstances; therefore, a pump running at 200 strokes per minute, with a ram ⅜ in. diameter and ⅜-in. stroke, should suffice.

[18,025] **Model Locomotive Design.** N. G. writes: In determining the size of cylinders for a given boiler, or *vice versa*, of a model locomotive, should the revolutions per minute be calculated from the maximum speed at which the engine will travel? To make it clearer what I mean, let me take as an example the ½-in. scale North-Eastern. I think its maximum speed is about six miles an hour, boiler pressure 80 lbs., and it evaporates ·55 cubic inch of water per minute. Now, calculating the size of cylinders from Mr. Greenly's table in THE MODEL ENGINEER, May 3rd, 1906, the cylinders would have to be considerably less than ½ in. in diameter, unless my calculations were wrong, if the r.p.m. were calculated from the engine travelling at 6 m.p.h. (2) Will you recommend me a good reference book on locomotives?

(1) The factor you have omitted to consider is that the steam pressure in the steam chest and in the cylinder will fall as the speed increases, owing to the throttling of the steam by the regulator valve, steam pipes, and steam ports. Therefore, calculations made on the assumption that the pressure in the cylinders will be the same as that which may be maintained or is required to be maintained in the boiler at the highest possible speeds will lead to abnormal proportions being adopted. You will find that if you reckon the steam pressure of the cylinder is practically the same as that in the boiler at 250 r.p.m., and that the consumption of steam at this speed exactly equals the estimated evaporation of the boiler, success will be obtained. Taking as an example an engine with 3½-in. driving wheels running at 250 r.p.m., the speed will be, of course:

$$\frac{3\frac{1}{2}\times\frac{22}{7}}{12} \times \frac{60}{5280} \times 250 = 2\frac{1}{2} \text{ miles}$$

per hour. This will be the approximate speed obtained with an engine *loaded up* so that the steam pressure in the cylinder is approximately equal to that in the boiler. If you turn to the table given in the issue of May 3rd, 1906, you will find that a locomotive with ½-in. by 1-in. cylinders working at 250 r.p.m. will maintain a pressure of 50 lbs. per sq. in. If, owing to mechanical imperfections, it only maintains 40 lbs., you will find that the model will easily pull a load of 30 to 40 lbs. at this speed. At the figures given for model train resistance in "The Model Locomotive"

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viz., 4 lbs. to the 100 lbs., reckoning the total load with the engine and tender to be 30 + 20 = 50 lbs., the tractive effort should be 2 lbs. approximately. The tractive power of locomotives may be estimated by the following formula:

$$\frac{D^2 \times L \times P}{D\,W} = T\,E.$$

Where D is the diameter of the cylinder.
D W is the diameter of the driving wheels.
L is the length of the stroke.
P is the steam pressure in the cylinders.

Assuming the latter at 40 lbs. with the given engine, the

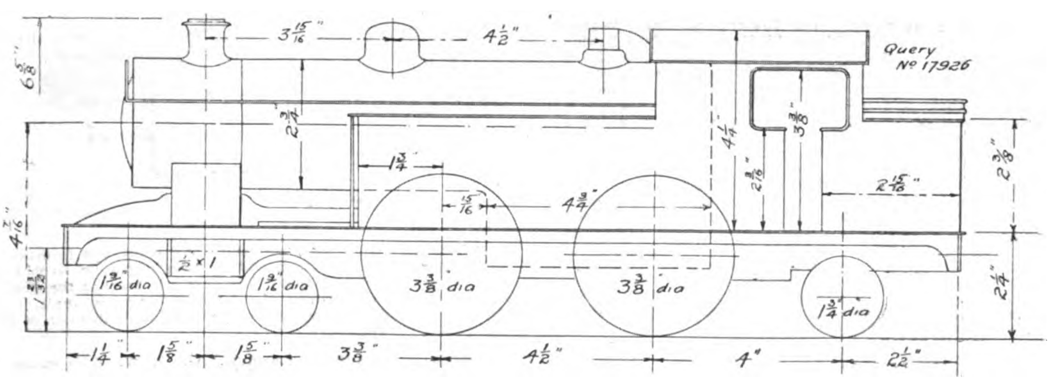
$$T\,E = \frac{\frac{1}{2} \times \frac{1}{2} \times 1 \times 40}{3\frac{1}{2}} = \frac{10}{3\frac{1}{2}}$$

$$T\,E = 2\tfrac{7}{8} \text{ lbs. approximately}$$

which leaves a balance to the credit of the locomotive. If there was no throttling of the steam by the ports, regulator valves, and steam pipes, the steam consumption of the engine would be greater than the boiler would bear, and, therefore, while a smaller cylinder might be theoretically better—to allow for this contingency—practical experience shows that the moderate size of cylinder with small ports and steam pipes gives best results. You will find that a ½-in. scale locomotive will not under ordinary circumstances pull a heavy load at six miles per hour continuously. (2) You are evidently more particularly interested in model locomotives, and, therefore, we recommend you to study Greenly's book, "The Model Locomotive: Its Design and Construction," 276 pages, 371 illustrations, and nine folding plates; price 6s. net, 6s. 5d. post free. Other reference books are "The Locomotive of To-Day," price 2s. 9d., post free; "The World's Locomotives," by C. S. Lake, price 10s. 6d. net, 11s. post free, from this office; "Locomotive Simply Explained," by the same author, price 6d. net, 7d. post free; and "Locomotive Engineering," price 21s. net, 21s 6d. post free.

[17,926] **Note on Design for Tank Locomotive.** E. A. O. (Clapton) writes: I enclose an outline tracing of a 4—4—2 type tank engine, ½-in. scale. Would you kindly oblige me by saying if (1) the design appears symmetrical. (2) Should I use ½-in. by 1-in. cylinders or 7-16ths-in. by 1-in.? I do not want trouble from insufficient steam. (3) Are three circulating tubes sufficient, or should I have four or five? Is the size right? (4) How far forward should side tanks come? (5) Are wheel sizes about correct? (6) Would you recommend the "new valve gear," or slip eccentrics for the locomotive?

(1) Generally speaking, it is very good, but you have exceeded the standard loading gauge. The height to the top of the funnel should be 6⅜ to 6 11-16ths ins., not 6 13-16ths ins. We would lower the boiler ⅛ in. or 1-16th in., and the chimney 1-16th in. The driving wheels might be 3⅜ ins. with advantage, more especially as castings can be obtained for ½-in. scale wheels of this size. The firebox may be shorter (it should not be longer than 5 ins.) and the cab made ½ in. longer. At present it is too high. The door opening is large enough for a giant driver of about 8 ft. 3 ins. high. Make it to scale equivalent of about 6 ft. 9 ins., viz., 3⅜ ins. from the footplate level. The roof of the cabs should be about 4½ ins. above footplate level. To look well the chimney of a ½-in. scale locomotive with a large boiler should measure 1 1-32nd in. diameter over the cap and 23-32nds in. diameter at the smallest portion of the stalk. (2) ½-in. by 1-in. cylinders by all means. The size of the cylinder, although important, does not matter so much as the quality of the workmanship put into them. (3) Three or four tubes will be found better than a larger number. There is nothing very great to be gained by curving the throat plate. The firebox may be reduced to 4½ or 5 ins. long with advantage. In a water-tube boiler it can be too long. (4) The side tanks should just cover the driving wheels. (5) The wheels are all right, and the driving wheels, which would be better 3⅜ ins. diameter. You can get castings for ½-in. scale wheels, 1 9-16ths ins. diameter, and 1¾ ins. all in the same style. In choosing wheels do not choose from the diameter only, but the scale of the wheels. (6) Use either slip eccentrics or the valve gear shown on page 154 of "The Model Locomotive" and illustrated in a recent query (see No. 18024, issue of September 19th, 1907). The modified Joy's gear is not suitable for an outside cylinder engine.



AMENDED DESIGN FOR A ½-IN. SCALE 4—4—2 TYPE TANK ENGINE.
(*Scale: Quarter full size.*)

[18,072] **Machinery for Fast Launch.** J. B. T. (Australia) writes: Would you kindly, if possible, answer the following questions through the pages of THE MODEL ENGINEER, as I am building a steam launch and am in trouble on a few points. The launch is 15 ft. long by 4 ft. 6 ins. beam by 2 ft. 3 ins. deep. I should like, if possible, for it to run at a speed of from 7 to 10 or 11 knots per hour. (1) Bore and stroke of cylinder, and size of steam ports of same? (2) Lap and lead of valve? (3) Diameter and pitch of propeller? (4) Size of boiler, thickness of shell and end plates, and number and size of tubes? (5) Boiler pressure, best kind of fuel, and, if possible, sketch of boiler?

To prescribe the complete dimensions for such a fast boat is entirely beyond our scope. As far as we can judge, about 7 to 8 to 10 h.-p. would be required for a 15-ft. boat to travel at 10 knots per hour. The machinery for this would require much skill and experience in designing and building. It would also be very expensive. However, we do not think that you really require such speed, and recommend for ordinary purposes either a 3-in. by 3-in. engine or a Stuart Turner 3 h.-p. compound, cylinders 2½ and 4 by 3-in. stroke. The steam ports should be half diameter of cylinder by 1-16th stroke; exhaust ports, half diameter of cylinder by ⅛-in. stroke. Lap, half steam port width. Boiler for ordinary work should have 4,000 to 5,000 sq. ins. of heating surface. Pressure for simple engine, 40 to 60 lbs. Compound engine, if condensing, 75 to 100 lbs. Propeller, 12 ins. diameter, 18 ins. pitch. The fuel used must depend upon which is the cheapest in your part of the world and the design of the boiler upon the fuel used.

[17,878] **Carbide.** W. H. C. G. (Birmingham) writes: I should be much obliged if you would answer the following questions; —(1) How much space would ¼ lb. of carbide take up, broken fairly small? (2) How much water would be needed to act on that amount of carbide? (3) How much acetylene would be given off with the water to carbide system, allowing for a reasonable amount of waste? (4) What is the effect of soaking carbide in paraffin?

(1) The broken carbide, as used in bicycle lamps, takes up approximately 12 cub. ins. per ¼ lb. The fact must be borne in mind where designing a container for the generating chamber that at least one-third of the container should be left to allow for the expansion of the carbide, as it gives off gas, and, if possible, it is better only to fill the container half full, as the more room allowed the less is heat evolved in generation. (2) In practice it is well to allow about ½ pint of water to each ¼ lb. of carbide. (3) About 2 cub. ft. per ¼ lb. (4) The paraffin prevents mere dampness from affecting the carbide and encourages slower generation, which is consequently accomplished with less heat.

[18,185] **Boiler for Vertical Engine; Piston Valves.** A. C. L. (Coventry) writes: I am building a vertical steam engine, designed by Mr. R. M. de Vignier, which appeared in THE MODEL ENGINEER last September, and shall be obliged if you will kindly assist me on the following points: (1) What size and type of boiler would be suitable for driving the engine at 500 r.p.m.?—the cylinder

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is 1½-in. bore, 1¼-in. stroke. (2) Should the piston valve be fitted with rings, and is there any advantage over the ordinary slide-valve?

(1) You will find the vertical boiler described in our new edition of "Model Boiler Making" (price 6d. net, 7d. post free), page 34, Fig. 10; work the engine at the speed named and maintain 40 lbs. pressure. Of course, a larger boiler, say a 12-in. by 24-in., will require less attenticn in the matter of firing and water supply. (2) Piston valves should be fitted with rings, but in model work it is not often found practicable. Solid piston valves of small size soon become leaky, and, of course, do not allow for trapped water in the cylinder to escape. Steel or iron piston valves, working in cast iron or *vice versa*, will give as good results as any.

[18,195] **Model Engine and Boiler.** J. R. H. (Sydney) writes: (1) I am going to build a copper boiler (8 by 4 diameter) of solid-drawn tube. It will have twelve ⅜-in. brass tubes for oil firing (slightly larger than the one on pages 31—32 of No. 6 Handbook), with cast ends, to work at 30 lbs. pressure to work a ¾-in. by 1½-in. slide-valve cylinder at about 400 r.p.m. What size steam piping will be required? (2) What size of safety valve and water gauge will be required? (3) Please state best method of fixing fittings—all are to be bought and of brass. (4) Would this design do for firing with an cil burner? (5) What size dynamo would it drive easily?

(1) ⅛-in. or 5-32nds-in. bore piping will do well. (2) The safety valve should be 3-16ths in. diameter. The water gauge glass may be 3-16ths in. or ¼ in., preferably the latter. (3) Silver-soldering the bushes supplied with them into the shell. (4) Yes, you may use a 3-in. burner with success. (5) If everything is well made, you may be able to get the plant to give about 10 watts continuously.

[18,034] **Current Supply for Induction Coil Work.** L. T. (S. Wales) writes: Would you kindly answer the following questions for me? (1) I have a coil which gives a 4-in. spark with a "Vril" break, or about 6 ins. with a Foucault mercury one. I am high and dry in the country and find accumulators a nuisance. There is a colliery here from which I can get a 220-volt continuous current. Is there any means by which I could use this to drive the coil? The coil is hardly large enough to use a Wehnelt break. Can you give me any suggestion? (2) Several electricians tell me I can reduce a 220-volt continuous current to about 12 volts by means of resistances. I say you cannot without a motor generator. I tell them the resistance will only alter the current, but they try to make out that it will reduce the voltage as well. Is it possible to reduce 220 to 12 volts without a motor generator? (3) What is the best substance to cover the mercury of the break with? I have tried alcohol, but it fires that, and paraffin, which is not successful. What, too, is the best way to recover the mercury afterwards? With paraffin I heat the scum in a crucible and drive it off that way, and so get back the greater part of the mercury.

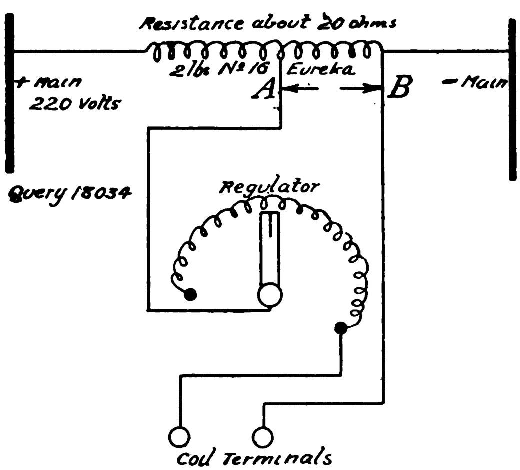
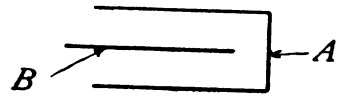


DIAGRAM OF WIRING FOR INDUCTION COIL.

(1) You can work your coil by shunting it from a resistance connected to the 220-volt supply. Distance apart of A and B to be found by trial; at first a distance of about one-twentieth of the length of wire should be tried. The main resistance takes a certain flow of current steadily from the mains. The coil shunts some of this current, which is regulated by the regulating resistance. The voltage at the terminals of the coil will vary according to the distance apart of the wires A B. Obviously, if A and B are connected to the ends of the main resistance, the pressure between the coil terminals will be 220 volts. If they are both connected to the same point on the resistance the voltage between the coil terminals will be *nil*, because the flow of current through the main resistance causes a regular fall of voltage throughout its length. You must connect a switch and fuse in circuit with the main resistance. (2) The working of a resistance is explained in THE MODEL ENGINEER for December 14th and 21st, 1905. (3) We can only suggest alcohol or paraffin, unless you can try coal-gas, as mentioned on page 207 of THE MODEL ENGINEER for February 27th, 1907.

[17,993] **Self-Induction Coils.** G. D. (Windermere) writes: I shall be glad if you could please answer the following questions for me. I wish to make a self-induction coil to give a high back E.M.F. (1) To get this, would it be better to have a large number of turns and not so many amperes (on account of increased resistance), or to have fewer turns and send a larger current through them? Does the induced E.M.F. depend on the ampere-turns or on the voltage and length of wire? The voltage is constant. (2) What size of condenser connected in shunt with the coil would be required to absorb the induced back E.M.F., the voltage being 8 volts, length of the coil 9 ins., diameter of iron core 2 ins., size of wire No. 20 I.S.G. (*a*) when there are 500 turns on the coil, (*b*) when there are 1,500 turns? Please say the area of tinfoil required, when paraffined paper is used to insulate, and if you count one or both sides of the foil. I want the condenser to reduce the spark at the contact-breaker; in fact, do the same work as it does in an ordinary induction coil. Your book on "Induction Coils," which I have, does not tell one anything of this, and I should be very much obliged indeed if you could let me know.

(1) Yes, a large number of turns. The induced E.M.F. depends upon the ampere-turns and the rapidity of break of the circuit.



Query 17993

(2) This is a matter for experiment. We advise you to make the condenser in several sections and try them in parallel so that you have a variety of capacities. You take into account the effective area of one of the coatings of the condenser; for example, a condenser composed of two plates, you reckon both sides of B as the effective area.

[18,167] **Engine for Launch.** G. D. W. (Fife) writes: I would be grateful if you would advise me on the following: (1) What diameter and stroke would the cylinders (H.-P. and L.-P.) of a compound launch engine require to be to give 1 h.-p. at any pressure you may like to name as suitable? What length of boat would it drive, and what speed would it go at? (2) Could you tell me the name or names of a book or number of a back MODEL ENGINEER that has a drawing of a launch engine with feed-pump and condenser?

(1) A 1¼-in. and 2½-in. by 1¼-in. compound engine will give 1 h.-p. (indicated) at a pressure of 100 lbs. per sq. in. and 1,000 r.p.m., but we would not advise such an output continuously. You would do better with a heavily built 2-in. and 3½-in. by 2-in. compound condensing engine. You ought to be able to drive a 14-ft. boat at about 4 to 6 miles per hour with such an engine. The boiler should have 2,000 sq. ins. of heating surface. (2) We would recommend you to obtain the issues of September 1st (1902) and February 12th (1903), price 3d. each post free from this office.

Further Replies from Readers.

[18,052. **Steam Engine for Workroom.** Having had many years' experience with both steam and gas as the motive power in my amateur's workshop, I should recommend "W. E. W." to try the effect of inserting three or four plies of cocoanut matting between the bedplate of the engine and the floor, and bolting down only sufficient to steady the engine; if tightened down the effect will be lost. If the engine is heavy enough to do without holding-down bolts so much the better. I find that my engine makes a noise if the ignition tube is not at a sufficient heat. The amount of gas in the mixture also requires regulating. I like to work with as weak a one as possible, and the bearings have to be free rom knock. As to steam, a boiler takes time to heat, requires too much attention, and makes a room hot and uncomfortable, not to mention the danger of explosion when the plates become pitted or grooved, and that where in most of the small boilers there is no possibility of seeing what is going on.—J. F., Newcastle.

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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.*

*** Files and Tool Steel.**

We have recently received from Messrs. Bernard Welbon & Co., 88, London Road, Sheffield, some samples of new lines in files and tool steel which they are introducing for amateurs. We have given these a practical trial in the workshop, and can recommend them with confidence to our readers.

The New Premises of Messrs. Richard Melhuish, Ltd.

Those of our readers who wend their way to Fetter Lane for the purchase of tools from the well-known establishment of Messrs. Richard Melhuish, Ltd., will find that the premises which for so many years have been familiar to them are now closed, and that the firm have migrated to a new building at Nos. 50 and 51 on the opposite side of the street. Extensive and well-stocked as the old premises were, they were not at all to be compared with the handsome and commodious establishment in which the firm is now installed. We recently had the pleasure of making a tour of inspection of the new building under the personal guidance of Mr. Richard Melhuish, and were much impressed with the very complete and convenient manner in which it has been equipped. Electric and hydraulic lifts are fitted for the transfer of both light and heavy goods from floor to floor, while the use of runways round the various departments has been extensively adopted. The counter and shelf fittings in the main showroom are splendidly arranged, and the same description applies also to the extensive storage fitments in the basement and on the upper floors. The lighting throughout is excellent, and we were pleased to note that special attention has been given to the convenience and comfort of the staff. We hardly ever call on this progressive firm without being shown something new in the way of tools or workshop appliances, and we would suggest that those of our readers who want to see the latest both in tools and tool showrooms should pay Messrs. Richard Melhuish, Ltd., an early visit.

*** New Rolling-stock for Model Railways.**

We have just had some striking novelties in model railway rolling-stock submitted to us by Messrs. W. J. Bassett-Lowke & Co., of Northampton. These are scale models of the rolling-stock of the leading British Railway Companies, a special feature being that instead of the colours being applied by hand, they are machine printed. The result is excellent in two respects. Firstly, not only do the colours match the originals exactly, but the lining out, the Companies' crests, and the finer details of the colouring are reproduced with wonderful neatness and accuracy. Secondly, the lower cost of the machine printing as compared with hand painting enormously reduces the selling price. Another improvement in these patterns is that the body of the vehicles is brought well down to the bogies, as in the real article, thus obviating the stilt-like effect of the earlier designs. The coaches are made in four sizes to suit gauges from No. 0 to No. 3, and they vary in length from 12 ins. to 21 ins. The smaller sizes are fitted with the usual form of pressed wheels, but the No. 2 and No. 3 sizes will have turned cast-iron Mansel pattern wheels, while the No. 3 size will be fitted with doors which open. These new carriages are quite the best things of their kind on the market, and their excellent appearance may be judged by the accompanying illustrations of the L. & N.W.R. coach and brake-van.

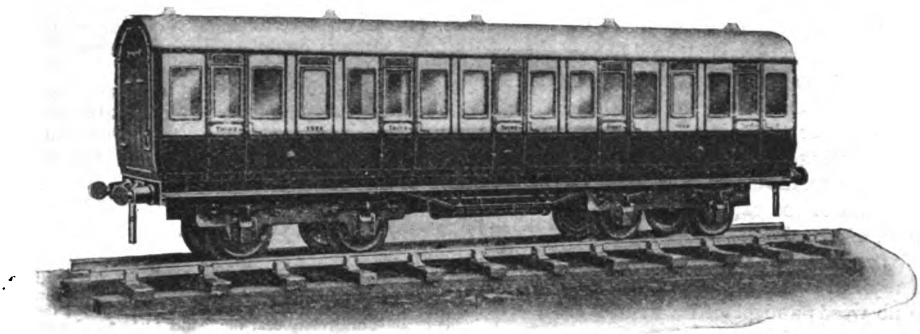

FIG. 1. MODEL L.N.W.R. PASSENGER COACH BY W. J. BASSETT-LOWKE & CO.

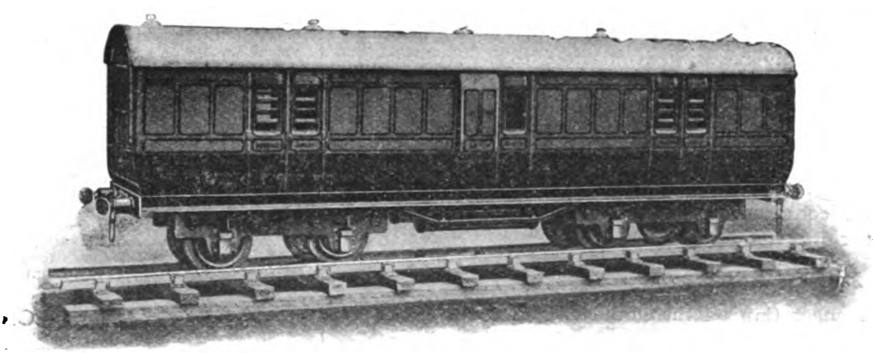

FIG. 2. MODEL L.N.W.R. BRAKE VAN. BY W. J. BASSETT-LOWKE & CO.

New Catalogues and Lists.

James Carson & Co., Ltd., 51, Summer Row, Birmingham. We have received an advance copy of Messrs. Carson's new list, which contains many items of interest to model engineers. The chief feature is the excellent series of ½-in. scale model L.N.W.R. locomotives, which are supplied both in a finished state and in sets of parts. There are, however, two new lines in the later Caledonian "903" ½ scale model and the G.W.R. Co.'s Pacific type, "The Great Bear." As the prototype of the latter model is not yet out of the shops, Messrs. Carson have shown great enterprise in putting this attractive model so promptly on the market. It is being supplied in both ½-in. and ¾-in. scales. The other items in the list include permanent way, signals, locomotive details, marine and horizontal engines, boiler fittings, injectors, etc. We hope to illustrate some of the above novelties at an early date.

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The Editor's Page.

WITH the appearance of this issue the Exhibition at the Royal Horticultural Hall, Westminster, will be in full swing. Whilst we hope that every reader living within reasonable distance will pay at least one visit, we quite realise that there are others who will find it quite impossible to attend. One reader writing from Sunderland suggests that we give a double Exhibition Number, containing a full report and photographs of the exhibits without curtailing the ordinary weekly contents. We may say that for the benefit of such readers we shall publish a full report of the Exhibition in an early issue.

* * *

With reference to the forthcoming Speed Boat Competition, and following a reader's suggestion in the issue for October 10th, that a circular course be used where a straight one of 100 yards is impossible, Bandsman J. Bance, of Shorncliffe, writes: "When in Madras, I used the moat of Fort St. George to test the speed of my boat on. I chose a portion where there were no weeds and placed a man over the other side with one end of a tape measure. After setting the rudder at several angles I at last found the right one. I then looked to water and fuel and started her again on the proper course. We each marked at our respective ends of the measure what spot she passed under. Calculations may easily be worked out from this. I observed one disadvantage, the resistance of water on the rudder draws the speed down a little, and the more acute the angle of the rudder the greater the resistance. Obviously we must get as large a circle as we can. I am of opinion that this is better than the cord and swivel system, because the boat has her own free headway."

* * *

The annual race of model motor boats for the Branger Cup on the Grand Lac du Bois, Paris, is to take place this year on October 24th. The contest bids fair to be an exceedingly interesting one, as we understand that two of the competing boats are fitted respectively with 4 and 8-cylinder engines. A special feature will be a number of model hydroplanes. As on previous occasions, we hope to reproduce some photographs and give some particulars of the winning boats in due course.

Answers to Correspondents.

T. D. G. (Port Talbot).—The articles on "Thermit" appeared in our issues for July 20th and 27th (1905), Vol. XIII.

H. T. (Cricklewood).—Your query is very vague; send us more particulars, and we will do our best to help you.

J. H. A. (Kilmarnock, N.B.)—We have not published any articles on the subject you mention.

F. R. G. (Crouch End, N.).—Have you seen our Handbook—"Telephones and Microphones," price 6d., post free 7d.? The following are also two good books on the subject, either of which we recommend—"Practical Telephoning," by Jas. Bell and S. Wilson, price 3s. 6d., postage 4d.; "The Practical Telephone Handbook," by Joseph Poole, price 6s., postage 4d. These can be obtained from our publishing department.

A. H. F. (Brighton) and other readers.—We regret an error in this column in our issue of October 3rd. The Great Central "Atlantic" locomotives were illustrated by working drawings in the *Engineer* for June 10th, 1904; the date of the *Railway Engineer* plate is December, 1903.

P. H. (Bothwell).—We thank you for your note, but the same is not of sufficient interest to merit publication.

W. S. F. (Cambridge).—Your post-card to hand. Let us know exactly what your trouble with the copper hull is, and we will try to assist you.

A. W. M. (Aberdeen).—We will endeavour to have an article on this subject.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

How to Address Letters.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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Contents.

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

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THE

Model Engineer

And Electrician.

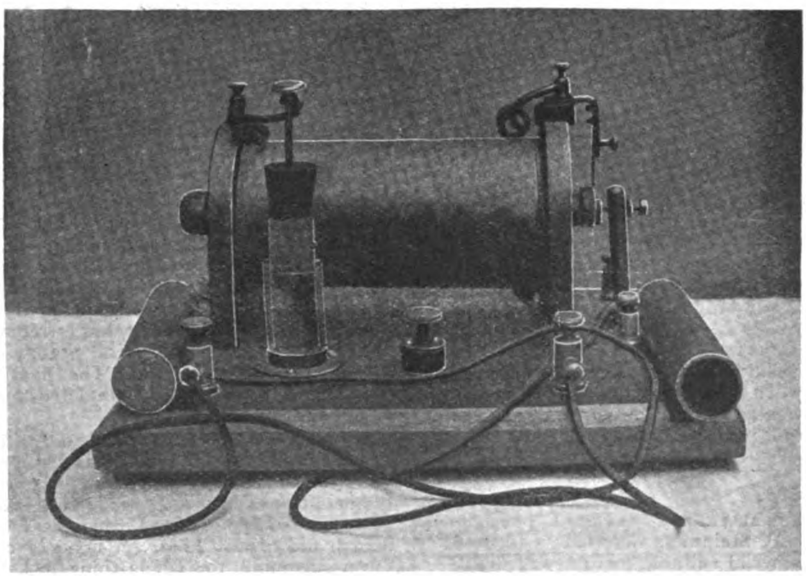
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 340. OCTOBER 31, 1907. PUBLISHED WEEKLY

A Shocking Coil.

By A. STANWAY.



MR. A. STANWAY'S SHOCKING COIL.

THE following brief description of my coil may, I think, be of some interest to readers of THE MODEL ENGINEER. The coil, from start to finish, with the exception of the terminals, is home-made. The bobbin is 6 ins. long by 3 ins. diameter, formed with two mahogany ends joined by a cardboard tube of ¾ in. internal diameter. It is wound with ½ lb. No. 20 D.C.C. wire for the primary, and ¾ lb. No. 36 S.C.C. wire for the secondary. The windings are well insulated; a waxed paper sheet being between every layer and four thicknesses of paraffin waxed paper between primary and secondary. The core is formed of 8 ozs. No. 20 soft iron wire fastened together by being sweated in solder at the ends, and over it slides a brass regulating tube.

The break is a slight variation of the ordinary break, the spring being supported on top of the bobbin end in such a manner as to allow of easy adjustment of the spring tension screw. The pillar was turned up from brass rod, and the contacts are of platinum. I have a screw-down switch (Fig. 2) on the primary circuit and a water regulator on the secondary. The latter was added after the coil was finished, for a shock from the secondary, with only one bichromate cell and the regulator tube

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full in, was very much too severe for one or even two persons to stand.

The water regulator (Fig. 1) is made of a small flat-bottomed glass tube. In the bottom of the tube I made a hole by pressing a hot needle into the glass whilst the latter was in the flame of a spirit lamp. A thin wire is threaded through the hole, and soldered to a small brass disc, which is imbedded in sealing-wax in the bottom of the bottle. The wire forms one terminal of the regulator, and the other is formed by a brass rod sliding through a

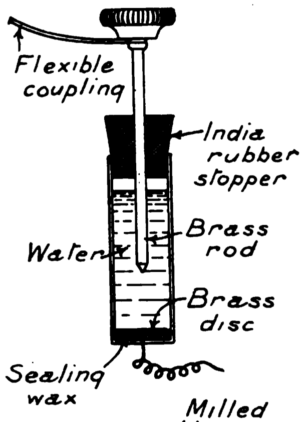


FIG. 1. WATER REGULATOR.

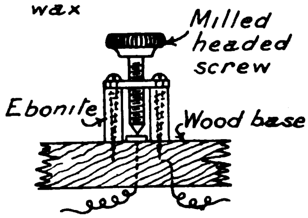


FIG. 2. SCREW-DOWN SWITCH.

rubber stopper. The bottle is supported in a brass frame and filled with water. By sliding the rod in the water the shock can be varied from quite a small one to the full power of the coil.

HIGH-RESISTANCE MATERIAL.—A recent American patent by Dr. C. P. Steinmetz describes a form of high-resistance material suitable for use with lightning arresters, etc. A mixture of clay and oxide of iron or chromium is mixed with a binding material, such as potassium silicate or sodium silicate. The material is made up into rods and baked until hard, and a fairly homogeneous product of constant conductivity is obtained.

A NOVEL STEERING WHEEL.—To overcome the necessity for the driver of a motor vehicle to remove his hand from the wheel to press the bulb of the hooter, often at the very moment the firmest grip may be required, a novel steering wheel has been invented, in which an elastic ring or tube is laid on the actual rim of the wheel, and upon the tube a solid top ring. The tube of the wheel is connected to the horn by a length of flexible tubing. By the sudden compression of the collapsible rim the hooter can be sounded.

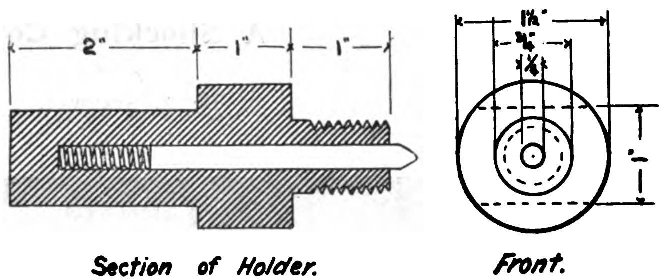
Workshop Notes and Notions.

[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.]

Improved Faceplate Holder.

By T. GOLDSWORTHY-CRUMP.

In THE MODEL ENGINEER for July 11th of this year I described and illustrated a faceplate or chuck-holder, and mentioned a means of centreing work. On further consideration the improvement shown in the drawing herewith presented itself, and now any circular or odd-shaped work can be accurately placed in position at once, as the sliding centre projects sufficiently to engage with the previously marked work. The procedure for



IMPROVED FACEPLATE HOLDER.

making this holder is quite simple. A piece of brass or mild steel is taken of a suitable size and turned up in a grip chuck, the thread cut to match the mandrel nose, and a $\frac{1}{4}$-in. hole carefully bored out, as shown. A piece of steel rod is next turned to a perfect sliding fit, and the point turned to an angle of 60 degs. while in its place in the holder and before the latter is removed from the grip chuck. A small spiral spring is required to press the rod upwards. The flats can then be filed and the holder is completed.

Recovering Tin and Solder.

A simple plan of recovering tin and solder from old tin cans and other scrap is given in a recent issue of *Mechanical World*. Run them in a perforated tumbling barrel which is mounted over a small fire of any kind. A hood or casing of sheet iron surrounds the whole thing to keep in the heat. The rotation gives the whole contents an equal heating, and the melted solder and tin flow down into a trough made for them.

A Cheap, Reliable Angle Indicator.

By "ORLANDO."

The following is a description of a handy little instrument which will be found easy to make, and will amply repay anyone for the time and trouble expended in its construction. As its name implies, it is a device for measuring the angles of inclined surfaces, and, if care is taken in the making of it, the result will be an accurate indicator.

The materials required are :—Three pieces of wood about 5 ins. by 3 ins. by $\frac{1}{4}$ in. thick, which may be cut from a cigar-box ; two of these pieces (Fig. 1) should have the grain running horizontally, while in

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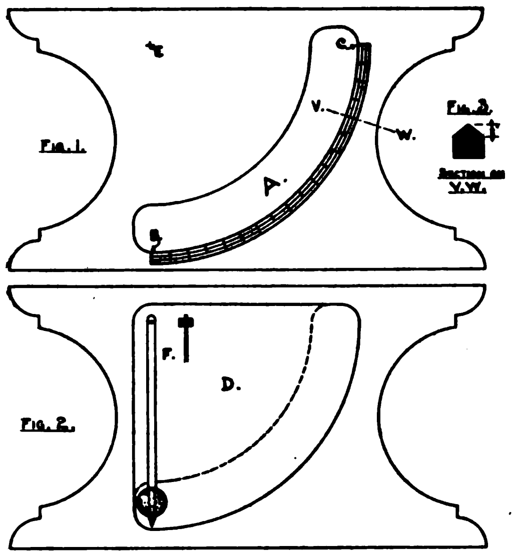
the remaining piece (Fig. 2) the grain should run vertically; this will prevent the wood from warping when finished. A piece of brass wire about No. 18 gauge by 2½ ins. long, a metal ball (preferably brass), 5-16ths in. diameter, and a few fine pins, will also be required.



A Simple Angle Indicator. (*One-third full size.*)

Take the three pieces of wood and fix them together *temporarily*, with the vertical grained pieces *between* the other two, in the form of a sandwich. Now set out the shape shown at Fig. 1 with pencil and dividers; after which, with a fretsaw, cut out of all three at once the outline and also to space marked A, ignoring the partly graduated portion between B and C, which is a bevelled edge. If possible, put under pressure until set. When set, sandpaper the top and bottom edges parallel with each other, and also smooth up the ends.

Make a fine hole with a needle right through the three pieces at E (Fig. 1), otherwise the centre from which the pointer has to hang will be lost. The wood will now be about ⅜ in. thick, and this must be reduced to 5-16ths in. by sandpapering both sides, which will also have the effect of finishing off the ends of the pins used in fixing.

The extremities of the bevelled edge (B and C, Fig. 1) must now be set out on both sides—B being squared from either the top or bottom edges on a line through E, and C being on a line through E parallel with the top edge. (These must be accurately set out.) Join B and C with an arc having a radius ⅛ in. larger than that already joining B and C, and then carefully bevel the two marked edges, as shown in Fig. 3.

The next thing is to graduate these edges, and to save the tedious job of setting out the gradations, they are provided in Fig. 4, and simply require cutting out and glueing in position on the bevelled edges with the 0° at B. It will be noticed that in Fig. 4 the radii are larger than in Fig. 1; this is necessary on account of the bevelled edges forming portions of a cone.

The article is now ready for varnishing, which should be done with two coats of a transparent varnish, giving it a light sandpapering when the first coat is dry. The graduated papers must also have the two coats of varnish, but must *not be sandpapered*. While the varnish is drying, the pointer F (Fig. 2) may be made, as follows:—Drill a hole in the metal ball large enough to take the brass wire, and after flattening the portion of the wire which is shown above the ball, solder the remainder into the ball, leaving about ⅛ in. projecting at the bottom, which must be filed to a point. Obtain a portion of a sewing needle 5-16ths in. long for the fulcrum E, and drill a hole in the top end of the pointer to fit this needle very loosely. To still further assist the free movement of the pointer,

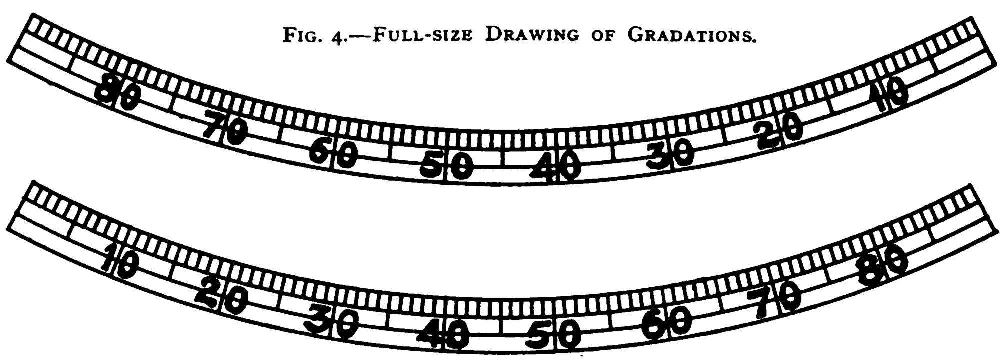


Fig. 4.—Full-size Drawing of Gradations.

When this is done, take the three pieces apart, and, on the centre piece *only*, mark and cut out the centre portion D (Fig. 2). This, when the instrument is fitted together, forms a cavity in which a pendulum or pointer has to hang.

Take the centre piece, and, after well glueing both sides, place it between the other two in the exact position in which they were cut, and fix them together with a few of the fine pins previously mentioned. by keeping it off the woodwork, make two washers, as shown in side view of pointer (Fig. 2), by flattening two pieces of wire about ⅛ in. long and drilling a small hole in each. Fix these washers one to each side of the pointer *with glue*, as they are required to free themselves when in position.

Everything being now ready, put the needle into the hole E, letting it just project through the first thickness of wood, then put the pointer in the

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opening prepared for it, pass the drilled end up to the needle, and press the needle home. This will leave the pointer suspended, and the indicator is complete.

How to Make an Inter-Communication Telephone.

By Fred Rudolph.

SEVERAL methods and systems are devised for giving telephone service between the various departments of a business establishment or private house, but of all the methods two stand prominently to the front. The first method is to instal a switchboard at a central point to which all the lines run and are connected. This method, besides being exceedingly expensive from the installing point of view, requires the attention of an operator to plug through as the calls arrive. The second method involves the use of what is called an inter-communication, or house, system (sometimes called a domestic system). With this system an instrument is required at each station, and is wired on to a separate line, the line belonging to each individual station running through all the other stations. A single switch device is arranged in connection with each instrument, by means of which the party at any station can connect himself with the line belonging to any other station and call up the party at that station *without the intervention of an operator.*

The wiring for this system necessitates the running of as many wires as there are instruments. The method of wiring is to run a cable having the correct number of conductors according to the number of stations. The outer braiding of the cable is pared off at each instrument, and wires are tapped on to the correct studs of the instrument. More often than not, a simple form of wood or porcelain junction box is used, which gives the wiring an exceedingly nice finish, as, however neat the jointing is done by the first method, it always appears a clumsy job.

An important item in all inter-communication work is the method of distributing the necessary insulated conductors over any building. This is generally done by enclosing all the wires in a neat cable, specially constructed to give the least possible inductive effect between any neighbouring pairs of conductors.

The tapping-off mentioned in the previous part of this article should be done by means of special junction boxes. These effect two main purposes: first, they enable the fixers of the installation to make a workmanlike job; second, they facilitate rapid testing for any faults, as section after section can be disconnected in the testing process and the fault rapidly located. With the old method of jointing, *i.e.*, soldering conductors on to the cable and carefully insulating all joints, it is, as will readily be seen, a difficult matter to locate a fault and put right, as it is impossible to separate one section from another.

For those who have a very elementary knowledge of telephony it would perhaps be as well if they first went through The Model Engineer Handbook No. 4, "Telephones and Microphones." They will then thoroughly grasp the why and wherefore of the different circuits mentioned, such as the microphone, receiver, and ringing circuit, etc.

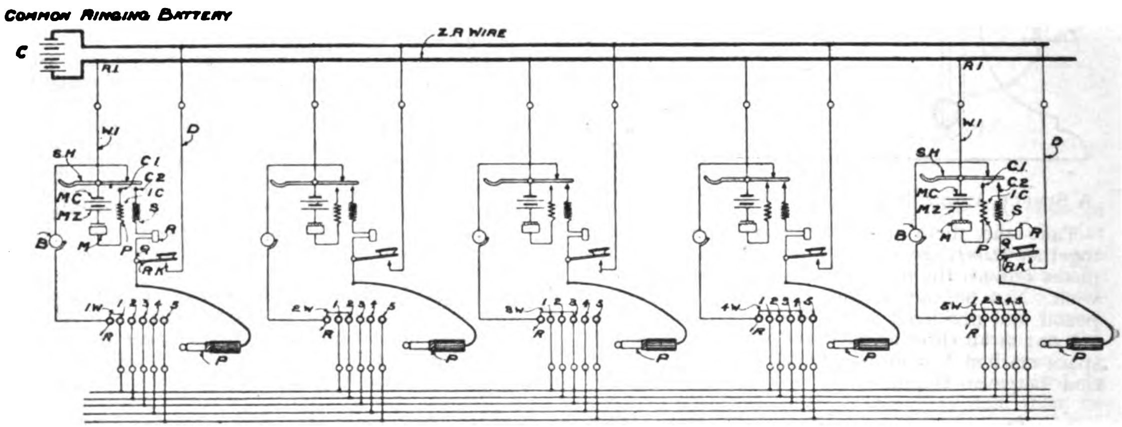

Fig. 1.—Diagram of Connections of a Five-station Intercommunication Telephone System with Lever Selector.

The connections for a system having five stations is shown in Fig. 1. Each of the telephone sets embrace the ordinary talking and ringing apparatus switched alternately into circuit by the ordinary form of switch-hook, the line required in this instance being selected by a switch.

Fixed on the base of each instrument is the switch lever L which lever is adapted to slide over the studs of R 1, 2, 3, 4, 5 arranged in a semicircle beneath. Each stud of the instrument is connected with a line terminal 1, 2, 3, 4, 5, connected across the set with wire from the studs. The line terminals are added to facilitate the external wiring, although on more simple sets the line wires are brought direct on to the studs.

Besides the lever L, we have the switch-hook SH, also induction coil IC, microphone M, receiver R, bell B, the ringing key RK.

The functions of the switch-hook are as follows:—On receiving a call the receiver is taken off; this cuts out the bell, closes the battery round the primary winding of induction coil and microphone, and also connects the receiver and secondary of induction coil direct to line.

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The microphone, receiver, and ringing key need no explanation. The induction coil is fitted in sets which have lines of over 50 yards in length, although sets fitted with a coil even on very short lines give much clearer articulation than when not fitted. The connection diagram, Fig. 1, represents the condition when station No. 1 is about to call and speak to station No. 5. For this purpose the person at station No. 1 has moved lever L from its home or reply stud to stud No. 5. This connects the instrument at station No. 1 with the line belonging to station No. 5. When the ringing key at station No. 1 is depressed current flows from the common ringing battery C, down wire D, through ringing key RK, through lever L, along line No. 5 to stud No. 5 on No. 5 instrument, along wire 5 W, to reply stud of No. 5, through bell B, top contact of switch-hook SH, along wire W, to zinc side of ringing battery—this being a complete circuit, the bell emits a loud ring.

When the receivers at both stations are raised, the talking apparatus is thrown into the circuit over which the calling current was just sent, and the parties converse over the common return or ZR wire and line wire No. 5.

Had station No. 5 called up station No. 1, instead of *vice-versa*, then the talking and ringing would have been done over the common return or ZR and No. 1.

We will now proceed to trace the speaking circuit, shown in Diagram 3, as we did the ringing. Immediately we lift off our receiver, the switch-hook SH breaks from the top bell contact, thus disconnecting the bell, and makes on to the two bottom contacts. This closes (first) the battery MC MZ, through contacts C1, round the primary of induction coil IC, and the microphone M. Thus we have a constant current flowing round this circuit, and on speaking into the transmitter we get a varying resistance in this circuit. This allows

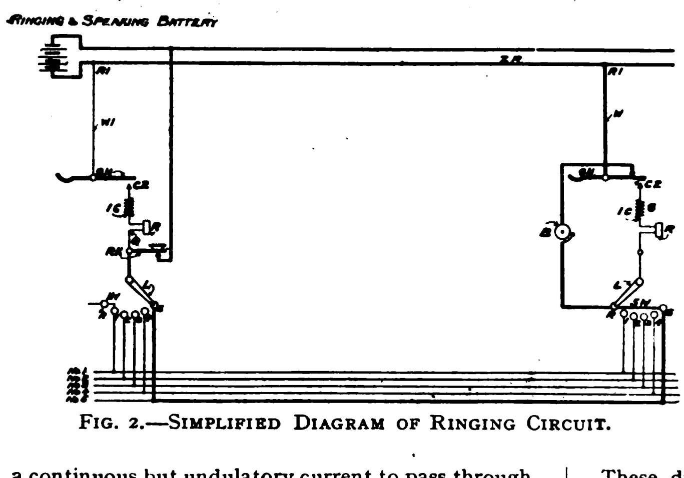

FIG. 2.—SIMPLIFIED DIAGRAM OF RINGING CIRCUIT.

a continuous but undulatory current to pass through the primary winding, which produces a field of force in its surrounding space, and thus the change of resistance due to speaking in the microphone causes a change in the intensity of this field, and as the secondary winding lies in this field, these changes cause currents to flow in the secondary winding, and this to the return and line wires. Secondly, the removal of receiver from hook closes the secondary winding of coil through contacts C2, and puts same on to the return wire and the line wire; therefore, when conversation is being held we get voice currents traversing, beginning at the return wire R1, through wire W1, over switch-hook SH, through contact C2, through secondary of induction coil, through receiver, along wire Q, through switch

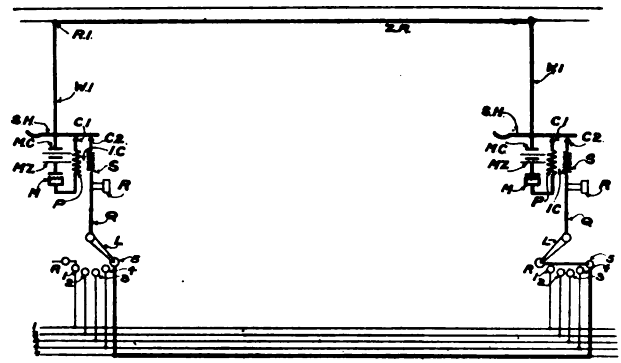

FIG. 3.—SIMPLIFIED DIAGRAM OF SPEAKING CIRCUIT.

lever L to stud No. 5, along wire No. 5 to reply stud of No. 5 instrument lever, being on reply stud along lever L through receiver, secondary of induction coil, contact C2, switch lever SH, wire W, and back to return line ZR—thus completing the circuit.

(*To be continued.*)

The Latest in Engineering.

Artificial Ice Rink. — What is claimed to be the largest artificial ice rink in the world exists at Crossmyloof, within a penny tram ride from the centre of the city of Glasgow. This enterprise is in the hands of the Scottish Ice Rink Company, and housed in a comfortable pavilion, is, of course, entirely independent of atmospheric conditions. The ice surface is oblong in shape, 140 ft. by 98 ft., and extends to 1,525 sq. yds. The freezing plant will, in the summer months, while the pavilion is closed, be used for the manufacture of ice for sale. The machinery is in duplicate throughout, one set for keeping the rink frozen, and the other for making 25 tons of cell ice per day. Refrigeration is on the ammonia compression system, and power is obtained from two "National" gas engines, each capable of giving 85 to 90 b.h.-p. when working with suction producer gas. These drive by belts on to a countershaft, which in turn drives the refrigerating machines. Two large brine coolers are placed in the engine-room. Pumps force the cold brine through mains to the rink and ice tanks. The ice floor surface, representing 100 tons of ice, is maintained by over six

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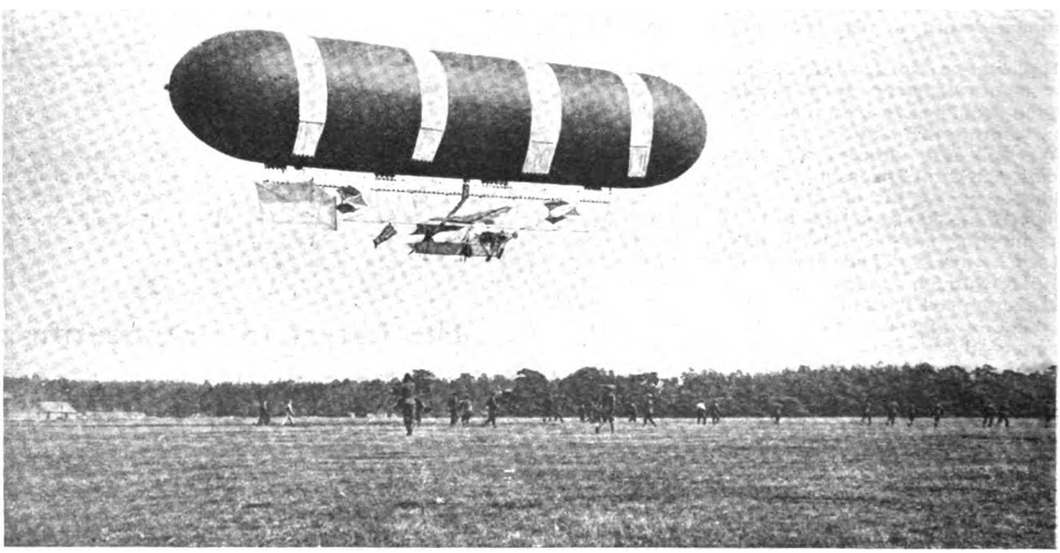
miles of wrought-iron piping, through which the brine is circulated.

The Military Airship, "Nulli Secundus."—An interesting sight was witnessed recently in London on the appearance of the first English military air balloon, "Nulli Secundus," which was successfully navigated from Farnborough, by Col. Capper, R.E., Mr. Cody, and Lieut. Waterlow. A trip was made round the dome of St. Paul's. The return journey proved rather more difficult, owing to the rising wind, and a descent was made at the Crystal Palace. The airship remained in the air 3½ hours, and travelled a distance of 50 miles, the speed through the air being about 14 miles per hour. The length of the balloon is 90 ft. from end to end. The carriage, which is suspended from the light framework, is about 16 ft. long, shaped like a boat, and covered with canvas. One-third of this space is taken up by the eight-cylinder Antoinette petrol engine. The supply tanks are carried above, and in the picture Mr. Cody is seen attending to them. The sail-like arrangement at the rear of the car acts precisely as the rudder of a ship. Huge wings are situated each side of the car; these allow of the ascending or descending at any desired angle without stopping the engines. There are two propellers, one each side of the car. The weight of the car and engines and three occupants is calculated to be just over 1 ton. It is noteworthy that this is the first instance of a navigable balloon envelope being made of gold beaters' skin. Whilst in the Palace grounds a strong south-westerly gale sprang up and loosened the ship from its moorings and more or less disabled the craft. Despite this fact, however, its navigators are hopeful as to future success. The photographs herewith reproduced show the airship under weigh.



THE FIRST ENGLISH MILITARY AIRSHIP, "NULLI SECUNDUS."

INSTRUCTION IN PHOTOGRAPHY.—Classes for tuition in various branches of the photographic art are commencing this month at the Polytechnic, 309, Regent Street, W. The subjects include—"Negative Making, Printing, and Enlarging," "Operating," "Re-touching," "Finishing in Black and White," etc. The pamphlet, giving all particulars, will be sent upon application to Mr. Robert Mitchell, Director of Education.

IN COMMON with other long tunnels on the Great Western Railway Company's system, the Severn Tunnel is provided with a wire fastened to the side, the cutting of which, by permanent-way or trainmen in case of emergency, has the effect of ringing bells in the signal-box at each end. In order to still further provide for emergencies in the case of the tunnel mentioned, the Company have recently provided telephones through it, connected with the signal-boxes, the instruments being fixed in the tunnel at intervals of about half-a-mile. In the *G.W.R. Magazine* for October (this month) one of these is illustrated, which, owing to the atmospheric conditions prevalent in the tunnel, are of special construction.

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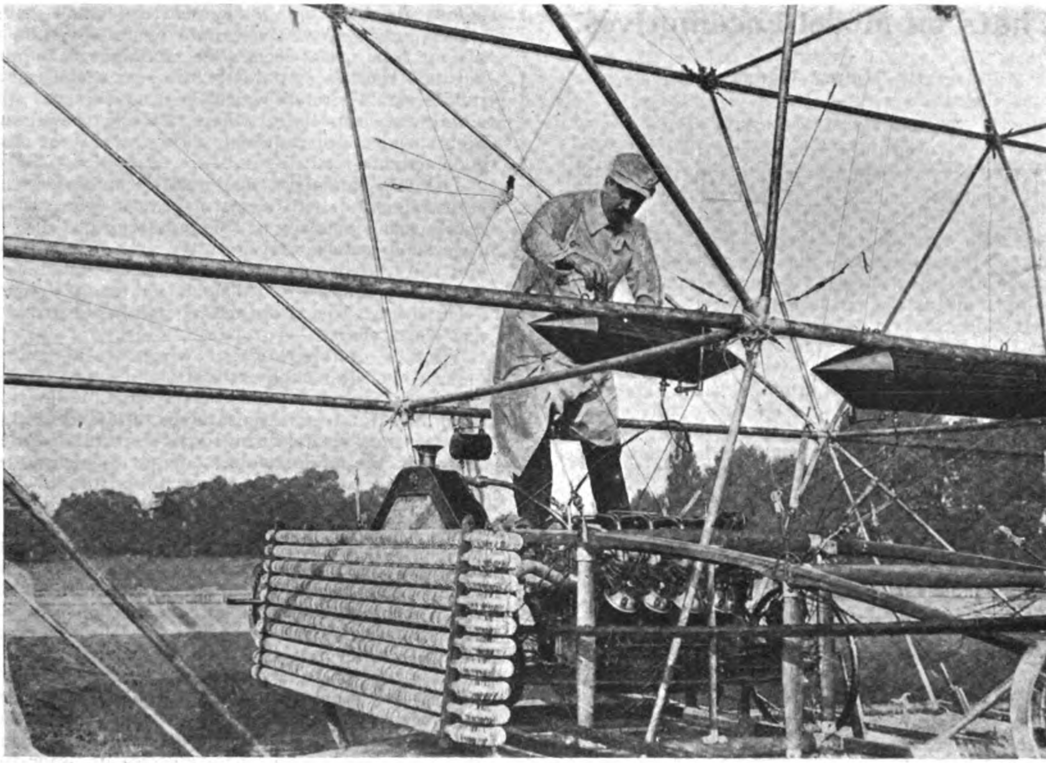
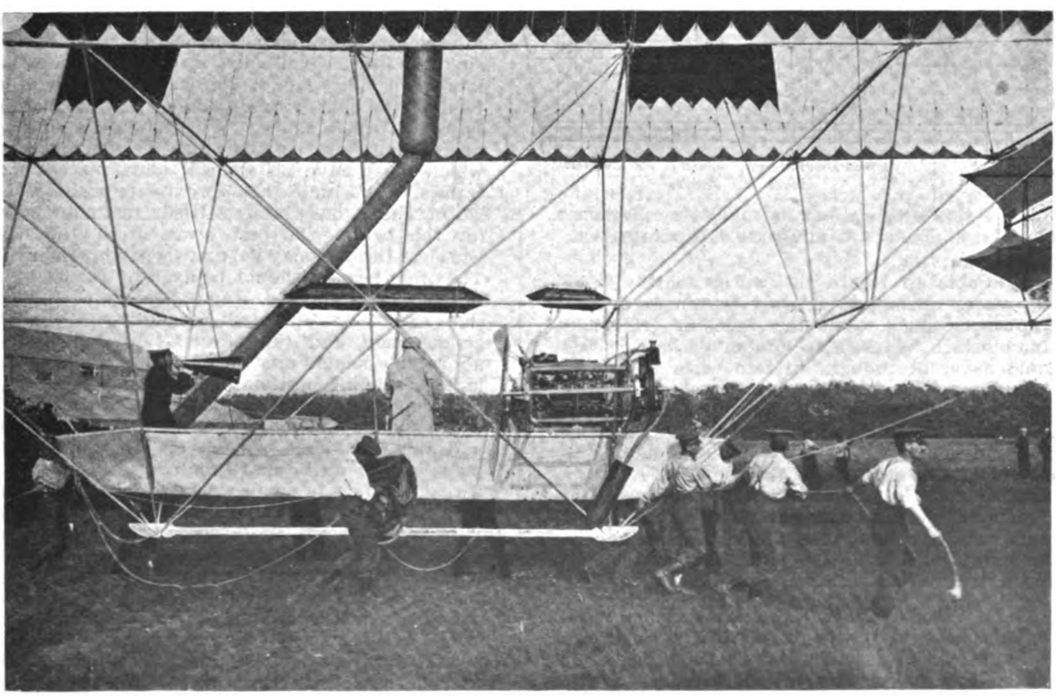


VIEW SHOWING ENGINES AND PORTION OF FRAMEWORK.



GETTING THE "NULLI SECUNDUS" READY FOR A TRIP.

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Chats on Model Locomotives.

By Henry Greenly.

Electric Locomotives.

(*Continued from page* 401.)

THE next system of drive is the worm gear, as shown in Fig. 8. This I tried in two ways —one with a single-threaded worm (the actual shaft, with type metal flywheel and pulley, being shown in the photograph, Fig. 6*a*), and the other with a double-threaded worm. Although worm gear forms a simple means of obtaining a large reduction of speed, it has several drawbacks, the chief one being that the gear is not reversible*, *i.e.*, the driving wheels cannot be made to drive the worm shaft with the ratio usually adopted in model work. Therefore, directly the current to the motor is shut off and energy in the rotating armature is exhausted, the driving wheels pick up, owing to the worm wheel

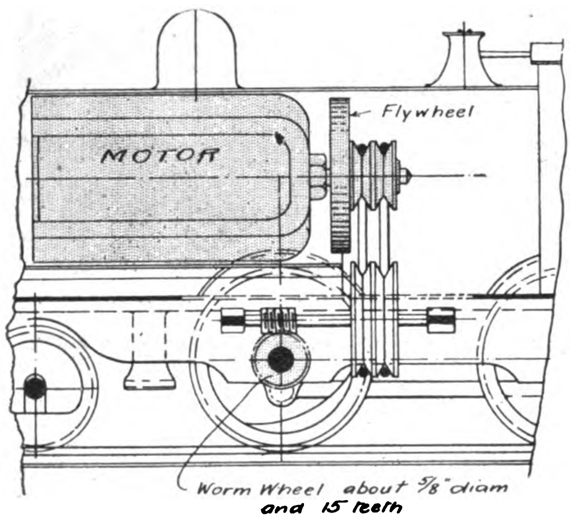

Fig. 8.—Combined Belt and Worm Driving for Model Electrically-driven Locomotive.

being unable to rotate the worm shaft. Therefore, where worm gear is used the engine cannot be pushed along, and the rheostat (resistance frame), which is used to obtain various speeds, should never be brought to zero when the engine is running fast and it is desired to stop, otherwise the wheels will pick up and the momentum of locomotive and train will strain the teeth of the worm wheel and the worm. The last notch should supply just enough current to keep the armature revolving and to stop the engine in a railway-like way. The operator should take care never to put the driving handle back to zero at once, but let it remain on the No. 1 stop of the rheostat until the speed of the train is reduced to almost a crawl. The chief use of worm gear in model locomotive work is to obtain a low speed ratio. In engines with small driving wheels large gear-wheels cannot be employed on the driving axle, as at least ¼ in. clearance is required between the lowest point of the gear wheel and the rail level. Therefore worm gearing presents some advantage, especially where hauling power and high speed is not required, as in the case of model goods engines.

The experiments I made with the single-wheel express engine with a worm gear in place of the spur-gearing shown in the photograph did not give such satisfactory results. The worm wheel had thirty teeth, and with a single-threaded worm (ratio, therefore, 1 to 30) the speed was rather low, even with a 1 to 1 speed ratio between the armature and worm shafts.

With a double-threaded worm (ratio 2 to 30 or 1 to 15) and slight reduction in speed between the armature shaft and the worm spindle (total ratio about 1 to 16, the same as obtained with the spur gearing, see Figs. 6 and 6*a*), the results were not so good ; the engine would not go up such a steep incline, and appeared less powerful on the level. Of course, the power may have been absorbed in the worm shaft bearings. This shaft was mounted on screw centres which were fixed in brackets screwed to the frames, as shown in Figs. 7 and 8. These gave a little trouble in adjusting the worm and the worm wheel, upon which much depends, and probably accounted for some of the loss of power. Where worm gear must be adopted I therefore suggest an alternative method of arranging the worm shaft bearings, which will allow of vertical adjustment of the worm and worm wheel without interfering with the alignment of the bearings. Obtain a couple of bronze balls about 7-32nds-in. to 9-32nds-in. diameter, and drill them with a 5-64ths-in. hole for the journals of the worm shaft. Make a pair of suitable bearing brackets as shown in the accompanying perspective sketches, the sinkings for the ball being made by the point of a large drill, the cap of the bearing brackets just holding the balls without shake when the clamping screw is driven home. When complete, the balls may be put into position, and the driving wheels, which must have no vertical play, placed in the frames. As soon as the approximate position of the worm shaft has been settled, the rear bearing (or the bearing farthest away from the worm wheel, as the case may be) may be fixed permanently. The other bearing should be fixed by screws having slotted holes in the frames, so that the worm shaft may be adjusted vertically. With this arrangement and the universal jointed bearings, no trouble should arise in obtaining the most satisfactory running position of worm and worm wheel.

Failing some special device, the end-thrust of the worm spindle will, of course, be taken by the ball and the shouldered portion of the spindle. This may be deemed unsatisfactory, and as collar-thrust bearings in small work will always be found to absorb a considerable proportion of the power, I therefore suggest another way of fixing the worm shaft. This method provides for the fine adjustment of the worm and wheel just the same, and consists of a separate bearing frame having two lugs, which are drilled and tapped for hard steel centre pivot screws, one of which should be movable and provided with a locking nut. Of course, bearings may be used, but centre points, if well made, are better where end-thrusts are present. When the

* This must not be confused with possibility of the locomotive being able to travel in either direction. Worm gear properly made will run one way as well as the other.

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worm shaft has been fitted up and everything is made to work sweetly, the bearing frame may be placed in the locomotive. One end may be fixed by a single screw, and with slotted holes at the other end (that nearest to the worm) the frame may be raised or lowered to meet the exigencies of the case and the best working positions of the worm and wheel obtained.

Reconsidering the three types of gearing, but leaving out for the moment the disabilities the worm gear labours under in allowing the engine to roll with the current shut off, I can recommend either arrangements of spur gearing (see Figs. 6 and 7) for express engine work, say for model locomotives with driving wheels of larger diameter than the scale equivalent of 5 ft. 6 ins., and worm gearing for slow running engines with small driving wheels—goods and shunting models—where spur gearing is likely to present difficulties. However, as a general rule use spur gearing in preference, as, although a little noisy, it will be found more suitable to locomotive work where methods of "reversing from track" are adopted.

In conjunction with the permanent magnet motors which I have described, the belt drive is very desirable, as it provides a flexible, comparatively frictionless and noiseless high-speed connection between the countershaft and armature shaft. Of course, it is only applicable to small engines.

Referring to the designs reproduced herewith, it will be seen that Figs. 6 and 7 represent the motor adapted to driving ⅜-in. scale models of the well-known "Stroudley" singles of the London, Brighton and South Coast Railway. These are pretty little engines, and with the total side play in the leading and trailing axles shown, should work well on curves of not less than 4 ft. 8 ins. radius. The absence of coupling-rods will reduce the internal

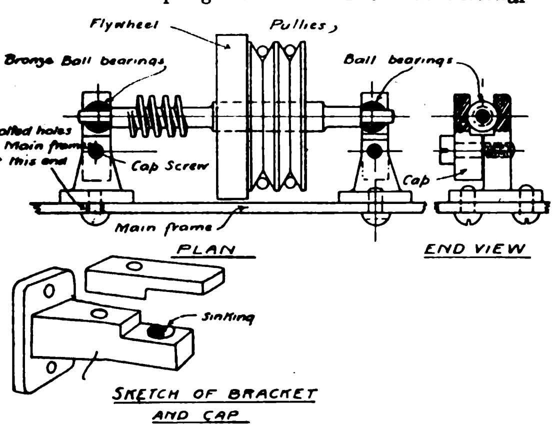

FIG. 11.—ARRANGEMENT OF BALL AND SOCKET BEARINGS TO PROVIDE VERTICAL ADJUSTMENT FOR WORM SHAFT.

friction of the mechanism to the minimum, and with only the leading and trailing wheels mounted on springs, a large proportion of the weight may be arranged to rest on the driving wheels.

The fixing of the motor does not present any difficulties. Where the crossed belt (Fig. 6) is used, a small portion of the underside of the tube forming the boiler barrel must be cut away, otherwise the tube is split down and opened out in the ordinary way to form the firebox. The boiler being rather low, a small opening will be necessary at each side to clear the driving flanges. For electrical reasons, the boiler barrel should be made of brass tube, but the whole of the other work may be done in sheet steel if it is desired to reduce the cost of material. The motor is easily fixed into the barrel. A few strips of paper are glued to the top limb of the permanent field-magnet. Three or four 3-32nds-in. screws may then be tapped into the underside of the barrel, and when tightened up grip the field-

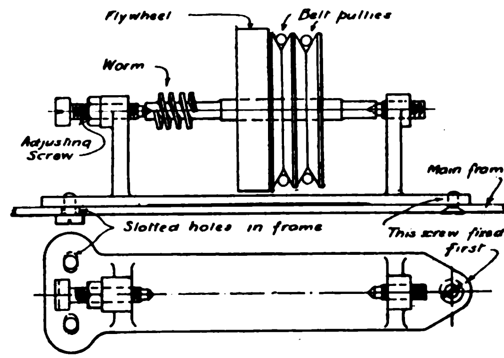

FIG. 12.—SEPARATE PIVOT BEARING FRAME FOR WORM COUNTERSHAFT.

magnet in the boiler barrel. The smokebox should be separate to allow of removal of motor, and the door should be made to open to get at the terminals.

The engine shown in Fig. 8 is a small goods or mixed traffic engine with four-coupled wheels and a leading bogie (or radial truck), the driving wheels being to the scale equivalent of about 5 ft. The exact ratio of the belt drive will depend on whether a single- or double-threaded worm is used. With a single-threaded worm and a wheel with 15 or 16 teeth the ratio of the belt drive should not be more than 1 to 1¼. To do this do not reduce the diameter of the worm shaft V-pulleys to any extent, but increase the size of the pulleys on the armature shaft as much as possible, as this will lead to a greater efficiency. With the worm gear, to obtain the maximum amount of rolling after the current is shut off, there is an advantage in using large heavy pulleys or flywheels on the armature and worm shafts, as shown in the drawing. As already mentioned, taking up the thrust of the worm is also important, and any tendency for the bearings to bind when the engine is at work should be eliminated.

MR. H. A. BENNETT'S LOCOMOTIVE.

With reference to the incidents in the steam trials of Mr. H. A. Bennett's model locomotive, described in the issue of September 12th, I may say that the engine has since been overhauled and the valve setting put right. It was discovered that one of the valves was not in its proper place on the spindle, and opened the exhaust port to the steam chest at a certain point in its stroke. This source of waste has now been eliminated, and Mr. Welsman tells me the engine pulled three trucks in which there were two adults and three children, and that the full steam pressure was maintained throughout the run. This speaks well for the new boiler and for those responsible for the reconstruction of the engine.

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Engineering Drawing for Beginners.

By H. MUNCASTER.

(*Continued from page* 306.)

THE method of detailing the eccentric and rod is shown in Fig. 76. As an example, draw out to half size, filling in the dimensions left out, making the bolts and studs ⅝ in. diameter, and showing the whole of the upper half of the strap in section. A reference to a previous example, page 103, will make this more clear. The centre line of the rod does not coincide with the centre of the strap, the line of the rod being 7-16ths in. further out to bring it in line with the valve spindle. A round rod is shown to correspond with the design of the connecting-rod. (It is worth while to give the matter of uniformity some attention when designing any piece of machinery, more especially in models which are made for show rather than for use. A flat eccentric-rod alongside a round connecting-rod is as much out of place as a Doric portico would be to a Gothic Church, and yet the combination is very common.) The rod is fitted with brass steps, so that any wear at the joint can be taken up. The details are shown, but should be more fully dimensioned, and the particulars of the rod separate from the strap given.

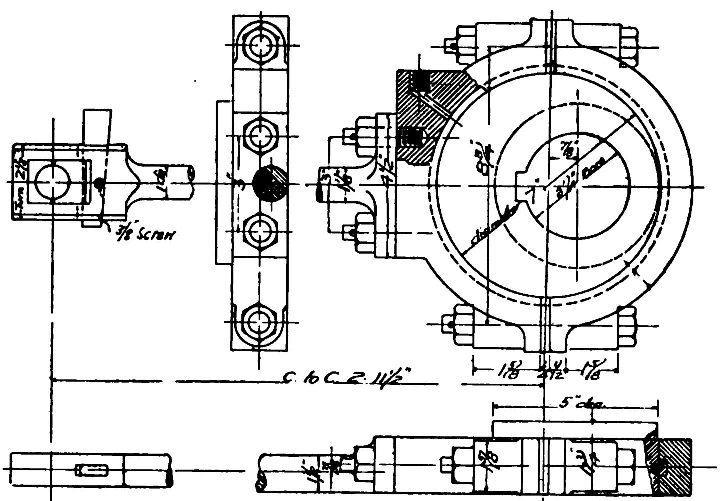

FIG. 76.

Fig. 77 shows the guide of the valve spindle. This is bolted to the engine bed, where the facing is prepared to receive it (see Fig. 73). This is of cast iron, and would be bored, the foot faced to suit the bedplate. A separate drawing of the spindle should be given showing details of the jaw to suit the valve-rod. Separate sketches of the parts for which forgings are required, or on which any smith's work is to be done, would be made for the smithy.

Fig. 78 shows in detail a design for a suitable governor. This is assumed to be made from existing patterns where some slight alteration is required. These are usually shown in red in place of the dotted lines shown in the figure. In THE MODEL ENGINEER for October 19th, 1905, a short exposition of the principles of governor design is given. This may be read with advantage before commencing to draw this example. It will be noticed that the counterpoise is as large as can be got into place, the object

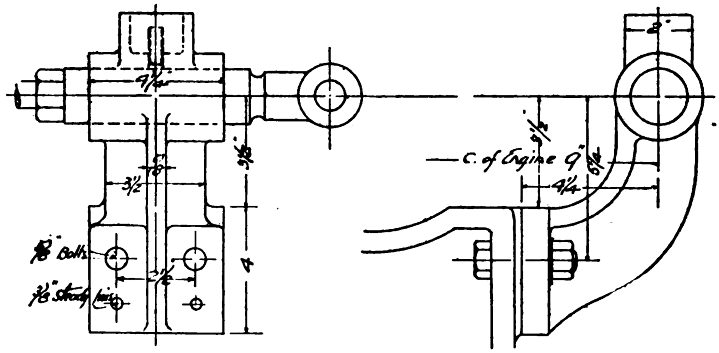

FIG. 77.

being to make the governor as powerful as possible. The power is, roughly, in direct proportion to the weight of this, and as lead is about 45 per cent. heavier than iron, it is usual to make the counterpoise hollow and fill up with lead, care being taken to "balance" it correctly.

The drawing as here illustrated is not quite sufficiently detailed for the shop, and the student should set out separately the following parts :—(*a*) Vertical spindle, showing slot for cotter passing through the sleeve. This should be arranged to limit the lift of the counterpoise to 1½ ins. (*b*) The sleeve, which will be a bronze casting with the lower collar screwed on, with particulars of the jaws for taking the bottom ends of the arms. (*c*) The clip (of wrought iron), with the trunnion for engaging the levers which operate the throttle valve. This clip will have the hole through which the sleeve passes elongated to, at least, the amount of the versed sine of the arc, having a chord of 1½ ins., and a radius equal to the length of the levers. Suitable arrangements should be shown for lubricating all the pins and rubbing surfaces.

We shall have something to say later on setting out toothed wheels. At present it will suffice to represent them as shown. The diameter at the pitch line is equal to $\frac{p \times n}{3 \cdot 1416}$ where p = pitch and

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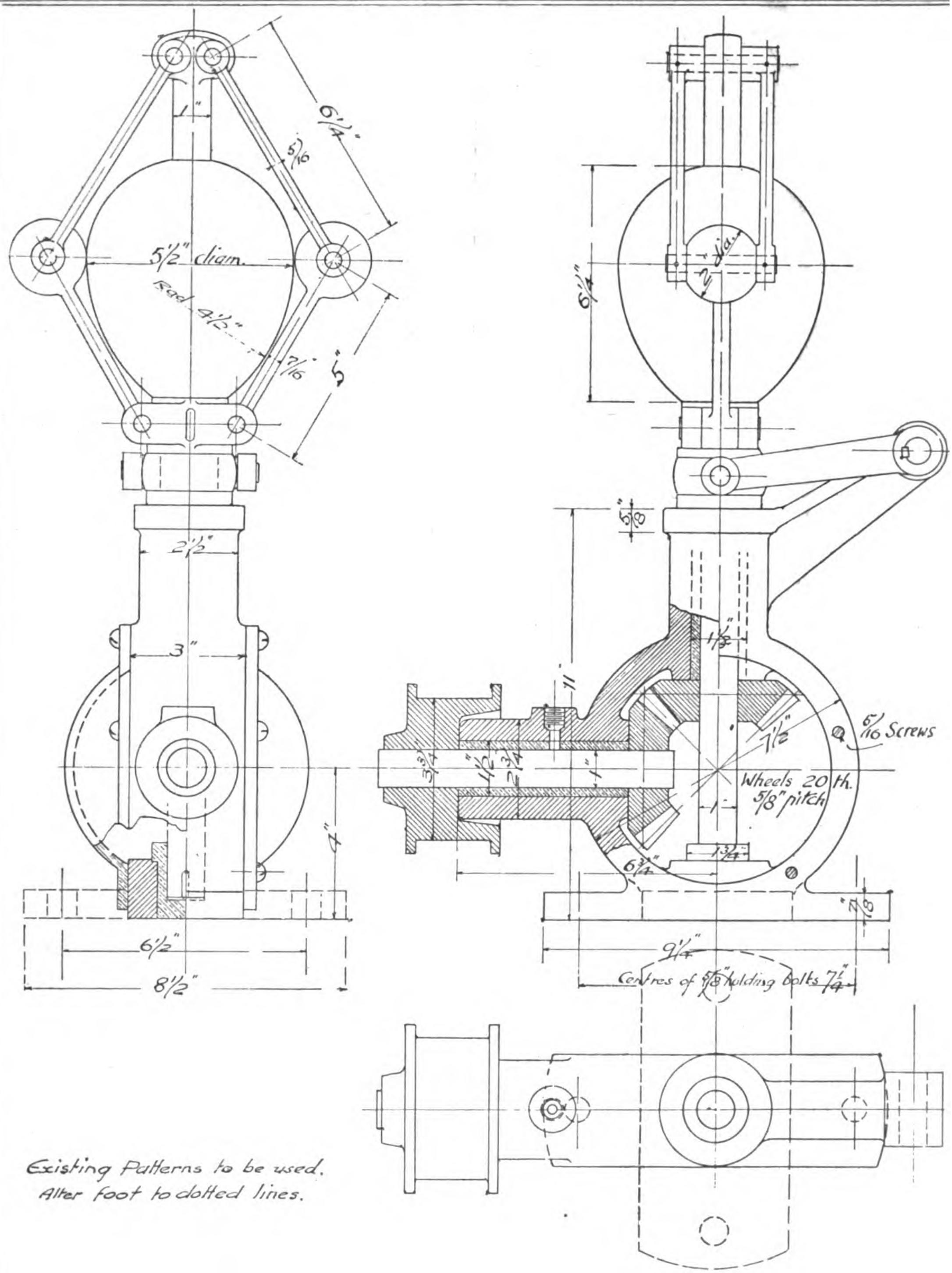

Fig. 78.—Showing General Arrangement of Steam Engine Governor.

ENGINEERING DRAWING FOR BEGINNERS.

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n = number of teeth.* Length of teeth = $\frac{2p}{3}$; clearance at bottom $\frac{1p}{12}$. Width of face = $p \times 2$. A keyway should be shown to each wheel, and shaft also to the belt pulley.

(*To be continued.*)

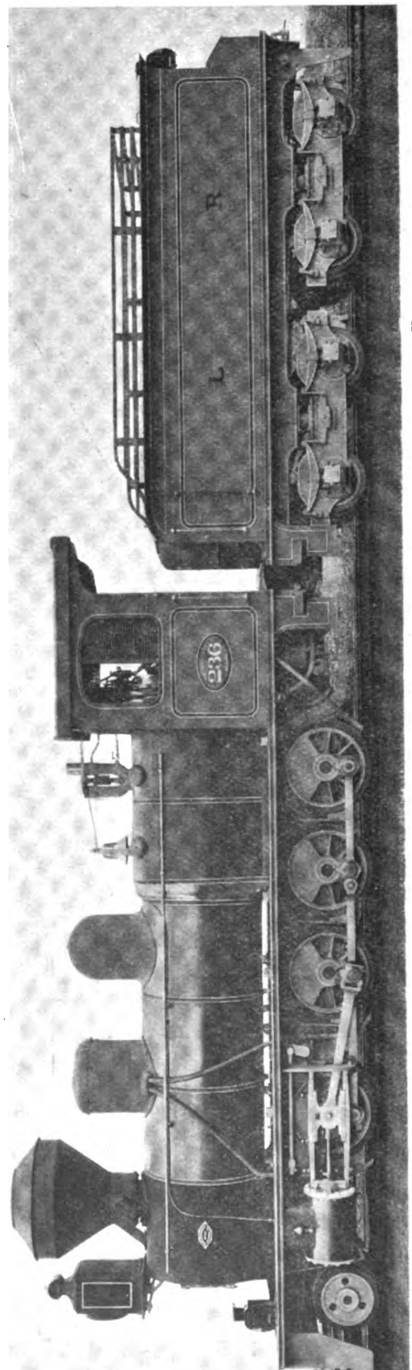
Locomotive Notes.

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

"Steam versus Electric Locomotives."

The interesting subject represented by the above heading was debated at some length after a paper upon it had been read before the New York Railroad Club at one of its recent meetings. The paper was intended as a reply to one read before the American Institute of Electrical Engineers earlier in the year on "The Substitution of the Electric Motor for the Steam Locomotive," and, as may be supposed, was strongly in favour of the latter form of engine. The author, Mr. Max Toltz, claimed that the track would have to be even more carefully and strongly made than at present if electric locomotives became general, and the charges on account of track maintenance would also be largely increased. He furnished data showing that the steam locomotive is more economical than electric ones when employed under similar conditions, and obtained the cost of locomotive power by assuming that each locomotive will develop, during six hours' work out of the twenty-four, 250 drawbar horse-power. By dividing the total horse-power-hours into the total cost of fuel it would give 6 cents for fuel per drawbar horse-power, as compared with that of 0·35 cent for electrical operation, the figure assumed by the authors of the opposing paper. As a further check on the cost of steam horse-power, the average coal used in locomotive fireboxes will evaporate 6 lbs. of water, requiring 4½ lbs. of coal per horse-power-hour, which at 12s. 6d. per ton will amount to 0·6 cent per horse-power-hour. Proceeding, the author questions whether it is fair to compare the up-to-date power plant with the average locomotive when 60 per cent. of the locomotives in present use were built over fifteen years ago, and are therefore of the smaller types, and cannot work so economically as the later engines. Reference was made to the locomotive tests conducted during the World's Fair at St. Louis, which established the fact that the coal consumption per drawbar horse-power-hour was considerably less than 2½ lbs. A large portion of the paper dealt with improvements in steam locomotives as distinct from a comparison between them and electrical ones, and prominence was given to the question of superheating. In concluding his remarks Mr. Toltz put forward the opinion that electricity for railway haulage has its place in big terminal stations and tunnels where the absence of smoke is specially desirable, but that it cannot, in its present stage of development, replace the steam locomotive for trunk line service.

* This is approximate only for wheels with a great number of teeth. The diameter is the same as that of a circle in which is inscribed a regular polygon having as many sides as there are teeth, each equal to the pitch.



"Consolidation" 2—8—0 Type Locomotive: Leopoldina Railway, Brazil.

The discussion following the reading of the paper produced some original expressions of opinion and particularly were the utterances of Mr. C. A. Seley, mechanical engineer of the Rock Island Railway, worthy of reproduction. Among other equally pungent remarks the following appeared in Mr. Seley's speech :—" All the steam railroads are not to be electrified, at least not in our day and generation, neither will a tithe of the magnificent sum of $188,000,000 be expended for superheaters, etc., for the improvement of the 47,000 locomotives now so industriously eating up the company's money."

" We are altogether too far up in the air in all this talk of millions and billions, and the assumption in this paper and the one upon which it is based suggests the approach of united and concerted action which can never be obtained until the millennium . . . . The lay mind knows or appreciates nothing of the fact that it is altogether possible that both systems are right in their theories and methods, hence the popular cry for electricity, the public apparently believing that with the elimination of the smokestack and other unpleasant concomitants of steam locomotives and the substitution therefore of the man with the controller handle, all travel and transportation will be made sane and safe, clean, swift, cheap, and in every possible way and some impossible ways an improvement on present steam railway methods.

" By this time I have probably established myself in your minds as opposed to progress and improvement in transportation methods. On the contrary, I am a firm believer in electric traction wherever there is density of population, and, where this condition is continuous across considerable territory, then electricity is possible and advisable as a railway main line proposition ; otherwise we must adhere to the steam locomotive. . . . . I will also admit the desirability, although not always conceding the necessity for, electrification of railways in large cities, particularly those which are terminals and which deal largely in suburban transportation. . . . . I am also a believer in the possibilities of improvements in steam locomotives and to a certain extent on the lines indicated in the paper and under discussion."

Although the reading of the paper and subsequent discussion upon it took place in America, and was, therefore, based on American conditions, and reflected the views held there, perusal of it cannot fail to be instructive to those interested in locomotive problems on this side.

New Locomotives for the Leopoldina Railway.

The writer has been favoured by Messrs. Robert Stephenson & Co., Ltd., of Darlington, with a photograph and particulars of one of a series of locomotives recently built by them for the Leopoldina Railway, a metre gauge line operating in Brazil. The engine is of the "Consolidation" 2—8—0 type, with outside cylinders driving the second pair of coupled wheels. The valve-gear, of the Stephenson link-motion type, is placed inside the frames, but the slide-valves themselves work above the cylinders outside, a rocker arm being employed for the purpose of transferring the motion derived from the gear from the lower to the higher plane. The leading end of the locomotive is carried by a two-wheeled pony truck having small wheels of the disc pattern. The boiler is fitted with a fire-box of the Belpaire type, over which are mounted a pair of Ramsbottom safety-valves.

Other mountings consist of a steam dome, cylindrical sand-box, whistle and bell. Sand is delivered in front of the leading coupled and driving wheels, and also behind the trailing wheels of the engine, and, as all the wheels of the engine and tender, with the exception of the leading truck wheels, are fitted with brake blocks, full advantage may be taken of the hauling power of the engine, which, for narrow gauge construction, may be regarded as very great.

The engine is equipped with steam and hand brake appliances and central coupling gear. The tender is of the eight-wheeled, double-bogie type, with a capacity for water of 1,300 gallons, and for coal of 3 tons.

The leading dimensions are :—

Cylinders, diameter, 15 ins.
Stroke of pistons, 18 ins.
Coupled wheels diameter, 3 ft. 1 in.
Total wheelbase, 17 ft. 8 ins.
Total heating surface, 818·5 sq. ft.
Grate area, 14·33 sq. ft.
Working pressure, 160 lbs. per sq. in.
Tractive force, 15,750 lbs.
Weight in working order, without tender, 30¼ tons.
Weight in working order, with tender, 48½ tons.

Automatic Motor Regulation.

By "Switch."

ONE of the most neglected uses of electricity is automatic control. In fact, the most complicated engine could be started by pressing the ever-popular "button." By means of simple, reliable switches, a motor of any power can be started and regulated by one small lever started by touching a bell push.

Figs. 1, 2 and 3 illustrate designs for automatic switches for this purpose. Fig. 1 is for small motors up to one-twelfth h.-p., such as light fans, etc. It is operated by pressing an ordinary bell-push; Fig. 2 illustrates a switch for starting motors up to one-fifth h.-p.; while Fig. 3 shows a starting and regulating switch for any power that an amateur is likely to deal with. Figs. 1 and 2 used together would start a one-fifth h.-p. motor by merely pressing a button.

The switches illustrated are for series motors, and are connected on the positive or negative side of the motor as an ordinary switch by the terminals X and Z in each case. For a shunt motor an extra set of contacts and connections would be necessary. These are left out for simplicity's sake. Fig. 1 consists of an electro-magnet, A, which attracts a lever, B, causing contact to be made between C and D, "closing" a circuit between the terminals X and Z. By pressing either of the buttons E1 or E2 the current passes from the mains to the terminals Z through the magnet C, then through the push to the other terminal X. The magnet will attract the lever, and when the push is released the current will still flow through the magnet to the terminal X but *via* C and D. The motor is stopped by pulling the lever away from the magnet, or breaking the extend circuit.

Fig. 2 shows a switch having a solenoid A, which draws up a plunger B, having a damping device C, consisting of a piston immersed in thick oil. When the current is switched on, it passes through the solenoid coils through the resistance H (of which more later). The motor then starts, and at the same time the lifter B starts, rising slowly. After a certain interval of time, the boss D lifts up the arm E. This causes the contact F to strike the contact G, which cuts the resistance H out of circuit, allowing the motor to run up to full speed and power. A damping device (C) is very necessary, because otherwise the space of time between the switching on and the resistance being cut out of circuit would be too short and too much current would pass through the armature. This "time" limit is regulated by the density of the oil used, and to a certain extent (depending on the strength of the solenoid) upon the weight of the moving part B. As both of these can be regulated, and since there is plenty of latitude allowable in the time the instrument takes to operate, adjustment should be easy.

The best starting current should be found, taking into consideration starting torque current for the maximum load it is likely to have, and the resistance used should be so that at a fixed voltage that current shall pass. This is easily calculated by Ohm's law :—

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

R = resistance in ohms.
E = voltage of supply.
C = current in amps.

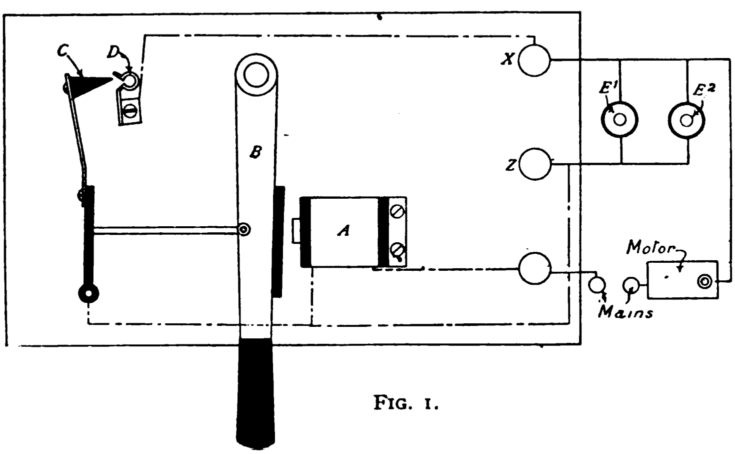


Fig. 1.

The best gauge and kind of wire for this is found by referring to the tables on pp. 68 and 69 of the handbook No. 14, of The Model Engineer series, referring to small motors.

A simplification of Fig. 1 added to this would enable a motor to be started from a number of points by means of pushes.

Fig. 3 is the switch by means of which all those having electrically-driven workshops—the machines in which are generally used singly—or wherever it is necessary to start and control a motor from

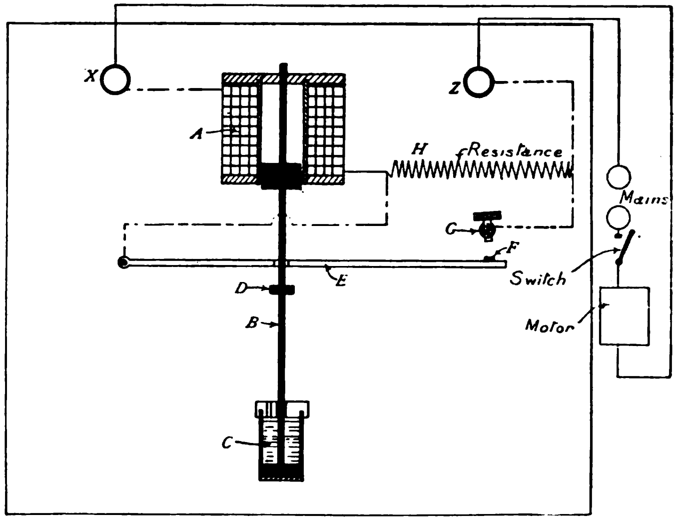


Fig. 2.

more than one place, could save time, trouble, and electricity, being able to stop, start, and regulate the speed of the motor from the machine at which he is working, without much extra expense, with absolute simplicity, and at the same time being fool-proof. The only apparatus necessary is a main switch (Fig. 3), as many subsidiary switches as machines to be controlled, and two safety devices, an overload cut-out and a circuit-breaker, described in a previous number.

To start the motor, the handle in the sub-switch (Fig. 3,A) is placed in the position 1 ; the current passes from the positive main through the magnet coils A to the pivot B of the lever C, through the resistance coils D to the terminal Z. This starts the motor. When the operator knows that the motor has started, he moves the lever (Fig. 3,A) to the position 2, and the current, instead of going through the coil A, goes through the coil E, which, acting as a solenoid, sucks up the plunger F, and thus, by means of the little roller G (to reduce friction) pulls up the arm C, which slowly cuts out the resistance D, bit by bit, until full speed is attained. The arm would probably rise too quickly, so a damping device (as in Fig. 2) would be essential, unless the device explained later is used. H and H1 are bearings, of which H is square, in order to keep the roller G fixed in one position. Now suppose half-speed be attained, and the lever be placed to the position 1 (Fig. 3,A). The current passes through the magnet coils A, instead of the solenoid; this attracts the arm J (which, when not attracted, is held back by a spring) causing the tooth K to be inserted into a notch of the catch-plate L, of the arm C. This holds the arm in the position left by the solenoid when the sub-switch lever was moved over. Thus the motor can be started, and when the required speed is attained the lever is moved and the main switch lever remains where it is required. To stop the motor the lever is moved back to the position illustrated; this "breaks" the circuit, releases the arm J (if in action), and allows the arm to drop to the starting position. The controlling resistance illustrated is of the step-by-step principle, but a liquid resistance current. For instance, suppose the "full load" current of the motor be 5 amps., then start up the motor as quickly as possible under full load, being careful that the ammeter does not read higher than 5 amps. Note how quickly you can do this. This figure will give an idea of the speed at which the solenoid should be allowed to pull the arm up. This rate will probably be faster than required, so the sub-switch lever should be moved to position 2 for a few seconds, and then to position 1 again, to allow the motor to reach that speed, and so on until the required speed is attained.

Thus it is, comparatively speaking, easy to make a switch which in its starting and regulating action is absolutely automatic. But as it stands there

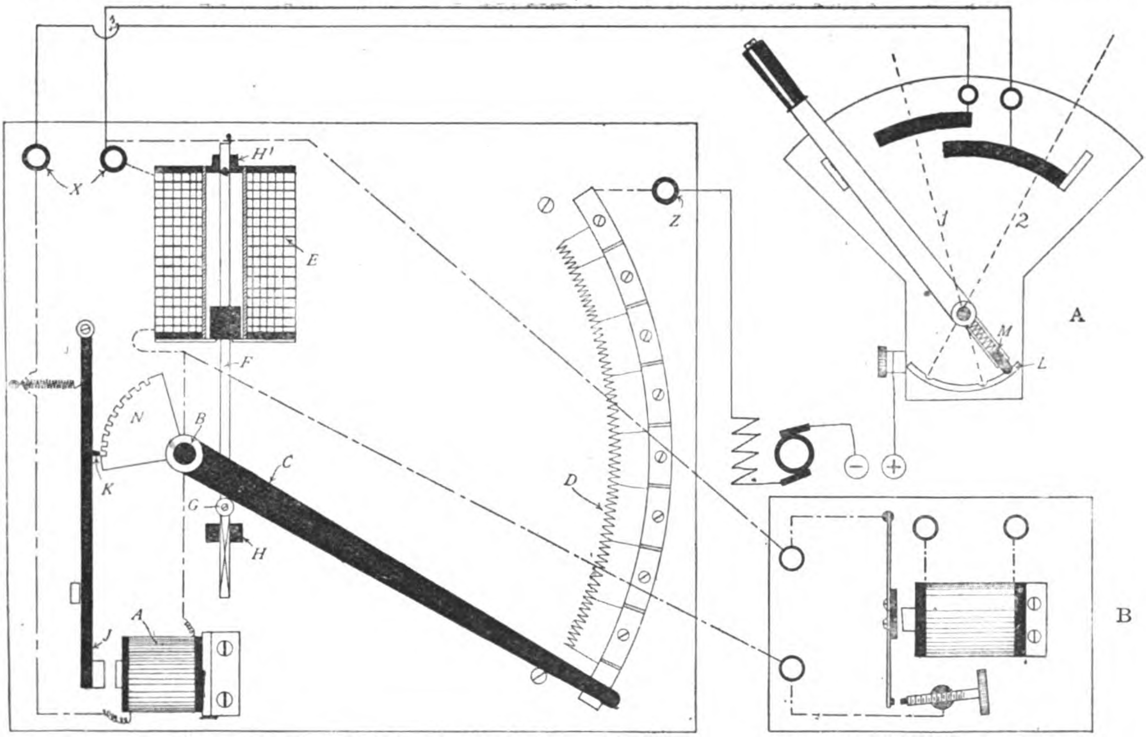


FIG. 3.

would be better, and could be used as a damping device at the same time. If the maker wishes to have the step-by-step principle, he must reduce the friction between the arm and the contacts, or else the solenoid would not be powerful enough to lift it. A little wheel fixed to a piece of springy brass on the lever might be satisfactory, but the action would be, to a certain degree, irregular. The connection to the sub-switch lever is made through the circular piece of copper L to a piece of copper rod M, which is pressed down by a spring. If this is used, the whole switch may be enclosed, the different position of the lever (off, 1 and 2) being known by the "click" as the rod M fits into one of the three notches made for it.

The "full load" current of the motor should be noted, and the minimum time in which the motor can be started and raised to the full speed, not allowing the ammeter to read higher than that is a very serious defect, viz., it is not automatically self-protected. For an instance, suppose the sub-switch was placed to the "increase" speed position (position 2), the arm would immediately start lifting. But suppose the armature of the motor was in some way held or jammed so as to make it immovable, or it was in any way overloaded, the arm would still lift, and a large excess current would pass, damaging the armature, and possibly the switch. This could easily be prevented by means of a delicate overload cut-out, which would cut out the solenoid until the back E.M.F. of the motor was sufficient to overcome the excess of current.

Fig. 3 B illustrates such a device, the moving parts of which must be very light, ensuring rapid action. When the magnet attracts the arm the solenoid is cut out of action, and this should happen when any current larger than the afore-mentioned full load current.

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Suppose this is 5 amps. The motor is started up, and the arm C is pulled up too quickly. The moment 5 amps. is exceeded the solenoid is cut out, allowing the arm to drop slightly, which lowers the current, allowing the solenoid to lift the arm again. Thus, if the cut-out is delicate enough, it would automatically regulate the speed at which the arm rises and no damping device would be needed. But suppose the sub-switch lever be placed at the "hold-speed" position, and an overload occurs, there will be nothing except fuses to prevent a large excess of current flowing. A circuit-breaker recently described would prevent this, and complete a switch which would be absolutely automatic—viz., in starting, self-regulation, and self-protection. Some reader may point out that, if full speed were required, it would be better to leave the sub-switch lever at the position 2, because the protecting switch would cut it out if overloaded. But it must be remembered that in order to have a powerful solenoid, it is necessary to have a large number of turns of wire, which means that the solenoid would have an appreciable resistance—enough to decrease the speed 50 or so r.p.m. Thus it is better to place it to the "hold speed" position, since the magnet needs very few turns. It must be remembered that a certain resistance to the solenoid is essential, because otherwise the cut-out would not perform its functions, viz., the current in the solenoid would only be decreased, and not reduced enough to make the action automatic. So it may be found necessary to add a small resistance to the solenoid. This would not deter the use of the switch as, when the lever was changed from position 1 to position 2 the probable slight drop of the arm would be compensated by the cutting out of the solenoid resistance. In Fig. 3 there has been accidentally left out another small roller above, G, to prevent F dropping when solenoid is not in use.

This gives the reader an idea of what may be done, and it would be just as easy to regulate and reverse. These designs are, as far as the author is aware, quite original. Of course, there are many similar kinds already in use.

A switch similar to the sub-switch is sometimes used to light two lamps, together or singly. To light them together a fair overlap of the contact plates would be needed, and the whole switch would be very much lighter.

The Railway Accident at Shrewsbury.

It is a matter of universal regret that another serious railway catastrophe has to be recorded, which transpired on Tuesday morning, the 15th inst., at Shrewsbury Station, resulting in the death of eighteen persons, including the engine driver, fireman, and the guard of the front van. The fatal train was an express running between the north and west of England *via* Crewe, Shrewsbury, and Bristol, and was composed of stock belonging to L. & N.W.R., G.W.R., and the Caledonian Railway Companies, comprising sixteen coaches. The locomotive was one of the L.N.W. "Experiment" type, 4—6—0, built in December, 1906. The photographs we reproduce on the opposite page show a carriage resting on the débris and the engine on its side.

The scene of the accident is a sharp curve on the north side of Shrewsbury Station: Two double lines—one from Chester and one from Crewe—run into the station on this side, and a train, part of which would have been added to the Bristol train on its arrival, was standing at the up platform. Signals were against the Bristol express, but in spite of this the train ran at a speed estimated at over 50 miles an hour over the curve on which a speed regulation calls for a maximum of 10 miles.

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

The entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in The Model Engineer. The awarding of the prizes may be summarised as follows:—

Silver Medal to the fastest boat in Class A beating previous records.

Bronze Medal in Class A to all other boats beating previous records.

Silver Medal in Class B to fastest boat provided speed is not less than 5 miles per hour.

Bronze Medal in Class B to the second fastest boat doing not less than 5 miles per hour.

Silver Medal in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

Bronze Medal in Class C to the second fastest boat doing not less than 3½ miles per hour

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour; and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

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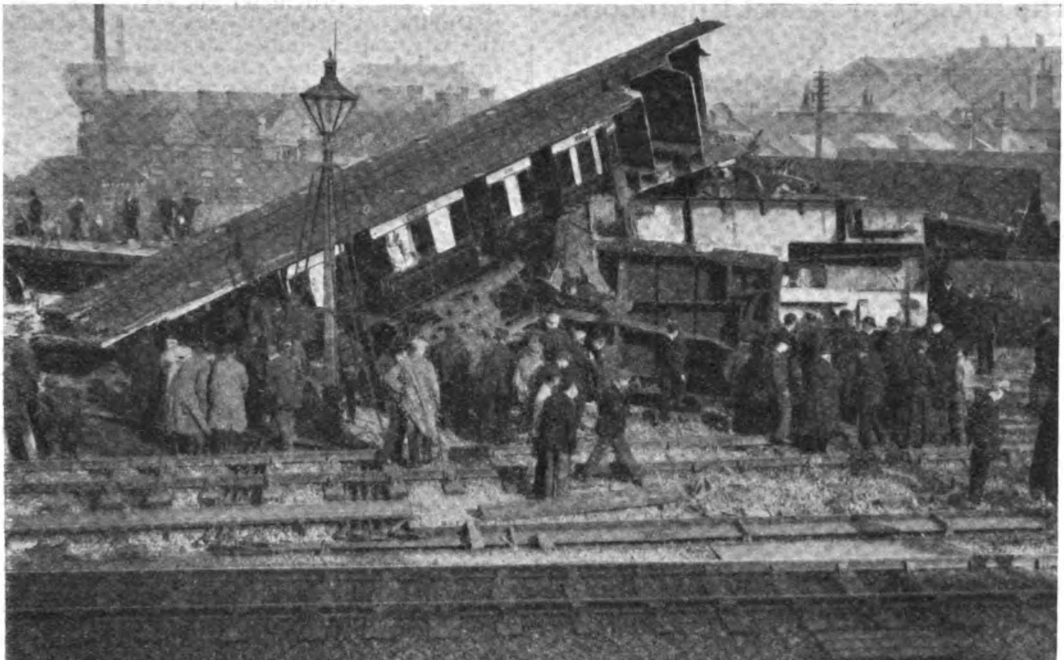

THE SHREWSBURY RAILWAY SMASH.

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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 Friday, October 18th, at the Cripplegate Institute, Golden Lane, E.C. Mr. A. M. H. Solomon took the chair at 7.30 and upwards of seventy members were present. The minutes of the previous meeting having been read, the Chairman announced that an unusually large number of applications for membership had been received and passed by the Committee, and the names of sixteen applicants were read and they were forthwith elected members of the Society. The Chairman also drew attention to the fact that a board for the exhibition of notices of articles for sale or required by the members had been provided, and requested all the members to make full use of it.

The rules governing the Rummage Sale were then read, and the Secretary having been requested to fill the post of auctioneer, he proceeded with the sale of forty-six lots comprising a most varied assortment of articles, including steam engines, together and in parts, boilers of several sizes and boiler fittings, dynamos, batteries, and accumulators, an electric engraver, resistance frame and sensitive relays, and a model yacht complete. In the collection of tools were two drilling machines, several emery and corundum wheels, turning tools, stocks and dies, fret-saw machine, and several small sundry tools. The most unusual articles were, perhaps, a pair of spring dumb-bells and a very finely made thermometer for taking the temperature of sea water on the bed of the ocean. The most sensational price was undoubtedly that given for a pair of large double-acting bellows, in good order, which the fortunate purchaser secured for the sum of threepence. With one or two exceptions, the whole of the articles were sold to the mutual satisfaction of vendors and purchasers. The meeting terminated at 10 p.m.

FUTURE MEETINGS.—The Annual General Meeting, as previously announced, will be held at the Cripplegate Institute, on Wednesday, November 13th, at 7 p.m.

In view of several contemplated important changes in the working of the Society and consequent necessity for an alteration of some of the rules, it is requested that all members in any way able to do so will make a point of attending this meeting.

The next ordinary meetings will be held on Friday, November 29th, and Monday, December 16th respectively.—HERBERT G. RIDDLE, Hon. Sec., 39, Minard Road, Hither Green, S.E.

Provincial Society.

Dublin.—A Society is about to be formed in this city, and all readers and others in any way interested and living in the district are invited to communicate with Mr. JAMES A. COTTER, 32, St. Anne's Road, Drumcondra, Dublin, from whom all particulars may be obtained.

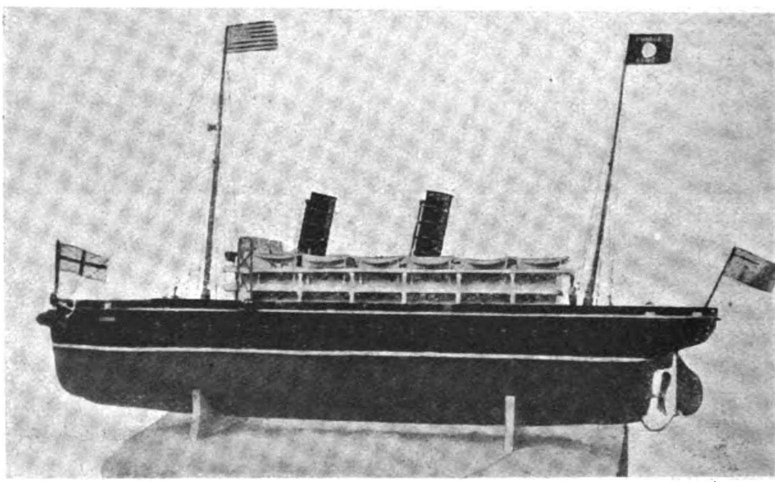
Practical Letters from our Readers.

[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 for publication.]*

A Model Atlantic Liner.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—The design of this model has been taken from a picture post-card illustrating the *Lucania*. Though not exactly to scale, it has a fine appearance on the water. It is exactly 3 ft. long, 4½ ins. beam, and also has a depth of 4½ ins. The model is electrically propelled by a motor taking 8 volts. When the accumulators are fully charged it travels about three miles per hour. The propeller is 2¼ ins. in diameter, and the shaft is connected to the motor with a flexible spring connection. I find it runs much better with this than with the ordinary fork connection. The rudder is worked from a wheel on the top deck placed just between the two funnels. On either side of the wheel are the switch levers, on one side three single-pole switches (Fig. 1) and on the other a double-pole main switch and a reversing switch (Fig. 2). The single-pole switches control: 1, searchlight; 2, head and side lights; 3, two inside lights. The double-pole switch controls all current for motor and lighting (see Fig. 3). The other switch is one entirely my own design. It is arranged to cut in one or two accumulators on forward or reverse. I find it quite as easy as with a resistance, and, of



MR. F. NEWEY'S MODEL ATLANTIC LINER.

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course, saves current. Only the handles of the switches are visible above deck, all contacts being concealed underneath.

The hull, which was cut out of a solid block, is divided inside into two compartments by an acid-proof bulkhead. I found it necessary to fit this in, as some of the acid bubbled out of the

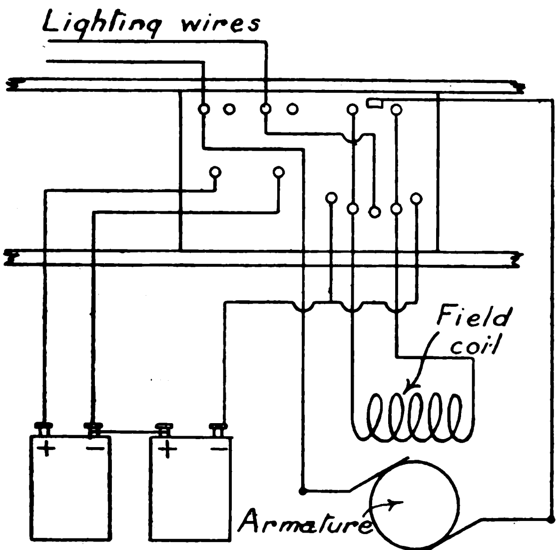

FIG. 3.—DIAGRAM OF CONNECTIONS.

accumulators and got on to the motor. The funnels are made of thin sheet copper, bent to shape on a round piece of wood. The bridge is also made of sheet copper, with two step ladders. The main deck is arranged so that by unscrewing a capstan at each end it can be lifted off, together with the masts, funnels, and nearly all of the top deck. Just enough of the top deck is left for the wheel and switch-boards. The joint between the hull and deck is made with thin sheet rubber, and when the capstans are screwed closely down, it makes a perfectly water-

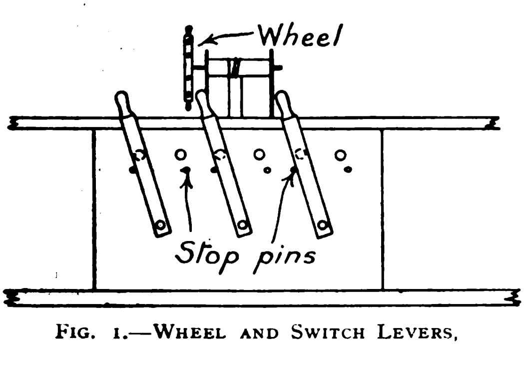

FIG. 1.—WHEEL AND SWITCH LEVERS.

tight joint. The portholes are shoemakers' eyelets let into the wood. Inside the portholes is a strip of thin celluloid. This keeps out all water and looks very much like glass when the inside lights are switched on.—Yours truly, F. NEWEY.

Oil Engine Troubles.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—If I may again take advantage of your pages, I should be very pleased to help "Puzzled" (Cockermouth), and any other readers who are in difficulties with their oil engines. I greatly appreciate the benefits derived from being able to use your pages for mutual help. My engine was purchased from the Leek firm mentioned, but not as castings. It was a finished engine, supposed to be ready for running. I never succeeded in getting it to do more than start for a few seconds and then stop. I concluded vaporiser was crude and oil feed irregular, and I would advise all who are trying to get a powerful and steady-running engine to convert to petrol as I have done, and fit electric ignition. I am a novice as regards being a draughtsman, but as I write specially for those who have Leek engines, I think they will easily understand the sketches I have made.

The vaporiser fitted to my engine differs a little from some of the vaporisers fitted to similar engines, but the principle remains the same. I have not taken any part from engine except oil feed pipe and

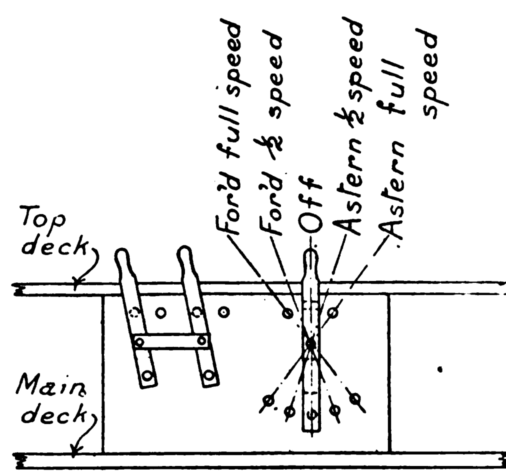

FIG. 2.—REVERSING SWITCH.

ignition tube. The existing valve gear to exhaust I have not touched, so have not illustrated it. The timing wheels in sketch I made to work inlet valve mechanically, and also to fit a new make-and-break contact, which works splendidly. I think the new valve gear will need no explanation, except that the bottom rod had to be cranked to bring it in line with top rods as they pass diagonally over cylinder to top of valve stalk. The timing wheels have 14 and 28 teeth respectively, the large one having a boss ½ in. wide, over which is driven the steel pear-shaped cam which gives 3-16ths in. travel to first rod and 1-16th in. lift of valve. At the back of same wheel another cam is screwed (A), made from sheet steel. This is packed away from wheel about ⅛ in. This cam brings the contacts together on spark cam. The big timing wheel is carried on an angle-plate fitted on top of engine bed, and the same pin which carries wheel also carries the spark cam. The only portion of this which is insulated is the stud to which wire is

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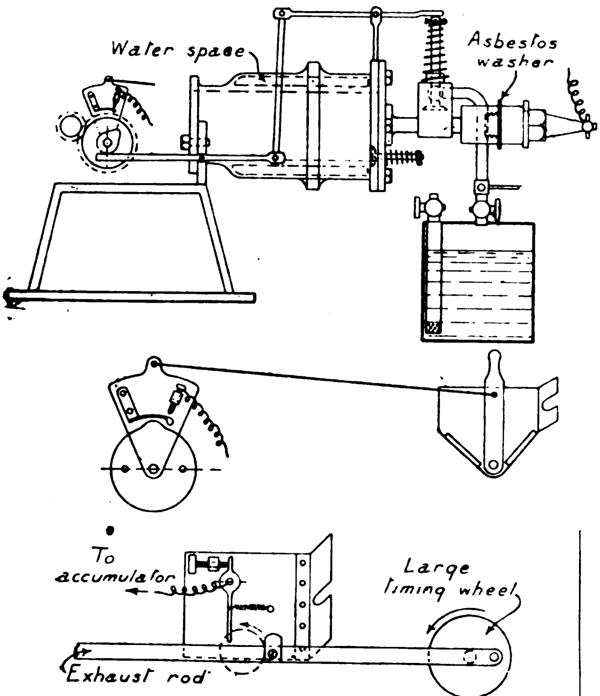
attached. The other portion is earthed. The spring is thin brass, the cam bringing it into contact with insulated stud. A backward or forward movement of this cam regulates the timing very keenly. The movement is transmitted to this from another quadrant fixed to one of the cylinder cover pins, a cycle spoke connecting the two.

The spark plug is screwed into a brass block, which in turn is screwed into hole made for ignition tube. The carburettor has been explained before. The feed pipe is fitted with air regulator and screws into vaporiser where oil pipe was fitted.

The make-and-break I mentioned in my first letter as working from exhaust rod I illustrate for the benefit of those who do not care to go to the trouble of fitting new wheels. It is simply a brass



Diagrams of Oil Engine, showing Altered Ignition Arrangement for Driving by Petrol.

bracket to which is riveted a piece of vulcanite . nd fastened under one of cylinder pins at open end. This carries a brass trigger, which can be set in different positions by the set screws, and is drawn back again by a light spring. I took advantage of the valve-rod rising and falling at one end. The tapper was soldered to rod, and each time the rod advances it comes in contact with trigger, which is carried forward until rod sinks and returns again underneath. I hope I have made myself clear on all points, and if any reader makes the same alterations I sincerely hope he will meet with the same success as I have, as I consider my engine runs second to none. I shall be pleased to hear if any reader is successful in running the engine after trying these improvements. I may say that the deeper the petrol in carburettor, the richer the gas, but I should not advise filling too full or engine will suck neat petrol.—Yours truly,

Cheadle, Staffs. Frank Holmes.

Re A Strange Occurrence.

To the Editor of *The Model Engineer.*

Dear Sir,—I notice that your correspondent, R. N., in his first letter on "A Strange Occurrence," says that the lamp which glowed was in series with other lamps on a 600-volt main. Now this, I think, is the reason for a small discharge taking place in the lamp with a ruptured filament, which, to all intents and purposes, is now nothing more or less than a type of vacuum tube. Of course, the current of the discharge also passes through the other lamps, but is much too minute to have any sensible effect on them. If R. N. will put the ruptured lamp on a 100- or 200-volt main, I do not think he will obtain any perceptible glow. Also let him try the effect of putting the lamp on the 600-volt main alone (not in series with other lamps) and let us know the result. I think he will find the glow a little brighter.—Yours truly,

"Theory."

The Atlantic Record.

Sir William Pearce, chairman of the Fairfield Shipbuilding and Engineering Company, Ltd., is to-day (writes a correspondent to the daily Press) a prophet with honour in (his own country. In the early years of the last decade of the past century, at a luncheon given in connection with the launch by his firm of the Cunard liner *Lucania*, he predicted that within the lifetime of most of the company present the land-to-land Transatlantic voyage would be accomplished in less than five days. At that time the *City of Paris*, built by the neighbouring Clyde yard of Messrs. J. & G. Thompson, now Messrs. John Brown & Co., Ltd., held the record with a passage of six days, and so much was then thought of that achievement that many of the assemblage felt inclined to regard the prophecy as Utopian. The *Lucania* reduced that record in 1894 to 5 days 8 hours, and now another British-built boat, the *Lusitania*, has gained the blue riband of the Atlantic in a passage of 4 days 19 hours 52 mins.

New Metallic Filament Lamps.—The Electrical Company, of Charing Cross Road, are now introducing an entirely new metallic filament lamp, giving 50–60 candle-power on circuits of 100 to 130 volts, with an efficiency of 1 watt per candle. As the filaments are somewhat fragile, the lamps can only be used in a vertical position, and some care is necessary in handling them. The average life is given as 800–1,000 hours, with practically no depreciation in candle-power during the whole of this period, and in size and shape they are similar to ordinary 16 candle-power carbon filament lamps. The Company do not advise these lamps being run in series at present, but recommend parallel running only.

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Queries and Replies.

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

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

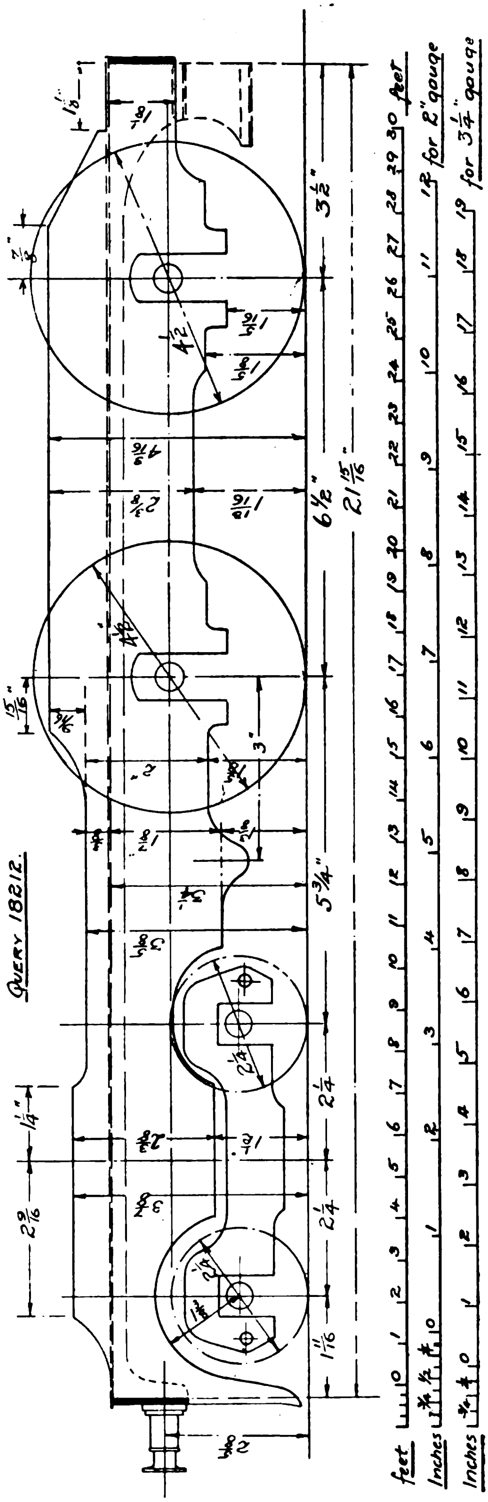
The following are selected from the Queries which have been replied to recently:—

[18,117] **½-In. Scale G.W.R. Locomotive.** A. F. H. (Neath) writes: I am thinking of building a ½-in. scale locomotive, and would like your advice on the following queries:—(1) Would the G.W.R. "City of Bath" type make a good working model; also could you kindly give me an outline sketch of it? (2) Would the boiler given on page 53 (Fig. 19) of "Model Boiler Making" suit a pair of double-action slide-valve cylinders ½-in. bore by 1-in. stroke? Do you think any alterations would have to be made? (3) Ought the case to be parallel with the barrel of the boiler? I mean if I make a Belpaire firebox shall I leave it hollow or simply have an imitation? (4) Which is best way to fit the wheels? Will drilling through the frames be sufficient? (5) Would Stevenson's link-motion be the easiest reversing gear to make? (6) Ought any play to be allowed on the back coupled wheels? What diameter should the coupled wheels be? What size for the bogie wheels?

(1) In reply to your query, you will find a drawing of the "City of Bath" type in our issue for October 13th, 1904, page 358. This issue is still in print and will be sent by our Publishing Department on receipt of 3d. in stamps. (2) Yes; this is what the boiler is designed for. (3) Make the Belpaire firebox a dummy. It will help to preserve the paint. If you do not wish to incur the trouble of making the taper boiler then work to the drawings of the "Atbara" class. See issue of November 1st, 1901. (Query No. 4,581, page 215). (4) No; you will want some sort of bearing. See "The Model Locomotive," by Greenly, price 6s. net, 6s. 5d. post free. (5) If you can make it well then fit Stephenson's link-motion with the valves between the cylinders, as shown in "The Model Locomotive," page 260, no inside frames being used. Otherwise use the gear illustrated in the issue of May 30th, 1907. (6) No, we do not advise any play in the trailing axle. Bogie wheels for ½-in. scale locomotive, 1 9-16ths ins. diameter. Driving wheels, 3½ ins. diameter on tread. Both sizes are stock articles.

[18,212] **Frames for 3½-In. Gauge Midland Railway Express Locomotive.** H. C. B. (Upper Sydenham) writes: I am building a ¾-in. scale Midland 4-coupled express (inside cylinders). I have "The Model Locomotive" book, but on reference to it for dimensions of frames, length, and centres, I cannot find any. The nearest approach I can get to it is on page 69, Figs. 52 and 53, frame sketch of a ¾-in. Caledonian locomotive. (1) Could you give me length of frames for engine? (2) Distance of centres between driving wheels? (3) Distance of centre of bogie frame to centre of driving wheels. In fact, if you could give me a sketch of the outline of the frames, as shown on page 69 of "The Model Locomotive," only ¾-in scale, I should be obliged.

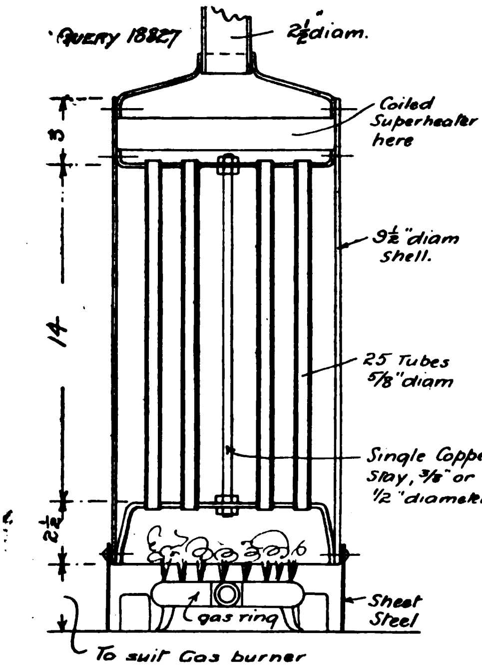
We include herewith a drawing of the frames of one of the latest Midland inside cylinder locomotives (No. 989 class), as illustrated by the photograph in our issue of August 1st. The drawing is reproduced to a scale of 7-32nds in. to the foot, as this is one of the most convenient scales for our pages. A drawing appears in the Query columns of the September 12th number, which is based on the same class of engine. The driving wheels are 6 ft. 2½ ins., and the bogie wheels 3 ft. 3½ ins. diameter respectively. Other useful dimensions are: Buffer centres, 5 ft. 8 ins.; width over footplates, 8 ft. 6 ins.; distance between frames at bogie, 3 ft. 11½ ins.; at driving and coupled wheels, 4 ft. 2½ ins., the frames being lap-jointed as in the case of the latest L. & N.W.R. engines, between the driving wheels and the smokebox. Width over driving splashers, 7 ft. 6 ins.; width over coupled splashers and cab sides, 7 ft. 10¼ ins.; length of firebox, 9 ft.; length of smokebox, 3 ft. 9½ ins.; diameter of smokebox, 5 ft. 6½ ins.; height of funnel, 1 ft. 11 7-16ths ins.; of dome, 2 ft. 0½ in.; boiler barrel, 3 ft. 3 ins. outside clearance. The scale we have adopted for the 3½-in. gauge model is 11-16ths in. to the foot.



FRAMES FOR LATEST MIDLAND 4—4—0 TYPE EXPRESS LOCOMOTIVE.

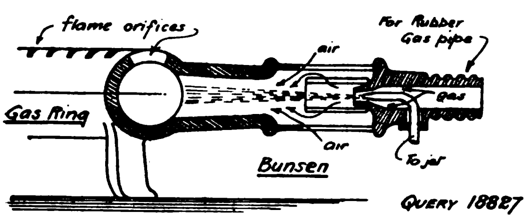
(Scale of drawing: Half fullsize for 2-in. gauge model. Figures refer to 3½-in. gauge model.)

[18,328] **Gas Fired Boiler.** T. W. W. M. (Vienna) writes: I have a piece of copper tube, 9½ ins. diameter, 19½ ins. long, 1-10th in. thick, which I wish to use for the outer shell of a vertical boiler, the firebox also to be of copper. As the boiler will not often be required, but at times at short notice, I wish to heat it with gas. Will you kindly give a sketch design for a boiler this size suitable for gas heating, and also a design for a really efficient gas burner. At what pressure could the boiler, if really well made, be safely worked?



GAS-FIRED VERTICAL MULTITUBULAR BOILER.

You do not require a deep water space firebox in conjunction with gas firing, and therefore we recommend a boiler of the "Locomobile" type (so named from its use on locomobile steam cars). The firebox should be about 2½ ins. deep, and should be so shaped as to provide a small water space in which any mud from the water may settle and be easily drawn off. The tube plates may be 14 ins. apart, which will leave 3 ins. for the smokebox. In this either a feed-water heater or a superheater may be placed. If the engine



SUGGESTED ALTERATION TO GAS-RING TO INCREASE INTENSITY OF FLAME BY A JET OF AIR OR POSSIBLY SUPERHEATED STEAM.

is some distance away we would prefer a feed-water heater in the smokebox and a superheater in the fire. The latter, if in the furnace, should be of steel pipe. We cannot say much as to the minimum number of tubes it would be advisable to fit, as you do not state the required evaporation. Most probably you would find some water tubes in the firebox, an advantage in the matter of steam raising, but the drawback to them lies in the fact that they will be found to get in the way of the tubes and prevent the tube expander being used. As to the gas burner, an ordinary commercial Bunsen stove or "gas-ring" would do. We offer a suggestion which may enable you to increase the power of the burner. It consists of fitting a jet pipe inside the gas jet of the Bunsen, which may be supplied by compressed air, or we suggest by highly superheated steam. A jet of air could be introduced at starting, and afterwards the steam. The latter should be passed through the fire in a coil of steel pipe (about ¼ in. diameter), and issue from a nozzle not more than 1-32nd in. diameter. We think that such an arrangement would induce more air and increase the temperature of the flame. The boiler, if well made and the tubes properly expanded in, should stand a working pressure of about 85 to 95 lbs. per square inch.

[18,030] **Model G.C.R. "Atlantic."** J. A. (High Wycombe) writes: Being a reader of THE MODEL ENGINEER, I am thinking of making a model of the Great Central Railway's locomotive 262, "Atlantic" type, with two driving, two trailing coupled wheels, 6¼ ins. diameter. Must the boiler be 5½ ins. outside diameter and 23 ins. long? Do you think a Smithies type boiler suitable? If so, what size inner tube to be used, also what number of water tubes, size of ports, diameter of bore, length of stroke to suit this boiler? The gauge is to be 5 ins. between rails. What kind of valve gear to fit to this engine? I should like some simple gear so as to be able to reverse from the cab. What pressure will the boiler be able to stand, also the pressure to work the engine at? Would this engine be capable of pulling about 10 stone behind it?

You will find drawings of the G.C.R. "Atlantic" engines in the *Railway Engineer* for December, 1903, price 1s. 2d. post free from this office. We do not advise a water-tube boiler for this engine as you will be able to obtain more power with an ordinary tubular boiler. We therefore recommend a copper riveted boiler with deep firebox. Cylinders may be 1¼-in. by 2¼-in.; ports: steam—⅛-in. by ⅞-in., exhaust—¼-in. by ⅞-in.; portbar, ⅛-in.; gauge, 4 13-16ths in. You will do best with Stephenson's link-motion arranged exactly as in the actual engine. For other particulars, see above drawings, and for general information as to design and construction, obtain "The Model Locomotive," by Greenly, price 6s. net, 6s. 5d. post free. Build the boiler to stand 60 or 80 lbs. pressure. The engine should pull 10 stone easily.

[17,772] **Compound Engines.** W. H. P. (Ledbury) writes: I am again troubling you for some information about my 2-in. and 3-in. by 5-in. by 4-in. triple expansion engine. It does go better, but still throttles when asked to do heavy work. Consequently I shall try to get another set of cylinder castings with steam faces large enough for me to make steam ports 11-16ths in. length per 1-in. bore of cylinder. I see from the Lune Valley Engineering Company's catalogue an engine like mine ought to give 10 to 12 h.-p. (1) What should be cubic capacity of receiver between H.-P. and L.-P. cylinders? They are tandem mounted. Present receiver is only 2·4 cubic ins. Pressure very fluctuating. Also between I.-P. and L.-P. cylinders mounted side by side, cranks set at 90 degs. Present receiver 5·8 cubic ins. No sign of any pressure in gauge fixed on L.-P. steam chest when pressure in H.-P. steam chest is 175 lbs. absolute, and the engine well warmed and running 350 r.p.m. I have read Tennant's book, and all I gather is that the receiver must not be too big nor too small, which is rather vague. What is "too large" and what is "too small"? (2) Can you tell me of a book which will show me how to find the relation between the amount of water a boiler must evaporate per hour or per minute to supply engine, given the horse-power required, number of revolutions per minute, and pressure? I see in the Lune Valley Engineering Company's catalogue a similar engine requires boiler to evaporate 260 lbs. of water per hour for engine to give 13 h.-p. at 175 lbs., *i.e.*, 20 lbs. water per h.-p. per hour; is that the usual amount? (3) I am going to fire the boiler with one of the above Company's patent paraffin burners, so shall be able to condense the steam instead of using it to create a good draught. What type of condenser do you recommend—that is (*a*) simple in construction, (*b*) light in weight, and (*c*) does not require a large space? Would one out of an old motor-car do? (4) Must the sectional area of steamway be exactly that of the port connected with it, or can it be somewhat less? In the case of large ports it is difficult to cut the steamway the same size and miss the bolts or studs which hold the cover on to the cylinder.

In a tandem compound the receiver can be very small, just sufficiently large to keep the back pressure fairly normal during the period between the exhaust port opening of the H.-P. cylinder and the admission of the steam into the L.-P. cylinder. The cubic capacity of the H.-P. cylinder is in your case about 12½ cubic ins., and of the I.-P. 28 cubic ins. We should therefore make the receiver half the capacity of the H.-P. cylinder, viz., 6¼ cubic ins., or thereabouts. Supposing, then, the H.-P. exhausts under high-speed conditions at seven-eighths of the stroke, the steam, unless a receiver is provided, has to wait until the L.-P. (or I.-P. in your case) is ready to receive it before it drops appreciably in pressure. Therefore, if you provide a receiver of half the capacity of the cylinder, a drop in pressure nearly equal to that of the normal receiver pressure is likely to occur. Furthermore, the larger receiver will reduce the throttling due to the small ports your engine is unfortunately blessed with, as unless there is a drop in pressure to the receiver, there will be no flow until the L.-P. (I.-P.) cylinder is open to steam and is in a position to draw on the H.-P. and receiver. The speed of the steam through the H.-P. ports would then be very high, and wire-

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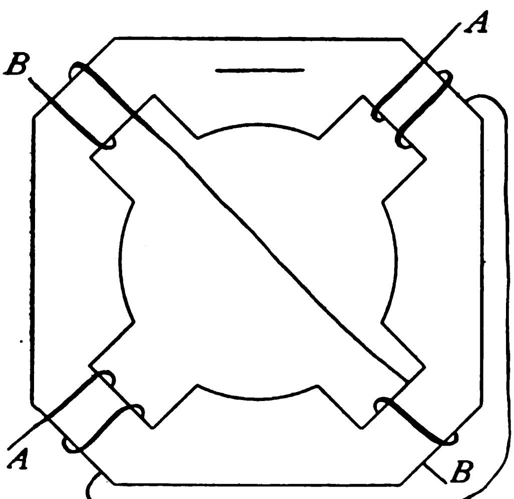
drawing result. We should make the H.-P. to L.-P. receiver at least 25 cubic ins. capacity. Theoretically the average L.-P. receiver pressure should be about 20 lbs. absolute (that is, 5 lbs. on the steam gauge), but you can easily destroy this gauge pressure by having the ports too small *and arranging the cut-off in the* H.-P. *and* L.-P. *cylinders too early*. As it stands at present, the L.-P. cylinder is no use whatever with the engine arranged as a non-condensing engine which has also to induce a draught (by a blast nozzle) in the boiler. We do not understand your remarks about the book on "Compound Engines." You have evidently not studied the diagrams. (2) Get a "Molesworth's Pocket-book," or one of the many other engineering pocket-books on the market. Our publishing department will be pleased to send you prices and particulars of suitable books. At 150 lbs. boiler pressure the theoretical consumption of steam of a properly designed non-condensing engine should be 13·6 lbs. of water per i.h.-p., but 20 lbs. per i.h.-p. would be nearer the correct figure in practice for a fair-sized engine. A smaller one, such as yours, would probably consume 30 to 35 lbs. of steam. The Lune Valley engine would appear to be very economical. (3) Are you going to use the engine as a stationary engine? If so the simplest arrangement would be a jet condenser to work off the water main. No air pump would be required. Kindly give us particulars of the pressure in your water mains. A motor-car condenser would not do, unless you fit a fan, as it requires a current of air to make it effective. (4) As the steamway or pipe is always open, it may be a little smaller in area than the port, say about two-thirds the area. The question of fixing cover studs depends on the design of the ports.

[17,953] **Small Induction Motor.** H. D. (West Kensington) writes: I should be extremely obliged if you would answer this query for me. Referring to the induction motor described in July 25th, 1907, page 76, of THE MODEL ENGINEER, would it be possible to wind the stator and rotor for 200-volt two-phase alternating current at 50 periods? If so, what gauge of wire and quantity would be required? It does not matter about being self-starting.



Query 17953

DIAGRAM OF WINDING FOR SMALL INDUCTION MOTOR.

Yes, it is worth trying. The opposite pairs of stator coils should be connected respectively to the two phases—that is, coils A A to one phase and coils B B to the other phase. Wind with No. 28 gauge D.C.C. copper wire; try and get on as much as stated in the article, but as the wire is of smaller gauge you may not be able to get so much in the space. Wind and connect rotor as described in the article, same gauge of wire (that is, No. 24 D.C.C.), and same quantity mentioned. If motor does not run, try connecting the opposite pairs of the rotor coils together. With two-phase current the motor should be self-starting. As the writer of the article does not state the periodicity of his circuit you may find some alteration necessary in the winding, or perhaps have to run through a resistance or choking coil; it is a matter for trial.

[18,112] **Water-tube Boiler.** C. M. T. (Gateshead) writes: I have a small vertical slide-valve engine (1-in. bore by 1-in. stroke), and would like it to drive a small dynamo of small output, say one lamp at low voltage. I would like to know your opinion of the water-tube boiler described by Barton Mott in THE MODEL ENGINEER of August 29th, 1907; also, what thickness the tube plates and covers should be: also, whether to use brass or copper tubes; and, also, what thickness or gauge the ¾-in. downcomers should be. Should they be brass or copper? What is the highest working pressure a boiler of this type would stand?

This type of boiler is quite satisfactory if not over-engined. Furthermore, the engine should be well made and have all valve faces, glands, and the piston quite steamtight. Although a boiler two-thirds the size would do, we would advise working to the dimensions given in Mr. Barton Mott's article. Use copper tubes. The endplates may be of hard brass (about 3-32nds in. or 5-64ths in. thick). Get the lightest tube usually made, *i.e.*, about No. 18 or 16 S.W.G. The weak point of Mr. Barton Mott's boiler seems to be the bolts for holding the drumheads on. The rest of the boiler would be quite strong up to a pressure of, say, 100 lbs., presuming that all fittings, etc., have the bushings silver-soldered on. The safe load for a 5-32nds-in. bolt screwed Whitworth, without allowing for loss of strength due to high temperature, would be, with a factor of safety of 4—

$$\frac{1}{100} \times \frac{22 \times 2{,}240}{4} = 120;$$

therefore, six of them would resist 6×120=720 lbs. The area of a 4-in. drumhead is 12½ sq. ins.; therefore, at 40 lbs. per sq. in., the pressure on the ends would be 500 lbs., which leaves a little to spare. With a pressure of 100 lbs., the tension on the bolts would be 1,250 lbs., so that to still provide a factor of safety of 4, you would have to put in at least 10 bolts. We would advise twelve bolts, as the factor 4 is rather low.

[18,124] **Model Speed Boats.** W. F. W. (Buenos Ayres) writes: I would be obliged if you will kindly let me have a reply to the following questions. I am a subscriber to THE MODEL ENGINEER and am particularly interested in the speed launch branch of the hobby. (1) What are the record speeds for large boats of about 6 ft., and for boats of about 1 metre? (2) Weight for weight, which will develop the highest speed, a steam or an electrically driven launch? (3) What is the record for an electric launch model?

(1) The following are the official speeds of models competing in our speed-boat races. Other records are claimed, viz., 10 miles per hour for Mr. Weaver's 7-ft. boat, and 6 miles per hour for Mr. T. Bowman Duff's *Ena* (1 metre):—

1902 COMPETITION.—Mr. J. Tharme's 5-ft. 6-in. *Express*, 5·00 miles per hour; Mr. H. Tharme's 5-ft. 6-in. *Darling*, 4·70 miles per hour; Mr. S. Keay's 5-ft. 10-in. *Fidget*, 4·56 miles per hour.

1903 COMPETITION.—Class A (3 ft. 6 ins. to 7 ft.): Mr. W. R. Weaver's 6-ft. 10½-in. *Era*, 7·13 miles per hour; Mr. D. Scott's model T.B.D., 6·522 miles per hour; Mr. S. Keay's *Greyhound*, 5·829 miles per hour.

1904 COMPETITION.—Class A (3 ft. 6 ins. to 7 ft.): Mr. D. Scott's *Bon Accord*, 7·719 miles per hour.

1906 COMPETITION.—Class A (4 ft. 6 ins. to 7 ft.): Mr. W. R. Weaver's 6-ft. 10½-in. *Era*, 8·766 miles per hour; Mr. H. Arkell's 5-ft. petrol boat, 7·95 miles per hour; Mr. W. Rimmer's 6-ft. 10½-in. *Wolf*, 7·67 miles per hour. Class B (4 ft. 6 ins. and under): Mr. J. Tillett's 4-ft. 5-in. *Doris*, 6·136 miles per hour; Mr. T. Bowman Duff's 1-metre *Ena*, 5·336 miles per hour; Mr. T. J. Davies' 4-ft. 2-in. *Vincent*, 4·352 miles per hour.

(2) A steam or petrol boat. It is impossible to discharge an accumulator sufficiently fast to obtain a racing speed with an electric model boat on account of maximum weight limitations.

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.*

* Pocket Tape Measure.

We have received from the Universal Tool Supply Co., 24 and 26, Holborn, London, E.C., a sample of a special line in 12 ft. steel tape measures. The measure is wound up in a neat nickel-plated case, and, when handle is folded over, the whole takes up no more space than 2 ins. diam. by ¾ in. thick, and is very compact for the pocket. The tapes may be obtained marked 1-16ths on one side only, or 1-16ths on one side and metric on the back, or 1-16ths on one side and diameter measure on the other. There is very little difference in the cost of these, and the price is very reasonable. Such a tape measure would prove very useful to many of our readers.

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The Editor's Page.

JUST as we go to press we are able to report the opening of THE MODEL ENGINEER Exhibition, which has been looked forward to by our readers for so long. From all points of view its success seems assured, and readers who have made arrangements to visit the Exhibition from near and far will find it has been well worth while. The collection of Loan exhibits comprises some of the finest models in existence, and the models representing the work of MODEL ENGINEER readers, as well as the many interesting and instructive trade exhibits, make a very fine display. Next week we shall publish, more especially for the benefit of readers who will find it impossible to attend, a Special Exhibition Number, containing an illustrated report embracing every feature of the Exhibition. This will not upset the usual contents, and although it will of necessity be a larger issue than usual, the price will remain the same. Orders should be placed early with booksellers.

* * *

We may here mention that the catalogue of the Exhibition comprises, besides the usual list of exhibitors, some interesting photographs, programme of lectures and demonstrations, a plan of the Hall showing the exhibitors' stands, and some interesting facts about the London Society of Model Engineers, the Victoria Model Steamboat Club, and THE MODEL ENGINEER, making a neat little volume, printed on art paper of some sixty pages. The price of the catalogue is threepence and will be sent post free for four penny stamps upon application to our Publishing Department.

* * *

On page 412 of this issue we are commencing a series of articles on "How to Make an Inter-communication Telephone." We think these articles will be very useful to a large number of our readers in view of the fact that we receive so many queries on the subject of telephony. We emphasise the advice of the author to readers with but an elementary knowledge of the subject to read THE MODEL ENGINEER sixpenny handbook on "Telephones and Microphones" prior to starting the articles above-mentioned.

Answers to Correspondents.

G. W. H. (Spain).—We thank you for your letter, but the method you describe has already been given in THE MODEL ENGINEER.

"LEX."—Kindly send us your name and present address.

B. W. H. (Stroud).—We have no trace of a letter or photograph received from you.

W. H. G. (Co. Dublin).—We thank you for your note, which we shall be pleased to insert as space permits.

N. C. (Moffat, N.B.).—On looking into the design you send us, we fear that it is not practicable, and therefore cannot see our way to publish the same. If you wish to have the article returned, a stamp should be enclosed for that purpose.

"WIND POWER."—There is very little literature on the subject. We hope shortly to publish some information such as you require.

W. H. (Stoke Newington).—We thank you for your letter, and are pleased that you have overcome your difficulties.

F. W. (Bradford).—This is beyond the scope of a query; however, if an opportunity occurs, we will insert a description. In the meantime, you would do well to look up a few text-books. See Prof. Pullen's "Steam Engineering," price 4s. net, 4s. 4d. post free.

J. F. (Newcastle).—Thanks for your instructive note, which we hope to use in an early 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, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

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

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THE

Model Engineer

And Electrician.

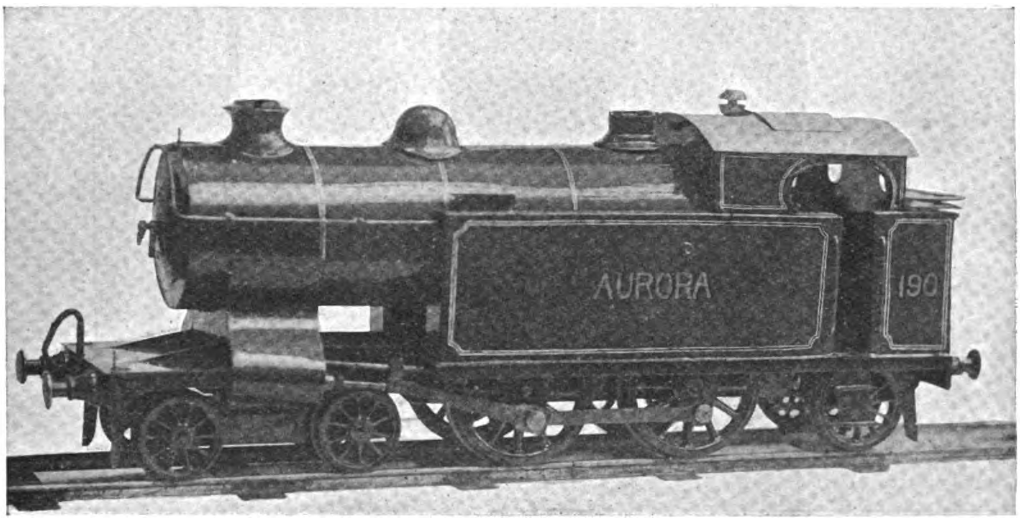
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 341. NOVEMBER 7, 1907. PUBLISHED WEEKLY.

A Model Ten-wheeled Tank Locomotive.

By H. T. H. GREETHAM.



MR. H. T. H. GREETHAM'S MODEL LOCOMOTIVE.

THE photograph shown herewith is of a ten-wheeled tank locomotive, which took about two years of my spare time to build. The following are the leading dimensions: Gauge, 2½ ins.; length over all, 18½ ins.; width, 4 ins.; height, 6¾ ins.; wheels—bogie, 1 9-16ths ins.; driving, 2¾ ins.; trailing, 1⅞ ins. The cylinders are ½-in. bore by 1-in. stroke. Slip reversing gear is fitted. The boiler is of the Smithies' type; the inner barrel is a piece of copper tube (solid drawn) 9½ ins. long, 2¼ ins. diameter, and 1-16th in. thick, fitted with a downcomer and four ¼-in. copper water-tubes. The outer barrel, which is made of sheet iron, is 3 ins. diameter and 11 ins. long. Instead of the throatplate being curved, the barrel was slightly coned for about 2 ins. from the throatplate towards the smokebox, which gave more room for the water-tubes and increased the ventilation. The boiler is fired with a six-wick spirit lamp. The main and bogie frames were cut from 1-16th-in. sheet steel. The chimney, dome, buffers, and safety valve casing are all castings filed up to shape. The smokebox door is of sheet iron and made to open. A hole 2 ins. square was cut in the roof of the cab, so as to get at the regulator, blower, whistle, etc.; a flap is hinged on to cover the hole. The engine is fitted with lamp irons, lamps, tank lids, etc., which all add to its appearance.

I have had the engine under steam, but the spirit in the burner soon runs low, the wicks begin to char, and the pressure soon drops; but, under these conditions, it has travelled very fast with a load of about 14 lbs. I hope, however, to get

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better results when I have fitted a spirit tank in the bunker to feed the burner automatically.

The boiler, tanks, cab, and bunker are all painted green, lined out with one black and two thin white lines. The frames are painted chocolate, with red buffer beams. The No.—190—appears on the buffer beams and bunker, while the side tanks bear the name "Aurora" in gold letters. In conclusion, I might say I have found many useful hints in THE MODEL ENGINEER which have helped me over the little difficulties which have arisen from time to time during the building of this locomotive.

THE new propellers now being fitted to the *Dreadnought* at Portsmouth are the third set supplied to the battleship. Should these be unsuccessful in obtaining the speed at which the ship is expected to steam, the original machinery will be re-introduced.

How to Make an Inter-Communication Telephone.

By FRED RUDOLPH.

(*Continued from page* 413.)

A SIMPLIFIED diagram of the ringing circuit is shown at Fig. 2, and of the speaking circuit at Fig. 3. Fig. 4 is a photograph of an instrument similar to the one described above, fitted up as a wall set; while Fig. 5 is the same instrument, but assembled as a desk set.

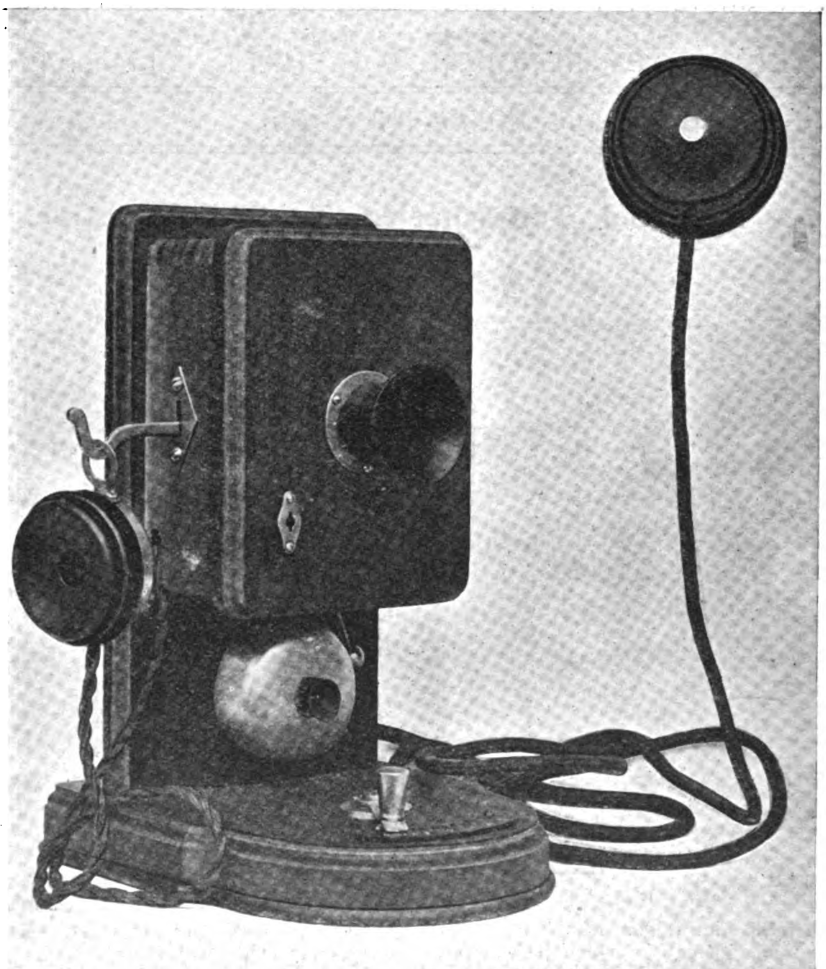

FIG. 5.—A DESK INSTRUMENT.

Frequently, instead of using a lever switch, an ordinary plug and cord is used, the studs being replaced by simple spring jacks into which the plug is inserted for connection. In Fig. 6 is shown such a system, plug P in each case taking the place of lever L in Fig. 1. Five line wires are shown, each connected with five jacks or sockets.

An improved common battery method of telephony

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for inter-communication work has of late years come very much to the front, and certainly offers distinct advantages over the older methods. This consists in supplying the current for ringing and speaking to all the stations from one central source, doing away at once with the necessity for sets of separate batteries located at each station, and by centralising the energy necessary for the whole of the installation, reduces very considerably the many troubles incident to an installation possessing many separate and differently placed batteries.

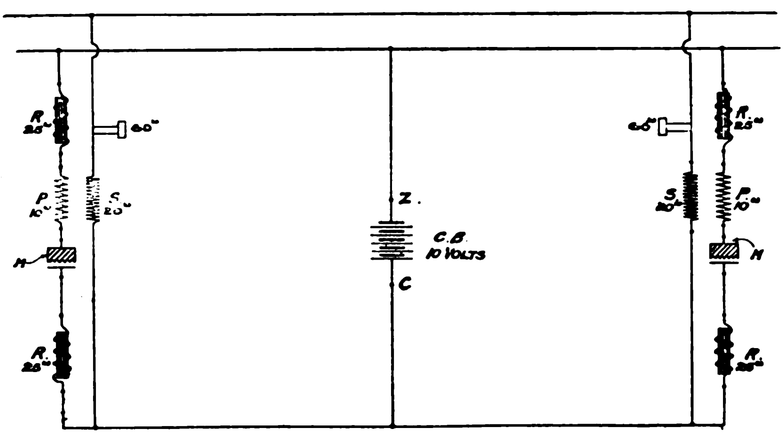

Fig. 7.—Simplified Speaking Circuit between Two Stations, Common Battery.

If any battery fault occurs on a common battery system, it can at once be located and remedied. Fig. 7 illustrates the principle of common battery telephony as applied to inter-communication work. The diagram shows, for the sake of simplicity, two stations only, the other stations being similarly connected. The common battery CB is located at the centre, and all the microphones M are supplied in multiple through impedance coils R.

The coils serve a two-fold purpose. They are necessary to give clear articulation between any two instruments. and also to act as "choking" coils between the main battery and any microphone reducing the current flowing through the microphone to the proper value as well as to minimise the cross-talk when two or more pairs are talking.

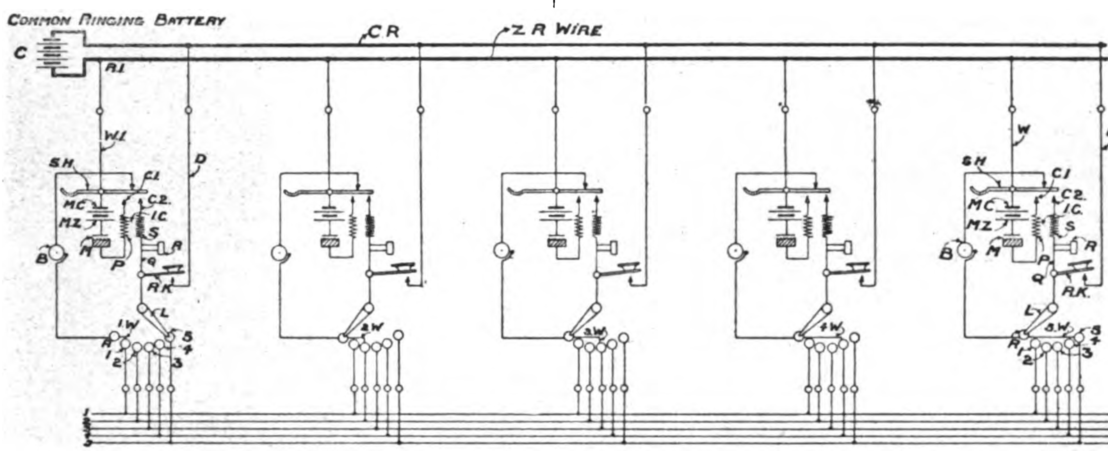

Fig. 6.—Diagram of Connections for a Five-Station Inter-communication Installation with Lever Selector.

Fig. 8 shows a complete installation of five CB inter-communication instruments. Each station has an ordinary trembling bell B, connected between the common return wire and the line wire pertaining to that particular station, through the top contact of switch-hook SH. The circuit through the bell is broken when the receiver R is removed from the switch-hook SH. To call a station the plug P is inserted in the line socket of the station it is desired to call, and the ringing key RK is depressed. A current now flows from the common battery through the ringing key and plug, along the line selected, through the trembling bell by the connection previously described, switch-hook contact, and back by the return battery wire. On taking down the receivers, the microphones M and primary windings P of induction coils IC are connected to the common battery by the switch-hook contact, the impedance coils I I being on each side of the battery and in series with the microphones. At the same time the secondary circuit is established through the secondary windings S of induction coil, receiver R, switch-hook contact, plug and plug socket to selected line, through distant instrument, and back by the common return ZR to the originating station.

It will be observed that on part of its current the speaking secondary current is superimposed on the battery current flowing in the return wire; this superimposition, however, making no difference to the effectiveness of the secondary current.

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The function of the secondary winding on the induction coil is to transform the varying undulatory current in the primary circuit into alternating impulses of much higher pressure than the battery pressure. The ultimate effect on the receivers is much better than is the case when induction coils are not used, although for very short distances induction coils may be dispensed with.

A disadvantageous feature in connection with most inter-communication systems is that conversations are not secret. All that it is necessary to do in order to overhear any conversation is to plug into or switch on to the line in use and take down the receiver. A considerable amount of thought has been given to devising a secret inter-communication system, but up to the present there are only about two systems which can be called absolutely secret. One method adopted is to dispense with the common return on the speaking circuit by automatically switching the same out of circuit and using the two lines pertaining to the two stations as a metallic circuit. This method has been very successful in practice.

Another method is to provide a separate metallic pair of conductors between the parts of station we desire to give secrecy. This is technically known as Secret Service wiring, and is very effective in practice, notwithstanding the fact that rather more wires are used than with the former system.

A modification of the above system arranged for common battery metallic circuit working has also been devised, which gives absolute secrecy between any pair of stations, the great advantage of the system lying in the fact that the energy both for ringing and speaking is centralised with all its attendant conveniences.

The diagram (Fig. 1) showing connections of a five-station system on page 412 of last issue, was described as, "with lever selector"; obviously, this should read, "with plug selector."

(*To be continued.*)

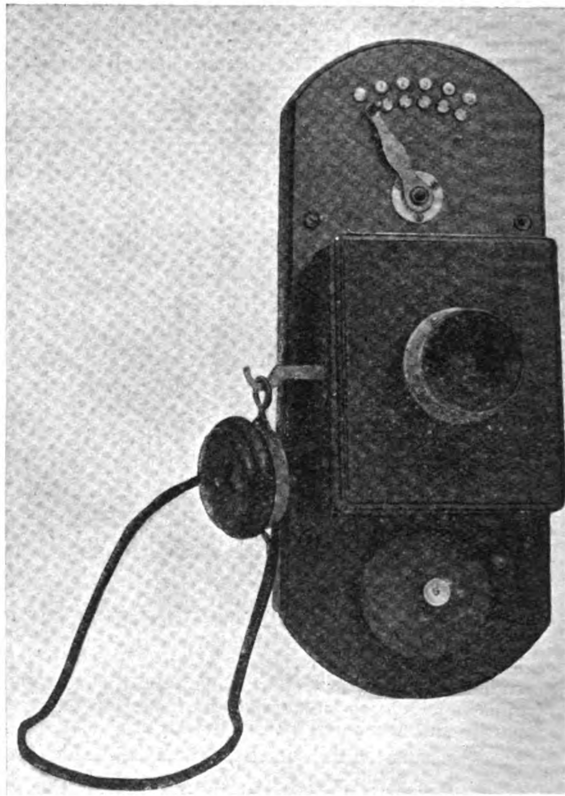

FIG. 4.—A WALL INSTRUMENT.

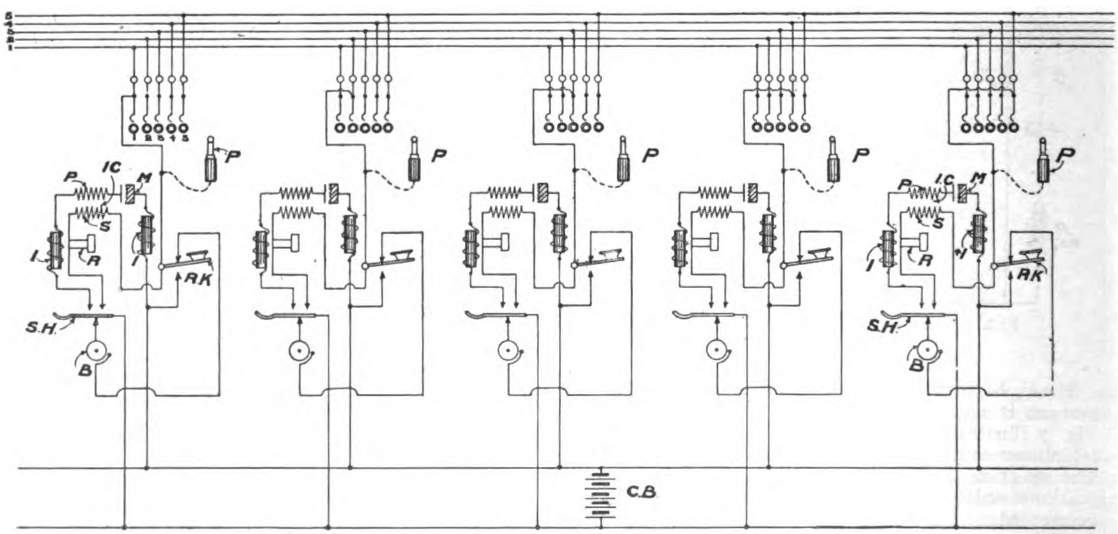

FIG. 8.—DIAGRAM SHOWING CONNECTIONS OF A FIVE-STATION COMMON BATTERY INTER-COMMUNICATION TELEPHONE SYSTEM.

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A 2 h.-p. Cycle Motor.

By Herbert H. Schneider.

As no doubt some readers of The Model Engineer are interested in cycle petrol motors, I herewith give particulars of a 2 h.-p. engine which I have recently constructed from a set of castings supplied by a firm who advertise in this Journal. Although so many sets of castings seem to be sold, very few readers indeed describe their work in these pages. In most cases probably the engines are never finished. Although there are, no doubt, various difficulties in the course of construction, these can all be overcome by exercising a little ingenuity and perseverance.

My engine was made, with the exception of boring cylinder and turning up the flywheels, on a 3-in. centre Britannia gap-bed lathe without back gearing. The most difficult job was the machining of the cylinder head, which must be grooved to receive cylinder. The lathe just mentioned is rather small for this piece of work, but I managed to do it by packing the head upon the faceplate and running at a very slow speed, taking small cuts. No packing is used between the cylinder and head, but the former is thoroughly ground in

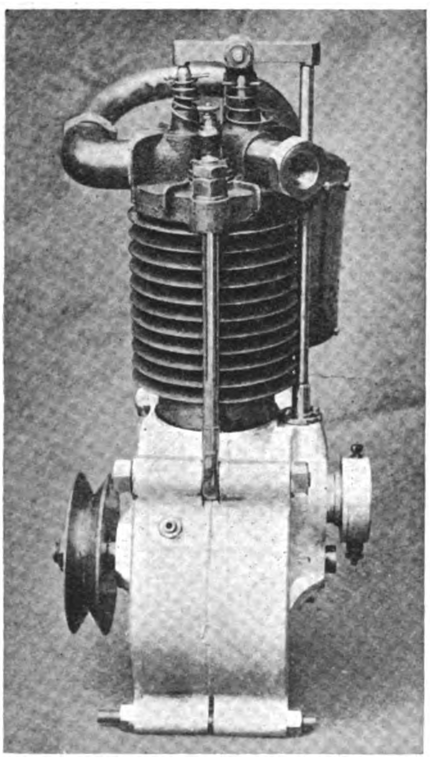

Fig. 5.—Front View.

with emery and oil, thus making a perfectly compression tight joint. This method is far more satisfactory than using asbestos or a copper ring, as these are almost certain to give trouble after some time of running.

The photographs and drawings give a general idea of the engine. Its overall height is 15¾ ins. and the crankcase is 6½ ins. in diameter. The cylinder has a bore of 2⅝ ins., the stroke being the same size. Three rings are fitted to the piston which is 2⅝ ins. long. The connecting-rod, which is 6⅞ ins. long, is a solid steel forging, being fitted with adjustable phosphor-bronze bushes, having a hole ⅝-in. diameter to receive the pin. The

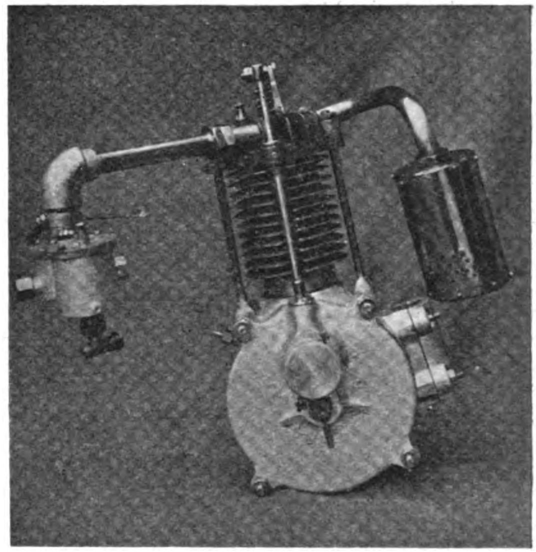

Fig. 6.—Side View.

gudgeon-pin, which is turned out of mild steel, is ⅜ in. diameter. It is securely held in the piston by two long 3-16ths in. cheese-headed screws, as will be seen by referring to Fig. 1. The compression space above cylinder is ¾ in., which seems to be about right.

Each flywheel weighs about 5 lbs. and is 6 ins. diameter, having a thickness of 1 in. The shafts supporting these are turned from mild steel rod—that at the pulley end being 13-16ths in. diameter, the other ⅝ in. diameter. The fitting of these shafts was another difficult piece of work, as the first connecting-rod used had not got brasses, and consequently after the shafts had been turned up the flywheels had to be taken apart at the pin in order to put on the rod. When the wheels were again put together the shafts did not run perfectly true, as the holes in the flywheels for receiving the pin are not coned as they should be. In order to get over the difficulty the present rod was made, which renders it unnecessary to take the wheels apart when once the shafts have been turned up.

The gear wheels are machine cut—the smaller, having seventeen teeth, is of gun-metal; the larger, having thirty-four teeth, being of mild steel. The head is firmly held on to the cylinder, and the cylinder on to the crankcase by two long ⅜ in. steel bolts, shown in Fig. 2. Each valve was turned from steel rod ¾ in. diameter, the shanks of same being 5-16ths in. The silencer shown in the photograph (Fig. 6) was made of a piece of old brass tube, 3 ins. in diameter. A brass casting is

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fitted into each end, and a second smaller tube fitted into the larger, into which the exhaust gases first pass. This form of silencer is very simply made and silences the explosions very well. The long bolts at the bottom of the crankcase, shown in Fig. 5, were used in order to fix the engine firmly into the bench for testing. The motor has not yet been used on the road, but has been run several times on the bench. It runs at a very high speed, developing considerable power, and, on the whole, the results obtained are very satisfactory.

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.]

Tailstock Drill-Pad.

By T. Goldsworthy-Crump.

The difficulty of accurately drilling a circular rod or other object exactly at right angles and truly central in the lathe must have been often experienced although the tailstock may have been fitted with a V-block and the work properly marked, there is generally an element of doubt as to the result.

The drill-pad and guide shown in Fig. 1 have been designed to remove as far as possible any liability of error, and by this means very precise work can be accomplished.

On reference to Fig. 1, A is a brass casting bored out as shown at letter A to fit the outside of tailstock spindle. The casting should then be chucked by means of a short mandrel turned to fit this hole, and the face and outside surfaces finished as shown, and a small hole drilled in the centre. This hole should then be enlarged to form a countersink of 90 degs., as a guide to the filing or milling of the V-groove. The position of holes for the two studs B should be marked off, drilled and tapped, care being taken to see that the holes are exactly at right-angles to the face of casting. The studs B are of mild steel turned parallel and threaded in the lathe to well fit tapped holes in A. The loose piece shown in Fig. 2 may be made of mild steel or brass. The holes should be very carefully set out and be a good sliding fit on pins B. The middle hole should be bored out when in position and revolving on A's mandrel, so that this hole shall be truly central.

Fig. 3 shows a steel boring collar turned on the outside to fit central hole in Fig. 2, with a shoulder to retain it in position. Several of these should be made and the central holes should be drilled in the lathe by the drills intended to be used, so that each size of drill will have its own boring collar, and each collar is interchangeable in Fig. 2. If necessary, these collars could be hardened. The drawings are to scale, showing hole A 1 in. in diameter and the relative proportions can easily be obtained to suit individual requirements.

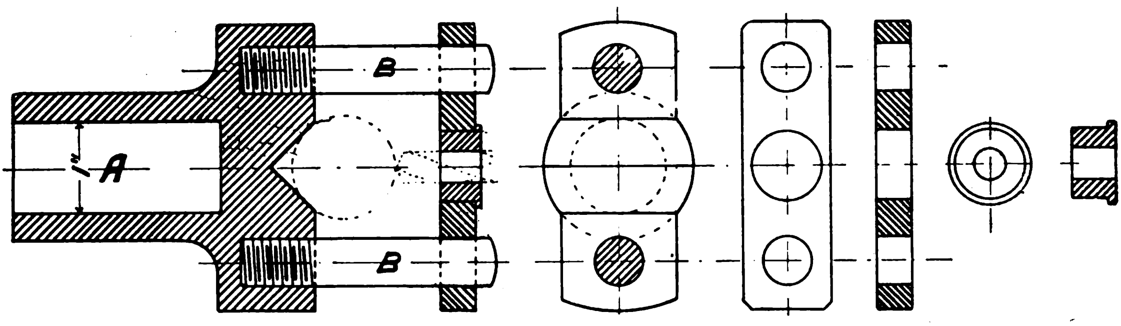

Fig. 1. Fig. 2. Fig. 3.

Details of Tailstock Drill-Pad.

Home-Made Drilling Machine.

By T. Harper.

The machine illustrated was made almost entirely from parts of an old whisking machine, used, I believe, by confectioners in the preparation of sponge and light pastry. It was given me by a friend who had no further use for it. The part of the original machine of most use to me was that which now forms the upper part of drilling machine, carrying the larger bevelled wheel. The under portion, forming the upright to which the top is securely riveted, is a casting made from my own pattern. This is also firmly riveted at the bottom on to a three-clawed foot (also part of the original machine), the whole forming a very rigid and firm machine. The other parts of the machine I had to adapt as best I could. To give the necessary up-and-down play between the spindle and small geared wheel, I filed a flat surface on the spindle for nearly its whole length. To engage this I screwed a small piece of flat steel on the inside of the hole of the geared wheel. This carries spindle round when the machine is worked, and at the same time allows for up-and-down play of pressure screw. The latter is merely a ½-in. bolt, with the thread carried its full length, the head cut off, and end riveted into a small iron wheel. Into the lower end of spindle I had to forge a square hole to take shanks of drills and bits. The table is turned out of a piece of hard wood, which answers very well, although I may have a casting from it. Generally, I think the photograph explains itself. No originality is claimed for the machine, either in design or any other particular, but I think it may be helpful to other amateurs in showing that many articles which are useless and worn out as far as the purpose for which they were originally intended is concerned, may often, with a little ingenuity

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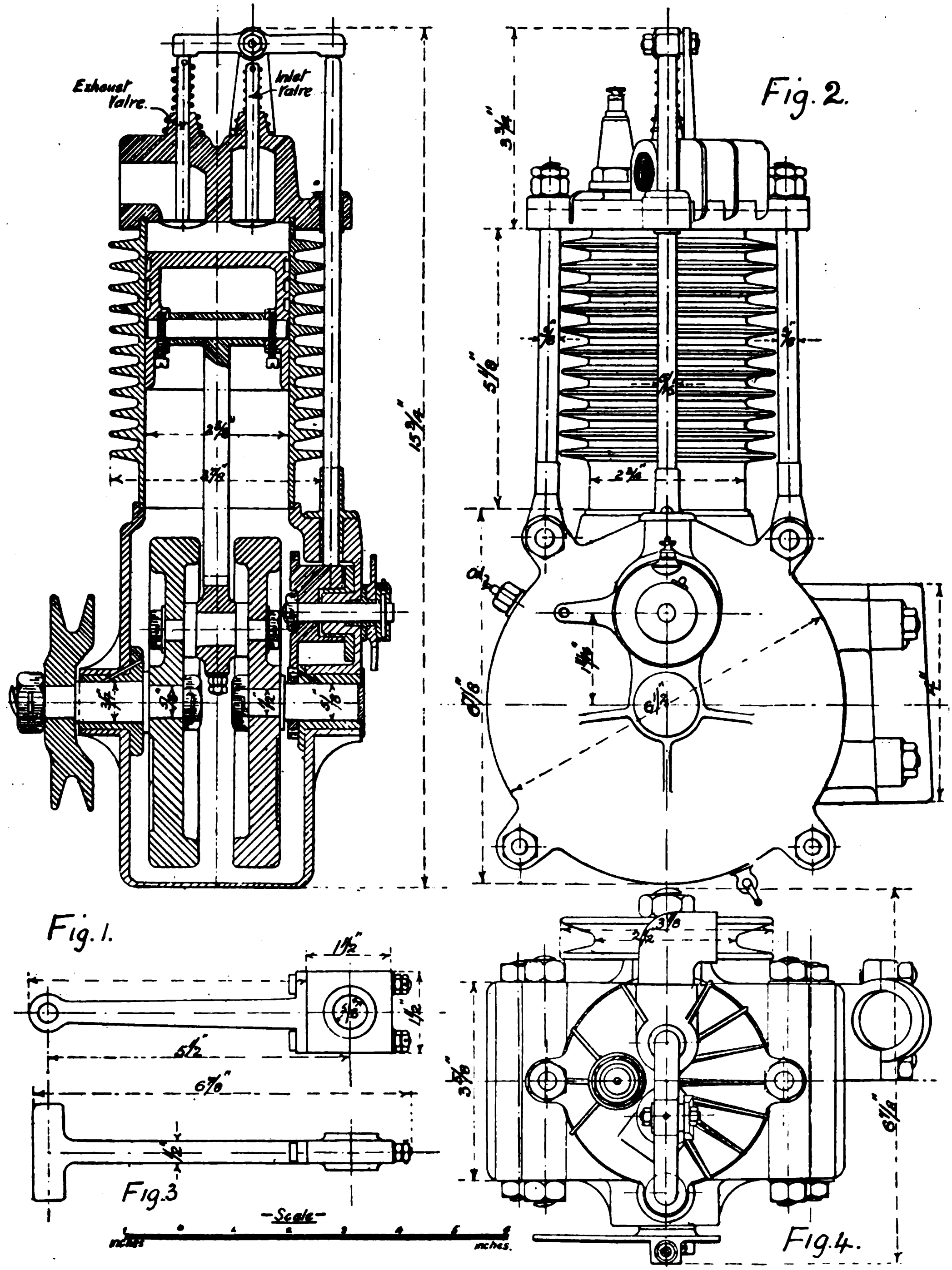
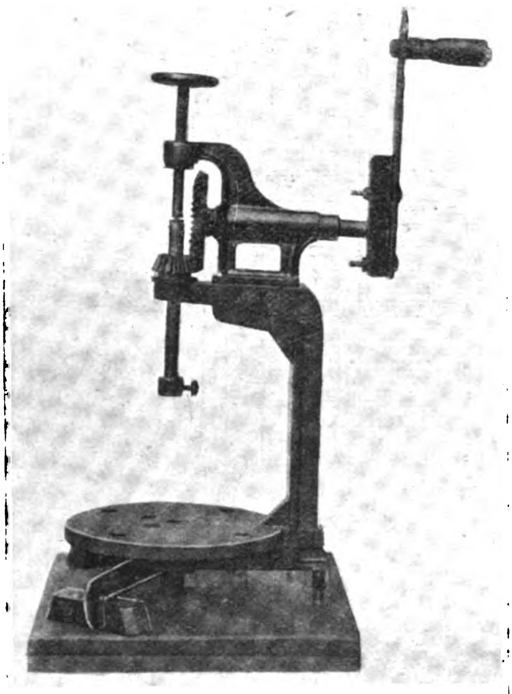


GENERAL ARRANGEMENT OF A 2 H.-P. PETROL CYCLE MOTOR.

For description] [*see page* 437.

and labour, be put to some other very useful purpose. This machine I have found most useful, and can easily run through a piece of ¼-in. steel with a 5-16ths-in. drill, which, of course, would mean real hard work with a hand brace.



MR. T. HARPER'S HOME-MADE DRILLING MACHINE.

Apart from my time, the whole thing cost me about a shilling for the casting. Certainly I was lucky in getting the original machine given to me, but I have no doubt similar or equally suitable articles could often be picked up in foundry yards and scrap heaps for a few pence.

An Expansion Bolt.

Secure a piece of pipe the size and length of the bolt that is intended to be used. With a hacksaw slit one end of the pipe about 1½ ins. deep in eight equal places around the pipe, as shown in Fig. 2. Take a hexagon nut and file each face on one

FIG. 1.

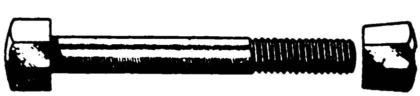
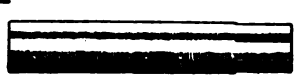


FIG. 2.



AN EXPANSION BOLT.

edge, only making it conical as shown in Fig. 1, so the small end will just start in the pipe. Place each corner of the nut in one of the slits cut in the pipe. When the bolt is screwed in, the eight wings of the pipe will be forced outward. — *Popular Mechanics.*

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows :—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

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"The Model Engineer" Exhibition.

"A BRILLIANT SUCCESS"—such was the verdict universally passed upon the first MODEL ENGINEER Exhibition, held at the Royal Horticultural Hall, London, S.W., from October 22nd to 26th last. Never has such a fine collection of models, such an excellent display of tools and materials, and such an interested and enthusiastic crowd of people been gathered together under one roof before. The Royal Horticultural Hall is itself a handsome building, but the tasteful stands and decorations, the beautiful engineering models, the snow-white sails of the graceful miniature yachts, and the brilliant electric lighting effects—all combined to make a show of infinite interest and beauty.

The doors were promptly opened at eleven o'clock on Tuesday morning, and the model engineering enthusiasts who had been patiently waiting without began to throng through the turnstiles. From then on till the closing hour on Saturday evening came one long stream of visitors from all parts of the country, and even from abroad.

There were those who had passed long years in successful engineering work of every kind, and those on whose apprenticeship indentures the ink was scarcely yet dry. There were amateurs who had made models by the dozen, and amateurs who had never seen a model other than their own Professors of engineering and other branches of applied science, naval and military officers, doctors, schoolmasters—and, indeed, people of every rank and calling, came, saw and admired. Those who knew what model engineering really meant went away with their approval more firmly established than before, while those who here made a first acquaintance with the model-maker's art were mpressed beyond all expectation. In securing public appreciation and public recognition of the real quality and value of model engineering, the Exhibition has, in fact, worked wonders.

The various exhibits were so numerous and so

A GENERAL VIEW OF THE EXHIBITION FROM THE BALCONY.

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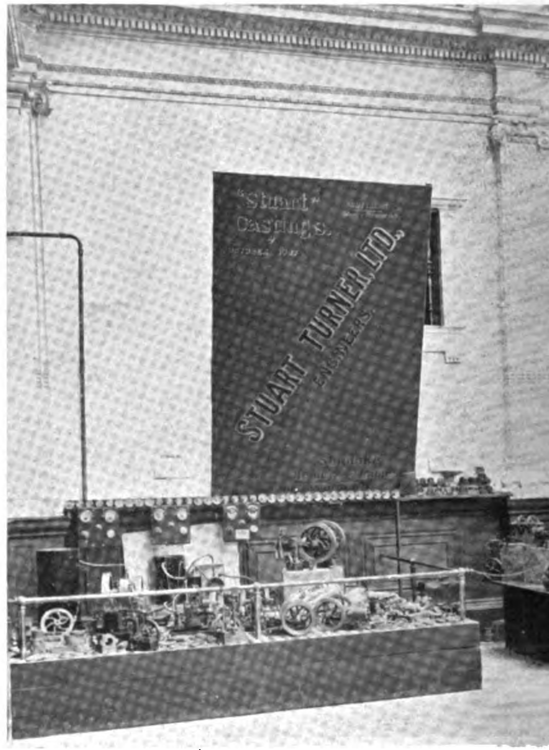
varied that it will be impossible for us to mention all in detail, but the following account of the principal items of interest will give some idea of the representative character of the Exhibition.

TRADE SECTION.

Stuart Turner, Ltd., Shiplake, Henley-on-Thames.

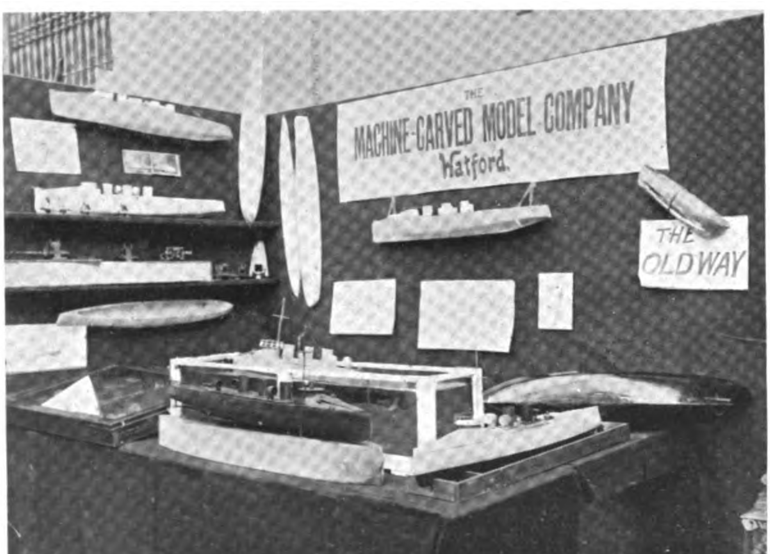
This well-known firm occupied considerable space with their well-arranged show of specialities. Their castings and finished parts for small power steam, gas and petrol engines were well represented, and need no special comment since they are known the world over. The firm had a number of finished models on view as well, and much interest was manifested in one of their small power gas engines, which was shown driving one of the Stuart charging dynamos. The engine was one taken from stock, and ran through the week without a hitch. Perhaps the most important exhibit at the stand—at least from the point of view of the model engineer—was the new "Stuart" lathe. This is a wonderfully cheap machine at the price. The firm are sending it out at £5 5s. The lathe is a screw-cutter, capable of cutting any thread the amateur is likely to require. The bed and headstock are cast in one, the former having a permanent gap and the latter being fitted with a mandrel having a ball-bearing thrust, a feature which will be greatly appreciated. The mandrel nose is screwed ¾ in. Whitworth, and is bored No. 1 Morse tapei. The height of centres in the gap is 4 ins., and the lathe will hold 9 ins. between mandrel taper and tailstock; height of centres over shears being 3 ins., and over boring saddle 2¼ ins. Saddle slide-rest and tool-post are of ample proportions, the slide being heavily made with V-slides and adjusting strips. The lead screw is placed at the back of the bed and is cut ten threads to the inch. It is automatically disengaged at the limit of travel. As we have said, it is a wonderful machine for the price, and is sent out complete with nine machine-cut change wheels, two steel centres, one six-face plate, and the usual spanner and accessories.



Stuart Turner, Ltd.'s, Stand.

Machine Carved Model Company, 11, Balmoral Road, Watford.

At this stand were shown a variety of types of machine-carved hulls in various stages of completion, as well as several finished model torpedo boats, one of the latter being exhibited at work moored in a glass tank. This was an electrically driven model, and was the object of much interest to visitors. Besides these, the firm exhibited, in connection with Messrs. Stuart Turner, the neat little enclosed single-acting engines designed specially for these model torpedo boats. The price



The Machine Carved Model Company's Stand.

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ARMSTRONG & CO.'S STAND.

for the completed engine is £1 5s., but for those who wish to do their own machining the firm are supplying a set of castings for 5s. This engine is undoubtedly one of the most suitable types for this class of boat. It may also be obtained geared for driving twin screws, the price being but 2s. 6d. more. Sets of castings for the boats themselves, specially designed water-tube boilers, and a good selection of electrical machinery for small boats completed the exhibit.

ARMSTRONG & Co., Twickenham.

This firm had a very good exhibit of their electrical specialities, including their new protected transparent celluloid horizontal boat accumulators. These accumulators are fitted with acid-proof terminals, and have specially thick plates. The shape is one which renders them particularly useful for driving small boats, as they may be placed athwart-ship, or indeed, in any desired position. They are made in several sizes, from 2 volts 4 amps. to 10 volts 5 amps., prices ranging from 6s. 6d. to two guineas. The firm's ordinary type horizontal accumulators are well known, and were shown in both ebonite and celluloid cases. Among other lines shown at the stand were several types of charging dynamos, small motors, and a number of well-made voltmeters, ammeters, etc., together with the usual selection of cycle lamps, pocket lamps, and bells.

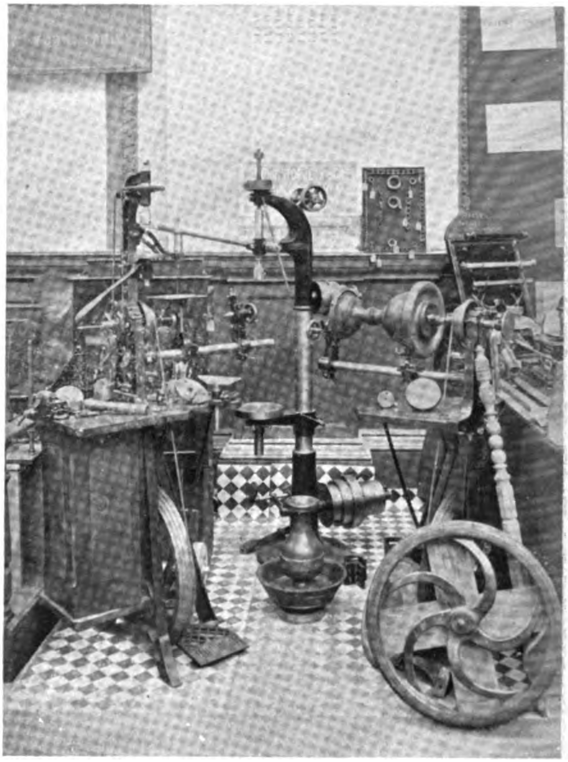
H. HECKMAN & Co., 27, Quinton Street, Earlsfield, S.W., and Henley-on-Thames.

Among the many exhibits of interest at this stand was the "H. & S." ½ b.h.-p. petrol engine, a well-designed engine mounted on a cast-iron box bed. It was shown separately and also mounted on a longer bed with a belt-driven dynamo. This latter was of first-class English manufacture, and designed to give 30 volts 8 amps. at 2,500 revolutions. These engines may be obtained either completed or as sets of castings, and are, without doubt, excellent value for money. One of the firm's new pattern two-cylinder engines, with crank case in aluminium, was also shown, and will, we understand, shortly be placed on the market. One other exhibit on the stand calls for notice. This was a beautifully made multitubular boiler of the vertical pattern, built of mild steel plates, riveted. It is fitted with 36 ½-in. weldless steel tubes, has a copper superheater, and is intended to be fired with coal or coke. The price, with Schaffer steam gauge and the usual fittings, is £7 10s.—exceedingly reasonable, considering the quality of the workmanship.

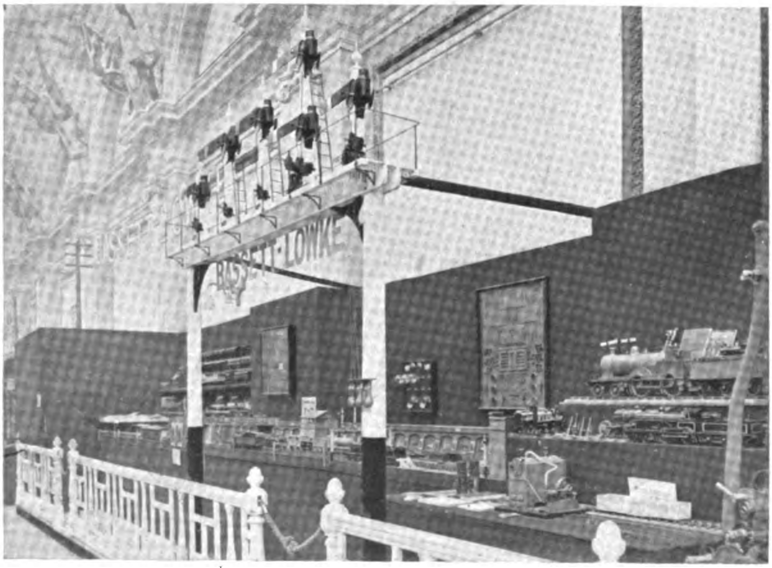
H. HECKMAN & Co.'s STAND.

W. J. Bassett-Lowke & Co., Northampton.

The exhibit of this well-known firm took the form of a working model railway, on which they showed during the week their various types of electrically driven locomotives. It was one of the greatest successes of the Exhibition, and from Tuesday morning to Saturday evening it was almost impossible to pass it, on account of the crowd which collected to watch the running of the models. The track (2-in. gauge) was laid on the third rail system, the whole being made to 7-16ths-in. scale. There were up and down main lines, sidings and crossings, a terminus station at one end, and a tunnel at the other. The control was obtained by the operator from a signal box placed about half-way down the line, which ran the entire length of the stand—35 feet. To those who were not fortunate enough to attend the Exhibition, some further details of the control arrangements used on this model railway may be of interest. We have said that the entire control of the line was obtained by one operator from one point—the signal box. This control, so far as the points and signals were concerned, was effected in the usual manner, with this addition—that by means of constructing the live rails in sections, it was possible to stop a train on any portion of the line desired merely by placing the signal against it, the action of doing this placing out of contact that particular section of rail controlled by the signal. Consequently, the effect produced was that of a train immediately slowing up whenever a signal was against it. The control of the reverse on the engines was effected in the manner described recently by Mr. Greenly in his present series of articles. The engines run on this model railway system were mainly the firm's Great Northern pattern, the motor in all cases being their new "Lowko" type, fitting on the boiler shell. Considering the scale of the models, their hauling power was wonderful, and was the subject of much comment. Besides this model railway system with its engines, carriages, and goods trucks, Messrs. Bassett-Lowke also showed their well-known steam locomotives, and during the week ran several of them on the Society's track. Over the stand was a quarter full-size model of a modern railway signal, the arms indicating sidings and through roads. This was lit up in the evening and was a very noticeable feature in the hall.



J. Christopher & Sons' Stand.



W. J. Bassett-Lowke & Co.'s Stand.

J. Christopher & Sons, 39 to 43, Clerkenwell Road, E.C.

The "Unique" combination machine which was shown at this stand comprises, in the words of its makers, "a complete machine workshop in a very small compass." The combination consists of a four-speed lathe, an upright drilling machine, a sawing machine for wood

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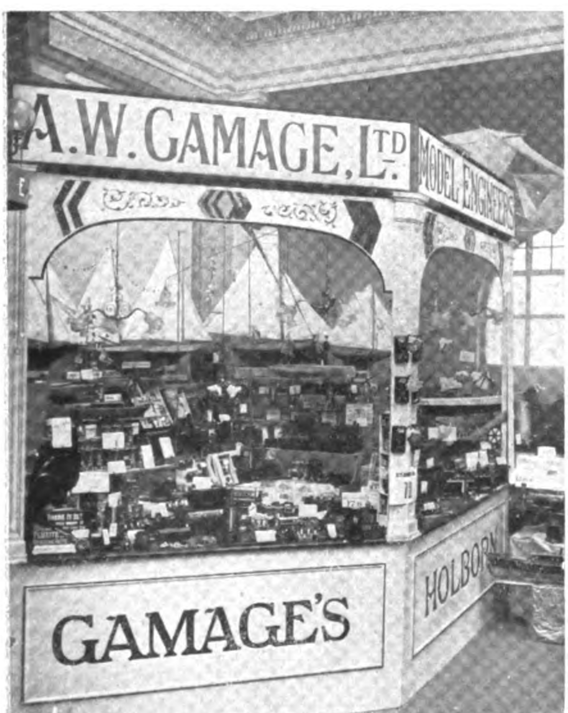
and metal, an emery grinder, and buffing and polishing mops. The lathe is certainly of surprising compass, for it permits of a diameter swing up to 30 ins., and extra bed shafts are provided for taking long work between centres. The other exhibits shown by the firm were two high-speed drilling machines and a case of small tools and engineers' stores.

A. W. GAMAGE, LTD., 125 to 129 and 118 to 121, Holborn, E.C.

Messrs. Gamage's stand, one of the most prominent in the hall, was occupied by a good selection of all kinds of models, both steam and electric. Among those particularly worthy of mention was a small boat motor to run at 4 volts. Racing yachts, complete motor boats, kites, wireless telegraphy sets, coils, engines, rails, and fittings and parts of all kinds, were shown in profusion. Gas engines in various sizes were also shown by this firm, who are evidently developing the model engineering side of their enormous business in a very active and enterprising fashion.

"THE MODEL ENGINEER" BOOKSTALL AND RECEPTION ROOM.



A. W. GAMAGE, LTD.'S, STAND.

GAWTHORP & SONS, 16, Long Acre, W.C.

Repoussé metal work, and the tools for its production were shown in great variety at this stand, and from time to time an exhibition of actual work was given. The designs shown were good, and ranged from simple work not likely to tax unduly the powers of the beginner to more elaborate designs. In all cases they were thoroughly artistic in feeling, and well within the limits of the material in which they were intended to be carried out.

W. T. LOVELL, 81, Carlton House, Regent Street, S.W.

This exhibit was the Phrenometer, the "Electrical Phrenologist," which was dealt with and illustrated in a recent issue. It calls for but a brief mention here, although from some points of view it was one of the most interesting exhibits in the building. Many well-known model engineers submitted to be read by its remorseless fingers, and, it must be added, agreed as a rule with its verdict.

EQUIPOISE, LTD., Ashford, Kent; also London, Brussels, and Paris.

From more than one standpoint the exhibit of Equipoise was of interest. It consisted of the firm's range of beds, couches, lounges, easy chairs, lounge chairs, etc., the chief and particular feature of them all being that the person reclining may assume "any position by volition." This is accomplished by an ingenious arrangement which allows the back and seat of the chair, couch, or lounge, to move with the bending of the sitter's body. For instance, from sitting one may easily assume a reclining position by the mere action of "leaning back"; and it must not be thought that the process involves any danger such as that which Max Adeler tells about in his "Combination Step-Ladder." Once the body has taken up the desired

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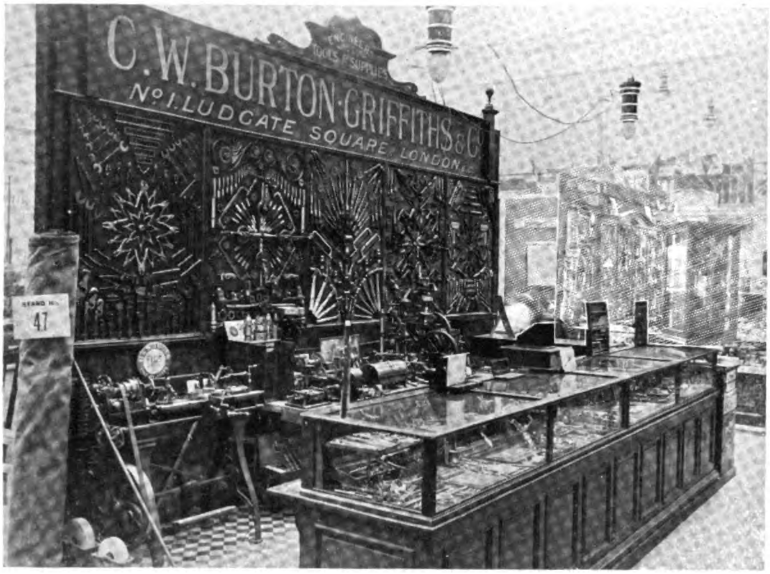


C. W. Burton, Griffiths & Co.'s Stand.

The Southwark Engineering and Model Works (Wright, Clark, & Wallis), 155 and 157, Southwark Bridge Road, S.E.

This firm were exhibiting a special line in ½-in. scale G.N.R. locomotive and tender, a model of excellent appearance and finish. They also showed their well-known Tilbury tank locomotive (7-16ths in.), and their ⅝ in. G.W.R. locomotive and tender. The firm's 3-in. scale compound launch engine was much admired. A selection of various kinds of rolling-stock of all gauges, and sets of castings and finished and unfinished parts, were additional attractions of the exhibit.

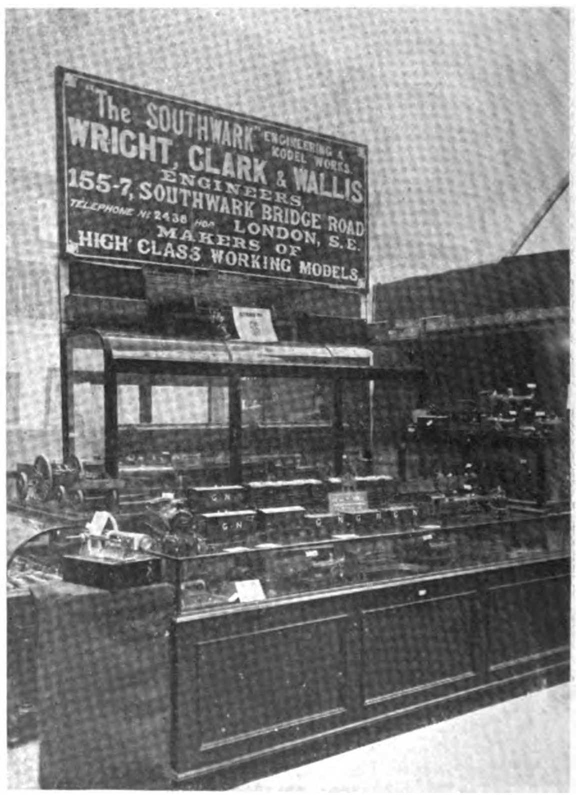
Fastnut, Ltd., 60, Aldermanbury, E.C.

The "Fastnut" Washer, which is the speciality of this firm, is one of the many devices which have for their purpose the secure holding of nuts, studs, and screws,

position it remains in that position until the person wills to alter it. However, since there are some who would wish to make the couch or chair immovable, there is provided a special form of locking arrangement by which any desired angle of back and seat may be, so to speak, permanently secured.

C. W. Burton, Griffiths & Co., Ludgate Square, Ludgate Hill, E.C.

A remarkable exhibit at this stand was that of the "Johannson" gauges, a complete case of these being shown. In form the gauges are short, flat, parallel bars or strips, two opposite faces being finished with extraordinary accuracy. The sizes of the various pieces in the set are so arranged that by placing two or more strips together any desired total measurement within the limits of the set can be obtained. Their shape and great adaptability renders them particularly suitable for testing shop gauges, dies, jigs, and other appliances where great accuracy is required. These gauges are finished so accurately that a number of them may be lifted vertically, holding the end gauge, if the mass has been pressed together so as to exclude the air. We were informed that a 4-in. gauge (they are, of course, made of glass-hard steel) had changed so little in the space of three years that when measured at the International Bureau at Paris it was found to be accurate to the 1-10,000th of a millimetre. Of the many useful appliances shown at the stand we have not the space to write at any length. Among them, we noticed an excellent little quick adjustment micrometer and an exceedingly cheap die holder, "The Ludgate,'' which, stock and one die complete, sells at 2s. 3d. These holders are suitable for screwing from 1-16th-in. to 5-16ths-in. Whitworth bolt threads and from No. 0 to 8 B.A. The dies are warranted to be made of the best quality crucible-cast steel.



The Southwark Engineering and Model Works' Stand

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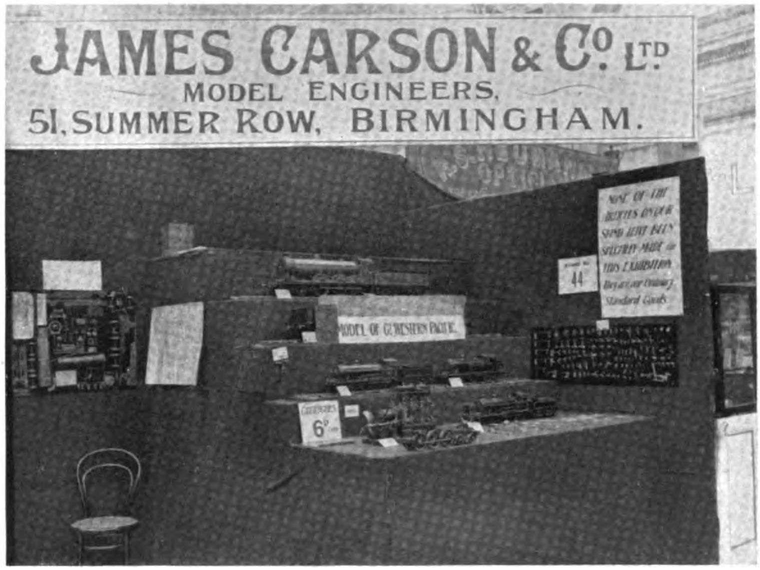
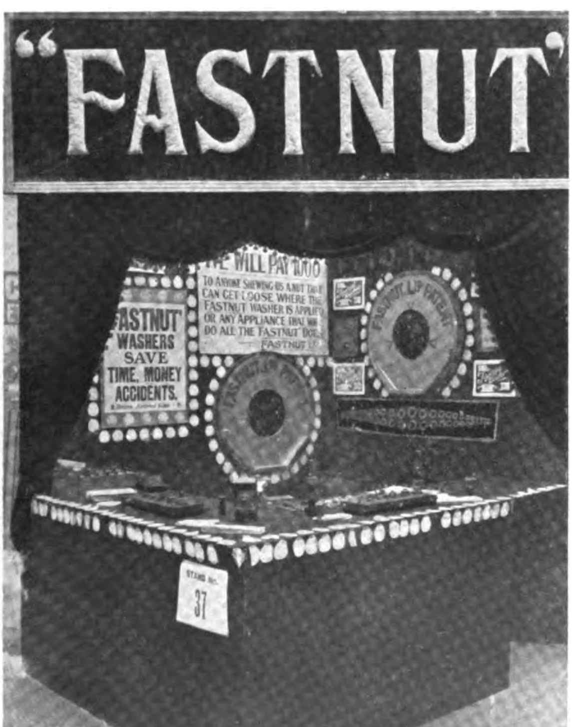
and from an inspection which we made of the latter contrivance we should say that it was one of the most successful. It has, in fact, already stood several severe tests, and we understand that the Accidents Insurance Company, Ltd., make a reduction of 5s. on their premiums on all motor-cars fitted throughout with the device. The arrangement is in the form of a washer which has three "prongs" or spikes which grip the bolt, and two side-springs which hold the nut in place. In the smaller sizes it should prove useful to the model maker.

JAMES CARSON & CO., LTD., 51, Summer Row, Birmingham.

The show of locomotive models by this well-known firm was one of the finest in the whole Exhibition. They may well claim to be up-to-date in their designs, for they were showing a completed model ($\frac{3}{4}$-in. scale) of the new G.W. Pacific engine, "The Great Bear," the prototype of which is not yet on the road. This model is an extremely handsome one, and is being made in $\frac{1}{2}$-in. and $\frac{3}{4}$-in. scale. The larger model has the complete Walschaerts valve gear, but in the smaller this has been slightly modified. The models are being made from full working drawings, supplied to the firm by Mr. Churchward, the locomotive superintendent of the Great Western. We may add that while the smaller model has but two cylinders, the large one has four, as the prototype will have. Some idea of the dimensions of the real engine will be obtained when we say that the $1\frac{3}{4}$-in. model is 4 ft. 4 ins. in length. Another fine model shown was the $1\frac{3}{4}$-in. scale model of the C.R. (903). Of course, a special feature was made of the firm's sets of machined parts for the L. & N.W. locomotives, "Experiment" and "Precursor."



JAMES CARSON & CO. LTD.'S STAND.



FASTNUT, LTD.'S, STAND.

JOHN TANN, 11, Newgate Street, E.C.

This well-known safe firm showed one of their "Anchor Reliance" fire and fall resistance safes. The bodies of these safes are made of steel plates $\frac{1}{4}$ in. in thickness, and are constructed without joints at any of the twelve corners. The fire-resisting chambers are $3\frac{1}{2}$ ins. thick, and are filled with the firm's patent moisture-generating fire-resisting composition. The doors are of solid steel plates, $\frac{1}{2}$ in. thick.

THE TELLA CAMERA COMPANY, 68, High Holborn, W.C.

The official photographers to the Exhibition, the Tella Camera Company had a stand at which they exhibited examples of their work as technical photographers.

BROOKS & WHITE, Regent's Row, Dalston.

This firm showed the patent "Bro-ite" strip system of electric lighting, a method of combining cable and lamps so that a row of lights may be quickly and easily fixed in any desired position. Effective displays for signs, special illuminations, and advertising, may be thereby quickly and easily

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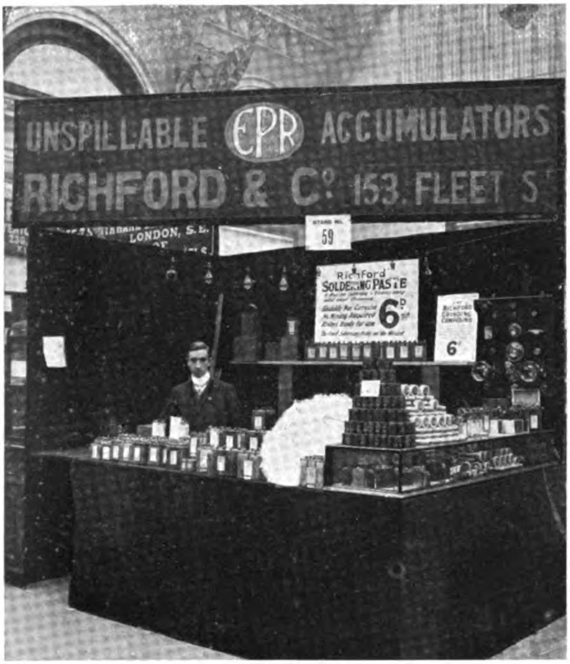


RICHFORD & CO.'S STAND.

arranged. They also showed a very neat and useful staple punch which should be much appreciated by wiremen. As official electricians to the Exhibition, Messrs. Brooks & White carried out the lighting arrangements of many of the stands, and gave complete satisfaction.

RICHFORD & CO., 52A, High Holborn, W.C., and 153, Fleet Street, E.C.

Accumulators, lamps, electric lighting sets, switches and accessories were to be found in great variety at this stand. There were the well-known " Crown " and " Double Crown " accumulators, both improved patterns, and the two styles of E.P.R. accumulator. A special feature was made of the ever-ready bulbs with " Osram " patent metallic filament. These are the lamps formerly known and sold under the name of " Osmi." They give a brilliant light for a small amount of current.

WALLIS BROS. & WICKSTEED, Stamford Road Works, Kettering.

The excellent " Joiboy " toys exhibited by this firm, while hardly coming under the heading of models, nevertheless attracted considerable notice, on account of their being more nearly to scale than this class of toy is generally. The wooden engines, for instance, partake more of the shape and general outlines of a locomotive than do the wooden abominations we remember having had in our childhood. Besides the engines there were wooden models of motor wagons, motor 'buses, and a selection of jointed animals, made, we understood, as correct anatomically as possible.

G. CUSSONS, The Technical Works, Broughton, Manchester; and 231, Strand, London.

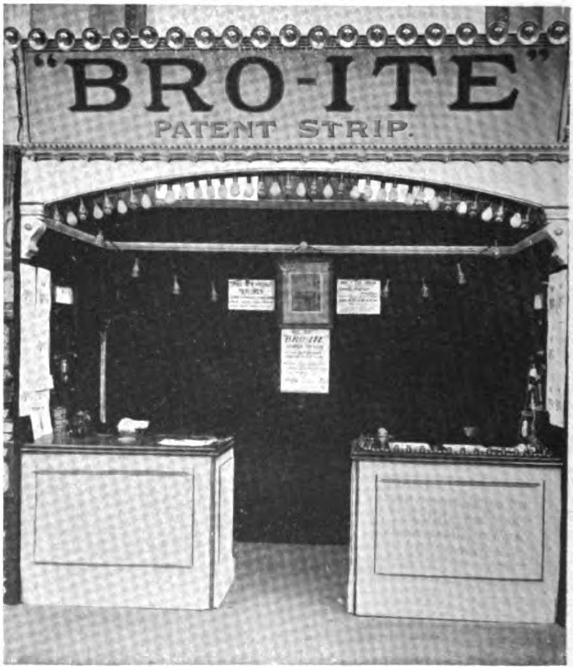
Experimental apparatus of all kinds, models of machine movements, building construction models, and sectional models of steam and gas engines, were among the principal exhibits at this stand. There was also a sectional model of a steam turbine, and various kinds of apparatus for the testing of materials.

THE BRITISH CALCULATORS, LTD., Invicta Works, Windus Road, Stoke Newington, N.

The BriCal weight-adding machine and the BriCal money-adding machine were both shown at this firm's stand. Both are very ingenious pieces of mechanism, and appealed greatly to the visitors to the show. As its name implies, the former machine is constructed for the addition of weights, converting pounds to quarters, quarters to hundredweights, and hundredweights to tons, no mental work beyond setting the wheels being necessary. The money adding machine works, of course, on the same principle, converting pence to shillings, and shillings to pounds.

DRUMMOND BROS., LTD., Ryde Hill, near Guildford.

The expression " as accurate as a Drummond lathe " is one which is familiar to model makers the world over, and is well based. Messrs. Drummond's exhibit included all their well-known patterns, ranging from the beautiful little 3½-in. centre to its larger brother of 6-in. centre. There is perhaps little need for us to say very much in



BROOKS & WHITE'S STAND.

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praise of the exhibit, but we may call attention to a slight improvement which the firm has made in the top slide-rest of the $3\frac{1}{2}$-in. centre lathe. Hitherto the swivelling portion of this has been made to turn direct on the face of the boring carriage. In the latest pattern this has been altered, and the top slide is made in two parts, which are divided for taper. The bottom part of the top slide now has a feather which fits one of the slots on the boring carriage. Although a trivial matter, it is a good example of the care which the firm is ever exercising in endeavouring wherever possible to improve their productions.

DRUMMOND BROS., LTD.'S, STAND.

F. DARTON & Co., 142, St. John Street, Clerkenwell, E.C.

Here was a large exhibit of vacuum tubes, voltmeters, ammeters, motors for boats, dynamos, and other electrical goods. Several of the motors and other models were shewn at work, and a revolving window stand, carrying an assortment of electrical novelties, and worked by one of the firm s motors, made an attractive centrepiece.

F. DARTON & Co.'s STAND.

THOS. J. SYER & Co., 45, Wilson Street, Finsbury Square, E.C.

The exhibit of this firm included the "Eureka" vice bench, an extremely handy little bench, of which, we understand, Messrs. Syer & Co. have supplied quite a large number to technical schools. It consists of a strong cast-iron bench, webbed underneath, supported on a cast-iron standard. The vice is of thoroughly good quality, and is firmly bolted to the bench. At one side of it there is a kind of tool cabinet in which the tools fit, a flap closing over this when desired, and so giving more room. At the other side of the bench is a surface plate, planed but not scraped, while at the back is a tool rack for files, scrapers, etc. This rack is also made in such a way that it will support a drawing board—a handy arrangement when working from scale drawings. A seat which swivels out on one of the iron legs of the standard completes the bench. Another extremely useful tool which we noticed at this stand was a quick-feed drill.

R. S. NEUMANN, 59 & 61, New Oxford Street. W.

Mr. Neumann showed, besides a good selection of lenses, spectacles, etc., an ophthalmometer, or sight-testing machine. This machine is intended specially for the detection of astigmatism, a complaint so extremely common at the present day as often to be disregarded. The optical goods shown at the stand were all of high-class quality.

WALTER TYLER, LTD., 48 to 50, Waterloo Road, S.E.

This well-known firm had a large stand, on which they showed their specialities in optical lanterns. From the model makers' point of view the most interesting exhibit was the firm's safety arrangement for the Cinematograph. This takes the form of a shutter in front of the lens which auto-

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matically cuts off the light (and consequently the heat) the moment the operator ceases to turn the handle. It is actuated by means of a contrivance somewhat similar to the old ball governor, a certain speed being necessary before the shutter is raised. The regulations controlling the exhibition of films are now very stringent, and this shutter should be an additional safeguard. In conjunction with it a safety "gate" is used, and we were informed that with this in operation it is impossible for more than an inch or so of celluloid to burn in the event of a hitch occurring. The two appliances should do away with the use of the much-discussed alum bath, the advantages of which were never very apparent. Messrs. Tyler gave an excellent series of cinematograph shows in the Lecture Hall, which were largely attended.

Louis Burn, The Studio, Westbourne Street, W.

The "Max" motor cycle, which was the chief exhibit at this stand, is somewhat of a departure in cycle construction, it being constructed for the rider to stand, not sit, though we understand that a seat could be provided if desired. The engine is well placed, and all the working parts are easily accessible. It should be a convenient cycle for running short distances, and would prove invaluable to a professional man in a country district.

Walter Tyler, Ltd.'s, Stand.

Hampson Bros., Ltd., Patricroft, near Manchester.

A beautifully-finished model of a 3 ins. by 2 ins. high-speed vertical engine was shown on this stand, and attracted considerable attention and appreciation. Sets of castings and parts for this engine, and also for a 2 ins. by 1½ ins. engine of the same type were also shown, in addition to a well-finished 3-in. centre bench lathe. The foregoing engines are perfect scale reproductions of a modern high-class electric lighting engine, and the design is quite one of the best now on the market.

Hanway Engineering Works, 8, Hanway Street, Tottenham Court Road, W.

The beautiful scale model locomotives at this stand attracted much attention during the week. One of these in particular, a model of the L. & N.W. three-cylinder compound (Webb) "Scottish Chief" was a truly magnificent piece of workmanship. Another model shown was that of the L.B. & S.C. Railway's engine "Holyrood." Besides these, there was a finely finished model of a compound surface-condensing marine engine, and another of a triple expansion T.B.D. engine, this latter being only partly finished.

Hampson Bros., Ltd.'s, Stand.

The Birmingham Model Engineering Company, Northwood Street, Birmingham.

This firm exhibited a length of nicely ballasted permanent way, laid out with their new "Tessted" rails, for which Messrs. A. W. Gamage, Ltd., are agents. As a small scale non-rusting rail at a moderate price this is likely to meet with considerable success.

Locomotive Publishing Company, Ltd., 3, Amen Corner, London, E.C.

This well-known company had a very neatly arranged stand on which were dis-

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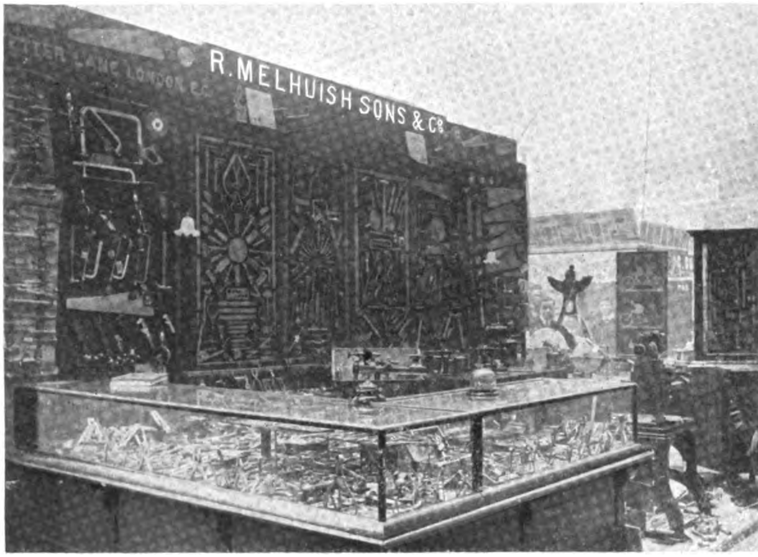
played some excellent examples of their specialities in paintings, engravings, and photographs of railway subjects. They also had on view a number of useful locomotive and railway books.

RICHARD MELHUISH, LTD., 84, 85, & 87, Fetter Lane; New Premises, 50 & 51, Fetter Lane, E.C.

This old-established firm had a splendidly arranged stand, on which they showed a great variety of tools, etc., of a kind likely to appeal very specially to the model engineer. A particularly interesting item was a light milling machine, having a draw-in chuck for holding the cutter and a very conveniently arranged table and vice. This should be an excellent machine tool for a model engineer's workshop. Some handsomely finished and well-equipped work bench tool cabinets, and some examples of this firm's excellent work benches, vices, and other labour-saving devices also attracted considerable attention.



RICHARD MELHUISH, LTD.'S STAND.

CASSELL & CO., LTD., Ludgate Hill.

This firm made an excellent display of technical literature, their handbooks for the building trade covering a particularly varied and useful range of technical subjects.

AUTO-CONTROLLER AND SWITCH CO.'S STAND.

AUTO-CONTROLLER & SWITCH COMPANY, Simplex Works, Vienna Road, Bermondsey, S.E.

"Fluxite" soldering paste, an article already well known to our readers, was the special exhibit on this stand, the demonstrations of the use of the flux being watched with keen interest. "Fluxite" is certainly all the makers claim for it, and even painted metals can be soldered without being previously cleansed. It will solder any metal, except aluminium—even cast iron. Being free from corrosive effects, it is particularly adapted to electrical work. It is packed in tins at 6d., 1s. and 2s., and may also be had in larger quantities. We understand that it has recently been adopted in the Royal Arsenal, Woolwich.

HENRY MILNES, Ingleby Works, Brown Royd, Bradford.

The machines shown at this stand were the firm's well-known and beautifully made 4½-in. treadle screw-cutting lathe with traverse shaft for self-acting sliding and surfacing; their 5-in. centre ornamental turning lathe with overhead, slide-rest, etc., and an excellent little planer, to plane 14 ins. by 8 ins. by 6 ins. deep. We need not say that in every case the workmanship in these tools was of the very best description. The planer in particular struck us as being just the thing for the model engineer's workshop. A set of horizontal engine castings and drawings was also on view.

ALEXANDER WRIGHT & CO., LTD., 1 Westminster Palace Gardens, Victoria Street, S.W.

This firm are the manufacturers of the Simmance-Abady Combustion recorders, and various other kinds of testing apparatus. They had a good and well-displayed show of their various specialities, which include such things as calorimeters, photometers, and a specific gravity cell, etc. To the professional engineering visitors this stand proved of special interest.

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ARTHUR FIRTH, Cleckheaton, Yorks.

Lathes, drills, planers, and accessories of all kinds were shown by this firm. The 3-in. centre back-geared treadle lathe which they showed appealed to us in particular. This lathe, in fact, is of a very good pattern. It has a gap-bed, veed-edges, and is hand-surfaced. The compound slide-rest is fitted with square thread screws and polished handles, the top slide being indexed for taper. We also made a note of the firm's improved hand-planer, which will surface work up to 18 ins. by 7 ins. and 5 ins. deep. American chucks, of various patterns, twist drills, surface-plates, and a number of good quality small tools were also shown at the stand.

ARTHUR FIRTH'S STAND.

THE YOUNG FIRM (E. C. YOUNG), 1, 3, and 5, Virginia Road, and 80, Boundary Street, Bethnal Green, E.

Selected hardwoods of all kinds, three-ply wood for panelling, etc., fretwoods, and other commodities for the use of the joiner and cabinet-maker, were shown by this firm. They also exhibited some pine blocks selected specially for shaping into hulls for model yachts.

THE HANDICRAFTS PRESS, LTD., Furnival Street, London, E.C.

The Woodworker and Art Metal Worker was the prominent feature on this stand, and a great many visitors were interested in the useful and artistic contents of this monthly publication. Popular handbooks on various branches of woodworking were also shown, as well as some interesting examples of art metal and wood-carving. A novelty in workshop appliances was the pattern-maker's vice, this being very similar to an engineer's vice, but constructed in wood.

THE HANDICRAFTS PRESS, LTD.'S, STAND.

THE INVENTORS' ENGINEERING CO., 149, 151, and 153, Pentonville Road, showed a record saving device for gramophones, a new match-box, several inventions by Mr. Raupach, a golf home trainer, an attractive wireless telegram advertiser, a sink trap, letter files, electric filter, &c. Messrs. Braun and Co. have acquired the old-established business of the Inventors' Engineering Co., and we are glad to hear that negotiations are pending for the sale of several inventions as the result of the Exhibition.

BRAUN & CO., Inventors' Engineers, 236 and 238, Pentonville Road, N.

This firm, who are well known as inventors' model makers, showed a number of trade samples and working models made for clients whose patents were for sale. Amongst interesting exhibits were a draughtsman's rapid liner, typewriter inventions, new variable throw cycle crank, casement fastener, cycle dress guard, a novel cooking apparatus, an improved attachment for kettles, saucepans, &c., a workman's time recorder, Audephone for teaching the deaf to talk, combined and blind bracket, a chemical cooling apparatus for milk, a new baby carriage, etc.

THE LOAN SECTION.

A splendid collection of models was to be seen in the Loan Section of the Exhibition, perhaps the most admired being the beautiful scale model of the L.B. & S.C.R. locomotive "Como," built by Dr. J. Bradbury Winter. This was arranged with an electric lamp at one end so that the delicate workmanship in the cab might be seen to advantage. It will be remembered that this model was illustrated

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and described in the first two issues of this journal, and many visitors to the Exhibition were delighted to find that they were able to see this magnificent example of high-class amateur work. In the same glass case the "Goldsmid" model clockwork locomotive was also shown, this being lent by Dr. Arthur C. Hovenden, for whom it was built by Dr. Winter. Another source of great interest was the valuable collection of historic models kindly lent by Mr. Ernest D. Löwy. These included an original model locomotive built by Richard Trevithick about a hundred years ago, a Maudslay table engine, an old broad-gauge G.W. model, a beautifully finished G.N. model, a M.R. model, and a fine scale working model Caledonian locomotive, besides a number of other models of engines of various types.

The 1906 silver medal speed boat *Era* was lent by Mr. W. R. Weaver, and interesting comparisons were made between this fine steamer and the Messrs. Arkell's model petrol boat, which secured the bronze medal in the same competition. Mr. W. H. Arkell and his brother, Mr. F. G. Arkell, were frequent visitors to the Exhibition, and immensely pleased the public by their demonstrations of the working of their petrol boat engine from the gas supply. A self-starting rectifier was shown by Dr. Reginald Morton, and other electrical exhibits of special interest were a welding machine by the British Insulator and Helsby Cables, Ltd., an early morning electrical kettle by Mr. C. J. J. Gray, a particularly neat model goods train with electric locomotive by Mr. Basil H. Reynolds, Cooper-Hewitt mercury vapour lamps, and Tungsten incandescent lamps by the British Westinghouse Manufacturing Company, Ltd., and some fine apparatus by Marconi's Wireless Telegraph Company, Ltd.

An excellently constructed scale model of a London United electric tramcar was shown by Mr. Samuel Emmett, and this looked particularly realistic when lighted up with both its head and interior lamps. Mr. Jas. C. Crebbin's fine model four-cylinder compound locomotive, "Cosmo Bonsor," also came in for much attention, and during the week this model gave some good performances under steam. Professor A. G. Greenhill, F.R.S., contributed a model beam engine in wood, this being of unusual interest, as it had both the Watt and Peaucellier motions combined. Messrs. J. I. Thornycroft and Co., Ltd., sent two models of vessels constructed by them, and also a model water-tube boiler of the "Daring" type.

Through the kindness of Mr. Wilson Worsdell, the North Eastern Railway Company were represented by two very handsome models showing engines of his design. These were a four-coupled express passenger locomotive, and a six-coupled mineral locomotive respectively, and Mr. Grey, the company's courteous representative, was untiring in his explanations to the numerous interested visitors by whom these models were invariably surrounded. Much attention was also given by railway enthusiasts to the very instructive exhibit of the Messrs. W. R. Sykes Interlocking Signal Company, Ltd., who showed several applications of their system to the electrical control of railway points and signals.

The two collective exhibits of the Society of Model Engineers and the Victoria Model Steamboat Club respectively were very prominent features of the Loan Section, but these are both specially referred to later on. Particular mention, however, should be made of Mr. J. Chadwick Taylor's splendid model of the old locomotive *Agenoria*. Apart from its interest as a striking example of high-class amateur workmanship, it attracted considerable attention by reason of its being an absolutely accurate reproduction of one of the most notable of the old time engines. Some of our readers will remember that this model was shown working under its own steam at a recent meeting of the Society of Model Engineers; and in order that the working of the motion might be demonstrated during the Exhibition, Mr. Taylor thoughtfully provided a short length of track on which visitors were permitted to move the engine up and down. A number of the models in the S.M.E. Section had won medals and prizes in the Society's own competitions, so that the high average quality of these exhibits may well be imagined. Among these may be noted Mr. W. H. Dearden's model gas engine, Mr. Sharman's electric clock, Mr. A. M. H. Solomon's Wimshurst machine and torpedo boat, and Mr. H. G. Riddle's overtype dynamo. A model G.E.R. locomotive boiler by Mr. Goodenough, a model electric locomotive by Mr. Bunt, and the model goods locomotive by Mr. Barrett were also much admired by the visitors. Other items which

A Portion of the Victoria Model Steamboat Club's Exhibits.

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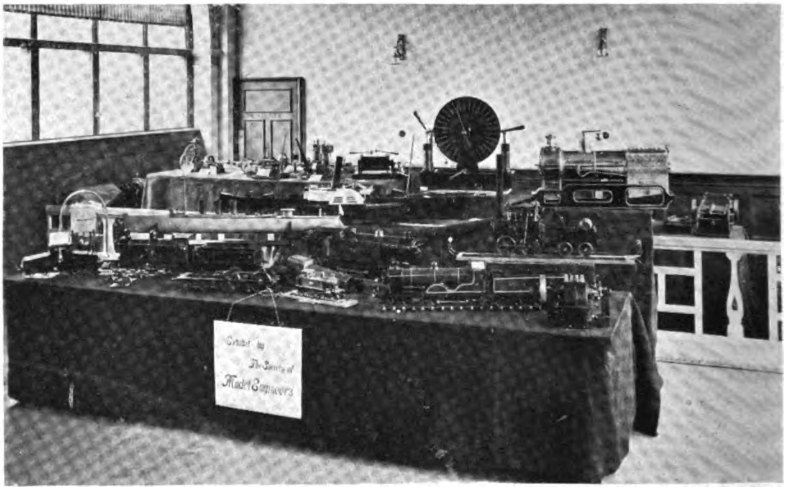
added materially to the success of the loan section were the scientific models of Mr. Sherard Cowper-Coles, the model of the *America* schooner yacht by the Rev. Albert Willan, the model petrol motor by Mr. W. J. Smith, Mr. George Gentry's small scale horizontal engine, Mr. C. Blazdell's model compound reversing diagonal paddle engine, the pump for model flash boiler by Mr. V. W. Delves-Broughton, the launch engine by Mr. H. W. Jackson, the vertical engine and pump by Mr. G. S. Owen, and the model quick-firing gun by Mr. R. J. Briggs. Commercial models were represented by a very neat model of a water-softening plant shown by Messrs. Lassen & Hjort, and by several interesting working models of Halliwell's patent smoke-preventing furnace, exhibited and demonstrated by Mr. Halliwell, of the Venetian Air Valve Furnace Bar Company.

Pictorial exhibits were made by the Norddeutscher Lloyd, who showed a large oil painting of the *Kaiser Wilhelm II* as she would appear if placed in Trafalgar Square; by Mr. Jas. P. Maginnis, Assoc.M.Inst.C.E., who lent some most interesting historical and other pictures for The Model Engineer Reception Room; by Mr. W. S. Campbell,

Mr. Ernest Löwy's Collection of Historic Models.

who exhibited some excellent examples of technical photography; and by Mr. E. W. Twining, who placed on view a frame of charming specimens of his abilities as a technical and artistic designer.

A number of models were shown in the Sale Section; these including Mr. Fred. Wilkinson's beautifully-made miniature high-speed governor engine, a fine model G.N.R. passenger brake van, exhibited by Mr. C. George Harrison, and "The Electric Villa," made by Mr. Jas. Miller. The latter was really a shocking coil, made up into the attractive form of a miniature house, and set into operation by the insertion of a penny in a slot.



A Group of the S.M.E. Models.

THE SOCIETY OF MODEL ENGINEERS.

This well-known and enthusiastic Society occupied one of the annexes, and made a most interesting display of their members' work. These were so numerous that it is not possible for us to mention them individually, but they were a continual source of attraction and delight to the visitors. The Society's new testing stand was on view, and a number of engine models were shown in motion running from an electrically driven countershaft. In the centre of the main hall two of the Society's model railway tracks were erected inside a strong barrier, and numerous trips of both steam and electric locomotives were made during the week, arousing great enthusiasm. There were many visitors who had not previously seen a model locomotive under steam, and both the members of the Society and the several trade firms who ran models on the tracks came in for much applause. A number of the Society's members attended regularly during the week and rendered valuable assistance in the arranging and supervision of the models.

THE VICTORIA MODEL STEAMBOAT CLUB.

The members of this flourishing Society of marine enthusiasts made a thoroughly representative display of model motor boats, which proved a constant source of interest to the visitors. Mr. E. Pierce's scale model of the late Sultan of Turkey's yacht *Ozzedin* was a fine piece of work, as also was the half model of the *Lusitania*, exhibited by another member. Our versatile contributor "The Carpenter's Mate" was represented by the electric launch *Misery*, happily shown in a tank of water where her propeller could run to its heart's content whenever the starting switch was set over. Hydroplanes,

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pressure gauges made at a phenomenally low cost, and other fittings were features which added much to the novelty of this stand, which, by the way, was draped and decorated in excellent style by the Club members. As the result of this exceedingly practical collection of working model boats, the reputation of the Victorians will be considerably enhanced.

"THE MODEL ENGINEER" COMPETITION SECTION.

Great interest was naturally manifested in the section devoted to the models made from instructions published in THE MODEL ENGINEER. There were twenty-five entries altogether which were accepted for competition, several further entries having been disqualified through not sufficiently fulfilling the conditions of the competition. In Class C, unfortunately, only one entry was received; and to equalise matters and to enable all the prizes to be awarded as offered, all the boat entries in Class A were transferred to this class. The Editor of THE MODEL ENGINEER nominated Mr. Alfred W. Marshall, M.I.Mech.E., A.M.I.E.E., and Mr. V. W. Delves-Broughton, Assoc.M.I.C.E., to assist him in the work of judging; and it needed a very prolonged and careful scrutiny of the work to finally allot the awards, so good was the average quality of the work.

In CLASS A the first prize of Silver Medal and £3 was awarded to Mr. John A. Barker for a beautifully finished model of a Stuart vertical compound engine. The second prize of Bronze Medal and £2 was well earned by a fine model compound undertype engine built by Mr. A. F. Hart; while Mr. J. Chadwick Taylor secured third prize of Bronze Medal and £1 for his excellent working model steam road roller. An extra bronze medal was awarded to Mr. Paul Blankenburg for a partly-finished model Caledonian locomotive, which shows promise of being a fine model when completed. Certificates of Merit in this class were awarded as follows:—

Very Highly Commended.—Two-cylinder launch engine, by Mr. J. Chadwick Taylor; partly finished model Caledonian locomotive by Mr. H. C. Waller.

Highly Commended.—Model De Laval steam turbine, by Mr. George Frakes; model hot air engine, by Mr. John W. Randall.

Commended.—Small model undertype engine, by Mr. Sidney Knight; cardboard model L.T. & S.R. ten-wheel tank locomotive, by Mr. A. J. Limebeer, Jun.

In CLASS B the competition amongst amateur dynamo and motor makers was very keen. There was, however, no doubt that the first prize of Silver Medal and £3 was well earned by Mr. Herbert Hildersley for his 160-watt ironclad dynamo, and that Mr. J. Clark fully deserved the second prize of Bronze Medal and £2 for his well-made model multipolar dynamo. An excellently finished small four-pole motor secured the third prize of Bronze Medal and £1 for Mr. Arthur W. Stoker. In view of the good quality of the workmanship displayed by Mr. Thos. Corkhill in his tangent galvanometer, he was awarded an extra bronze medal, and the same distinction was accorded to Mr. Albert Lonsdale, who entered a small ironclad type dynamo, made entirely from scrap material, without a lathe. Certificates of merit were awarded as follows:—

Highly Commended.—Overtype dynamo, by Mr. W. R. Humphrey; 80-watt undertype dynamo, by Mr. John Robertson.

Commended.—Automatic cut-out, by Mr. W. H. Sharman; electric tramcar, by Mr. Thomas Bush.

In CLASS C Mr. H. M. Savage's magnificent model sea-going yacht *Muriel* took the first prize of Silver Medal and £3, and an excellent piece of model-making in the model steam yacht by Mr. O. A. Tiefenbock well deserved the second prize of Bronze

VIEW OF HALL SHOWING THE SOCIETY OF MODEL ENGINEERS' RAILWAY TRACK.

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Medal and £2. The third place for Bronze Medal and £1 was secured by Mr. Leonard G. C. Warner for a model sloop-rigged yacht, this securing preference over a beautifully finished model yacht from Mr. J. T. Hughes, by reason of the more practical way in which the details of the rigging and sail-making had been interpreted. Mr. Hughes' model received a *Very Highly Commended* certificate, while a *Commended* certificate was awarded to Mr. R. Wischman for a well-finished lathe indicator.

The whole of the entries in this competition were highly creditable examples of work, and formed a striking testimony not only to the practical nature of the working instruction given in THE MODEL ENGINEER, but also to the high executive ability of its readers.

LECTURES AND MUSIC.

The entertainment programme was a most enjoyable feature of the week. The delightful lectures by Mr. Richard Kerr, F.G.S., F.R.A.S., on "Sound Waves and Voice Forms," "Colour Photography," and "Microscopic Wonders in Nature," with his fascinating demonstrations of electrical and scientific apparatus of every kind. drew crowds all through the week: and had the rooms in use been twice the size, they could easily have been filled. Mr. Kerr was ably assisted by his two charming daughters, whose really expert handling of scientific apparatus was a novel experience to the majority of the visitors.

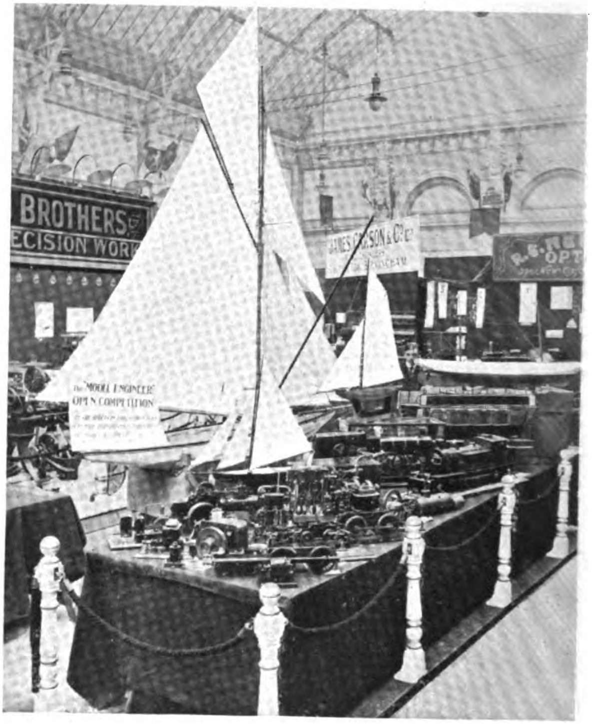
Our well-known contributor, Mr. William J. Tennant, M.I.Mech.E., discoursed on "Modern Applications of the Gyroscope," and incidentally gave a non-mathematical explanation of the principles of the gyroscopic action. In the art of clear exposition of fundamental mechanical principles Mr. Tennant is a past-master; and he delighted his audience by his ingenious and distinctly successful manipulation of the homely umbrella to illustrate the peculiar movements of the gyroscope when at work. A number of engineers made a special point of attending this lecture, and Mr. Louis Brennan, the distinguished inventor of the gyroscopic mono-rail locomotive, was himself an interested member of the audience.

As was only to be expected, Mr. R. P. Howgrave-Graham's lecture on "Electric Oscillations and Waves" was one of the most popular items in the programme, and although given four times during the week, this subject never failed to draw a full audience. The experiments shown by Mr. Howgrave-Graham were startling in the extreme, but of the greatest possible scientific interest. They were rendered additionally attractive by the fact that Mr. Howgrave-Graham has recently effected some remarkable improvements in his apparatus and methods, and the visitors were enabled to see the experiments carried out on the most approved lines. As indicating the great interest taken by many of our readers in this subject, we may mention that one of the visitors to the Exhibition travelled 180 miles especially to hear these lectures.

The delightful music performed by Herr Ph. Meny's White Viennese Band was appreciated by all the visitors, and on Saturday the performance of a special item entitled "THE MODEL ENGINEER March" evoked great applause. The excellent cinematograph displays by Messrs Walter Tyler, Ltd., were also very popular.

During the week the Exhibition was officially visited by the Society of Model Engineers, the Junior Institution of Engineers, the Association of Engineers-in-Charge, and the National Association of Manual Training Teachers. The latter Association held a well-attended meeting in the Lecture Hall on Saturday, under the chairmanship of Dr. C. W. Kimmins, Chief Inspector of Education to the London County Council, when Mr. J. G. Edwards, A.M.I.M.E., read a very instructive paper on "The Equipment of Workshops for the Teaching of Metal Work."

Altogether the Exhibition was visited by over



THE COMPETITION MODELS.

10,000 people, and it is very satisfactory to record that no complaint or hitch of any kind occurred. Indeed, the whole function was characterised by extreme friendliness and kindly consideration on the part of everyone concerned, and it partook more of the nature of a huge gathering of personal friends than of a meeting of people who were mostly absolute strangers to one another. This good feeling culminated on Saturday evening in loud calls for the Editor of THE MODEL ENGINEER. Mr. Percival Marshall, who was not permitted to retire without making a speech from the musicians' balcony. Mr. Marshall took the opportunity of thanking both the trade, the exhibitors in the loan section, and the visitors, for the whole-hearted way in which they had all contributed to the great success achieved during the week, and so with ringing cheers and with "Auld Lang Syne" this unique Exhibition came to a most happy end.

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Notes on Wireless Telegraphy Apparatus.

By V. W. Delves-Broughton.
(*Continued from page* 370).

Coherers.

THERE are a number of coherers that are of comparatively easy construction which are little used by amateurs on account of the apparent difficulties in making them. Perhaps the most useful coherer for general work is the Lodge-Muirhead; but as this is really rather difficult to construct, I propose describing other

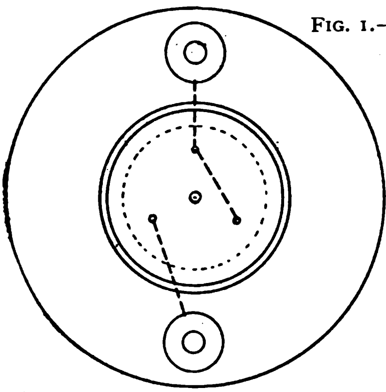


Fig. 1.—Plan.]

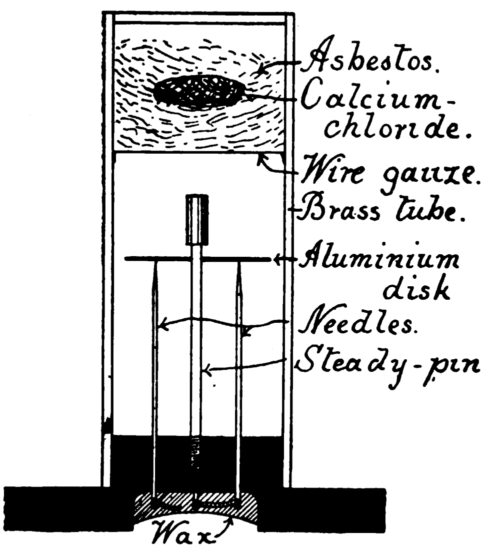


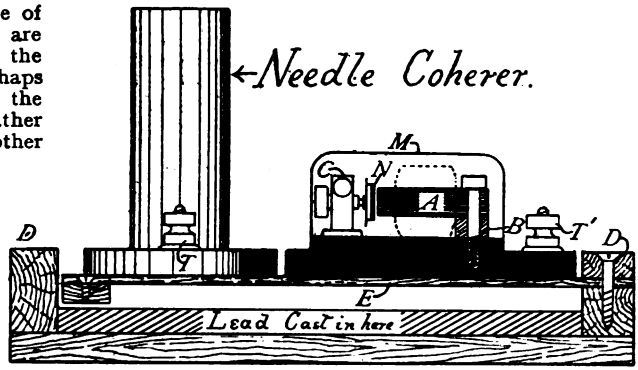
Fig. 2.—Section of Coherer.

forms first, which will give excellent results with very little trouble.

The first of these consists of a piece of very thin aluminium resting on three needle points, two of these points being connected to one terminal, and the third to the other terminal.

Figs. 1 and 2 show this coherer, which should be enclosed in a tube case containing a little fused chloride of calcium to prevent the moisture in the air corroding the aluminium or the needle points. Several aluminium discs of different gauges should be tried, as no definite thickness can be stated,

Fig. 3.



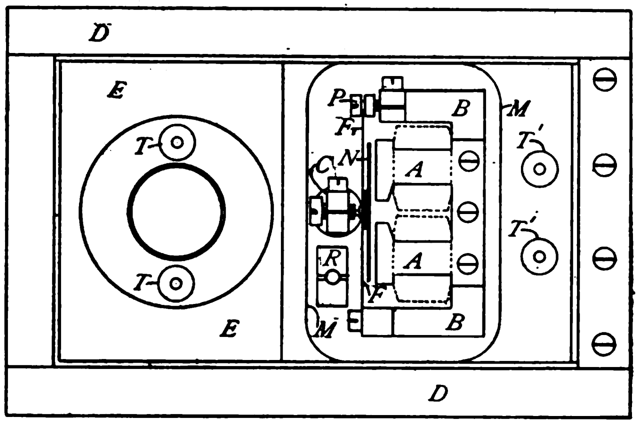


Fig. 4.

thicker discs giving better results with some coherers and thinner discs with others. About 36 gauge generally works well when used with No. 8 needles.

The construction calls for no special comment beyond the fact that the needles are connected to the terminals by thin copper wire threaded through the eyes of the needles and soldered, after which they are pushed through fine holes in the base, from the underside, and fixed by filling in the recess in the base with wax and resin cement. The pin in the centre passes through a hole in the disc, thus preventing it slipping off the needle points. This coherer should be stood on a light wooden diaphragm (E) to which a small electric vibrometer is attached. This is illustrated in Figs. 3 and 4, and resembles a small electric bell with the hammer removed, with a very light armature, and provided with a resistance, across the break, wound on the non-inductive principle, *i.e.*, with the wire doubled together before being wound on the reel. This resistance should be about eight times that of the wire on the magnets, which

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themselves should be wound with about No. 30 wire. It is useful to provide a plug connection by which this resistance can be disconnected when this part of the instrument can be used to test the coherer, etc., the spark produced at the contact then being sufficient to cause the coherer to act at close quarters.

As a further precaution, it is desirable to cover this instrument with a metallic cover, M, an empty 2-oz. tin of Player's Navy Cut tobacco, serving excellently for the purpose, and looking quite neat if properly japanned.

In Figs. 3 and 4 the windings are indicated only with dotted lines. The laminated cores, A, should be wound with about No. 30 s.c.c. wire, during which process the stampings should be temporarily screwed to a small slip of brass, using the same holes, which will eventually be used for holding the core to the brass base B. Before starting to wind the wire on, the core should be thoroughly insulated with thin silk ribbon. The contact pillar, C, is fixed exactly opposite the centre of the magnets. The spring, F, is securely screwed at one end to the block B, and fitted into a slot formed in the head of the screw P, which is securely clamped in the other end of B. By adjusting the screw P, a very high speed of vibration can be secured.

N is the armature formed of a piece of soft iron and riveted to the spring F, in the centre only. The central part of N is left thicker, to prevent it from interfering with the movement of the spring. D is a wooden frame supporting the light wooden diaphragm E. This frame is closed at the bottom with a thin piece of wood and lead cast in, and securely fastened in order to absorb as much of the vibration as possible, and prevent its transmission to other pieces of apparatus resting on the same table.

For the same reason the whole apparatus should be rested on short lengths of rubber tube.

R is a block divided into two parts and fitted with a plug. C is connected directly to one half of R, and between the other part of R and B the non-inductive resistance, already mentioned, is fitted. This can be stowed away in a recess, not shown in the drawing, cut in the ebonite base of the vibrometer. The terminals T′ and T′ lead to a small dry cell to supply the power; T and T are the terminals of the needle coherer.

The special screws P and the stampings A can be obtained from Mr. J. A. Cole. I know that he has a large stock of these on hand.

This coherer is very suitable to use with a telephone receiver, and the combined noise caused by the sparks at the sending station with the interruption caused by the vibrometer is most distinctive. A powerful telephone should be used for this purpose, as it should not be necessary to hold this instrument to the ear, both hands being often wanted when receiving a message.

The Castelli Coherer.

This in its original form consisted of a globule of mercury resting between two pole-pieces of iron or carbon contained in a glass tube.

This containing tube should have an internal diameter of ¼ in., and should be provided with some means of adjusting the distance between the poles.

It has been found that one globule of mercury does not give sufficient resistance when no waves are acting, therefore it is usually made with two globules of mercury instead of one. It has also been found that alternating the pole-pieces between carbon and iron gives better results than with both poles of the same substance.

The globule of mercury should about two-thirds fill the tube, at any rate not more, less will do. The distance apart between the pole pieces is very important, and must be found by trial, and on this account I have been experimenting with a coherer, constructed as shown in Figs. 5, 6 and 7, and have succeeded in receiving through a telephone messages from a station twelve yards away, sent by the spark, due to the extra current caused at the break of an ordinary medical coil excited with one dry cell. The antennæ used

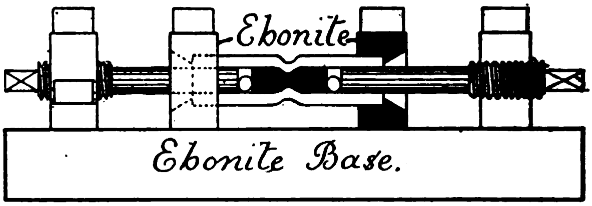

Fig. 5.

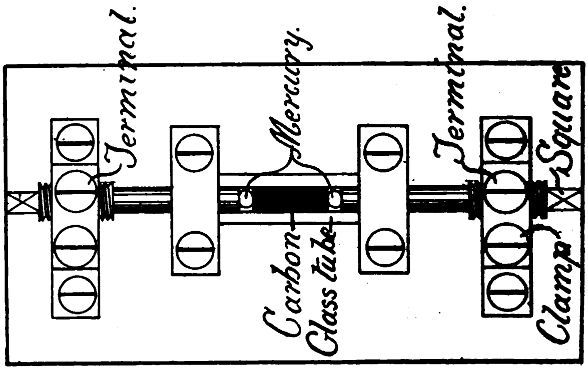

Fig. 6.

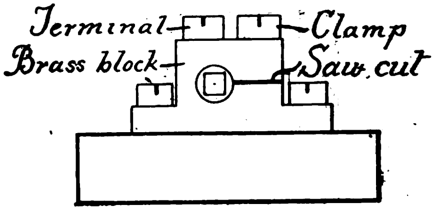

Fig. 7.

consisting of two brass rods, each 15 ins. long. One great advantage of this coherer is that it automatically de-coheres and no tapper is required, and it works with a telephone receiver perfectly.

The coherer consists of a piece of glass tube 1 in. long by ¼ in. bore. In the centre of this a piece of fine grade carbon such as is used for microphone transmitters is fixed by the glass being compressed into a pair of notches filed in the carbon whilst hot.

This glass tube is held between the ebonite clips fixed to an ebonite base, which also carries

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two split brass blocks, through which two iron plugs are screwed in such a manner that the plain ends enter the tube and the distance between them and the carbon can be adjusted by turning the screw plugs by means of a clock key fitted to the squares provided at the ends of the screw plugs.

The mercury used should be absolutely pure, and further, should be passed through a double thickness of chamois leather folded in such a manner that it forms a sort of bag. Into this the mercury is poured, after which the mercury is forced through the leather by screwing it up, much as a washer-woman does when wringing out clothes. Avoid wearing rings whilst doing this!

Any amalgam, oxide and most other impurities in the mercury will remain in the leather. This modified form of Castelli coherer is adjusted by first screwing up one of the iron pole-pieces till the mercury is thoroughly in contact with the pole-pieces. The other iron pole-piece is then adjusted till messages are received well, and the position of the screw is accurately noted (a small micrometer head might be fitted to each screw for this purpose). This pole is now screwed up and the second globule adjusted, when the screw which has already been adjusted should be turned back to its original position.

In this manner each globule can be adjusted in turn. Care must be taken that the screws are not screwed up so much that any mercury is forced past the pole-pieces, between them and the tube.

Note.—Since writing the above I have found considerable difficulty in accurately centreing the iron pole-pieces in the glass tube. Hence I have modified the coherer by attaching the blocks to light phosphor-bronze springs, which allow the pole-pieces to adjust themselves to the required position and prevent the glass tube from breaking. A photograph will be given with the next instalment of these notes.

(*To be continued.*)

Models of Old London.

WE have recently had the pleasure of inspecting a model of Old London Bridge, as it appeared about 400 years ago. The model has just been built to ¼-in. scale, by Mr. John B. Thorp, architect, of 98, Grays Inn Road, London, W.C. It is one of a series which is to be exhibited at the Franco-British Exhibition next year, and will represent some of the principal buildings of Mediæval London, including Old St. Paul's, Bridewell Palace, with entrance to the Fleet river, Cheapside, Parliament House, Westminster Hall, etc. The model of Old London Bridge, which is now completed, is most interesting, as it shows the bridge, which was one of the wonders of the world, in all its magnificence.

These models should prove most valuable on account of their educational and instructive nature. They are built of wood and other lasting material, as it is intended to exhibit them, not only in London, but in various parts of the United Kingdom, on the Continent, in the Colonies, and the United States.

The colouring and general finish give a very realistic effect, and we congratulate Mr. Thorp upon the excellence of his work. A visit was recently made by Lord Rosebery, who expressed his approval of the work, as also many of the Fellows of the Society of Antiquaries and several members of the City Corporation.

A Design for a Small Model Undertype Engine.

By H. Greenly.

(*Concluded from page 274.*)

No. X.—Lamp, Tanks, and Pump.

ALTHOUGH this article is, officially, the conclusion of the series on the construction of the small model undertype engine, a further suggestion will be made at some later date on the subject of installing the plant in a suitable model engine-house. At present we will consider the making of the water-tank and pump proposed

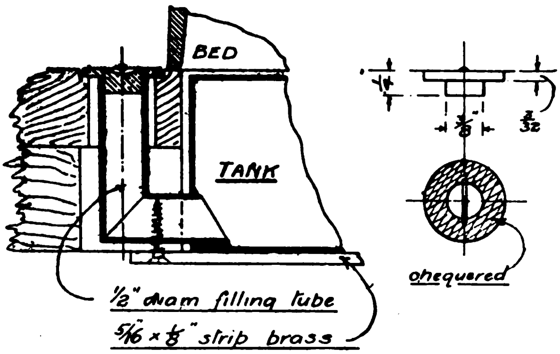

Fig. 57.—Filling Tube and Stopper for Water-tank. (*Half full size.*)

for the model. Before going into details, however, it may be mentioned that two boards are used for the base of the model. In the first outline drawing (see Fig. 1, page 349 of the issue of April 11th last) the upper one was arranged to represent a masonry plinth, the board underneath being extended to any desired distance in either direction. If, however, it be thought that this raises the engine

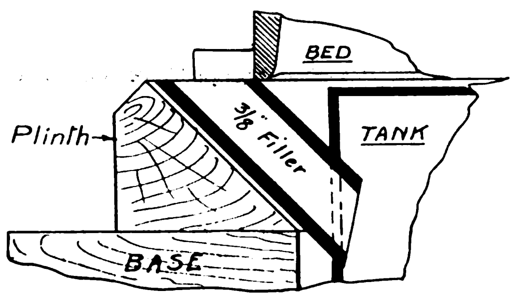

Fig. 58.—Alternative Design for Filler, where Plinth Board is used. (*Half full size.*)

too high off the "ground," then a single base-board of any required over-all dimensions may be employed, this being screwed down on the top of another plank, or, better still, on to a jointed frame, the space below being utilised to hold the water tank and pump, as indicated in the general arrange-

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ment drawing. Of course, a deeper and longer belt race will have to be made in the baseboard, but where the whole is forming a floor in a proper engine-room, this will not matter in the least. If the engine is simply mounted on a baseboard, and the idea of the proposed engine-room, with three walls, water-tower, engine-room, coal bunker (which may hold the spirit), engine-room clock, dynamo, and switchboard is vetoed, then the small plinth board, and the sub-baseboard, consisting of a panelled frame, may be adopted with advantage. In any case, however—subject to a better or side of the tray can be strengthened at the pump corner by allowing an ample amount of lap on the back end of the closed water-tank.

The water-tank should have a small vent pipe, as shown, and this should be arranged to clear any webs or other projections on the under side of the bed. Then comes the question of a filler. One idea—which is more particularly applicable where the plinth is not used—is shown in Fig. 57, and where it is, the simpler device placed at the front end just under the cylinders (shown in Fig. 58) may be used. The filler in Fig. 57 is made

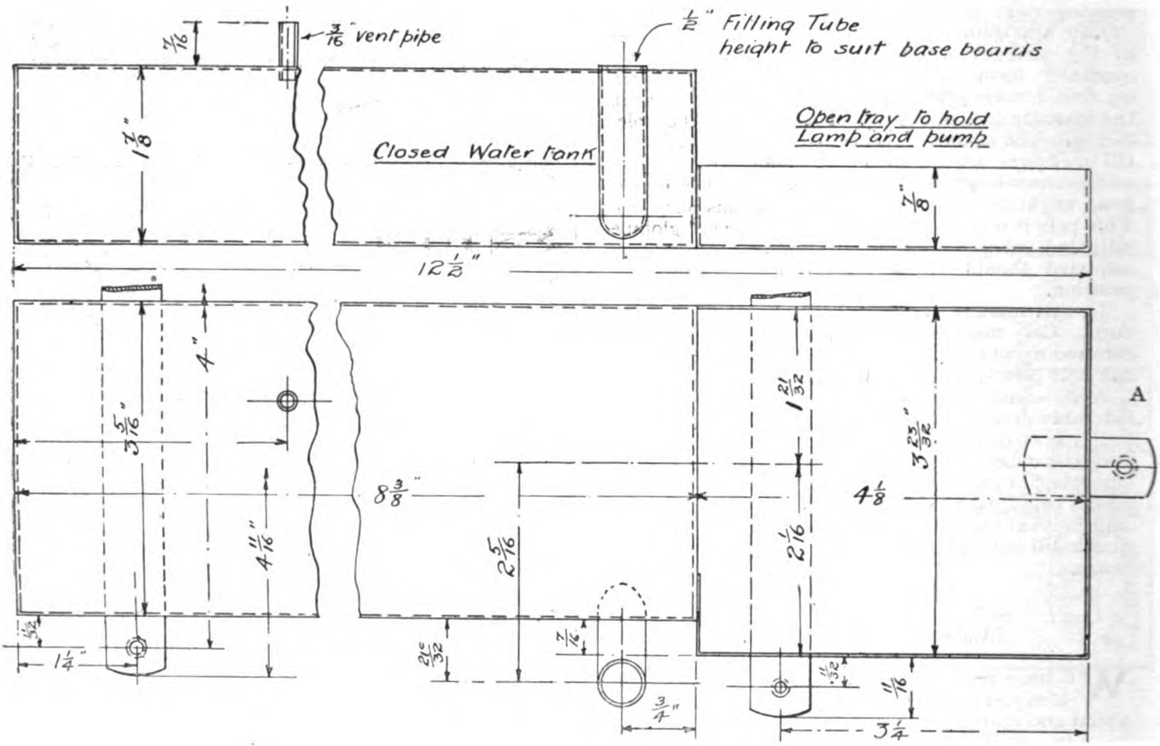

FIG. 56.—FEED-WATER TANK AND LAMP TRAY FOR SMALL MODEL UNDERTYPE ENGINE. (*Half full size.*)

scheme—the spirit supply will be right away from the model and the water-tank placed under the bed, as shown in the original drawing.

The feed-tanks are shown to a scale of half full size, and comprise a closed water-container and open tray in which the pump and wick-holders of the lamp are placed. This tray is designed to catch the drippings from both, and may have a small overflow pipe (say, 1/8 in. diameter) arranged in any convenient corner of it and led away to any convenient receptacle. The work to this is purely a tinman's job, and the writer has to confess no great knowledge of the art of the snips and shears. Hot-plates with square edges, sharp, straight flanges, and a hot soldering-iron will, however, result in a clean job if the plates are carefully marked out. The tray, it will be noticed, is wider than the tank, to allow for the pump and the vertical member from a piece of 1/2-in. tube, the elbow-joint, if possible, being silver-soldered. This tube is splayed off at the end of the horizontal member, so that a more firm joint is obtained with the tank. The orifice at the top should be filed off to the proper level, according to the exact thickness of the wooden base, and a stopper fitted to it, as indicated. This stopper is intended to represent a flush grid in the floor, and may be made by turning a flanged cap in the lathe with a sinking in the centre. The cap is shown chequered, and has a piece of wire soldered across the sinking to form a hand-hold. The chequering can be done in one or two ways, and the writer thinks might, in any case, be done before the sinking is turned in the top face. The diagonal lines may be hand-engraved, cut by using the lathe as a planer, or by squeezing the disc of brass out of which the cap or grid will

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be formed against a coarse file in the vice. The latter procedure will not give diagonal lines, but will be found to produce a very pleasing result.

In addition to the vent pipe, some means of holding the tanks to the baseboard must be provided. The drawings show a piece of strip brass soldered on to the under side of the tank and tray, the ends of which project on either side and form lugs through which screws may be driven up into the baseboard. Should there be any tendency for the thrust of the pump to lift the open tray, a small lug, as at A, Fig. 56, may be added at the back.

(*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 Meetings.—Wednesday, November 13th: Annual General Meeting, at the Cripplegate Institute, at 7 p.m. In view of the specially important matters to be discussed, it is hoped every member of the Society will be present at this meeting. Friday, November 29th: Ordinary monthly meeting, at the Cripplegate Institute, at 7 o'clock. Lecture by Mr. L. M. G. Ferriera, "Further Wrinkles in Model Making."—Herbert G. Riddle, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

Provincial Societies.

Tyneside.—The members of this Society are requested to note that the next meeting will be held at the workshop—2, Princess Street—on Saturday, November 2nd. As this is the Annual Meeting for receiving treasurer's report and the election of officers, a full attendance is desirable. Attention is also called to the purchase of a planer for the use of members, which will be ready for use on that day. Prospective members will be welcomed, and any particulars can be had from the Hon. Secretary, Thos. Boyd, 128, Dilston Road, Newcastle-on-Tyne.

Dukinfield, Cheshire.—Model engineers and others who are interested in the formation of a Society in this district are asked to communicate with—Mr. Walter Chadderton, 121, Hope Street, Dukinfield, Cheshire.

The Junior Institution of Engineers.

The Annual General Meeting of this Institution was held at the Westminster Palace Hotel on Friday, October 18th. Mr. Lewis H. Rugg, Assoc.M.Inst.C.E., the retiring chairman, presided at the commencement, and was succeeded by Mr. Frank R. Durham, Assoc.M.Inst.C.E., elected at the meeting. The Council's annual report, which was presented, recorded a very satisfactory year of work. Eight meetings for the reading and discussion of papers had been held, and thirty-six visits had taken place, the average attendance at the former being 118, and at the latter 81. Reference was made to the successful summer visit to Glasgow and Edinburgh; to the Institution's monthly journal, the annual volume recently completed consisting of 616 pages; to the development of the library; and to the Institution's Benevolent Fund. It was stated that the membership was now 967, as compared with 908 a year ago, and the accounts indicated that the Institution was in a sound financial condition.

The Annual Meeting of the contributors to the Benevolent Fund then took place, after which a paper on "The Economic Design of Hollow Shafts" was read by Professor W. E. Lilly, D.Sc., of Dublin University, the Institution's Member of Council representing Ireland. It described a number of original experiments on secondary flexure carried out by the author at Trinity College. General considerations of the existing methods of the design of shafts were first dealt with, and the influence of secondary flexure on design was dwelt upon. The author then passed on to the experimental study of the various forms developed by such flexure; derived formulæ from theoretical considerations were given, and applied to particular cases; and reference was made to analogous cases of beams and columns. A discussion followed in which Messrs. H. P. Philpot, Edward Goffe, M. T. Ormsby, and W. H. Shephard took part, and a vote of thanks was accorded the author.

It was announced that M. Gustave Canet, of Paris, the newly elected president, would deliver his inaugural address on November 18th, taking for his subject—"The Latest Improvements in English and French Modern Artillery," and that the meeting for its delivery would be held at the Institution of Civil Engineers, Great George Street, Westminster, by kind permission of the Council.

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.*]

Re Small Dynamo.

The Universal Electric Supply Company, of 60, Brook Street, C.-on-M., have wrote us as follows with reference to our reply to Query No. 18,093, in September 19th issue:—

To the Editor of *The Model Engineer*.

"Gentlemen,—In your issue of September 19th, Queries and Replies (Reply No. 18,093), we notice a reply which concerns us. These 'Novelty' dynamos we will guarantee to do all we claim for them; in fact, we believe you have had one from us to test. Of course, it is a *special* 6-volt lamp we use; if this customer is using a 6-volt lamp that he may have purchased elsewhere, or even from us, without saying what it was wanted for, it is possible he may have a lamp requiring anything from ·5 to ·8 amp. Possibly, he has been trying the machine as a motor, clearly against the note in our list warning customers not to use it as a motor. We have sold (without exaggeration) thousands of these machines, and rarely have a complaint. We have also made this machine to run in conjunction with a small water-wheel, and it requires hardly any pressure to drive it; in fact, a man with strong lungs can blow it round and produce light.—Yours truly,

Universal Electric Supply Co."

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Queries and Replies.

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

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

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

[18,305] **Model Yacht Clubs.** H. A. L. (London, E.C.) writes: Being desirous of joining a model yacht sailing club, might I ask whether you can give me the names of some of the principal ones whose head-quarters are in London, with the names and addresses, in order that I may ascertain their rules and places of sailing.

The Highgate Model Yacht Club: Hon Sec., W. T. Vine, 15, South Hill Park Gardens, Hampstead, N.W. The Victoria Model Steamboat Club and the Alexandra Model Yacht Club, Bathing Lake, Victoria Park, E. The above are two well-known clubs in the London district, and we should be pleased to let you have other names and addresses whenever the respective Secretaries of other clubs will notify us of their existence.

[18,150] **Induction Coil Wiring.** A. M. (Deptford) writes: I have bought a medical coil, but it is out of order and not wired up right. I have enclosed sketch of same (not reproduced) hoping some reader will show me how to wire it up. I have wired it, but it gives full shock at once, and I want it to go gradual to full shock.

By inserting a small regulating resistance in the battery circuit supplying coil you can vary the strength of the shock. Read up recent back numbers of this Journal. Several replies have been given on this subject.

[18,151] **Miscellany.** W. D. G. (Heyside) writes: Will you please answer me the following questions. (1) Where is it possible to get a small railway door handle of the old pattern so that I can put it on a model railway? I want it to work same as the real thing. (2) Where is it possible to get a small dynamo to be slung under a model carriage so as to enable me to light the carriage up with electric light? I only want a small one as it is only for one carriage with one light: either 4 or 6-volt lamp. It is simply for experiment with the light. (3) To put three batteries in series will it give out the same power as putting the same in parallel? (4) In a model railway with points, crossings, etc., as per tram railway working with a brass trailer from a motor in carriage on the middle rail, how do you connect switch to it and also the batteries? The switch I have is like sketch (not reproduced). The wire is connected to four screws. What kind of a switch do you call this, and where do you connect the wires? Also what kind of batteries would you recommend as the best to use?

(1) Try Bassett-Lowke & Co., or Cotton & Johnson. (2) Thompson, of 28, Deptford Bridge, Greenwich, would supply you. (3) Putting cells in series increases the voltage only and not the current too; in parallel, increases the current output, but not the voltage. See some elementary book on Electricity and Magnetism, as that by S. P. Thompson, 4s. 9d. post free. (4) You should read the articles on a Model Electric Locomotive which began in the January issue 1905. The whole subject is fully explained therein. Your sketch (not reproduced) shows an ordinary regulating switch.

[18,166] **Mercury Vapour Lamp.** J. L. C. (Sutton Coldfield) writes: (1) I should feel much obliged if you could tell me what amounts of wire and gauges to use for a coil for sparking a 20 h.-p. engine? I can use a 4-volt accumulator—rate of discharge 2–4 amps.—or two 4-volt accumulators in series if necessary, same current. (2) What voltage is necessary to work an 8-in. bore mercury vapour lamp? Is a larger voltage necessary for starting it?

(1) We recommend you to make a coil which will give a ½-in. spark. Particulars for wire, condenser, and proportions are given in our handbook No. 11. (2) Probably about 100 volts. No, to start the lamp it must be tilted so that the mercury trickles from one pole to the other and thus makes a circuit through which the currents can flow. At that instant the lamp must be tilted in the opposite direction to cause the mercury to flow away from one pole and strike an arc. The arc follows the retreating mercury and gives off light.

[18,162] **Small Lighting Plant.** J. W. (Bridgnorth) writes: (1) I would be glad of your advice on the following matter. My gas engine belt has got a little greasy and is liable to slip. What is the best thing to do with it? (2) My dynamo (Avery-Lahmeyer) has just been re-wound for 12 volts 10 amps. I cannot get it to give the amperes. I have it coupled up to three 50 amp.-hour accumulators and it only gives about 4 amps. (it was originally wound for 40 volts 6 amps.). I can get it to give 12 volts at dynamo terminals when coupled up to accumulators, but no matter how I adjust brushes, it won't give above about 4 amps., and the amperemeter index hand jumps about from 1 to 8 and then steadies on 4 for a second, and then jumps about again from 2 to 8. I have tried it at various revolutions and the quicker it goes the less amperes register. When it goes slower (that is its proper speed, 1,200) it seems to register on amperemeter more definite, viz., does not jump about so much, but still jumps. Mr. Avery says it will easily give its proper output when coupled up to accumulators. The accumulators are good (E.P.S. Co.) and in perfect condition. I have tried it coupled to two accumulators and it gives more amperes, but still the meter hand jumps about a lot. I also tried it with four accumulators and it hardly registers any amperes. I tried another amperemeter and they both work exactly the same.

(1) Melt some resin in an iron ladle or old spoon and pour it upon the belt pulley side whilst it is running. This is only a temporary remedy. (2) The cause of fluctuations of current may be due to slip of driving belt or to the fact that engine may be working considerably under full load. In the latter case, the speed gradually falls and with it the current until the engine fires its charge, then the speed runs up until the load is overpowered, then engine ceases to fire for a few strokes and speed falls again. The remedy for this is to connect some lamps or a resistance to the dynamo until the engine is fully loaded, or so much so that it fires regularly and maintains a steady speed. The flow of current through the accumulators is determined by the resistance which they offer to the dynamo voltage. If you do not obtain sufficient flow you must increase dynamo voltage by raising its speed. Another cause may be bad contact of brushes with the commutator.

[18,316] **Converting Small Petrol Motor to Run on Gas.** R. B. S. (Cheltenham) writes: I am writing to ask you if you would be kind enough to answer the following questions. I have bought a 2–2½ petrol engine (Iris) for a motor bike. Would you tell me if I could run this engine off gas to work a few models? Would you tell me the simplest way and the cheapest way to convert it? Would you kindly say which ignition ought to be used—ignition tube or sparking plug, and how I can make the air valves to give a proper mixture? I should be very much obliged if you would explain it as full as possible. Could I get as much power by gas as by petrol, and which would be the cheapest to make it up to—petrol or gas?

As far as we can say from your letter you only need to disconnect the petrol supply and put your gas pipe on in place. A gas-bag should be used, as explained in our handbook—"Gas and Oil Engines," by Runciman, 7d. post free. A suitable gas-cock should be fitted on the gas supply, and possibly an auxiliary gas valve will be needed, working on the suction principle. Either a properly dimensioned sketch of your motor, or a personal inspection is necessary before a detailed reply can be given. We advise you to read the above-mentioned handbook and also the articles on the "M.E." Gas Engine, which appeared in Vol. XIV of this journal. Use spark ignition preferably. Rather more power can be had from petrol. The price of gas in your district determines the relative cost of running.

[18,310] **Lalande Cells and Cells for Lighting Small Lamps.** E. R. (London) writes: (1) I have a set of four Edison Lalande batteries. What am I to charge them with and what quantities? They hold 3 quarts of water each. Also cost to charge, if possible. (2) Will you kindly describe the best battery for cheap home construction for lighting two or three 6-volt lamps about 15 minutes a day to need practically no attention? (3) I have parts of a small Don motor with tripolar armature, 1½ ins. diameter by ⅞ in. long, magnet core ⅞ in. diameter and 1¼ ins. long, outside diameter of bobbin about 1¼ ins. barely, 1-32nd in. air-gap. Will you kindly tell me if it is possible to make this into a dynamo to charge a 4-volt pocket accumulator? 6 volts by ½ amp. would do. What gauge wire to use? Of course, shunt wound.

(1) The electrolyte is a solution of caustic soda, and the depolariser a plate of copper oxide. Zinc is the other element. (2) Large Leclanché cells with circular zinc plates instead of rods. Also see that the lamps are good ones and take very little current. (3) This is hardly suitable for charging purposes, as it would give very little current. We advise at least a 10-watt machine as per "Small Dynamos and Motors," Fig. 8.

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[18,063] **Engine and Boiler Proportions.** J. B. G. (Bath) writes: I have partly finished castings of a slide-valve engine (2-in. bore, 3-in. stroke)—(1) What horse-power will it give? (2) What thickness crankshaft should be used, as bearings will only take about ½ in. when bored out? Will ½ in. be thick enough? (3) I want a flash boiler for above engine. Could you give me a design, or tell me where I could get description and measurements of one? It must be fairly simple, as it is my first attempt at boiler making.

(1) At 50 lbs. pressure and 500 r.p.m., the engine should develop ¾ i.h.-p., or about ½ b.h.-p. (2) We should have advised a ⅝-in. shaft, but a ½-in. diameter shaft would do all right. If you use one only ½ in. diameter, reduce the pressure and the speed. (3) See issues of March 23rd and 30th, 1905. If you have had no experience with boilers, do not attempt a flash boiler and expect success at the outset.

[18,057] **Switchboard Wiring for Charging, Etc.** A. B. C. D. (Bray) writes: With reference to my letter of the 15th instant *re* electric lighting, I would be greatly obliged if you would kindly say if the enclosed rough diagram shows correct wiring of a switchboard to do the following:—(*a*) Charge battery alone; (*b*) charge battery *and* discharge lamps simultaneously; (*c*) work lamps direct from dynamo, battery being cut out; (*d*) work lamps direct from battery, dynamo being cut out. I would also be very grateful if you would kindly show me how to connect voltmeter to give the following readings, viz.: (1) Dynamo voltage before closing main switch and auto cut-out. (2) Voltage of battery to be charged. (3) Number of volts between lamp terminals. (The voltmeter has an internal switch.) I presume a three-way switch should be used for this.

The connections are correct. When the dynamo is charging the cells and lighting lamps at the same time, the charge ammeter will indicate the sum of the lighting and charging currents. It must, therefore, be calibrated to read sufficiently high to accommodate this flow. Connections for voltmeter are marked dotted upon your sketch. Make two sets of plug blocks in brass, one for each terminal of the voltmeter, and a pair of taper brass plugs with insulated handle. With plugs in D D voltmeter is connected to dynamo, in L L to lamps, in B B to battery. Blocks L L and B B are really the same, and either L or B would serve, but it may be convenient to make three distinct blocks as shown for clearness of indication. Make blocks as shown and use a moderate taper.

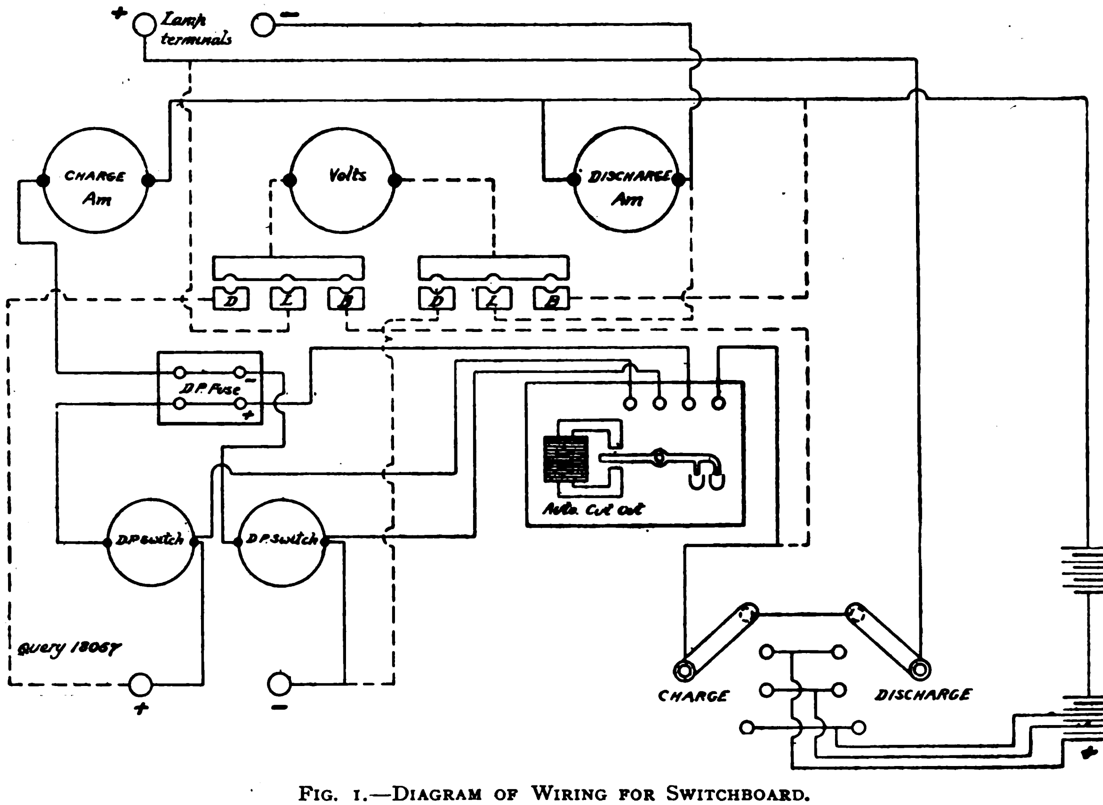

Fig. 1.—Diagram of Wiring for Switchboard.

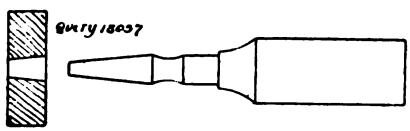

Fig. 2.—Connecting Plug.

[18,218] **Transmission of Power by Compressed Air.** J. I. L. (Pembrokeshire) writes: I would be very thankful if you would kindly answer me this Query. Supposing an engine (2 h.-p.) was working a 2 h.-p. compressed air machine, compressing air into a certain tank. Would an air-compressed engine develop 2 h.-p. from that tank afterwards? If not, how much less?

In reply to your query—No; there will be losses in the transmission and conversion. Everything will depend upon the respective efficiencies of the compressor and the air engine, and we cannot make any definite statements on the subject of the amount of loss in both machines without full particulars of their construction. If the engine does not expand the air properly, there will be a large loss. The heat loss, without some form of re-heater, will be considerable.

[18,170] **Model L. & N.W.R. Three-cylinder Compound; Wheel Patterns.** J. N. (Kirby) writes: (1) As I am desirous of making an ½-in. scale model of the L. & N.W.R.'s eight-wheeled three-cylinder compound, "Greater Britain," and require a side elevation of engine showing shapes and sizes of main frames, boiler, firebox, smokebox, chimney, dome, safety valves, cab, splashers, etc., could you give me an outline of the front view of the engine? What size cylinders would be most suitable for a model of this size? Would you recommend them to be made compound? (2) Would you be kind enough to give me a few hints on making patterns for castings for such parts as locomotive wheels, locomotive boiler tubeplates, and endplates? Has any article on the subject ever appeared in the pages of The Model Engineer?

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(1) We still have a few drawings of this engine among our plates, and they will be sent on receipt of 6d. in stamps. There are so many articles on the subject of "Model Locomotive" construction in our back issues that it is difficult for us to pick on any one number. We can recommend you "The Model Locomotive: Its Design and Construction," by Greenly, price 6s. net, 6s. 5d. post free, if you are not already in possession of a copy. (2) The cylinders should be 7-16ths in. by 1 or ¾ in. by 1 in. Make the model a simple engine, using the outside cylinders only. (3) Make wooden patterns for the wheels, one for the carrying wheels and one for the driving wheels. Make the latter without the crank-pin boss or balance-weights. Obtain brass castings, and clean up for the iron castings. Use two brass castings for the driving wheels, one with crank-pin boss and one without. The wooden patterns should have about 5-16ths in. per foot allowed for the two shrinkages. You may make other patterns in metal or wood, according to circumstances. We cannot advise you, because we do not know what type you are intending to adopt.

[18,141] **Small Permanent Magnet Dynamo.** G. F. (Southampton) writes: I am sending sketches (not reproduced) of a small dynamo, the field-magnets consisting of three permanent magnets, which I am building. I should be very much obliged if you could answer me the following questions. (1) Please tell me what size armature (in diameter), and whether Siemens H or cogged drum is suitable? (2) Could armature tunnel be made in one piece (as indicated by dotted lines)? (3) What gauge wire is armature wound with, and about how much? (4) What output will this machine give, and how many 4-volt lamps will it light?

(1) Use a drum armature, 1¼ ins. diameter, and wound with No. 24 S.W.G. wire. Get on as much as you can. (2) No, armature tunnel (*i.e.*, field-magnet pole-pieces) must be separated by an air-gap, otherwise machine would never work. (3) We advise you to read "Small Dynamos and Motors," 7d. post free. Also some elementary book on Electricity and Magnetism. (4) The output is an uncertain matter as it depends on the strength of the field-magnets, of which we know nothing.

[18,228] **Small Telephone Construction.** V. E. V. (Sheffield) writes: (1) What is a suitable size of horseshoe magnet, size of pole-pieces for fitting bobbins on, diaphragm (carbon or ferrotype), and the total quantity and gauge of wire for the horse-shoe form of receiver, in place of the watch receiver described on page 33 of "Telephones and Microphones"? Would the magnet lose its magnetism if a hole were drilled and tapped in each pole and the pole-piece screwed in, as it appears to me that if these pieces were firmly attached in this manner the contact would be better than by using a bracket? (2) Not being in possession of a lathe, could an ordinary bell push (hollowed out a little more) be used for the case of the Hunnings type of transmitter? (3) What amount of wire should be used for the induction coil?

(1) We advise you to use the form of receiver shown on either pages 24 and 25 or page 57 of handbook. There is no need to put in pole-pieces to the magnet tips as you suggest. (2) The bell push case could be adopted for use as a transmitter, but care must be taken to get the ferrotype plate to bear evenly all round the edge. (3) For the induction coil, wind on as much as space will allow.

[17,954] **Locomotive Boiler.** N. B. R. (Crewe) writes: (1) Will you kindly inform me the maximum working pressure for my 1½-in. locomotive boiler, made of copper, by Goodhand? Barrel diameter, 6 ins.; solid drawn tube; all plates 3-32nds in.; rivets, 3-16ths in., ⅝-in. pitch; rivets for front tube plate (brass casting), ⅛ in. and ⅜-in. pitch. (2) Does a copper boiler deteriorate in any way, as I always keep boiler half full of water? (3) Should it be washed out at all with acid or any other substance, or is there no necessity? I always use rain water.

(1) The riveting is all right, except perhaps that the rivets for the front end plate might have been made 5-32nds in. or 3-16ths in. diameter instead of ⅛ in. for 90 lbs. pressure. The boiler barrel alone is quite safe up to 100 lbs. pressure (factor of safety, about 5). The stays should be 5-16ths in. diameter (fine thread)—that is, if six are used. Press the boiler to 80 to 85 lbs. per sq. in. (2) Practically no corrosion will take place, except in the presence of acid. (3) Do not employ any chemical for cleaning out except under special circumstances. Using rain water in which the dirt has been allowed to settle, you should not require to clean the boiler out very often if you blow off any sediment from time to time.

[18,193] **Induction Coils.** J. B. (Manchester) writes: Being a regular reader of your valuable paper, I take the liberty of asking your aid in the following. I have made a medical coil, 8 ins. long between the bobbin cheeks. It has a core ⅜ in. diameter, tube regulator, and a tube made of two thicknesses of brown paper for the body of bobbin. On this I have wound four layers of No. 24 D.S.C.C. wire for primary, and eight layers of No. 36 S.S.C.C. wire for secondary. It has a separate contact-breaker made from two bell bobbins and a clapper. The wire is very neatly wound and well insulated with thin waxed foreign note-paper. When coupled up to a freshly charged Bunsen cell the strongest shock one can get, viz., combined primary and secondary with regulator right out, is only a fairly mild sensation, and the addition of a second cell does not make it in any way unbearable to only one person; while there does not seem much variation between primary, secondary, and primary-secondary currents. On testing the core, made of 22 gauge soft iron wire, I find there is little magnetism. Can you please explain the above? Could you kindly give me the proportions, etc., of a coil, 8 ins. long between the bobbin cheeks, which when connected with only one Bunsen cell will give at the third strength a little more current than six people can stand. I want a good all-round medical coil to work well with one cell, so that I shall not have too much weight to carry.

Your primary winding is of too small a gauge. Try re-winding it with about 12 ozs. No. 19 gauge D.C.C. copper wire, and for the secondary use your present No. 36 gauge. If the secondary shock is still insufficient, wind on some more layers until you do obtain sufficient strength of shock. Your contact-breaker coils should not be in series with the primary winding. A separate break should be on its own battery circuit so that it did not interfere with the action of the current in the primary winding. It can be worked off the battery which is supplying current to the coil or from a separate one.

Further Replies from Readers.

[17,942] **Mercury Break for Coil.** As a supplementary reply to "A. M. (Plumstead)," your correspondent should first get an old bell magnet, armature, and contact, and the rest is fairly easy. In the break figured, the bobbins are about 1½ ins. in length and wound with No. 28 S.S.C. wire. The bell armature is about ⅛ in. thick, 1½ ins. long, and ½ in. wide; length of armature spring, 5 ins. If too long, you get too much dip and the spring is too loose and springy. Three inches is rather too wide; 2½ ins. is enough, and a piece of clock spring is as good as anything, though other material can be used—*e.g.*, a piece of broken hacksaw of suitable length, tightly clamped down, is first-rate; you want great tension at this part. "A M." would find the "Motor" mercury break much easier to make, and for several reasons this is to be preferred.—J. PIKE.

Notices.

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

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Contents.

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

PAGE.

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THE

Model Engineer

And Electrician.

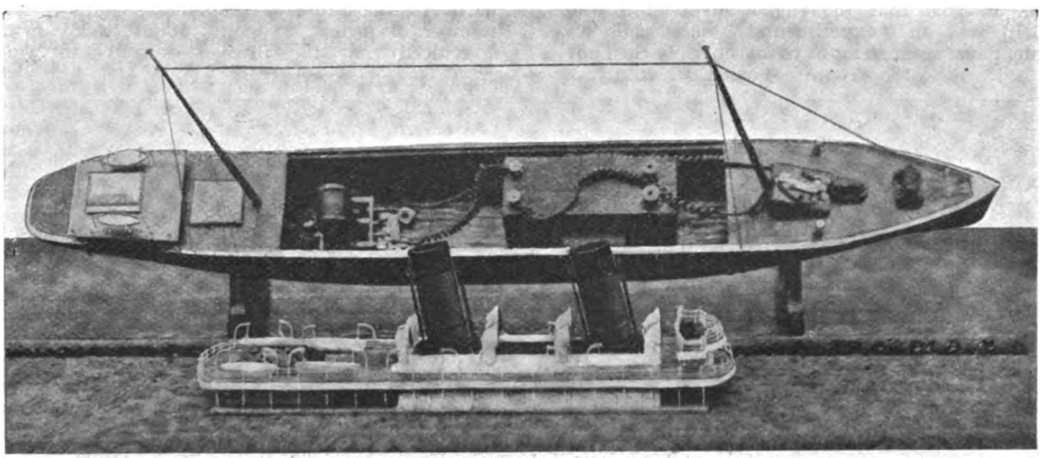
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 342. NOVEMBER 14, 1907. PUBLISHED WEEKLY.

An Electrically Driven Model Liner.

By J. ATHLONE.



VIEW OF MODEL LINER, WITH DECK REMOVED.

THE photographs herewith show my model electrically driven liner, which I have made in my spare time from particulars in THE MODEL ENGINEER Handbook, No. 12. I first procured a block of white pine 32 ins. long, 4 ins. wide, and 3 ins. deep, planed well, and then marked off, using cardboard templates to ensure equal proportions, finishing one side first, using wood chisel, broken glass, and finishing the boat to shape with glass-paper. The most tedious work was the hollowing out to the desired thickness. Using four pieces of wood screwed to bench to hold boat firm, I then with auger and bit drilled holes, after using gouge to shape out the inside of hull, which, when finished, was exceedingly light ($\frac{3}{8}$ in.). I bought a small boiler and engine; but, finding I could not get sufficient power, I did away with them and adapted electricity, which has proved very successful. I obtained a small "Pet" motor and 4-volt accumulator, which drives the boat at a good speed. I gave the inside a good priming with white lead. After fixing the motor, etc., I proceeded with the decks and fittings, building up accordingly to get free access to working parts (watertight compartments fore and aft); then fitted decks in with white lead and small pins. The midship section can be lifted off without interfering with any working parts. The railings are small dolls' pins with copper wire wound around, then painted. The funnels are made of tin (Williams' shaving soap tins). The boats are all cut out of wood, and davits are large pins bent and hammered flat at the heads to fasten the wire to. Ventilators are of wood and enamelled. Deck-houses can be removed to grease the mainshaft bearings, which are chiefly gun-metal. The stern tube is made of brass, being much larger than the shaft, which has about $\frac{1}{8}$ in. to spare all round, except at each end,

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where a gun-metal bush is used, the space between being filled with tallow to make a sound watertight bearing.

The building part finished and the boat in good working order, I next gave the hull several coats of paint, sandpapering the lumps out. I enamelled the boat black at top sides and peacock pink on bottom, the boat having a very fine appearance.

Locomotive Notes.

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

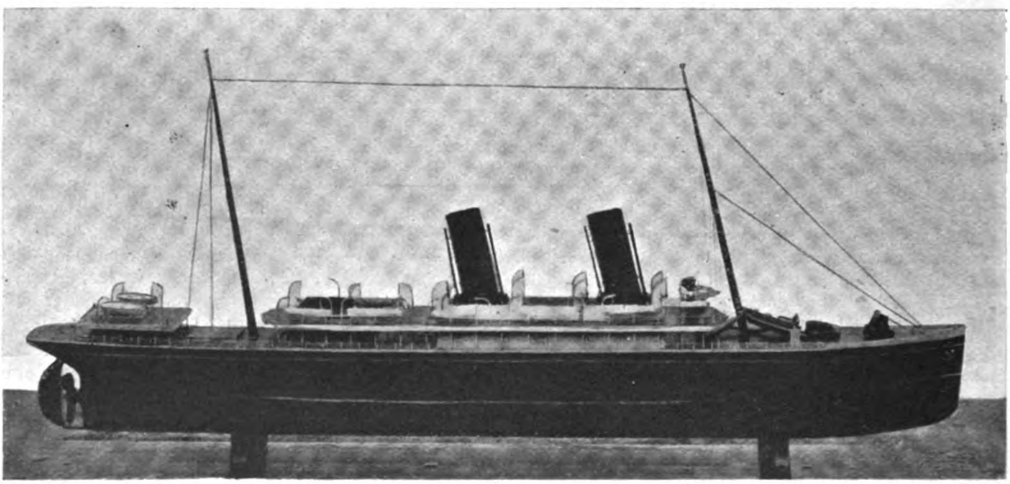
The Shrewsbury Accident and the Non-Technical Press.

The terrible accident which befell the 1.20 a.m. up London and North-Western express from Crewe to Bristol on the night of Monday, October 14th, when approaching Shrewsbury Station, gave the non-technical Press one more opportunity of publishing a good deal of arrant nonsense on the subject of locomotives and railway rolling-stock in general, and the L. & N.W.R. locomotives in particular. To begin with, many of the daily papers asserted that the engine involved in the accident was an "experimental" one, while an evening paper went so far as to say not only this, but and further, that the application of the name to the first of the series had no real meaning in the general acceptation of the term. Many of these "20" class L. & N.W.R. locomotives bear the names of cities served by the railway, and had it so happened that the prototype of the series had borne such a name, then we should never have heard anything about No. 2,052 being "experimental."

As to the 4—6—0 type being "unsafe" for express work, any driver will tell you that they rank among the easiest riding of all engines when running at high speed, and the writer can testify to this fact also after a not inconsiderable experience on the footplates of such engines. The probability is that were the person who wrote about the type being unsafe asked to define what constitutes the 4—6—0 engine, he would be totally unable to do so.

The statement about the engine being an unlucky one, and having, some years before, fallen over a bridge, is, of course, condemned at once when it is remembered that the first engine of the class only made its appearance about two years before the accident, and, in all probability, No. 2,052 had not seen more than from a year to eighteen months' service at the time of the disastrous occurrence.

Ridiculous as these effusions are to all who know the facts, they nevertheless do a great amount of harm to the railway companies. Quite a large number of people are going about to-day firmly convinced that the three statements to which



Mr. J. Athlone's Electrically propelled Model Liner.

(*See front page.*)

also condemned the 4—6—0 type of locomotive as unsafe for express work. Yet another evening journal, retailed at ½d., proclaimed that the engine, No. 2,052, "Stephenson," was an unlucky one, inasmuch as, "some years before," it had fallen over a bridge at Nuneaton, when "both driver and fireman were killed."

The absurdity of these statements is at once apparent when it is recognised that, beyond the fact of its belonging to a class of locomotives known on the L. & N.W.R., as the "Experiment" class, there was nothing whatever to connect the ill-fated engine with the word in any shape or form; attention has been called have their foundation in fact; indeed, it is hard to convince many that they are not only wide of the mark, but totally and stupidly inaccurate.

A Fine Run on the L. & N.W.R.

Apropos of locomotive work on the L. & N.W.R., the writer recently enjoyed being present when a very fine run was made by one of the "Precursor" class engines, viz., "Celtic," which was attached to the up two-hour non-stop express leaving Birmingham (New Street) at 5 p.m.

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The train did not leave Birmingham until 5.8 p.m., and thus only had 112 minutes in hand in which to cover the 113 miles to Euston if punctuality were to be observed. A high rate of speed was quickly reached after starting, and, through Coventry station, the running was very fine. After clearing Rugby the driver had exactly 80 minutes in hand and 82¾ miles to go, a task which might readily be accepted as impossible in view of the character of the road to be covered and the approach to the terminus at the finish. Excellent progress was made as far as Bletchley, which station was passed through at very high speed at 6.17 p.m., which left 43 minutes for 46¾ miles. Unfortunately a slackening of speed occurred at Stoke-Hammond, about mid-way between Bletchley and Leighton, so that on passing the latter station only 35 minutes were available in which to cover 41¼ miles. This distance, as results showed, was actually run off in 40 minutes, the train arriving at Euston 5 minutes late, after having been as much as 10 minutes behind at some points in the journey. The load consisted of five eight-wheeled vestibuled coaches and an eight-wheeled parcels van, this being reckoned as equal to nine vehicles.

A VULCAN FOUNDRY PUBLICATION.

The writer has received from the Vulcan Foundry Company, Ltd., of Newton-le-Willows, Lancs., a copy of a very handsomely prepared publication illustrating the leading types of locomotives built recently at their works. Below each illustration is given a full list of dimensions and other particulars, the whole forming a very useful and desirable addition to one's stock of locomotive literature. The engines illustrated include a heavy "Consolidation" type goods locomotive for the Bengal-Nagpur Railway, India; a crane locomotive for the Oudh and Rohilkund Railway; a 4—6—0 type express engine for the Bombay Baroda and Central India Railway; a modified "Fairlie" type engine for the metre gauge Burma railways, and a four-cylinder compound express locomotive of the 4—6—0 type for the Buenos Ayres Great Southern Railway. The whole of the engines have been illustrated and described in THE MODEL ENGINEER during the past few months. The blocks are of large size, and excellently reproduced. The type is clear, and the general style and appearance of the book leave nothing to be desired.

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.]*

GUIDE TO THE ENGINEERING PROFESSION. By W. Galloway Duncan. Price 3s., postage 3d. Dundee: James P. Mathew & Co.

This is a book of short chapters, each giving some particulars of the work and training required by the civil engineer, mechanical engineer, electrical engineer, and mining engineer, with further information upon the subject of technical education for engineering students. Chapter VI is entitled "The Science of the Engineering Workshop," and in a general way indicates the application of scientific methods and reasoning to workshop processes. Chapter VII gives particulars of the North-East Coast Institution of Engineers and Shipbuilders' recommended regulations for apprentices. Other chapters relate to the instruction available at the Municipal School of Technology, Manchester, the Glasgow and West of Scotland Technical College, University of St. Andrews, Dundee, and Messrs. Yarrow & Co.'s regulations for the admission of apprentices to their works. This book is of the kind likely to be of service to masters of elementary schools, parents, and others knowing nothing of the world of engineering, but requiring some information to assist them in advising a lad in the choice of a career. An excellent feature is the number of photographic illustrations of the engineering workshops and structures, though the picture of the Forth Bridge scarcely does justice to that magnificent work. Some typographical errors occur on pages 39, 44, and 98. We also doubt the statement on page 93 that a soft steel lap is used for diamonds. As far as we are aware practical polishers use cast-iron laps, though soft steel has been tried. The book can be recommended as a prize to present to mechanically inclined lads near the age of leaving school.

Design for a Handy Lathe.

By W. MUNCASTER.

(Concluded from page 352.)

A FACEPLATE.

A LATHE could hardly be considered complete without a faceplate. This useful auxiliary is shown in Fig. 1. It is tapped ⅞ in. Whitworth, and screws on to the lathe spindle. The face is trued up when in place, so that the surface is absolutely flat and normal to the centre of the lathe spindle. A few circles are generally marked on the face with a sharp-pointed tool to assist in centreing work when being fixed to the face. The slots and holes shown will generally be found sufficient to enable any work to be held. If not, an occasional hole may be drilled where required without injury to the faceplate.

Fig. 2 shows a catchplate fitted with a ⅜-in. pin, which engages the dog and pushes round the work in the lathe. There are several forms, but this is quite the best, as the disc affords some protection against fouling the end of the dog or carrier.

Fig. 3 gives details of a rest suitable for turning wood, ivory, etc. The stem of the T is turned to ⅝ in. diameter to fit the socket, Fig. 4. The upper edge of the T must be carefully filed or ground to a smooth surface. The underside of the socket will require facing to lie on the surface of the lathe bed.

Fig. 5 shows a socket fitted to the saddle to carry a stop, gauge, or support for the work (see Fig. 6).

In addition to the self-centreing chuck already illustrated there is a hollow chuck shown in Fig. 7. This is a cylinder with eight screws, in two sets of four, arranged zig-zag. The chuck is screwed to the lathe spindle, and is turned truly cylindrical, both outside and inside. There are two sets of screws—one set 1 in. long under the head, the other set 1½ ins. long—all with hardened points.

An extremely handy chuck for small drills, etc.,

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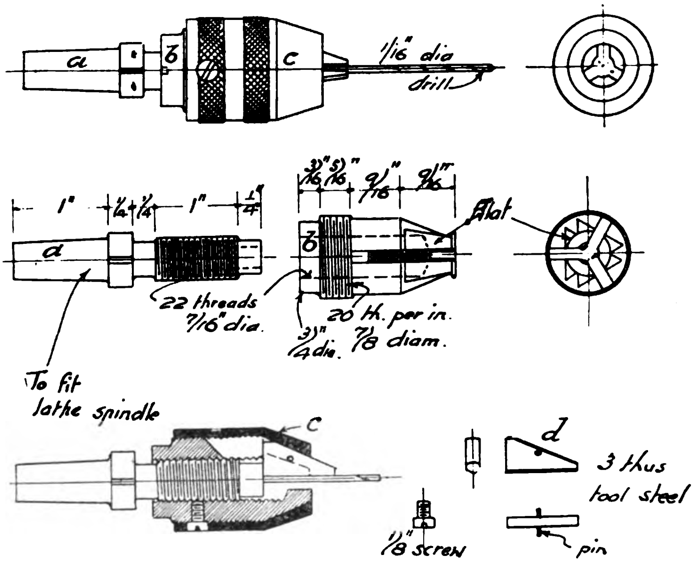
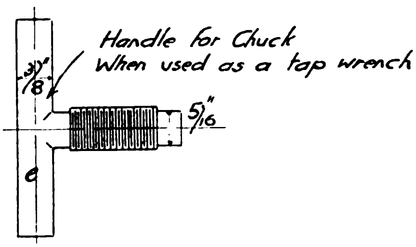


FIG. 8.



is shown in Fig. 8. This will fit either lathe centre, so that the work to be drilled may either be held against the back centre, and the drill chucked to the lathe spindle, or the work may be revolved in the lathe and the drill chucked in the tailstock. Any size drill can be held, from 3-16ths in. diameter down to 1-32nd in. or less.

The action of the chuck will be understood by referring to the drawing. The stem *a* presses the claws *d* against the internal conical surface of the shell *c*, forcing them on to the object which is required to be held. The use of the part *b* is chiefly to keep the three claws in their proper relative positions.

A useful appliance is shown in Fig. 9. This is intended to be slipped over the end of the spindle of the tailstock, and takes the place of the table in a drilling machine.

If it be required to hold a drill against the back centre, as, for instance, when holing a piece revolving in the lathe, the female cone shown in Fig. 10 is used. This is necessary where (as is often the case) a drill has no centre pop at the end of the stem.

Fig. 11 is a chuck for use in turning wood. Several sizes of centre are made to suit the one socket, which is screwed on the lathe spindle.

For steadying long pieces of work of small diameter some form of steady rest is required. Fig. 12 shows such a rest to be bolted to the saddle when in use, so as to be close to the cutting tool, which it is generally made to follow. The work is steadied by the three steel pieces, *a*, *b*, *b*, which are fixed to a cast-iron standard *c*, and are made adjustable to suit the diameter of the work, the piece *a* being opposite the tool and preventing the work from springing away from the tool.

We have briefly described a lathe that has been very useful and, when properly handled, given satisfaction. There are some points that may be modified to advantage, although very often any alteration to gain some benefit in one direction is made at a sacrifice of efficiency in some other direction. We have been content to set it forth as it is, and maintain that, whatever fault it may have, it certainly has proved itself a "handy lathe."

WE are asked to state that MR. CHAS. H. UNCLES, of "Pomona," Audley Road, Hendon, Middlesex, will be glad to meet any reader living in that district who is interested in the construction of model railways.

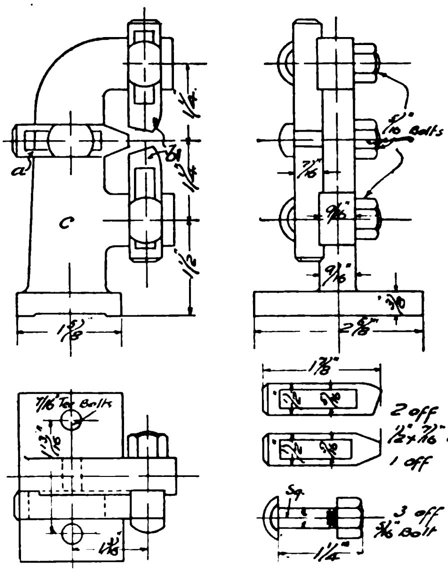


FIG. 12.

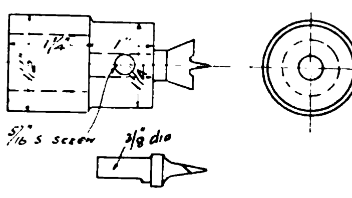


FIG. 11.

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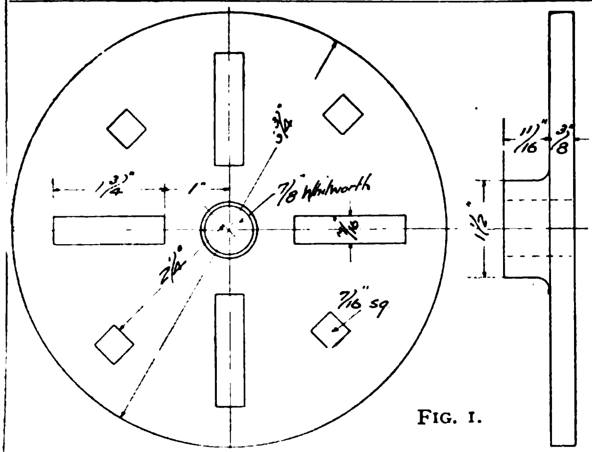

FIG. 1.

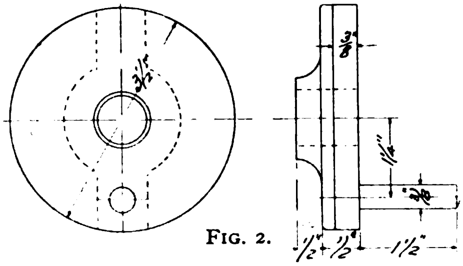

FIG. 2.

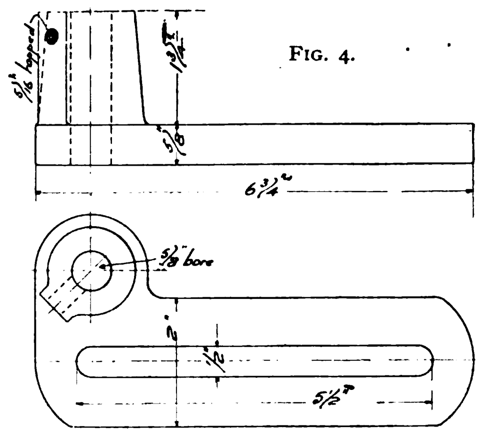

FIG. 4.

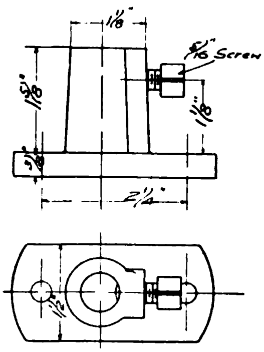

FIG. 5.

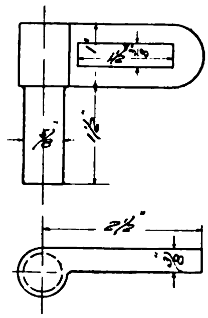

FIG. 6.

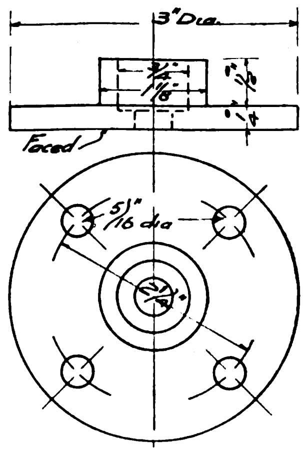

FIG. 9.

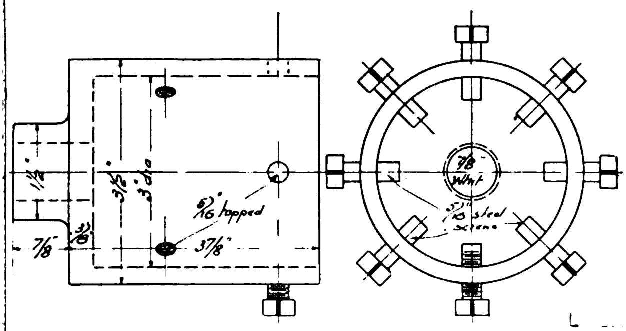

FIG. 7.

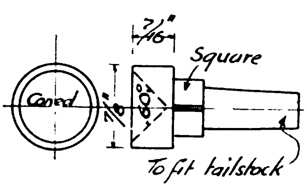

FIG. 10.

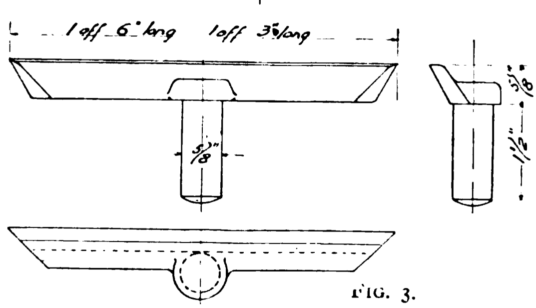

FIG. 3.

ACCESSORIES FOR A HANDY LATHE.

For description] By W. MUNCASTER. [*see page* 467

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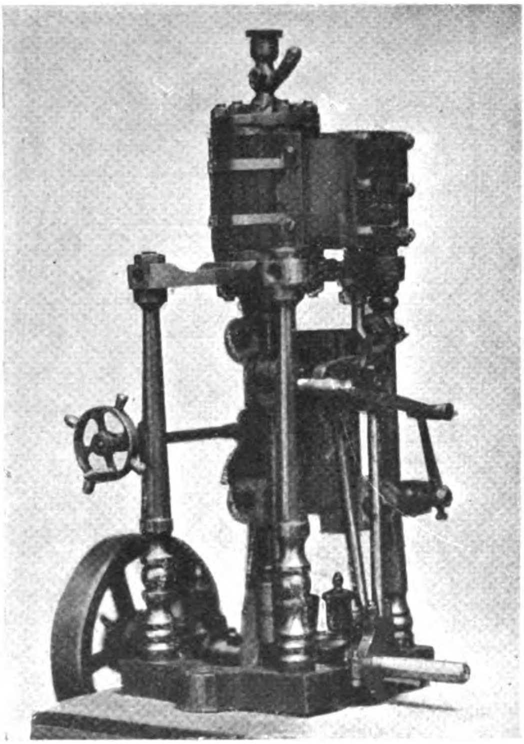
A Model Torpedo-boat Engine.

By W. Wright.

THE accompanying photograph shows a model of a single high-speed torpedo-boat engine, and following are some of the dimensions: The cylinder, which is a built-up one, was made out of a piece of 1 5-16ths-in. hard brass—¾-in. bore, 1 9-16ths in. long; the stroke is 1 7-16ths in. The covers are let in the cylinders 1-32nd in., which leaves same amount for clearance. The ports in the cylinder were cut in by a milling cutter revolving in a chuck, the cylinder being pushed on a mandrel tightly for half its length



Mr. W. Wright's Model Torpedo-boat Engine.

and then clamped in the tool-rest parallel with the lathe bed, and brought up to the cutter, the ports being cut right through from the inside, no drilling or chipping being required. A flat was filed on the cylinder between the flanges about ⅜ in. wide.

The next job was the steam block on the part that fits the cylinder. Two passages were cut—one from either end (1-16th in. deep and ⅜ in. wide), leaving about ⅜ in. not cut. The ports on the other side were ⅜ in. long and 1-16th in. wide; exhaust, ⅜ in. by ⅛ in.; travel of valve, ⅛ in.

The cylinder is lagged with mahogany. The mahogany I bored and turned in the lathe, and polished, and the divisions were scribed on before parting off. I then split it up into four parts, and fastened on with brass bands. The bottom cover of cylinder is let into the baseplate or platform, allowing the gland to project through, also the studs of the cylinder (which can be seen in the photograph).

The four columns supporting the cylinder are of brass, and screwed 3-16ths in. at each end, securing both the bed and the upper plate. The two back columns have each two balls turned on them and a ⅛-in. hole drilled through them, and faced up on either side, so as to have a true face to bolt to the crosshead, guide or backboard. The backboard is made out of 3-16ths-in. sheet brass, and a 3-32nds-in. by ⅝-in. groove is milled along it for the crosshead slipper to work in. The piston and crosshead are both in one, and it is kept in position by two brass strips bolted on the backboard (which can be seen in the photograph).

On the two left-hand columns—where the small hand-wheel is—two brackets are dovetailed to carry the reversing gear. On the other end of the shaft—opposite the hand-wheel—is a worm which gears into a quadrant, which is keyed on the weigh-shaft. The bearings for the weigh-shaft are made to act as nuts as well, for securing the backboard. You can see their shape by looking at the photograph.

The drag links were made out of ⅜-in. mild steel—1-16th-in. hole drilled at each end, then turned down in the middle and filed flat; then the bosses turned up to the same size as the pin-head.

The eccentric-rods were made out of ⅜-in. mild round steel, one end being thrown out of centre, so as to get the fork end out of it. The eccentrics are made in one, and are of gun-metal. Making these was the worst job of all—marking the mandrel off for the throw, which is only 1-16th in., and being so close to the proper centre; the division groove between the two sheaths was also a rather ticklish job, it being only 1-32nd in. wide. The radius in the link or quadrant was done in the lathe, the proper radius being scribed on, two holes drilled, fastened on the faceplate of lathe the proper distance from centre, and the remaining portion tooled out by pulling the faceplate backwards and forwards. The slide-valve rod is strengthened by having a double-necked gland (as shown in the photograph), which keeps the motions nice and rigid when working. The bearings are of gun-metal, and are fitted into journals previously milled out in the bedplate.

The wheel is 3 ins. diameter, the whole engine being strongly built. It will stand a bit of rough usage, having been dropped on the floor a time or two, only damaging one of the drain cocks, which I removed before taking it to the photographer.

Unfortunately, the boiler I have is rather small, and I have not been able to test the capabilities of the engine. The first time I tried it, it went off at a terrific speed, and soon used up all the steam. So I am making another boiler to work it. I have already made the pump, from particulars in the 6d. "Model Boiler Making" book, which I have obtained.

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The Latest in Engineering.

Santos Dumont's Hydroplane.—We reproduce herewith some interesting photographs of the new hydroplane with which Santos Dumont hopes to obtain a speed of at least 60 miles per hour. The apparatus is composed of three cigar-shaped chambers of aluminium and wood framing, covered with silk, and inflated with gas. The tubes are held together by means of a light framework, as shown in the illustrations. An Antoinette motor of 120 h.-p. is to be placed upon a platform above the central tube, and is coupled to a three-bladed aerial propeller, as shown in the view Fig. 3. When in the water the craft lies submerged to about the centre of the tubes, but in motion it rises on to the blades and glides over the surface of the water. Some idea of the size of the hydroplane may be gathered by the length of the centre tube, which is about 33 ft. The total weight of the machine is about 440 lbs.

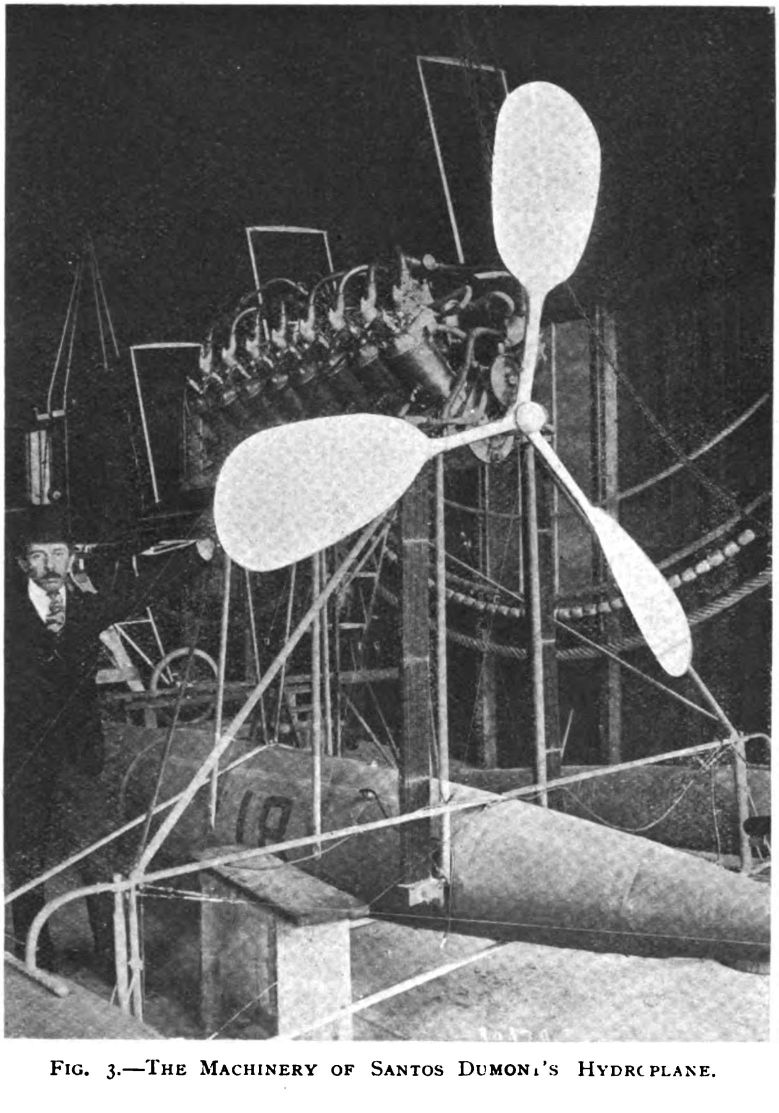

Fig. 3.—The Machinery of Santos Dumont's Hydroplane.

A Train-Ferry Steamer, the *Lucia Carbo*, has been built and engined by A. & J. Inglis, of Glasgow, for the Entre Rios Railway, of the Argentine Republic. It will have a run of about fifty miles on the River Plate to connect this road with lines running to the port of Buenos Ayres. It is of steel construction, 278 ft. long, 56 ft. beam, and 18 ft. 10 ins. deep. At the middle are steel columns supporting an upper deck with superstructures for pilot house, quarters, and cabins. There are three tracks, one in the centre and the others curving along the sides of the deck. The twin-screws are driven by triple-expansion engines, steam being supplied by four single-ended Scotch boilers carrying 175 lbs. pressure. On the trial trip it made 14½ knots with the engines running at 150 r.p.m., and developing 2,250 h.-p. The ship went out from England under its own steam, carrying sufficient coal for the entire voyage, which was made in about four weeks.

A Revolution in Rowing.—A new rowing-boat has been invented in Hamburg, consisting of two single boats, which are flat on the inside and connected by cross-carriers. The middle space contains the rowing parts, and the oars, which work like levers, are connected with the blades by means of discs and chains, which work on a gear. The so constructed boat has no rudder, and can be manipulated in all directions — forward, backward, also sideways—which is quite uncommon with the ordinary rowing-boats, and can be turned round very easily. The first boat after this principle is built to carry eight, and travels about 9½ miles an hour. Capsizing is impossible, and a child can manage it. The invention is protected by patent in all countries.

The "Max" Motor Cycle.—This machine is the invention of Mr. Claude Johnson, and is intended

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to serve the purpose of a safe and comfortable "run-about" motor cycle. Such a machine could be very serviceable to enable anyone to get quickly about the yard of a large works, for inspecting purposes, by engineers-in-charge of pipe lines, gas and water mains, electric cables, etc., or for any purpose where many short distances have to be travelled quickly and without fatigue. The principal feature is the standing position of the rider, whose feet rest upon the boot-plates shown at either side of the rear wheel. These are hinged, and when folded, so that they are vertical, form supports which keep the machine upright. The handles rotate, and by means of "Bowden" transmission control the engine, the movement being effected without the rider having to place his hands

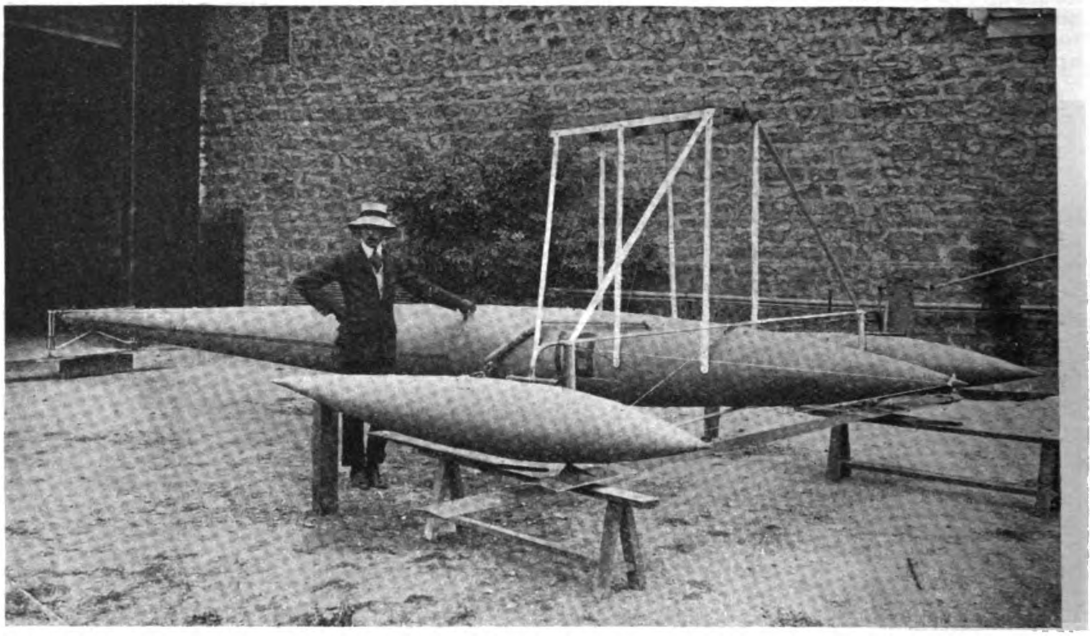

Fig. 1.—Santos Dumont's Hydroplane, ready for the Motor.

Fig. 2.—The Hydroplane in Tow, without the Motor.

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to another position on the steering-bar. That at the right hand lifts the exhaust valve of the engine and regulates the spark advance, that at the left controls the throttle valve. One brake is fitted, and acts upon the rim of the front wheel, being moved by a lever at the left hand; the act of moving the brake lever interrupts the flow of current from the battery, and thus stops the ignition spark. As made at present, the machine is fitted with a 2½ h.-p. Triumph engine, geared to the driving wheel by V-belt. There is no clutch to the engine and no free-wheel. By unscrewing four bolts the

THE "MAX" MOTOR CYCLE.

engine can be removed entirely from the frame. Wheels are 18 ins. diameter; tyres, 2-in. Palmer cord; wheelbase, 34 ins.; length over all, 53 ins.; footplates are 4 ins. above the ground. Ignition is by trembler coil. The frame is made of extra strength. Thorough trials have been made at Messrs. Johnston & Phillips' Works, Charlton, Kent, and in the neighbourhood by Mr. Louis Burn, chief of the experimental department (under whose direction the design has been developed), and various employees. It is very easy to handle; has been run about the works yard, and up Shooters Hill—gradient at one place 1 in 12—in about 42 seconds. The original machine has been in use for over a year by the inventor and his assistants. It is stated to be very comfortable and safe at any speed from 2 to 15 miles per hour, and to climb a hill of 1 in 6 grade at 10 miles per hour. Mr. Burn finds that, owing to the low gear—3¾ to 1—a dangerously high speed cannot be attained, about 18 miles per hour being the limit. A machine is being exhibited at the Stanley Show, and manufacturers of motor cycles wishing to obtain a license to manufacture are invited to apply to the Inventor at 6, Pall Mall Place, London, S.W.

A Design for a Small Model Undertype Engine.

By H. GREENLY.

No. X.—LAMPS, TANKS, AND PUMP.

(Concluded from page 461.)

HAVING settled the tanks, we now come to one of the most important features in the model, viz., the force-pump. As the margin of power is small, the writer decided that a hand-pump would give the greatest satisfaction, the water capacity of a water-tube boiler being greater than that of an ordinary loco-type multitubular boiler of the same size. This being so, a large pump is fitted, theoretically, half a minute's pumping being sufficient to enable the engine to run 5 or 6 minutes under heavy load. Ordinarily, the engine should run continuously for 25 minutes without water; therefore, with occasional pumping, it should be a simple matter to get a non-stop run of one hour's duration out of the engine.

The pump has a 5-16ths-in. plunger and ½-in. to ⅝-in. stroke. The valves are all get-at-able, and are designed on the lines advocated by Mr. Ferriera. The diameter of the valves is 3-16ths in; therefore, holes of this diameter may be drilled in the valve chamber castings first. Then a pin drill may be made to bore the valve chambers out to a diameter of ¾ in., and at the same time to form the knife-edge seating. All other passages may be drilled in the manner indicated on the drawing. As the pump plunger works in a blind hole, and the bottom may not be exactly correct diameter, the end of the plunger may be turned slightly taper, so that there will be no tendency to bind when pushed right home, as holes which are not drilled right through are generally a little smaller at the bottom than at the top. Should, however, any considerable error be detected in the internal diameter of the barrel, a rimer may be used to ensure greater accuracy. The stuffing-box shown on the drawing is of the usual pattern, with a studded gland. Although this type of gland is easier to make, as it requires only plain turning and boring —and when once fitted up and packed should require attention only at lengthy intervals—it may be deemed rather awkward to get at. Therefore, a screw gland, with tommy holes in the flange, may be substituted, where the cutting of the internal screw is not deemed troublesome. The pump, it will be seen, is screwed down to the bottom of the open tray by three screws, and to provide for a certain amount of flexibility between the pump

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and the tank the connection of the suction valve box to the water-tank is made by a piece of 3-16ths-in. pipe, which should be as long as possible and soldered into the back end of the tank on the right-hand side (near the bottom) of the open tray. The covers of the valve boxes are square, and may be secured by four 3-32nds-in. brass screws. The drag links should also be made of brass, the pivot screws in the plunger being sufficiently long to lock on themselves. The hand-lever may be made out of 3-32nds in. by ⅜-in. steel, which should be painted below the level of the bedplate. The length and shape may be as shown in the general arrangement drawing, viz., 5⅛ ins. from the centre of the drag links to the top of the handle; or, the lever may be arranged to reach only just above the level

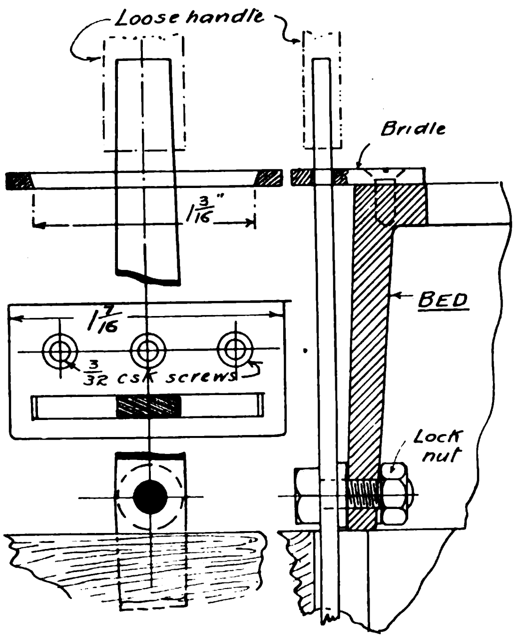

Fig. 64.—Upper Part of Lever for Hand Pump, showing Bridle fixed to Bedplate. (*Full size.*)

of the top of the bedplate (at firebox), a loose handle (as shown in Fig. 65) being made to fit over the lever to lengthen it sufficiently to make it convenient to work and to provide ample leverage over the pump. To limit the movement, a bridle or quadrant should be fitted to the bedplate, as shown in Fig. 64.

The delivery pipe should have an elbow or a short bend made in it by either of the methods already described in this Journal. Silver-solder, however, is imperative for this joint, and before it is made the tube should be screwed for the cover. The joint, with the latter, only requires soft solder. Where a standard no-cock check valve is used, it will be as well either to provide one on the delivery pipe (below floor level); or, better still, to alter the valve to the same type as that used for the suction and delivery of the pump.

The general arrangement drawing showing an air-inlet at the back under the bedplate, a piece of chequer-plate (as shown in Fig. 66) should be employed to cover the hole when the engine is not in use. This may be made out of 1-16th-in. brass, and should be painted or chemically blacked.

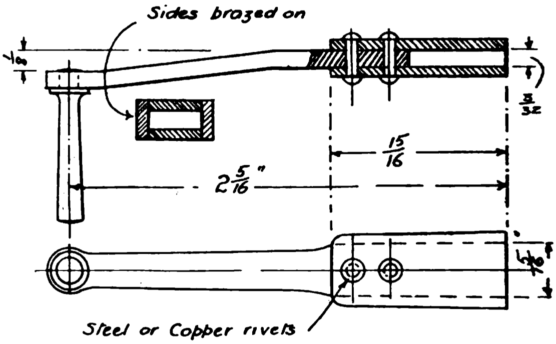

Fig. 65.—Removable Handle for Lever of Pump. (*Full size.*)

The spirit lamp is of the ordinary type, six 9-16ths-in. wick tubes being used. These are intended to be fed by three tubes, and if any regulation over the fire is thought desirable, a cock, with two female ends and a loose handle, may be placed on each of the three feed-pipes, as indicated on the general arrangement drawing. These cocks

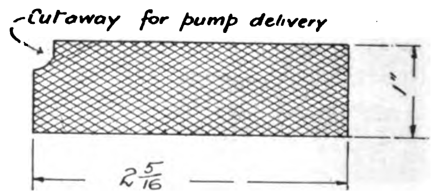

Fig. 66.—Chequer-Plate for Fireman's Footplate. (*Half size.*)

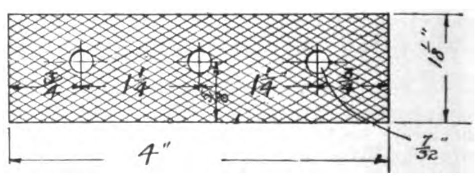

Fig. 67.—Chequer-Plate over space occupied by Feed Regulators.

should have extended plugs, the handles being above the floor level. To cover the hole in the baseboard, the chequer-plate shown in Fig. 67 should be employed. And as the belt race of the flywheel may come in the way of the chequer-plate where the model is not raised up on a plinth, the pipes and cocks will have to be set back, so that the end of the 4-in. chequer-plate coincides with the back end of the iron bedplate of the engine.

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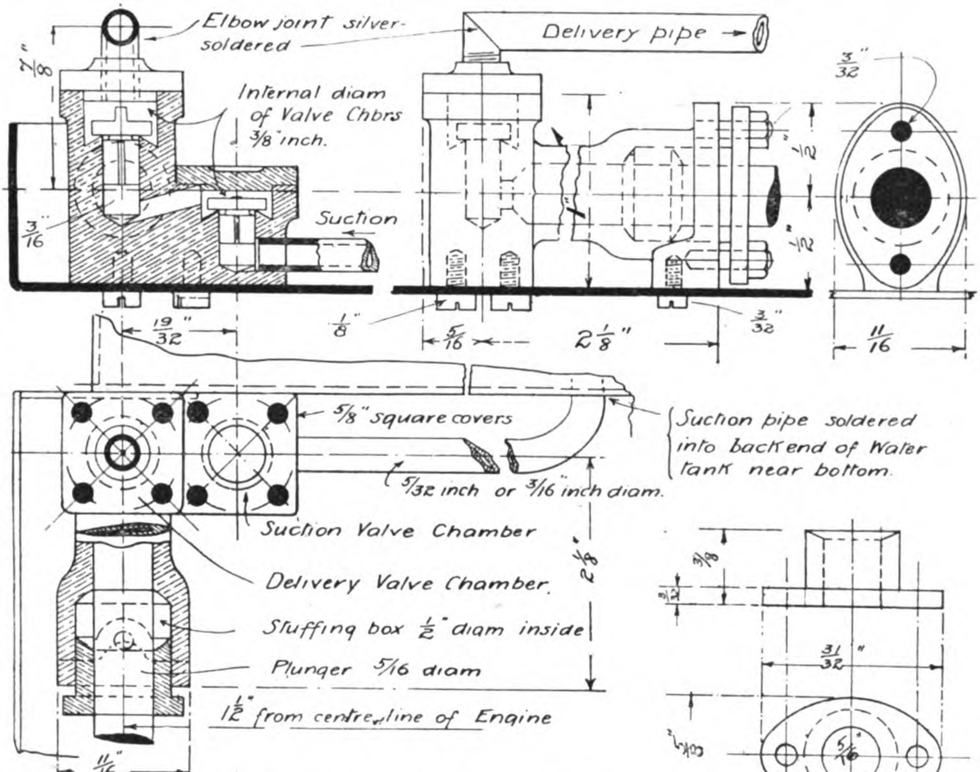
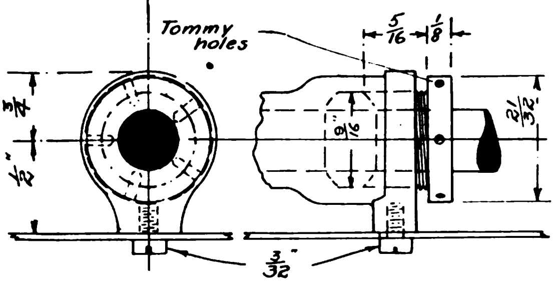


Fig 59.—Hand Pump for Small Model Undertype Engine. (*Scale: Full size.*)

Fig. 61.—Studded Gland for Pump. (*Scale: Full size.*)

Fig. 62.—Screwed Gland for Pump. (*Scale: Full size.*)



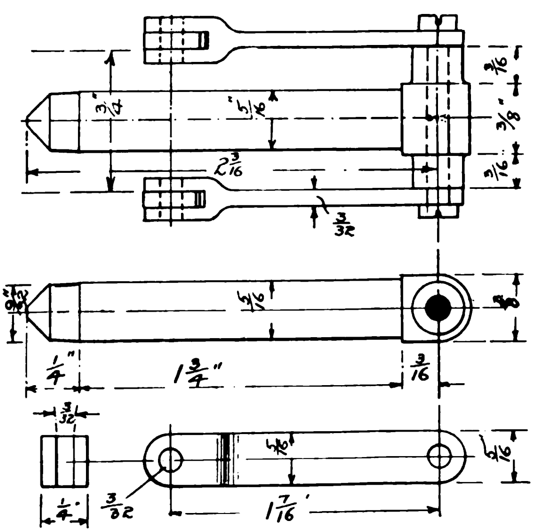


Fig. 60.—Plunger and Drag Links for Pump. (*Scale: Full size.*)

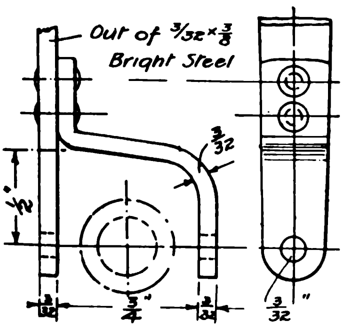


Fig. 63. Bottom End of Lever for Hand Pump. (*Full size.*)

Engineering Works and Accessories for Model Railways.

By E. W. Twining.

(*Continued from page* 392.)

IT will, no doubt, be noticed that if built to scale a model of any of these Great Western tunnels will seem unnecessarily large. This great size will not be without its advantages in cases of derailments in the tunnels; but, of course, if this is not thought to be worth considering, they can be reduced to a size just sufficient to enable the trains to pass through. There is no doubt the tunnels between London and Bristol *are* large. Of course, we all know that they were built to accommodate the broad gauge of 7 ft. between rails, with a much higher loading gauge than that adopted on the narrow or standard gauge, but even this does not account for the necessity of a height at the arch centre of 35 ft. Probably the great Brunel, when he engineered the line, thought he foresaw in

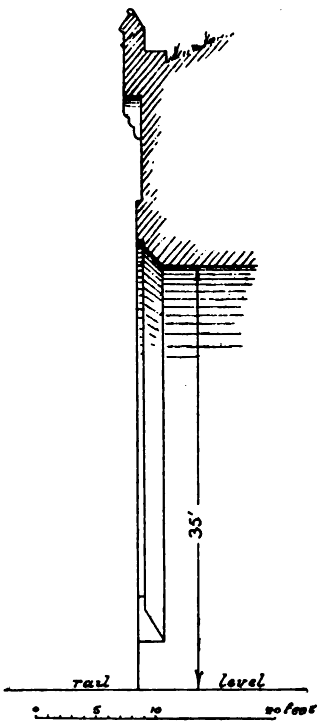


FIG. 2*a*.

the then distant future such great developments in railway traffic—which we have not reached, and which we are not now likely to—as would require for the broad gauge a loading gauge approximating to this great size. Be that as it may, the masonry which he designed is of massive and noble proportions, quite dwarfing in point of size most of those built for the standard gauge.

Fig. 2 is the western end of what was originally No. 2 tunnel, now No. 1, and Fig. 2A a vertical section of the same. I stated in THE MODEL ENGINEER of February 1st, 1906, that Brunel conceived the idea of giving the work the effect

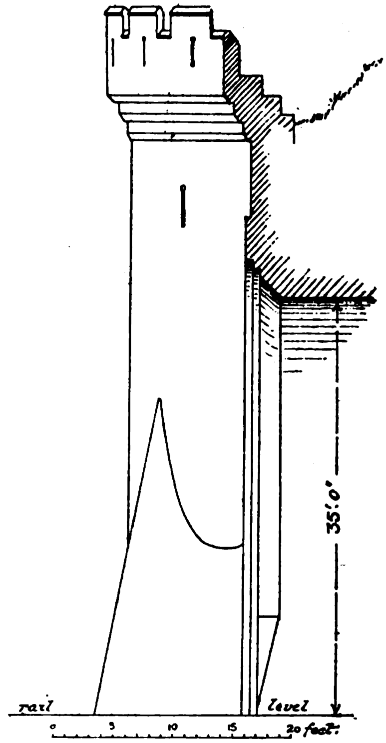


FIG. 3*a*.

of a ruin by leaving it in an unfinished state. I find that this is only a part statement of the case. The fact was, a complete retaining wall was intended to support a loose portion of the hill, but before the work was complete a landslip occurred, rendering the wall unnecessary; then, I suppose, followed the inspiration. The romantic effect was at one time more pronounced when the masonry was overgrown with ivy.

This tunnel has an opening of the same dimensions as the previous one, a length of 475 ft., and depth from rails to surface of 99½ ft. In plan it is slightly curved. The style is that employed in mediæval times in the construction of castles and similar fortresses. The eastern end is very similar, but without the castellated top to the wall.

In Fig. 3 is given the western end of the "Long Tunnel," near Brislington, No. 2 on the line. This also is of simple but massive Norman or Mediæval design. The towers here serve as enormous buttresses to take the thrust of the hillside. On the right-hand side there is a strong retaining wall with arched hollow panels, carrying a heavy mass of rock above. The opening is the same as

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Fig. 2.—Western Front of No. 2 (now No. 1) Tunnel near Bristol, G.W.R.

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before, except at the eastern end, where the rock is hewn out to a height of forty feet. This tunnel is not lined throughout, being cut entirely through coal measures, shale, and pennant sandstone. The natural rock forms the entrance at the eastern end, there being no masonry here whatever. The tunnel has a length of 3,148 ft., has four ventilating shafts 9 ft. in diameter, and a depth from surface to rail level of 116 feet. The depth of the mouldings and the distance the round tower projects from the face is indicated by the section, Fig. 3A.

FIG. 3.—WESTERN FRONT OF THE "LONG" TUNNEL, BRISLINGTON, G.W.R.

(To be continued.)

A WELL-EQUIPPED BARGE.—The capacity of the American Standard Oil Barge No. 94 is greater than most tank steamships engaged in the Transatlantic trade, being 2,704,000 gallons, and is 370 ft. long, 50 ft. beam, and 30 ft. moulded depth. Should the barge break adrift from its tow, it can easily take care of itself, as it is equipped with five masts, rigged with fore and aft canvas. The barge is also equipped with a complete wireless telegraphy apparatus. It carries a crew of thirteen all told.

WIRELESS TELEGRAPHY AT THE ANTIPODES.—An Australian record in wireless telegraphy has been achieved by the successful transmission of messages from H.M.S. *Challenger*, one of the Australian squadron stationed in Hobson's Bay, to the flagship *Powerful*, which at the time was moored in Farm Cove, Port Jackson. The *Challenger* was in communication with the flagship by means of wireless telegraphy the whole of her voyage, and never once lost touch with her—that is, of course, when the signalling was in operation. The longest message, one flashed over a distance of 410 miles in a direct line, constitutes, as already stated, an Australian record, as previously never more than 240 miles had been achieved by warships on the Australian station.

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How to Make an Inter-Communication Telephone.

By Fred Rudolph.

(*Continued from page* 436.)

A Five-Line Inter-Communication Instrument.

THE following drawings and descriptions will enable any reader possessed of a few tools to make for himself an inter-communication system such as is described in the foregoing articles, and although simple in design, will be found very effective in service, provided care is taken in making the various parts.

The five-line inter-communication instrument shown in the drawing, Fig. 9, is composed of the following component parts: Trembling bell, watch-pattern receiver, induction coil, ringing key, automatic switch-hook, microphone or transmitter, selector switch, and battery terminals MR, MC, MZ, ZR.

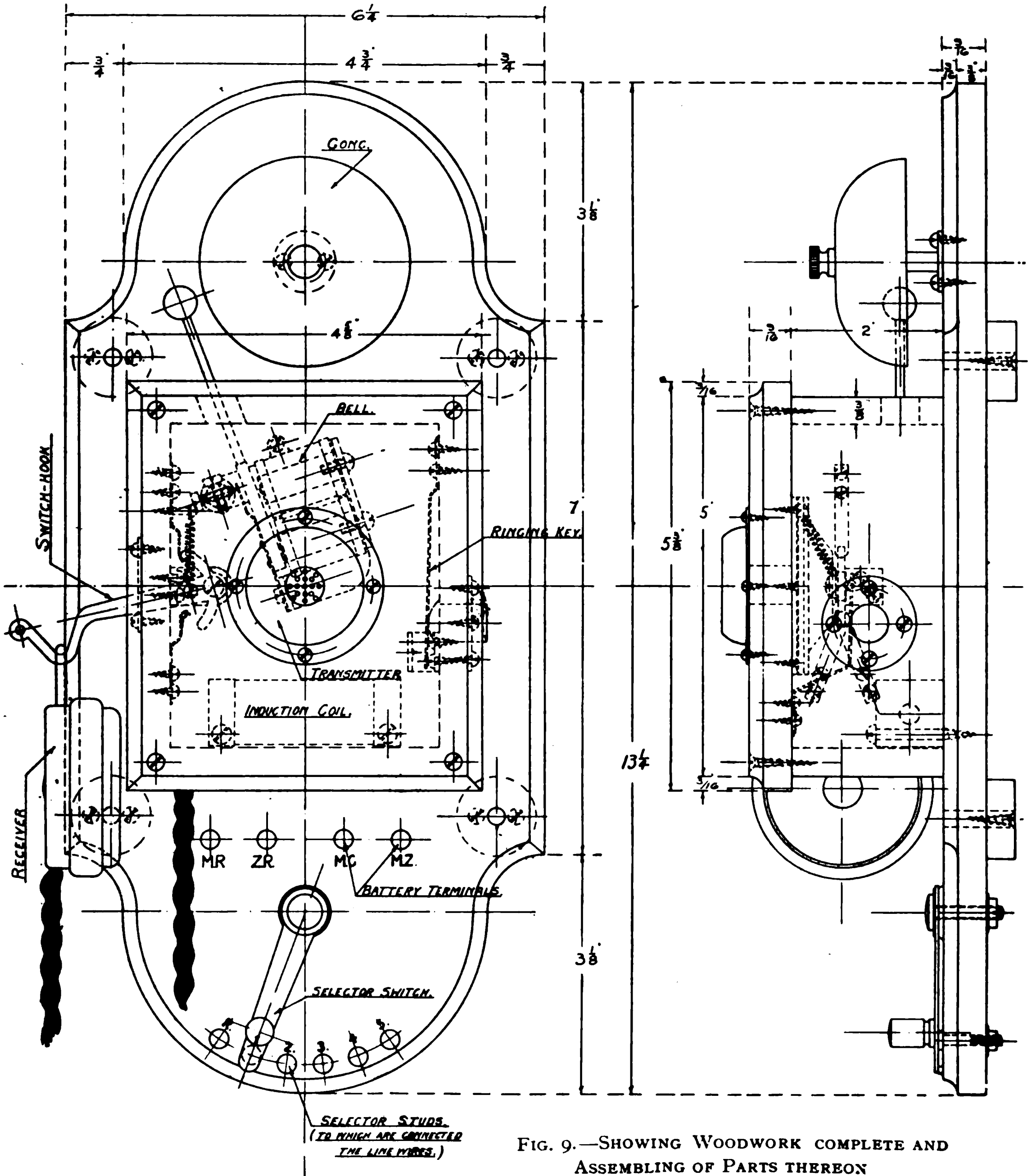

Fig. 9.—Showing Woodwork complete and Assembling of Parts thereon

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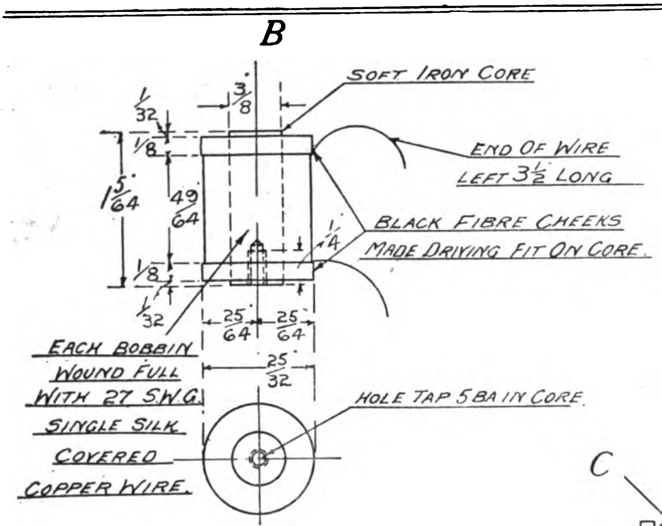
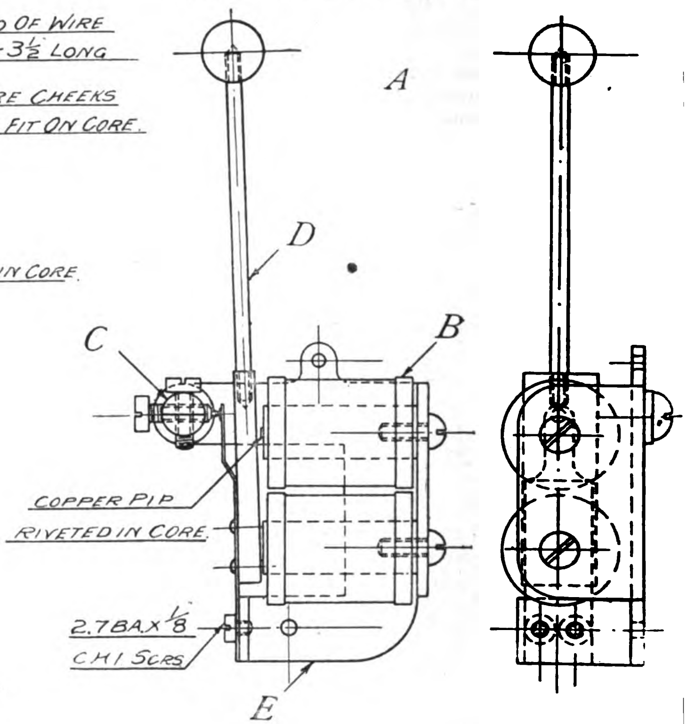
The instrument is arranged for local speaking with a common ringing battery. The assembling together of the various items is shown on the drawing. The method of wiring is clearly shown on connection diagram Fig. 1. A brief description of the various compound parts will be subsequently described and illustrated.

The wood base, cover, and lid, look exceedingly well if made from well-seasoned walnut, stained or French polished. It is advisable to make all the apparatus and parts ready for mounting on the backboard and case, and then to mark out, with the apparatus in position on the wood, and then drill wood to receive same. There is then no danger of the apparatus not fitting neatly and accurately on the woodwork.





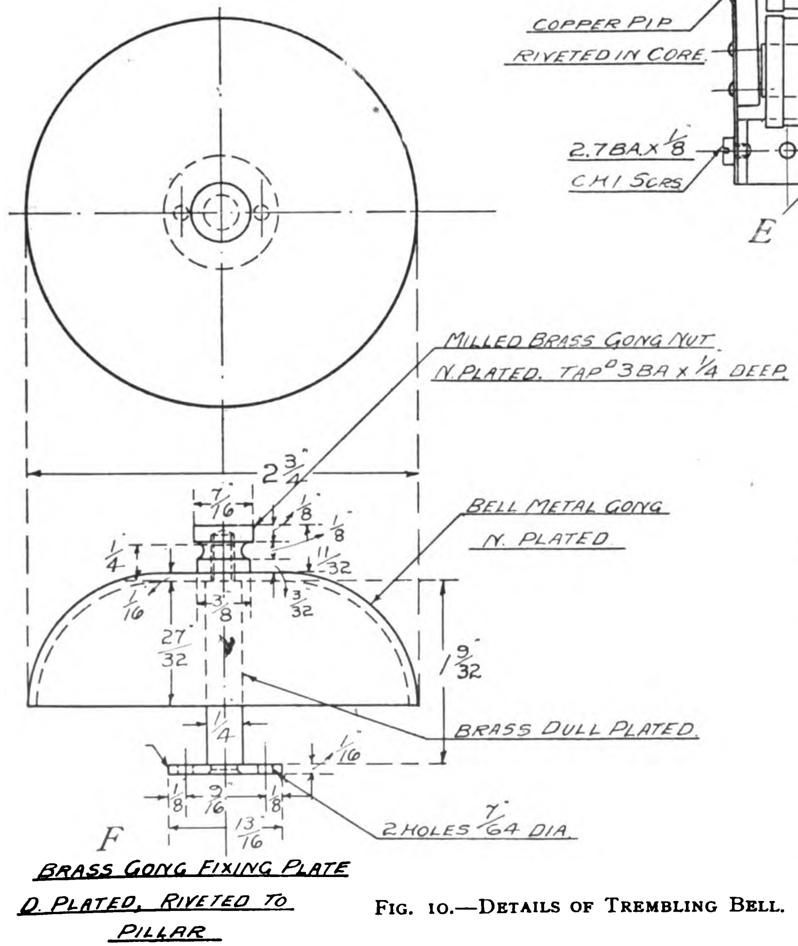
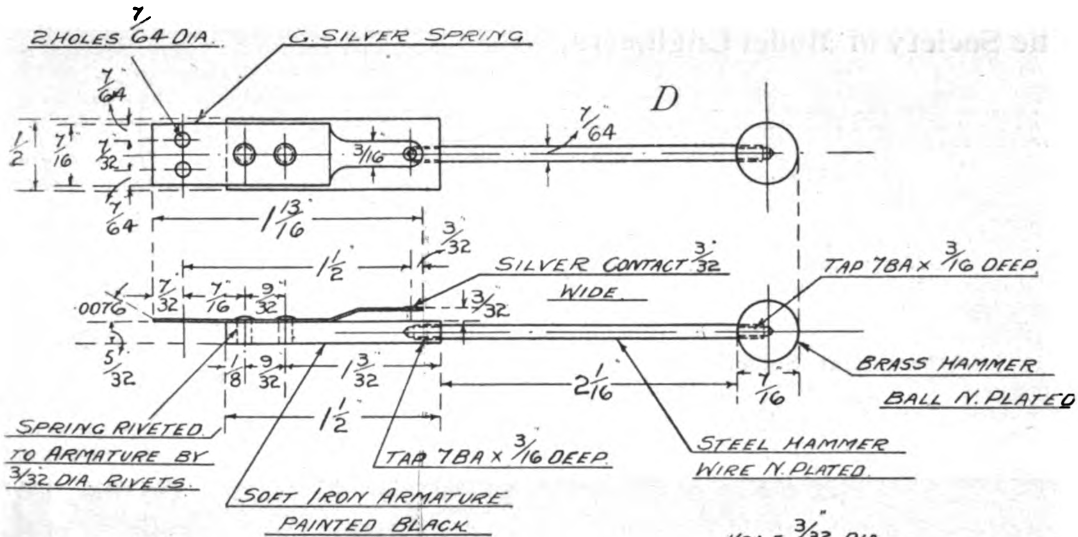


FIG. 10.—DETAILS OF TREMBLING BELL.

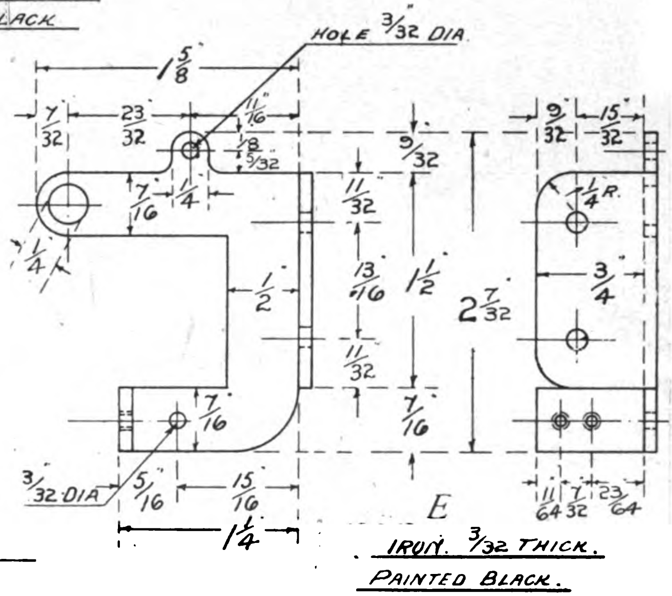
THE TREMBLING BELL.

This is shown in Fig. 10, and consists of the



usual electro-magnet, armature, carrying contact springs, and hammer-head D. The iron base, E, serves to complete the magnetic circuit for the iron pole-pieces B, which are screwed to base by two 5 B.A. round head iron screws, shown in A. The coils, B, are assembled on the frame, and the armature screwed to bent-up frame lug of base by two 7 B.A. C.H. iron screws. The method of making contact pillar is clearly shown in C. Care should be taken in making this so that the contact screw is perfectly insulated from the iron frame. At F is shown the bell-metal gong with securing nut and fixing pillar. The contact pillar screw should be adjusted to give a strong and regular beat when the current is flowing.

(*To be continued.*)



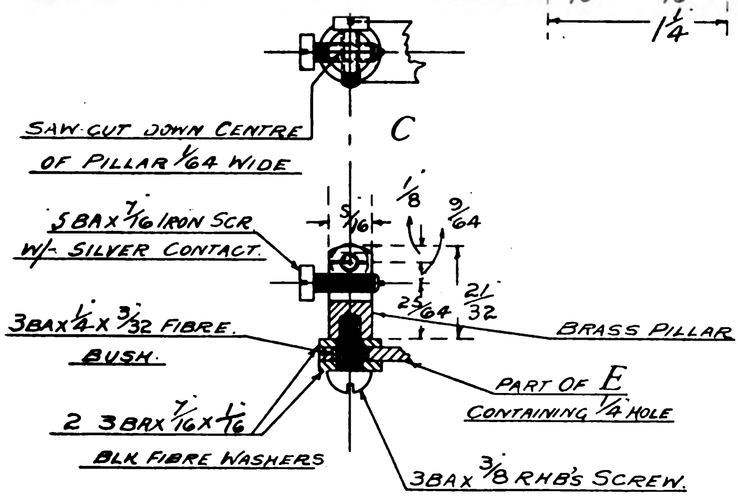


FIG 10.—DETAILS OF TREMBLING COIL.

RAPID SHIPBUILDING.—Messrs. J. L. Thompson and Sons, shipbuilders, of Sunderland, claim to have established a record in the quick production of a steamer, having built the *Blackwell*, a vessel of 7,500 tons, in 69 days from the laying of the keel to the launching.

THE steam end of the 6,000-kilowatt Allis-Chalmers turbine alternator recently shipped to the King's County Electric Light Company of Brooklyn is said to be one of the largest and most powerful so far built. As an indication of its size, it is interesting to note that a steel forging weighing 240,000 lbs. went into construction of its spindle.

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The Society of Model Engineers.

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

London.

FUTURE MEETING.—Friday, November 29th: Ordinary monthly meeting, at the Cripplegate Institute, at 7 o'clock. Lecture by Mr. L. M. G. Ferriera, "Further Wrinkles in Model Making."—HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

Provincial Societies.

Leeds.—On Saturday the 26th ult., the members of the above Society and several friends paid a visit to the Crown Point Generating Station of the Leeds City tramways. The main building was gone through first, in which are several sets of cross compound horizontal Corliss engines, by Fowlers (Leeds) and Hick, Hargreaves (Bolton), driving direct generators of 600 and 800 kw. respectively. These were pretty thoroughly examined, as well as a small Parsons turbine set, which is used during the few hours of early morning when the load does not warrant the running of one of the big engines, for lighting the various depots doing repairs, running snow ploughs, etc. Then there were the Borster sets, which are used for working sections in which the load is temporarily heavy. The steam is generated by fifteen Lancashire boilers fitted with Benis's patent stokers. From the boiler houses to the new building is only a few steps, and here are two sets of Curtis's vertical turbo alternators of 1,000 kw. each, by the British Thompson - Houston Company (Rugby), supplying current at 6,600 volts to substations in outlying districts in which are rotary converters to correct it ready for the trolley wires. These machines embody many interesting features, among which are the electrical controlling of the steam inlets and the hydraulic footstep bearing, which is an ingenious arrangement for overcoming friction and wear. One of these sets, together with its motor driven pumps, water and oil pumps, etc., would only occupy one-fourth of the floor space that would be required by a horizontal set of the same capacity. The kindness and courtesy of the officials merited the hearty thanks of the whole party.—Hon. Secretary, W. H. BROUGHTON, 32, St. Michael's Road, Headingley.

MODEL STEAMER RACING ON THE GRAND LAC OF THE BOIS DE BOULOGNE, PARIS.

The Race for the Branger Cup.

THE annual race on the Grand Lac of the Bois de Boulogne in Paris for the trophy presented by M. Branger, took place on October 24th last. From the brief particulars we have been able to obtain at the time of writing, it appears that several minor races were held in which a great variety of model craft competed. In the chief event, however, the first place was gained by M. Girard for his boat *Girard VI*, and from the previous successes which this enthusiastic model-maker has achieved, it seems that he is invincible on his own side of the Channel. We regret that we have no particulars of

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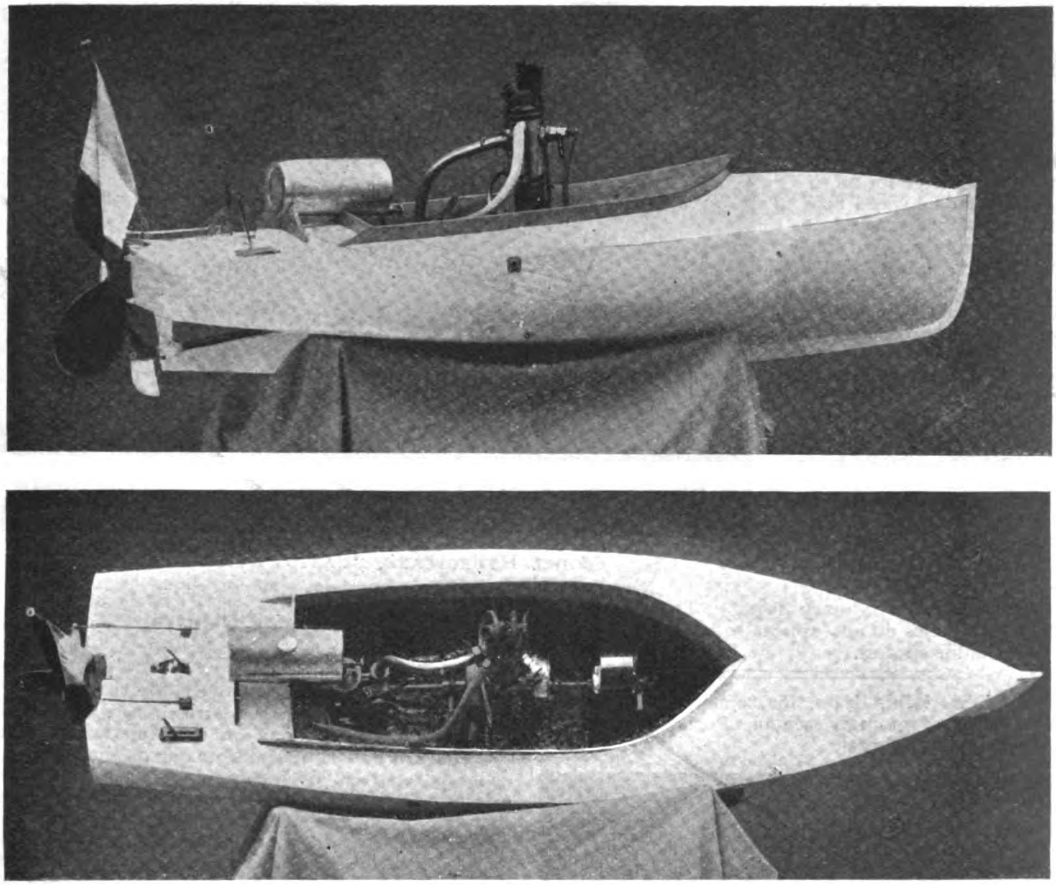
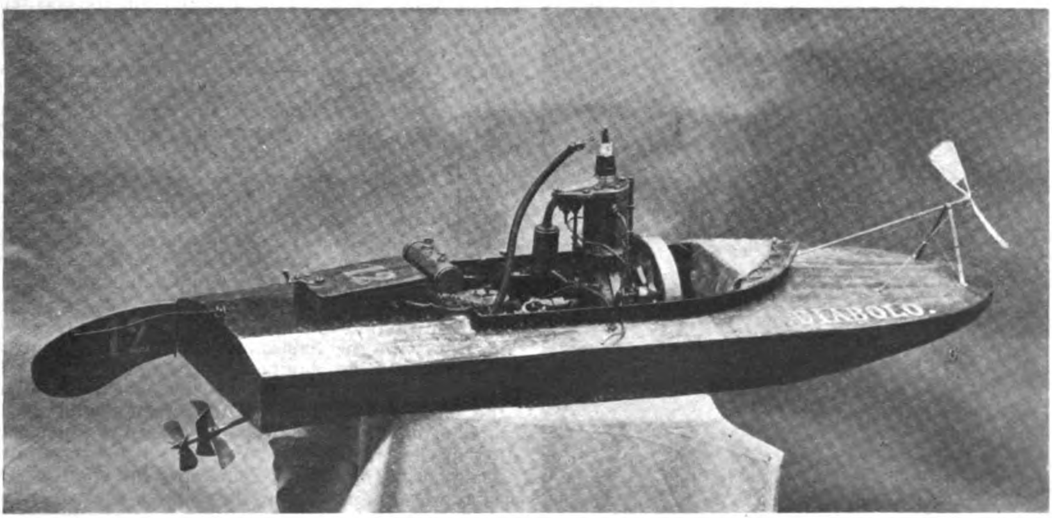
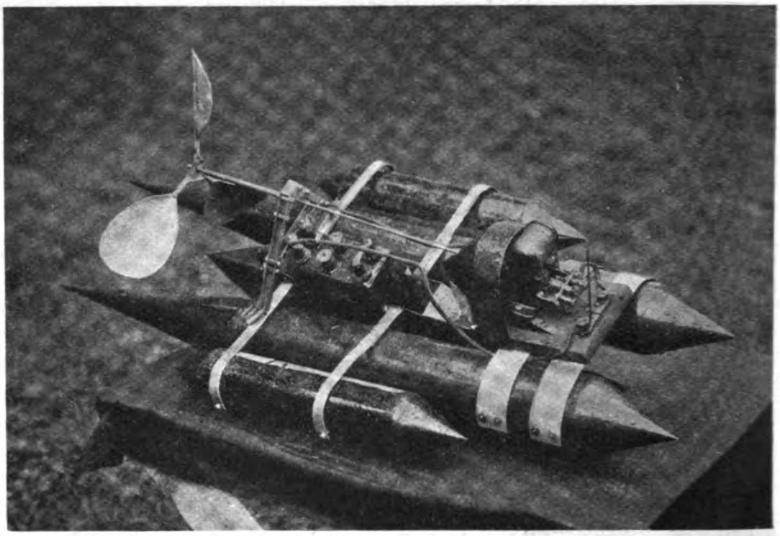


Two Views of "Girard VI," Winner of the Branger Cup



Model Petrol Driven Hydroplane, "Diabolo".

the speed accomplished by the various boats, but we feel confident in saying that nothing has yet been done to approach the records set up in the various MODEL ENGINEER Speed Competitions. Perhaps it may some day be possible to arrange for an international model speed boat contest. We are pleased to be able to give photographs of M. Girard's latest model, and also of some of the other competitors. It will be noticed that, whatever may be their achievements in regard to speed, our Parisian friends are certainly not lacking in novelty of design, at least two hydroplanes being among the competitors. Some English model hydroplanes, however, were recently shown at THE MODEL ENGINEER Exhibition, and we shall be interested to know how these compare in actual running with boats of the ordinary type. The French model hydroplanes do not appear to have achieved any remarkable success.



MODEL HYDROPLANE, "SANTOS DUMONT."

THE old battleship *Hero*, for some time tender to the *Excellent* gunnery school, Portsmouth, is being fitted up as a target.

"GIRARD VI" AT FULL SPEED AHEAD.

Crossing Niagara.

A NOVEL system employed for supplying the city of Buffalo with electrical energy, not only from two power-stations on the American side of the Niagara Falls, but also from one on the Canadian side, is reported by a contemporary. The power cables are carried across the river at Buffalo. The pressure is 22,000 volts and there are two three-phase lines, 16 miles long, from the power-station on the Ontario side of the Falls to a point opposite the terminal station in Buffalo. The distance between the supporting towers could not be made less than 2,192 ft., and the minimum clearance permissible at the lowest point of the span was 131 ft. Aluminium cables were adopted of 500,000 circular mils, each cable consisting of 61 strands; there are three circuits, one being a spare, each consisting of three cables supported at the corners of an equilateral triangle of 15-ft. side, with apex uppermost. The towers nearest the river are 212 and 215 ft. high respectively, and on the Canadian side there is an additional span of 1,668 ft., the third tower being 104 ft. high. At each of the terminal towers the aluminium conductors are dead-ended on electrose bobbin insulators connected with steel cables; the latter pass over large sheaves, and carry at their lower ends counterweights weighing 4,300 lbs. each. By this means a constant tension in the span is ensured, providing for expansion and contraction and for storm stresses. The connection with the line is made through aluminium cable drop leads clamped to the span cables. At the intermediate tower the cables are interrupted, the ends being connected by steel chains 25 ft. long, which pass over saddles on the tower, insulated by electrose insulators. A slack cable of aluminium passes over the saddle connecting the span cables, while the chain carries the weight of the spans, and also relieves the conductors of the vibration and friction which might injure them.

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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:—

[17,950] **Milling Cutters and Spindles.** C. O. A. (Norwich) writes: I have purchased a vertical slide and am making some circular cutters for use therewith, some between centres and some on plug in self-centreing chuck. (1) Kindly advise me as to the best way of fixing the cutter to spindle or plug if made interchangeable, or would you advise me to make a separate spindle or plug for each cutter? (2) How is the semi-circular keyway, usually seen in such cutters, made?

(1) The cutters should be a dead fit on the spindle. The spindle should have an ample shoulder against which the cutter can bear. The cutter may be fixed by a central screw and washer. A nut working on a projecting end to the spindle for use between centres may, of course, be employed, as in Fig. 2, but a screw takes up less room. Where a projection is undesirable, a countersunk screw and washer may be used, as shown in Fig. 3. Where face teeth are present, the fixing arrangements will not under these conditions project. (2) Make all cutters of about the same size to fit a standard spindle and group the cutters into two or three sizes with a spindle for each. (3) We do not know exactly how they are made, but if you make your own cutters you may drill the keyway hole before the large hole for the spindle is bored. In the case of the spindle, go to work in a similar manner. Drill the hole before and fit the pin or key after the shouldered portion of the spindle is turned down.

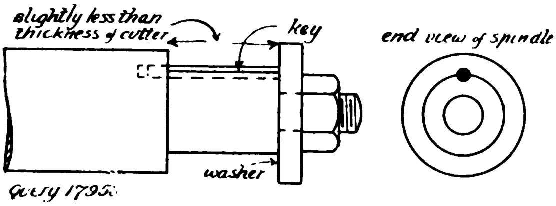


FIG. 2.—MILLING SPINDLE FOR USE BETWEEN LATHE CENTRES.

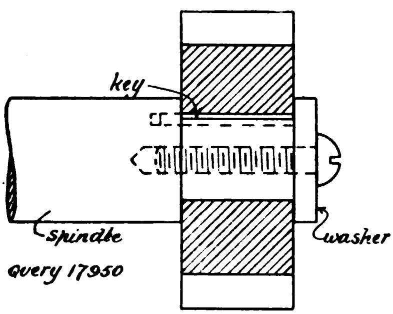


FIG. 1.—MILLING SPINDLE.

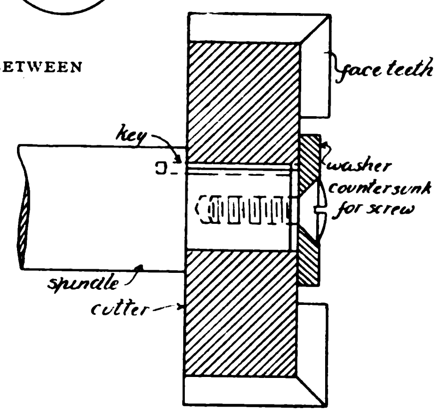


FIG. 3.—SPINDLE FOR CUTTER WITH FACE TEETH.

[18,061] **Heating Water by Steam.** J. W. (Stafford) writes: It is required to bring 26 gallons of water to boiling point by steam from a small boiler in about one hour's time from time steam is up in the boiler. Will you please tell me what size piping I shall require, and how many turns, and what diameter to make coil? Also smallest boiler I could use for the purpose, and lowest pressure it could be worked at?

You will only require a few pounds pressure if the boiler is very close, but to allow for transmission losses we recommend 20 or 30 lbs. pressure. To heat the water, the amount of piping does not matter very much. You want enough to quickly condense the steam when the two temperatures (towards the end of the coil) are nearly alike. We should think that 15 or 20 ft. of ½-in. copper pipe would suffice. More will not hurt, however. The units of heat (B.T.U.'s) which will be required to raise the water from 60° F. will be—$26 \times 10 \times (212 - 60) = 260 \times 152 =$ (roughly) 39,000 B.T.U.'s per hour. This means a consumption of steam, in one minute, of

$$\frac{39{,}000 \text{ lbs}}{1{,}100 \times 60} = \text{roughly,}$$

⅔rds of a lb. per minute = ⅔ of 27 cub. ins. per minute = 18 cub. ins. per minute. We advise, therefore, a boiler with 2,000 sq. ins. of heating surface, or, say, a vertical multitubular measuring 18 ins. diameter by 30 ins. high, fitted with about eighteen tubes 1¼ ins. diameter. This would be a costly method of doing the work. We suggest that you heat the water by a coil taken direct from the 26-gallon tank through a suitable furnace (gas or coal fired). This would save a large proportion of the cost of the boiler (about £6 or £7) and would be more efficient. The coil could be connected to the top and the bottom of the tank at its lower and upper ends respectively, so that the water would be circulated by convection. You could, of course, use a "Geyser" as employed to supply baths with hot water. We would point out that this is hardly a query within the scope of THE MODEL ENGINEER. However, it will, perhaps, be of interest to other readers: for this reason we reply to it.

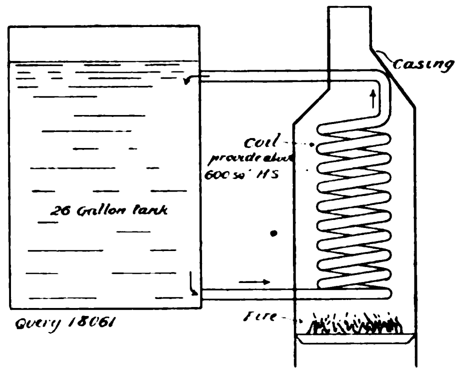


DIAGRAM SHOWING METHOD OF HEATING WATER BY STEAM.

[18,345] **Model Electric Tramcars.** N. B. (New Zealand) writes: I am constructing a model electric street car and would like some information about the following questions. I am not an electrician, but am a draughtsman in the employ of the Corporation tramways of this city. What I would like to know about is this: The car I am constructing is 20 ins. long, 5 ins. high, and 4 ins. wide, is of the double bogie or eight-wheel type. I thought

of fitting a trolley pole and take the current through the car to the motor, as the car is not very large. You cannot very well control the speed by a controller on the car, so I thought of having the controller off the car. The current to come from the dynamo or battery to the controller, from the controller to the overhead wire, and then to the car. In this way you could regulate the speed of the car. Could this be done? If so, will you please explain how to do it? If it is impracticable, will you please show me which way to do it, but I would like to use the trolley system if possible. What would be the best way to generate power to drive the car – a dynamo or accumulators? I would prefer the least expensive way. One motor will be quite sufficient as I do not want a very high speed. Briefly, what I want to know is this: What is the best and cheapest way of generating power for the model? How to take the electricity from the generator to the motor? Would you please let me have a sketch of how to wire the car? I do not want to be put to a large expense over this model as it is a first attempt. Would you please let me know the names of any firms who supply all the fittings for a model electric car?

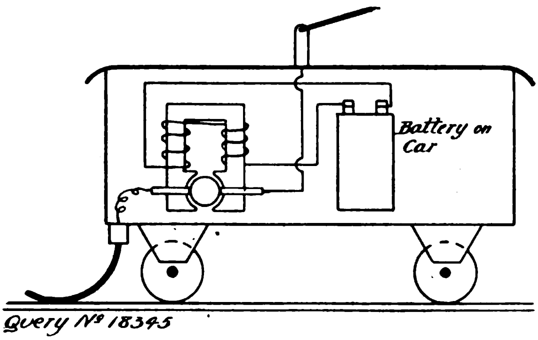
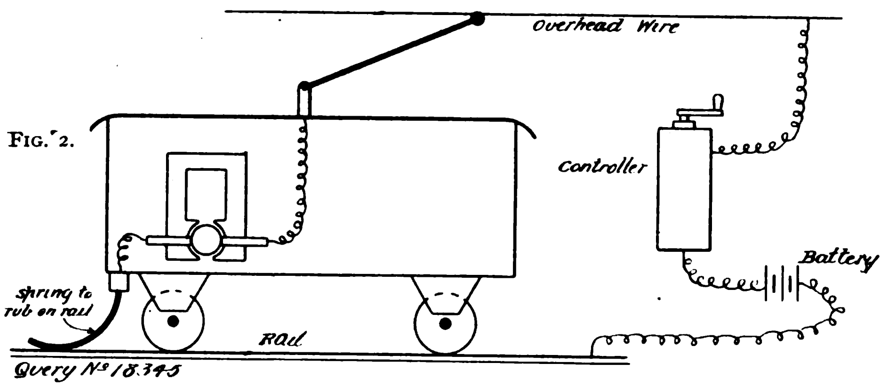


FIG. 1.

FIG. 2.



DIAGRAMS OF CONNECTIONS OF MODEL ELECTRIC TRAMCARS.

You can run as suggested, but if you wish to reverse the direction of car movement it is necessary to make the motor with a permanent field-magnet or to separately excite the field-magnet from a small battery carried on the car. The above illustrations will explain. This is the arrangement with permanent magnet or separately excited motor. By reversing the direction of current the motion of car will reverse. If the motor has a wound field-magnet the coils are connected as shown in Fig. 2. The contact spring to rail must be insulated if any other part of the wiring makes contact with the car in such a way that the passage of the current would be short-circuited. Speed control can be effected by causing the controller to switch in resistance wire in the circuit (see our handbook No. 14). If you use an ordinary series-wound motor, reversing the direction of flow of current will not reverse the motion of the car. You would have to put a reversing switch on the car itself arranged to change over the connections to the motor brushes, so that the current flows in a reverse direction through the armature only. Regarding supply of current, if you can get them recharged easily accumulators would probably be the more convenient. It is absolutely necessary, however, not to allow them to stand in a discharged condition. A small gas engine and dynamo would be, perhaps, the cheapest if you are going to do a great deal of running; failing either of these, you can use primary batteries (bichromate pattern). Have them as large as possible, and arrange for systematic supply of chemical, zincs, and cleaning. The rail spring contact could be arranged to rub on wheel axle instead, if desired; but oil in axle-box may cause interruption to flow of current. Whitney or Thompson, or other of our electrical advertisers would supply you with parts for electric tracmars.

[18,316] **Small Oil Engine Trouble.** A. T. B. (Leytonstone) writes: I have one of the British Electrical Co.'s oil engines, 2¾-in. bore, 3-in. stroke. I cannot get it to run. I have tried it on paraffin oil. I got the tube very hot with a blowlamp recently and it made an explosion once when I turned the flywheel and began to run back. I have not much faith in paraffin oil, as it does not seem explosive enough, but I do not care to try anything else until I have had advice on the matter. There is another thing about this engine I do not like: the way they fit their valves. I daresay you have had queries on these engines before and should be pleased if you could help me.

We believe it is only a question of nicety of adjustment of oil and air supply, but it is quite impossible to say what is wrong without a personal inspection. Remember, too much is as bad, or worse, than too little oil. See that your exhaust is quite clear, and no pipes or flange holes stopped, or partially stopped up, and see that all valves are a good fit and well ground in.

[18,183] **Running Small Lighting Plant.** S. P. (Douglas, I.O.M.) writes: (1) I have a water-cooled motor, 3-in. by 4-in. stroke, and I shall be obliged if you will give me a design for a vaporiser or carburettor for paraffin to suit it, or could let me know where I could get one? (2) At what speed shall I have to drive above motor to give power enough for a 400-watt dynamo? (3) Would a flat or V-shaped belt drive be best? (4) What width of flat belt shall I require (if used) for 400-watt dynamo? (5) What distance apart should dynamo and motor be from one another to obtain best results in driving? (6) What resistance will be required to start 100-volt 4-amp. dynamo as a motor from 100-volt supply? Will lamps do?

(1) See June 1st, 1906, issue. (2) About 350 or 400 revolutions. (3) Preferably a flat. (4) A thin 1-in. belt. (5) With normal sizes for respective pulleys they may be 3 or 4 ft. apart; not less. (6) About 25 ohms; or use three or four 16 c.-p. lamps in parallel.

[18,188] **Windings for a 6-in. Gong Electric Bell.** C. G. R. (Kensington) writes: I should be much obliged if you could give me the following information. I wish to construct an ordinary trembling electric bell with 6-in. gong and two bobbins, 3½ ins. long by ⅝ in. inside and 1⅛ ins. outside measurements, wound with s.s.c. 18 gauge wire. How many cells would be required to work this for a period of about 7 seconds ten times a day over a length of about 15 yards of twin wire? I propose using ordinary Leclanché cells, and should prefer using several of the quart size connected in series-parallel rather than the 3-pint size. I should also like to know how much current this bell would take to ring loudly, and if 2/18 wire is the correct size, or would 2/20 be large enough for the line wires?

We advise you to use 18 gauge wire for the line. Try four one-quart size Leclanché cells in series-parallel. We cannot say what current is required, probably about 2 amps.; it will fluctuate owing to the action of the contact-breaker.

[18,321] **Boiler for a 1-in. by 1½-in. Double Cylinder Engine.** L. S. (Barnsley) writes: I should be very pleased if you would give me dimensions of a model Lancashire boiler (single tube) suitable for driving a double cylinder engine, 1-in. bore, 1½-in. stroke, at a pressure of 50 lbs. (boiler pressure). Also thickness of steel plate and size of rivets.

See "Model Boiler Making," pages 18 to 23 (new edition), price 7½d. post free.

[18,189] **Starting Switches for Motors.** J. G. (Llanelly) writes: Will you be so kind as to favour me with an answer to the following? Any suggestion by a drawing of an arrangement of switches, starters, etc., to enable a motor to be started from two or more different places, and under what conditions you think in practical work would it be advantageous.

Particulars of starting switches are given in our handbook No. 14. To start a motor from a number of places you can place any suitable switch at each place and connect them in parallel

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to the motor; that is, you simply repeat the connections of one switch as made between the mains and the motor. Another method is to have one starting apparatus at the motor so constructed that it will automatically switch on the current through resistances and in the proper way whenever a flow of current is sent to the device which puts the apparatus in motion. This device may be an electro-magnet. Arrangements of this kind can be worked by a simple push button placed at each position from which the motor is to be started. The conditions in practice under which it may be desirable to start a motor from various positions would be in working lifts, the lift being started from various floors. Lift makers have devised such automatic starters, each maker preferring his own arrangement and protecting it by patent. They would be provided with gear to automatically cut off the current when the lift reached a stopping place. Your query covers too wide a scope to be answered in greater detail.

[18,159] **40-watt Dynamo Windings.** C. H. (Ipswich) writes: Will you kindly assist me in the following. I have some castings of a dynamo with 2-in. by 2-in. armature and fields of usual proportions, wrought-iron core. (1) What length or amount of wire and what gauge shall I require for field-magnet? (2) What amount and gauge for the armature (drum, eight cogs)? (3) Would it run better as a motor or a dynamo? Will you please give me the amounts for what you think would make the most suitable motor or dynamo for the castings? (4) What number of revolutions would it require to give its highest output?

(1) Wind field-magnet with about 1 lb. of No. 22 s.c.c. copper wire, and connect in shunt to the brushes. (2) Wind armature with No. 24 gauge double silk-covered copper wire (or No. 25 gauge if you can get it); about 3½ ozs. will be required, but wind on as much as you can in the space. Use eight coils, wound two in each slot, as per diagram 43 of our handbook No. 10; commutator to have eight sections. (3) Will do well as a motor and may work as a dynamo. (4) About 4,000 r.p.m. Try it with a small lamp of about 6 volts 1 c.-p. size.

[18,190] **Accumulator Charging.** W. R. G. (Merton) writes: I shall be obliged by your answering the following questions. I have two accumulators, both 4 volts—one has three 4-in. by 4-in. positive plates, while the other has only one 4-in. by 4-in. positive plate in each cell. To charge these at different times, should I buy a dynamo giving 5 volts 4 amps. for charging large accumulator and reduce the ampereage for smaller one? If so, how shall I do it? How long will each accumulator take to charge?

Yes, have the dynamo with capacity to charge the larger cell. You will probably find that the smaller cell will cut down the current by virtue of its internal resistance being greater than that of the other cell. You can regulate the flow of current by altering the speed of the dynamo, or by putting a wire resistance in series with the accumulator. A yard or two of No. 24 gauge bare German silver wire would very likely suffice.

[18,213] **Accumulators.** P. B. (St. Albans) writes: Please would you answer the following query. I have just bought through your paper three accumulators for electric lighting. Each accumulator has three separate cells which have six negative plates, size 4 ins. by 4 ins. and ¼ in. thick, and five positive plates, size 4 ins. by 4½ ins. and 3-16ths in. thick, and the charging rate is 6·5 amps., and the discharge is the same. Could you please tell me the voltage and number of amperes each accumulator has, and the number of lamps I could light up (using the three accumulators), and the number of hours they would keep them burning?

Accumulators give about 2 volts per cell when discharging. Each of your three cell accumulators should therefore give 6 volts. The capacity will vary according to the rate at which you discharge them. The smaller the rate of current flow the larger the capacity in ampere-hours (see our handbook No. 1 on "Small Accumulators"). We cannot say exactly what would be the capacity, as you must find it by trial; possibly 8 amp.-hours for each accumulator. You should not discharge them right out or let them stand in a discharged condition. As soon as the voltage falls to 1·8 volts per cell—that is, 5½ volts for either accumulator, they should be re-charged. We should advise a discharge rate of about 3 amps. Connect the three accumulators in series and use three 15-volt 5 c.-p. lamps, or six 2½ c.-p. lamps in parallel as a trial. They may light these for about three hours at one charge.

[18,191] **High Frequency Effects.** E. P. H. (Oldham) writes: I shall be very pleased if you can inform me as to how I can obtain the following effect. I believe there is trickery about it as I saw two conjurers do it. The effect is as follows:—One of the performers came on the stage and showed to the audience what appeared to be two hollow glass tubes about 4 ft. in length by 1 in. diameter. He held a tube in each hand. On sliding one of the glass tubes on to the other there appeared to be a light bluish light filling the tubes from the point where the tubes crossed to the operator's hands. The next thing the performers (two) did was to place the ends of a tube in their mouths and while thus holding the tube between them the tube was again filled with light.

These effects are probably produced by means of "Tesla" high frequency discharge, the tubes being brought into the influence of electric waves of very high frequency, the tubes lighting up when brought into the wave field which would be invisible. Read the articles appearing in THE MODEL ENGINEER by Mr. Howgrave-Graham upon "Electric Oscillations and Waves." A powerful induction coil, say 10-in. spark size, or special high tension transformer and a Tesla coil would be necessary. The tubes would be exhausted of air.

[18,368] **Small Gas Engine Trouble.** F. C. (Chorley) writes: I should be very much obliged if you could help me out of a difficulty which I am at present placed in with my gas engine. I have a 1 h.-p. engine which I got from the British Electrical Co., Leek, Staffs. I got it in castings a few months since and I cannot get it to work at all. I am sure everything has been done that is possible, but still it is just the same. It will sometimes fire once and sometimes not at all. The valves work all right and the compression is good. It has a good supply of gas and the air inlet is fitted with back pressure valve. The ignition tube is in good condition, and is kept white hot, and I have tried all sorts of things but cannot get above one or two fires out of it. I have also a gas-bag which came from the same place. If you can help me in any way I shall feel very much obliged. Will you kindly let me know what size valveshould be diameter for 3½-in. bore, 4-in. stroke?

It is difficult to say without a personal inspection exactly what is wrong with your engine, but as you say you have managed to get her to fire once, we think it is merely a matter of careful adjustment in order to get proper running. A few points which can easily be overlooked are: See that the exhaust passages are perfectly clear and free from as many bends as possible; that the timing of the valves is correct, and that you are not using *too rich* a mixture, which is as bad as too weak, if not worse. The air and exhaust valves should be as near as possible 1¼ ins. diameter, especially for high-speed engines of this size. Let us know how you get on. Also see handbook—"Gas and Oil Engines," by Runciman, 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.]

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

Fluxite.

The Auto-Controller and Switch Co., Bermondsey, S.E., inform us that they have recently received from the Royal Arsenal Woolwich, an order for a large quantity of "Fluxite" soldering paste. Before this order was placed, the flux was subjected to a prolonged test extending over more than three months.

• Small Patterns and Castings.

According to pamphlets received, S. B. Gosling & Son, of 13, Artillery Lane, Bishopsgate, London, E., are open to undertake small mechanical work, such as making patterns to customers' drawings, and small castings for electrical and motor work and model making. The firm also construct demonstrative models for civil engineers, architects, inventors, and others.

A 600-watt Dynamo.

We have received a circular giving a drawing and description of the "Griffin" 600-watt dynamo which is now being placed on the market by Mr. A. O. Griffiths, of Caergwle, near Wrexham. The machine is designed for the requirements of small electric light installations. Prices for castings of parts or of the finished machine may be obtained of Mr. Griffiths as above.

* Files and Tool Steel.

With reference to the new lines in files and tool steels which we commended to our readers under this column in the issue of October 24th last, we should have stated that these are supplied only by W. Muncaster, 42, Machon Bank, Sheffield.

New Catalogues and Lists.

Woodfall & Morris, 70A, Rye Lane, Peckham.—A list of prices and particulars of "Osram" battery lamps of various shapes for use with accumulators, &c., can be obtained on application to the above.

H. G. Kingston, Tokenhouse Yard, High Street, Putney, S.W. —We have received an illustrated list entitled "Something for the Boys," comprising small clockwork, steam and electric working models, which are stocked by this firm. The list will be sent to readers of this Journal upon application, enclosing stamp for postage.

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The Editor's Page.

A VERY pleasing feature of our late Exhibition has been the very cordial appreciation with which our efforts have been received by the model-making public. Apart from the congratulations personally tendered to us during the week the Exhibition was open, we have received a large number of letters from readers who visited the show, and who felt that they could not let the occasion pass without writing to say how pleased they were with everything they saw. Since these letters have been too numerous for us to reply to individually, we take this opportunity of tendering our best thanks to our correspondents for their kind remarks.

* * *

One or two readers have also written asking if we could spare them a copy of our Exhibition poster to decorate their workshops with. We may say that we still have a few copies of the pictorial poster in green and black left, and we shall be happy to send one, so far as the supply lasts, to any reader who cares to ask and sends a stamp for postage. This design by Mr. Twining has been very generally admired, and as a workshop decoration it should prove very pleasing and appropriate. We also have a few copies of the official Exhibition Catalogue and Souvenir left. Besides giving a complete list of exhibits, this contains a number of illustrations of the principal models and some interesting notes on model engineering by the Editor of THE MODEL ENGINEER. It altogether runs to some 64 pages, and has a very attractive cover. Copies may be secured, post free, 4d. each, if early application be made.

* * *

Mr. Jas. C. Crebbin, who has taken considerable interest in the work of the members of the Victoria Model Steamboat Club, asked us at the Exhibition to nominate one of the members' boats for a special prize of 10s. which he had offered to the club. A careful examination of the exhibits resulted in our decision in favour of the fine model of the late Sultan of Turkey's yacht *Izzedin*, and the builder of this model, Mr. E. Pierce, has accordingly been the recipient of the prize. As one of the earliest and most enthusiastic members of the club, Mr. Pierce is to be complimented on the distinction thus conferred.

Answers to Correspondents.

H. A. (Coolatore, co. Westmeath).—Your letter was forwarded as requested.

T. T. (Kidderminster).—We thank you for your letter and diagram.

E. R. L. (Chichester).—We have forwarded your request to the right quarter.

H. GREEN (Sheffield).—We cannot say definitely without seeing a photograph of your model if it will be of interest to our readers.

G. U. J. (Christchurch, N.Z.).—We are much obliged for your interesting photographs and description, and shall insert them as opportunity occurs. The copies you request shall be forwarded to you.

S. P. (Douglas).—See issue for June 21st, 1906, for a suitable design.

" KNOWLEDGE " (In the Panama).—Use a 40-watt machine as described in " Small Dynamos and Motors," 7d. post free. See also the " A B C of Dynamo Design." Any of our advertisers of electrical goods would supply suitable castings.

W. G. H. (Margate).—See the recent articles on " Design for a Handy Lathe." Drawings of a chuck are given in the issue for October 10th, 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, &c., for review, to be addressed to THE EDITOR, " The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

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

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THE

Model Engineer

And Electrician.

A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

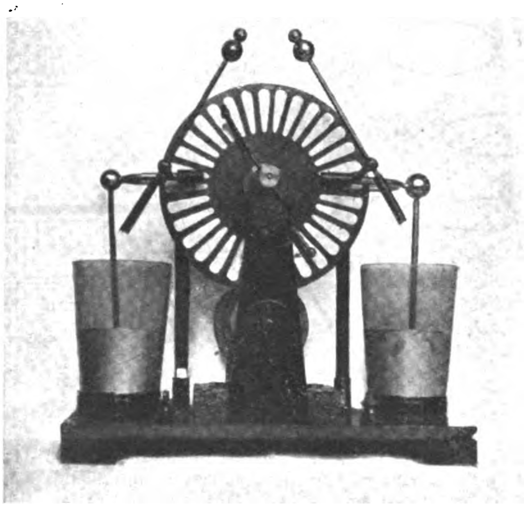
EDITED BY PERCIVAL MARSHALL, A.I.Mech.E.

Vol. XVII. No. 343. NOVEMBER 21, 1907. PUBLISHED WEEKLY

How I Made my Wimshurst Machine.

By W. J. Haynes.

In the construction of my Wimshurst machine I have had three failures, one caused through the sectors not being perfectly smooth at the edges, thus causing dissipation of the electricity by a brush discharge from the lower end of the sectors to the spindle; this difficulty was overcome by re-grinding the punch with which the sectors were cut out, and by running a brush charged with shellac varnish round the lower end of the sectors after they were secured to the plates. The second failure was caused through the solder on the lower part of the collectors not being all scraped off, which also caused dissipation of the electricity; and the third, which perhaps cannot be called a failure, for the machine generated electricity right enough, but the spark was very short — not more than ½ in. in fact. This time I found the fault in the equalising brushes which were spread out at the lower end; but when they had the ends secured by a piece of cotton, the machine worked perfectly, giving in dry weather a good 2¼-in. spark. The framework of the machine is of pitch pine, stained to a dull black with Judson's wood stain and varnish. The standards carrying the spindle and plates are screwed to a block of wood, which in its turn is secured to the baseboard by two bolts, which enable me to take the machine to pieces for packing away when not required for use. The plates are of ebonite, 6 ins. in diameter, and each has thirty-six sectors of tinfoil stuck on with seccotine. The Leyden jars consist of plain thin glass tumblers, and are coated with tinfoil inside and out. I have had considerable trouble with these jars, for two of them cracked almost as soon as I commenced coating the interior of them. They are varnished with shellac, which I find increases their retaining powers considerably. The jars fit into sockets on the baseboard constructed out of the tins in which the Nugget Blacking is sold. A wire is soldered to the base of each socket, the object of which is to connect the outer coating of the jars to the two terminals on the baseboard. The brasswork of the machine is all lacquered, except the two balls on the discharging rods, which I left to enable me to polish them with a piece of leather when the machine was wanted for use, for, if these balls are not polished to a mirror-like brightness, the maximum length of spark will not be obtained. The collectors are two U-shaped pieces of brass tubing of 3-16ths-in. diameter, soldered at the bend to two brass balls, which, it will be noticed, are not of equal size. This, of course, does not matter except in appearance. I had a ⅝-in. brass ball by me, but the nearest I could get to match it was ¾ in., although I tried several shops in our neighbourhood. The equalising rods are constructed of ⅛-in. brass wire



Mr. W. J. Haynes' Wimshurst Machine.

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bent to the shape shown in Fig. 4. These rods are threaded at both ends, the top being fitted with a small brass ball ½-in. diameter, in which a socket is drilled to take the tinsel brush, which is wedged in with a small piece of match stick. The lower end is screwed into a small brass disc which is held in its place on the spindle by a brass nut not unlike the terminals on the baseboard for connecting the two outer coatings of the Leyden jars.

The discharging rods and balls I was fortunate enough to pick up at an old second-hand furniture shop, and these I have adapted to fit on one limb of the collectors. The manner in which this was done was as follows: into one end of the arms carrying the discharging rods I fitted a small split plug, in the outer end of which I threaded and drilled a small hole into which I soldered a pin point to collect the electricity from the plates. Next, I took a piece of brass tubing such as would just fit on the front limb of the collector, and through this I drilled a hole and tapped it so that I could screw the threaded long by ⅜ in. diameter, and through the top drilled a 3-16ths-in. hole, into which I fitted the long arm of the collectors. The lower end of the rod fits into a small brass socket on the baseboard. In drilling the hole through the top of the rod I adopted a device which I saw used in a workshop that I was in recently. A block of wood 6 ins. by 3 ins. by 3 ins. has a V-shaped groove cut in the upper surface; at one end a piece of wood is let in to serve as a stop. The work is placed in the groove, and when the drill is once started it will be found to pierce straight through the article to be drilled. This rest is shown at Fig. 1. The driving spindle consists of a piece of 3-16ths-in. steel rod fitted at one end with a cast-iron wheel to which a handle is fastened. The driving pulleys were bushed in the following manner: a piece of ⅜-in. brass rod was taken and two pieces of ½-in. long were cut off; these were drilled so that they would just fit on the spindle nicely. Next a piece of ⅛-in. brass wire was taken, ¾ in. long, and threaded with a screw, and

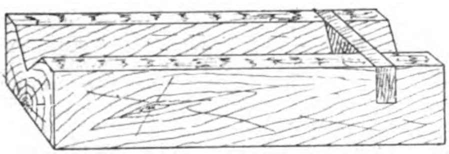

FIG. 1.

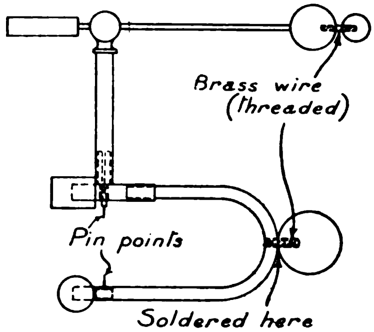

FIG. 3.

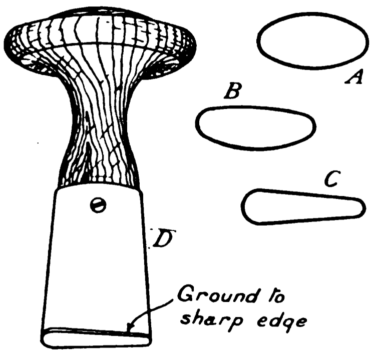

FIG. 2.

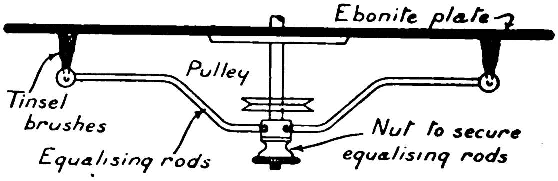

FIG. 4.

DETAILS SHOWING CONSTRUCTION OF WIMSHURST MACHINE.

end of the plug into it. A piece was then cut off the front arm of the collector and the end of the short limb thus left is split a little way down with a hacksaw, and on this end the piece of tube was fitted so that the end of the pin point on one side corresponded with that on the other. The arm of the discharger was then placed on the plug, and I was then able to adjust the discharging rod to suit the length of spark required. It will be understood, of course, that this was done with both dischargers (see Fig. 3).

On the end of the piece of brass tube nearest the spindle a cap of ebonite is fitted to prevent leakage from the collectors to earth through the spindle. The collectors are supported by the rod, which is connected to the inner coating of the jars, and also by an ebonite pillar at the back. To make this pillar I took two pieces of ebonite rod 7½ ins. a hole was then drilled through the bushes down to the spindle, and tapped with a thread to correspond with that on the wire. When these bushes were put in their place in the pulleys, slipped on the spindle, and the pieces of wire screwed down, the pulleys were held perfectly rigid. The driving handle is removable, and a similar pulley to those used on the spindle, only smaller, is made to replace it. When the pulley is connected up to a flywheel driven with a pedal the plates are driven at a much more regular speed than that obtained by driving by hand, and it also enables the operator to use both hands in the manipulation of auxiliary apparatus.

A few words as to how I made my sectors may be of interest to some readers who may turn their hand to this interesting branch of model making. My method of procedure was this: a piece of ¾-in.

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thin drawn brass tubing was taken and flattened out somewhat by hammering until on looking at the end it appeared as shown at A, Fig. 2; next the tube is turned over and hammered to the shape shown at B; next I continued hammering until I made both sides even, when it appeared like C. Now all that remained to be done was just to round the ends nicely; the edges of the punch were then ground on an oilstone. For convenience I fitted a handle to the punch. The appearance of the finished tool is shown at D.

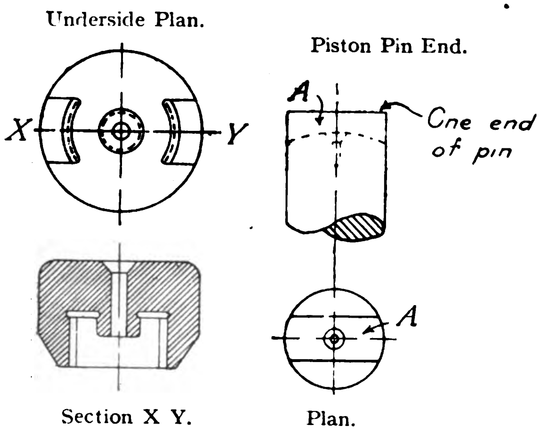
Workshop Notes and Notions.

[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 Drilling Jig.

By "SREGOR."

The accompanying sketch illustrates a drilling jig for centreing the ends of piston pin ends and shows a method of securing the pin in place in the piston, which is used by many motor manufacturers. The processes through which the pin goes during its manufacture are—turning the diameter to grinding size, which should be about ·005 in. above finished size, after which the slots A are milled in each end, when the centres are drilled. It is obvious that these centres must be within a few thousandths of an inch of being central with the pin to ensure the diameter cleaning up to size when grinding,



DRILLING JIG.

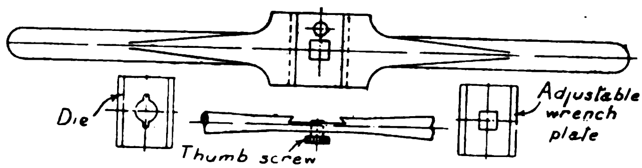
and the method shown herewith guarantees this accuracy. Also it provides for rectifying any inaccuracy of the drilling of the slots out of centre with the diameter, after they are ground on these centres. It is assumed that the turning process is done on a Capstan lathe, or, if done between the centres, these would be milled out by the milling operation. Referring to the sketch, it will be observed the jig can be made complete at one setting as regards the turning operation which ensures the recess which fits the outside of the pin being true and central with the centre hole and the centre projection which fits in the slot. A portion of the diameter is cut away to relieve the bearing surface and allow the centre piece to more readily enter the slot. The top of jig is slightly countersunk to allow the drill to enter more readily.

Die Stock and Tap Wrench Combined.

By JOHN HEYES.

The length of the wrench shown is 13 ins., which is sufficient for a ½-in. tap. It should be forged to the shape shown, the slotted part can be drilled and filed out afterwards. In the centre of the slotted part, drill a hole and file it out to the square form ½ in. diagonally. Drill the hole and tap same for a ¼-in. thumbscrew, which should be milled. The sides of the square hole should be case-hardened as follows: Heat the centre of the wrench to a red heat, then round the part to be case-hardened, spread a little prussiate of potash, rubbing around with an iron rod. When well melted, quench in cold water. Repeat this two or three times.

The wrench and die plates should be made of



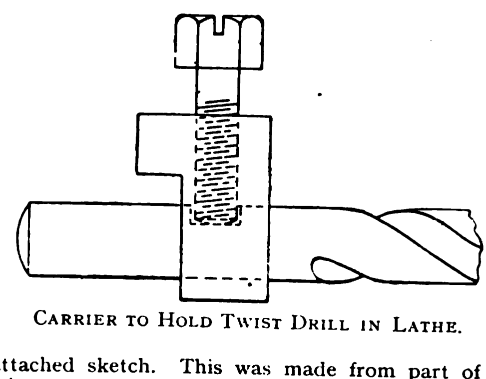
COMBINED DIE STOCK AND TAP WRENCH.

tool steel, the edges filed bevel to suit the slotted part of the wrench. It will be evident that the centre of these steel plates can take any form required. They should be about ¼ in. thick. It is a handy and useful tool in the workshop.

Drilling in Lathe.

By A. GREEN.

The ordinary three-jaw self-centreing chuck will not hold twist drills so that a satisfactory cut can be obtained, and to get over the difficulty I made a small carrier to fit over the drills as shown in



CARRIER TO HOLD TWIST DRILL IN LATHE.

attached sketch. This was made from part of a ⅜-in. gas socket—that being the thing that first came to hand. Part of this was sawn away leaving about ⅜ in. of the diameter projecting which fits between

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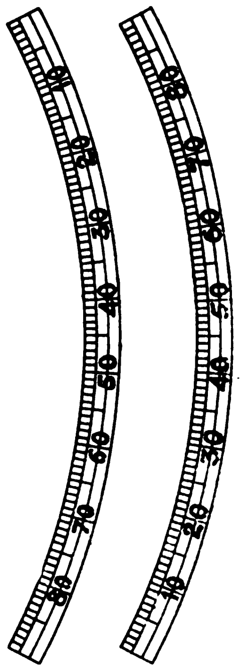
the chuck jaws and acts as driver. A setscrew was put in at the widest part and a flat filed on drill with the edge of file, forming a slot across, to take the end of setscrew. When the setscrew was screwed home it engaged in this slot and thus prevented the drill being pushed through chuck by pressure of feed, and at the same time made a positive drive. I recommend fellow readers to make one; they will find it answer the purpose well, and make it unnecessary to go to the expense of a proper drill chuck.

A Correction, *re* Angle Indicator.

By an oversight we regret that an error has crept into the note on "A Cheap, Reliable Angle Indicator,"



which was described in this column in the issue for October 31st. Figs. 1, 2, and 3 are there reproduced to one-half full size, and not one-third as stated. Fig. 4 is herewith shown full size, so that the gradations may be cut out and stuck in position required, as suggested in the article.

According to *L'Electricien*, a Vienna firm has recently placed on the market brushes made of glass, which are to replace emery cloth for cleaning and polishing the commutators of dynamos and motors. These brushes are said to clean the commutators without scoring the metal, and their use avoids the inconveniences and dangers of emery cloth.

Engineering Works and Accessories for Model Railways.

By Ernest W. Twining.

(*Continued from page* 478.)

Since writing the previous instalment of this series I have had an opportunity of examining closely the western end of No. 2 tunnel (illustrated in Fig. 2), and found it extremely interesting to note the great hollow left in the side of the hill by the landslip to which I have referred.

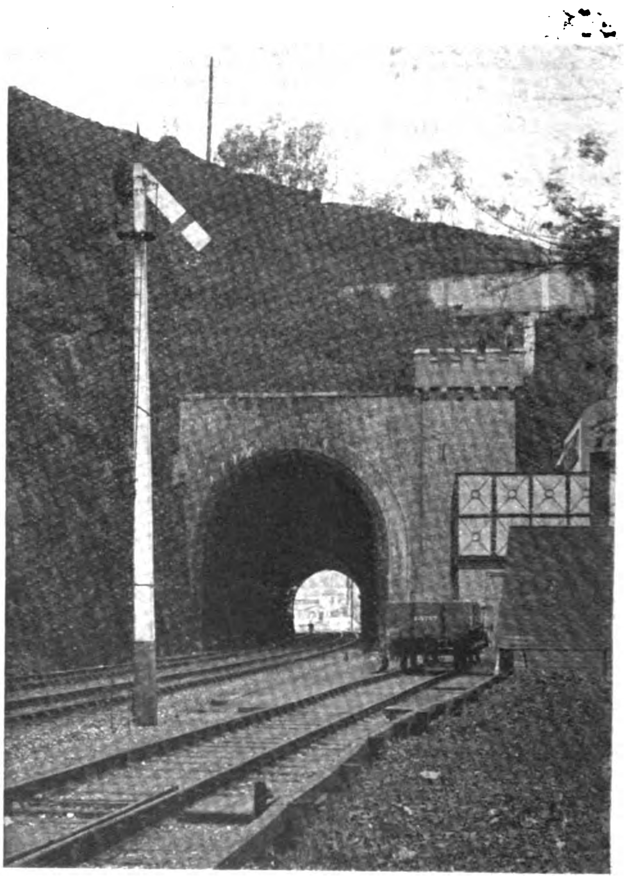


Fig. 6.—The Eastern End of Tunnel (now No. 1) near Bristol, G.W.R.

This is still clearly defined, although overgrown with woodland, and so perfectly is the cavity formed that it seems as though some great scoop had clearly cut away many tons of the hillside. A photograph (Fig. 4) taken at the time of my recent visit may prove of interest, for it will give an idea of the great weight and size of the masonry of the tunnel front, both of what exists and also of what was intended. The square portion nearest the foreground of the picture is the lower half of what was to have been a great square tower. This would have been embattled at the top, and somewhere

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near the centre of its height on the face of the tower there would have been a loophole in the form of a cross, one half of which is seen in the photograph. The work which included the other half was never executed.

As this tunnel would have been very beautiful had it been finished, and as some readers may prefer this tunnel is very similar to the western, and a comparison between Fig. 5 and the photograph (Fig. 6) will show how much they would have resembled each other had the western end been completed. The elaborate wall capped by battlements, however, renders the western end the more ornate. Measurements for the masonry of the

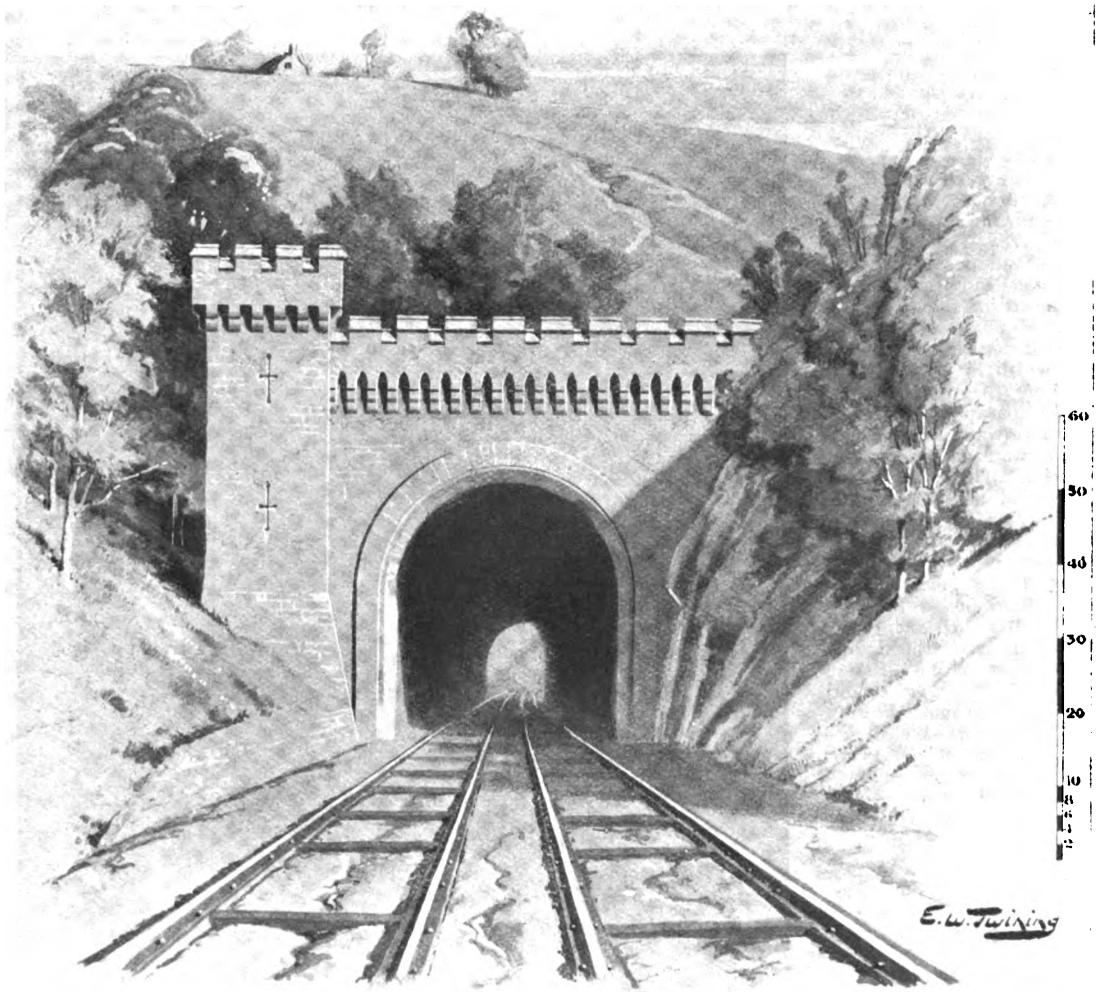

FIG. 5.—THE WESTERN END OF NO. 2 TUNNEL (NOW NO. 1) AS IT WOULD APPEAR IF COMPLETED.

to model it as a finished work instead of reproducing its incomplete state, I give a drawing showing what the appearance of the front would have been like had the landslip never occurred (see Fig. 5). A fine irregular line on the drawing running diagonally across the masonry marks the limit of the existing work.

I have already stated that the eastern end of eastern front can be obtained from Fig. 5 since the measurements in each case are practically the same, except that the tower and wall of the eastern front is somewhat less lofty.

East of the "Long" tunnel, the Conham or western end of which was shown in Fig. 3, there used to exist a short one 111 ft. in length cut through pennant rock, but this disappeared

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gradually years ago as the result of quarrying operations. No special architectural features make it worthy of further mention.

(*To be continued.*)

The Junior Institution of Engineers.

A VISIT of this Institution was recently paid to the Blackfriars Bridge Widening Works, through facilities kindly extended by the engineer, Mr. Basil Mott, M.Inst.C.E. The members, about one hundred in number, were received by the resident engineer, Mr. D. Anderson, and Mr. H. Cunningham, engineer to the contractors, Messrs. Sir William Arrol & Co. Divided into groups, they were first shown the working drawings, and a description of the operations being carried out was given. The existing fascia and parapet on the up-river side are being removed for the insertion of three additional ribs at 10 feet centres, increasing the width by 30 feet, and making the distance between parapets 105 feet, the roadway to be 73 feet wide, and each footpath 16 feet. The L.C.C. tramway will be laid on the western side. The members, in the course of the inspection, saw the last one of the pier caissons to be sunk on the staging preparatory to being let down from overhead girders by means of hydraulic jacks. The air compressors, cranes, hoists, etc., are worked electrically by current supplied from the public mains, so that the smoke nuisance may be entirely avoided.

Altogether, a most enjoyable afternoon was spent in the examination of the numerous features of engineering interest, and before dispersing the members' acknowledgments were conveyed by the chairman of the Institution, Mr. Frank R. Durham.

A visit will be made on Saturday, November 23rd, at 10 a.m., to the Royal Arsenal, Woolwich.

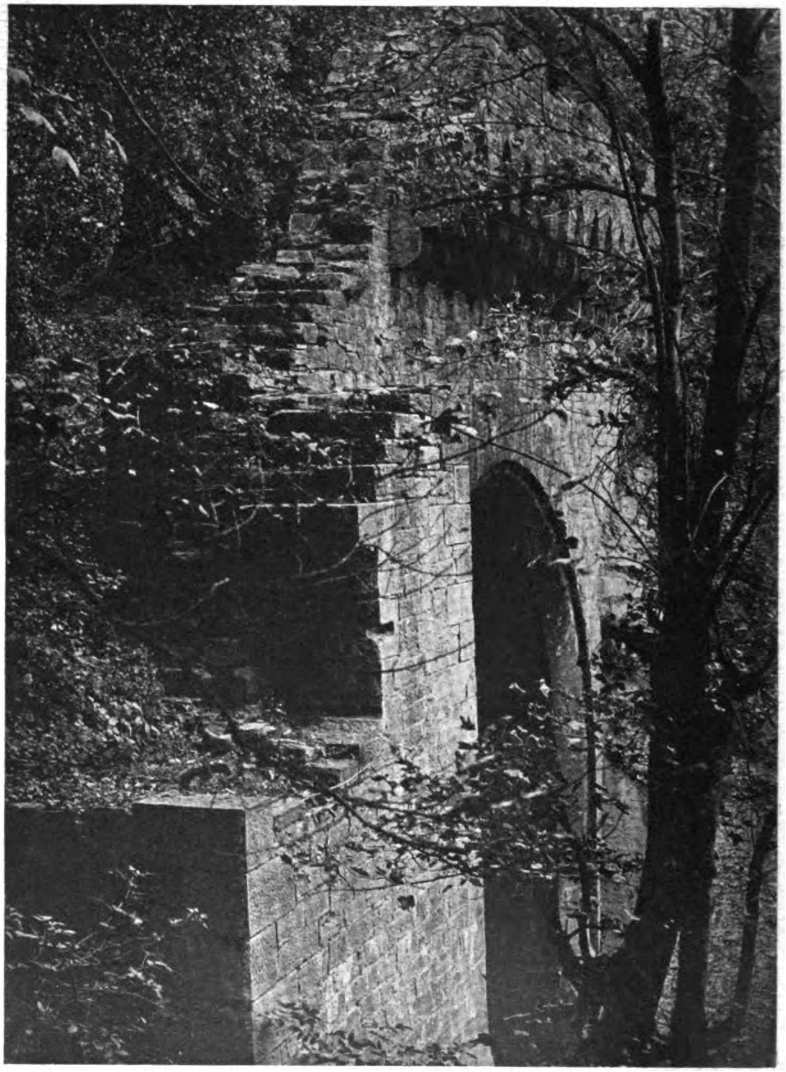

FIG. 4.—THE WESTERN END OF NO. 2 TUNNEL (NOW NO. 1) NEAR BRISTOL, G.W.R.

LIVERPOOL AND DISTRICT ELECTRIC ASSOCIATION.—The members paid a visit to the Mersey Railway Generating and Pumping Station, Birkenhead, on Saturday, the 2nd inst. The party were much interested in the very large generators, switchboard, boilers, pump-house, etc. At a meeting held on Nov. 5th, a discussion took place on "The Commutation of Direct Current Machines," opened by Mr. S. Frith, the chair being taken by Mr. W. H. Hamilton. In the course of his remarks, Mr. Frith referred to the effects of "Cross Magnetisation" and "Remagnetisation," lag and lead; also carbon brushes and auxiliary poles. At the meeting held in the Common Hall, at 8 p.m., on Tuesday, Nov. 19th, there was some further discussion on the subject.—S. FRITH, Hon. Secretary and Treasurer 77, St. John's Road, Bootle, Liverpool.

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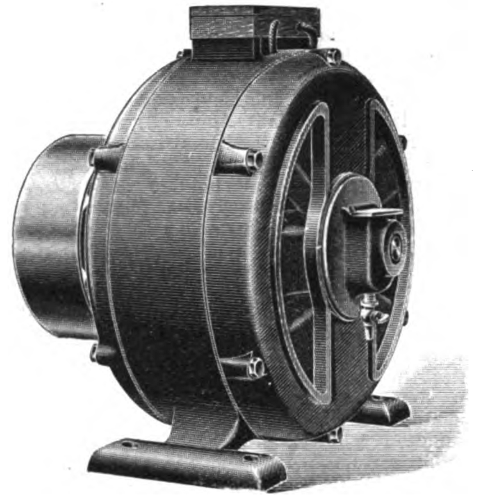
Electric Power at "The Model Engineer" Exhibition.

An interesting problem arose in connection with the supply of electric current at The Model Engineer Exhibition. Mr. Howgrave-Graham required single-phase alternating current at about 60 volts pressure for the experiments shown at his lectures on "Electric Oscillations and Waves." The Royal Horticultural Hall is connected to the Westminster Electric Supply Company's mains, and the current available is continuous at 200 or 400 volts pressure. An alternating current of about 30 amps. at a frequency of 50 periods per second, approximately, was wanted. If a rotary converter was used it would have to be of about 1½ kilowatts size and, therefore, a fairly substantial machine. A step-down transformer would also be necessary, as the alternating volts given by a rotary converter supplied with continuous current have a fixed ratio to the voltage at which the continuous current is supplied to the machine. A converter supplied with continuous current at 200 volts pressure would give single-phase alternating current at about 140 volts pressure.

No suitable rotary converter was available, however, but thanks to the kindness of two manufacturing electrical firms, the difficulty was solved by using an alternator driven by belt from an electric motor. This is, perhaps, an obvious solution, but alternators of so small a size are not so plentiful that one can be obtained anywhere or wound to requirements at short notice. There was also anxiety to have machines which would be certain to work well, as the experiments depended almost entirely upon this supply of alternating current.

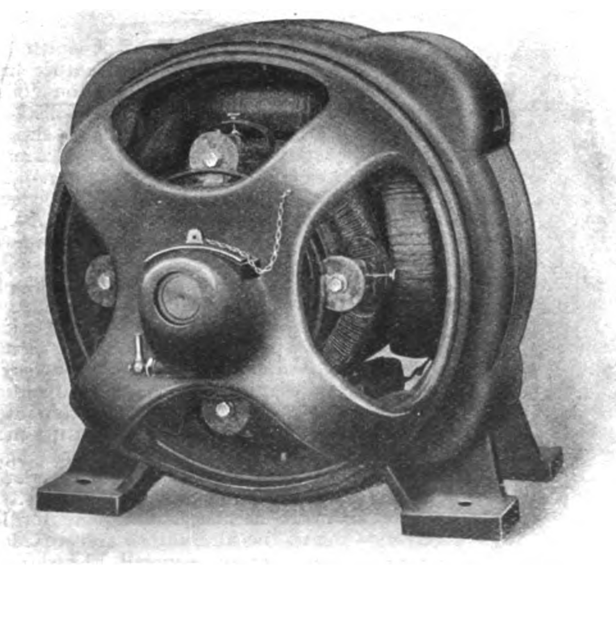
Messrs. The Crypto Electrical Company, of



Crypto Electrical Co.'s Small Power Alternator.

Bermondsey Street, London, consented to lend one of their small slip ring alternators, 2 kilowatts size, a machine particularly suitable for experimental work; and, further, altered the windings to meet our requirements, though their staff were extremely busy and working overtime. This settled the generator question, but not that of the motor. We found a friend, however, in Mr. T. L. Reed Cooper, the manager of the Johnson Lundell Electric Traction Company, Ltd., of Southall, Middlesex, and our difficulties were over when that gentleman said that his Company would send a 4 h.-p. shunt-wound motor with starter for our use to drive the alternator. With so well-known a name as Johnson Lundell upon it, the motor, we were sure, would do everything expected from it.

The machines were bolted upon a beam of wood about 5 ft. apart and connected by flat driving belt. It was necessary to adopt some arrangement of this kind as the machines were placed behind the lecture table, and we were not allowed to make holes into the floor of the room. Both motor and alternator worked splendidly from the start, the experiments were a brilliant success, and the small cost of the current used from the mains was a testimony to efficiency of both motor and alternator. Regarding the motor, its rated power was much more than required; but the results emphasised the



Johnson Lundell Electric Motor.

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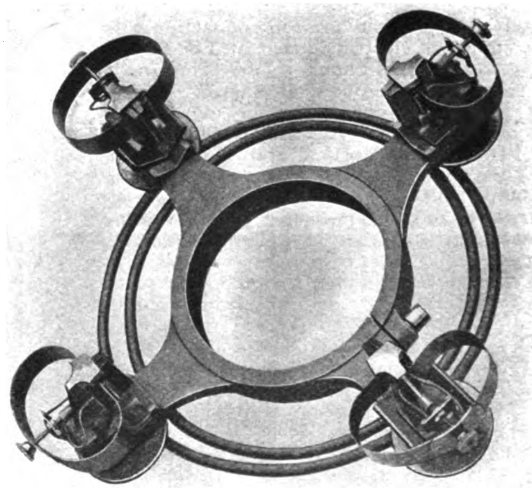
sound advice that it pays to underload rather than overload a motor, and to get a good one.

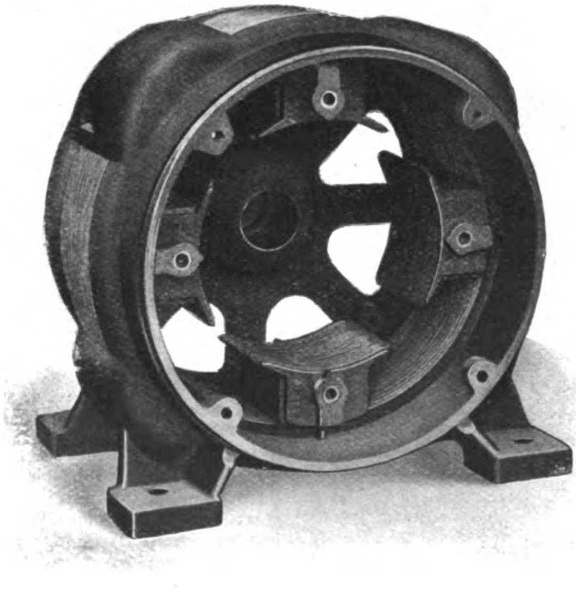
The motor has some special features. Armature is former-wound with very neat coils; at each end is a fan-shaped casting which circulates a steady current of air through the commutator and out at air spaces provided at each end of the coils. The field-magnet yoke is laminated and composed of rings of finest Swedish steel built upon a drum and cast together with the frame, thus avoiding all holding-in bolts which would tend to interrupt the magnetic path. The pole-pieces are also laminated and held in position by means of strong screws, which pass through the frame outside the laminated yoke, and pull upon bosses formed on the end plates of the poles. Each brush holder is fitted with two brushes. The leading brush, pressing upon the approaching commutator segment, is of soft quality carbon. Its function is to convey the current into and away from the commutator. The trailing brush, pressing upon the preceding commutator segments, is of hard quality carbon; its function is to minimise the sparking at the commutator segment which is leaving the brush in its course of rotation. The soft leading brush gives a low contact resistance and, therefore, is suitable to convey the current. The hard trailing brush gives a high contact resistance and, therefore, assists better to stop the flow of current in the short-circuited coils under process of commutation. To provide for the unequal wear of the brushes, a special arrangement of steel bow spring is fitted. The ends of the spring press upon the respective brushes which slide in separate slots. A screwed nut presses upon the centre of the bow, and by this the pressure is adjusted.



THE PATENT DUPLEX BRUSH GEAR.

The Crypto alternator is fitted with a laminated rotating armature having eight poles upon which the coils are wound. The current is collected by brushes which press upon slip rings placed at each end of the armature. The field-magnet is stationary. There are eight poles of soft cast steel attached to the cast-iron frame. An exciting coil is wound upon each pole.

These notes were omitted from our special Exhibition report so that they could be given in greater detail and space provided for illustrations of the machines. The courtesy extended to us by the firms mentioned was further evidence of the interest taken in THE MODEL ENGINEER Exhibition by many engineers engaged in "big" business. We tender our very best thanks to Messrs. The Crypto Electrical Company for lending us the alternator, and to Messrs. The Johnson Lundell Electric Traction Company for lending us the electric motor and starting switch; and we must not omit to mention Messrs. J. Christopher and Sons, one



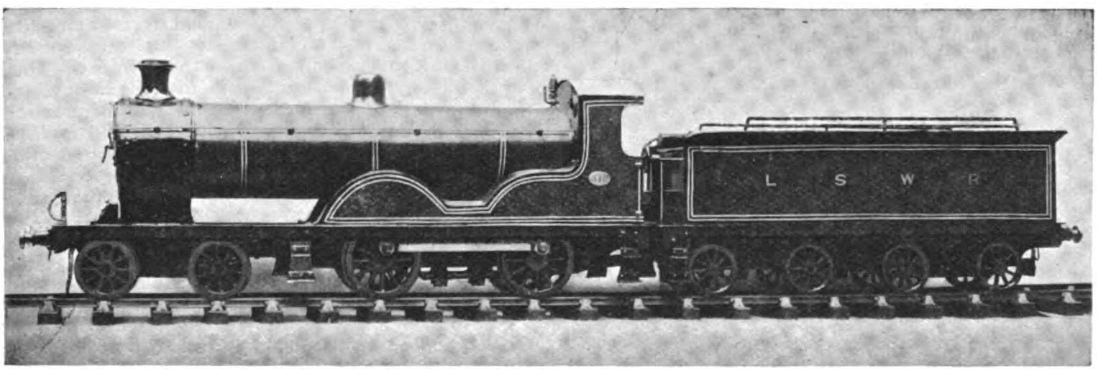
JOHNSON LUNDELL ELECTRIC MOTOR, SHOWING ARRANGEMENT OF MAGNET POLES.

of the exhibitors, who were kind enough to lend the leather driving belt which ran "real sweet."

A ⅝-in. Scale Model L.S.W.R. Locomotive.

By Walter J. Russell.

THE model illustrated by the accompanying photographs was designed and built by myself during my leisure hours in the last eighteen months. The frames were cut from ⅛-in. mild steel with a hacksaw. The foot-plating was cut in the same way and trued up with files, etc. Having finished the plate-work, I started the wheels (bogie wheels 2 ins. diameter and driving wheels 3 ins. diameter), drilled all of them, and fitted them with ⅜-in. axles, then made bearings (which are not fitted with springs), and I find she runs just as well without them. I then made the bogie truck for the front of locomotive, then fitted all together, and made a short length of line to try her on. The next job was to fit the motion-work, which is as follows: a single cylinder (¾-in. bore, 1¼-in. stroke) is all that is used, with slip-eccentric reversing slide-valve. The only castings used were for the cylinder and steam chest; all the rest of the parts were made from sheet and scrap metal, and are not numerous, only consisting of connecting-rod, eccentric ditto, eccentric sheaf (turned from brass rod), the foregoing being worked from mild steel and fitted with separate brasses. Glands and other screw parts were made from gas fittings (such as adapters and nipples), which I find exceedingly useful for turning little odd bits out of. The coupling-rods were the last part of the motion-work I did; they were made from two thicknesses of mild steel, soldered together, filed up, and drilled; and they fit all right. The next job I tackled was to make the boiler, which was very successful, being made of solid-drawn copper tube, with two brass ⅛-in. ends and ⅜-in. stay through middle, five ¼-in. water tubes, and has the following mountings: water gauge, three cock, and 5-32nds-in. glass; and pressure gauge, registering up to 100 lbs. The regulator is worked with the ordinary plug cock, with the handle in the cab, and the cock in the smokebox connected with steel rod. The safety valve is also in the smokebox, and is pressed down to about 75 lbs. Steam is taken from the steam-dome in the usual manner, and exhausted out of the blast pipe up the chimney. The working pressure is about 45 lbs., with which she runs at a good speed on a straight track. Having finished boiler and steam connections (3-16ths-in. steam and ¼-in. exhaust pipe), I next considered lagging the boiler, which was done with sheet asbestos and a short length of stove pipe 3½ ins. diameter. I obtained a casting for the steam-dome and chimney, also buffers, from my patterns; ⅜-in. angle brass was largely used in making the framework, and ¾-in. each end. The cab is all built up with sheet iron, and brass is partly used for the wheel-splashers. The smokebox was made with sheet iron, wrapped round twice to get the required size, and riveted to boiler lagging; in the front it has the double-hinged door, with proper locking handles, as in the real thing. I might say I have copied all the details as well as my workmanship would permit. The locomotive is fitted with vacuum brake pipe, drawhook, chain for coupling, lamp (with bracket), spring buffers, etc. The roof slides off to facilitate driving.



Mr. Walter J. Russell's ⅝-in. Scale Model L.S.W.R. Locomotive.

The tender is fitted with double-bogie trucks of four wheels each, which it is not necessary to describe, being very much like the locomotive. Below the footplate level is a rectangular brass container to hold methylated spirits for the six-burner lamp, which is used for firing the boiler. Rubber tubing is used for connections between locomotive and tender. Above the foot-plating is the water supply, which will supply the locomotive for over 1½ hours, and the spirits the same. In the middle of the tender is the force-pump, with check valve in the cab, brass tube and screw-union for connections. The railing round the top is flat mild steel wire, riveted together with countersunk rivets. Screw brakes worked from the cab go on all the wheels of the tender, as can be seen from the photograph. Water is poured into the tender through a screw manhole on top. The painting and lining was done in the proper L.S.W.R. colours, being

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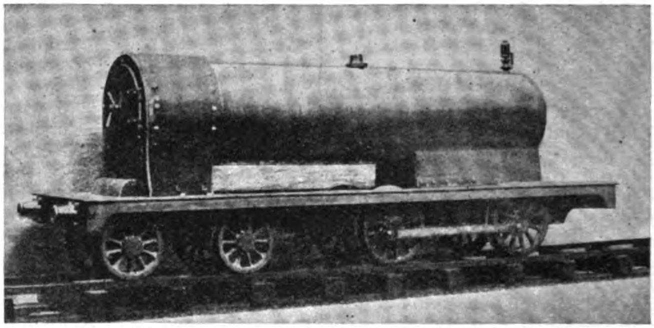
chiefly green and black, and all the motion-work polished up bright. Before having fitted the wheel-splashers, I tried her under steam, standing with my feet on either side of the boiler on the footplate. With this heavy weight over her driving wheels, they could not possibly slip, and with a little start she just managed to haul me along at a nice speed. I think this was a very good performance, considering she has only one cylinder $\frac{3}{4}$-in. bore by $1\frac{1}{2}$-in. stroke, but heavily built. Steam pressure about 60 lbs. The boiler is $2\frac{1}{2}$ ins. diameter and 14 ins. long, and will last for twenty minutes without use of pump.

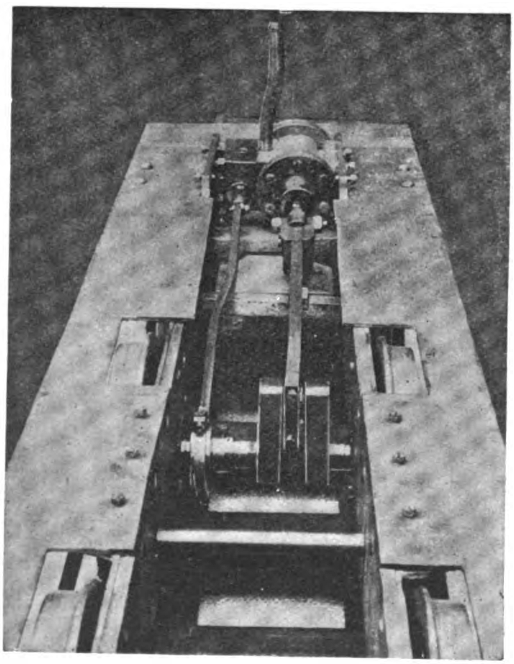
A few of the measurements are as follows: Length of engine and tender over all, 40 ins.; length of engine only, $22\frac{1}{2}$ ins. (not over buffers); width of footplate, $5\frac{1}{2}$ ins.; height of locomotive from rail to chimney, $8\frac{3}{4}$ ins.; total weight in working order, 32 lbs. Only eight castings were used (except the wheels) in its entire construction, being nearly all built from sheet metal and scrap.



SHOWING ENGINE PARTLY FINISHED.

For the Bookshelf.

ENGINEERING WORKSHOP PRACTICE. By Charles C. Allen, Lecturer in Engineering Municipal Technical Institute, Coventry. London: Methuen & Co. Price 3s. 6d.; postage 3d.



SHOWING ARRANGEMENT OF CYLINDER, ETC.

An excellent book, one which every machine shop or fitting shop apprentice or mechanical engineering student might buy and read to his advantage. In fact, many full-fledged mechanics would profit by the information contained in its pages. We can also recommend it to amateurs, not, perhaps, to study seriously, but to read easily according to the inclination of the moment. They will find much to assist them in their hobby, and obtain an insight into modern mechanical practice, which would be certain to help them and increase their interest in using tools. The book is a selection of useful information upon workshop processes, as developed by modern practice. It is not a catalogue of machine tools, and the illustrations are chiefly line drawings; there are no mathematics, and the explanations are very simple and clear.

Chap. III on Measuring and Gauging is capital, the sketches and examples showing how to use and read micrometer and vernier calipers are just the thing for mechanics. We are pleased to note the author points out that nothing can be made with absolute accuracy, but all parts are of necessity within limits of error depending upon the refinement of measuring appliances available and fixed according to the requirements of the work. Information is given about transmission of motion by gearing, cutting tools, tool steel and its treatment, lathe work, drilling, milling, grinding and lapping, screen cutting, and gear cutting. There are some useful tables and notes on chipping, filing, and marking out. The author refers upon page 92 to a taper turning attachment as generally consisting of *a slotted slate* fixed to the lathe bed. There is an appliance known as the slate taper attachment; perhaps he had this in mind, but the words are confusing. In the first paragraph of Chap. I it is stated that "Beginners should study carefully and, if possible, work the whole of the sixty exercises for which detailed instruction is given." We think this sentence could have been well left out. No two students are alike, some may be hindered by such directions. The exercises referred to are very good—an amateur or student may benefit by the knowledge acquired—but it is better left to his discretion as to whether he need read or work any at all. A short appendix on high-speed steel concludes a book that is sure to be of assistance to novices in mechanical engineering work, to professional mechanics, and to inspectors of finished parts of machines, etc.

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Elementary Ornamental Turning.

By T. Goldsworthy-Crump.

THERE is an old saying that "All work and no play makes Jack a dull boy." It is not intended to apply this exactly to the case of the model engineer, but only so far as to actual model making, and, as a recreation from a recreation, it is hoped that the practice and study of elementary ornamental turning will provide that relief which will prevent the aforesaid dullness, and at the same time foster a study of design and form, combined with ingenuity in execution, which shall afford pleasure to the maker and bring forth expressions of admiration from all lovers of the beautiful, curious, and wonderful work which the ornamental turner is able to produce.

In the following articles it is intended to describe the tools, methods, and procedure for producing many plain and ornamental forms, and the various movements required in their production, most of which can be accomplished with tools already to be found in the amateur turner's shop, or can easily be made as required.

As an incentive and to show what can be accomplished with home-made apparatus, the whole of the work illustrated has been produced with home-made tools—with the exception of the lathe and slide-rest—and the results are quite equal to any that could have been obtained had expensive fittings been employed.

The most important tool, of course, is the lathe, as on its accuracy depends the exactness of the work produced. It is necessary that the headstock should be without any perceptible shake, and that it be fitted with a division plate or other means of dividing. The slide-rest should also be in good condition, and any shake or slackness carefully taken up, otherwise good work is impossible. It is necessary that an overhead be available for driving the various cutters, and as a commencement of additional apparatus, a drill spindle and a vertical or universal cutting frame should be provided.

There are many forms of overhead, but perhaps the simplest for purely ornamental high-speed work is that shown in Fig. 1. It consists of an upright support with a movable arm, four cast-iron pulleys, a 7-lb. weight, and a shilling clock line. The dimensions must vary according to individual circumstances.

The drill spindle and vertical cutter have been treated of so often that a detailed description is unnecessary. Suffice it to say that the pulleys should be small and the bearings and adjustments in perfect condition. The various forms of drills and cutters required will be described and illustrated later.

It is presumed that a set of ordinary wood-turning tools are at hand, and that the reader is fairly adept in their use, as in nearly all cases the general form is produced by hand-turning alone, and the work properly finished before the ornamentation is commenced.

Specimen of Ornamental Turning.

There are very many substances and materials that may be used for ornamental work, the most suitable—and expensive—being ivory. As a substitute white xylonite can be used with advantage, although great care should be taken as it is inflammable stuff, and when once alight burns fiercely, especially the shavings. Next to these come the hard woods, such as coco, African black wood, lira, lignum, box, etc., also vulcanite, ebonite, and other preparations of a similar character, the materials being selected for their size and colour, having regard to the work to be produced.

The soft woods are of little use from an ornamental turner's point of view, as the grain is too open to allow of satisfactory work being done. Gold, silver, brass, and other metals can be used for some objects and embellishments, with very pleasing results.

As a commencement it is proposed to show and describe the many uses and movements that the drill spindle is capable of executing, and for this purpose a piece of hard wood, say 4 ins. in diameter by ½ in. thick, is secured to the faceplate or other chuck and properly faced up, the slide-rest being carefully set at right angles for this purpose. The drill spindle is now fixed in position on the slide-rest, so that its shank is parallel with the lathe bed, and its pulley towards the tailstock. The centre of the spindle must be *exactly* to height of lathe centres, this being most important. A drill is now selected—say No. 2, and secured in a perfectly central position in spindle. The overhead is next adjusted so that the line runs freely from flywheel to pulley, and in such a position that there is no likelihood of the line running off. The index finger is then clamped to engage with one row of divisions commencing at zero.

The slide-rest with drill is adjusted to, say, ¼ in. from edge of work, and also ¼ in. away from face of same. The drill spindle should now be put in motion and driven at a high rate of speed in its proper direction. It should then be slowly advanced into cut, making a penetration of, say, 1-16th in. The position of handle controlling the feed-screw should be carefully noted, or a fluting stop fixed so that the depths of succeeding cuts may be the same. The drill is withdrawn and the division plate with work revolved "*x*" divisions and held by index, the drill being advanced and withdrawn as before. If this is continued the result will be a ring of holes all equally spaced and of the same size and depth, the number and size being governed by the number of divisions between each hole and the size of the drill employed. We will call this movement A (see Fig. 2).

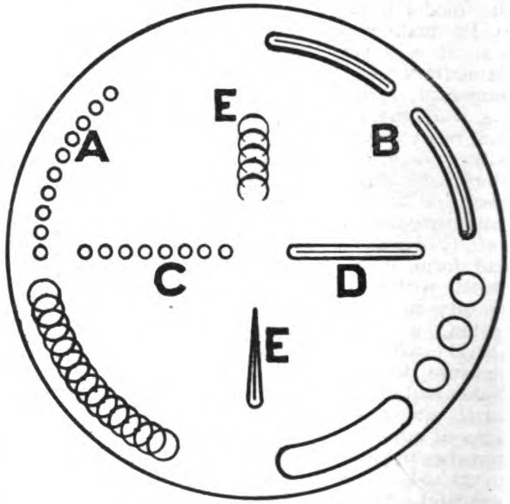
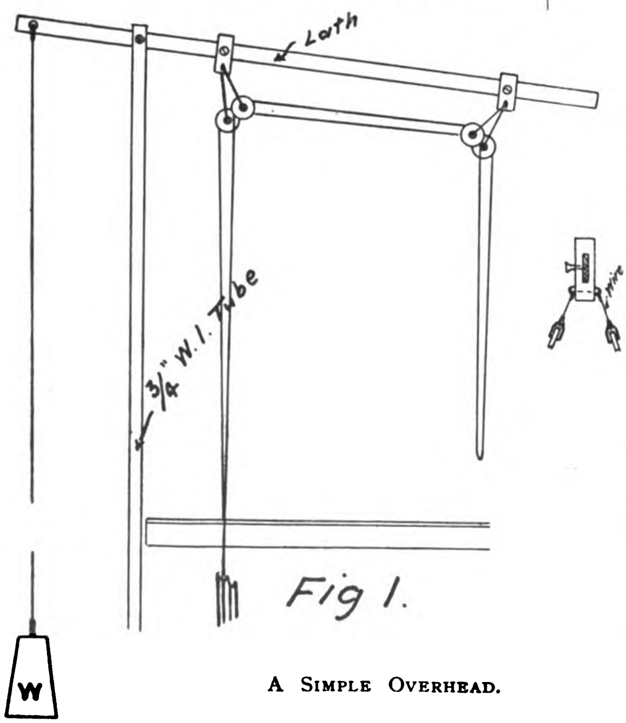


FIG. 2.



A SIMPLE OVERHEAD.

The drill can now be advanced a ¼ in. towards the centre and the index pointer again placed at zero. The drill is to be brought into cut as before and withdrawn. "*x*" divisions are now taken, and the drill brought into cut, and while still there the index pointer is carefully withdrawn, and the headstock slowly revolved so that the drill will cut a circular groove towards the first made hole stopping exactly in this hole (movement B).

The work can now be revolved any convenient distance, and again held by the index finger, the drill being advanced into cut and withdrawn. The cross-slide screw is now revolved one or two turns, carrying the drill across the work. The drill is again advanced and withdrawn, the cross-slide again moved the same distance, and drill advanced and withdrawn (movement C).

Instead of withdrawing drill, advance cross-slide, thereby cutting a groove across face of work (movement D).

Set cross-slide at a slight angle to work and proceed as movement D, the result being a gradually increasing or decreasing groove, according to direction of motion (movement E).

As an exercise, these movements should be practised with the various drills until the user is quite proficient in the production of regular work, properly divided and of equal penetration, and also to gain a knowledge of the different effects produced by the same drill in the amount of penetration and movement employed.

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The drills must be most carefully set and sharpened, as upon this depends entirely the beauty and charm of ornamental turned work. The cut has to be *absolutely finished by the tool, no after polishing being permissible under any consideration.* The tool must leave the cut perfectly clean and highly polished, and this remark applies to every tool used in producing ornamental work.

Before describing the many figures that can be executed with cranked drills on the flat surface, the foregoing movements should be practised on the cylinder, and for this purpose a piece of hard wood, say 3 ins. long by 1½ ins. in diameter, is gripped in a chuck and turned true. The drill spindle is now set at right angles to the lathe bed and the overhead fixed up. The finger is placed at zero on the division plate, and the drill advanced by the cross-slide to such a depth as will cut a hole or bead and withdrawn. The division plate and work are now rotated "*x*" divisions and the procedure continued as described for movement A, the result being a ring of holes or beads around the cylinder.

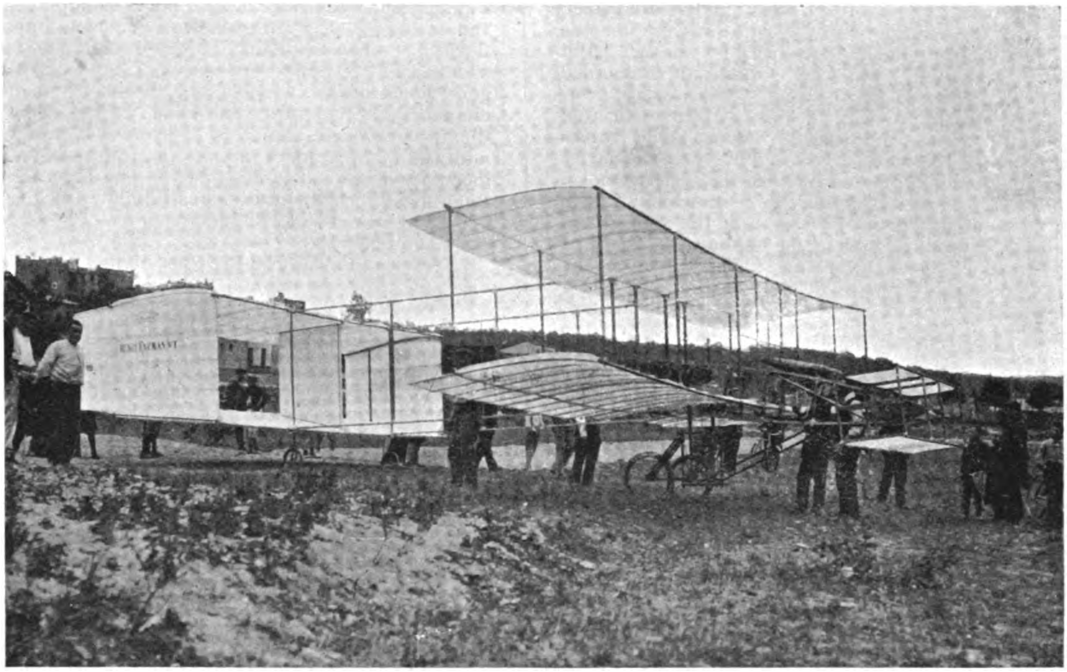
Next proceed as before, but use movement B. Movement C can also be practised, using the main slide for dividing, as also movement D, which will produce a groove along the cylinder. For movement E, the headstock must be set over or main slide swivelled to the necessary angle.

(*To be continued.*)

The Earl of Ellesmere is having another railway constructed from Ashton Field, Farnworth, to Brackley, Little Hulton, which will bring the mileage of his lordship's private mineral railways up to nearly seventy.

Flying Machine Record.

The world's flying machine record, until recently held by Santos Dumont, has now been beaten by an Englishman resident in Paris. The Santos-Dumont record was 220 metres (about 275 yds.), achieved in November of last year. Mr. Farman's aeroplane, of which we give herewith an illustration, recently made four flights, the first at eleven in the morning, the last at four. In his first flight he flew 397 yds., in his second 382½ yds., in his third 448¼ yds. This last flight was accomplished in 31 seconds. In his fourth attempt Mr. Farman flew 850 yards in 52 seconds, slightly over 16 yds. a second—over 32 miles an hour. The machine was controlled with the greatest ease, and flew at heights varying from 18 ft. to 22 ft. above the ground. During recent experiments the aeroplane was steered round a flagstaff nearly 600 yards from the starting point. In one of his evolutions Mr. Farman described the letter "S"; but it is true around an axis of 500 yards.



The "Farman" Aeroplane No. 1.

Model Yachts Destroyed by Fire.—A disastrous fire occurred on October 23rd at the Model Yacht Club House in Stanley Park. The building is the property of the Liverpool Corporation, from whom it is leased by the Stanley Park Model Yacht Club, lockers being provided for members' boats. According to a local press report, it is believed that about seventy yachts have been destroyed, many of them representing considerable skill and perseverance in their construction. We sympathise with the model yachtsmen in their loss.

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Locomotive Notes.

By CHAS. S. LAKE, A.M.I.Mech.E.

BRITISH LOCOMOTIVES FOR ABROAD.

The Vulcan Foundry, Ltd., whose works at Newton-le-Willows are at present full up with work on orders for Indian locomotives, have supplied to the Buenos Ayres Great Southern Railway several 2-cylinder compound goods engines, one of which is illustrated herewith. The wheel arrangement is 2—8—0 and the cylinders are placed outside the frames with the low-pressure on the right hand and the high-pressure on the left hand side of the engine, while the second pair of coupled wheels are utilised as drivers. The valve gear, which is of the Stephenson link pattern, is located inside the frames and actuates balanced slide-valves working at the sides of the cylinders. The latter are compounded on the von Borries system, and a special starting valve, the casing of which is seen in the illustration, projecting from the side of the smokebox near the base of the chimney, is provided for the purpose of admitting boiler steam to the high-pressure cylinder when the engine is starting with heavy loads or working up steep inclines. The boiler is fitted with a Belpaire firebox and the smokebox is considerably extended. A cab specially suited to the climatic conditions of the Argentine, and having a double ventilated roofing, is provided, and a cowcatcher is attached to the front buffer beam. The tender is carried on two 4-wheeled bogie trucks and has ample capacities both for water and coal.

Below is given a list of the principal dimensions:

Cylinders: H.-P. (1), 19 ins. diameter; L.-P. (1), 27½ ins. diameter.
Piston stroke, 26 ins.
Wheels: Truck, 3 ft. 5 ins.; coupled, 4 ft. 7½ ins.
Wheelbase: Fixed, 15 ft. 4 ins.; total engine, 24 ft. 1 in.; engine and tender, 49 ft. 8 ins.
Heating surface: Tubes, 1409·3 sq. ft.; firebox, 122·4 sq. ft.: total, 1531·7 sq. ft.
Grate area, 24·4 sq. ft.
Boiler pressure, 200 lbs.
Weight in working order: Engine, 58½ tons; tender, 37 tons: total, 95½ tons.
Water capacity of tender, 3,000 gallons.
Fuel capacity of tender, 4½ tons.

When the writer visited the Vulcan Works recently the erecting shop space was fully occupied with locomotives of the "Consolidation" type building for the North-Western Railway of India. These will be very large and powerful engines, with 21-in. by 26-in. outside cylinders and high pitched boilers with Belpaire fireboxes. The two engines practically completed at the time referred to presented a very fine appearance, even in the rough, and, doubtless, when finally painted and at work on the road, they will do ample credit alike to the designers and builders.

An order for several tank locomotives of the 0—6—4 type was just being put in hand. This is a repeat order from the East Indian Railway, and the locomotives are intended for heavy suburban passenger traffic, for which work their design eminently suits them. An illustration of one of their number appears on the opposite page. The cylinders are inside and they drive the crank axle of the middle coupled wheels. Steam is distributed to them by link-motion actuating slide-valves working between the cylinders. The design taken generally presents, in the writer's opinion, a well proportioned and workmanlike appearance, well in accordance with the latest British ideas for this class of construction. A boiler of the telescopic pattern, with ordinary round-topped firebox, is fitted and the cab is provided with sliding shutters at the sides.

The coal bunker and rear water tank are of ample capacity without the drawback of height interfering with the outlook of the enginemen when running bunker in front. A 4-wheeled bogie is employed at the trailing end of the locomotive which imparts flexibility when travelling in that direction. Steam sanding and steam reversing gear form part of the general equipment, which is of a thoroughly modern character throughout. The gauge of the railways upon which these engines will work is 5 ft. 6 ins., and the same remark applies in the case of the locomotive previously described. The East Indian tank engine has the dimensions tabulated below:—

Cylinders, 18 ins. diameter.
Piston stroke, 26 ins.
Wheels: Coupled, 4 ft. 6 ins. diameter; bogie, 3 ft. 1 in. diameter.
Wheelbase: Fixed, 16 ft.; total, 27 ft. 6 ins.
Heating surface: Tubes, 1131·7 sq. ft.; firebox, 125 sq. ft.; total, 1256·7 sq. ft.
Weight in working order: On coupled wheels, 49 tons 10 cwts.; on bogie wheels, 18 tons 15 cwts.: total weight, 68 tons 5 cwts.
Tank capacity, 2,000 gallons.
Fuel capacity, 3 tons of coal.

"PACIFIC" TYPE LOCOMOTIVE—GREAT WESTERN RAILWAY.

To those who had not previously seen the drawings of, or who had no other means of ascertaining what sort of an appearance the new "Pacific" type express locomotive now building at the Swindon Works of the Great Western Railway would present, the excellent model shown at THE MODEL ENGINEER Exhibition, recently held at the Horticultural Hall, formed an opportunity of gauging the proportions of the coming leviathan which otherwise would have been impossible.

The engine will undoubtedly rank among the finest looking express locomotives in the United Kingdom, and if, as may be anticipated, its running qualities are as good as its outlines, the Great Western Railway Company will have added to its already large stock of locomotive designs one more up-to-date type of great utility. The "twentieth century" methods of Mr. Churchward are commendable; but, at the same time, the opinion has been expressed in more than one quarter that it might be a good plan to adopt a settled design for each class of locomotive as standard and build to that design while its efficiency lasted, rather than to construct only a comparatively few engines to each design and change the latter at frequent intervals.

There can be no two opinions about the value of advancing with the times in all matters, and developments in accordance with new ideas is doubtless highly desirable; but there are few railways where so many changes in locomotive design have been made under the same locomotive superintendent, or where the practice of building so few engines to one pattern has become the rule as on the Great Western of late years.

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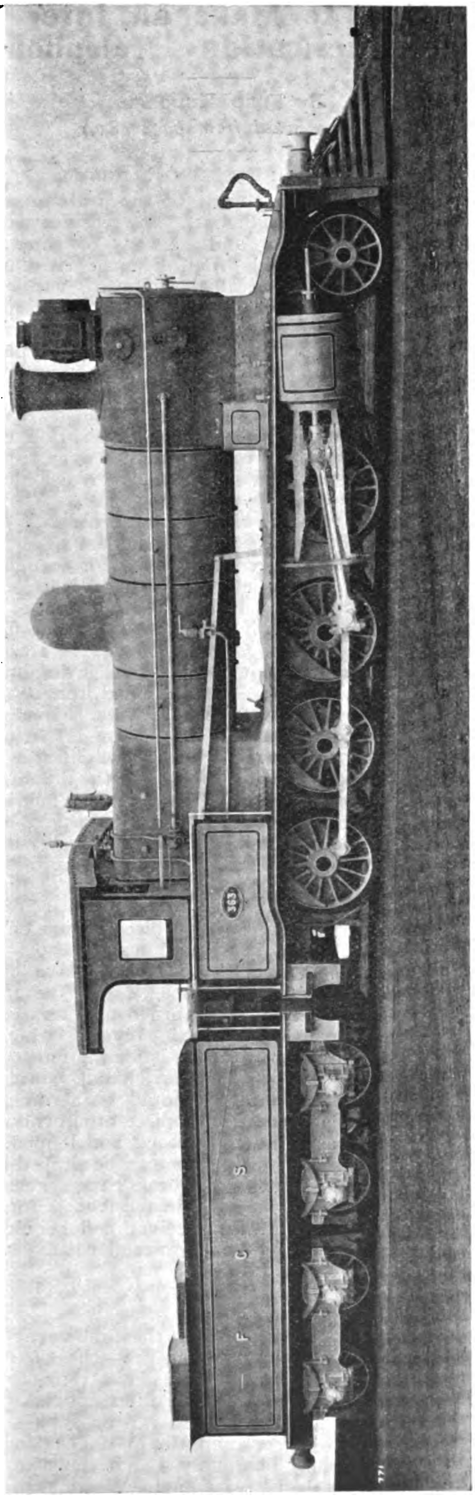
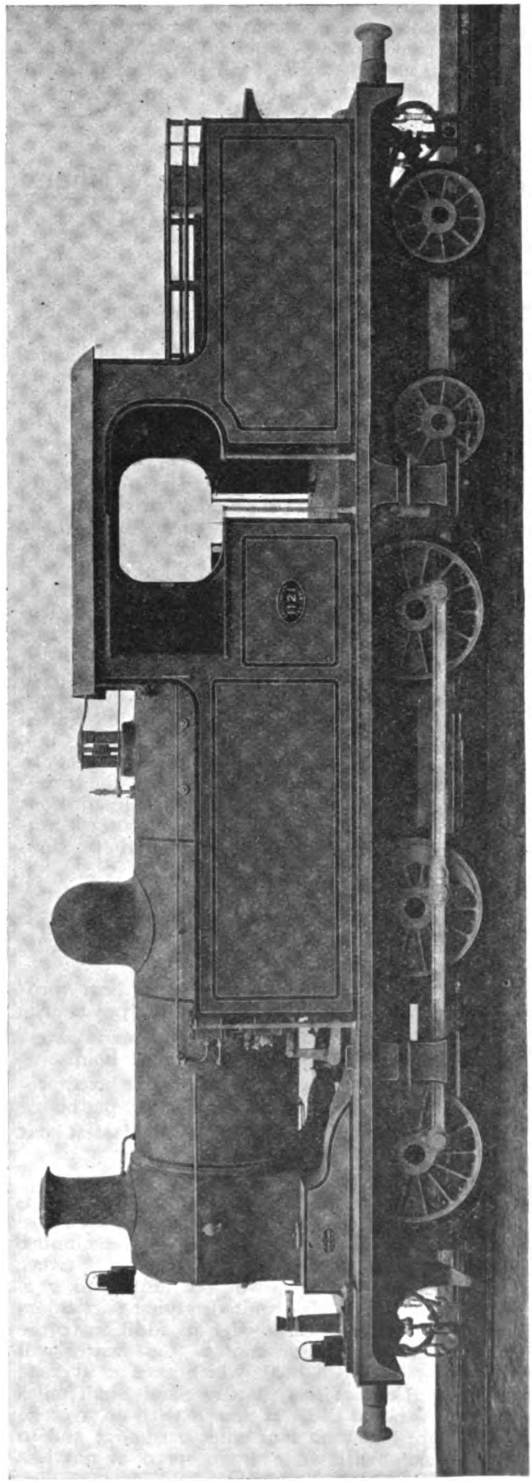


TWO-CYLINDER COMPOUND GOODS ENGINE: ARGENTINE GREAT SOUTHERN RAILWAY.



0—6—4 TYPE TANK ENGINE: EAST INDIAN RAILWAY.

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The introduction into England of the 4—6—2 type of locomotive is a matter for congratulation in engineering, and especially locomotive engineering circles, and the result will be awaited by all concerned with interest.

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prizewinners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows :—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour; and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

How to Make an Inter-Communication Telephone.

By FRED RUDOLPH.

(*Continued from page* 481.)

THE WATCH-PATTERN RECEIVER.

The general arrangement of the watch-pattern receiver is shown at A, Fig. 11. The receiver magnet is a compound one, and consists of three flat steel rings, D. Each ring is magnetised with unlike poles diametrically opposite, with one pole at the point of fixture of the south pole-piece, and great care should be taken in putting the magnet together to see that the rings are placed with their like poles together. If this is not done the magnetism will not be apparent at the soft iron pole-pieces, and it will be rendered useless. With the coil it is enclosed in a small brass case, shown in B, screwed to receive the ebonite ear-piece, E. The case can be either lacquered or nickel-plated, the latter being the better finish. The coil and pole-piece is shown at C, and consists of a soft iron pole-piece bent at right-angles. Two thin brass cheeks are driven and soldered, forming a bobbin, on which is wound the insulated wire of the receiver coil. The iron forming the core of the bobbin is insulated with a layer or two of paraffined paper and No. 40 S.W.G. D.S.C. copper wire wound on to a resistance of about 60 ohms. The diaphragm is shown at L, and is a disc of tinned iron 10 mils. thick, cut to a diameter of 2 1-16th ins. Great care should be taken that the diaphragm is perfectly smooth and not buckled in the slightest. The distance between the pole-pieces and the diaphragm is of great importance, the speaking efficiency depending more on this than on anything. The distance should be about 18 mils. or ·018 in., and for which purpose the distance ring, K, is provided. This can either be made from sheet brass or zinc of the requisite thickness. The other pole-piece of the receiver is made by screwing a piece of iron on the opposite side of the compound magnet, to where the wound coil is fixed. This is illustrated in H. The receiver cap or ear-piece, E, can be made from ebonite or hardwood turned and treated as shown on drawing. The fixing eye B, which is screwed and sweated into case, is for the purpose of hanging the receiver on the switchhook when not in use. The receiver cord should be about 3 ft. long, and can be made from a piece of electric light flexible wire, with the ends bared and looped. A small piece of indiarubber tube can be slipped over the wire where it enters the brass case, serving to protect the insulation. If the receiver is for use in a damp situation, the receiver coil should be saturated with wax or shellac to render it moisture-proof.

(*To be continued.*)

THIS year is the centenary of the first voyages of the earliest practical steamship—the *Clermont*, which was launched on the Hudson in 1807, as the result of the genius of Robert Fulton and his partner, Chancellor Livingston, and ran as a passenger boat between New York and Albany. The *Clermont* was a paddle-wheel boat only 130 ft. long, 16½ ft. wide, and 4 ft. deep. Her engines were made by Boulton and Watt, of Birmingham.

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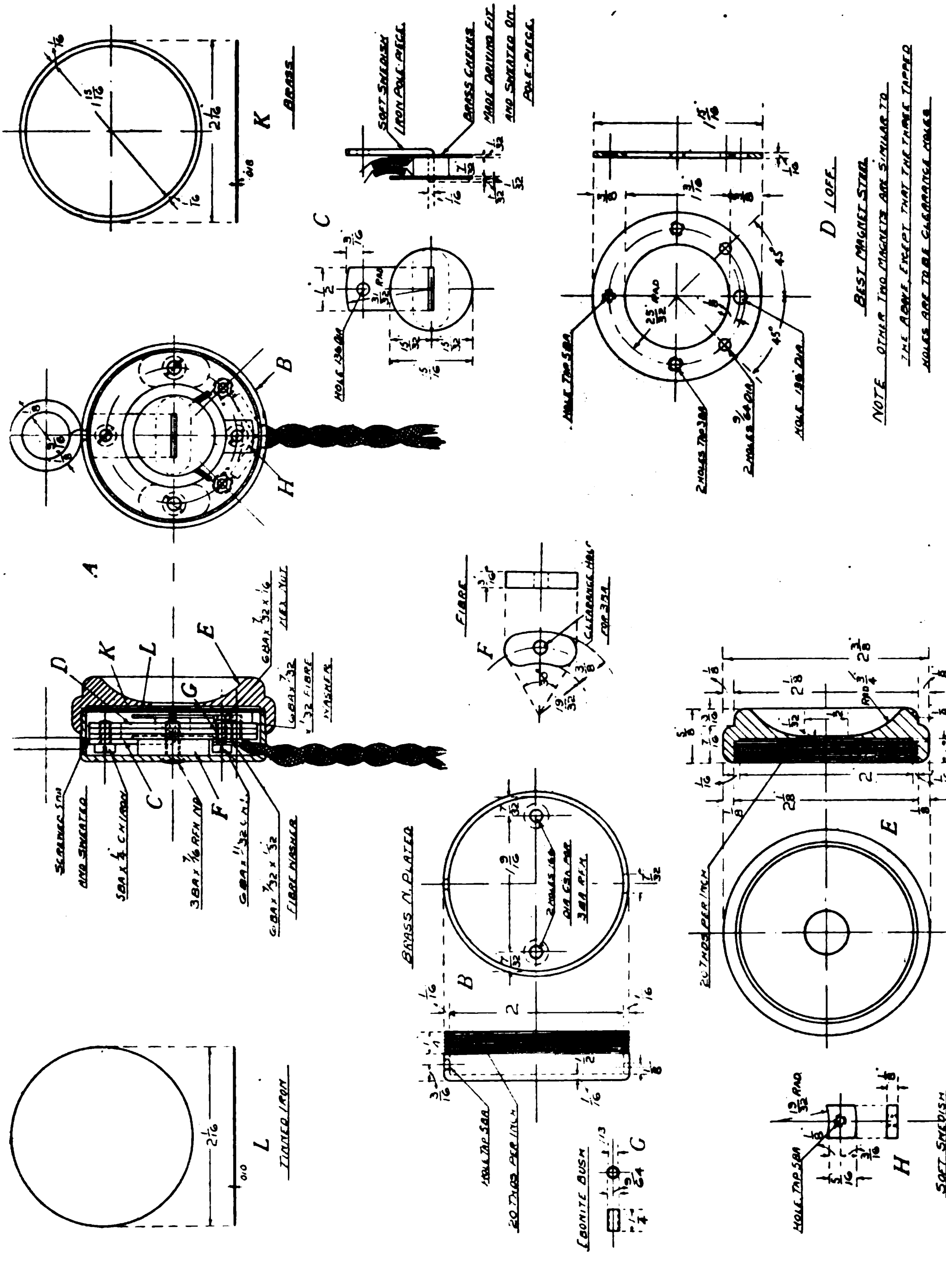


FIG. 11.—DETAILS OF WATCH PATTERN RECEIVER.
(*Half full size.*)

AN INTER-COMMUNICATION TELEPHONE.

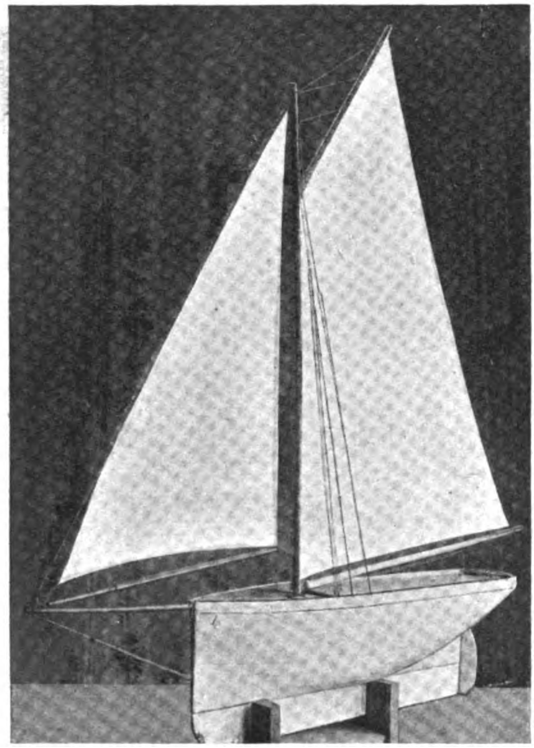
Model Yachting Correspondence

[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.]*

A Model Pilot Cutter.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The following notes will give a few particulars of the construction of my model boat:—First I secured a piece of pine, 27 ins. by 7 ins. by 6 ins.; shaped it roughly from the outside, then hollowed it out, leaving ¼ in. in thickness. I next secured a piece ¼ in. thick for deck. This I lined out to imitate planks, then cut hatchways 6 ins. by 3 ins. The deck is screwed on with ½-in.



MR. F. BUCK'S MODEL CUTTER.

brass screws. The rail round deck I made from a piece of ordinary plastering lath, ½-in. deep, fastened on with stout pins. The keel I made from a piece of bar iron 23 ins. by 2½ ins. by ½ in., screwed on with four 3-in. screws, countersunk half-way through keel. The rudder is cast from a piece of lead, weighing about ¼ lb.; this I use for reaching. I also made two other rudders, one weighing 2 ozs., and the other 6 ozs.—the light one I use for beating, the heavy one for running. The masts are made from mahogany, ½ in., tapered to ¼ in. at masthead. The boom is made the same; gaff and bowsprit from same wood ⅜ in. to ¼ in. The sails I made from fine white canvas. The mainsail I roped on to leech, to make it sit better. The rings for mainsail are ordinary split rings looped on to sail with thread. Halyards and rigging are brought down to deck and secured with slips; this enables me to raise and lower sails very quickly. Fore and main sheet are fastened on to travellers. Finished off with a varnished deck and three coats of blue paint to water-line; below, pink paint.

Dimensions when finished: length, 27 ins.; beam, 7 ins.; depth, 8 ins.; mast from deck to truck, 32 ins.; main boom, 30 ins.; gaff, 18 ins.; bowsprit, 10 ins. from stem.

Re her speed, she has never been strictly timed; there is no model yacht club, or competitions of any kind, round here. In her trials she has proved to be a very good sailer, and I am satisfied that she would stand a fair chance (in her class) if I could get her in a competition.—Yours truly,

F. BUCK.

Model Sailing Yachts.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I have made a model yacht to the instructions and diagrams in THE MODEL ENGINEER of January, 1907, "Model Yacht Building for Beginners," by Arthur Rollesby. I have been very careful in construction, having put a fin of sheet iron 1-16th in. thick, as suggested; I find, after everything is on, it is below the water-line. I have added ½ lb. lead on fin, which brings the water within ½ in. of deck at stern. She will not carry her sails, so is quite useless. I should be glad if you could let me know what I can do with same so as to make it a success. Do you think if I took the iron fin off and made one, say, 1½ in. deeper, having it cast in aluminium 1-16th in. thick, this would be strong enough? Having spent a lot of time on same for my son. I am anxious to make a success of it if possible. Thanking you in anticipation,—Yours faithfully,

S. HOBBS.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In reply to your correspondent, who has found a model built on the lines suggested by me in your January issues not altogether satisfactory, I regret to learn this; but as the model I was describing, of which the photograph appeared, was a very fast little craft, I think Mr. Hobbs may be able to remedy the defects he finds in his own vessel. Of course, with a boat of the type, especially a small one, it is difficult to float to a certain waterline. But the boat should bear far more than the ½ lb. lead which has been put on.

I would first ask whether pains have been taken to hollow out thinly, and to use light wood for the deck. Heavy wood and rough workmanship would make a great difference. Again, are the spars as thin and light as possible, and the sails of fine calico? If all possible has been done in these directions, then, as Mr. Hobbs suggests, the fin might be altered. I do not think, however, that I can recommend aluminium. I believe wood would be found better, of any stiff kind. There would be no harm in reducing the size as much as deemed safe. The difference between the weight of the present iron fin and the wooden one would of course be added to the bulb.

I believe attention as above should remove the difficulties. I may say, however, that in light displacement boats, the "sliding gunter" is some-

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times of a preferable rig to the "sloop": no gaff is used and top weight is saved. The schooner rig is good also, as the spread is low. Again, the power of a boat may be increased by adding on top another layer or "slice" of wood, in the "bread and butter" fashion described by me. This, however, I should not advise except in an extreme case, as I trust that by making the hull of the boat, the spars, and the sails as light as possible, and trying a wooden fin, the boat made by your correspondent will prove as satisfactory as did my own.—Yours faithfully,

ARTHUR ROLLESBY.

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.*]

An American Reader's Model Loco.

TO THE EDITOR OF *The Model Engineer.*

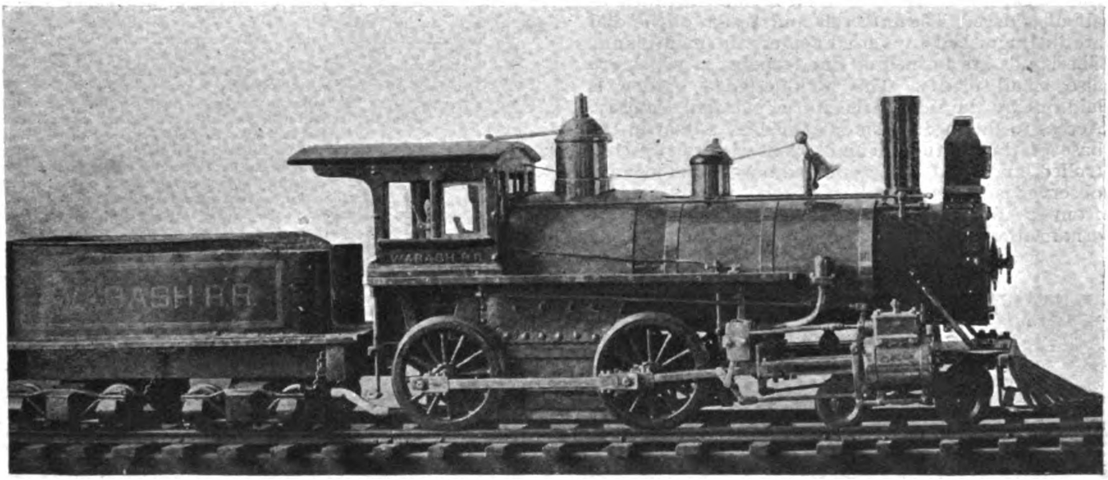
DEAR SIR,—Seeing an article in the September 12th number of THE MODEL ENGINEER, "An Interesting Rebuild," I wish to state that I am going through the same stage of experiment as Mr. H. Bennett.

I herewith enclose a photograph of my engine, as originally built. The same was in actual operation on December 10th, 1892. There was no pretence at finishing, as the engine was built of railroad scrap brass, so she had been partly a locomotive engine before. I made my own drawings and patterns, and did some brass casting. I had no lathe—all pretty true hand-work. There were eccentric sheaves on axle, but these were never used. I adopted the Joy gear for simplicity and accuracy sake, which proved to be entirely satisfactory. I think it a good gear and easy to construct.

Had I known then about the Primus burner, I should have never attempted to change same; but for charcoal she was too small.

The following are the chief dimensions of engine:—Boiler—inner barrel (galvanized iron), diameter 4 ins., length 20¼ ins.; outer shell (Russian iron), diameter 5¾ ins., length 24 ins. Water tubes (two rows)—top row, seven tubes, ⅜ in. by 9¾ ins.; bottom row (eight tubes), ⅜ ins. by 15¾ ins. Rail to centre of boiler, 7 9-16ths ins.; driving wheels, 4⅞ ins. diameter; bogie wheels, 2 ins. diameter; centres of driving wheels, 6¾ ins.; centres of bogie wheels, 4 9-16ths ins.; centre of driving wheel to centre of bogie, 9¾ ins. Cylinder—1⅛-in. bore, 1⅝-in. stroke.

The downcomers and upcomers were of my own make. The tube holes were laid out first and drilled; then the upcomers fitted to the shell, their holes laid out and centre-punched. I had a brace-bit shank welded to a 5-16ths-in. by 20-in. Norway rod, and a drill-bit welded thereon at the other end. I now passed the long drill through the holes of the downcomer and then to the upcomer, so I got the proper angle to have my tubes to enter. When my model is again complete, I will send you a photograph of same, with other full particulars as to my experience with the Primus burner, of which I possess two—one to be placed ahead and one behind the rear driving axle.



AN AMERICAN MODEL LOCOMOTIVE.

THE MODEL ENGINEER reaches me every Thursday—two weeks after its publication, and I think it to be a most excellent little Magazine. I also have a copy of the "Model Locomotive," which I prize very highly.

As I seldom see an item from this side of the "herring pond," this may seem something out of the ordinary.—Yours very truly,

Carleton, Nebr., U.S.A. THEODORE C. BECKE.

Rolling-Stock Wheels.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I am making some small trucks for a 2⅞-in. gauge locomotive, and, not having a lathe, I

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have to purchase my wheels. I find a difficulty in obtaining wheels at a price which enables me to make my own rolling-stock. The wheels I want to get are of lead or cast iron, and are fitted to most cheap clockwork locomotives. I have tried to get them, but without success. Is this because they are of foreign manufacture? I require them about 1½ ins. over tread. I have seen some of Bassett-Lowke's stamped steel wheels, but they are made in sizes smaller than that which I want. I have tried the Clyde Model Dockyard, Richford & Redding (London), but have been unsuccessful. I should be much obliged it you would tell me where I could obtain the wheels I require, or failing that, any cheap substantial wheels of about the same size.—Yours, etc.

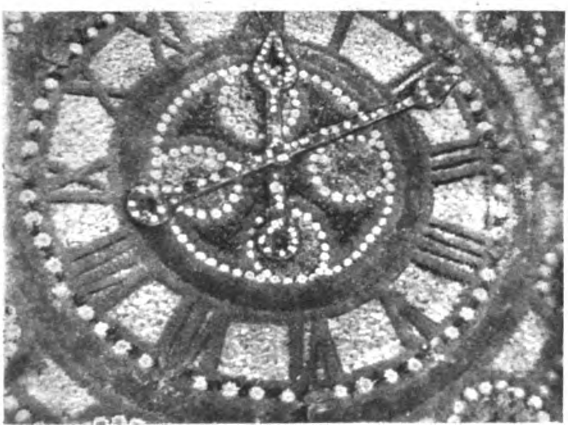
G. BIGNELL.

Bournemouth.

A Novel Clock.

To the Editor of *The Model Engineer*.

DEAR SIR,—Whilst in Edinburgh recently I chanced to see in the famous Princes Street Gardens of that city an exceedingly novel clock, a brief description of which may be both suggestive and interesting. The novelty lies principally in the face of the clock, which is set out on a bank inclined at about 45 degs. The numerals and design of the dial are distinguished by varied colours in small plants. The hands are formed of zinc troughs, in which are also small plants. This well-designed garden is laid out by the side of the statue of Allan Ramsay. Access to the mechanism is gained by a door in the base of this statue. The clock is electrically controlled, and what is more interesting to the average observer is the sound of "Cuckoo" which is heard from a protruding horn forming part of the ornamentation of the base of the statue. I send



A VIEW OF THE FLORAL CLOCK DIAL, EDINBURGH.

you a snapshot herewith, and it is thought perhaps some of your readers who are professional gardeners may be able to act on the suggestion that is here offered.—Yours truly,

Hither Green, S.E. F. F.

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.—Friday, November 29th: "Further Model Making Wrinkles," by Mr. L. M. G. Ferriera.—Monday, December 16th: Special model night. Prizes will be awarded by popular vote to the most interesting models brought to this meeting.—HERBERT G. RIDDLE, Hon. Secretary, 37, Minard Road, Hither Green, S.E.

MR. F. COXON, Egerton Villa, Melksham, Wilts, would like to hear from any reader interested in model making living in the above district.

Queries and Replies.

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

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

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

[18,367] **Rotary Convertor to give 150 watts.** D. L. (Leeds) writes: I wish to make a rotary convertor to give about 30 volts at 5 amps. Our current is alternating, 200 volts at 50~. I have a transformer that reduces this to 50, 40, 30, 20, or 10 volts, and I could get 5 amps. at those voltages from same without overheating. Will you please give me particulars so that I can work a rotary convertor? I have been using a chemical rectifier but have not got satisfactory results from same. I have seen the convertor in November 9th, 1905, but there are not sufficient particulars for me to work to, as it is not explained how the slip rings are attached to the winding of armature and how the convertor is started. Also I want 30 volts at 5 amps., whereas the output is given at 20 volts 10 amps. What would be the difference in the winding of the armature and field-magnets? Also I notice the metal formers for field-magnet coils are 2¼ ins. wide whereas the field-magnet is only 1¾ ins. wide. Is this correct Am I right in understanding that the convertor in November 9th, 1905, was run with 15 volts?

If you wish to make a machine suitable for doing real work in rectifying alternating current for charging accumulators, we recommend you to make a similar one to that designed and used regularly by Dr. Reginald Morton, as we know this to be a successful machine. The design is described with drawings and full particulars in THE MODEL ENGINEER for August 23rd, 30th, and September 6th, 1906. Windings given are for 50 volts 50 periods, so should just suit you. However, if you prefer to make the machine mentioned in your letter, we advise you to make the field-magnet laminated with soft iron stampings. We very much doubt if a cast-iron magnet, as described, would be satisfactory, or even a solid wrought iron one, except for very short periods of running, owing to heating due to eddy currents. The bobbin flanges and cores should be cut through at one place so that they do not form closed circuits, as if they are not cut through they will heat very much owing to the action of the alternating flux in the field-magnets producing current in them. The connections

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to slip rings are made to opposite sections on a diameter of the commutator, one ring being connected to a section and the other ring to that diametrically opposite. The voltage ratio of such a machine would be about 7 to 1, the alternating being lower. The continuous voltage would thus be higher than the alternating voltage applied to the slip rings. You would therefore have to apply about 25 volts to the slip rings. Armature winding to be No. 20 gauge D.C.C. copper, and field-magnet winding shunt to be No. 20 S.C.C. copper wire, and No. 16 gauge for the series winding (if wanted), the one layer being put on as before and more to make up 52 turns. The magnet bobbins appear to have been made 2¼ ins. inside so that they could be slipped over the pole-pieces. Such a machine must be run up to synchronous speed before the alternating current is switched on, either by mechanical means or by running the machine as a motor by continuous current from the commutator side.

[18,344] **Model L. & N.W.R. 4-cylinder Compound Locomotive.** R. R. H. (Lancashire) writes: Can you give me (1) Outline of a L. & N.W. altered "King Edward" type of locomotive and tender with measurements? (2) What radius of curve would such an engine require, 3½-in. gauge? (3) How many tubes should I require and what bore of cylinders?

(1) You will find a drawing and photograph on pages 177-179 of "The World's Locomotives," by Chas. S. Lake, price 10s. 6d. net, 11s. post free. (2) As the valve gear will not allow a very extensive movement of the bogie, the minimum radius will be about 25 to 28 ft. (3) Use ½-in. tubes, and for design of boiler see "The Model Locomotive," by H. Greenly, price 6s. 5d. post free. You will in this book find a design for the compound cylinders, see page 130.

[18,370] **Model Steamer Building.** A. P. T. (Glasgow) writes: Would you mind explaining this little difficulty I have with No. 12 handbook on "Model Steamer Building." I do not understand fully the drawings of the T.B.D. on page 33. You mention on page 11 and also in drawing page 10 that the stern of a destroyer slopes up; now, when I look at the design for a hull on page 33 I distinctly see the stern drawn in the usual way in both "sheer and body plan," with keel, etc. Is this correct for the stern if one desires to design a "squat" stern?

You can build the model either with or without the body of the hull extending at the stern in a line with the keel of boat. If it is cut away to give a flat underside, then the propeller shafts will be carried out from where they begin to leave the hull; but if the stern is built in one with the hull, as shown in handbook, then the stern tubes will carry the propeller shafts to within a few inches of the rudder. To make a "squat" stern, simply carry the lines at 17 and 16 round in a fair curve, and do not bring them out again to form the part which carries the shaft.

[18,361] **2-in. Induction Coil.** W. B. (Beith) writes: I shall be glad to have a reply to the following questions. (1) I am thinking of making a 2-in. spark coil, the secondary to be wound on in layers, same as described by a reader in THE MODEL ENGINEER of August 22nd, 1907—that is, wound in one large section; first a layer of wire, then a layer of paper, then wire, then paper, and so on; each layer of wire to diminish in length by about three turns of wire at each end. I would propose putting a turn of paraffin waxed paper between every layer and also insulating every layer of wire with paraffin wax. I do not want to wind in sections at all, but on one bobbin. Do you think this would make a satisfactory coil? (2) Would 2½ lbs. of No. 34 S.W.G. s.c.c. wire give a 2-in. spark? (3) Would a thicker wire than No. 36 not do as well if I used more of it? How much No. 32 S.W.G. s.c.c. wire would it take to give 2-in. spark? (4) What is the objection to winding the secondary in layers, as compared with winding it in sections? I should like to know why it is better if wound in sections than in layers? (5) How many bichromate batteries with zincs 5 ins. by 3 ins. by ¼ in. would be required to work this 2-in. spark coil? (6) Is wire numbered B.W.G. same thickness as that numbered S.W.G.? *Re* Wimshurst machine. (7) Please say size and number of plates required for a Wimshurst machine to give from 3 to 4-in. sparks, and also say if a machine this size would be suitable for radiography? Would glass plates do as well as ebonite?

(1) Good results could be obtained by this method, but in case of breakdown it is more difficult to locate the fault and execute repairs. (2) Preferably use No. 36 S.W.G. About 2½ lbs. is usually used. (3) No. (4) See above (1). (5) About six bichromate cells—good large ones. (6) Approximately. (7) Some useful articles on Wimshurst machines have been given in back numbers to which please refer. A two-plate machine of about 16 or 18 ins. diameter would give this.

[18,365] **100-watt Multipolar Dynamo Windings.** W. T. (Farnworth) writes: I should be extremely obliged if you will kindly answer the following questions *re* Avery multipolar dynamo, 20 volts 4 amps. It is desired to replace ordinary armature by a drum type having twelve slots and commutator with twelve segments. (1) Kindly state amount of wire and gauge for each section? (2) Method or direction of winding, with sketch if possible? (3) Is the sketch, Fig. 45, MODEL ENGINEER handbook—"Small Dynamos and Motors," suitable for a six-brush machine or only a two-brush. (4) Will the ordinary winding of field-magnets require altering with drum armature in place of old one?

The winding can be precisely the same as for a four-pole drum, as shown in Fig. 49 of our handbook—"Small Dynamos and Motors," except that the winding must span across an angle of one-sixth of the circumference instead of one quarter of the circumference. You need not cross connect the commutator if you use six brushes. You can also wind as Fig. 45, if preferred. Field-magnet winding can be same as in description; armature winding can also be No. 24 gauge wire as described. Wind on as much as you can in the space; probably about 8 ozs. will be wanted. We cannot say that your alteration will be a success. Mr. Avery probably had very good reasons for adopting the particular form of armature shown in the drawings. However, we do not desire to persuade you from making the trial.

[18,005] **Simple Switchboard Connections.** W. E. K. (Kensington) writes: I received the sketch of wiring for switchboard connections, for which I thank you, but the connections for ammeter and voltmeter I do not quite understand clearly. I enclose copy of your connections sent me by you. The connections that are not quite clear to me are those I have marked dotted. Will you tell me if these connections are the same gauge wire as the main leads, or must the dotted connections be a finer gauge wire, and will you tell me if the switch is on or off while dynamo is running? What is the switch for? If I switch it off, the circuit is broken to voltmeter, and if I run dynamo with it in it looks like all the current going through the meter. I am under the impression that volt and ammeters only take a shunt current. Also kindly tell me what gauge and strand wire will carry safely 30 volts 6–8 amps.

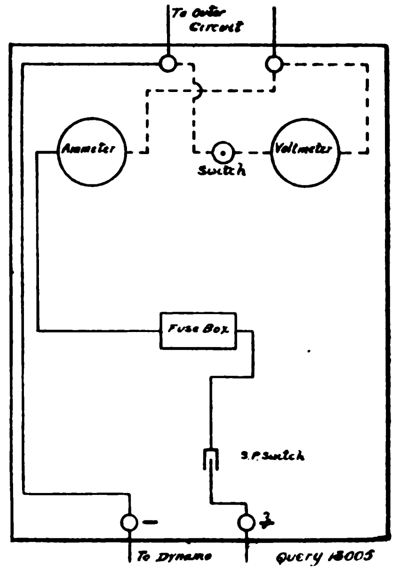

DIAGRAM OF SWITCHBOARD CONNECTIONS.

The connections shown are quite correct. Some ammeters take all the current—that is, are in series, and voltmeters are wound so as to be of very high resistance. Thus, when connected across the mains, only a very small portion of current flows through them. If you like you can connect the voltmeter across the mains as they leave the dynamo, before the switch that is, then it will always be in circuit, even if the main switch is opened and supply to the outer circuit cut-off. When buying your instruments state which type you require, or ask makers to supply instructions for connecting up. Some ammeters, of course, take only a portion of the current. The wires to and from ammeter must be as heavy a gauge as the main leads. Voltmeter wires may be smaller gauge —say, 22, S.W.G.

[18,341] **Lahmeyer Type Motor.** E. S. D. (Catford) writes: I am thinking of constructing the model Lahmeyer type motor illustrated on page 20 of "Small Electric Motors" (No. 14 of THE MODEL ENGINEER Series). I want it to be powerful enough to drive a small model wagon, to carry its own accumulators, and, if possible, a load of 7 lbs. or more. I intend making the field-magnets out of hoop-iron. (1) What size armature shall I require and what type (tripolar or drum)? (2) What will be the most efficient voltage to use? (3) What weight and gauge of wire shall I wind the armature and field coils with? (4) I wish to make the motor with a speed controller. On page 66 of the above mentioned book it is said that this can be done in a series-wound motor by cutting in or out small sections of the field-windings. This appears to me to be inconvenient, as it necessitates winding the field coils in sections. Will it not be advisable to have motor

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shunt-wound, and then insert resistances in the path of the field current? (5) What reduction in speed will be required to drive wagon with load at a fairly quick rate?

(1) Diameter, 1¼ ins.; length, 1¼ ins.; drum is to be preferred (eight slots); commutator, eight sections. For diagram of winding see our Handbook No. 10. Tripolar would do, if you cannot manage drum. (2) Four volts will probably be best to adopt. (3) Wind armature with No. 26 gauge s.c.c. copper wire, and field coils with No. 20 gauge D.C.C. copper wire, connected in series with armature. Armature will take about 3 ozs. and field perhaps 8 ozs.; but the weight does not matter if you keep to the proportions of the drawing and get on as much wire as you can in the space. (4) No; a shunt motor is not suitable for traction work. The most simple way is to use an adjustable resistance in series with the motor, and, on the whole, we think you will find it satisfactory in this case. (5) About 3 or 4 to 1.

[18,354] **Automatic Reversing Switches for Electric Locomotives.** "HELM" (New Malden) writes: Referring to "Chats on Model Locomotives," page 373, will you kindly tell me if instructions for making an automatic polarised switch for reversing the motor on the locomotive from the track have appeared in your paper; if so, the date will oblige. If not, could you give me details of construction. Mine is a 1¾-in. gauge electric engine, worked on the three-rail system, and requires 6 volts.

Several devices have been described in THE MODEL ENGINEER—(see issues of April 9th, June 4th, July 9th, September 17th, 1903). These devices seem to have been fairly successful; but, as with all polarised relay switches, the range of action is not very great. We shall describe—in the course of the articles—the device recently patented by Messrs. Cole and Winteringham, and which is being made by Messrs. W. J. Bassett-Lowke & Co. From what we understand, this apparatus gets over many of the difficulties heretofore present in automatic reversing switches. Locomotives fitted with these switches were shown at work at the recent MODEL ENGINEER Exhibition at the Horticultural Hall, Westminster.

[18,360] **Water-tube Boiler.** W. E. W. (Nelson) writes: Since writing the letter which you replied to last week, I have seen another design for a water-tube boiler in your issues of February 4th and 25th (1904), which I think I could construct. I should be glad, however, if you could give me suitable dimensions of same for a compound engine 1½ ins. by 2¼ ins. by 1½-in. stroke, at about 350 to 500 r.p.m. Also, please say if there would be any objections to making the cast frames of cast iron or other material—as malleable iron or steel—instead of brass, as it is desired to keep the cost as low as possible.

The dimensions given in the articles will give you a satisfactory boiler, and we can see nothing against using cast mild steel for the frames and mild steel plates for the tube plates. Make the latter a little thicker than for brass or copper plates, to allow for corrosion.

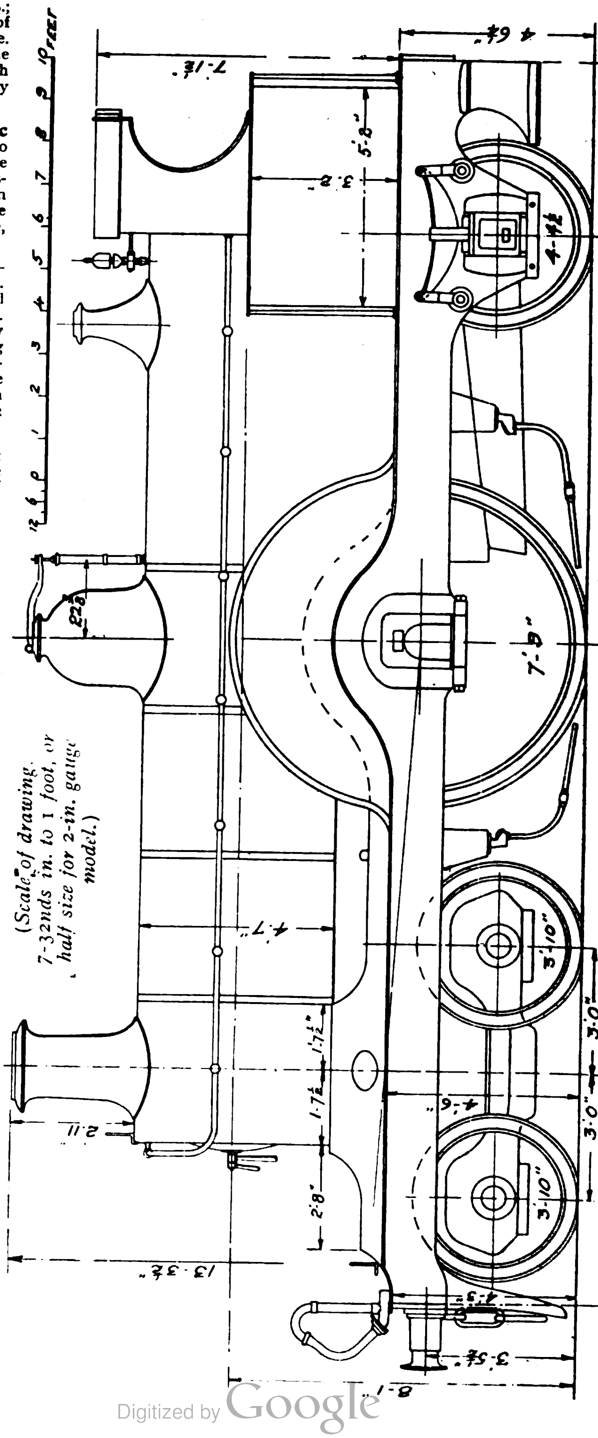
[18,355] **Engine and Boiler for Workshop.** H. P. (Torquay) writes: I have a small plain lathe of 3-in. centres, and I wish to drive it by a horizontal steam engine. Would one 1½-in. bore by 3-in. stroke be suitable? What size centre-flue boiler would be suitable for same? What would be the most economical firing? What size force-pump?

Although—with proper precautions and with a good engine—a 12-in. by 24-in. centre-flue boiler might work the plant satisfactorily, a 16-in. by 30-in. boiler should be fitted, if possible. The larger boiler would require less attention and would work on natural draught. Use steam coal or anthracite, mixed with a little coke. We would recommend an injector if the larger boiler is used; but, if you prefer a pump, fit one with a ½-in. plunger and a stroke of ½-in. or ⅝-in. Regulate the feed by a by-pass pipe from the delivery.

[17,907] **Midland Single Express Engines.** C. W. H (Brentwood) AND OTHERS write: Please publish a sketch of the Midland single express engines.

We append herewith a drawing of the No. 2,601 (old series) single express locomotive on the Midland Railway, built by Mr. S. W. Johnson, at Derby Works, about 1900. The drawing is reproduced to a scale of 7-32nds in. to the foot, or half size for a 2-in. gauge model. The other important dimensions of these engines not included on the drawing are as follows:—Width over footplates, 7 ft. 7 ins.; width over outside frames, 6 ft. 2 ins.; width over buffer centres, 5 ft. 8 ins.; distance between inside frames—at buffer plank, 3 ft. 9 ins.; at driving wheels, 4 ft. 1½ ins.; at rear buffer plank, 4 ft. 1½ ins.; at cylinders, 3 ft. 11⅝ ins.; centres of cylinders, 2 ft. 3 ins.; length of firebox, 8 ft.; firebox behind crankaxle, 1 ft. 11 ins. The bogie tenders fitted to the single-wheeled engines are slightly different to the later tenders for the three-cylinder compounds. The former have equalised spring gear on the bogies, not separate springs, as shown on the drawing herewith. The leading dimensions, not included in the sketch, are as follows:—Width over bogie side frames, 5 ft. 9 ins.; centres of journals and equalisers, 6 ft. 6 ins.; width of footplates, 7 ft. 7 ins.; width of buffer centres, 5 ft. 8 ins.; width over top edging of tender sides, 8 ft.; width over main frames, 6 ft. 2 ins.; width over tender tanks, 7 ft. 3 ins.; diameter of bogie wheels, 3 ft. 6 ins.; depth of rear buffer plank, 1 ft. 3 ins.

JOHNSON'S SINGLE WHEEL EXPRESS LOCOMOTIVE (MIDLAND RAILWAY), "PRINCESS OF WALES," NO. 2,601 (OLD SERIES).



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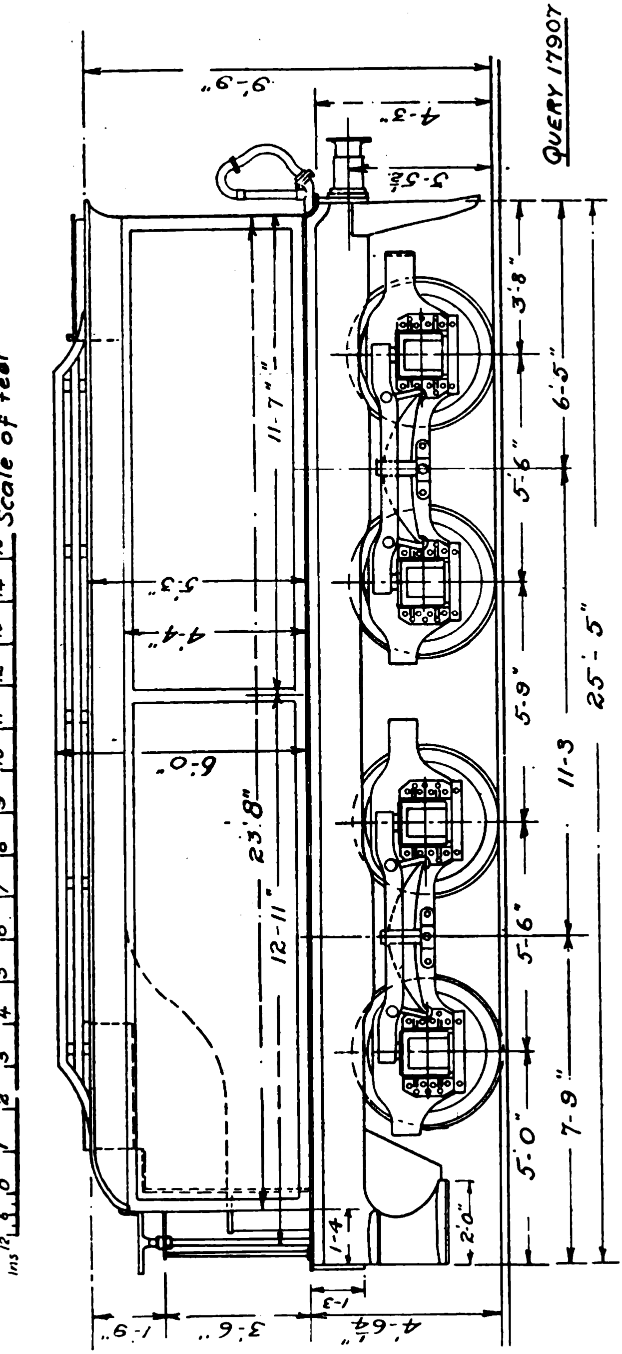


(Scale of drawing, 7-32nds in. to 1 foot, or half size for 2-in. gauge model.)

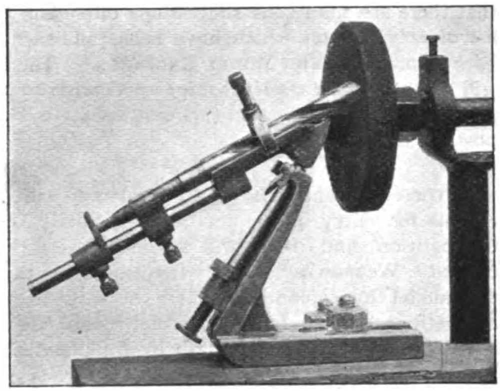
The News of the Trade.

[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 Simple Automatic Twist-Drill Grinding Jig.

Messrs. W. E. Growther, 308, Mansfield Road, Nottingham, are placing on the market a new twist-drill grinder which is simple, automatic, and accurate. The jig is clamped to the emery wheel stand by means of a holding down bolt, which passes through a slot in the jig casting to allow for adjustment, and the drill (any size up to ½ in.) is carried by a clamp in a trough provided for the purpose. This is designed to enable the drill to be given a semi-rotary motion at the exact angle used by the Morse Twist Drill



"RELIANCE" DRILL GRINDING JIG.

Company, thus ensuring perfect uniformity in every drill dealt with; and, moreover, the clamp is so devised that the proper regulation and projection of the drill point is readily effected, whereby the need of a sliding trough and scale has been obviated. The illustration herewith gives one view of the apparatus, and further particulars can be obtained from the above address.

*The New Tessted Rustless Steel Rail.

A sample of this new material, which, we are informed, has been exposed to all weathers out of doors for about eight months, has been sent us for inspection. It appears to comply fully with the claims of the makers, and should meet with a ready sale, as it will fulfil the requirements of model engineers desirous of laying a more or less permanent out-door track. Fuller particulars and prices may be obtained from the manufacturers, the Birmingham Model Engineering Company, 45-49, Northwood Street, Birmingham.

New Catalogues and Lists.

Messrs. Arthur Firth, Cleckheaton, Yorkshire, have sent us their illustrated catalogue of engineers' tools and appliances. Every item is clearly priced and fully described, and we may say it forms a useful and handy reference list, which may well be consulted by the prospective purchaser.

Messrs. Woodfall & Morris, Electrical Engineers and Manufacturers, 70A, Rye Lane, Peckham, London, S.E., have sent us their supplementary price list, giving particulars and cost of various appliances and apparatus, such as measuring instruments, flash-lights, pocket compasses, permanent magnets, domestic telephones, induction coils, electric motors, and shocking coils, etc.

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The Editor's Page.

A VERY pleasant change is afforded from the actual work of model making by turning the attention occasionally to the subject of ornamental turning. In this issue we publish the first of a series of articles on "Elementary Ornamental Turning," by Mr. T. Goldsworthy-Crump. We can promise our readers who interest themselves in this branch of work some good things in the forthcoming articles. The author's practical knowledge of his subject is evidenced by the excellent specimen of work we reproduce on page 499.

* * *

We also think it an opportune time to remind readers who are trying to fix their minds upon something to make during the long winter evenings, that there are numerous suggestions offered in the list of articles, etc., which have been published in back numbers of THE MODEL ENGINEER. The list will be sent to any reader making application to our publishing department, and enclosing stamp to cover postage.

* * *

A correspondent asks if hydroplanes will be eligible for entry in the forthcoming Speed Boat Competition, and if so, will a separate class be formed? We may say, in reply to this, that we think the model hydroplanes, if there be any in the competition, should be entered under the existing classes, according to the length over-all, and that the same rules should obtain. The closing date of entry is drawing very near; competing models, if not yet ready, should soon be in trim. We are anticipating a large number of entries, and some good speeds.

Answers to Correspondents.

D. H. R.—Thanks for your contribution, which, however, is not suitable for insertion in our journal.

R. M. (Harrogate).—Thanks for photograph and letter. If you care to submit a description of the apparatus you refer to, we shall be pleased to give it due consideration.

F. W. (Old Flexton).—We advise you to obtain a proper starter from the firm supplying your motor, and if you have had no experience in electrical matters, you had much better get the same firm, or some local electrician, to fix it up for you—especially as it is a job you require to be done properly for business purposes.

W. P. (No Address).—We are publishing a diagram showing the connection in an early issue.

L. A. W. (London).—Smith & Son, St. John's Square, Clerkenwell Road, E.C.; also Cotton and Johnson, 14, Gerrard Street, Soho, W., and Spencer & Co., Stamford Bridge Works, S.W.

A. J. L. (Holloway, N.).—We do not think your idea is practicable for model work, and we are unable to accept your contribution.

E. A. (Leytonstone).—Thanks for your interesting photographs. We have made a note of your wishes.

F. B. (Herne).—All the "Atlantics" on the G.N.R. have wide fireboxes, except the original batch—the 990 class, No. 271, the four-cylinder engine, and the Vulcan Company's compound (No. 1,300). See "The World's Locomotives" for illustrations and particulars. The Brighton "Atlantics" are practically the same as the G.N.R. 251 class.

G. H. C. (Worksop).—Townsen & Mercer, manufacturing chemists, 89, Bishopsgate Street Within, would supply you with a suitable crucible.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

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Contents.

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

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THE

Model Engineer

And Electrician.

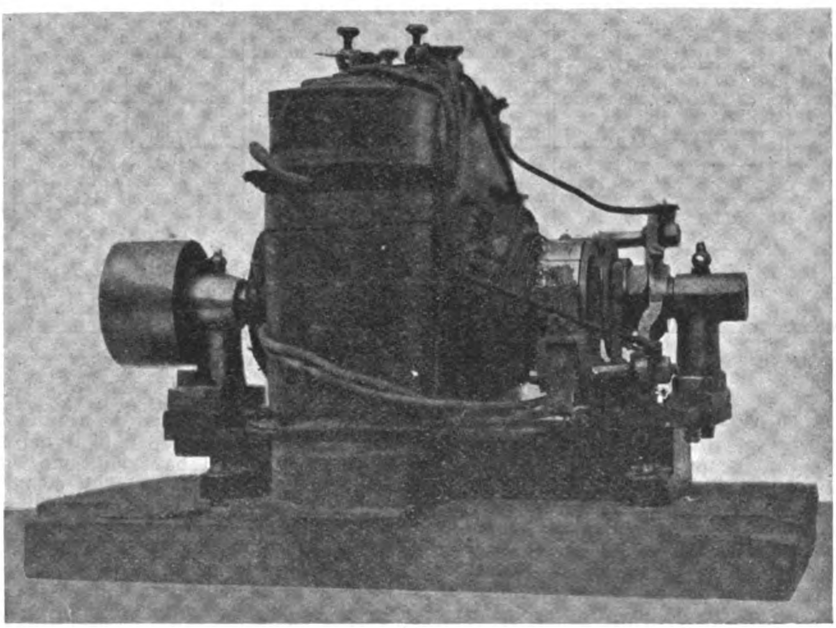
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 344. NOVEMBER 28, 1907. PUBLISHED WEEKLY

100-watt Manchester Type Dynamo.

By L. S. WINKWORTH.



A 100-WATT MANCHESTER TYPE DYNAMO, CONSTRUCTED BY MR. L. S. WINKWORTH.

DURING my spare time last year I constructed the Manchester type dynamo shown in the accompanying photograph. I bought the castings from a local firm who advertise in THE MODEL ENGINEER, and the windings were taken from THE MODEL ENGINEER Handbook, "Small Dynamos and Motors." The spindle was turned out of a piece of ¾-in. rolled steel, and the laminated core built on and secured by two ¾-in. check-nuts, through which two rivets were fixed. The core consists of 100 varnished punchings, and is 3 ins. diameter and 2½ ins. long, having twenty-four slots ½ in. deep by ⅛ in. wide. The slots were insulated with presspahn, and the armature wound with No. 26 D.C.C. wire having twelve coils each of forty-two turns, the pitch being 1—11. The commutator was made by turning a brass bush, dividing it into twelve segments, and screwing each by two wood screws to a turned fibre bush. The spaces between the segments

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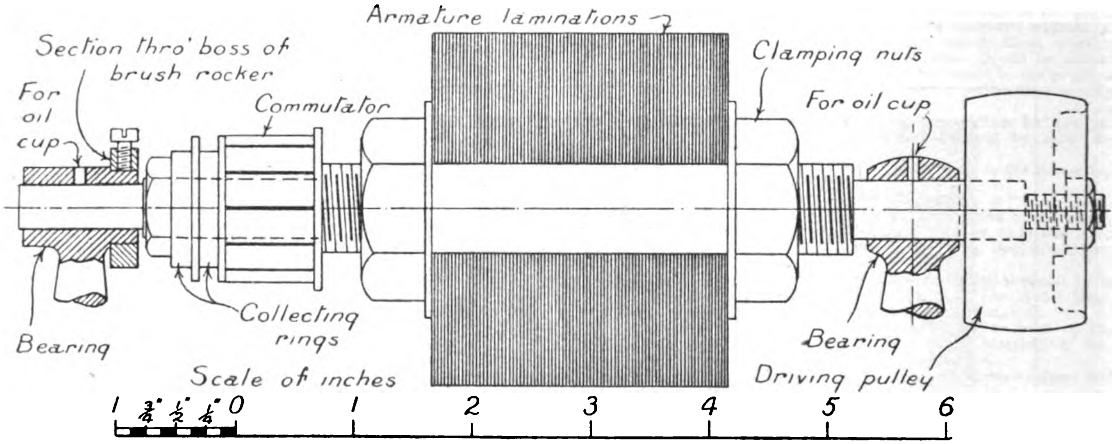
were filled up with mica, and after fitting on the shaft and being locked by a nut, the whole commutator was turned up true. The ends of the coils were then soldered to the commutator. As it was intended that the machine should give alternating as well as continuous current, two slip rings made of copper insulated with fibre were fitted to the shaft next to the commutator, each ring being connected to an opposite commutator segment. Two bands of binding wire were wound over the core to keep the wire in the slots; the whole armature was immersed in varnish and baked in a vacuum. The magnet cores are of 1¼ ins. diameter wrought iron, and are fixed right through the yokes so as to make a good magnetic contact. The bobbins are made separately from the cores, and each is wound with 4,290 turns of 29 s.c.c. wire. Owing to having slip rings, the spindle had to be longer than what the casting allowed for, and I had to lengthen the bedplate by screwing a piece of ½-in. iron to it and fitting the bearings to these extension pieces. The bearings are fitted with cycle oil-cups for lubricators. The pulley, which is 2 ins. diameter by 1 in. wide, is screwed to the spindle and locked with a check-nut. The brush-rocker is of the usual type, with wire gauze brushes. The alternating brushes are made of spring brass and padded with wire gauze. The terminal board, which is fitted to the top of the machine, has eight terminals—two each for alternating and continuous brushes, and four for the ends of the shunt coils. They are arranged so that the shunts can be put in series or parallel at will.

The machine will give 100 volts 1 amp. at 3,000 r.p.m.; but it will probably give twice as much, as I intend making it into a compound wound machine. The total cost of this machine was £1, and I am very well satisfied with it, this being my first attempt at model making.



ARRANGEMENT OF DYNAMO SPINDLE AND ARMATURE.

To LANCASTER READERS.—Mr. FRED LAYCOCK, Springfield Terrace, will be pleased to hear from other model engineers interested in the formation of a society in this district.

Design for a Portable Drawing Frame.

By W. B.

SUFFERING from the baneful effects of working at a table, I had often thought that I should find a frame advantageous and also convenient. I do not wish it to be understood that mine is *the* original idea, but I have a thought that for convenience, rigidity, and portability it will compare with any I have hitherto seen.

How many draughtsmen would be glad to be able to work in their own sitting-room, and, when work is done, take off the drawing-board, fold down the top frame, swing round the wide feet to the span of the feet at the base of the frame standards, lay their square on the brackets and instrument on the square, push all back into a convenient corner, drop a light baize cover over all, sit down, and have an hour with a fellow-amateur? This is what I did several years since, and I do not regret the five shillings spent for material and the time occupied in the making.

Before I describe the drawings, I should like to say there is ample space and provision for a foot rail, if desired; but I prefer it as it is. This frame is perfectly free from the least vibration, even under strain.

Fig. 1 gives the front elevation of frame as set for a man about 5 ft. 8 ins. in height. The drawing-board simply lays upon the framed top, and can be shifted to any position to suit the light and convenience of the draughtsman. This is a great convenience, especially where one's sight is failing.

Fig. 2 shows an end elevation. Fig. 3 a line view of one of the standards. Fig. 4 a plan and front view of the framed top and open shelf underneath (now shown 4 ins. clear, but mine is only 3 ins. clear). Fig. 5 is the braced sliding frame and the plan of same, and on the right hand the sliding case is shown in section; the bracing is as seen from the back.

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Construction.

To those who will afford it, the whole of the wood used should be kauri for the frame and yellow pine for the top and shelf. But where economy has to be studied, even white deal will do. But the whole should be carefully and truly wrought. *A* (Fig. 2) are bases with claws glued and screwed on and prepared for the swivelling screw, which should be 4 ins. and stout. These bases will be swung round when the frame is not in use. *B* (Fig. 2) are the feet of the standards, into which are tenoned the lower pieces of 2 ins. by 2 ins., on D (Fig. 2) are four holes, into which the pin E passes, and through one or more holes in the 2-in. by 2-in. F F (to choice). These pins take up the dead weight and relieve the thumb-screws. Fix—where shown at B—carefully squared angle-blocks, also glued and screwed. There is shown at B thumb-screws, passing through and screwed into a flush-nut in A.

Fix at G on the slides (Fig. 5) ⅜-in. brackets, as shown, with a gap in same so that the back edge of the blade of the square may rest in same when not in use.

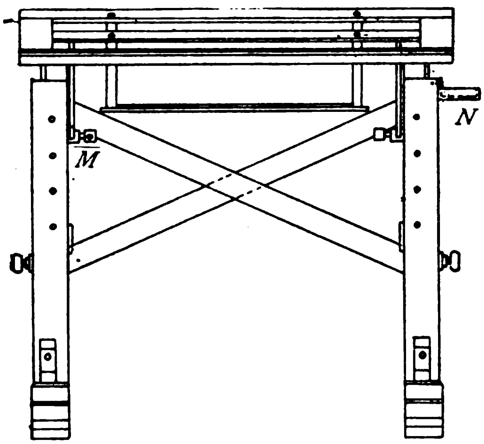

Fig. 1.

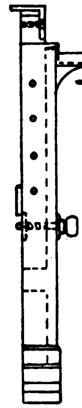

Fig. 3.

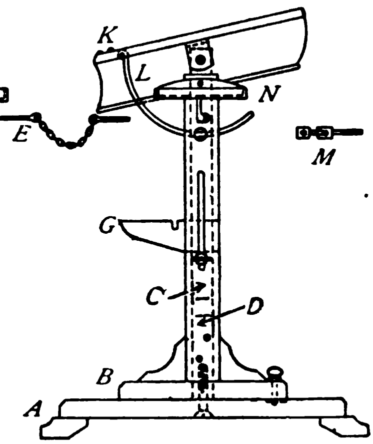

Fig. 2.

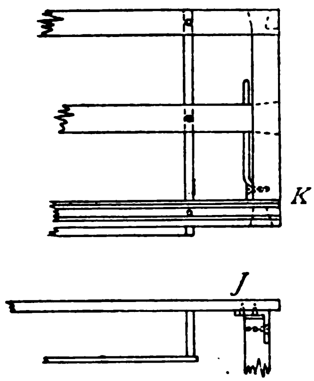

Fig. 4.

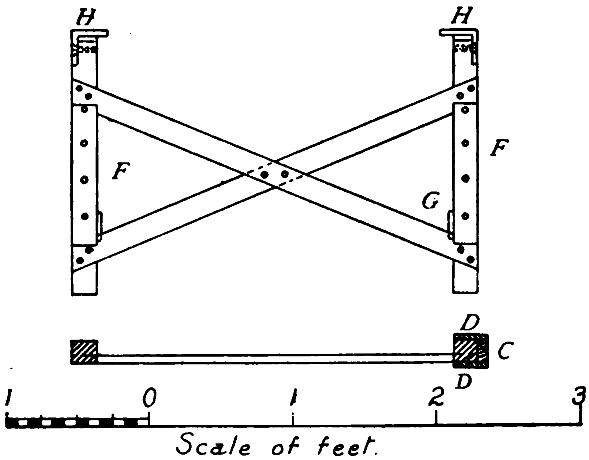

Fig. 5.

Design for a Portable Drawing Frame.

as shown by dotted lines. *C* is the stoutest portion of the sliding case, and, as shown, is glued and screwed to the 2 ins. by 2 ins. *D D* are the back and front portions of the slide case, and these are screwed to C and also to the 2 ins. by 2 ins. The slot shown in C is for the thumb-screw, as shown, which, with its brass nut, is let into the 2-in. by 2-in. front slides for clamping. Shown

The carefully braced frame (Fig. 5) should have, if possible, hard wood 2-in. by 2-in. slides at F F, braced as shown. *H H* are two pieces of coach hooping, carefully forged with a sharp internal angle, each drilled and countersunk from the underside with four screw-holes, and fixed to under side of top frame (as at J), recessed into slides at H H, and made with lower end curved, and fixed with

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a well-fitted pivot-screw to slide F F, but not too tight.

Form the shelf (Figs. 1, 2, and 4) by screwing through the top frame, as shown, into the checks and nailing the bottom to the checks. All the edges of the bottom to be rounded; the back and front ends of checks to be cut to form, as shown. The reason for the edge next the draughtsman projecting is to give him a quicker touch of his various instruments. It is as well to fix on the bottom a bevelled strip to prevent slipping. Fix—where shown at K (Fig. 2)—two fillets (⅜-in. by ¼-in.), the upper one to form stop for drawing-board and the lower one forms a channel for instruments. The edge of top frame next the draughtsman should be eased away, as shown, for comfort of touch.

At K (Figs. 1 and 2) are stays made of ¼-in. soft steel, neatly bent at upper end so as to receive a screw, and fixed, not too tightly, to the inside edge of top frame. (This part of top frame to be 3½ ins. wide.) The remaining portion of the stays are to be neatly bent to a radius of about 6 ins. from the centre of the pivot-screw. Screw guide-eyes M (also shown on Fig. 1) and set screws are fitted in the heads of M to pinch the stays L. The zinc tray N (Figs. 1 and 2) is very easily made, and is convenient for instruments and for colour platters.

A Model Undertype Engine.

By J. R. Tucknott.

THE following photographs and description go to show the result of three years of spare time spent on the above model. The boiler was the first piece of work, and was to a great extent screwed together for the sake of simplicity, with screws (see Fig. 2) which were all home-made, a special turret rest and cutters being made for the purpose, which turned them out at the rate of three-quarters to one minute each. The boiler is screwed, riveted, and sweated together, and contains fourteen ⅜-in. fire tubes, screwed into firebox plate, and expanded and sweated into smokebox end; also nine downcomers being screwed into firebox crown, one of these being fitted with a fusible plug. Two solid and one hollow stays are fitted from front to back, the hollow stay being used for steam blower, which is controlled by a small wheel valve, seen in top left-hand corner of firebox end of boiler. There are seventy-six stays fitted from outer to inner firebox, and four from side to side of outer firebox above firebox crown. The smokebox door is made as in locomotives, with the two handles, one for turning the catch-bolt, and the other for pulling the door tight. Instead of adhering to the type of sliding firebox door in the design, I made one of the swing-open type, as seen in photograph. The boiler has the following fittings:—Safety valve, steam gauge (pressed to 160 lbs.), three-cock water gauge, two "Pet" cocks, steam blower valve, and blow-off cock, the safety valve, blower valve, and blow-off cock; being home-made. The boiler is to be fired with petrol, the container being a copper drum fitted with a wheel valve, the oil ways being 3-64ths in. diameter. The container is shown at A, Fig. 1. I omitted to mention that the regulator is of the usual type of revolving perforated disc.

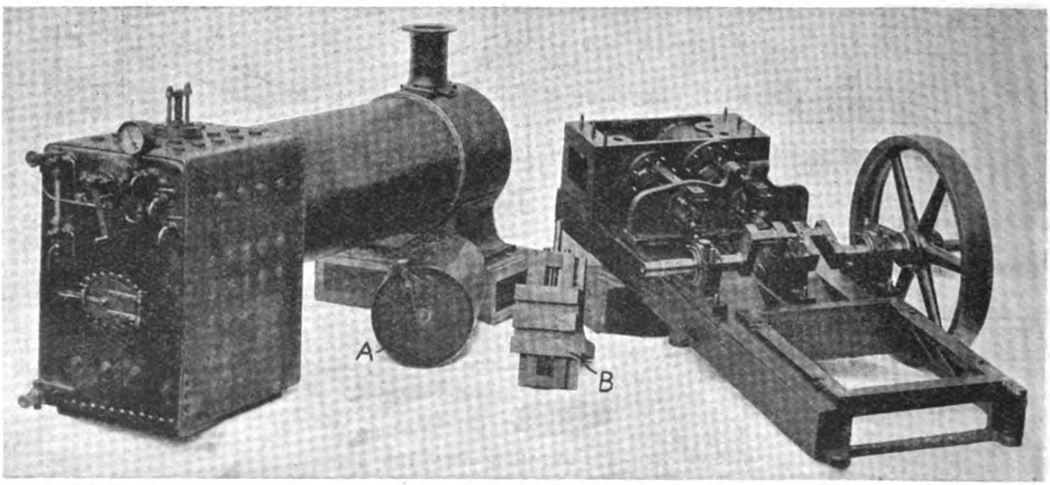

Fig. 1.—View of Model Undertype Engine, before assembling.

A start was then made on the engine, the cylinders, of course, being the first piece. I was fortunate enough to have the use of Dr. Winter's workshop, in which to plane up the bedplate and cylinders, which had previously been set out. All was plain sailing till I came to the valve faces, which were ⅞ in. and 1⅛ ins. below the cover faces; but after making a special tool, a first-class job was the result.

The next thing was to bore the cylinders, for which I made two boring bars and two parallel packings of iron, and then clamp down on boring carriage of lathe (3½-in. Drummond), the ends of bore being counterbored about 1-16th in. larger, so that the piston rings *just* rode over the edge of counterbore, therefore leaving no shoulder after continuous wear. Then came the setting out, drilling with hand-brace and tapping stud holes, for all covers, glands, smokebox saddle, and holding-down studs, number,

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ing eighty-six on cylinder casting alone, all my studs, nuts, and washers being home-made. The smokebox saddle is made by flush-riveting steel plate to front and back of two side castings, thus making a comparatively solid saddle when in position. The three plummer blocks were then planed on base, fitted with tenoned caps, studs, and nuts, and bored out on angle-plate, also faced on sides of bosses; then split brasses were made and fitted, and numbered in proper fashion, and held down to bedplate by three studs each.

re-lining when dismantled for any purpose, they are fitted with dowel pins and cone-headed bolts. The cylinder covers were fixed to vertical slide, and milled across faces to receive guides, which are 7-16ths in. by ⅛ in., and the bottom ones have an oil well milled in each end of the stroke, so that crossheads wipe up a film of oil as they pass over I next started on steam pipe connections, but having no brazing apparatus, I am now engaged in making one, the blowpipe (adjustable flame) and brazing pan being finished. The materials for bellows are two

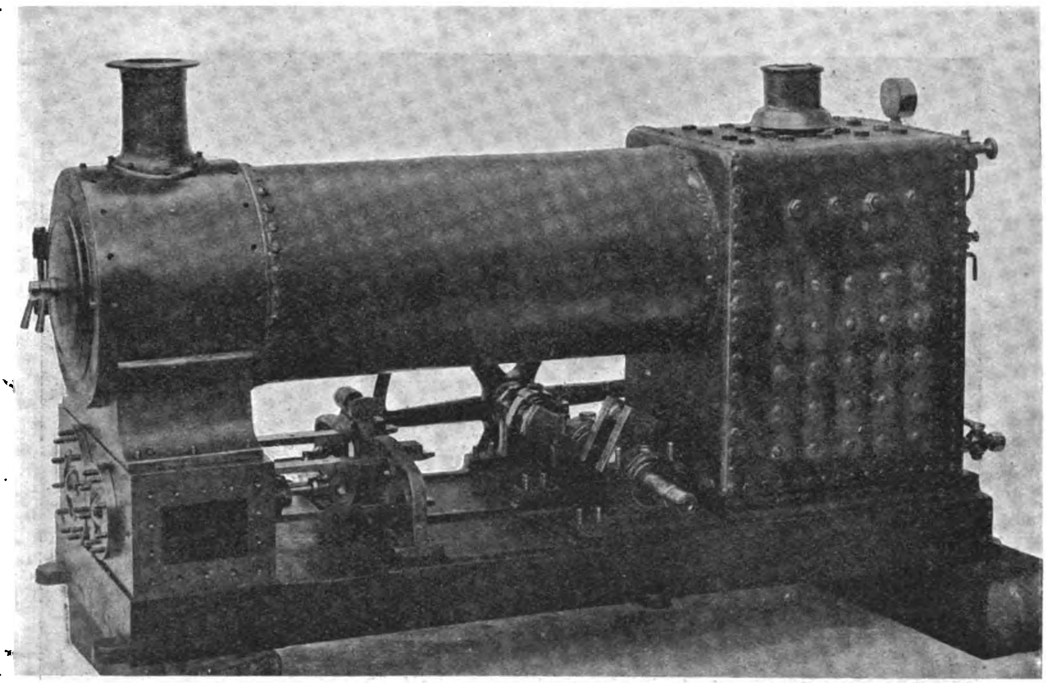

Fig. 2.—Mr. J. R. Tucknott's Model Undertype Engine, showing Boiler in position.

The crankshaft was dealt with next, and after doing the worst part of the work, namely, getting rid of superfluous metal, I came across a large spongy place in the centre of one of the crank-pins, which necessitated getting another casting (malleable) and starting over again, this time all being well. The flywheel was then turned, bored, and keyway cut while in the lathe, slotting-machine fashion. I omitted to mention the pistons and rods. These are made as in large engines, the pistons being pulled on a taper with nut and washer, and the other end turned taper to receive the crossheads. Before describing these, I must say that I made patterns and fitted up a vertical slide, B, Fig. 1, for milling the grooves. Then they were drilled, put on a mandrel, faced to correct width, both on boss and sides, then bolted to vertical slide, and grooved with cutter, and lastly fitted with gun-metal bushes to receive crosshead pins. Next came crosshead guides and motion-plate, which required the most careful fitting up, so as to ensure free running without shake or binding. So that all these pieces may go together without

small chopping boards (domestic) and a football bladder. I think this brings my description to a close, hoping it may be of some interest to my fellow readers. To anyone interested I extend a hearty welcome to inspect my little workshop at 11, Clyde Road, Brighton, if they first make an appointment, so as to avoid a lost journey.

The Latest in Engineering.

A New Turbine.—According to a morning daily contemporary, a Swiss engineer named Corthesy, who has lived in this country for several years, has patented a remarkable model of a turbine engine, for which the usual claim is made that it will revolutionise marine engineering. But still, the figures given are at least promising, for it is stated that a working model, which weighs only 30 lbs., develops 12 h.-p., when driven at 4000 revolutions a minute, and 16 h.-p. at 5,000. The

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patentee proposes purchasing an obsolete torpedo-boat, which he intends to fit with the new type of engine, and test its efficiencies upon the Clyde. The invention has been patented in every country

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House Cleaning by Electricity.—At the Electrical Exhibition recently held at Madison Square Garden, New York City, U.S.A., a novel application of the electrical current was shown by the "Invincible" carpet sweeper, which resembles the ordinary carpet sweeper in its general appearance. The material used in construction is chiefly aluminium, making the machine light and easy to handle. A ½ h.-p. motor is directly connected with a turbine and brush. Revolutions of the brush serve to agitate the nap of the carpet and loosen the dirt, while the turbine creates a vacuum which acts as a suction drawing up all dust and dirt and depositing it in the dust receiver provided. Carpets can be thoroughly cleaned on the floor, and every corner is reached. Nothing need be moved. Attachable appliances are also provided for treating walls, ceilings, cornices, chandeliers, curtains, rugs, pictures, and stairways; mattresses, cushions, upholstered furniture and pillows may be aerated as well as cleaned by these appliances adapted to their various uses. The renovator is operated by one person, as shown in the illustration, who can accomplish in a satisfactory manner as much work as four or five women can do with the old style of broom and duster—a very important item of economy.

AN ELECTRICAL HOUSE CLEANING APPLIANCE IN OPERATION.

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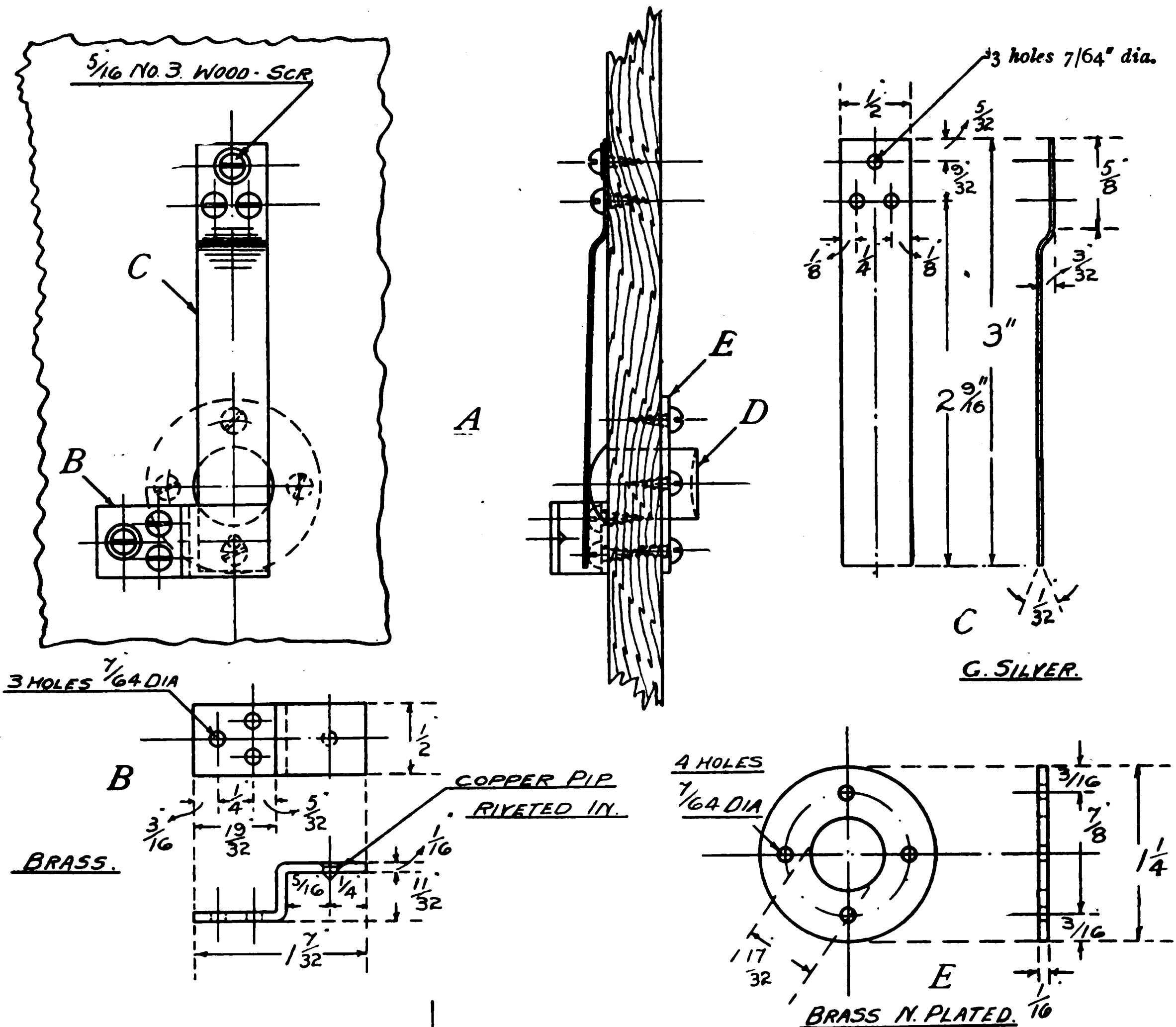
How to Make an Inter-Communication Telephone.

By Fred Rudolph.

(*Continued from page* 504.)

The Induction Coil.

This part of the instrument is constructed as shown in Fig. 12, consisting of two end cheeks of hardwood ⅞-in. square, with a centre hole 5-16ths in. diameter, into which is glued a brown paper barrel. This is made from good quality paper wrapped round a 9-32nds-in. rod, the inside face being glued so that a perfectly hard tube is made when dry. This is cut off to 2½ ins., and carefully glued into the end cheeks—we thus have a bobbin admirably suited for our purpose. The winding for the bobbin is in two distinct parts, primary and secondary, each carefully insulated from the other. The primary winding is composed of five layers of 26 S.W.G. s.s.c. copper wire. A layer of paraffined paper is then



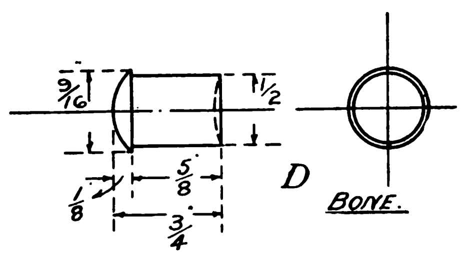


Fig. 13.—Details of Ringing Key.

placed over the primary, the ends of which are brought out and left of sufficient length to allow for a neat spiral for connection purposes. The secondary winding is fifteen layers of 34 S.W.G. s.s.c. copper wire, the ends of this winding also being left sufficiently long to spiral for connecting up in instrument. Each layer of both primary and secondary

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must be perfectly even and insulated with paraffined paper every two layers. The coil presents a very neat appearance if a final wrapping of American cloth or bookbinders' cloth is wrapped over all. The core of the coil is fitted with annealed soft iron wires about 23 S.W.G. and 2½ ins. long, packed full in the core. The coil can be fixed by round-headed brass screws to the instrument.

Ringing Key.

The complete key is shown in A, Fig. 13, and consists of German silver spring (C), plunger (D), brass bracket (B), and brass escutcheon (E). The brass bracket B can be made from sheet brass bent to drawing, with a copper or silver pip riveted in to give good electrical contact. The finish can be either dull plated or lacquered, care being taken in the latter case not to cover the contact. The spring C can be either made of German silver or brass, cut and drilled to drawing. The electrical contact is improved by soldering on a silver disc where it makes contact with the bracket. The plunger D can be turned from bone, ebonite, or hardwood, hollowed on top where finger is put to depress key. The escutcheon shown in E is to give a nice finished appearance to the front of the instrument. The hole in the centre is 17-32nds in. diameter, and provides for a nice working fit for the plunger. The finish can be nickel plated or lacquered.

(To be continued.)

Glass telegraph poles are to be manufactured in a factory recently built at Grossahmerode, Germany. An architect of Cassel has been granted patents in Germany and other European countries and in the United States for a machine to be used in their manufacture. The glass is reinforced by wires suitably disposed. These poles, it is believed, will be particularly adapted for use in countries where wooden poles are quickly destroyed by insects or climatic conditions. The Imperial Post Department of Germany has ordered these poles for use on one of its telephone or telegraph lines.

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

The entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prizewinners must furnish photographs and descriptions of their boats for publication in The Model Engineer. The awarding of the prizes may be summarised as follows:—

Silver Medal to the fastest boat in Class A beating previous records.

Bronze Medal in Class A to all other boats beating previous records.

Silver Medal in Class B to fastest boat, provided speed is not less than 5 miles per hour.

Bronze Medal in Class B to the second fastest boat doing not less than 5 miles per hour.

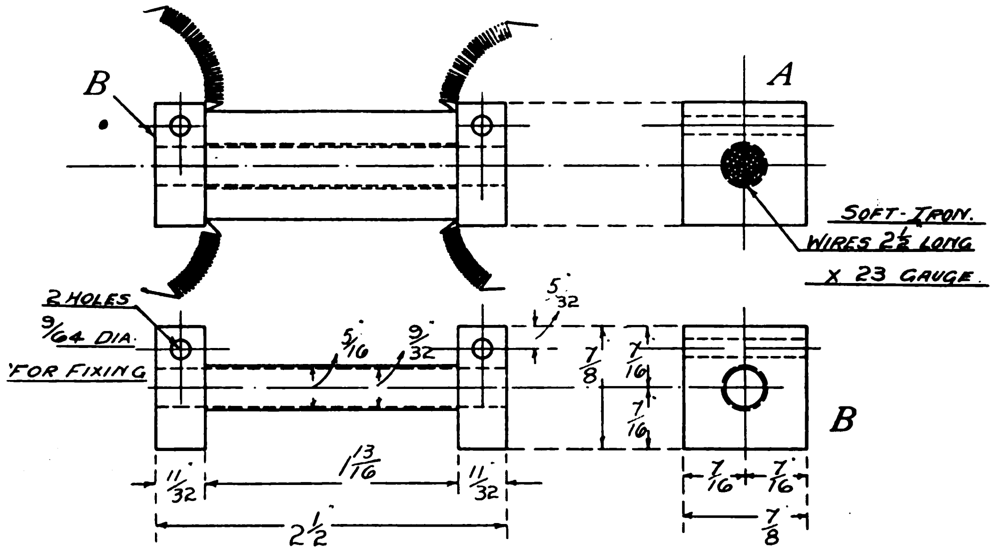

Fig. 12.—Details of Induction Coil.

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Silver Medal in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

Bronze Medal in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

A Model High-speed Boat.

By Bros. Coxon.

The following description and drawings are of a successful boat in the Sefton Model Steamer Club. Her highest speed over a course of 300 yards was 7·2 miles an hour, doing the course in 1 min. 25 secs. Her length, L.W.L., is 6 ft. 8½ ins.; maximum beam, 8½ ins.; draught, 3 ins.; with a total displacement when in running order of 40 lbs.

She is designed on the lines of a T.B.D., and a feature about her running is that she lifts her nose out of water about 3 ins. from the stem. Having a good flare forehead, she is a most seaworthy boat in rough weather, turning the bow wave completely away. The hull is of cedar in two halves, placed so that the grain runs in opposite directions, and eliminating the possibilities of warping, stitched together and glued. This method is a much simpler and cheaper way of making than the bread-and-butter method or solid plank, for each half can be almost finished by itself, and the removing of the inside is simplified enormously. Cedar being a very open grain wood, a good deal of time was spent in filling up the outside surface with red lead and gold size and continual glass-papering.

Boiler.—The boiler is 6¼ ins. diameter tapering down to 6 ins. diameter by 14 ins. long, water space having two 2-in. copper fire tubes, each tube with 10½ ins. diameter water-tubes. The shell of boiler is 16-gauge copper double riveted lap joint. The fire tubes are flanged each end and riveted on to the boiler ends. The ends are also flanged and are fastened to shell by ⅛-in. diameter copper rivets, ⅜-in. pitch. When the tubes and boiler ends are secured together the whole is driven into the shell and riveted up, this necessitating having a slight taper in the shell. The boiler is fitted with a safety valve of the spring loaded type with a ball seating 5-16ths in. diameter clear opening. The amount of opening is always made too small by many marine modellers for the proper relieving of the boiler, and this tends towards many accidents, both to the machinery and worker. As an instance of the power when blowing off through priming, the hatch over the boiler or middle hatch is frequently lifted bodily up, through catching on the fore funnel, and

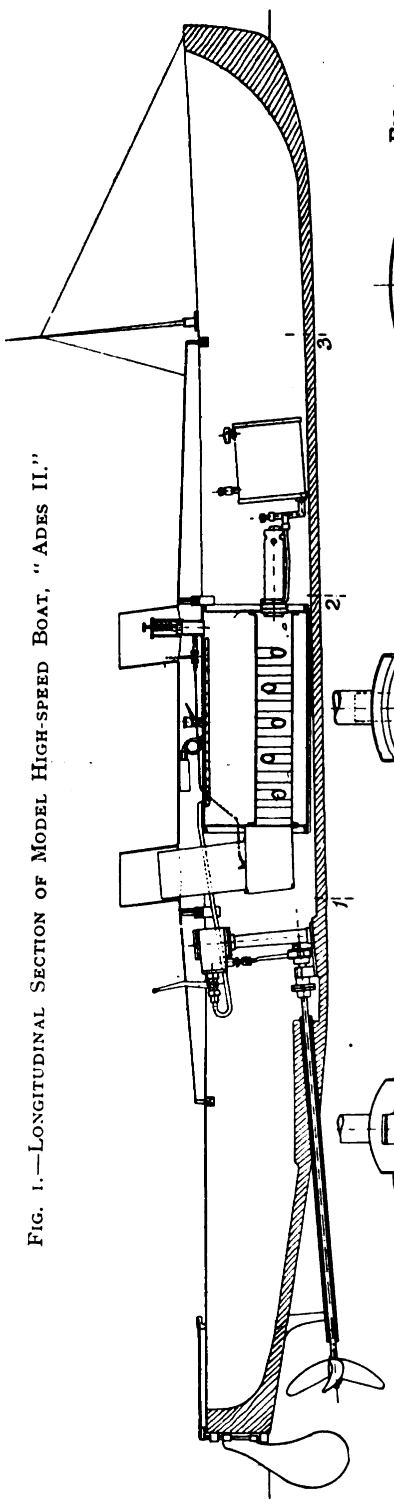


Fig. 1.—Longitudinal Section of Model High-speed Boat, "Ades II."

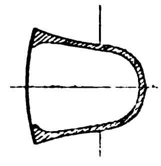


Fig. 4. Cross-section at 3, showing Flare.

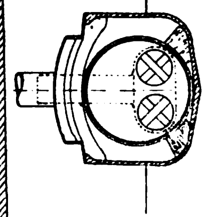


Fig. 3. Cross-section at 2, showing Boiler.

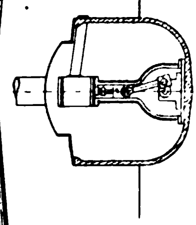
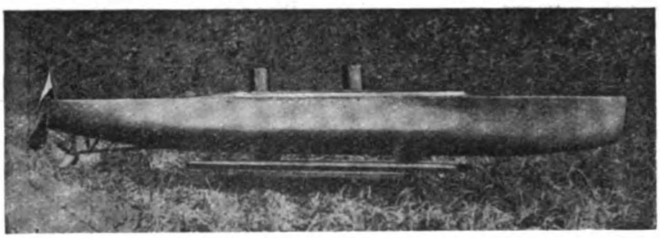


Fig. 2. Cross-section at 1, showing Engine.

a sharp look-out has always to be kept on all these large racers when attending to them and bending down over the safety valve. For feeding the boiler a small cock is provided on top having a female end for ⅜-in. pipe on the feed pump, all feeding being done by hand pump, to reduce weight. There is no water gauge on, owing to the rapid evaporation of water: the boiler is filled, and at the end of the run is just on top of the fire tubes, and will not safely do another trip. Although a perhaps dangerous practice, yet it does away with the worry of a broken glass and its attendant awkward fitting of a new one, and the probability of a lost race. The main feed to engine is supplied by a ¼-in. diameter pipe, and is brought along the top of boiler inside. Here the pipe is slotted about ⅜-in. pitch slots, which allows any water to drain before it gets to the bend turning out of the boiler and reduces priming considerably by taking a small amount from all points, as it were, of the surface. An indispensable part of a large boiler like this is the blower, or forced draught, which can clearly be seen in the sectional drawing. The pipe is 1-32nd-in. brass tube, and is worked down to a fine needle-hole. The boiler is completely lagged with ¼ in. thick wood laths, with asbestos composition back and front ends. A sheet-iron combustion chamber is fitted over the two furnace ends, and the funnel connected on top. The steam gauge runs up to 150 lbs. pressure, but the boiler works at 65 lbs., the higher readings being used chiefly for testing.

Engine.—The engine is of the single-cylinder type, 1¼ ins. by 1¼ ins., cutting off at three-quarters of stroke and cushioning on the exhaust. The most interesting part of the engine is the rigid coupling of propeller shaft to engine shaft, and no flywheel is used. It is hard to start under 20 lbs., but, once away, it runs very sweet, the difficulty being through having no momentum at first to take it over the lead and cushioning of the exhaust. The valve and piston being so well set and packed, it is almost impossible to turn the engine round with the cock shut off. This rather novel idea would, no doubt, form an interesting discussion in the correspondence columns. The exhaust is taken directly out to side of the boat, it being found that a large volume of steam like this fluctuates the firing too much when taken up the funnel.



A View of "Ades II."

Lamp.—The lamp is on the double burner coil principle. Coils are ¼-in. diameter copper, with gas cups brazed on the delivery end, and each cup has three holes. This gives a better distribution of the air and gas, and reduces the roar of the lamp. The lamp seems to be a "burning" question with all amateurs, but as far as the writer can see, and by his own experience, the whole trouble is caused by dirty petrol. The simplest and best way to prevent any stoppage is by putting a small roll of fine gauze wire, about ½-in. long, inside the copper tube where the nipple or gas cap screws on. This then most effectually prevents any dirt from reaching the nipple, and can easily be renewed after a few runs. It will be astonishing to see the amount of dirt that will be collected in this way.

Propeller.—The propeller is cast gun-metal, 5½ ins. diameter, four blades, 9·4-in. pitch, 12·7 sq. ins. blade area. As a standard size for most boats is to have the propeller shaft ¼-in. diameter, it would be a splendid thing if owners would keep to a standard way of securing their propellers to the shaft, as any member could then try another's on his boat. A really good and well-designed propeller is not to be seen everywhere, and is no easy and cheap article to make, and I feel certain we could make a big stride in speed over our present performances if propellers were interchangeable.

Some Exhibits at the N.Z. International Exposition, Christchurch.

By A Londoner Abroad.

At the time of writing it is no less than nine months since I viewed, with very considerable pleasure, an excellent collection of models and other engineering exhibits at the New Zealand "International" Exhibition, at Christchurch.

That loudly-heralded enterprise is now quite a thing of the past—not altogether forgotten, and quite unregretted. Not even the most patriotic New Zealander is likely to find fault with the statement that it was a gigantic piece of bombast—and badly managed bombast at that.

The fact that only quite recently was it possible to get into communication with even a few of the exhibitors is but a minor item of condemnation of its management; a much more serious aspect being visible in smashed showcases, damaged exhibits, and absolute chaos in awards. To New Zealanders "the Exhibition" is practically synonymous with muddle—and worse; and although I would rather have left alone all mention of that unhappy state, it will be impossible entirely to refrain. From the point of view of workmanship, no model engineer who sent his efforts to Christchurch to meet others in friendly rivalry has any reason to be ashamed, but few, I think, will reflect on the results without disgust.

I had intended giving to fellow-modellers some connected narrative, not only of model engineering as I found it in New Zealand in particular, but some general description of the machinery exhibits and engineering. It was not an exceedingly modern or absolutely representative collection, lacking some of the most recent and promising engineering specialities, but yet was fairly substantial and extensive. At the same time, there would be little to interest the English reader in the main classes of exhibits, and I have therefore, with the exception of the railway section, restricted myself entirely to the model engineering department. This was not very large; but small as it

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was, I am yet unable to deal with more than a fraction, owing, primarily, to the fact that the Exhibition authorities had adopted an almost perfect means of thwarting my intentions. It was done in this way. All models were sent in for "competition," and were therefore marked only with an official number and class, the maker's name being presumably filed away until after the judging. This latter was *deferred until the close of the Exhibition*—a most disappointing arrangement, and some time during the intervening period most, if not all, the official numbers originally given were altered. It was manufacturing chaos; the publication of the awards was a revelation. Those who were awarded gold medals and £20 prizes obtained—after much objurgation—various certificates. Those quoted as "bronze medallers" received big cheques. One lucky man, who was prevented at the last moment from sending in his model at all, nevertheless received high praise and a gold medal for a model the judges had never seen! I am constrained to add that this is no fanciful description, but solid fact.

After no little labour and much worrying of a very willing friend, I got at last into touch with various exhibitors, and persuaded them to give their efforts to the world through the medium of THE MODEL ENGINEER. Generally speaking, I have let them tell their tales in their own words, although one or two busy or bashful ones have requested the loan of my pen. I can only say I feel sure the descriptions of these New Zealand-made models will be as interesting to other home-folk as to myself, and I will not, therefore, apologise for the share I have taken in bringing them into these pages.

My first, as they say in acrostics, is a New Zealand locomotive. By the courtesy of Mr. A. L. Beattie, chief mechanical engineer, N.Z. Government Railways, I am able not only to give the following interesting particulars of one of the most imposing exhibits, but also to illustrate it with the photograph in Fig. 1. This really fine engine was displayed most advantageously. A deep pit between the rails, with steps at both ends, allowed of easy inspection of cylinders and motion, the whole of which was well lighted with incandescent electric lamps. I was interested to note the up-to-date methods of machining and construction adopted (shown by separate items in various stages of manufacture) and the general smart "engineering" look of the engine as a whole. On only one point did I think the exhibit fell short of the best English work—and that was in regard to finish. The painting was distinctly inferior to that with which I was familiar, and tool-marks on machined parts were a little more pronounced. This would not in the least militate against good performance, and I merely mention it to make up the sum of my criticism.

Following are the details of this engine, which is illustrated by the photograph (Fig. 1):—

PARTICULARS OF CLASS "A" FOUR-CYLINDER BALANCED COMPOUND LOCOMOTIVE, BUILT IN NEW ZEALAND GOVERNMENT RAILWAY WORKSHOPS.

High-pressure cylinders, 12 ins. diameter by 22-in. stroke; low-pressure cylinders, 19 ins. diameter by 22-in. stroke; coupled wheels, 4 ft. 6 ins. diameter; boiler pressure, 225 lbs. per sq. in.;

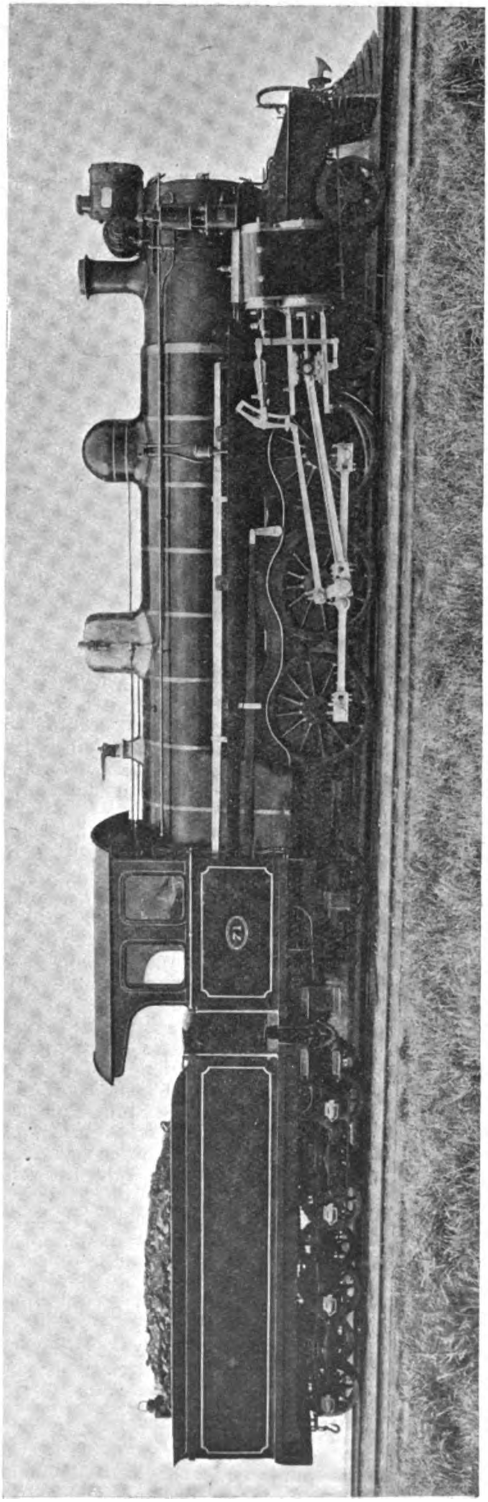

FIG. 1.—CLASS "A" FOUR-CYLINDER COMPOUND LOCOMOTIVE, NEW ZEALAND GOVERNMENT RAILWAYS.

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tractive power (working compound), 17,440 lbs.; total heating surface, 1,724 sq. ft.; area of fire-grate, 30 sq. ft.; capacity of tanks, 1,700 gallons; fuel space, 140 cub. ft.; total weight (in working trim), 72 tons.; gauge, 3 ft. 6 ins.

The high-pressure cylinders are placed between the frames, and the low-pressure cylinders outside the frames. The high-pressure cylinders are coupled to the leading cranked axle, and the low-pressure cylinders to the intermediate driving wheels. The high- and low-pressure engines are each provided with independent valve gear, thus allowing ratio of cut-off to be varied by means of separate reversing levers. Piston valves are used.

A starting valve admits boiler steam (up to 120 lbs. pressure) direct to the low-pressure cylinders, and the intercepting valve, which is controlled from the cab, opens the high-pressure exhaust to the atmospheres and makes it possible to use either high- or low-pressure cylinders alone, and therefore admitting of working both sets of engines non-compound for a special effort.

These engines are used for passenger and mixed train services. In this type of compound, with the four cranks set at 90°, the turning moment is, of course, much more uniform than in two-crank engines. On heavy grades, with a greasy rail, these four-cylinder locomotives show a very noteworthy advantage over two-cylinder engines of similar tractive power.

Experience has demonstrated that while both types of engines will take up their maximum load on a good rail, the load for two-cylinder engines has to be greatly reduced if rail is greasy. The four-cylinder balanced compound locomotive slips very little on a bad rail, and can haul a full load under nearly all conditions, which in daily working on heavy grades, saves an additional engine.

The New Zealand Government Railways have been the first to adopt the four-cylinder balanced compound locomotive for a 3-ft. 6-in. gauge.

The Railway Department exhibited also a number of very fine specimens of passenger coaches, as well as another smaller locomotive and a good collection of other railway specialities. I was much struck by the appearance of a well-made model of a steel viaduct. As a specimen of the comparatively large undertakings necessitated by the nature of much of New Zealand's conformation, it struck me that some description would be of interest to young English engineers. It should be remembered that notwithstanding finances are limited by reason of a comparatively sparse population, every unit of that population has quite British ideas on the subject of speedy and frequent transportation. To the credit of our Railway Department is to be placed that pluck and determination which gives us such fine examples of engineering skill as this viaduct shows.

For particulars of the real bridge, and for the excellent photograph, I am indebted to Mr. John Coom, M.Inst.C.E., Chief Engineer, Maintenance Branch, N.Z. Government Railways. Following is the description given in connection with this viaduct.

Ormondville Viaduct.

The Ormondville Viaduct, erected over the Mangarangiora Stream (see Fig. 2), is situated in the Hawkes Bay Province of New Zealand, and within a mile of the township of Ormondville, on the Wellington-Napier main line of railway. Its erection was necessitated by reason of the timber viaduct having reached the limit of its life, and the further fact that it was possible to considerably improve the line by deviation. A favourable site was found for the bridge, and the Kinsua type of viaduct was selected as being the most suitable and economical, and a design giving the following spans was prepared, viz., four 81 ft., three 61 ft., eleven 33 ft., and two 30 ft. 6 ins., the total length of the bridge being 931 ft. and the height of the centre pier from water level of stream 130 ft.

There were used in its construction 360 tons of steel and 2,479 cub. yds. of concrete, the whole work, including the earthworks, costing £21,240.

The structure was designed to carry engines of a distributed load of 1·75 tons per ft., with 12-ton axle loads. A wind pressure of 50 lbs. on the unloaded structure and 30 lbs. on the loaded structure and train were allowed for.

The concrete piers and approaches were built by Departmental labour, the steel piers and superstructure being manufactured and erected by Messrs. J. & A. Anderson, of Christchurch, New Zealand.

The model exhibited in the Christchurch Exhibition was constructed in the railway workshops, the scale being ½ in. to the foot.

One other exhibit shown by the Railway Department was also noted for introduction to The Model Engineer readers. This was a full size sample windmill, such as is used at many wayside stations in New Zealand to pump water for locomotive purposes. Here, again, I solicited Departmental help, which Mr. Coom met by supplying a complete drawing and description of the machine. I have thought it desirable to deal with this separately, since it is largely constructional, and may therefore omit further mention of it herein.

(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.]*

Modern British Locomotives. By A. T. Taylor. London: E. & F. N. Spon, Ltd. Price 4s. 6d. net; postage 2d.

Locomotive enthusiasts will welcome such a book as this. The author has brought together by the aid of various locomotive engineers a collection of diagrams of locomotives representing the latest practice on the leading railways of Great Britain. The diagrams, which number 100, are accompanied by the leading dimensions and particulars, which are also to be found in tabulated form convenient for reference under the following headings:—four-coupled bogie engines, four coupled Atlantic express, six-coupled express, six-coupled goods, eight-coupled mineral, four-coupled bogie tank, eight-coupled tank, six-coupled radial tank, four-coupled 10-wheeled tank, four-coupled radial tank, six coupled radial (double-ended) tank.

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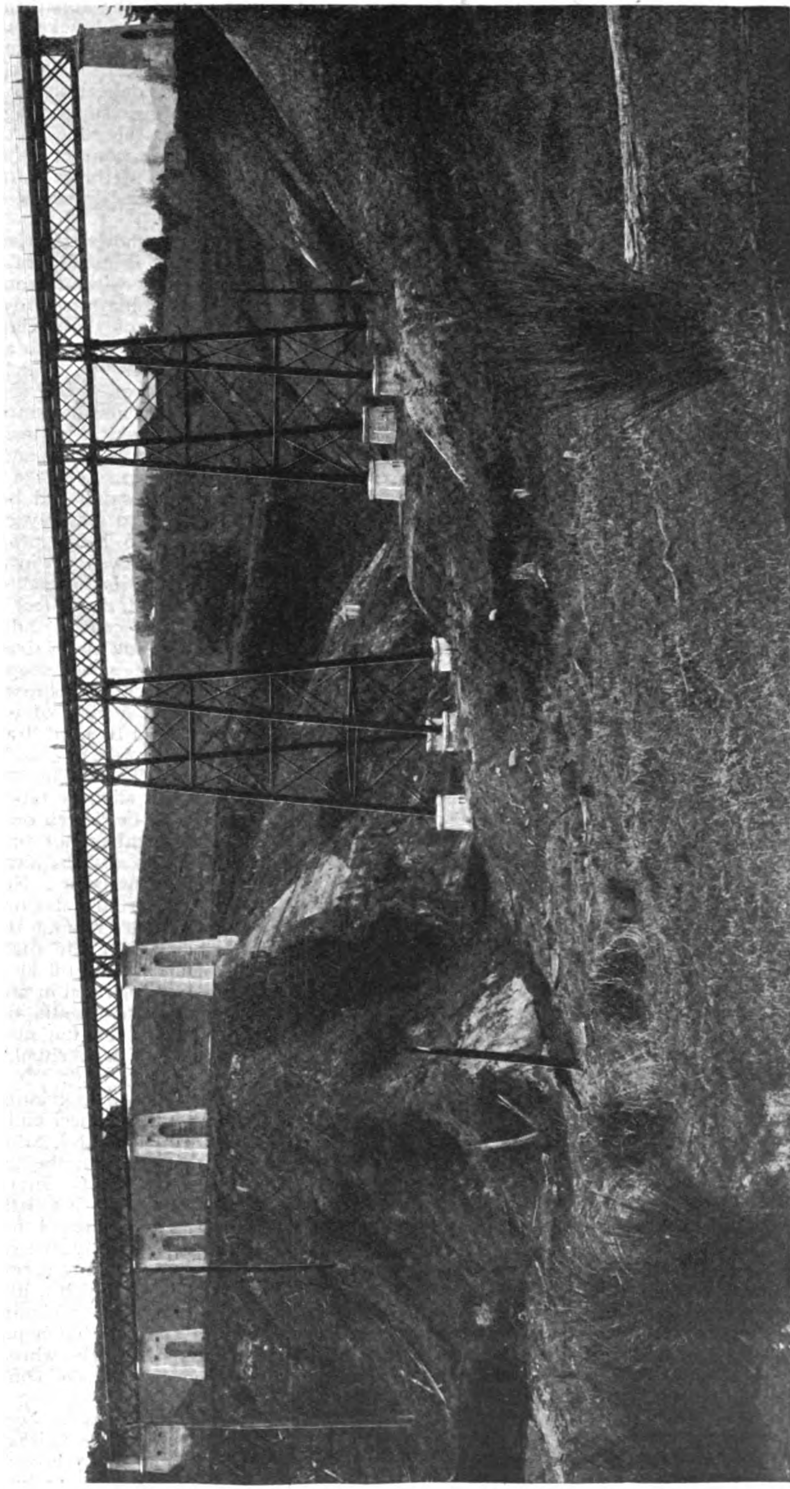

Fig. 2.—Ormondville Viaduct, Wellington-Napier Branch, New Zealand Government Railways.

Notes on Wireless Telegraphy Apparatus.

By V. W. Delves-Broughton.
(*Continued from page* 459.)

The Lodge-Muirhead Coherer.

THIS, although a more ambitious piece of work, as already stated, need not frighten an amateur, provided he can do some accurate work, and has overhead motion fixed to his lathe, or can improvise a lapping spindle to grind up the wheel. A screw-cutting lathe is, I believe, essential to successfully constructing a coherer as described below, although I have come across one or two men capable of doing the most extraordinary work with the simplest of tools.

Before constructing this coherer, "Wireless Telegraphy for Amateurs," by R. P. Howgrave-Graham, should be thoroughly studied, and, further, it would be courteous, to say the least of it, to write to Messrs. Lodge-Muirhead, asking their permission to infringe their patents!

Mr. Howgrave-Graham gives an excellent design in his book for a coherer of this type, but there are one or two items which he advises the amateur to have constructed by a watchmaker, and I propose showing how these can be made at home; besides this, I have altered the "drive," as a knotted thread is not satisfactory, and clockwork is difficult to regulate to give a regular speed.

The coherer, when constructed, should be fixed to a circular lead base with a groove turned in the upper surface to receive a bell glass and the lead weight rested in turn on three short lengths of rubber tube to absorb all external vibrations. Screws might with advantage be passed through holes in the lead base and fixed securely in the table or board carrying the rest of the apparatus, but care should be taken that the screws do not come in absolute contact with the base itself when the coherer is being used; whilst being carried from place to place these screws might be tightened.

The first thing to be made is the ebonite base; this consists of a piece of ebonite 3½ by 2 by ⅜ in., to which are screwed two brackets—one 2 by 1⅞ by ¼ in., and the other 2 by 1½ by ¼ in., shaped as shown in the drawings, Figs. 8 to 11.

Next take a piece of ⅞-in. ebonite rod and make the main body of the mercury well and fit the cap as shown in the drawings. This cap must be most accurately fitted, so that it may be turned by hand, but without any shake.

Similarly the small ebonite capsule must be fitted to the bottom of the well and the brass plug with the platinum spiral, as shown in the drawings (for details of platinum spiral see page 94 "Wireless Telegraphy"). The object of the screw cap to the mercury well is to provide a simple means of regulating the form of the surface of the mercury and also to form a safe arrangement when carrying the apparatus, as it is very objectionable to have mercury spilt about amongst valuable apparatus; when it is desired to move the coherer the cap is unscrewed a few turns, when the mercury will descend into the cavity under the head of the cap.

The height of the mercury can be regulated by screwing up the well in the bracket which carries that part of the apparatus; as will be seen in the drawings, this bracket is parted by a saw cut, and provided with a clamping screw to fix the well when adjusted. The various small pillars carrying the brush connection to the revolving sleeve, the small spring supporting the wash-leather pads bearing on the edge of the wheel, and the spring clip making contact with the brass plug which carries the platinum spiral, are sufficiently clearly shown in the drawings to need no further description.

Fig. 11 shows the last-mentioned spring clip in plan, as it could not be shown clearly on the general plan without confusing the drawings.

All these pillars are provided with screws to adjust the tension of the springs, and the first and last with terminal screws to attach the leads.

The spindle on which the wheel revolves is formed out of a bit of No. 12 knitting-needle, which should first be tempered to a deep blue colour, one end of which is turned down where it passes through the ebonite and provided with a large nut which forms a flange to hold it square with the ebonite, the small end being provided with a nut and washer to securely clamp it in position; the free end also being provided with a nut spring and washer, as shown in the drawings.

The wheel is formed out of a slice turned off a ½-in. bar of cast steel, a ⅛-in. hole being bored through the centre and the wheel roughed out to shape, being made about 3-64ths in. thick at the centre. The wheel should now be hardened and tempered to a deep straw colour.

Next take a piece of 3-16ths in. round brass rod, which should be hard drawn, or, if this is not available, take a piece of ¼-in. brass and hammer it down well. Chuck this in the lathe and turn down about ⅛ in. slightly taper to fit the wheel, which should now be driven on and soldered in position, care being taken not to lower the temper of the wheel. This can be done without removing the work from the lathe. Next take a No. 13 knitting-needle and grind a flat on the end extending about 1¼ ins. in such a manner that the thickness is reduced to exactly half the diameter of the needle, the end being ground off at an angle to form a D-bit, as already described in previous articles, the original temper of the needle being sufficient for boring brass. After having made a small hole to start the D-bit, a hole should be bored about 1½ ins. deep.

Now fit up the grinding spindle and, first with a small emery wheel and afterwards with a copper lap, finish the wheel, taking great care not to overheat the wheel in the process, or a "wire edge" will be the result. In the final stages of lapping rouge mixed with a little vaseline should be used, and the lap changed from side to side at short intervals. Finally, the edge of the wheel should be polished by making it revolve whilst a folded piece of leather, to which a little rouge and oil has been applied, is lightly clamped against the wheel in such a manner that a portion of the leather bears on each side of the wheel equally—a watchmaker's hand-vice may be conveniently used to clamp the leather.

The wheel having been finished, the outside of the sleeve can be finished off, and finally the hole through the centre broached out with a tool formed of a piece of No. 12 knitting-needle, as shown in Fig. 12. This broach must be used very carefully,

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and if there is any tendency to bind, it should be instantly withdrawn and brushed clean with an old toothbrush dipped in paraffin.

If this process is carefully carried out, it will be found that the sleeve will revolve on its own spindle freely, but without any shake. The object of boring the hole so deep in the first instance is to allow sufficient depth for the conical end of the broach to pass right through that part required for the finished sleeve.

The sleeve can be cut off to length after the end furthest from the wheel has been turned slightly taper and lightly knurled with a small milling wheel.

On this end of the sleeve a small ebonite disc is driven, which, if to be used with a thread drive, need only be provided with a narrow V-groove. (A little rubber solution, such as is used by bicyclists for repairing tyres, will assist in holding the vulcanite wheel securely on the sleeve.)

If it is proposed to drive the coherer with a simple water re-action turbine, or Barker's mill, it is advisable to form a worm wheel on the ebonite disc.

For this purpose procure two ordinary wood

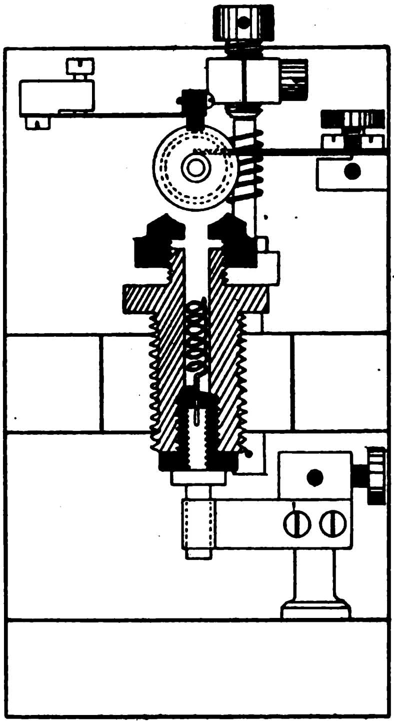

FIG. 8.

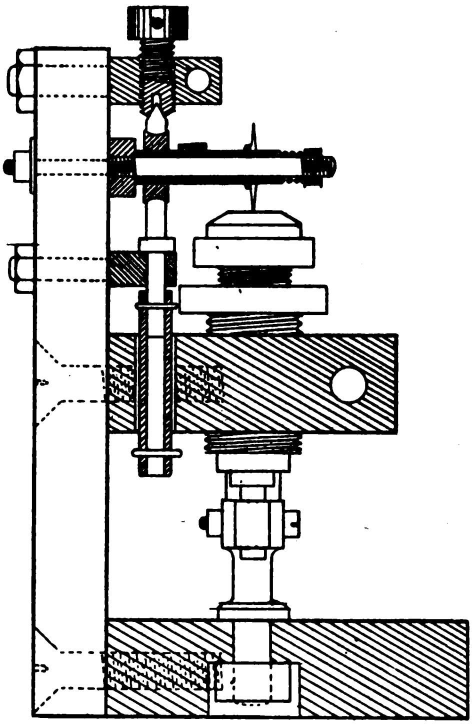

FIG. 9.

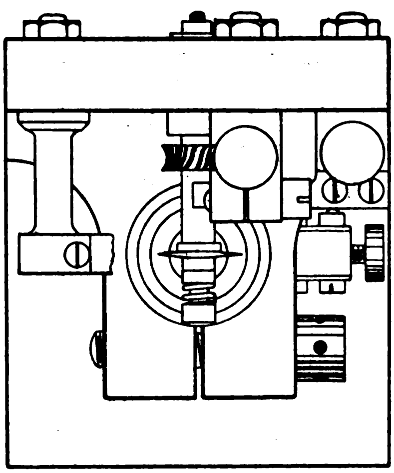

FIG. 10.

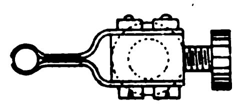

FIG. 11.

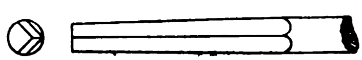

FIG. 12.

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screws about 2 ins. long and 3-16ths in. diameter. Take one of these, chuck in the lathe and turn to the shape and dimensions shown in the drawings, any burrs on the edge of the thread being removed with a fine file and finished with different grades of emery cloth.

The other screw is next taken and flutes cut in the thread, as if making a hub tap. The ebonite wheel, after having been mounted on the sleeve, is fitted to a temporary spindle made of another piece of the same knitting-needle, and the worm hubbed out in the usual manner.

The screw used for the hub should not have the burrs removed from the thread; in fact, rather a rough screw should be chosen, as this roughness helps to cut the ebonite and make the teeth on the finished worm wheel work freely on the worm.

The Barker's mill, clearly shown in Figs. 13 and 14, should be mounted under the bench on which the apparatus is stood, the connection between the turbine and the coherer being made through a flexible shaft formed of a bit of the G or silver string of a violin. This can be cemented with shellac in short ebonite sleeves, one of which is fitted and pinned to the end of the worm, as

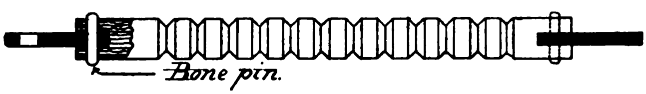

Fig. 15.

shown in the drawings, and the other to the upper end of the turbine spindle.

This form of drive is most regular, and may be used to drive a recording instrument at the same time. The worm drive for this is clearly seen in Fig. 13. An upper and lower tank should be provided to contain the supply and waste water respectively, the water being baled or pumped back, as required; of course, on the size of these tanks the duration of the time that the machine will run depends. Water could be led from the house supply and run to waste, when the length of time that the machine would run would depend on the capacity of the house cistern or the size of the town reservoir, if the house is supplied under constant pressure.

The size of the nozzles will have to be found by experiment, but if made ⅛-in. bore in the first instance, can be opened out as required. The exact speed can be finally regulated by adjusting the supply cock.

Another advantage in this system of driving is that if the size of the tanks is properly proportioned the apparatus can easily be arranged in such a manner that the first signal received will automatically release a detent which will start the coherer and the recorder, so that any ordinary message can be received without the presence of the operator, and when the water has run out the recorder will automatically stop without running out an endless quantity of paper. Clockwork could also be set to work for a given time and then come to a rest; but if a motor drive is used, it is extremely difficult to arrange any system for cutting off the current after a predetermined length of time. Otherwise, a small electric motor would be very suitable to drive both the coherer and recorder.

The Barker mill is a very simple piece of apparatus to make, and if arranged under a bench, which will allow the upright tube to be made 2 ft. in length, will drive the apparatus for about five minutes with each cubic foot of water used. It is a great advantage to have a small foot-pump for raising the water from the lower to the upper tank

Fig. 14.

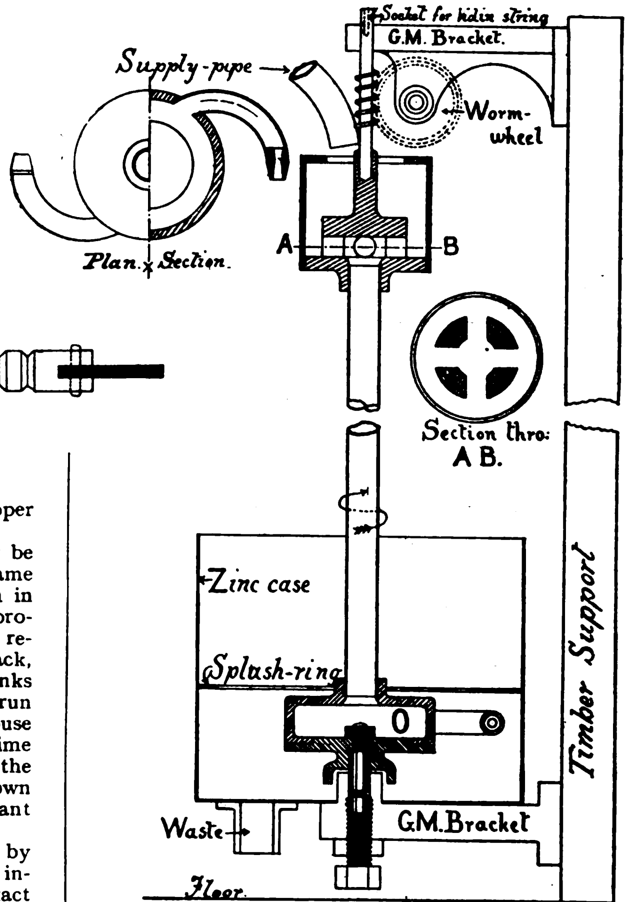

Fig. 13.

and this can easily be made with very little trouble out of a short length of 3-in. brass tube, a few home-made zinc castings, and a little dodging.

I have not tried this coherer in its entirety, but have used the mercury well and turbine drive for another type of coherer, in which a fine steel wire was drawn across the mercury at a slow speed, and there was no fault to be found with these parts of the apparatus, although the coherer itself did not work satisfactorily. I found that the platinum spiral could be done away with and a small spiral of tinned iron wire, such as is used for soda-water

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bottles, used in its place. This wire must be amalgamated before being made into a spiral, by simply dipping it into a little pool of mercury and drawing it through a piece of wash-leather pinched between the fingers; this process should be continued till the tin has been dissolved away from the iron, care being taken that the mercury used for this purpose is not used in the coherer. I also found that the surface of the mercury could be cleansed from oil and dirt by means of a small camel-hair pencil dipped in benzine, and that with a little care the mercury could be kept in working condition practically indefinitely. In making up this coherer the same care as to the mercury should be observed as mentioned in the case of the Castelli coherer.

I have found that nothing can beat mercury cups for making contacts for wireless telegraphy work, as there is no doubt about the contacts being perfect.

String boiled in wax makes a perfect suspension for high-tension wires indoors; but if exposed to the weather, wooden insulators about 1 ft. long, turned with a lot of grooves and well boiled in wax, leaving a quantity adhering to the outside, answer even better than ebonite, as moisture will not condense on the wax so rapidly. The ends should have ebonite attached, as, if the wax on the surface becomes abraded, the wood seems to absorb a certain quantity of water. (See Fig. 15.)

Near the apparatus all high-tension wires should be heavily insulated with rubber; ordinary high-tension leads, as used for motor-cars, will answer for coils up to 12-in. spark; but in any case, when using a powerful coil, it is advisable to place it and all high-tension wires well out of reach, and for this reason it is as well to place the coil on a shelf fixed high on the wall. I once got a spark from a 4-in. coil right on the tip of my nose, and that was quite enough to make me careful in the future.

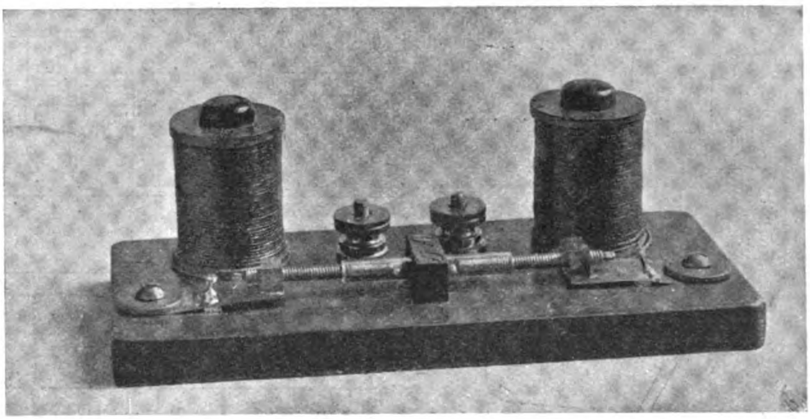
A convenient way of taking the lead out of the room to the aerial is to bore a hole through one of the panes of glass and pass the rubber-covered wire through this, carrying this about 2 ft. through, and there joining it to plain wire. Unless the lower capacity is very thoroughly insulated—and I have found no necessity for this—the lead to that can be taken through the woodwork of the window; but it is still advisable to use heavily covered rubber wire for this indoors, as a nasty shock might be obtained if anything happened to earth the aerial.

In conclusion, I cannot do better than again refer my readers to Mr. Howgrave-Graham's book, than which it would be difficult to find a more concise treatment of the whole practice of radio-telegraphy, taken from a practical point of view.

There is only one point on which my limited experience does not agree with his. I found that the choking coils joined in series with the coherer should each have about 500 turns, instead of 100, as he states. This is doubtless due to the fact that the relay that I used had a very much higher resistance than the moving coil instrument he used.

I was greatly troubled by stray rays affecting my coherer till I hit upon the plan of covering the table on which the instruments stood with a sheet of metal and cased all my connecting wires in thin lead pipe, which was done by drawing the pipe down on to the wire by means of a kind of large drawplate, which was made of hardwood, ordinary bell wire being used throughout. As far as possible the leads were twisted together and stapled at close intervals to the sheet lead, which was earthed through a gas pipe.

Coherers are the most aggravating things to deal with, and often go wrong in a most unaccountable way. In experimenting, I have obtained fairly good results with a coherer made up in the roughest manner, and when properly finished and accurately made have failed to obtain any results at all. One special coherer—a modified type of filings coherer—worked excellently until it was exhausted, but when exhausted failed to record sparks 10 ft. away from a 10-in. coil. On nipping the end of the tube off it started work again, but, of course, the filings had to be changed periodically.



View of Castelli Coherer, showing the Method adopted for Accurately Centreing the Iron Pole-pieces in Glass Tube.

In another experiment with a mercury coherer, the cap of the mercury well was formed out of a lump of wax moulded on to the screw and carved out with a pocket-knife; this, rough as it was, worked better than a carefully turned ebonite cap, and a number of caps had to be turned before as good results could be obtained. Then, again, the coherer sometimes gets blamed for faults which exist in other parts of the apparatus—perhaps a loose contact somewhere.

Note.—The two bobbins on the base of the Castelli coherer are choking coils. The terminals between the choking coils are joined to the receiving circuit and the aerials are clamped under the washers, which also serve to hold the springs.

(To be continued.)

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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.]

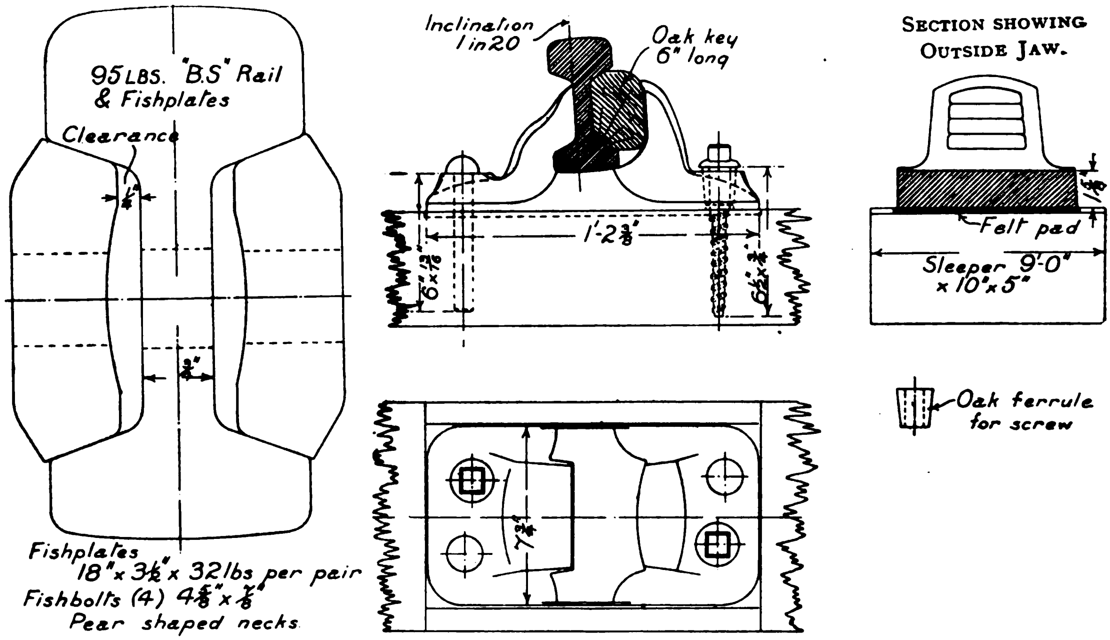
Permanent Way Details.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In the current issue of THE MODEL ENGINEER you give in answer to a query a sketch of the rail and fishplate and chair of the L. & N.W.R. Permit me to point out that you are a little behind the times, as you will see by the enclosed rough tracing. This was adopted by the L. & N.W.R. as a standard in 1905, and is now being laid by them. You say that the section of rail was taken from the end of a new check rail. Well, I may point out that older rails of a lighter section are very often used for checks. There is a special chair used at the joint which is 10 ins. wide on the base, but similar in all other dimensions to the centre chair on the tracing, while a 12-in. by 6-in. sleeper is used with it.

I must record here my great appreciation of THE MODEL ENGINEER, and say that it is very seldom one has an opportunity of bringing you up to date in any matters connected with engineering, whether civil or mechanical.—Yours truly,

JOHN W. MELVILLE.



PERMANENT WAY DETAILS.

Re Balance of Turbine Wheel.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In reference to A. E. Harbord's account of his turbine steamer and the trouble of balancing the turbine rotor, in October 17th issue of THE MODEL ENGINEER, it may interest some readers to know the reason of this. No matter how carefully the disc may be balanced when at rest, its centre of gravity does not coincide with its geometrical centre, and this at a high speed causes severe vibration. To overcome this, a flexible shaft is used, which allows the wheel or rotor to swing a little in its plane of rotation. With the flexible shaft there are vibrations which increase with the speed up to a certain point, called the "critical speed." At this speed the vibrations cease and the wheel settles down and runs smoothly. This phenomenon is called the "settling of the wheel" and is caused by the wheel rotating at slower speeds round its geometrical centre. When it reaches the critical speed the shaft is sprung out of its centre and the wheel rotates round its centre of gravity.—Yours truly,

W. H. COLE.

A Repair to a Signal-Post.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—A short time since the writer had to repair a model signal-post, which, under the circumstances to be described, did not admit of being dealt with other than by the method adopted. This, the writer ventures to think, was sufficiently novel to merit a brief description.

The post was a model of apparently Continental manufacture, and was a pretty correct copy of the iron lattice posts often seen on British railways. It was in two lengths, as per sketch, with a railed stage at mid-height, and the upper length was originally soldered to the floor of the stage. This

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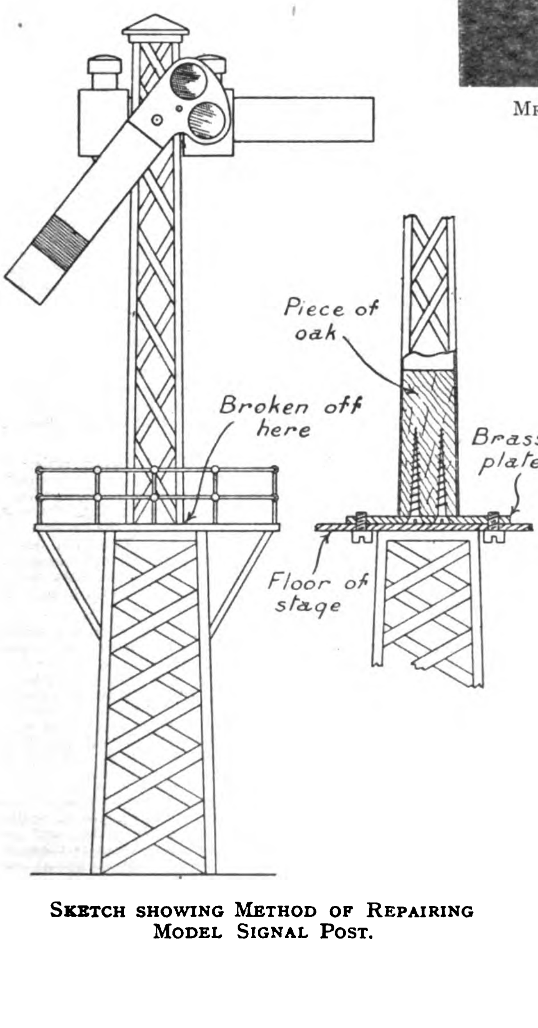
piece had been broken off at the joint, and as the writer's capabilities for soldering are limited (to say the least), and as, moreover, the rails of the stage were much in the way, it was resolved to attempt a screwed joint, as follows :—

The floor of the stage being filed flat and smooth, a piece of hard, straight-grained oak was taken and planed up a good driving fit in the lower part of the top length. The end being carefully squared and filed flat, a piece of stout sheet brass was cut to the width, or rather less, than the stage, and three holes were drilled and tapped for ⅛-in. screws, as shown. Three holes being marked and drilled in the stage to correspond, the screws were inserted from beneath.

It should be mentioned that the piece of brass, is secured to the oak stem by two slender screws their heads being well countersunk. The enamel—where chipped—was touched up, and the result is a strong and satisfactory job.—Yours faithfully,

SIDNEY RUSSELL.

Cranbrook.

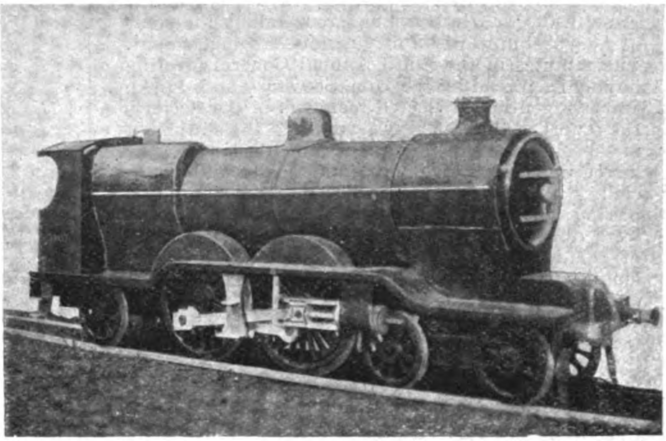


SKETCH SHOWING METHOD OF REPAIRING MODEL SIGNAL POST.

A Cardboard Model G.W.R. Locomotive.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Enclosed is a photograph of my 1 in. to the foot model express locomotive, intended to be of the same type as G.W.R. No. 40, "North Star." I made it principally last winter, and every part is wood or cardboard, excepting the wheel-guards and hand-rails, which are copper and ⅛-in.



MR. R. MOXON'S CARDBOARD MODEL LOCOMOTIVE.

wire respectively. Each wheel spoke is fretted out, and, in all, these number 140 for the ten wheels. The "brasses" for the coupling and connecting-rods are large drawing pins, and effectively prevent the rod end coming off when the engine is pulled along. The engine is some 2 ft. 6 ins. long, and weighs about 25 lbs.—Yours faithfully,

R. MOXON.

Re Small Spark Plugs.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I should be very pleased if any of your readers could inform me where it is possible to obtain small sparking plugs, diameter of threads about ½ in. I believe same are made, but do not know makers. As I have had several inquiries as to where I obtained the castings for my 2 h.-p. motor described in THE MODEL ENGINEER (November 7th), I might just mention here that they were purchased from the Madison Motor Company of Woolrych Street, Derby, and can recommend same to prospective purchasers.—Yours faithfully,

HERBERT H. SCHNEIDER.

DISPERSAL OF LONDON FOG.—An apparatus has been invented by M. Demetrius Maggiora, having for one of its objects the application of atmospheric vibrations to prevent the formation of fog or to disperse it in case it is already formed. The inventor claims that this can be effected by means of explosion of acetylene or other gas in a strong steel cannon about 60 ft. high and 6 ft. in diameter. The director of the Meteorological Office has consented to examine and report upon the proposal and its suitability to the atmospheric conditions of London.

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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 tenth Annual General Meeting of the Society was held on Wednesday, November 13th, at the Cripplegate Institute, Golden Lane, E.C., Mr. Herbert Sanderson taking the chair at 7.30, and upwards of fifty members being present. The minutes of the ninth Annual General Meeting having been read by the Hon. Secretary and signed, and five gentlemen elected members of the Society, the report of the last year's work and the statement of accounts were presented and discussed, the increasing prosperity, both numerically and financially, being much commented on. Their adoption having been formally moved and seconded, they were duly passed by the meeting. The attention of the members present was then engaged in a lengthy discussion of the proposed alteration and addition to several of the Society's rules (of which notice had previously been sent to all members), the result being that the alterations moved by the Chairman to Rules III, VII, VIII, and IX and Library Rule IV were passed; while the alterations to Rules V and VII, moved by Mr. W. T Barker, were rejected.

The election of officers for the year was then proceeded with, Mr. A. M. H. Solomon being unanimously elected chairman; Mr. F. R. Welsman, vice-chairman; Mr. Herbert G. Riddle, secretary; Mr. T. Norman Gilbert, treasurer, and Mr. H. Hildersley, librarian. The ballot for members of committee resulted in the following being elected, viz., Messrs. H. W. Greenfield, L. M. G. Ferriera, John Wills, and Paul Blankenburg; while the following were elected as the new Track Committee, viz., Messrs. L. M. G. Ferriera, John Wills, Edward Seldon, F. H. J. Bunt, W. B. Hart, and S. L. Solomon.

Votes of thanks having been moved and heartily accorded to the retiring officers; to Mr. Percival Marshall for the space given to the Society at THE MODEL ENGINEER Exhibition; and to Messrs. Keiller and Meredith (who had acted as scrutineers during the evening), the meeting was brought to a close by the presentation to the late Chairman and Treasurer, by Mr. P. Blankenburg, of a silver cigarette-box, filled with 100 cigarettes, subscribed for by the members present at the meeting on October 18th, an inscription having been engraved thereon that it was "presented to Mr. Herbert Sanderson as a mark of esteem and appreciation of his many services to the Society." The presentation was made amid much enthusiasm.

FUTURE MEETINGS.—Friday, November 29th: A continuation of his "Model Making Wrinkles," illustrated with diagrams and demonstrations, by Mr. L. M. G. Ferriera. Monday, December 16th: Special Track and Model Night. Prizes will be awarded by popular vote to the three most interesting models or articles exhibited.—Full particulars and forms of application for membership may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

Queries and Replies.

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

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

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

[18,375] **Power for Driving Small Machine Tools.** G. L. (Malo les Bains) writes: As a two years' reader of your valuable journal, I should take it as a favour if you would answer the following five questions:—(1) I am thinking of installing a small electric motor to drive my lathe—a Holmes three-in. centre, used for light metal and wood-turning. Would ¼-h.-p. electric motor be powerful enough? (2) What size circular saw would a ¼-h.-p. motor drive? (3) What sort of motor would it be best to employ as regards windings? Is a starting resistance necessary? (4) Could you mention the name of any London firm who would supply me with complete castings and wire for ¼-h.-p. motor, enclosed type, to work off 100-volt mains? (5) Would you kindly give me sketch of a small circular saw table or bench?

(1) A ¼-h.-p. motor would do for very light work. You would have to let it run at a good speed, and gear down rather low, except where very light cuts were taken. (2) Circular saws take a lot of power, even running light, because they have to run at very high speeds. We are afraid you would find anything less than 1 b.h.-p. of little practical value. (3) You can obtain compound wound motors specially suited to variable load work. Thompson & Co., of 28, Deptford Bridge, Greenwich, or Darton & Co., 142, St. John's Street, London, E.C. A suitable starting resistance and switch should also be had from the makers. (4) The above firms would do so. (5) This will have to be given in article form.

[18,171] **Electric Circuits with Earth Return.** J. C. R. (Loftus, R.S.O.) writes: Please tell me if I should be able to obtain electrical conduction through sea water from three miles distance up to five miles: that is to say, should I be able, with a strong current sent through the water, to detect anything with a telegraphic needle at the distances stated above? Also could I get a positive and a negative current; that is, the needle to deflect from right and from left?

Yes, but you must have a complete circuit through which the electricity can flow. If you use the sea as one part of the circuit, you must provide a wire from the place at which the current leaves the water to the place at which it enters for a return path. Reversed currents are obtained by reversing the polarity of the battery. We advise you to read a text-book on telegraphy. The actual flow of current need be very small to affect a good needle instrument, but you must add battery cells in series according to the distance and other circumstances until sufficient voltage is obtained to send the requisite current through the entire circuit.

[18,322] **Water-tube Boiler.** W. H. W. (Lurgan) writes: I am taken with description of small water-tube boiler in your issue of August 29th, pp. 197 *et seq.* I think of making one large enough to drive a Stuart No. 1 or No. 3 compound, which I would use to drive a small lathe. (1) Is this a suitable shape of boiler for the purpose? (2) What diameter should the end drums be? (3) What thickness should end and tube plates be? (4) How many water-tubes ought I to use, and of what diameter? (5) What is the highest pressure at which it would safely work? (6) What is the probable cost for materials for boiler alone?

(1) To work such a large engine you will require an all-steel boiler with copper tubes. About 600 to 800 sq. ins. of heating surface will be required at least. Taking this at 800 and presuming that the water tubes are ½ in. diameter, about 35 tubes will be required 15 ins. long. (2) This will necessitate drums at least 7 ins. diameter. (3) Cast the drums in steel at least 5-32nds in. thick, with only one joint, viz., that for the cover. (4) Thirty-five tubes, ½ in. diameter, 15 ins. long. (5) About 75 lbs. (6) Make your drawings and submit to trade firms for prices.

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[18,343] **Engine for Dynamo Driving.** M. L. (Newcastle-on-Tyne) writes: I am building a horizontal slide-valve engine, 1-in. bore, 1-in. stroke, from Stuart's castings, and I should like to know, will the engine be capable of driving the "Simplex" dynamo, described in THE MODEL ENGINEER handbook No. 10, on pages 52–58? Could it drive a larger dynamo; if so, of what output? I propose building a boiler for engine from instructions given in THE MODEL ENGINEER handbook No. 6. Will the boiler described on page 17, Fig. 1A, made of drawn tube 4 ins. diameter by 12 ins. long, fitted with water tubes, and the steam carried through a superheater, generate sufficient steam to drive engine, which will be coupled with dynamo, at a speed to get stated output? Kindly give dimensions of force pump, also number and diameter of tubes required for the boiler.

No: a 10-watt dynamo is the largest we would advise you to couple to the engine, and even then it must be very nicely made. A water-tube boiler 4 ins. diameter by 12 ins. long will do if the number of water tubes is not less than nine and the diameter 5-16ths in. outside. Do not fit a force pump, as the engine has no margin of power, but employ a good hand pump.

[18,045] **Telephone Failure.** N. M. D. (Bristol) writes: I should feel extremely obliged if you could put me right as to the working of a single line telegraph system which my friend and myself have endeavoured to instal between our two houses. The method of procedure was as follows: At a distance of two yards from each other we dug two holes, 1½ ft. deep, in the earth; we then placed two zinc plates (dimensions, 4½ ins. by 1½ ins.) in the holes and filled in the latter. We next connected the tapper, needle and battery with each other, as per sketch enclosed. On switching on the current and signalling no result was forthcoming, so we connected the earth lines together to make sure that there was no mistake in any connections, and we found that on signalling they were reproduced on the galvanometer. We then gradually lessened the distance between the plates, but with no success. What was the cause of the failure? I may say that the current at its best was from 8 to 9 volts.

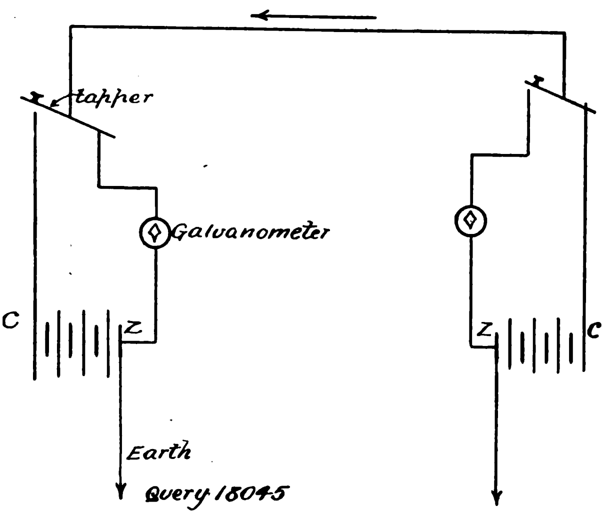

DIAGRAM OF TELEPHONE CONNECTIONS.

Your trouble lies with the earth plates. You ought to go down two or three feet or so until you find a place where the earth is permanently damp. Further, your plates are too small; the dimensions should be at least 2 ft. square.

[18,357] **400-watt Kapp Dynamo Trouble.** S. P. (Douglas) writes: I shall be much obliged if you will answer the following queries. I have a Kapp type dynamo supposed to give 400 watts. It is wound for 100 volts 4 amps., 9½ lbs. of No. 25 S.W.G. on field-magnet and 2¼ lbs. of No. 22 S.W.G. wire on armature. I have had it tested by a gas engine of 1½ b.h.-p. belonging to a friend of mine, but have failed to get any satisfactory results. The armature is wired according to your handbook No. 10, and tests all right for leakage, etc., before fitting up, the commutator being a 16-part one. The machine is connected up as shown in the enclosed diagram (not reproduced). The air-gap between armature and field-magnet is a good 1-16th in., the armature core being a plain drum. In running the machine the only result I can get is the deflection of a galvanometer needle to 45°—that is, running at 2,200 to 3,000 r.p.m. I cannot vouch for above speed being correct as the engine speed fluctuates a little, as the governor is out of order. I have put on a load of eight down to two 100-volt 16 c.-p. lamps, but I cannot get any further results than the deflection of galvanometer needle and sparking at the brushes, so I would be obliged if you can help me in any way and explain the cause of the failure to generate, if you can.

There must be something radically wrong with your machine, and we advise you to send it some electricians to have it looked to. Machines built carefully to the directions in handbook have always been successful. The air-gap, 1-16th in., is rather large, but at a good speed you should obtain some output. We advise you to test for polarity at the field-magnets, and to use an ammeter and voltmeter to see what you are really getting. The brushes of a dynamo require to be given a forward lead as the load increases, owing to the magnetic field between the field-magnets becoming, as it were, bent. A motor requires backward lead—*i.e.*, set back somewhat from their normal position when running on a load. See text-books on the subject, such as S. P. Thompson's "Lessons in Electricity and Magnetism," 4s. 9d. post free.

[18,416] **Accumulator Making.** J. L. (West Ham) writes: Being a constant reader of THE MODEL ENGINEER, I should be glad if you will kindly answer the following queries. (1) I have made, according to the instructions given in your MODEL ENGINEER handbook No. 1, Chap. III, the first half of the plaster mould for casting the leaden plates. I have also made the wax pattern of this half, but I fail to see how I can make the other half of the mould from this pattern. The book says: "The wax impression already taken should next be taken and laid on its back," etc., but I find that when I lay the wax impression on its back on the mould that the lug of the wax impression comes opposite to one on top of the whole of the mould. It would thus be useless to pour on the plaster-of-paris. Please explain the difficulty. (2) Will ordinary lead known as "old lead" do for casting the plates? If not, please state what kind must be used and the price per lb.? (3) How long must the pasted positive plates remain in the lime chloride solution? (4) I am thinking of making the battery accumulator light installation as described in your handbook No. 22, Chap. VI. If I increase the number of cells in the accumulator to five, thus getting 10 volts, and increase the number of battery cells by three, would I be able to light 25-volt lamps by running the battery in series with the accumulator? Would the current in amperes by such a combination be the average or the lowest of the two, at a pressure of 25 volts, that is? (5) What is the current of a single Daniel cell? (6) Is the maximum charging current of an accumulator the same as the maximum discharging current? (7) What is the current in amperes given out by a bichromate cell per square foot of zinc?

(1) In reply to your inquiry it appears that your difficulty is due to the lug coming on the wrong side when the second half of the plaster mould is going to be made. The proper method to adopt is to cut off the lug on the wax pattern before making the second half of mould, for in all other respects the mould will be alike. This would give you a lead casting with the lug half the thickness of the plate, but if desired this can be obviated by cutting away the opening for the lug on the second half mould by hand, in the position it should occupy. We think this should be perfectly clear to you when you get actually to work with the materials, though on paper it may appear rather confusing. (2) Yes. Ordinary lead sheet if clean. (3) This depends on the size of the plates to a great extent, but you will see the colour change, and can judge when the action is complete. (4) We should not advise you to run the accumulators and other cells in series, as the discharge, with even small candle-power lamps, would be rather too heavy for the primary cells. Besides this, the method would be inefficient owing to the rather high internal resistance of such a group of cells. (5) This depends upon the resistance in the circuit and the internal resistance of the cell. (6) Yes. (7) The reply to this is same as for (5).

[18,237] **Boiler for Electric Light Plant.** P. D. F. (Torquay) writes: Is the following sized boiler large enough to drive the horizontal engine and dynamo? Boiler (vertical): Size, 24×12; ¼ steel plates; twelve 1½ steel tubes across firebox, inclined; works at 100 lbs. pressure; tested to 200 lbs.; made by Goodhand. Engine: Cylinder, 2×4-in. stroke; flywheel, 11 ins. Dynamo: From ¼ to ½ h.-p.; pulley, 1 in. If not large enough, what boiler would you advise?

No, the boiler will not drive the engine and dynamo satisfactorily. You would do better with a 16×30 vertical multitubular boiler with fourteen flue tubes 1½ ins. diameter; or, if you see that the steam is delivered quite dry and all pipes are protected from radiation, a 16×24 boiler with fourteen flue tubes 1½ ins. diameter would suffice, and would save you about a sovereign in first cost. However, the provision of a larger boiler than that absolutely necessary will never be considered a mistake.

[18,250] **Model Boiler.** D. J. (Yeovil) writes: Could you tell me about the right size boiler for a ½ by 1-in. horizontal engine; also power to be expected from same?

Everything depends on the type of boiler. What sort do you fancy? About 50 sq. ins. of heating surface would be ample. The boiler, Fig. 9A, "Model Boiler Making" would do well; or, Fig. 1 with water-tube as at Fig. 1A. The locomotive type boiler

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(Fig 19) would also do well, the barrel being made a little shorter and the firebox sides straight. The power would not be more than 1-50th i.h.-p.

[17,935] **Small Power Boiler.** R. T. (Cleckheaton) writes: I propose making a boiler for an engine I have made. I enclose rough sketch of same. For the flanged ends of boiler I propose to use gun-metal castings 3-16ths thick, and to screw the tubes into the bottom end and to expand the ends of the tubes into the top end. What I wish to know is, will this method make a good boiler, and will the flanged ends of boiler do without stays? If not, how many stays should be used and diameter of same? Will the top ends of tubes do without soldering or brazing after being expanded into end plate?

Yes, you will find that a single stay in the centre will be required. In proportion to the number of tubes used the unsupported area is rather large and, therefore, we recommend a single copper stay made out of ¼-in. bar in the centre. This should be screwed into both plates and lock-nutted on outside. Of course, you can make the rod parallel throughout and screw the two ends only. The stay should then be fixed in one end, say, the bottom, by screwing into a tapped hole and lock-nutting afterwards on the outside. The top plate should be drilled ¼ in. clearing and lock-nutted both sides, the inside nut being adjusted before the top plate is riveted in. With the same number of larger tubes or a much larger number, staying would not be absolutely necessary. No

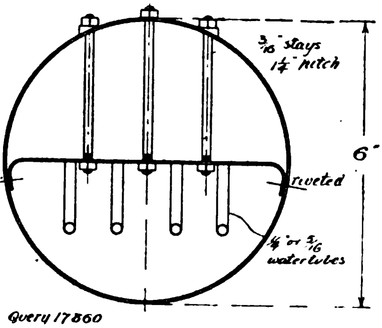

Fig. 1.—Cross-section of Boiler.

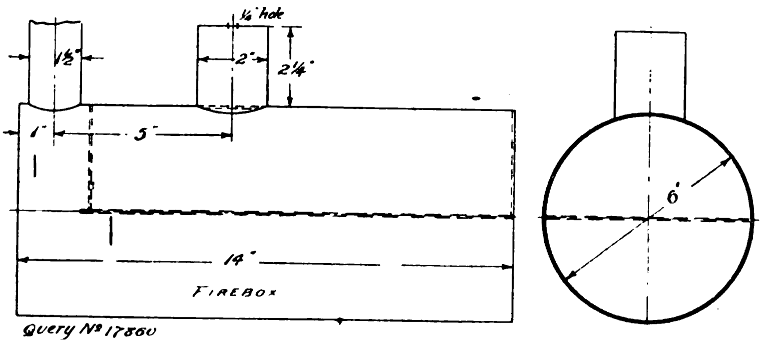

Fig. 2.—Elevation and End View of Boiler.

soldering will be required if the top ends of the tubes are properly expanded in. Why not use copper for the outer shell instead of brass? You can, of course, expand the tubes in at both ends. There is no great advantage in screwing them in at the bottom with such a large boiler, as it is not a question of being unable to use the expander for want of room as often occurs in the case of a small model locomotive boiler.

[18,376] **Miscellany.** F. R. writes: I shall be very much obliged if you will answer me, as far as possible, the following questions. (1) In a few back numbers you showed how to tell the number of a piece of wire by means of winding it on a pencil and counting the number of turns to the inch. I have not got this issue, and so I shall be pleased if you can tell me by answering this letter. (2) How many amperes will the various numbers of wire carry? (3) Will a motor when used as a dynamo generate as many watts as is necessary to drive it as a motor, at the same speed? (4) How much wire (weight), and how many watts is necessary to magnetise an electro-magnet, which weighs 1 lb., to its fullest extent, and what weight would it lift? (5) How is it that a tube should vary the strength of the current in a shocking coil, as I understood there was no insulator of magnetism and that the shocking coil was worked on that principle? (6) Why is it when I attach one end of my battery to the usual place on the shocking coil and connect the other end of the battery to one of the terminals at the shocking end, that I am able to get a shock, as in the construction there is no connection between the primary and secondary? (7) How many amperes does a Leclanché cell give? (8) How much insulated copper wire is necessary to give the resistance of one ohm?

(1) A table of wire gauges, etc., is given in our January 1st, 1901, issue. (2) This is given in above table. (3) No. There will be a loss owing to the inefficiency of the machine. No machine ever gives out 100 per cent. of the energy that is put into it. (4) This depends upon the shape and the quality of the material, etc., and can only be found by trial. (5) Much of the induction effect is absorbed by the interposition of the brass tube. (6) You get a primary shock owing to the rapid make and break of the current flowing. The effect is similar to that obtained from a magneto shocking machine. (7) Discharge rate should not exceed ¼ amp. Even this is rather heavy. The current given by any cell is dependent on the resistance of the circuit, and its own internal resistance, and its voltage, and is stated by Ohm's Law—

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

See "Lessons in Electricity and Magnetism," by S. P. Thomson, 4s. 9d. post free. This book will assist you in many ways. (8) See table previously referred to.

[18,379] **Indicating Gas Engines.** C. B. (Kilburn) writes: Will you kindly send me particulars of methods for preventing belts slipping on pulleys, and if there is any preparation sold for coating same? If so, is it reliable, and where may it be obtained? I am having a good deal of belt slipping on a gas engine belt drive to shafting. Would wooden pulleys be powerful enough for a gas engine belt drive? Kindly advise me with any other particulars for obtaining a maximum drive. I might add the gas engine is a 7 h.-p. (nominal), and is subject to heavy loads when all machines are on (printing machines). Would I be able to get better results from engine with two flywheels, as my engine has only one, but I think the belt slipping is primary cause. Would you advise having gas engine indicated now and again, say, in the course of every three or four years? Is it necessary to ensure good results to have this done, or is there any apparatus for fixing to gas engine permanently so that a man not an engineer is guided as to the behaviour and performance of his engine, and whether he is getting the best possible results? What is generally the cost of indicating engines?

(1) There are a good number of reliable belt compositions on the market, notably, "Cling-Surface," a preparation of great merit. Any of our advertisers would obtain it for you. We should prefer a metal pulley on the engine shaft, but bent-wood pulleys can be used successfully on the counter shafting and machines. Two flywheels will not make matters more satisfactory, provided the engine is of good design in the first place. If there is any doubt as to how the engine is behaving, then by all means have it indicated. As a rule, unless something extraordinary happens, one can tell by ordinary observation how the engine is working, especially so if one is looking after the engine day after day — any slight derangement that occurs is then easily and quickly noted. No rule as to how often indicating is required can be given. We can recommend you to read our handbook on "Gas and Oil Engines," 7d. post free, by Runciman, and also the series of articles on indicating gas engines which appeared in *The Engineer-in-Charge* for April, May, June, July, August, September, November, and December, 1906; also (the articles on indicating) January, March, April, May, and June of this year, by the same author. These issues can be had 3½d. each post free, from this office. There is no apparatus that can be permanently fixed to indicate what the engine is doing. As regards the cost of indicating, most firms —any firm of repute—would send a man down once a year or so, to see to the engine and, if desired, *i.e.*, if you think it is not working well and economically, would charge you a purely nominal amount to cover travelling expenses and man's time. If you had mentioned the maker's name, we could have advised you more definitely.

[18,346] **G.W.R. "City" Class.** "Crank-Pin" (Plymouth) writes: I wish to make a model of one of the "City" class engines on the G.W.R. Could you kindly send me a side and front end view of one of these engines, showing as many of the outside details as possible?

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You will find a drawing of the "City" class G.W.R. engine in the issue of October 13th, 1904. See also issue of June 14th, 1906, for tender.

[18,397] **Electric Wiring.** W. M. G. (Dumbreck) writes: On a 250-volt lighting main if I wish to add more lamps, say to a room, how can I manage it? Suppose there exists only one lamp in this room, can I by using an adapter in the lampholder connect up to three or more lamps, or will the inserting of so many lamps blow out the fuse on the branch to this room? Is there any way of reducing the flow of current from an accumulator? For instance, I have a 4 amp.-hour at 4 volts accumulator, and a coil taking 4 volts 2 amps. Can I make *one charge* in the accumulator *last longer* by causing it to give a current of only 1 amp. to the coil? The gauge on the primary coil is 20, and this absorbs about 2 amps. at present.

(1) You should find out what gauge the branch wire is, and from a wire table see if it will carry the extra current for the other lamps. You must guard against overheating the wires, especially if in wood casing, as this is how many fires are caused. Read "Private House Electric Lighting," 1s. 3d. post free. (2) Insert a resistance of any suitable material—usually German silver wire is used for small jobs. The lower the discharge rate of accumulator the longer the charge will last. See "Small Accumulators," 7d. post free.

[18,320] **Wimshurst Machines.** A. C. R. (Cuckfield) writes: Would you kindly answer me the following questions concerning a Wimshurst machine:—(1) Which type of collecting comb gives the best results. (2) Does dust shot give results as good as tin foil for inside of Leyden jars? (3) What speed must an 18-in. glass plate machine be worked? (4) Must all brass work be varnished or polished? (5) Is it safe to touch the neutralising rods when working?

(1) Probably that having a comparatively large number of points sloping slightly in the direction of rotation of the plates. It is very important that the supports of the combs, that is, the parts to which the points are fixed, have no sharp edges or ends; the surface of the metal should also be very smooth. Anything of the nature of a point causes the charge to leak away. (2) Probably not, but is practically as good. (3) There is no definite speed, about 500 to 700 r.p.m., but effects are produced at lower speeds. (4) All brass work should be very smooth, but need not be highly polished or varnished. Avoid edges and points as much as possible. (5) Yes.

18,271] **Compound Engines.** J. R. J. (Hexham) writes: I am attending to a compound horizontal Robey engine, the steam pressure from boilers being 120 lbs., which has now been reduced to 70 lbs. The result is that at 60 lbs. pressure the engine governor closes and the engine slows up. Now, to stop this the engineer altered the lift on the valves which admit steam to the cylinders so as to admit more steam from the steam-chests. The low-pressure engine steam valves have now a big lift to make an easy exhaust for the steam. The high-pressure engine works now with the governor at 40 lbs. pressure. We have no indicator to take a card, and just set these valves at chance. I am only 20 years of age and do not know much about engines, and would like you to tell me if you would have done the same with the engine? Is there any likelihood of harm being done, for, to my fancy, the engine works better now, as before we were always running slow.

It is impossible for us to give an opinion from the information provided. Setting the valves by chance, however, is a risky proceeding, from the point of view of engine economy, but, of course, the ratio of expansion needed alteration, so that the L.-P. cylinder would take its proper share of work under the new circumstances. Read the reply to query in the issue of June 20th last.

[18,337] **Blowlamp for Model Steam Boiler.** F. C. P. (Sheerness) writes: I have a model Cornish boiler (steel), 9½ ins. long and 4½ ins. diameter, with a single furnace tube 1½ ins. internal diameter. I desire to know what means I can use to fire this boiler. (1) With paraffin as fuel would the burner (sketch enclosed) be suitable? (2) If so, would brass or steel tubing be necessary? (3) Would a steam blast be necessary in the funnel, or would exhausting up the chimney be sufficient? The boiler works at 25 lbs. per sq. in., driving two engines of ½-in. by ¾-in. and ½-in. by ½-in. respectively. (4) What size hole would be necessary in the vapour outlet?

(1) You would do better with benzoline as fuel. It is cleaner and will give less trouble. However, paraffin will work all right, but not in the burner you have designed. You would do better to buy a complete "Vesuvius" burner, price about 4s. 6d., and make the rest of the lamp. You will find a design for a benzoline burner in our handbook—"Machinery for Model Steamers," price 6d. net, 7d. post free. Benzoline burners are easier to make. (2) Brass or copper tubing; preferably the latter. (3) A steam blast is only necessary when steam is shut off from the engine. (4) Use a standard Primus burner nipple.

[18,369] **Magnetising Steel Rods.** T. V. A. (Harringay) writes: I wish to magnetise two small pieces of steel, ¼ in. square by 1½ ins. long. Will you please let me know what size bobbin and gauge of wire to form a coil for this purpose? I have a 6-volt accumulator composed of seven 4×4 plates in each cell. I can use each cell singly or together as you may advise. The magnets are best cast steel made as hard as possible.

Make a bobbin about 1½ ins. long and wind it with 43 yds. of No. 28 S.W.G. wire (copper, silk covered). This will give you approximately 6 ohms resistance, and consequently about 1 amp. will flow when it is put in circuit with your 6-volt set of accumulators. The opening of the bobbin should just be large enough to take the steel to be magnetised. Then insert the steel, and leave the current flowing for a few hours. You can find by trial how the magnetisation is proceeding. A few sharp taps with a hammer on the piece of steel when the current is flowing will help matters. The bobbin should be made of quite thin stuff. In fact, there is no need for a bobbin, except that it is convenient for winding the coil of wire on.

[18,430] **Small Electric Lamps for Open-air Decoration.** F. C. (Wollaston) writes: I beg to thank you very much for your reply to my last query, and I should like your advice on the following. I am going to fit up a 4-volt Osram lamp to light a rose bower out of doors. It will require 48 yds. of wire, single run. I thought about enclosing it in compo gas tubing to make it weatherproof, but I should prefer a well-insulated wire instead, if possible. Please give me your opinion on these two systems, and, if the latter is feasible, please tell me what gauge wire and what insulation to ask for. Please advise what kind of batteries would be most suitable for above circuit to work without any attention for about three months at a time. I should only want to use the light about twice an evening for three minutes' duration. I should prefer the ordinary Leclanché cell for cheapness, as I do not want to give more than 2s. per cell. I think the most likely type would be either the agglomerate or sac Leclanché or the Empire wet battery. Please state how many cells will be required to light the lamp through 96 yds. of wire (inclusive). Please tell me where I can obtain two-way tumbler switches.

We advise you to use No. 20 S.W.G. for your leads. Obtain rubber-covered and taped wire, suitable for outdoor purposes. Its resistance will be approximately 2·25 ohms and, therefore, at least 6 volts will be needed to supply your 4-volt lamp, assuming it does not take more than 1 amp. Leclanché cells, grouped in sets of two in parallel, and four such sets in series would probably do if provided with large circular zinc plates instead of rods. But 1 amp. is a very heavy discharge rate for these cells. Good dry cells, such as are used for ignition coils on motors, are more suitable, though, of course, more expensive. Whitney's or Thompson and Co. would supply switches required.

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.*

*** Scale Brass Rail.**

We have received a specimen length of brass rail for railway track from The Liverpool Castings Supply Co., Cathedral Works, Church Lane, Liverpool. The rail is introduced for such cases where durability is required, combined with neat appearance, and ease of laying. The specimen we have before us is suitable for 1 in. to 1½ in. scale railways. Price and further particulars will be supplied upon application to the above-named firm.

New Catalogues and Lists.

C. Nurse & Co., 181-183, Walworth Road, London, S.E.—We have received the fully illustrated catalogue issued by this firm, comprising 372 pages, and giving prices and particulars of numerous kinds of tools for wood and metal work. The section devoted to engineers' tools contains many items specially serviceable to model engineers, such as calipers, micrometers, gauges, screw-plates, squares, rules, clamps, steel rules, files, pliers, vices, hacksaws, stocks and dies, taps, etc. Large tools are mentioned, such as drilling machines, shapers, portable forges, anvils, lathes and lathe slide-rests, chucks, drills, etc. The catalogue will be sent post free for 10d. to readers of THE MODEL ENGINEER upon application.

F. Darton & Co., 142, St. John Street, London, E.C.—Sections A, B, and C of this firm's catalogue are to hand, comprising particulars of standard meteorological and other instruments manufactured by this firm. There are aneroid and mercurial barometers in various designs for observatories, laboratories, domestic and yachting equipment; also leather travelling sets, pocket compasses ranging in quality and price from a few pence to pounds, pedometers for recording distances walked, clinometers, thermometers (from the cheap boxwood scale wall fitment to the thermograph or scale recording instrument), thermometers also for steam, refrigerator and oven testing, lactometers, hydrometers, pyrometers, also steam, vacuum and gas pressure gauges.

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The Editor's Page.

THE Honorary Secretary of the Sefton Model Steamer Club, Liverpool, notifies us that a model steamer meeting is to be held on the Sefton Park Lake on Saturday, Dec. 14th, at 3 p.m., when the club officials will be pleased to time and certify any boats which readers who are non-members of the Club may wish to enter for THE MODEL ENGINEER Speed Boat Competition. The Club extends a very hearty welcome to all interested in model steamer matters, and they haye generously offered to give a gold centre medal to the steamer that makes the quickest time at that meeting over a 300-yd. course, subject to THE MODEL ENGINEER conditions, but irrespective of length of boat. This competition is open to anyone residing within a 30-mile radius of Liverpool, and entries must be sent in before Saturday, December 7th, to Mr. T. Coxon, 32, Lomond Road, Liverpool. We congratulate the Sefton Club on their enterprise, and trust they will be rewarded by a great gathering and some good racing.

* * *

With reference to some queries and correspondence we have recently published on the subject of small oil engine troubles, we have received a letter from the British Engineering & Electrical Company, of Leek. who regard the notes we have inserted as a reflection on the design and quality of their engines. We have pleasure in quoting the following remarks from this letter, which will serve to make our correspondents' position in the matter quite clear: "You are no doubt aware that oil engines, even in *large* sizes, take some little management in working and starting, which is accentuated in the case of *small* engines of 2-in. bore, and we have, in view of these difficulties, experimented with *every known type* of inspirator and vaporiser since we first commenced manufacturing these engines; and after exhaustive trials we find for the *ordinary amateur* and engineer who have no special knowledge of the working of oil engines, the type of inspirator we now use is the simplest and most reliable. The 'suction' and 'forced' oil supply have been tried in various types by us, but require more skill and management in starting than most amateurs possess. In the case of the letter from Mr. Holmes, of Cheadle (enclosed), the oil engine supplied to him was tested *personally* by myself, running for over an hour without a stoppage, before it was forwarded, and I invited him to come over to our works with the engine to *see it working*, and give him some hints as to getting the best results from it, but heard no more from him until the correspondence in your columns, which we consider very unfair to us, as we are always most willing and anxious to help any purchaser of our engines or sets in any difficulty they may experience; and we consider you might either refer them to us, or, at any rate, avoid bringing our name prominently forward as manufacturers of 'primeval' and 'unsatisfactory' articles, as no trouble or expense is spared by us to supply really good articles. We should be the *very last* to offer goods we do not *personally* know will give the results claimed for them, if properly treated."

Answers to Correspondents.

T. S. BECKE (Carleton, U.S.A.).—Patent flexible metallic tubing (oil-resisting quality) is used for the fuel supply pipes between the engine and tender. We are almost sure that this is obtainable in the States.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

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

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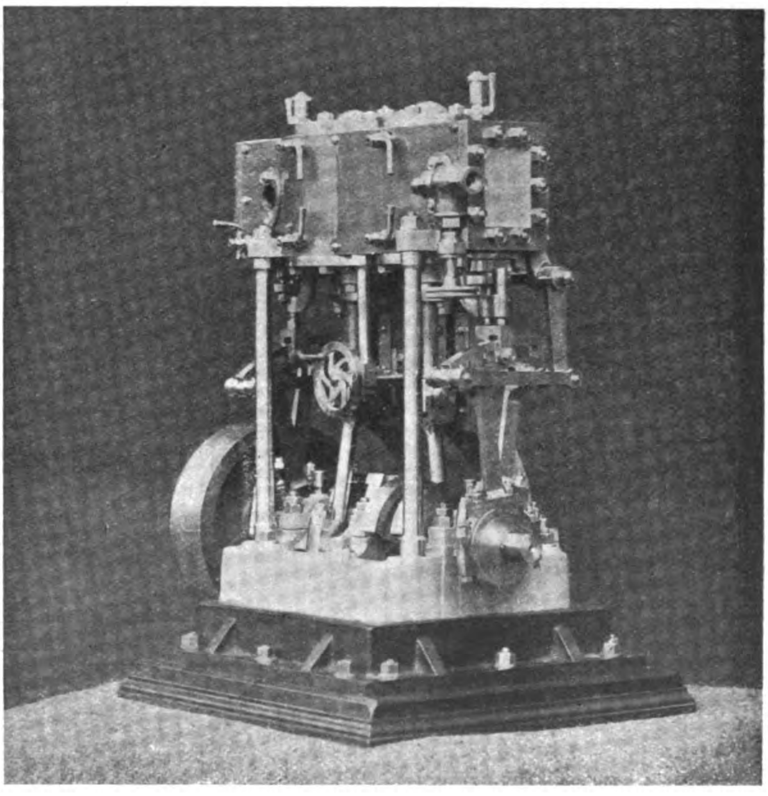
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.

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

VOL. XVII. No. 345. DECEMBER 5, 1907. PUBLISHED WEEKLY

A Well-Finished Model Vertical Compound Engine.

By JNO. A. BARKER.



MR. J. A. BARKER'S MODEL VERTICAL COMPOUND ENGINE.

FOLLOWING are a few particulars of the engine illustrated above, which gained first prize of silver medal and three pounds at the recent MODEL ENGINEER Exhibition. About two years ago I purchased through THE MODEL ENGINEER Exchange columns the casting of a pair of cylinders by Messrs. Stuart Turner—H.-P. 1½ ins., L.-P. 2¼ by 1½ ins. The necessary castings to complete the engine were obtained. Up to this time my model work had been of a very simple character, and the array of castings and, to me, complicated set of drawings, made me very doubtful as to whether I was capable of tackling it; but I studied the drawings and then the castings for some time, and gradually daylight began to dawn. The simple parts were taken in hand first, such as planing up and sweating together all the brasses, then the covers of steam chests and cylinders, piston-rods, pistons, front and back columns, etc., my determination being to finish off everything to exact measurement, no matter how long I took over it.

I now began to grow ambitious. The baseplate was too plain; the eccentric-rods and sheaves were not quite in accordance with shop practice, and wheel and square thread for reversing would look so much more "classy" than a lever, so I set to work and made the necessary patterns. These alterations very materially increased the work, but they added, I think, greatly to the appearance when finished.

The turning of the crankshaft pins was a source of trouble to me, but this I got over by bolting a pair of right angle lugs at each end and blocking up with hard wood. For the slotted links I made the tracings which, after planing up the steel to required thickness, I glued to the face and then filed out to shape. It was a long, tiring job, and most likely a very unorthodox method, but it was the only way I could think of getting the correct arc.

The reversing gear is composed of ¼-in. square thread steel running through a frame bolted to the L.-P. back column and through a hanger bolted to the base of the cylinder casting.

The measurements are: Height, 14 ins.; length, 10½ ins.; width, 9½ ins.; weight, about 35 lbs. There are 532 separate pieces. Each face of the 184 nuts was separately polished. All glands packed with metallic packing. The base is painted "dead" black. Bedplate, back columns, etc., French grey.

Before polishing up for Exhibition I had the engine running for about two hours with very satisfactory results, no vibration, and hardly any sound but the beat of the valves.

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.

How to Overcome Some Model-making Difficulties.

By H. H. C.

When starting model making, like many others, I did not possess any practical knowledge as to the use of tools. The tools I had were of a poor quality, so perhaps some of the remedies I found for overcoming my difficulties may be of use to some of my fellow-readers. One difficulty I have met with is the making and fixing small pistons for steam engines. The front cover of the cylinder, with its stuffing-box, is also an obstinate fellow—at least, it used to be. Fig. 1 shows an arrangement, which, I believe, would serve its purpose fairly well for those who do not possess a really good lathe. Two new centres should be fitted to the lathe, only instead of having points, they should be coned out with a taper of about 60 degs. A piece of rod, say 3-32nds in. or 3-16ths in., with the ends carefully bevelled and mounted between these cup centres should run very nearly dead-true. The piston should be fitted as shown in The Model Engineer for April, 4th, 1907, Vol. XVI, page 334. The piston-rod should project through both sides of piston, as shown in Fig. 1; when placed between centres, it could be trued up. This view also shows a front cylinder cover in position on the other end of the piston-rod; if placed in this position after the piston has been turned up and the rod turned, the front cover could then be trued up, which will ensure the hole for piston-rod being central and square with the cover. It is very necessary that this part of an engine

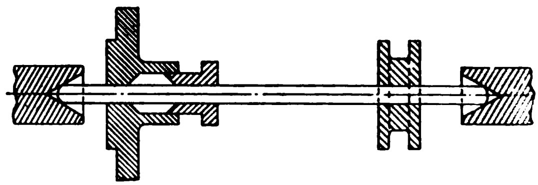


Fig. 1.—Method of Fitting Piston and Rod.

should fit accurately, but this is by no means easily accomplished when only home-made flat drills are available. This difficulty was mastered in a somewhat simple manner. A piece of the same silver steel rod as the piston-rod was made of had its end filed to form a reamer, as per Fig. 2; the length of the flats were made five or six times the diameter. I made the hole through cover and gland a little small, then passed the reamer through; the result was a good fit. By the way, the first one I did this way had a hole too large; the fault was that I had not removed burrs formed by filing the flats.

A simple carrier, for use when trueing the cover, can be made by soldering a bit of rod to one side of piston.

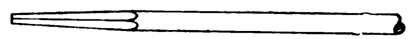


Fig. 2.

Another difficulty I had to deal with was the grinding-in of a regulator. It was made of a "petrol" fitting. It was necessary to silver-solder the pipes into it, which made the plug to fit very badly. I tried several ways to grind it in without success; indeed, it looked like having

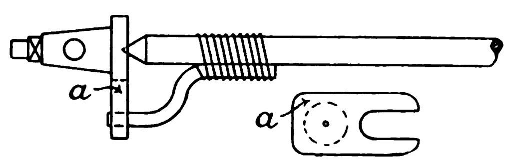


Fig. 3.—Showing Method of Grinding-in Regulator.

to buy another one until I tried the way shown in Fig. 3; it also shows the shape of the plug.

A piece of 3-16ths-in. silver steel had one end pointed, as shown, and a piece of ⅛-in. rod bound on with small wire and well soldered to form a driver. It is important that the point should bear on the centre of the plug. This can easily be done by making a taper hole in a piece of wood fastened to a faceplate, then press the plug into it, and, as it is running, make a small hole with

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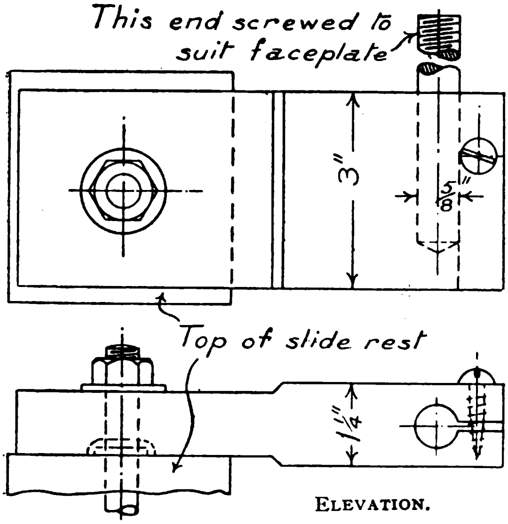
some pointed tool. I gripped the end of the rod in a breast drill, fixed the regulator in the vice, and used Brooks's soap and water for grinding in, washing all the soap off frequently. For testing, I soldered a tyre valve on to one of the pieces of pipe, and pumped into it with a cycle pump having a small diameter. I could get a pressure of about 45 lbs. per sq. in; while under this pressure I placed the regulator under water, hardly a bubble of air leaking through. This regulator has been in use in the smokebox of locomotive type boiler for some time, and it leaks but very little.

After I had become the possessor of a three-jaw self-centreing chuck, I began to look about for some suitable arrangement for drilling in my lathe. The loose headstock was too poorly constructed for use in this direction, so I made an arrangement as shown in Fig. 4, to bolt to the top of my slide-rest. It is made of hard wood, and held in place by the same nut as that which holds the tool clamp. A mandrel is fitted one end, going nearly through the wood, the other end being screwed to suit a faceplate.

The hole in the wood into which the mandrel fits is most easily made by placing a drill in the chuck and the wood in position on the slide-rest, the wood

PLAN.



ELEVATION.

FIG. 4.

being fed up to the drill by the longitudinal screw of the rest. It will be seen that nothing has been done to ensure its going back perfectly square after it has been removed. My method is to place a piece of 3-32nds-in. brass wire in the chuck, bend one end out so that it will make a circuit nearly as large as the faceplate to be used as a drilling pad. When the wire is rotated and the faceplate is moved up towards it, it can easily be seen which way to move it to bring it square. I have set mine to within very fine limits in less than a minute by this method.

Brushes for Small Electro-motors.

By A. GREEN.

These are generally made of hard copper or brass strip unnecessarily wide considering the amount of current they have to conduct, and are sprung to bear well on the commutator. More especially is this the case when the commutator is not quite true, which causes the brushes to jump and spark, unless they are made to bear very hard on commutator. Thus they act as a brake and absorb from 23 per cent. upwards of the power.

Make them of about half-a-dozen (more or even less, according to size of motor) of the No. 36 wires from a piece of flexible electric light lead. It will be impossible to put pressure on these sufficient to absorb any power, and at the same time they have sufficient spring to make good contact.

The Latest in Engineering.

Wireless Telegraphy: The Poulsen System.—Developments in the sphere of wireless telegraphy have of recent years been so rapid that Sir William Preece's words when introducing Mr. Vlademar Poulsen to a large and distinguished assembly of British scientists some time ago is worthy of comment. Sir William Preece stated that the demonstration his audience were about to witness was to sound the death-knell of spark telegraphy. From so distinguished a scientist, such a statement was highly significant and recent events have afforded ample proof of its correctness. Until the appearance on the scene of Mr. Vlademar Poulsen, a Danish physicist, all the systems in use employed what is known as spark telegraphy for the transmission of their signals. Spark telegraphy owes its name to the fact that an electric spark is employed to set up the necessary etheric vibrations. The essential feature of Mr. Poulsen's invention is that instead of the spark, he employs the electric arc with which every layman is familiar, and instead of the intermittent, or as they are technically termed "damped oscillations," he is enabled by the arc to produce a train of continuous or undamped oscillations. To the lay mind this fact may not present any great importance, and in order to illustrate it, we must have recourse to analogy. If you take a pond of still water and cast into it a large stone weighing, let us say, 20 or 30 lbs., you will observe a large ring-shaped wave, radiating outward from the point at which the stone strikes the water. If you continue to watch the wave, you will observe that as it spreads over the surface of the pond its amplitude very rapidly decreases and the wave dies down, and before you can obtain another impulse, you must expend a considerable amount of energy in throwing in another heavy stone—in this case the throwing of the stone is analogous to the electric spark, and therefore clearly explains the intermittence of the waves.

Suppose now that instead of your 30-lb. stone, you take a small stone of 1 or 2 lbs. in weight and attach to it a short string; if now this small stone be rhythmetically dipped into the water, we shall obtain, instead of the one big impulse, a *continuous* series of unbroken waves—this corresponds to Poulsen arc. The net result of comparing these two methods is this: that with the second method you will obtain, with a minimum expenditure of energy, a continuous wave of smaller amplitude but one that will travel to a much greater distance, such distance being of course, proportional to

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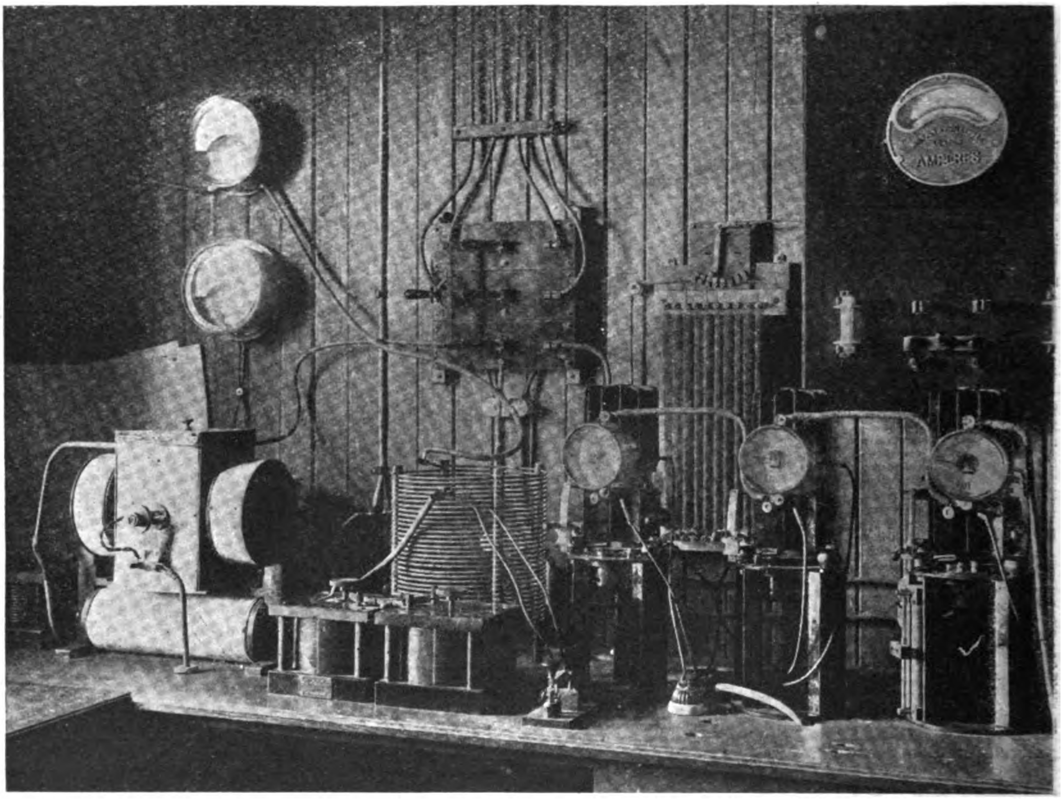
the energy expended in producing the waves. The Amalgamated Radio-Telegraph Company, Ltd., of Salisbury House, London, who are the owners of the Poulsen patents, have established a number of stations in England, Denmark, and Germany, between which perfect communication with the Poulsen system has been established. The distance between their English station at Cullercoats (Newcastle-on-Tyne) and their Danish station at Lyngby (Copenhagen) and Esbjerg are some 560 and 350 miles respectively, and during their earlier experiments, perfect communication was established between these places with masts of only 100 ft. in height, and with about 2 kw. energy. The experiments were next conducted over a distance of 860 miles, a large part of which was overland, between their Copenhagen station and the English station at Hartland Point (North Devon), the power employed and the height of masts being precisely the same. During the last week in July, the Company completed the installation of the Poulsen system on board the s.s. *Hellig Olav*, a Transatlantic passenger steamer belonging to the United Steamship Company of Copenhagen. The installation was completed as the vessel lay in dock at Copenhagen on the day before she sailed, and, on the apparatus being tested, perfect communication was established on the same day between the vessel and two of the Company's stations, namely, the one at Cullercoats and the other near Berlin. A few days later, when the vessel was in mid-Atlantic, a message of twenty-one words was received from the s.s. *Hellig Olav* at the Company's station at Steglitz (Berlin), when the vessel was distant 2,060 miles. This message was received direct from the vessel with no intermediate station, and in its course passed over Ireland, England, and Wales and a great part of Germany. This was the first time that the Poulsen system had been worked on board ship, and never before had a radiogram been sent over so great a distance from ship to shore. The Company's new Transatlantic station on the West Coast of Ireland is situated at Knockroe, co. Kerry, and the Amalgamated Radio-Telegraph Company confidently claim that before the end of the year they will be able to transmit messages across the Atlantic by means of the Poulsen system, and to be further able to print these messages at the rate of 100 words per minute. This extraordinary feat can easily be performed by the improved form of photographic printer as manufactured by the above-named Company. As with the Morse recorder, messages issue from this instrument in the form of a long strip of tape, the signals being exactly similar to those of the Morse Code, and it is a peculiar and



THE POULSEN SYSTEM OF WIRELESS TELEGRAPHY: TRANSMITTING APPARATUS.

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De Forest's Receiving Room: The Operator receiving a Wireless Message from a Passing Liner.

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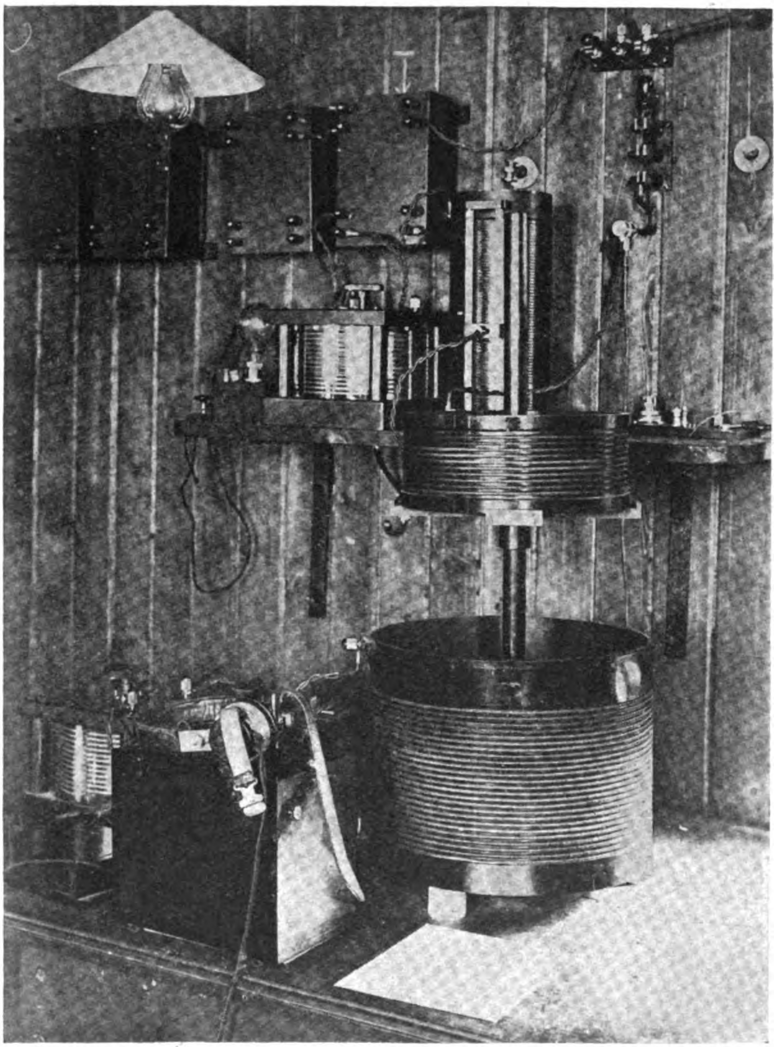
noteworthy fact that the legibility of the messages, as recorded by this instrument, is no way affected by atmospheric disturbances or "static." Besides its adaptation to the requirements of radiotelegraphy, Mr. Poulsen's discovery is of equal importance to the science of wireless *telephony*, and it is interesting to learn that already during some official tests, a distance of 40 km. has been bridged by this system when employing model apparatus only. At the present moment two experimental stations at Oxford and Cambridge are being fitted out with apparatus for wireless *telephony*, and very shortly we shall be carrying on our telephonic communications without any intervening medium between these two places – a distance of 65 miles overland



POULSEN RECEIVER ARRANGED FOR READING THE SIGNALS FROM A TELEPHONE.

How to Make an Inter-Communication Telephone.

By FRED RUDOLPH.

(*Continued from page* 520.)

THE SWITCH-HOOK.

THE switch-hook shown in the accompanying sketch is composed of figures B to F, A being the general arrangement; B is the contact spring, made of German silver or brass; C, a special shouldered brass screw which fixes and acts as a pivot screw between lever D and angle-plate F. The brass hook D has on the back two curled-up pieces which make contact with the springs B, in either the up or the down position. The finish is nickel-plated, but, of course, the finish throughout must be consistent—that is, if the bell and ringing key escutcheon is lacquered, switch-hook must be lacquered, and *vice versa*. Escutcheon plate E is to cover and give a neat appearance to the slot in wood cover which takes switch-hook. F is a piece of brass angle metal cut and drilled to the sizes shown, to which the lever D is screwed and supported. A spiral stee spring is fixed under the head of a 7 B.A. screw in lever D, and stretched under the shank of screw fixed into wood case. When receiver is on the hook, the lever is making contact with the top or bell contact; immediately the receiver is taken off the hook the spiral spring actuates same, and it makes contact with the two bottom springs forming the speaking circuit.

(*To be continued.*)

RAILWAY SPEED TESTER.—An ingenious instrument has been invented by Mr. W. A. Shortt, A.M.I.C.E., and has already been taken up by the L. & S.W.R. and Midland Companies, by means of which a surprise visit to dangerous curves and other sections of the line where there is a speed limit can be made. Three switches are fastened to the rails, and the train passing over, records its speed and the number of carriages of which it is made on his instrument. Drivers exceeding the speed limit can thus be easily discovered.

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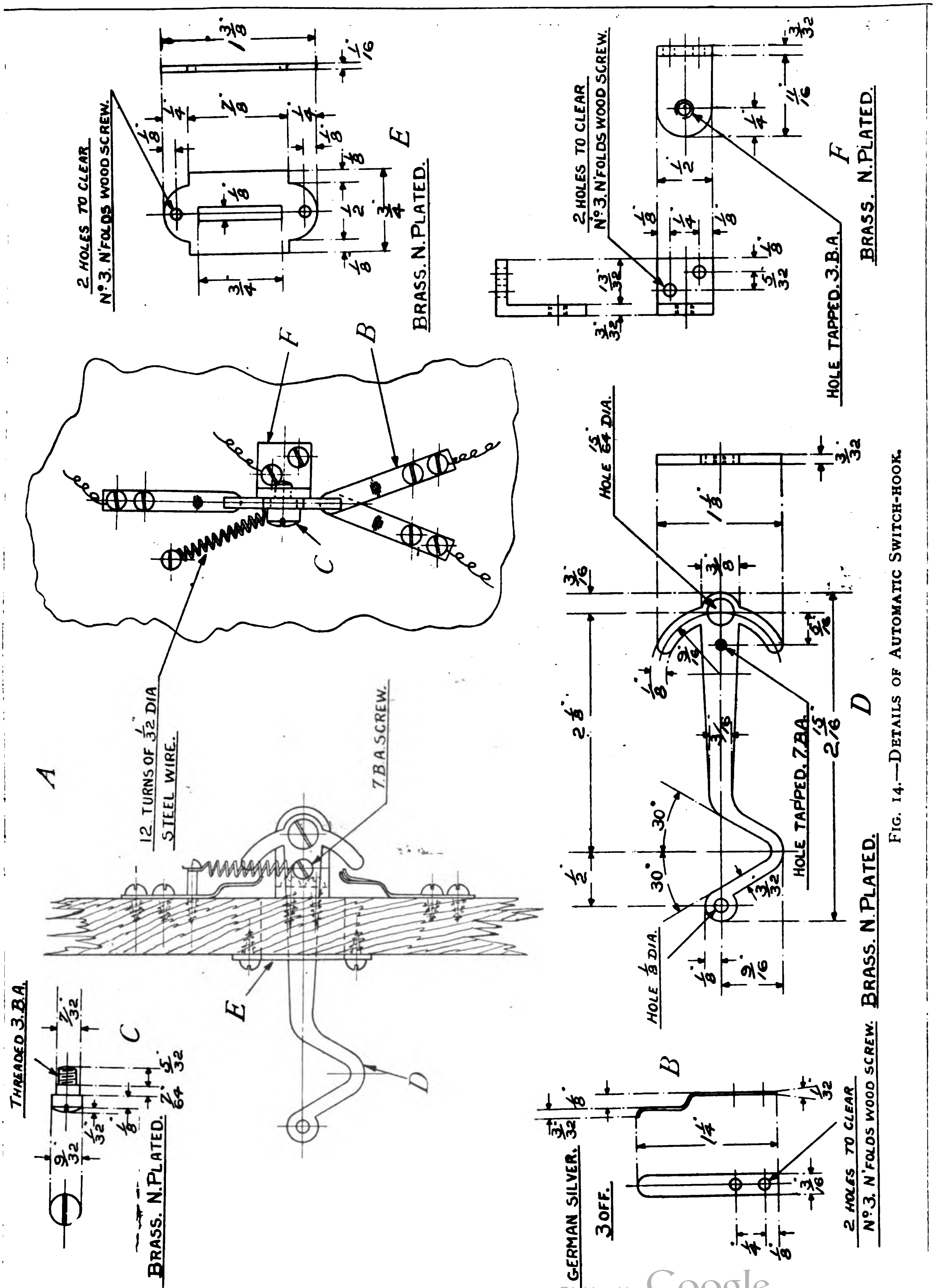

Fig. 14.—Details of Automatic Switch-hook.

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Some Exhibits at the N.Z. International Exposition, Christchurch.

By A Londoner Abroad.

(*Continued from page* 524.)

ONE of the finest models exhibited I had already had the opportunity of admiring in Auckland. This was Mr. H. A. Davison's ¾-in. scale L. & N.W.R. tank locomotive, illustrated in Figs. 3, 4, and 5. On writing to Mr. Davison for particulars of his model, I received from him a very cordial invitation to pay him a visit and see not only this specimen of his workmanship, but his workshop and other examples of his skill. I lost no time in acting upon this invitation, and soon after spent a long and enjoyable evening in this manner.

Mr Davison is like many other model engineers in one respect—he must have something to do, and, judging by what I saw, he is one of those who carries a thing through to the end. He has but little unfinished work to show the visitor, and yet—or perhaps because of this trait—can show a great deal. I was surprised to learn that Mr. Davison was not an engineer by trade, and that he had received no practical instruction whatever in engineering workshop practice. On this point he informed me that the only help he had had was that gleaned from The Model Engineer and The Model Engineer handbooks. A natural aptitude was the basis, no doubt; but it was pleasant to hear such a tribute from one who need not be ashamed to set his work beside that of first-rate professionals.

The first item of interest in the workshop was, of course, the lathe. This was a Pittler B2 machine, with all accessories, and kept in apple-pie order. My host modestly stated that he was by no means complete master of all its features, which need not surprise anyone who knows what this lathe is capable of doing. At the same time, a model engineer who turns his hand to petrol motor construction would find the machine too small for much of the work, which is the reason why Mr. Davison was promising himself the addition of a much larger lathe, and, eventually, a power-driven workshop complete.

Before its cover was removed to show me the specimen of model-making I had specially come to see, I had plenty to examine in the way of petrol motors of various sizes, steam engines, electrical machinery, and what not. Mr. Davison, like other Colonial model-makers and engineers, had much to say in praise of certain English castings, and much in condemnation of others. In regard to the first of those articles, it seems impossible at present to obtain a locally-made casting that will compare, for example, with an ordinary bedplate or cylinder casting for a 2-in. by 2-in. engine. Either the piece is clumsy, or the casting unsatisfactory, scaly, or honeycombed. This is hardly surprising, considering that the manufacture of these small castings is an art in itself, only possible where a reasonably large demand will justify the outlay on special appliances.

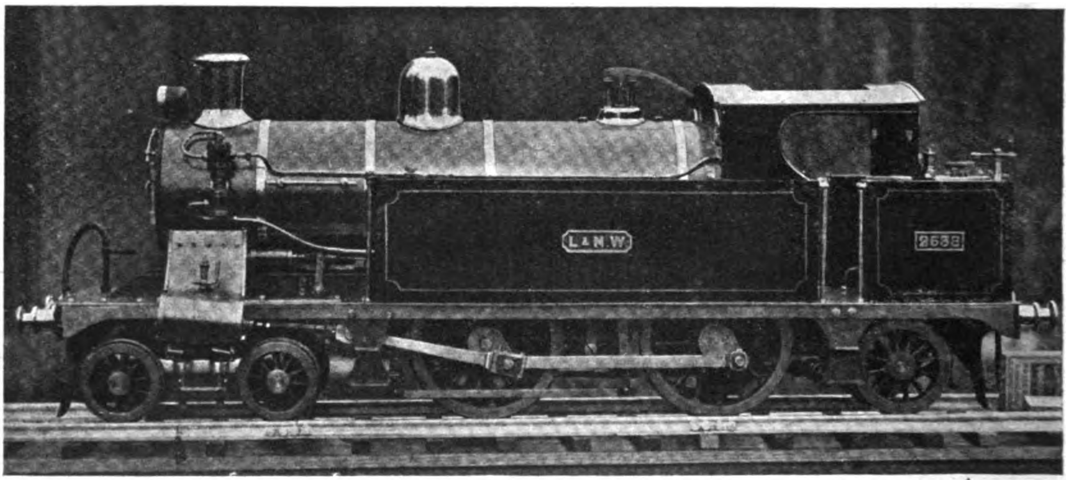

Fig. 3.—Mr. H. A Davison's Model L. & N.W. Tank Locomotive.

On the other hand, there are certain cheap sets of castings very largely sold by English firms which give anything but satisfaction. An enthusiast who dwells some 12,000 miles from the source of supply must depend a great deal on the advertisement he reads; but he is quite unable to realise that an advertisement may be perfectly truthful and yet convey to his willing imagination an idea that is not borne out by facts. He expends his money on the "cheap set," only to find that such materials at the very least require more labour in making up, and perhaps even better tools and more skill, than a higher-priced article. He is dissatisfied, if not disgusted; and instead of blaming his want of insight, which should teach him that cheap things are generally dear in the long run, throws all the blame on the seller. This is a point I have often had

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occasion to bring home to amateur—and even professional—engineers here, and I shall have done good work if these words will persuade any aspiring model engineer to invest his money *only* in the best of castings and materials. It is obviously impossible and undesirable to particularise, but no reader of this journal can have any doubt as to the class of goods he is recommended to purchase.

It is to be hoped that not every model I have seen in connection with this article will result in such a homily as the above, or we shall never get to "our muttons" at all. Well, then, I saw petrol motors, both of "real" and "model" proportions—the former intended for running boats on the magnificent Waitemata harbour; the latter (one only) for a model battleship of excellent proportions for its type, well made from a sound log of kauri, but hardly adapted for speed.

An excellent piece of work was a No. 4 Stuart-Turner vertical engine. The facts about this model were curious, and well illustrate the difficulties under which a colonial reader works. Mr. Davison was much in need of a trifling piece of Russian iron for lagging, but in all Auckland he could find none whatever. At last he found that the thing he wanted was sold with the Stuart-Turner sets of castings, but could not be sold separately, as that would break the set. So, for the sake of the sheet iron, he bought a No. 4 set, and having them, built them up into the well-finished machine I inspected Happily, Russian iron is not now-a-days quite such an expensive and rare a luxury in Auckland.

Passing over dynamos, switchboards, and innumerable interesting mechanical and electrical appliances, I came at last to the locomotive under discussion. Something of a shock awaited me

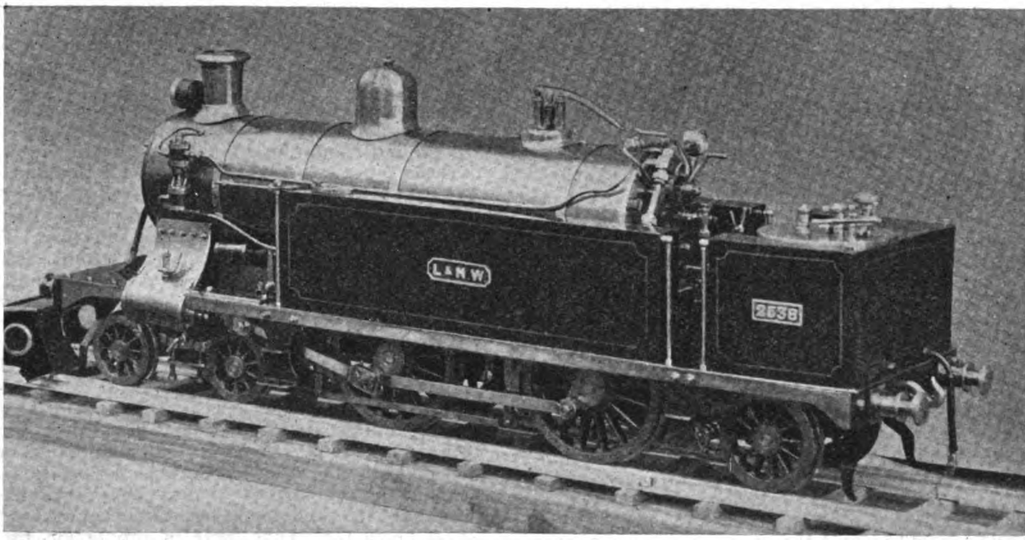

FIG. 4.—MR. DAVISON'S LOCOMOTIVE, WITH CAB REMOVED.

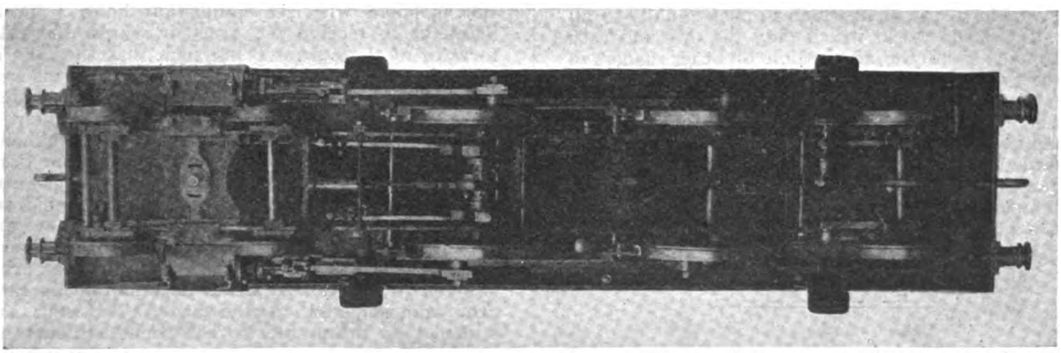

FIG. 5.—VIEW OF UNDERSIDE OF MR. DAVISON'S LOCOMOTIVE.

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This fine model, seen to such advantage in a well-made glass case at the Exhibition, now presented a forlorn aspect—limping, surrounded with débris, standing disconsolate in the midst of a shattered case. Mr. Davison then told me it was exactly as it had been sent back by the Exhibition authorities. He pointed out that none of the precautions proper for the packing of such an exhibit had been taken, but the whole thing, glass case and all, had been dropped in the packing case, nailed down, and sent off. I can only call it disgraceful. The special arrangements Mr. Davison had made to secure safe transit were pointed out to me, and that they were ample was proved by the condition in which the model had been landed at Christchurch. Now, thanks to this shameful carelessness, its maker would be put to endless trouble repairing pipes, brakes, and other fine parts, to say nothing of the permanent blemishes of scratched and disfigured machined parts.

The engine is made up from a set of Messrs. Stuart-Turner's ¾-in. scale L. & N.W. tank locomotive castings, but a considerable number of details have been added by Mr. Davison to aid the realistic appearance. Perhaps the chief of these is the working model Westinghouse brake—a splendid piece of fine machine work. The neat train-pipe coupling in connection with this will be noted as adding very considerably to the appearance, though I doubt not that many English readers will cavil at a Westinghouse brake on a L. & N.W. engine!

Another addition was the steam reversing gear, seen above piston-rod, in Fig. 3. The electric head lamp, containing a tiny glow lamp lit by accumulators, is perhaps a concession to New Zealand views, the headlight being as common and conspicuous an adjunct here as in its native American home (compare Fig. 1 in these articles).

I trust the photograph (Fig. 5) showing the underside of engine will reproduce satisfactorily enough to do justice to the original, as it so clearly shows not only the disposition, but even the workmanship of the motion and other details. The whole is beautifully made, a statement which applies equally to all Mr. Davison's work, which only his own modesty withholds from the admiration of other readers of these pages. For this fine model the maker was awarded a gold medal. But although he received official notice of this fact, no medal was forthcoming! It appears it had been sent to someone else, though awarded to him. I believe Mr. Davison still lives in hopes that the golden trophy will be sent as some recompense for his maltreated model, but it is, so far, a hope deferred.*

(To be continued.)

* Just as the above was ready for posting I received word from Mr. Davison that he had at last received the gold medal. He was also, to judge by all the facts, entitled to a special prize of £10, which would have gone some way towards the expenses incurred in renovating the model and its case. This, however, by a process little short of jugglery, had been transferred to another competitor, who had been given the opportunity of working his model in express contradiction of the preliminary competition announcements.

A Small Windmill and Pump.

By G. S. and C. B.

THE following is a description of a simple and inexpensive windmill adapted for pumping purposes. Before going into the construction of the actual mill, a few words with reference to the work it was designed to perform and the reasons for its conception may prove of interest.

Having a garden with a clay subsoil, it was thought necessary for horticultural reasons that the ground should be drained, and a simple system of drain pipes was accordingly laid for this purpose. The accumulating water was arranged to run into a well or sump, from which it was originally intended to be drawn by hand with a bucket and rope. This, however, proved to be a most troublesome task, as considerable quantities of water were found to accumulate after a heavy fall of rain, so it was thought that some form of pump would be a very welcome addition to the system.

The description of a 1 h.-p. windmill in The Model Engineer suggested a small wind-driven pump, the mill being, in some respects, a very humble imitation of the excellent design referred to. Unfortunately, it was not found possible to erect the mill in the most advantageous position for catching a free current of air. This difficulty in providing the vital element will account for the wheel being somewhat large in proportion to the pump, and also for the absence of governing gear, the force of any violent winds being sufficiently broken by surroundings to prevent any damage being done to the mill. Those thinking of erecting a similar mill in an exposed position, would do well to fit some form of governor as then being a very essential part of the machine.

Starting with the detail of the windmill, it will be seen from Fig. 1 to be 5 ft. 6 ins. over the tips of sails, the boss being about 9 ins. diameter by 2½ ins. thick, made from a piece of hardwood shaped as shown; this is bored with six equidistant holes 1 in. in diameter to receive the arms or whips, the rake forward of these arms being such that the sails in revolving will clear the tower. The arms are circular in section, of hardwood 1 in. diameter. This section, not the best from consideration of strength, was selected because of the simplicity with which they could be attached to the boss. The sails are of tin-plate to the dimensions given in Fig. 2, this being the largest that could be cut from a 20-in. by 14-in. stock size sheet. They are attached to the arms by nailing, a flat being planed on each arm to receive them. Additional security is given to the sails by metal clips embracing each arm and soldered to the back. The sails are stiffened by means of two half-round stiffeners of the same material as the arms, split down the middle. These are fastened to the front of each sail by nails driven in from the front and clenched at the back.

A ⅝-in. diameter hole is bored through the centre of the boss to receive the windshaft, which is of ⅝-in. diameter steel, this shaft being driven tightly into boss leaving sufficient length protruding at each side. It is securely fixed to the wooden boss by means of the collar shown, which has three screws for attaching it to the boss and also a small

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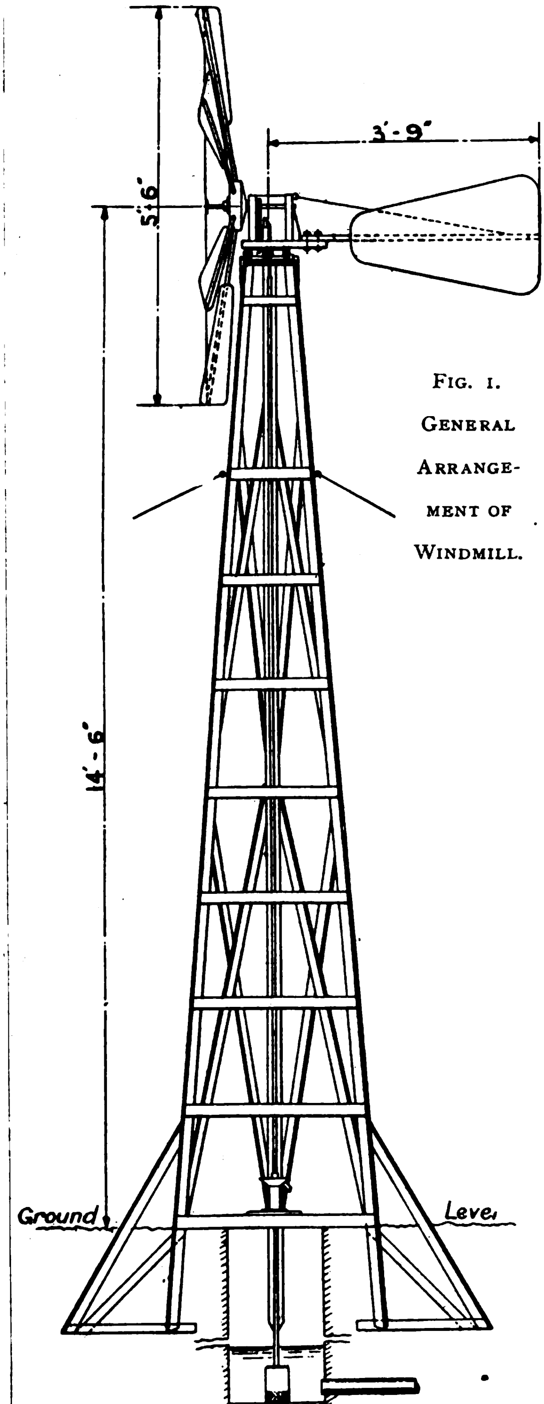

FIG. 1. GENERAL ARRANGEMENT OF WINDMILL.

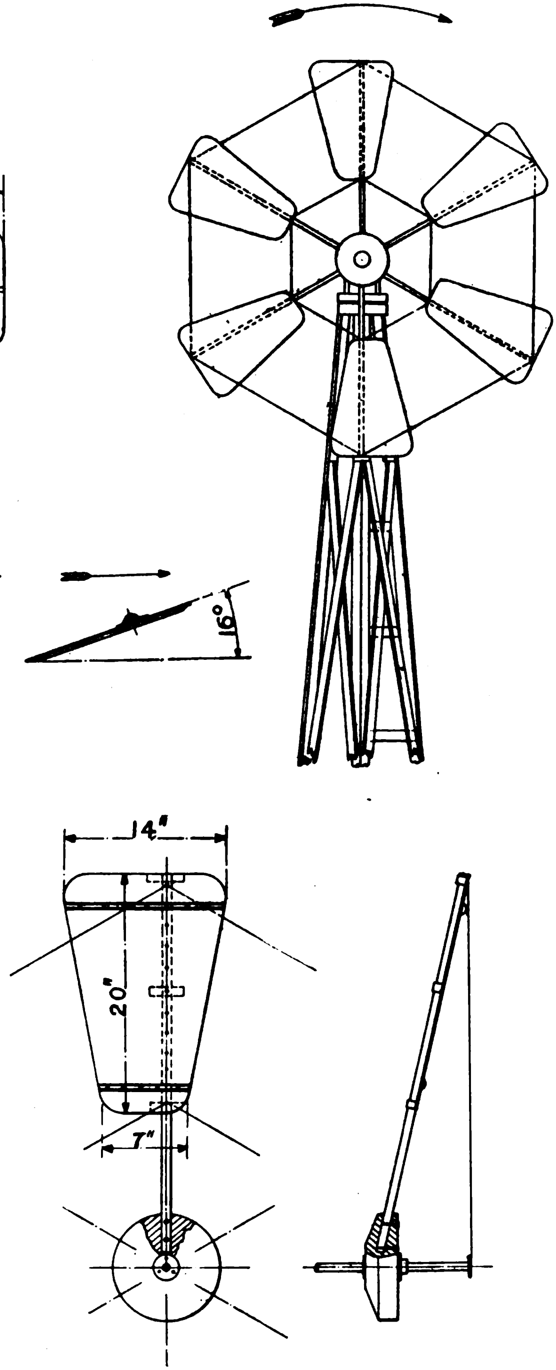

FIG. 2.—DETAIL OF SAILS.

DESIGN FOR A SMALL WINDMILL AND PUMP.

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pin driven through the collar and shaft. On the reverse side of boss is fitted a brass plate about 2½ ins. diameter, which runs in contact with white metal bearings in bracket to take the thrust. At the forward extremity of the windshaft is secured a small disc drilled with six equidistant holes for the straining wires. In setting up the wheel the whips with sails attached are inserted in their respective holes at the correct angle of weather, and nails driven in from front of boss through the whips make them secure. Some care must be exercised in building up the wheel so as to have it in good balance, when the whole is securely tied together by wire stays.

The ⅝-in. diameter windshaft above mentioned runs in two white metal bearings. These bearings are, of course, secured in a frame or bracket capable of being revolved in a horizontal plane by the "tail," so as to present the wind wheel square to the wind. This bracket, together with the gear it carries, is shown at Fig. 3, three views being given. Some hard well-seasoned wood should be used for this frame—in our case a piece of elm board about 1¼ ins. thick being employed. Three pieces are cut to the shapes shown in the drawing, the uprights being securely attached to the base piece by long screws, and strengthened by brackets fitted in the corners.

The "tail," shown in Fig. 4, should be built as light as possible, and is arranged to swing round on the bolt A; when it is not required to run the mill the pin B is withdrawn, and the "tail" swung round 90 degs. to a position parallel to plane of wind wheel, when the pin is re-inserted into hole C.

For the bearings for windshaft about 1-in. diameter holes were bored in the vertical members of frame and were countersunk. The frame was set up on the bench so as to bring the vertical members into a horizontal position, the ⅝-in. diameter spindle being passed through holes and temporarily secured at each end so as to be concentric with both holes. The undersides of both holes were stopped with clay and molten white metal run in, filling the annular space between the spindle and wood, thus making two satisfactory bearings. The spindle must be well greased before running in the white metal, otherwise the latter may adhere to it and so prevent its being withdrawn. The bearing in horizontal member of frame for the central pivot about which the mill swivels is made to suit the 1-in. gas barrel, and is cast in a similar way. The windshaft, it will be seen, carries a pinion which gears with a larger toothed wheel having a ratio of about 2 to 1. Any wheels of approximately this size would be suitable, ours being taken from an old sewing machine. The pinion is made a good fit on shaft, where it is fixed by means of a small pin driven in tight through the collar and shaft. The larger wheel runs freely on a pin, which is shown in detail at Fig. 5. This pin passes through a hole in bracket, and is fixed by a nut on the other side; the hole in bracket is a little larger than diameter of pin so as to allow the latter being moved slightly in relation to the pinion on windshaft to obtain the proper meshing of the teeth before finally tightening up the nut.

In the face of the large wheel a ¼-in. diameter hole is drilled 1 in. from the centre, into which is driven and secured a piece of ¼ in. diameter steel rod for the crank-pin. It will be seen from the drawing that this wheel is arranged to run in an oil bath attached to the bracket. A separate detail of this bath is given at Fig. 6.

(To be continued.)

The "Model Engineer" Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prizewinners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows:—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour; and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

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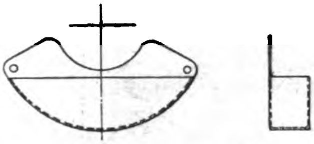

FIG. 6.—OIL BATH.

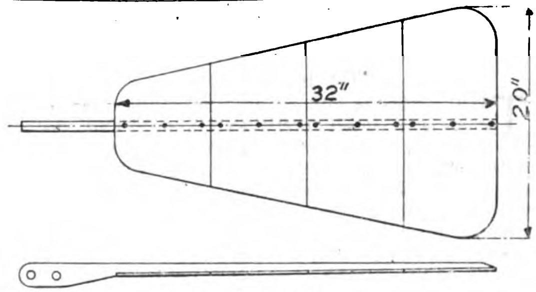

FIG. 4.—TAIL.

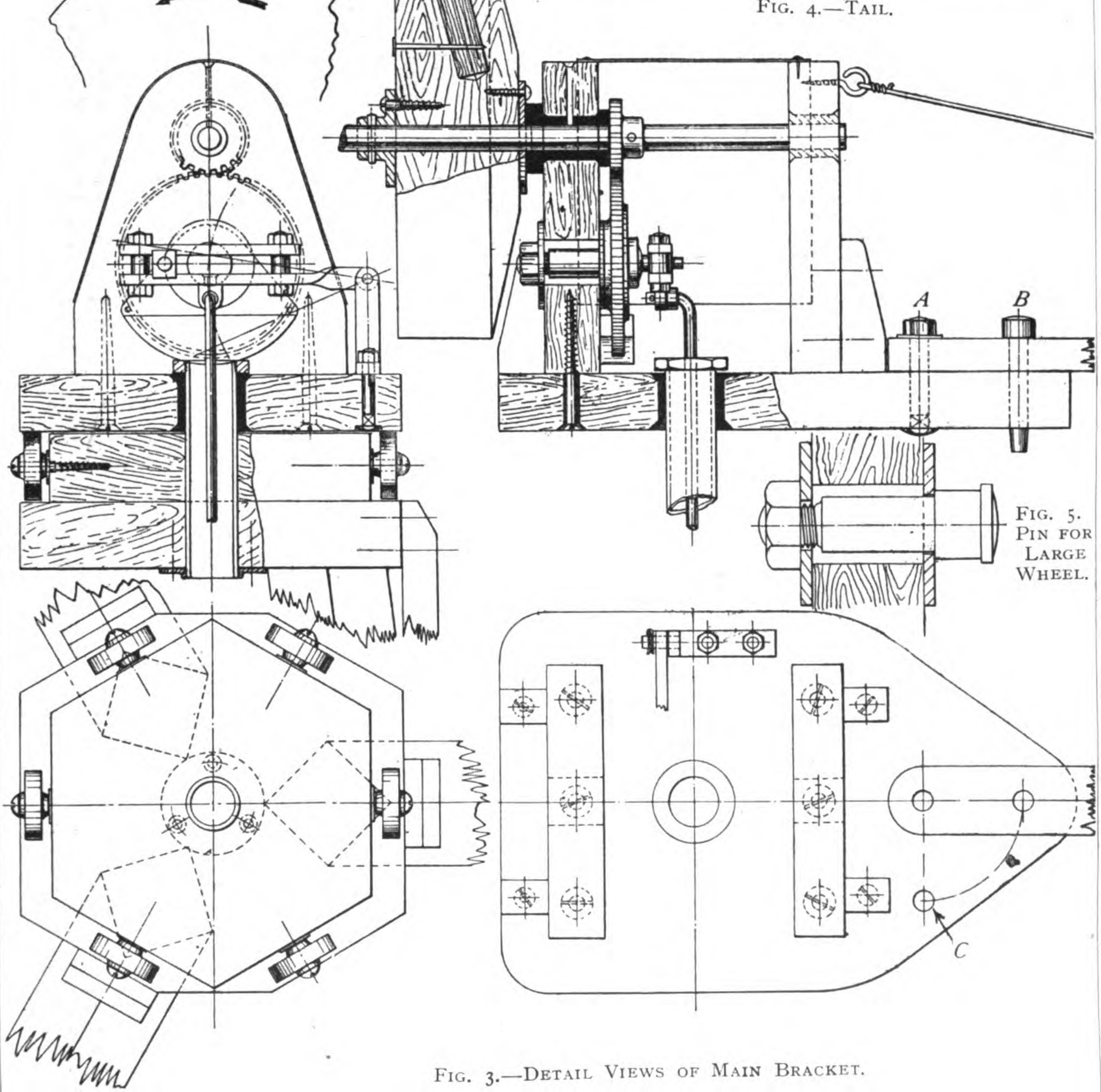

FIG. 5. PIN FOR LARGE WHEEL.

FIG. 3.—DETAIL VIEWS OF MAIN BRACKET.

DESIGN FOR SMALL WINDMILL AND PUMP.

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A Small Switchboard.

By John Wood.

THE photograph and diagram herewith show a small model switchboard and motor I have constructed myself in spare time. The switchboard measures 17 ins. by 20½ ins., and is made of two pieces of ⅜-in. whitewood (taken from an old packing-case). These were planed up smooth and glued together as close as possible, so that the joint would not be noticed. Straps of wood were then glued and nailed to the back in order to strengthen it. The face was then glass-papered and varnished.

The switches are as follows: Beginning at the top left-hand corner is the starting switch; then next, on the right, is the reversing switch. (This was made from instructions in The Model Engineer.) Immediately below this is the battery switch; to the left of this is the resistance coil board; and then, lastly, comes the terminal strip.

The starting switch is perhaps rather a novel one, but it was designed principally for simplicity of construction. I mounted the resistance coils on one board and the switch on another, as I thought this would be easier than putting the coils in the base of the switch, like the larger types. The coils are ordinary iron wires stretched a little to make them straight and also to keep each turn from touching. The studs in the switch are ordinary round-headed brass wood screws, with a large square brass stop at the end. Contact is made by a small piece of copper on the end of switch arm. A wire is soldered to this and carried to the other end of arm, and there soldered to a copper washer.

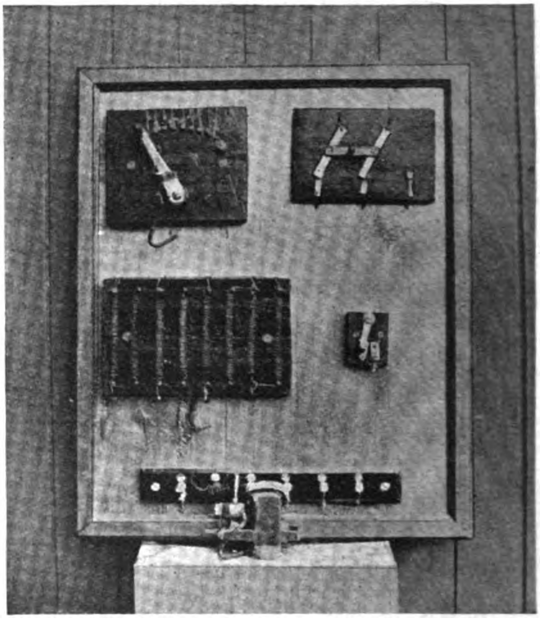

Fig. 1.—View of Switchboard.

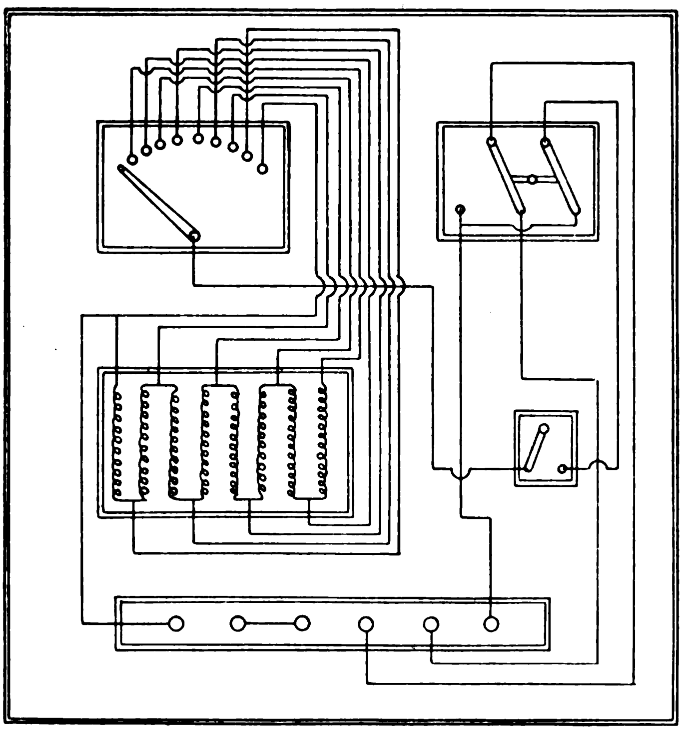

Fig. 2.—Diagram of Connections.

The terminal strip is very handy. I have printed little round tickets and gummed them above the terminals, so that I know to which terminals to connect the different wires. Reading from left to right in the photograph, they are as follows: Battery, battery, field-winding, field winding, motor brush, motor brush. All I have to do is to connect up the motor and battery wires to the terminals, and everything is ready; so that, besides being very handy and compact, it ensures good contact between motor and battery.

The battery switch I bought, also the terminals and moulding round the edge, but all the rest has been made up from odd screws, copper, fibre, etc. The boards for the separate switches are only whitewood, stained and polished a dark mahogany colour, and form a contrast against the light-coloured background.

I made a bichromate battery from instructions in The Model Engineer Handbook, and on to this I hitch the switchboard by means of small hooks and screw-eyes. The battery is a four-cell one, and supplies plenty of power to motor. The motor seen in the front of the photograph was also made by myself from a set of castings

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I purchased from a firm who advertise in THE MODEL ENGINEER. The armature is 1¼ ins. in diameter, and wound with No. 26 S.W.G. The field-magnet is wound with No. 20 S.W.G.

I have no lathe, so had to get armature and commutator turned for me. The brush rocker was also made for me by a friend.

With the switchboard I can run motor at any speed, stop or reverse at will, and at a distance by lengthening the conducting wires.

LIVERPOOL AND DISTRICT ELECTRICAL ASSOCIATION.—On Tuesday, the 19th instant, a meeting was held, when the subject of "Commutation of Direct Current Machines" was further considered, and some very helpful remarks were contributed by Mr. J. J. Richardson (vice-president), illustrated by sketches.—S. FRITH, Hon. Secretary and Treasurer, 77, St. John's Road, Bootle, Liverpool.

Engineering Works and Accessories for Model Railways.

By ERNEST W. TWINING.

(*Continued from page* 494.)

THE next tunnel we meet with on the line (I am dealing with tunnels only for the present) is that at Saltford, a photograph of which was reproduced in THE MODEL ENGINEER for Feb. 1st, 1906; but as the photograph did not render the mouldings with sufficient clearness, I now give a drawing (Fig. 7) which also serves as a means of obtaining dimensions. The photograph did not, of course, give any measurements. The details of the mouldings, etc., will be obtainable from Fig. 7A.

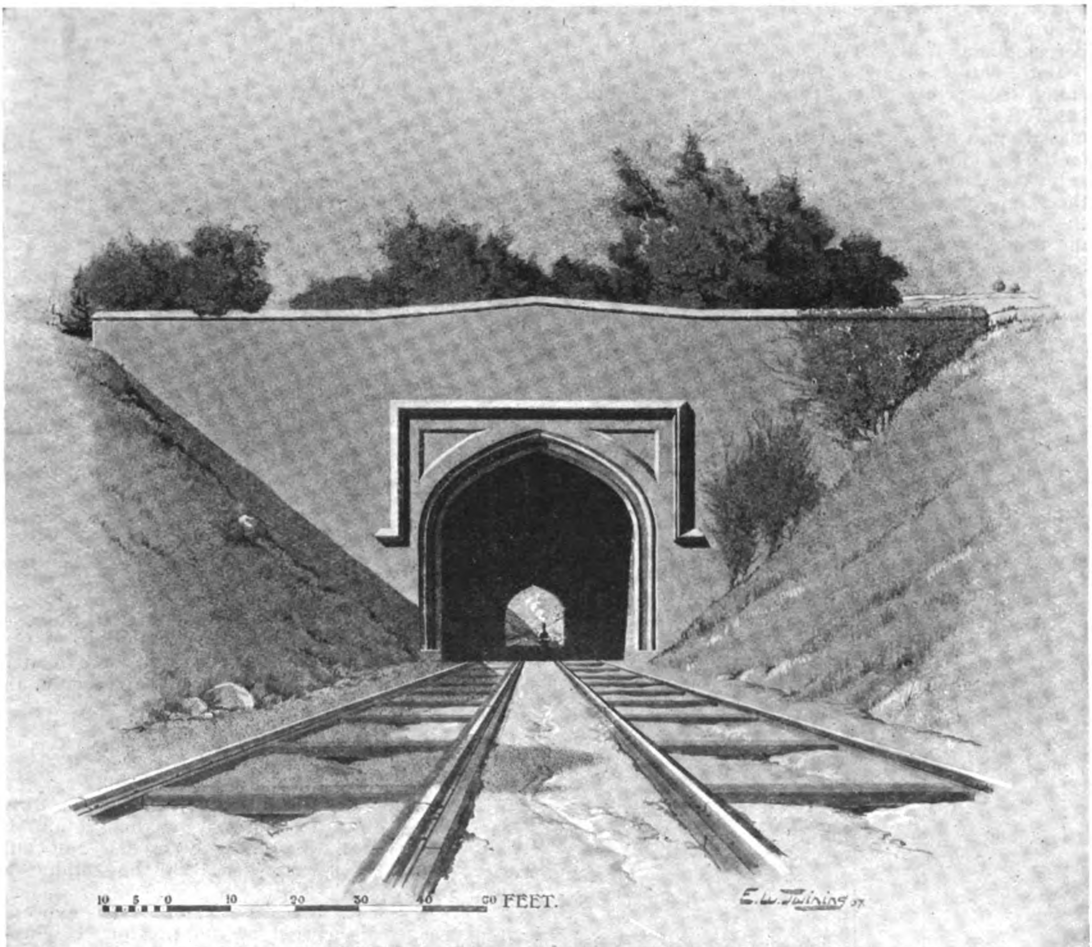

FIG. 7.—THE EASTERN FRONT OF SALTFORD TUNNEL, G.W.R.

The ends of this tunnel, both of which are exactly alike, are in the Tudor style of Gothic. The arch is of the depressed form with radii struck from four centres. A dripstone moulding covers the opening.

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The Saltford tunnel is 499 ft. 11 ins. long, 30 ft. wide, and 32 ft. 6 ins. high. The two longer radii are 30 ft. each, and the versed sine or rise of the arch is 13 ft. The tunnel is arched throughout its length and was cut through lias, which geological formation is here on the surface and may well be seen in the deep cuttings at each end of the tunnel.

After Saltford we next have the Twerton tunnel (the name was in the early Great Western days spelt Twiverton). This tunnel, bored through red marl, is 767½ ft. long. The western front is represented in Fig. 8. whilst Fig. 8A gives a cross section through the arch. An illustration of the eastern end will be given in the next instalment.

The western end is, of the two, the more beautiful and is a little more elaborate, though both are very fine. They are both in the Tudor or late perpendicular Gothic style.

Both entrances are flanked on either side by embattled turrets of great beauty; these, in the case of the eastern end are heavier and more massive and are not of equal size. The larger one on the left-hand side as we face the masonry serving as in the case of the "Long" tunnel to take the thrust of a considerable weight of material forming the side of the hill; indeed, this is the object of the towers in all of these tunnels. The main wall between the towers at the western end is embattled

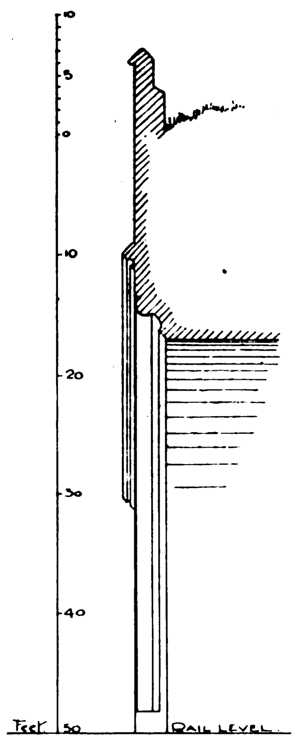

Fig. 7A.

like the turrets, but that at the eastern end is plain.

The width of the opening is the same as in the others, viz., 30 ft., but the height from rails to the crown of the arch is less and differs at the two

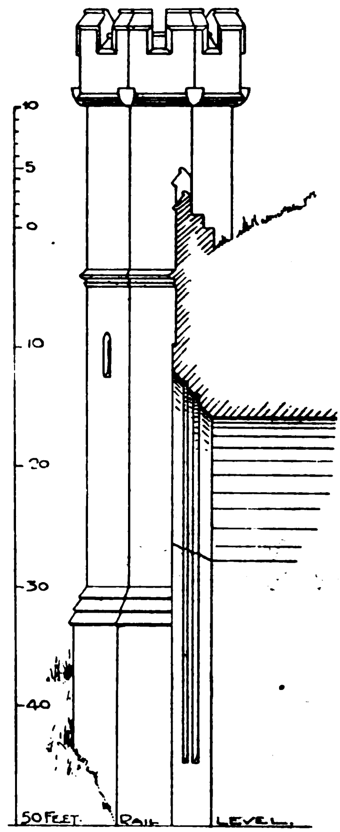

Fig. 8A.

ends—that at the western end is 34 ft., whilst at the eastern end it is 18 ins. less, *i.e.*, 32½ ft.

The arch at the western end is more acutely pointed and is struck from two centres only, the other being struck from four centres.

(*To be continued.*)

Manganese, according to the *American Machinist*, is the best deoxidising agent for nickel and its alloys, and is now extensively used. Not only does it remove the oxygen, but the sulphur as well.

L.B. & S.C.R. Electrification.—It is expected that the electrification of the London, Brighton, and South Coast Railway between Victoria and London Bridge will be completed by next March. The single-phase alternating-current system is being adopted. Along the route iron lattice girders have been erected at distances varying from 100 ft. to 400 ft., and these carry the conductors over the roofs of the trains. The current will be supplied by the London Electric Supply Corporation. There will be eight trains, each consisting of three coaches, and there will be first and third-class compartments.

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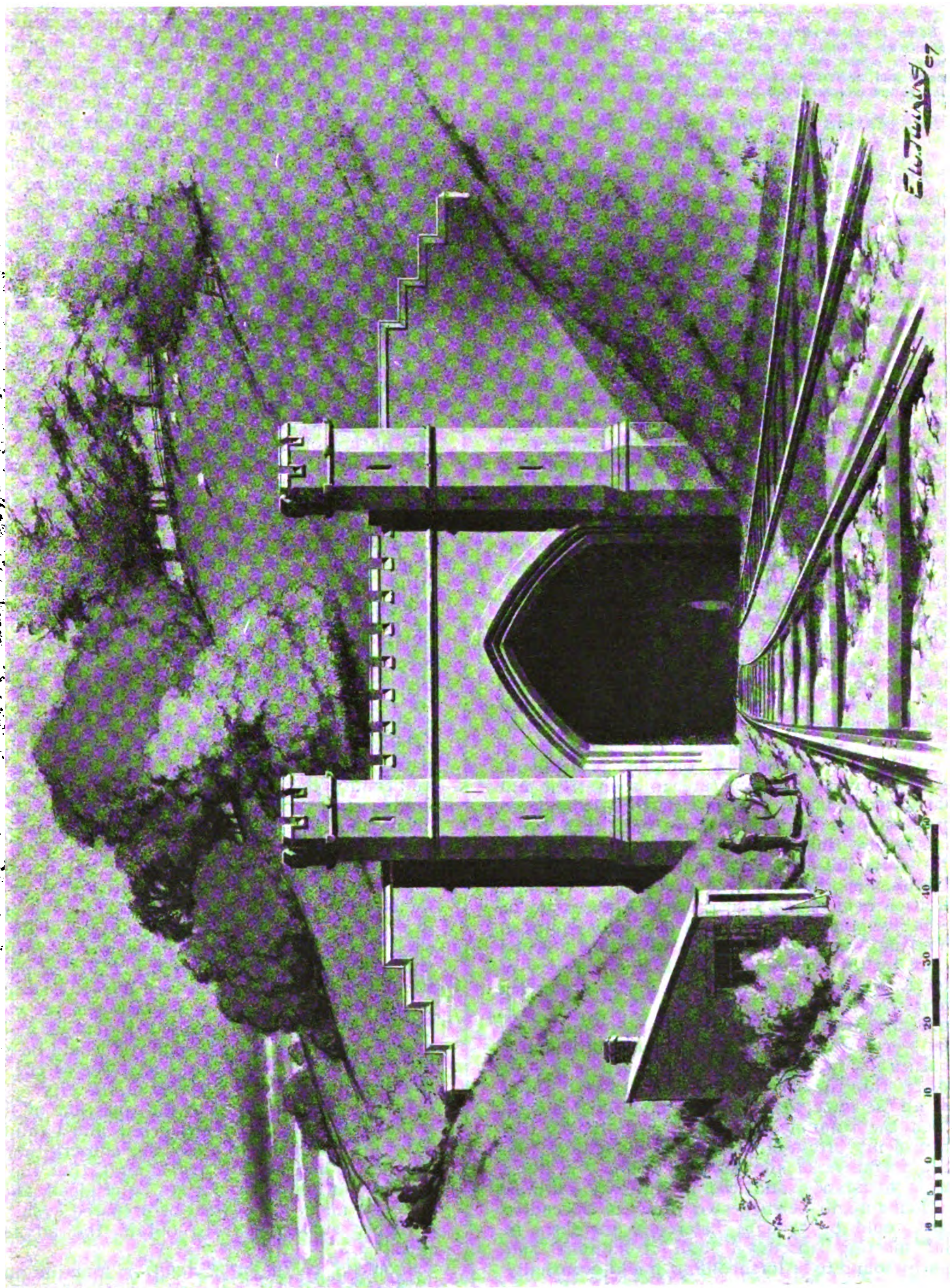

FIG. 8.—THE FINE TUDOR GOTHIC WESTERN FRONT TO TWERTON TUNNEL, G.W.R.

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 Suggestion for the London Society of Model Engineers.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Thanks to your enterprise and courage, the model engineers of London have had an opportunity of learning in a practical manner the possibilities of model engineering in all its branches, and I feel that the present is a fitting opportunity to request your kind permission to bring before your readers a suggestion which I venture to hope may eventually resolve itself into something more practical and material.

Interesting as are the debates and papers which are read before the members of the Society, I have felt, all the same, that there has been a "something" wanting in the proceedings, to bind the members of the Society more closely together, to bring them into a more intimate and closer connection, and thus further develop that thirst for more practical knowledge of those matters which every week are so ably treated by the various talented contributors of the articles in your Journal.

There must be a large number of members who, not having the advantage of possessing a private workshop of their own in which they can execute all kinds of work, would be only too glad if there were some means by which they could obtain the necessary technical assistance and knowledge to enable them to finish their jobs in the proper and orthodox manner by the aid of proper machinery, tools and appliances. Many do not care to incur the expense of obtaining outside professional assistance; many do not care to send their unfinished models or parts of models to be completed by professionals, and many have only their evenings as leisure time in which they can pursue their hobby to its full advantage and enjoyment.

I think, Sir, that a fitting corollary to the late Exhibition held in the Horticultural Hall would be the establishment of the nucleus of a fully-equipped engineering and woodworking workshop, owned and run by the members of the London Society of Model Engineers, on a sound and self-supporting financial basis.

I am quite aware that at first sight there must seem to be very weighty objections and considerable difficulties to be overcome before such a scheme could be fully developed and take shape; but I think, all the same, that if you would be kind enough to open the columns of your journal to the discussion of my proposal, that probably some of the leading members of the Society would give their valuable assistance, and the preliminary outlines of a scheme might be suggested which, in the course of time, could be brought before the members in special meeting, discussed, and if support and sympathy found to be forthcoming, might eventually develop into *un fait accompli.*

One of the difficulties is, of course, to find at a moderate rental and in a "decent" generally-accessible neighbourhood premises which could be easily converted into an engineering workshop. The heavy rents required for all premises in London may render this a matter of difficulty: on the other hand, there ought to be such premises in this huge London of ours which, owing to unforeseen circumstances, might be obtainable on not too prohibitive terms. To find such premises is no easy matter, and would tax to the utmost the patience and time of any one person who would take upon himself to travel about and visit all districts in which such premises are likely to be found. I would suggest, therefore, that a committee of the Society of Model Engineers of London should be appointed to consider all suggestions, to invite proposals, and to formulate a scheme, every member of the Society being invited to make special enquiries in such district with which he is most familiar, with a view to ascertaining what premises might be obtainable. In this way there would be several enquiries out simultaneously, and a suitable spot might be brought to light which otherwise would remain unnoticed.

Assuming that such premises were obtainable, the next course would be to consider the best ways and means for the fitting out of the same with plant and machinery suitable for general requirements, the nature of the power to be eventually adopted for driving the same, and the rules and regulations to be adopted in the management of the workshop. I believe that the question of power would offer very few difficulties, inasmuch as electrical power is obtainable in all parts of London, the cost of the same can be easily computed, and its application would form no difficulty. I would, however, also suggest that supplementary power should certainly be provided by the erection and installation of a 2½ to 3 h.-p. gas engine, and furthermore by the erection of a suitable high-pressure boiler for the benefit of such members who wish to use steam for their models.

With reference to the plant and machinery, I believe many engineering firms would be quite prepared to instal machines of their make on terms and conditions to be arranged, which would have the double object of being an advertisement for their goods and be a great economy in the initial capital outlay.

An engineering workshop fitted out in the way I have suggested would undoubtedly be an enormous attraction to many men to join the Society, in order to be able to take advantage of its workshop and tools, and if the premises were thrown open the whole day and also every evening in the week to members, and members were allowed to take their own work there and obtain assistance, the value of the Society would be doubled, its status would be at once raised, its membership roll would be greatly increased, and it would take its place as one of the technical educational systems of the city.

I am quite aware that the question of finance is the first point to be considered, and I think that if it were decided to raise the subscription from 10s. 6d. to at least 21s. per annum, that the extra 10s. 6d. per annum would not be grudged, and that there are many who would be prepared even to pay a higher subscription to obtain the advantages named.

Should it, on the other hand, be found impossible to obtain suitable premises at anything like a reasonable rental, the committee might consider the feasibility of procuring a site and erecting a workshop out of the funds of the Society, issuing

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debentures bearing a fixed rate of interest to those members who would care to take them up as an investment; and if the committee were promised a fair amount of financial support, means might, no doubt, be found to further finance the scheme. Steps would, of course, have to be taken to see that the workshop and its contents were always under the charge of a respectable caretaker, who might at the same time be a skilled mechanic and whose services would be always available for those members who might wish to take advantage of his knowledge. Such a man could easily be found, and there are any number of Government artificers who would be admirably suited for such a post.

In putting before you the rough outline of the above scheme, I have no doubt that possibly in the past the same may have already been suggested and found impracticable; and although I am fully alive to some of the obvious difficulties which would have to be overcome, I still think that a way could be found to surmount those difficulties and that eventually a thoroughly equipped amateur engineering workshop would come into being.

I am also firmly convinced, Mr. Editor, that if you would personally lend your valuable support to the members of the Society there would be many willing helpers prepared to do their best to further the project.—Yours faithfully,

Winchmore Hill, N. H. M. SAVAGE.

Cleaning Mercury.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I noticed a reply in your issue of October 24th to a correspondent ("L. T.") inquiring for a means of cleaning mercury used in a mercury break, and it struck me that the method given entailed a large amount of waste. The following method is one used by most users of large breaks, such as the motor-driven rotating jet variety, which employ up to 15 or 16 lbs. of mercury in connection with large coils and heavy currents, viz.: Stir up the metal to be cleaned in concentrated sulphuric acid with wood or glass rod; this will be found to reduce most of the "floured" mercury of which the sludge is composed to its normal condition, in which the globules will coalesce. When this has occurred, the bulk of the acid can be poured off and the mercury washed clean of acid with water, followed by a weak solution of washing soda, and again by clean water and run through wash-leather with hardly any resulting waste.

With regard to the fluid used for immersing the spark gap in a mercury break, I use with perfect success a good quality of ordinary kerosene, and it works well with a voltage of up to 110 and 15 or 20 amps.

Absolute alcohol is better, and will not fire if there is plenty of it over the spark, but is expensive and deteriorates, owing to its great affinity for moisture. Methylated spirit will not do. I have not had it actually fire, but at high voltages and heavy current I think it is dangerous, as heavy explosions occur in it with considerable evolution of light and, apparently, flame, so after giving it a short run I discarded it. Further, it does not seem to wipe out the spark as well as kerosene or absolute alcohol.—Yours faithfully,

A "DOCTOR MAN."

Electrical Connections for a Model Liner.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—In a recent issue of THE MODEL ENGINEER a correspondent described a model electric liner which he had made, also the special switch gear for obtaining two speeds forward or reverse.

Some little time ago I built a model launch with a somewhat similar gear, but of a slightly improved pattern. In my case, when I required two volts for half speed, I switched both cells of a 4-volt accumulator in parallel, and when I required 4 volts I put them in series. I enclose sketch of connections to show how this can be done.

A, B, and C are three switches, D is the ordinary type of reverse switch, E is a 4-volt accumulator with all terminals separate, F is a series wound motor. To obtain full speed, A must be closed and

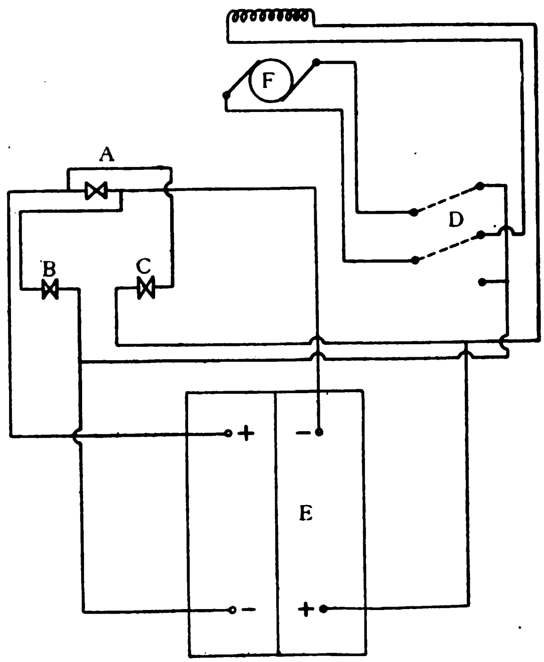

DIAGRAM SHOWING ELECTRICAL CONNECTIONS FOR MODEL LINER.

B and C opened (but B and C must be opened before A is closed). To obtain half speed, B and C are closed together and A is opened; all three switches must be insulated from one another; in the one I made they are all connected to one lever and so arranged that B and C are closed simultaneously, but just before they make contact A opens. This arrangement prevents any possibility of short-circuiting the battery owing to the wrong switches being closed together.—Yours faithfully,

W. H. DENNIS.

Charging Small Accumulator with Leclanche Batteries.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Leclanché batteries, for many reasons, are very suitable for charging small accumulators. But after they have been working some

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time they become polarized, and consequently the current passing through the accumulator is considerably diminished. The following is an idea of mine for overcoming the difficulty. A, B, and C are boxes, each containing four Leclanché cells in series. All the positive terminals are connected to the positive of accumulator. E is a round board, on which are mounted the three pieces of metal (each one insulated from the other), shown by the shaded portions, and each of these pieces of metal

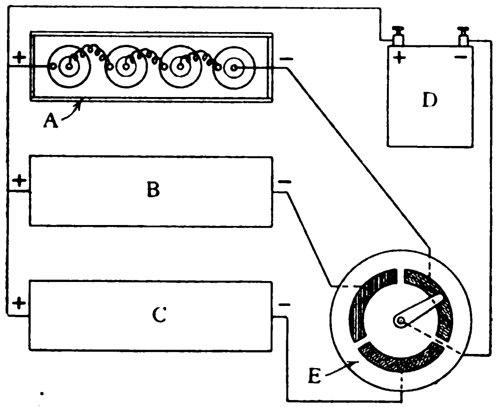

DIAGRAM OF CONNECTIONS FOR ACCUMULATOR CHARGING.

is connected to the remaining terminals on the boxes. The switch bar, which had better be made of very light and springy brass, is connected to the negative terminal of the accumulator, and is operated by suitable clockwork under the board. Care should be taken that the bar does not press too heavily on the segment, to stop the clockwork, and yet heavily enough to make contact. This device enables fresh sets of batteries to be switched on to the accumulator automatically every few hours, and of course there is no limit to the number of sets that may be used. By dispensing with the clockwork, the dial may be operated by hand and so used as an ordinary switch.—Yours truly,

J. G. NICKSON.

The Society of Model Engineers.

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

London.

FUTURE MEETING.—Monday, December 17th: Special Track and Model Night. Prizes will be awarded by popular vote to the three most interesting models or articles exhibited.—Full particulars and forms of application for membership may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

Provincial Societies.

Dublin.—A very well attended meeting was held on November 21st in the Pillar Café, Dublin, at which it was decided to form a Society of Model Engineers for Dublin and District. A large number of members handed in their names, and the proceedings were marked by the utmost enthusiasm. After considerable discussion, a committee of seven was appointed to formulate a constitution and rules for the Society, to be brought before a general meeting early in December. As the members who have already joined are representative of every class of model engineering, it is anticipated that it will appeal to all readers of "Ours," residing in or around the Irish metropolis. Intending members are invited to communicate with JAMES A. COTTER, Honorary Secretary, 32, St. Anne's Road, Drumcondra, Dublin.

Tyneside.—A very successful and interesting meeting of this Society took place on Saturday, November 16th, at the Society's workshop. Two members from Whitley Bay, who are building a 1-in. scale Stirling's G.N.R. single-driver locomotive, brought up the completed motion, wheels and frames, and had it tried under steam from the Society's marine type boiler. The necessary connections for steam and exhaust were soon made, and the excellence of the workmanship of the builders—who are amateurs—demonstrated by the smooth and easy working of all parts, to the admiration of those present. Following this exhibition a short paper, descriptive of a recent visit to Souter Lighthouse, was read by another member; and the election of two new ones, and thanks to those who had provided the night's enjoyment brought a very pleasant evening to a close. On Monday evening, November 18th, a party of members visited the model exhibition at Birtley in aid of the local St. John Ambulance Association, to which several had lent their models. A good collection of engines (most of which were worked by compressed air) and electrical machines had been got together, and Mr. Watchman's locomotive (THE MODEL ENGINEER, August 13th, 1903), and the vertical tandem compound marine engine by a "Beginner" (THE MODEL ENGINEER, August 17th, 1905) were easily recognised. Judging by the number of queries answered for enquirers from this district, there are still many who, by joining the Society and discussing their difficulties with the members, would materially add to the interest of the meetings and secure the help of enthusiasts like-minded with themselves, and to these a cordial invitation is extended. Meetings are held on the first and third Saturday evening in each month (next meeting December 7th), and as a new year has just commenced, the time for joining is a favourable one. The Secretary will be glad to answer any enquiries, and also to hear from anyone willing to lend models for an exhibition in the City, January 2nd and 3rd, 1908.—Hon. Secretary, THOS. BOYD, 128, Dilston Road, Newcastle.

EXPERIMENTS are being made in New York with a new type of steamer to run 60 miles an hour. The keel is practically one huge propeller, with flanges working up and down, enabling the vessel to travel at a great speed.

THE grandest train in the world is said to be the Kaiser's. It cost £200,000, and took three years to build. In the twelve sumptuous saloons are two nursery coaches, a gymnasium, music-room, drawing-room, furnished with oil paintings and statuary. The treasure-room, with its two safes, is burglar-proof.

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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:—

[17,890] **Pressure Gauge Syphons and Water Gauges.** C. B. F. (Barnstaple) writes: Is the syphon simply a piece of ordinary tube; if so, how does it keep the gauge cool? Could you give a specification and drawing of one suitable for 2½-in. dial gauge for vertical centre-flue boiler? The top tap of my water gauge on upright boiler is centre punched and hammered too tight. I cannot get it to turn, and, should a glass break, I could not turn off the steam. How can I loosen it? Would soaking in petroleum do it?

A steam gauge syphon is a simple U-loop in the connecting tube, which traps the water condensed in the gauge and prevents hot steam from coming in contact with the delicate mechanism of the steam pressure gauge. The action is as follows: When steam is let down, the water of condensation which is formed in the gauge and its connections by radiation falls by gravity into the U or syphon pipe, as shown in Fig. 1. This would not happen if the gauge were connected as shown in Fig. 2, as all water condensed in the tube would drain away back into the boiler. When steam is raised again, the water in the syphon tube is, of course, forced up into the gauge again, and water being practically incompressible, the pressure of steam on the top of the water is transferred to the working part of the gauge, and the correct pressure registered. This state of things is shown in Fig. 3, and it will be noticed that hot steam cannot come in contact with the steam gauge, owing to the plug of water intervening. It will also be noted that the steam is touching the surface of the water only. This prevents the steam heating the particles of water it comes in contact with and the said particles heating the rest of the water by convection (circulation). The heated particles never travel downwards; therefore, *water being a bad conductor of heat*, the steam gauge is kept comparatively cool; cooler, at any rate, than it would be if arranged like Fig. 2, where hot steam would continually rise to the gauge and the water of condensation drain away. Even if there is not enough water in the gauge when pressure is first raised to fill both the vertical members of the syphon tube, the water of condensation will soon fill the short tube up to hole in the boiler, and convection current will be absolutely prevented. Syphon fittings are made to fulfil the same object. Fig. 4 is a sketch of one of these. You do not want a "specification" for such a simple object. So long as you loop the tube below the connection to boiler, you will be all right. See Fig. 5 for suitable fitting for end of syphon tube. Except for appearances, three-cock water gauges have no great advantages for small models. What happens when a glass breaks? Well, the crack occurs, and there is a cloud of steam and rushing water. By the time a pair of pliers to turn off the top and bottom cocks have been found, the steam has all disappeared, and will require to be raised again. This is all that would happen if there were no cocks. Furthermore, a model water gauge is a rather disagreeable thing to handle when very hot. Therefore, a single cock water gauge is all that is necessary for a model which is essentially a working model, bearing in mind also that cocks reduce the steam and water passages considerably. The water gauge should not have riveted-over cocks. Yes, try soaking it in paraffin. Also heating the body of the cock with an iron and at the same time endeavouring to loosen the plug with a pair of pliers.

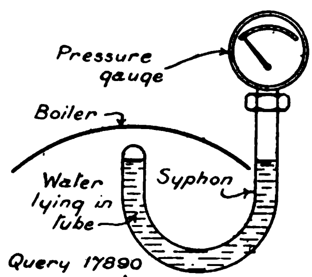

FIG. 1.

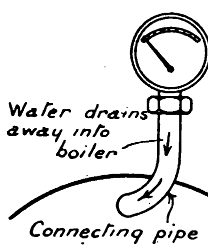

FIG. 2.

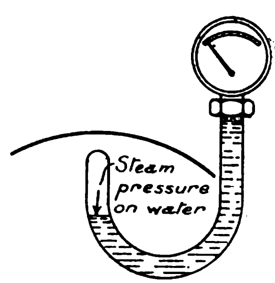

FIG. 3.

PRESSURE GAUGE SYPHONS AND WATER GAUGES.

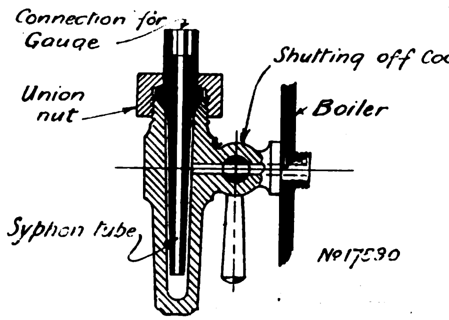

FIG. 4.

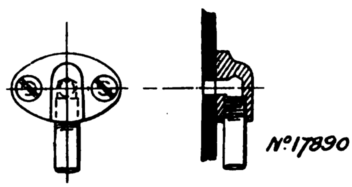

FIG. 5.

[18,348] **Locating Faults in Lighting System.** G. B. M. (Maghull) writes: I am in charge of a small electric lighting plant, and have got on fine up to now. Lately, a fault has shown which is puzzling me, *i.e.*, four lamps are in one room, controlled by one master switch and four separate switches. When I put the "master" off, one light goes only half out, and on putting off the other switch belonging to that lamp it goes down a little more. Other lights about the house do the same on their own switch. I think there is a "dead" earth on the positive, as I can light a three-light fitting from the negative and earth. How do I trace this?

Without a plan showing arrangement of the wiring and switches we cannot advise you very fully. There are evidently earths upon the wiring. The only way to locate them is to test each section separately by means of a battery and sensitive galvanometer or testing set. Disconnect the different sections and lamps, and when you find an earth or very low insulation resistance, examine that particular piece of wiring. It may be due to collection of moisture. Read our Handbook on "Private House Electric Lighting." Your connection to earth for testing can be made to a water pipe.

[18,318] **Burning Out a Faulty Coil.** J. G. (Llanelly) writes: Kindly explain the following—The principal precaution in order to secure success in shorting out a broken coil in the armature circuit, and state reason why it should be done.

In reply to your inquiry, the remedy employed by experienced men would be to "burn out" the faulty coil. One terminal of the dynamo or testing battery would be connected to the faulty commutator bar, and the other end flashed or wiped quickly across.

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the dynamo spindle. This is repeated, if necessary, several times, and if the earth or fault is not a very bad one, it will in all probability be "burnt out." A regulating resistance should be used in the testing circuit, but low enough to allow a large enough current to flow to do what is necessary.

[18,391] **Wireless Telegraphy.** J. M. (South Ashford) writes: I am constructing a wireless set and should be pleased if you would answer me the following questions. (1) Would two aerials work as well as one aerial and one earth? (2) How is connection made on board ship, as they cannot have an earth wire, as water, I understand, will not conduct electricity? (3) Can you give me instructions how to make an anti-coherer? I have read about one that had a thin film of silver on a piece of glass with a fine cut made by a razor 3 cms. long. (4) Will an ordinary Leclanché cell work through a resistance of 40 ohms?

(1) We suppose you mean two vertical aerials side by side? If so, there would be no advantage, and the arrangement would not work unless they were very widely separated. In Mr. Howgrave-Graham's book on "Wireless Telegraphy"—one of our publications—you will find an account of the Lodge-Muirhead system with details of an aerial having upper and lower capacity-areas and no earth connection. (2) Pure water is an insulator. Lake and river water are always sufficiently impure to conduct as well as is necessary. Sea water and most other saline solutions conduct quite well. Earth is often made to the metal hull of the vessel. (3) Instructions for anti-coherer are given in the above mentioned book. (4) Work what? Your question is too ambiguous for it to be possible to give an answer. Obviously it will *not* work a ¼ h.-p. motor and obviously it *will* work a sufficiently sensitive galvanometer.

[18,076] **Lamp Wiring.** N. S. (Barrow-in-Furness) writes: I have five rows of lamps, as shown in sketch (not reproduced), and I want to connect them up so I can switch them on separate, with switch and fusebox attached to each. Will you also give me

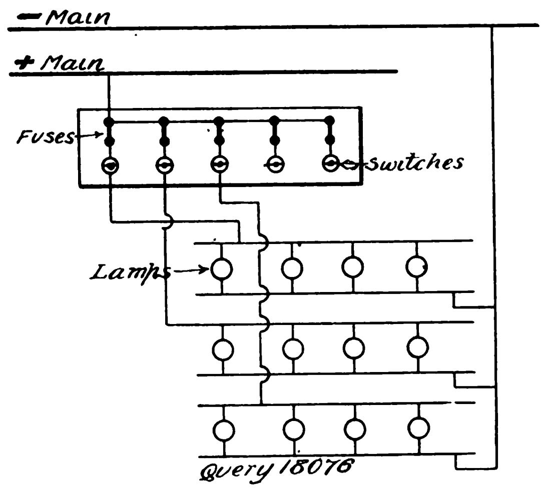

Diagram of Lamp Wiring.

the connection of the five rows of lamps to the cable, which is about 250 volts?

The lamps should be wired as above, and so on to all five groups of lamps.

[18,174] **Charging Plant.** F. F. P. (Tewkesbury) writes: I have just put down a small gas engine (¾ h.-p.) and a Thompson shunt dynamo, 30 volts 8 amps., but I find I am only able to get 2 to 2½ amps., and this at whatever position the regulating switch is placed; the voltage, however, is quite right. I should mention the field-magnet windings get very hot whilst running, thermometer registering 90° when placed close to same. Supposing I get the amperage right, could I charge up my five storage accumulators (80 amp.-hours, charging rate 7 amps.) direct, *i.e.*, without running through a resistance? Can you recommend some work that would be of service to me on the management of charging plant?

The amps. flowing from the dynamo will be determined by the resistance of the circuit which you connect to its terminals. If the volts are maintained you can increase the flow of current by decreasing the resistance of this circuit. If it is an accumulator, the resistance will be composed of the internal resistance of the cells plus the opposing voltage of the accumulator. If this voltage equals that given by the dynamo, you will obtain no flow of current at all. If the dynamo voltage is equal to 2½ volts for every cell in the accumulator in series then the accumulator is fully charged under this state of things. What you are really concerned with is the rate of flow of current through the cells. If this is not sufficient, and the regulating resistance is all out, you should drive the dynamo at higher speed until you do get sufficient current. The heating of the dynamo coils is not serious if you can bear your hand upon them. Our sixpenny handbook on accumulators gives information on charging. A larger book is that by Sir D. Solomons on "The Management of Accumulators."

[18,168] **Voltage and Current for Arc Lighting.** C. J. (Edge Hill) writes: In thanking you for your past aid (*re* 40-watt motor windings), I would be much obliged if you would tell me if it is possible to light two carbons from an ½-in. spark coil, and if it will produce a proper arc; also, if it is necessary to have a resistance inserted between the coil and carbons; and, if so, what kind of a resistance I should use? I should be much obliged if you would give me a rough sketch of the resistance and how to connect up—that is, if one is required.

You can obtain an arc discharge between the carbons, but not an arc as understood in connection with an ordinary arc lamp. The amount of current required by an arc lamp is far in excess of that possible to obtain from the secondary of a ½-in. spark coil, or any intensity coil. Intensity coils give very high voltage, but exceedingly small current. You cannot get a large current from them. If you require an arc such as produced by an arc lamp you must use a dynamo or battery, giving at least 40 volts and several amps.

[18,317] **Marine Boiler.** A. G. Q. (Liverpool) writes: I am about to make a boiler for destroyer hull (on usual lines), 3 ft. 3 ins. long, 4½ ins. beam, and 3½ ins. deep; not too intricate, as I have not much experience in model-making. I have your 6d. handbooks on boilers, hulls, and machinery, but my beam seems narrower than usual. Also method of firing same.

The design of a boiler for such a small boat is a difficult problem. If the top hamper is not very great, then a water-tube boiler, about 2 ins. diameter, fired by a spirit lamp and placed in a casing nearly fitting the hull, will work well, but to obtain proper ventilation of the lamp a tray wick-holder should be used. A horizontal marine boiler 3½ ins. diameter, with a 1¾-in. diameter furnace and cross water-tubes, would have a longer centre of gravity, and if sufficiently light and fired by a petrol or benzoline lamp should successfully steam the boat. You must, however, cut weight down to the minimum.

[18,351] **To Prevent Tools Rusting.** T. C. H. (Lower Edmonton) writes: As a model engineer and a constant reader of your paper, I am writing to ask your assistance on the following trouble. I have a 3½-in. Drummond lathe in my workshop which on being left idle for a day or two gets coated with a thin film of rust over all the bright work, slides, hand wheels, etc. I have tried smothering them in oil, but it seems to dry up in places with the same result. I have also tried covering it with a cloth when not is use, but it makes little difference. My workshop is built of corrugated iron, has a tongued and grooved wooden floor, and the ceiling is lined with match-boarding. The only heat is from the lamp which lights the place at night. There is no dampness to be seen and there is an air space under the floor.

We can only attribute the rusting to the fact that your workshop must be damp through some cause or other, and would suggest that you instal a small slow combustion stove, and have it going two or three evenings in the week, especially in damp weather. In the case of small tools, etc., it is possible to obviate rusting by keeping a saucer of strong sulphuric acid standing in the case in which they are kept, but this could hardly be used in your circumstances. Try the effect of covering the inside walls with a felt cloth. This would prevent the cold striking through immediately after you have left the shop (and the lights are out) and condensing the moisture in the atmosphere. Also remember to cover the lathe over with a cloth directly you shut up for the night.

[18,325] **Boiler Queries.** A. L. N. (Highgate) writes: I am building a stationary boiler, as illustrated on page 15 of "Boiler Making." It is 10 ins. by 4½ ins. seamless drawn brass tube 1-16th in. thick. The ends are cast as a cocoa tin lid ½ in. bare, and are going to be riveted (single) on to the tube. Boiler will have a stay through centre 3-16ths in. The fittings are safety-valve, filling plug, gauge glass, and pressure gauge. The lamp will be covered in by sheet tin to keep draught out. (1) Will a lamp (methylated spirit), as Bassett-Lowke's No. 8, with seven burners (spout 8 ins. long, reservoir about 2 ins.) be too large? If so please give size. (2) Would a paraffin blowlamp be too powerful for the above? (3) How much pressure will this boiler stand, taking into consideration that it is my first attempt? (4) Some time ago you very kindly answered me a question (18,033) *re* marine boiler. You said that if I made the size of boiler 10 ins. by 4½ ins. instead of 12 ins. by 5 ins., and furnace 2½ ins. diameter, it would suit splendidly the boat that I described to you. What engine, diameter of cylinder, etc., would the boiler drive well?

(1) The plain lamp or a gas "ring" will give the best results. The lamp you have chosen is large enough. (2) A blowlamp is hardly suitable, but, of course, could be used. (3) So long as the riveting is properly done and the proportions and pitch of rivets are correct, the boiler will be quite safe to 25 to 50 lbs. per sq. in.

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(4) Your present boiler has no tubes, and therefore cannot be compared with a marine boiler with a single flue tube (as page 46 of "Model Boiler Making"). The stationary boiler should work at ¾ in. by 1 in. cylinder very well, but would do better still if provided with a few water tubes.

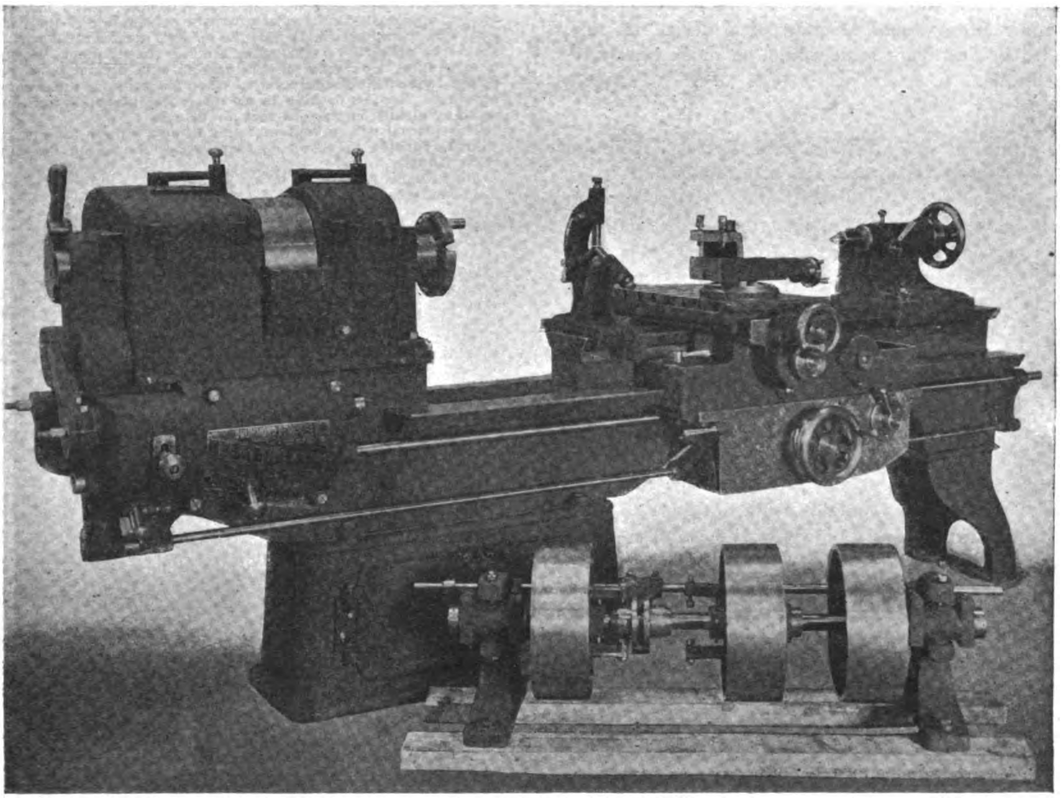
The News of the Trade.

[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 Large Drummond Lathe.

We show in the accompanying photograph a novel type of lathe, which is one of the latest productions of Messrs. Drummond Bros. Ltd.'s, rapidly growing works at Guildford. It was shown for the first time at the recent Engineering Exhibition, at Olympia, and is of interest as an example of what this firm can do outside the ordinary requirements of the model maker. It has 9-in. centres and a 9-ft. bed, the approximate weight of the lathe complete being 6,000 lbs. It has been specially designed to suit the modern high-speed tool-steels. There are 14 spindle-speeds, and forty-one threads can be cut without taking off a gear wheel. The whole design is exceptionally substantial and convenient, and, we understand, that the special features of the lathe have been so much appreciated by the engineering trade that a large number of orders for this tool have already been placed.



A NEW 9-IN. CENTRE LATHE BY MESSRS. DRUMMOND BROS.

* Small High-speed Engine Castings.

The castings for small vertical high-speed single-cylinder engine (⅝-in. bore and ⅝-in. stroke), which The Majestic Engineering Company, of Milton, Staffs., have sent for our inspection, appear to be of very good quality, and should present no trouble in making up into very well-finished models. For the best models finished from these castings the above firm are offering two silver and two bronze medals. Particulars are sent with order for castings. The parts may be purchased with a balance-wheel in place of flywheel, for completion as a launch-engine, if so desired.

*Small Accumulators.

We have received for inspection specimens of the "Young Spark" miniature 2-volt and 4-volt accumulators in celluloid cases which are being advertised by Frank Wyatt, of 10, Dollis Villas, Neasden, N.W. The widths of these are respectively 1½ ins. and 3 ins by ⅞ in. thick, and 4½ ins. height over terminals. They are substantially made and sealed with celluloid tops, in place of the usual wax composition.

New Catalogues and Lists.

S. G. Waters, 45, Algernon Road, Hendon. — We have received a list from this firm giving prices of various makes of talking machines, records, accessories, and parts. Readers interested in these machines should apply for list, which will be sent post free.

The Editor's Page.

ONE or two readers have written lately asking us to publish a design for a model locomotive of a larger scale than usual, the suggestion most generally made being for a 1½-in. scale model. We may say that we have had something of this sort in mind for some little time past, but pressure on our space has prevented any active steps being taken in the matter till now. Before actually putting such a design in hand, we should be glad if all those readers who would like particulars of a model of this size would write and let us know the exact scale and type of engine they would prefer, and we will then endeavour to produce something to meet the wishes of the majority. Another suggestion has reached us to the effect that we should publish a design for a model traction engine. We should be glad to know how many of our readers would be glad of a design of this kind also, and what scale would be most generally acceptable.

* * *

We publish in our "Practical Letter" column this week a very interesting communication from Mr. H. M. Savage, on the subject of a workshop for the London Society of Model Engineers. We happen to know that a movement in this direction is now under consideration by the Society; but Mr. Savage's suggestion comes quite independently, and he certainly puts the case in a very forcible way. It is a scheme which we have advocated for a long time past, and no one would be better pleased than ourselves to see it brought to a successful issue. There are, however, several difficulties in the way, the high rent required for central premises in London being one of them, and the cost of a suitable caretaker being another. These are difficulties which follow on the small annual subscription now required from the members, but we believe that they can be overcome, and that the executive of the Society will find a way of doing it. The Society was never in a more healthy and satisfactory condition than it is now, and a development of the kind indicated would do more than anything else to still further increase its prosperity and utility. We wish the movement all success.

* * *

Mr. A. H. Avery, of Tunbridge Wells, asks us to give space to the following: "As you occasionally open your columns for the ventilation of trade matters, will you kindly permit us to say a few words in self-defence concerning the well-known 'Avery-Lahmeyer' and our 'T-type' dynamos and motors? We do not intend to decry productions of any trade competitors, nor do we claim proprietary rights to the *general* design of dynamos, etc., of the 'Ironclad' type, but we wish to make it clear to our model engineering friends that all the machines built by our firm are of registered design in all details, the copyright of which is exclusively our property. Although in one sense it is gratifying to find these designs (which we originated some eight or nine years ago) so extensively copied now, we regret to find that many novices write to us under the impression that they are the possessors of the genuine article. The imitations differ from our designs just sufficiently to evade the law of copyright—but there the resemblance stops."

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 26–29, Poppin's Court, Fleet Street, London, E.C.

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

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Contents.

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

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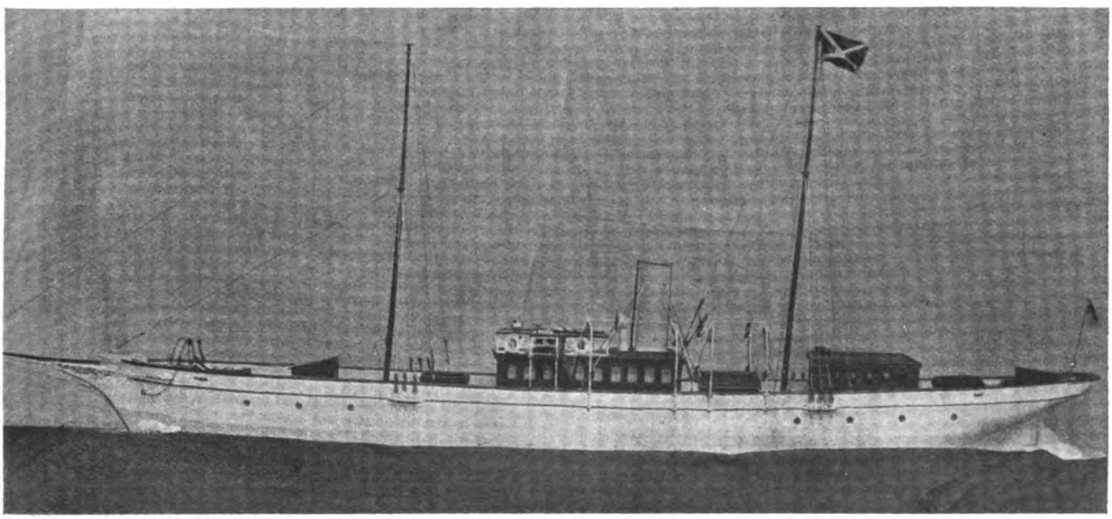
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. XVII. No. 346. DECEMBER 12, 1907. PUBLISHED WEEKLY

A Model Steam Yacht.

By J. R. JACK.



MR J. R. JACK'S ELECTRICALLY DRIVEN MODEL STEAM YACHT.

THIS model yacht, *Daphne*, has been built to scale from the plans of the steam yacht *Yarta*, 357 tons Y.M., designed by A. H. Brown, Esq., N.A., 10, Pall Mall, S.W. The hull is 7 ft. 2 ins. in extreme length, the water-line being 6 ft. 5 ins.; depth, 9 ins.; draught, 5½ ins.; beam, 11¼ ins. She is constructed on the "bread and butter" plan, in planks of 2½ ins., dowelled and strengthened with solid bulkheads screwed from outside in each section. Her total displacement is 112 lbs. when fully ballasted; the motor is about 16 lbs. in weight, and is driven by two 4-volt accumulators. These also serve for lighting lamps in the saloon and cabins, also sidelights and masthead light, and for telegraph on the bridge. The motor is controlled by two small wheels on the bridge, one giving "ahead" and "astern," and the other being a cut-out for starting and stopping. The sidelights and masthead light have been added since the photograph was taken. Each lamp has its separate switch, and all wiring is hidden; the movable decks and cabins being fitted with "make-and-break" connections for lighting and telegraph. The cabins are upholstered and carpeted, and a staircase communicates with the saloon from the upper cabin or companion, all the woodwork being painted white and gilt. The skylights are hinged and glazed; all davits are working

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models, also anchors, cables, binnacle, etc. The running and standing gear is finished as nearly to correct nautical style as possible. All parts are home made, except motor and accumulators, and as many of them required much consideration, but would take up too much room for general description, I shall be pleased to give particulars and sketches for the construction of lifebelts, buckets, ventilators, ports, stuffing-box, cables, shackles, bollards, fairleads, davits, etc., on the principle of making one thing out of another without any but the simplest of tools, to any who require the information.

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.]

Hardening Fine Circular Saws.

By B. J. Buckman.

Seeing in these pages a short while ago a Query on hardening saws, and having occasion to make a very fine circular saw for sawing a slot ·015 in. wide, ⅞ in. deep, in the

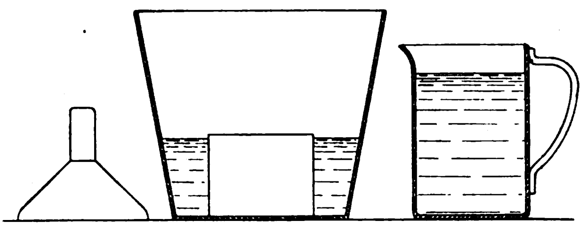

Fig. 1.

end of some pieces of ¾-in. round steel, the following method may prove useful to others. I found it an absolute impossibility to harden these saws without buckling in either of the following ways:—

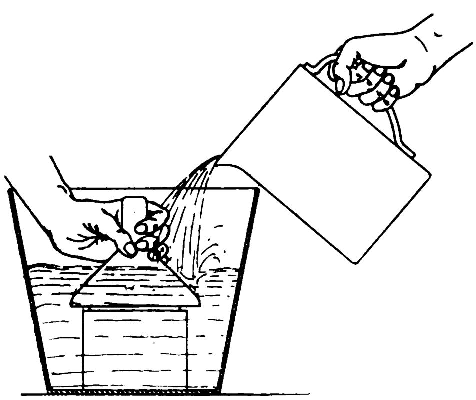

Fig. 2.

First, slacking out in water, dipping quickly edgeways; result, serious buckle. Second, as above, but dipping indiscriminately; result, much the same. Third, clamping between two specially turned mild steel plates, ⅜-in. thickness, leaving the teeth bare; result, worst buckle of the lot. Fourth, numerous trials on a blank—chisel indentations, dipping in oil, drawing temper from centre, and dipping the edge only in a shallow tray of water; but in neither case was any success experienced.

Happening to ask a friend of mine—a toolsmith—if he had had any experience with very fine saws, he said: "Yes, I'll do it for you in five minutes, if you will get me the necessary tackle." Needless to say, I soon procured him the tackle, which comprised a bucket, a can, and two pieces of flat-surfaced material larger than the saw. He placed one block in the bucket and filled with water barely to cover (as Fig. 1). He then heated the saw to a nice red, placed it on the block in the bucket, immediately placing the other flat piece on top, and as quickly as possible covering the whole in water. The result was a dead-flat saw, beautifully hard. I have tried the same method since, and in every case success has been the result.

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.]*

Metric Weights with English Equivalents. By Hugh P. McCartney. London: E. and F. N. Spon, Ltd. Price 1s. net; postage 1d.

All who have business relations with Continental Europe will find this little pocket-book invaluable. The relative value in English pounds avoirdupois of from 1 gramme to 50,000 kilogrammes is shown; also a table is given of equivalents in pounds troy. All calculations have been carried to the fourth decimal place.

The "Practical Engineer" Electrical Pocket Book and Diary, 1908. Price 1s., cloth; 1s. 6d. leather; postage, 2d.

The 1908 Pocket-book appears to be in every way up to the standard of usefulness which previous issues have attained, and we can recommend it to the notice of all practical engineers.

The Elements of Electrical Engineering. A First Year's Course for Students. Fourth Edition. By Tyson Sewell, A.M.I.E.E. London: Crosby Lockwood & Son. Price 5s.; postage, 5d.

In the fourth edition of this useful work, the reader will find several welcome additions. The newer forms of arc and incandescent lamps have been dealt with, including the "Flame" arc lamp, the Nernst, Osram, Tantalum, and Mercury Vapour lamp. In the appendix we find the three-wire system of distribution is briefly explained within the limits of six pages. Following this, a large number of questions and answers are given, which are based on the contents of the volume. These will be found a material aid and of much interest to students, who, by subjecting themselves to a cross-examination, will be enabled to find out how much of the information contained in the previous pages they have absorbed. We can recommend the work to all serious students of electricity.

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Elementary Ornamental Turning.

By T. Goldsworthy-Crump.

(*Continued from page* 501.)

HAVING mastered these movements and the varying forms produced by straight drills, we will now consider the use of cranked drills—if such a term may be applied—as in reality they are not drills, but special tools used in the drill spindle to produce figures and forms which are usually executed with the excentric cutter; but as the latter instrument is not under consideration at present, the capabilities of cranked drills will be fully described. Several patterns of cranked drills are illustrated, but there is no limit to their variety, shape, or the uses they may be put to, and the following forms and movements simply indicate the general principles of their application and the style of work produced by their aid.

As a commencement, we will take a pointed cranked drill, say No. 23, having a radius of ¼ in., and consider the different work it will produce.

Fasten a piece of hardwood plankways on the faceplate as before, and turn same to a true surface. Arrange drill spindle as for movement A. Adjust position so that the cranked drill will revolve just inside edge of wood. Now proceed as previously described for straight drills, and the result will be a ring of circles either separate or interlacing, according to the number of divisions used (see Fig. 2).

Substitute movement B, and a circular groove ½-in. in width will be produced.

Next practise movement C, using the cross-slide screw for spacing, or by substituting movement B, a straight groove will be produced across face of work. Movement E should also be used, the result being a circle, or portion of a circle, of unequal penetration, giving a form somewhat after a crescent moon, and which is found very useful for certain decorations. This effect can also be produced by setting the drill spindle at an angle to the work.

The use of the cranked drill on the cylinder should next be studied, and the various movements practised. By its use triangular, square, hexagon, octagonal, or any number sided figure in the solid can be produced, either parallel or taper or in combination.

A piece of hard wood is taken as before, and held either in a grip chuck or between centres and turned parallel. The drill spindle is set at right-angles to the lathe bed. For producing, say, a hexagonal bar, the index finger is set at zero on the 96 circle. The drill is then advanced into cut and fed lengthwise, the penetration being gradually increased after each traverse until the necessary amount of material has been removed. The work is then revolved 16 holes and the process repeated, care being taken that the penetration is the same for each side. The remaining faces are produced in the same manner, a perfect hexagonal bay being the result. Many ornamental forms can be produced on flat faces formed in this way, as will be shown later. Instead of the faces being flat, they can be made concave by simply setting the spindle at an angle so that the drill only cuts during half a revolution.

The movements previously described as to circles and interlacing circles should also be practised on the cylinder or the flat faces.

While considering the cylinder it may be well to explain the effect of using drills, as shown in Fig. 4, Nos. 31-38, which will be seen are cranked at right angles to line of revolution. These can also be made in a great variety of sizes and shapes, and are a most useful form of cutter. Having placed the drill spindle parallel with the cylinder and inserted one of these cutters—the work being held firm at zero—advance into cut and a semicircular cut will be produced of the same radius as the cutter and same width as face. By traversing with the main screw, a concave groove or flute is obtained. By using the division plate, a series of flutes can be produced or a circle of cuts according to which movement is employed. This style of drill is most useful, as will be seen from some of the designs. Needless to say, the use of this drill should be practised in all movements.

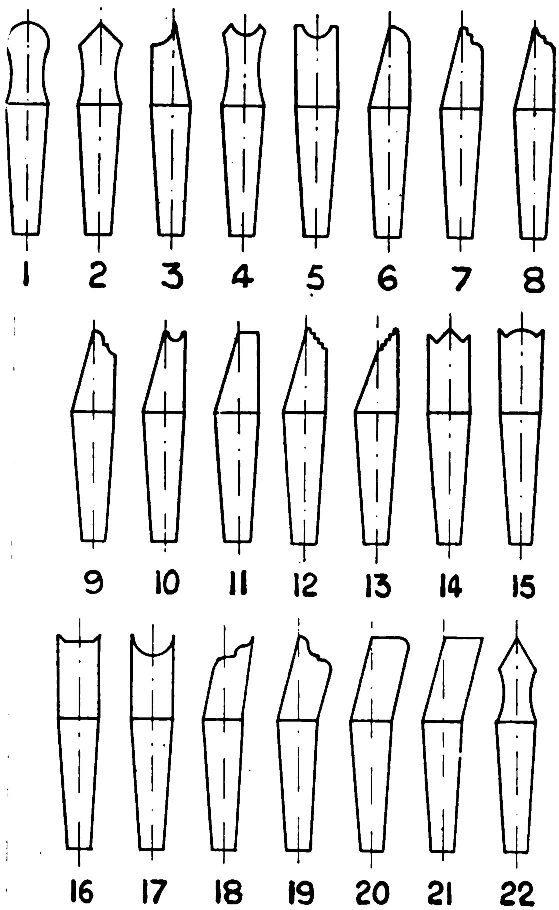

Fig. 3.—Drills for Ornamental Turning.

In using cranked drills, great care must be taken not to over-feed, and that they are driven as fast as possible, also kept *sharp*. The turner, having made himself thoroughly conversant with the use of the various drills and movements and acquired enough knowledge and practice to execute the figures with precision, the manner and procedure

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for producing many ornamental patterns and designs with the drill spindle *only* will be described and illustrated, after which the vertical cutter will

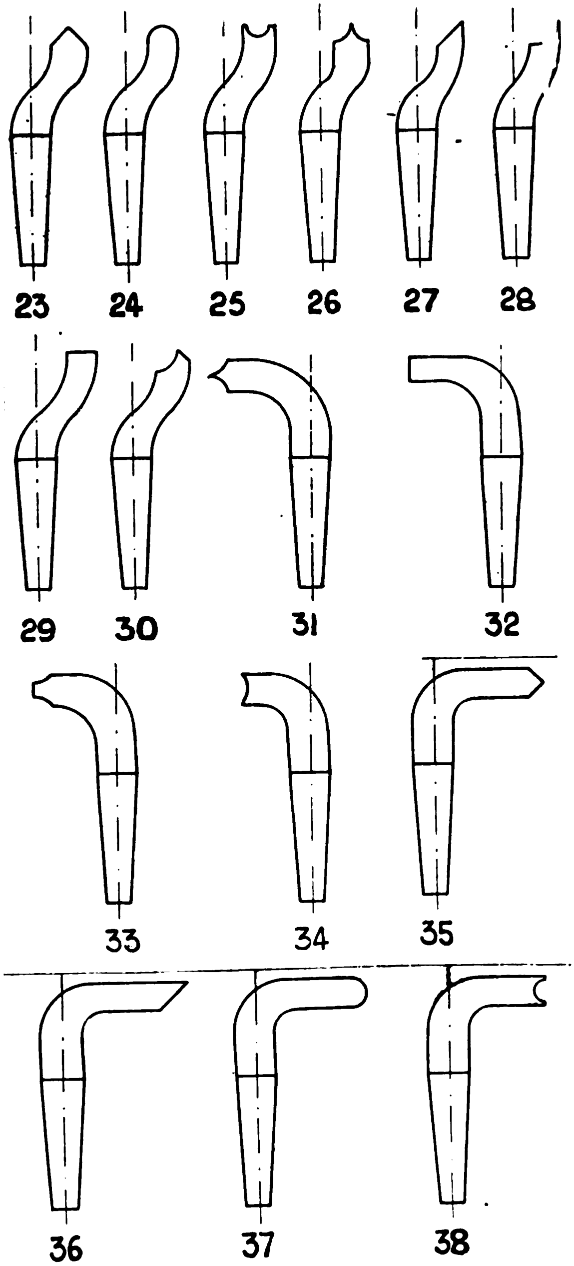

FIG. 4.—CRANKED DRILLS FOR ORNAMENTAL TURNING.

be dealt with and work produced by the use of both tools.

As, however, there may be some who have not the necessary drills, or knowledge how to make them, it may be well perhaps to devote a little consideration as to the method that should be employed in their production. As a great variety of shapes and sizes are required, it will be a good plan to make, say, 50 blanks. These must be, of course, made to fit the particular drill spindle that they are to be used in, and the following remarks are general :— Having obtained enough steel wire of suitable size, proceed to cut up in lengths for each drill, allowing an extra length for the cranked ones. The blank should now be held in a grip chuck and carefully turned to fit the socket of drill spindle either taper or parallel—the former for preference; but if the parallel fitting is well made and a recess made for pinching screw there is no reason why they should not be satisfactory.

The next step is to mount the drill spindle so that it can be driven from the headstock. For this purpose the spindle is set at centre height, and exactly in line with centres, so that pulley can be gripped by a chuck or driven with a pin and carrier from a faceplate. The hand-rest is then adjusted, and the blank carefully turned with a graver to the size required. Now it is a convenience to have drills of a definite size and in a certain ratio to the slide-rest screws. Thus, for a screw of 10 threads per inch, the drills should be hundredths of an inch, as 10-100ths, 20-100ths, and 25-100ths in. diameter, or for 8 threads per inch, the usual inch divisions can be used as 1-32nd, 1-16th, ⅛ in., etc. The reason for this is, presuming a drill being used 20-100ths in. on a 10 threads per inch screw, two revolutions of screw will shift the drill exactly its own width, and this set ratio being known, saves a great amount of adjusting, etc. It is well to make a notched gauge out of a piece of tin to the various diameters so that they may be turned to size. In turning the profile of drill always leave a little point projecting at the centre of front end.

As an example of procedure, we will take drill marked No. 2. Having turned the blank to the desired diameter and faced the end to the angle shown, the blank is removed from spindle and for convenience held in a hand vice. The front portion of drill is now filed flat on each side. Be very careful to keep the thickness exactly the same each side of the little guide point. This little point must be greatly respected, as upon this depends the accuracy of the drill and the work it will produce. The cutting edges should be backed off to about 35 degs., and the drill hardened and tempered. The drill should now be mounted in the spindle and tested for truth, and, if out, carefully corrected, so that the guide spot runs perfectly true. This being satisfactory, the drill should be sharpened and polished. The various bead, step, and other drills are first filed flat, and the particular form produced by fine files, leaving a cutting edge of 35 degs., care being taken that no part is undercut.

In making the cranked drills, the steel is bent hot to the desired shape, and only the point hardened, so that after completion they can be bent sufficiently to bring the radius exactly to the predetermined size. It is well to mark all drills as to their particular dimension, so that mistakes may not arise. This can be done with fine file marks, not necessarily figures.

Care should be taken not to make the drills too hard, as by so doing the liability to fracture is increased, and for ivory and the hard woods it is quite unnecessary. A light straw colour is about

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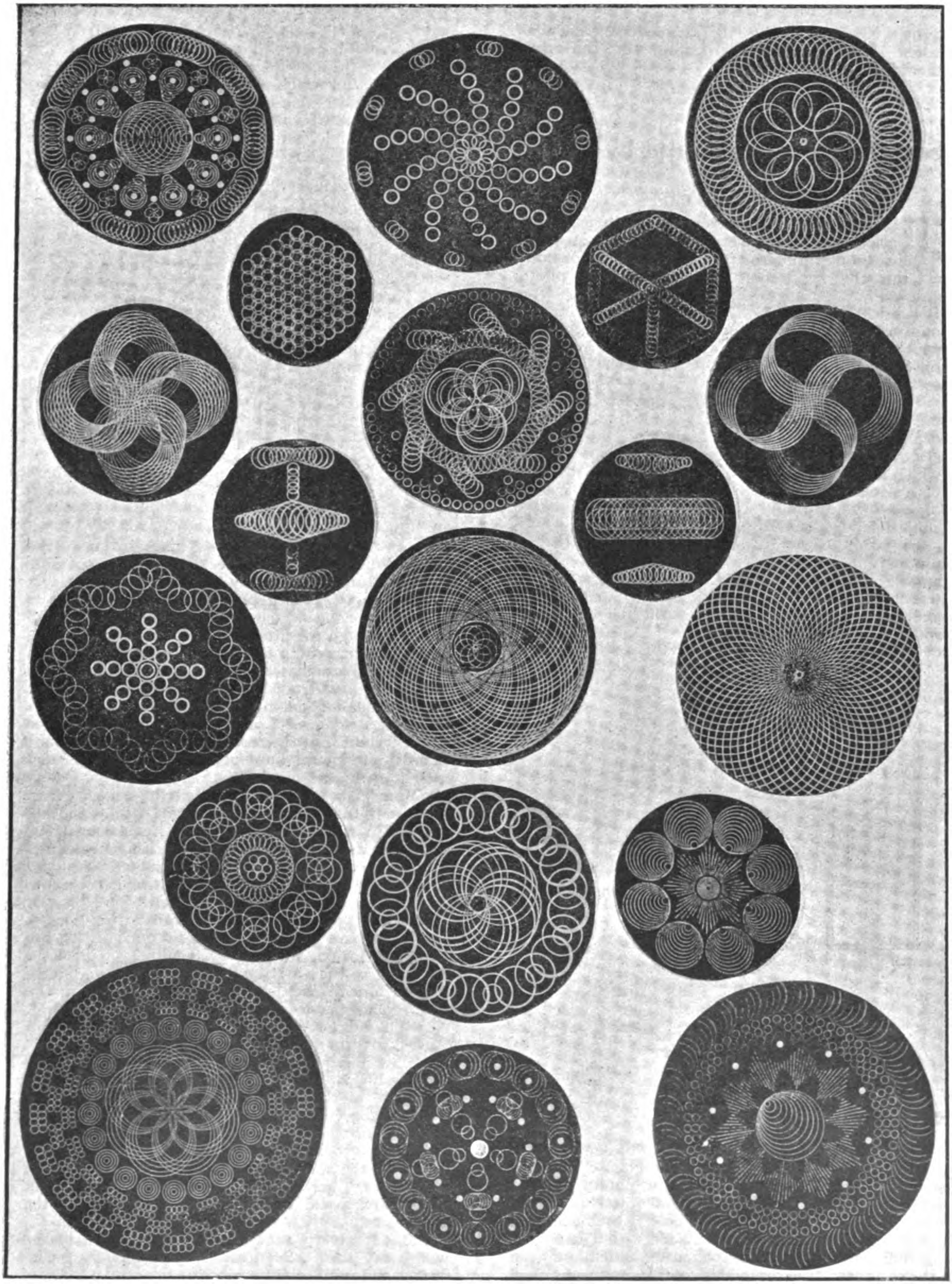

DESIGNS PRODUCED ON FLAT SURFACES WITH DRILL SPINDLE.

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right. Needless to say, the greatest care must be taken in setting and sharpening, and the edges should be highly polished.

(*To be continued.*)

Sending Photographs by Wire.

By T. Thorne Baker.

THE successful transmission of photographs by electrical means, between two stations nearly a thousand miles apart, has introduced a new era into the worlds both of telegraphy and photography. A photograph can be sent now from Berlin to Paris or to London, or *vice-versa*, in twelve minutes, and the inventor of the ingenious apparatus which renders this possible—Dr. Korn, of Munich—fully deserves the congratulations which have been so lavishly bestowed on him.

Dr. Korn's invention depends upon the extraordinary property possessed by selenium, a metal of the tellurium and oxygen family, of varying in its electrical resistance according to the amount of light which falls upon it. The selenium is used in the form of a "cell," which is merely a rectangular piece of slate, wound round with platinum wire, to which small particles of the metal are attached.

In order to understand quite clearly how a photograph is sent by wire, we must consider the apparatus as made up of two parts—the sender or transmitter, and the receiver. Each part shall be explained separately. The transmitter is shown roughly in diagram form in Fig. 1. Here a glass cylinder C, attached to an axis with a spiral thread

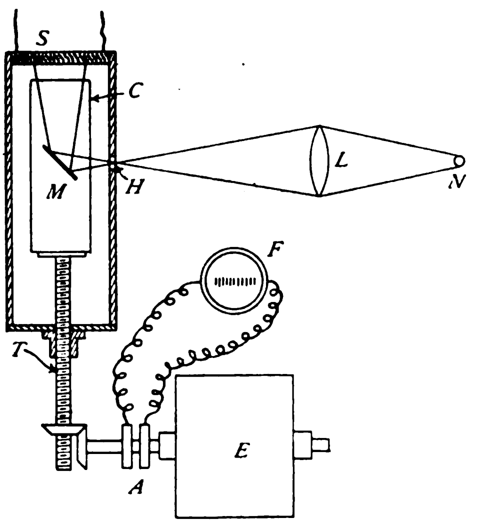

Fig. 1.

T, is enclosed in a wooden box which has an aperture H in the front of it. Round this glass cylinder is fixed a film transparency, *i.e.*, a photograph on celluloid film. The light from a powerful Nernst lamp N is condensed on to the hole H by means of a large lens L, and H is also provided with a small lens so that the light is concentrated on a small point of the cylinder. The axle T is rotated by means of an electro-motor E, and this motor, driven from an accumulator battery to ensure even running, is provided with a double-wound armature and two rings at A from which two brushes take off an alternating current; this current operates a frequency meter F, by means of which the exact speed of the revolving cylinder can be ascertained, and a delicate resistance is used to adjust this speed accurately.

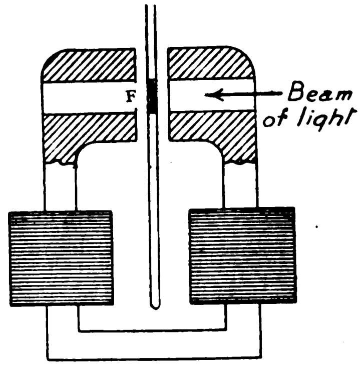

Fig. 2.

Now, as the cylinder revolves it rises, owing to the screw thread, and thus the spot of light passing through illuminates, bit by bit, the whole film, just in the same way as a phonograph style traces its course over the whole record. The light which passes through the film (and which naturally varies in strength according to the density of that portion of the film immediately behind the aperture H), is reflected by a mirror M upwards on to the selenium cell S, through which an electric current of 200 volts is passing. The cell S offers a very great resistance to the current, but the resistance varies each instant according to the amount of light which is reflected upon it from the mirror M. In practice a second selenium cell, of inertia and light-sensitiveness, opposite to that of S, is used in series with it, and the two are in shunt with a powerful regulating resistance and the 200-volt battery. By this means it is possible to overcome the tendency to lag or respond slowly to the variations in the light, which are too evident in an "uncompensated" cell.

We thus see that what the transmitter does is simply to send a series of electric currents to the receiving station, which vary in intensity precisely according to the variations in density of the photographic film as each successive tiny portion of the latter comes between the hole H and the mirror M. We shall next see how these current changes are utilised to form a photographic image in the receiver. The resistance of the telephone line between Paris and Berlin is about 3,000 ohms. The enormous resistance of the selenium cells brings the current from the 200-volt sending battery to about one two-millionth of an ampere, and thus the telephone line resistance is to a great extent negligible. Telephone wires, by the way, are essential, as a *closed circuit* is necessary, and one earthed wire, as we use for telegraphy, would be fatal to the working of the apparatus.

In the receiver we again have a strong Nernst lamp whose rays are concentrated by means of a condenser and supplementary lens upon a tiny portion of

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another revolving cylindrical drum, on which is wound the sensitive film. We might thus imagine in Fig. 1 a solid drum substituted for the cylinder C, and the mirror M and cell S non-existent. The sensitive film which is to receive the photograph is revolved by an exactly similar motor, so that, if nothing intercepted the light from N, we should have a spot of light travelling round and round the cylindrical film until every bit of it was exposed.

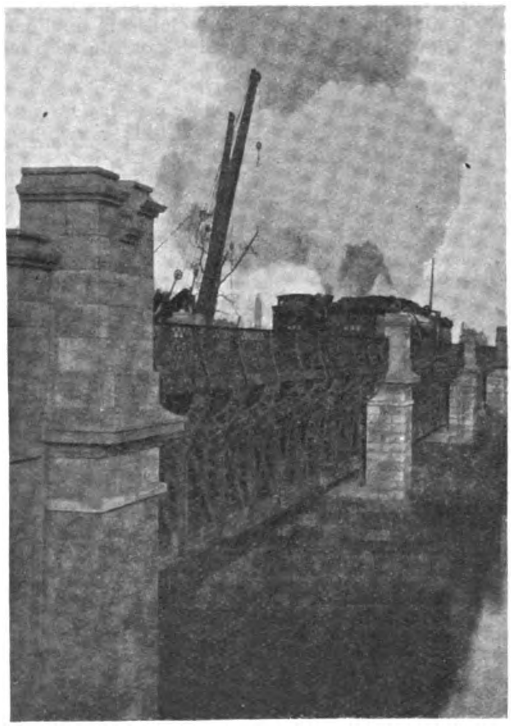
But between the lens L and the aperture H is placed a special form of galvanometer. Between the poles of a powerful electro-magnet (Fig. 2) are suspended two delicate silver wires, in a plane perpendicular to that shown in the figure, to which a piece of magnesium foil F is attached in their centre. The telephonic current is made to pass through this, and according to its strength so F is shifted more or less towards one side of the magnet. Now the galvanometer is so arranged that F just intercepts the light from the lamp N, and this casts a deep shadow over the hole H. But when a "strong" current is received from the transmitter, F shifts aside, and allows the pencil of light to meet the revolving sensitive film. The foil F therefore is constantly shifting more or less in response to the current strengths received from the sending instrument, and the sensitive film more or less exposed in consequence. On developing the film we get a negative picture of that transmitted, and thus the telegraphing of a photograph is accomplished.

The Latest in Engineering.

A Steamer's Record Voyage.—It is claimed for the German cargo steamer the *Schwaben*, which belongs to the North German Lloyd, that she has made a record on her trip from Antwerp to Freemantle. The voyage lasted forty days; no coaling took place *en route*, and the engines were not stopped once during the voyage, a distance of 10,966 nautical miles; the aggregate number of revolutions of the engines was 3,999,840. Moreover, the stokers were not particularly skilled, the steamer having left Antwerp during the strike, and the weather in the Indian Ocean was unfavourable. Had it not been for these adverse circumstances, the captain thinks the trip could have been done in two days' less time.

Baldwin Locomotive Works.—Interesting statistics recently published give some idea of the size of the Baldwin Locomotive Works of Philadelphia. Up to 1900 the greatest number of locomotives built in a year was 1,000. In 1906 the number turned out reached the figure of 2,650; 19,000 men are employed, and the acreage of floor space of the buildings is 63·2, while the total acreage of works is just over 200. Steam and oil engines of an aggregate horse-power of 16,988 are employed, and 1,115 electric motors of an aggregate horse-power of 14,200. The consumption of iron and other materials (excluding the coal consumption of the works) reaches a total of 6,460 tons per week.

Success of the Marine Gyroscope. — The device invented by Herr Schlick to minimise the rolling of ships in a seaway has been improved considerably, and Messrs. Swan, Hunter & Wigham-Richardson, of Wallsend-on-Tyne, have just completed some most successful trials on an old first-class torpedo boat. She is 116 ft. long, has a displacement of 56·2 tons, and is fitted with a gyroscope weighing just over a ton. This is driven at a speed of 1,600 revolutions per minute by a steam turbine. The vessel was recently taken out into the North Sea in very rough weather and laid broadside-on to waves about 8 ft. high by 100 ft. long. Ordinarily the boat rolled, under these conditions, through an angle of about 30 degs.; but when the gyroscope was put in action the rolling was almost extinguished, and the deck remained practically horizontal. The above firm have prepared the designs of an apparatus suitable for ships of 2,000 tons displacement.



SHOWING THE METHOD OF TESTING A RAILWAY BRIDGE.

Testing a Railway Bridge.

We are indebted to Mr. James Littlejohn, of Stirling, for the interesting photograph reproduced herewith showing the testing of the new Caledonian Railway bridge over the Forth, at Stirling, on Sunday, November 17th. Five 8-coupled engines (total weight 400 tons) were used, the test lasting 1½ hours.

A LARGE CONTRACT.—Messrs. Bruce, Peebles and Co., of Edinburgh, have obtained the contract for the electrification of the Moscow tramways at a cost of £2,000,000.

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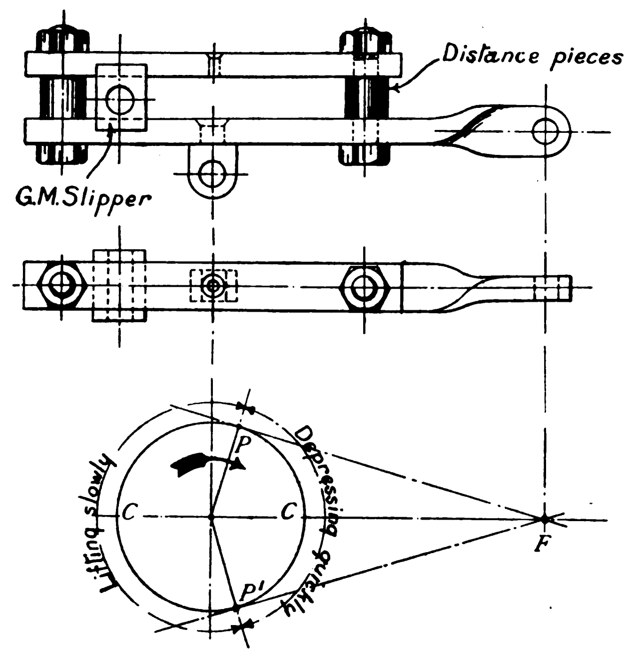
A Small Windmill and Pump.

By G. S. and C. B.

(*Continued from page* 548.)

WE spent some time in devising the best means of transmitting the motion of crank-pin to the pump below, with the result that the arrangement shown was the best we could arrive at. It will be seen that a connecting-rod attached directly to the crank-pin would give the required motion, but, owing to the angular positions it would take up, the connecting-rod would not pass down through the hollow central pivot. We therefore introduced the form of slide-crank shown in the arrangement Fig. 3, and also in detail at Fig. 7. Though primarily adopted because of its ease of construction, it should be noted that this gear provides an advantage in that it gives a quick return motion. This motion is an interesting mechanical movement, and is frequently employed on shaping machines. As the principle on which its peculiar motion depends may not at first sight be apparent to all model engineers, we accordingly attempt to explain it by the diagram in Fig. 7. In this diagram the circle C C represents the path of crank-pin ; F is the fulcrum about which the lever, or, as we have called it, slide-crank, oscillates ; P P1 represent the positions of crank-pin when slide-crank has been raised to its highest and depressed to its lowest positions respectively. These points P P1 are found on the diagram by drawing tangents to the crank-pin circle from the fulcrum F. It will be seen that the points are not exactly opposite to one another on the crank-pin circle, but are closer together on the fulcrum side by an amount depending on the distance of F from centre of circle. Consequently, supposing the crank-pin to be revolving at a uniform rate, a longer time will be taken in travelling from P1 to P in direction of arrow than from P to P1, because of the unequal lengths of the two paths ; hence the slide-crank will be depressed faster than it is raised. The nett result of its application to our windmill should be that the wheel may be run at a greater number of revolutions per minute, without the pump falling off in efficiency due to the bucket rising faster than the water can follow it, the slow motion, of course, being during the lifting stroke.



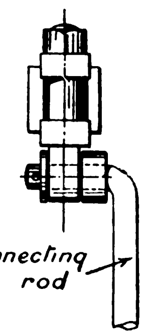


Fig. 7.—Slide-crank. (*Half full size.*)

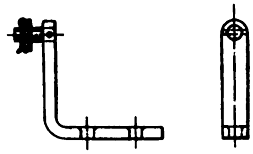


Fig. 8.—Bracket for Supporting Slide-crank. (*Quarter full size.*)

The slide-crank is very simply constructed from ¼-in. by ½-in. black wrought-iron bar, to be obtained from an ironmonger's for a few pence. Two pieces are cut off, the top piece being about 4 ins. long and the bottom about 5¾ ins. long, the latter piece being twisted as shown in detail, Fig. 7, through 90 degs., at a distance of about 1¼ ins. from one end. We found no difficulty in twisting the iron when heated to redness, one end being held in the vice whilst the other was twisted by means of a cycle spanner. A ¼-in. diameter hole should be drilled at end of lower bar for the fulcrum. Two holes for ¼-in. diameter bolts are drilled through both bars at 3¼-in. centres, distance pieces of 5-16ths-in. bore tube being fitted over bolts between bars to give the required clearance for gun-metal slipper. This slipper was filed up to shape from a piece of scrap, and drilled with a ¼-in. diameter hole for crank-pin. In a central position in lower bar a brass eye-piece is fitted, being drilled to receive the ¼-in. diameter iron connecting-rod end. A ⅛-in. diameter oil hole, drilled in centre of top bar, completes this part of the gear. It will be observed that a zinc-plate hood covers the upper bracket, and thus prevents the oil bath from being flooded by rain-water. Fig. 8 shows the bracket for supporting slide-crank. This is made from similar material to that of crank, a piece about 5 ins. long being bent as shown, two ¼-in. coach bolts securing it to the horizontal member of bracket. The fulcrum about which the slide-crank oscillates, is of ¼-in. diameter steel rod driven into this bracket and there secured. A small split pin and washer keep crank in position on its fulcrum. The ¼-in. diameter iron connecting-rod end previously mentioned is about 15 ins. long,

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and is bent sharply at one end for insertion into eye in lower bar of slide-crank, where it is retained by the split pin shown. The other end of rod is forged flat for a distance of about 4½ ins. in order that small fastenings may be passed through it to make an attachment with bamboo connecting-rod.

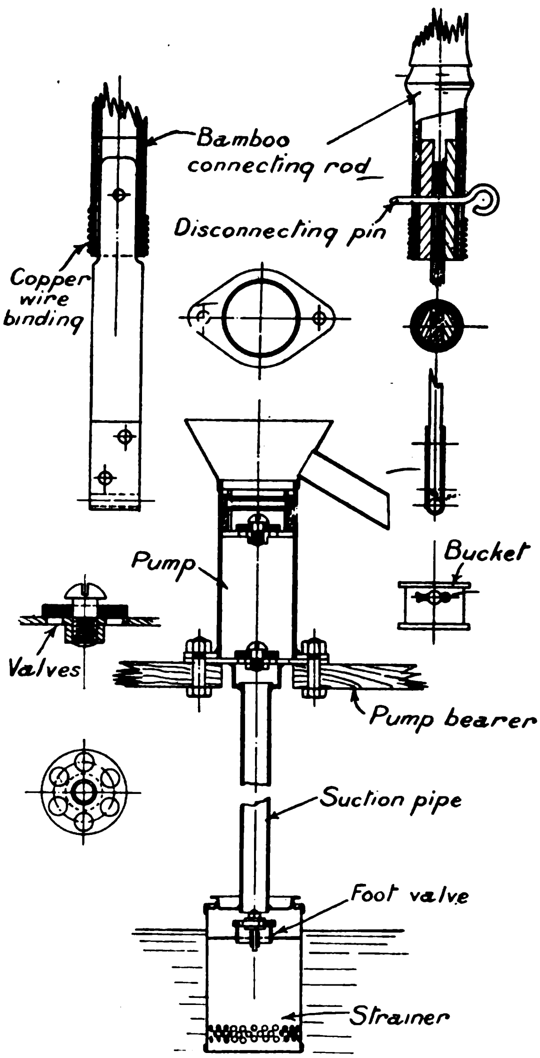

Fig. 9.—Details of Pump and Connecting-rod for Small Windmill.

This bamboo connecting-rod is about 1 in. diameter, and as straight as possible. It is provided with means of disconnection from the pump at lower end. A disconnecting pin for this purpose is shown in detail at Fig. 9. This pin on being withdrawn, allows the bamboo rod to rise clear of the pump-rod when the pump bucket is at bottom of stroke. Dealing next with the construction of tower, the general arrangement will be clearly seen from the photograph, and drawings, Fig. 1. It is of tripod form, having for its main members three lengths of 2-in. by 2-in. deal. These should be planed, otherwise some trouble may be had from splinters when mounting tower to attend to gear. The apex of tower was as closely built as possible, whilst the size at base was arranged in conjunction with mill sails, etc., sufficient clearance being allowed between the sails and main members of tower. Two sides are cross-braced, whilst the remaining side is built in the form of a ladderway, this giving means of access to the gear; 2-in. by ¾-in. slate battens were used for cross-braces and ladder treads. The tower is securely "anchored" at base and all woodwork buried under ground well tarred. Wire guys attached to main members at as high a position as will clear sails add considerably to the rigidity of the tower. All woodwork above ground, together with mill sails, has two coats of paint.

Mounted on the top of tower and securely attached to it by means of bracket pieces, is the platform shown in Fig. 3. This was made from two pieces of hardwood screwed together to give the required thickness, as it was not found convenient to get a piece as thick as was wanted. These are cut to shape shown in plan view, being fitted with rollers on which the revolving bracket rests. The rollers, six in number, are of cast iron, and can be purchased at an ironmonger's for 1½d. each; they should run freely on long brass screws driven into the platform, the rims of wheels being arranged to stand about ⅛ in. from the upper side of platform.

Through the centre of this platform is drilled a hole to receive the hollow spindle or trunnion about which the revolving frame swivels. This spindle is cut from a piece of 1-in. gas barrel, and is screwed for a short distance at each end. It is driven tightly into hole in wood, and there secured by the flange on lower end. At upper end is fitted a keep nut screwed after windmill and bracket are in place on tower, the duty of this nut being to prevent any tendency of the bracket to ride up spindle.

Fig. 9 shows a detail of the pump, which is as simply constructed as possible without using castings, together with the strainer box, and also the method of connecting bamboo rod to pump-rod. The pump barrel is a piece of 1½-in. bore brass tube, about 3¾ ins. long and having a true and smooth bore. To the upper end is soldered the funnel containing outlet pipe. This funnel was made from a piece of thin sheet copper, the outlet branch being a brass tube soldered into it. At lower end of pump barrel is soldered a gland-shaped flange, which is connected by two ¼-in. bolts to one of similar shape containing the suction valve. The construction of this valve, together with the valve in pump bucket, is shown to a larger scale in same figure. It will be seen from this detail that the seat for valve is drilled with six 3-16ths-in. diameter holes, these holes being covered by a ⅛ in. thick rubber valve. These valves can be obtained at an ironmonger's, being sold as tap washers. The brass screw shown screwed into plate and thickening piece is of sufficient length to allow valve to lift about ⅛ in., the hole in valve being slightly larger than diameter of screw to allow valve to rise freely. On the underside of flange carrying suction-valve is soldered a brass suction pipe ⅜ in. diameter, as shown in drawing, this pipe at other end being soldered to the top cover of strainer box.

The pump bucket, two views of which are shown, is made from a piece of brass tube, 1½ ins. outside diameter and 1 in. long for the body, having soldered

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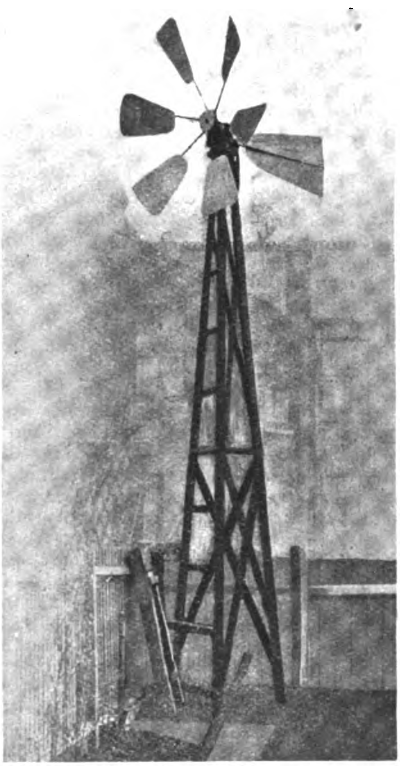
to its lower extremity a brass disc carrying a valve of similar construction to the suction valve. This disc is of slightly less diameter than bore of pump barrel, and is soldered concentrically with the 1¼-in. diameter tube. To the top end of this tube is soldered an annular ring of same diameter as lower disc, the space between the two protruding edges of disc and ring being wound with packing. A ¼-in. diameter brass pin is fitted through bracket, as shown, to take the pump-rod end, this pin being retained in place by a split pin. The end of connecting-rod joining this pin is constructed of a piece



General View of Small Windmill, erected to Drive Pump in a Garden.

of hardwood, about ⅞ in. by ¼ in. thick. A strap of brass plate is bent round the lower end, leaving a space ¼ in. diameter to take the pin. The upper end of this rod is drilled for connection to the bamboo. It will thus be seen that the connecting-rod is in three sections: an iron piece joining slide-crank, a long bamboo rod reaching to within about 12 ins. of pump, and the connection between bamboo and pump just described.

A strainer box is fitted to lower end of suction pipe to prevent, as far as possible, any dirt being drawn into pump, and so give trouble with valves. An air-tight tin canister of the type used for holding syrup was employed for this strainer, a diaphragm plate being soldered across the can about ⅞ in. from the top cover. This diaphragm carries a non-return valve which keeps the suction pipe always full of water, and so ensures the pump re-starting should it have been at rest for some time. This valve is an indiarubber washer, similar to those used for pump valves, and seats itself upon the edge of a piece of brass tube soldered into diaphragm plate, the plate inside tube being perforated with six 3-16ths-in. diameter holes. It will be seen from the sketch that the rubber valve has a small diameter brass rod passing through its middle, where it is attached by a nut and washers, the lower end of valve tail being guided in diaphragm plate, whilst the lift of valve is restricted by the suction pipe protruding through top cover of strainer. The canister below diaphragm is perforated with a sufficient number of small holes to give some three times the area of suction pipe. The construction of certain parts, notably the pump, is somewhat difficult to explain with a reasonable amount of written description, but the drawings, taken in conjunction with the notes, will, we trust, make things quite clear. The total cost of this mill did not exceed 10s., and has been running intermittently for several months.

How to Make an Inter-Communication Telephone.

By Fred Rudolph.

(*Continued from page* 542.)

The Microphone, or Transmitter.

THIS piece of apparatus is shown in Fig. 15. Very special care must be exercised in the making of the microphone and the instructions detailed carefully followed. The microphone is composed of parts B to G; A shows a general arrangement of the assembled parts. B is a mouthpiece preferably made from sheet brass, finished in lacquer or nickel-plated, and fixed to woodwork by 4-in. by ⅜-in. No. 3 3-in. round-headed brass screws. C is a brass connection ring permanently fixed to back of wood case by C.S. wood screws. This ring furnishes the necessary connection to the carbon diaphragm. A connecting wire is attached to the brass ring. The spring shown in D is made from German silver or spring brass, shaped as drawing, and secured by wood screws to the woodwork. The spring serves a double purpose, mechanically holding the carbon cup in its position, and also as a connection strap to the carbon cup. It should be noted that this spring should have sufficient tension to safely hold the brass cover well up to the cardboard ring. The carbon cup F is clamped to the brass cover G by a special screw E and a back nut and washer. The brass case G is turned and drilled to the dimensions given. The carbon cup is then fixed by means of its screw and washer. Over the cup is fixed a small cardboard ring, to which is glued a ring of flannel or felt. A cardboard washer exactly the same dimensions as C, except that it has no screw holes, is glued or seccotined to the brass cover G. This is essential as an insulator between diaphragm and cup. The carbon cup is about three parts filled with carbon granules, and the carbon diaphragm is laid on gently to get the correct adjustment. The small rings on carbon cup can be seccotined in place when it is found the small felt ring touches the

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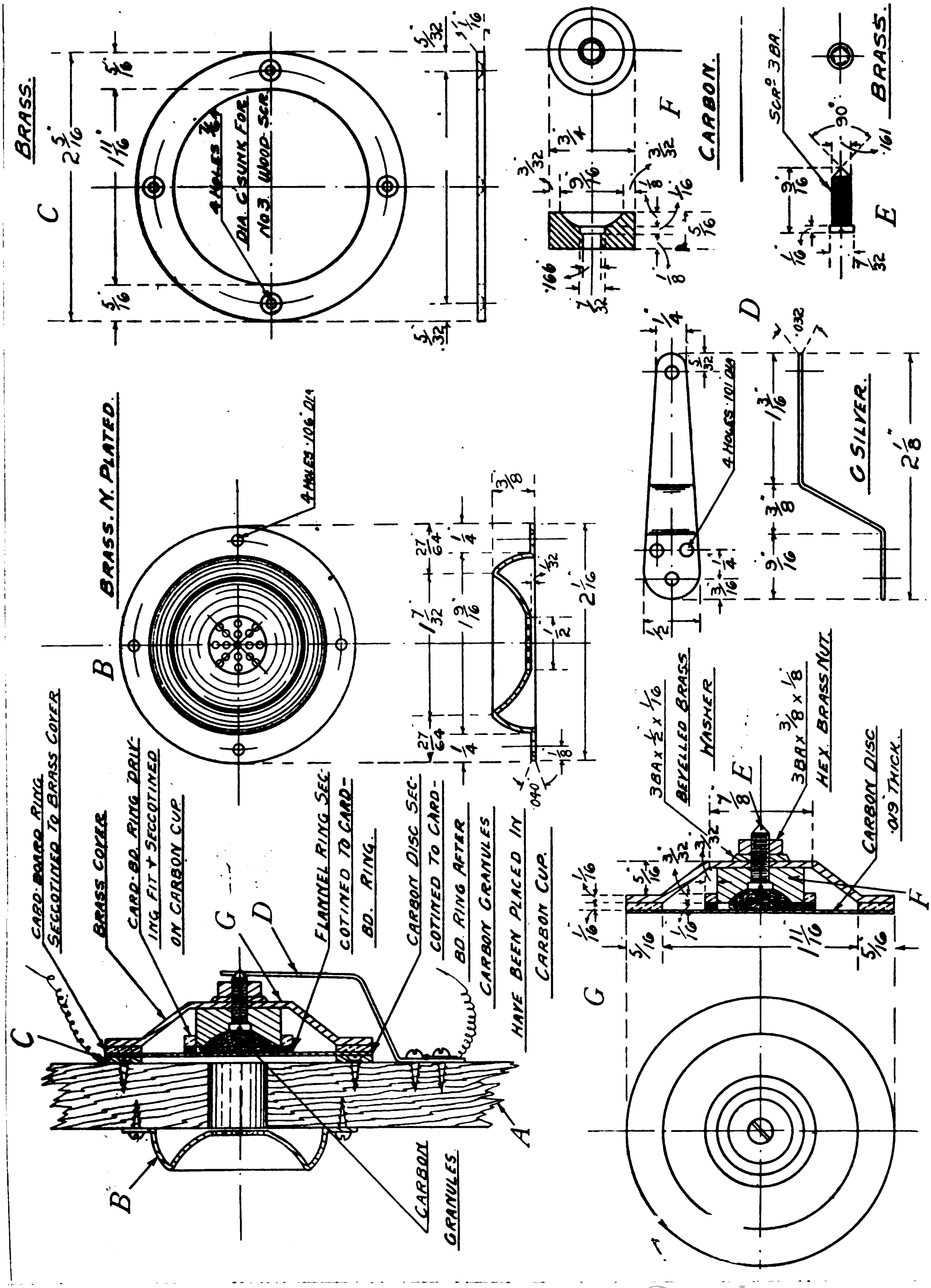


Fig. 15.—Details of Microphone or Transmitter.

underside of diaphragm. The carbon granules can be made by crushing a Leclanché carbon or a bit of arc lamp carbon and sifting the same to get the granules fairly uniform in size. The carbon diaphragm can be bought from any good electrical firm, and will cost about 2d., the Western Electric Company, Woolwich, or the General Electric Company, London. A substitute can be made, however, by procuring a thin disc of pine wood, or even suitable cardboard, and fixing in the centre a thin disc of carbon sufficiently large to cover the small felt ring on the carbon cup. For the connection a thin copper wire should be fixed to the carbon disc and the seating ring. The best method of fixing the connecting wire on the disc of carbon is by copper plating the disc on one side in an ordinary copper sulphate bath. It will be easy to solder on the copper face. The connections and general arrangement are as shown in A.

(*To be concluded.*)

Locomotive Notes.

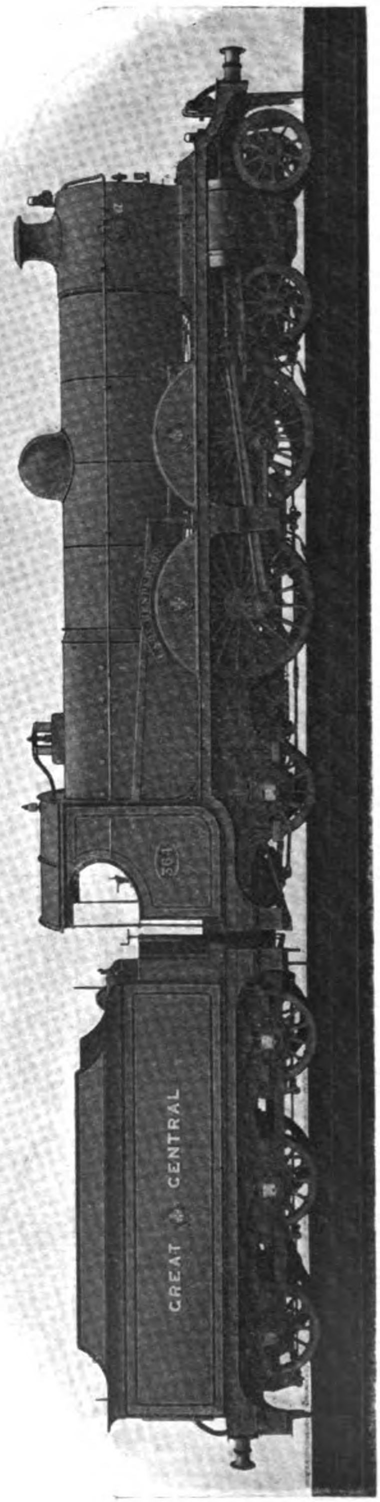
By Chas. S. Lake, A.M.I.Mech.E.

Good Locomotive Work on the Great Central Railway.

The writer recently travelled by Great Central route between London and Manchester and return, and on both trips the train was hauled by one of the latest three-cylinder "Atlantic" type compounds, to wit, No. 364, "Lady Henderson." On the outward journey the train selected was the one leaving Marylebone Station at 3.20 p.m., which is booked to run to Sheffield without a stop, and is known as the "Sheffield Special." The non-stop run of 164¾ miles is scheduled to be made in the level three hours, which represents an average speed of practically 55 miles per hour. When the character of the line on the Metropolitan Railway section between Harrow and Quainton Road, and the stiff grades on the Sheffield-Manchester length have been taken into account, the through run of 206 miles in four hours must be considered an exceedingly good one. Carriages are slipped at Leicester, which station should be passed through at 5.10 p.m. or 110 minutes for 103 miles—a very smart piece of work.

On the occasion noted the train was brought to a standstill in Rugby station for the purpose of taking water for the engine, the supply usually picked up from the Charwelton troughs not being available on this particular evening. Some three minutes were lost in this way, but the whole was made up before passing through Leicester at great speed at substantially the scheduled time. From this point onward good progress was made, with the result that the arrival at Sheffield was well in accordance with the time-table, the station clocks standing at 6.20 p.m. as the train stopped at the platform.

After a stay of six minutes, the journey northwards was resumed, 54 minutes being available in which to cover the 41 odd miles—much of it very difficult going—between Sheffield and Manchester. In the result, the latter place was reached only two



Three-cylinder Compound "Atlantic" Type Locomotive: Great Central Railway.

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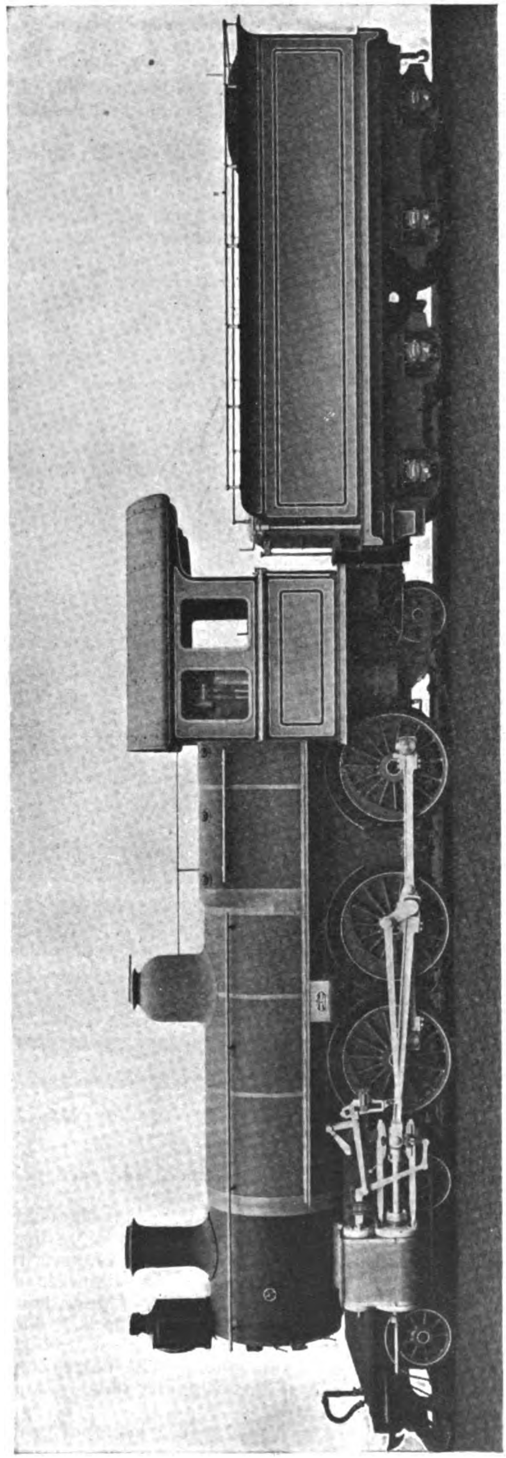
minutes late, and this trivial departure from the ruling of the time-table would have been avoided, but for delay caused in the neighbourhood of Ardwick, just outside London Road station, apparently by the lateness of a local passenger train. The net running time from London, after deducting the Rugby and Sheffield stops, amounted to 231 minutes and, as the total distance by the Great Central Railway is 206 miles, as before stated, the average speed, deducting stops, would be rather over 53½ miles per hour. The load was seven bogie coaches to Leicester and five from there to Sheffield, a sixth vehicle being added at the latter place for the run to Manchester. The return trip was made by the train leaving Manchester at 2.15 p.m., which is booked to run to London in 4 hours 20 minutes, with stops at Guidebridge, Penistone, Sheffield, Nottingham, and Leicester. Although rather disappointing as far as Leicester, which place was reached eight minutes late, the running onwards from there to Marylebone, and especially to the junction with the Metropolitan Railway at Quainton Road, was particularly fine and in places brilliant. Five of the lost eight minutes were made up on this portion of the journey, the 59 odd miles being covered in 61 minutes. Subsequent running on the down grades between Amersham and Harrow was exceedingly smart, but delay in the vicinity of Neasden prevented an exactly punctual arrival after everything seeming favourable to that end. As it happened, the arrival at Marylebone took place at 6.39 p.m.—four minutes late.

The writer on this occasion, as on many previous ones, was courteously provided with travelling facilities by the Great Central Railway authorities. An illustration of the "Lady Henderson" engine appears on the opposite page.

"Pacific" Type Locomotive, Western Australian Government Railway.

The locomotive shown in the second illustration is one of several built in this country for service on the Western Australian Government Railway. As seen, it is of the 4—6—2 (sometimes called the "Pacific" type), with outside cylinders and Walschaerts' valve gear. For a narrow gauge engine —it is designed for the 3-ft. 6-in. gauge—it must be considered a powerful type, and the general arrangement and details of construction are of the most modern description. The boiler is of the Belpaire pattern, and the safety valves are mounted over the top of the steam dome, following the practice adopted on the South-Western and a few other railways in this country. The cylinders drive the middle pair of coupled wheels, and the slide-valves, which are of the piston type, work above the cylinders. A commodious cab is fitted, and the general equipment includes the automatic vacuum brake, sight-feed lubricators, and other up-to-date fitments. In the writer's opinion the design, taken generally, presents a well-proportioned and workmanlike appearance, and every provision appears to have been made to meet the requirements of heavy traffic of a "mixed" character, for which the engines are specially intended. The tender is carried upon two four-wheeled bogies with outside frames, and it possesses, for the narrow gauge, a large coal and water carrying capacity.

The engine, which, with several others of identical design, was built by the Vulcan Foundry, Ltd., of



"Pacific" Type Locomotive: Western Australian Government Railway.

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Newton-le-Willows, has the dimensions given below :—

Cylinders : Diameter, 17 ins. ; stroke, 23 ins.
Wheels Diameter : Coupled, 4 ft. 6 ins. ; bogie, 2 ft. 6 ins. ; truck, 2 ft. 6 ins.
Wheelbase : Coupled, 11 ft. ; total engine, 27 ft. 2 ins. ; total engine and tender, 46 ft. 5½ ins.
Heating surface : Firebox, 118 sq. ft. ; tubes, 1,300 sq. ft. : total, 1,418 sq. ft.
Grate area, 19·25 sq. ft.
Tender : Tank capacity, 2,200 gallons ; fuel capacity, 4½ tons of coal.
Weights in working order : Engine, 51¼ tons ; tender, 27¾ tons : total, 79 tons.
Gauge of railway, 3 ft. 6 ins.

British Built Tank Locomotives for Argentina.

There are at present under construction at the works of Messrs. Nasmyth Wilson & Co., Ltd., at Patricroft, near Manchester, several heavy tank locomotives for the Buenos Ayres Great Southern Railway. These have outside, simple cylinders, and the 2—6—2 wheel arrangement. The valve gear is of the Stephenson link-motion type. The leading and trailing pairs of wheels are of equal diameter, viz., 3 ft. 2 ins. on tread, and each pair is arranged as a two-wheeled truck.

The six-coupled wheels are 4 ft. 4 ins. diameter, and distributed over a wheelbase of 12 ft. 10 ins., while the total wheelbase of the engine amounts to 27 ft. 9 ins. The cylinders have a diameter of 17 ins. and a piston stroke of 24 ins. ; they drive the intermediate pair of coupled wheels. The boiler is fitted with the Belpaire type of firebox, and has an extension smokebox. The barrel contains 213 tubes, each 1⅞ ins. diameter outside, and pitched at 2½ ins. centres.

The boiler centre is placed 7 ft. 4 ins. above rail level, and the height from rail to top of chimney is 12 ft. 10 ins The heating surface totals 1,245 sq. ft., of which 1,146 sq. ft. is contained in the tubes, and the remainder in the firebox. A grate area of 20·3 sq. ft. is provided. The boiler is pressed for 180 lbs. per sq. in. The tractive force exerted by the engine at 90 per cent. boiler pressure is 21,608 lbs. With 1,200 gallons of water in the tanks and its 87 cub. ft. of fuel space full, the engine weighs 61½ tons. Of this weight, 45¾ tons is available for adhesion.

Some Exhibits at the N.Z. International Exposition, Christchurch.

By "A Londoner Abroad."

(*Continued from page* 546.)

ANOTHER noteworthy exhibit was also by an Aucklander, who, when written to, at once confessed himself a confirmed admirer of The Model Engineer. This was Mr. Jas. J. Furlong, whose excellent model electric locomotive is illustrated by the two photographs (Figs. 6 and 7) and by several detail sketches and drawings.

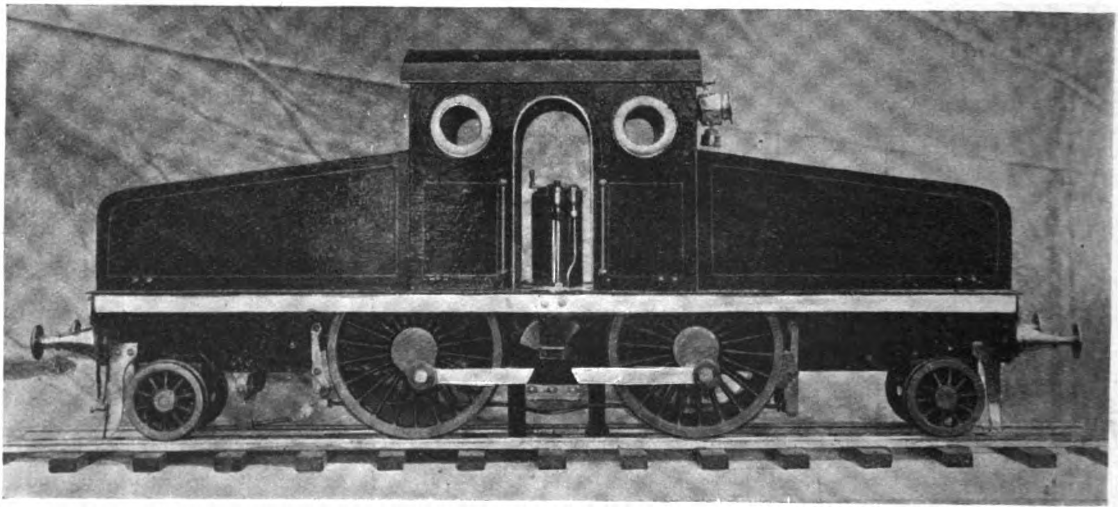

Fig. 6.—Side View of Mr. Furlong's Model Electric Locomotive.

Mr. Furlong gives the following description of his model electric locomotive, which was awarded a bronze medal at the New Zealand International Exhibition. He says :—

The design was evolved in view of the projected electrification of our (Auckland) suburban railways, and the model is built to a scale of 1 in. to the foot of a possible prototype, for use in high-speed passenger services on such electrified lines.

It is of the 2—4—2 type, with leading and trailing Bissel pony trucks, and is fitted with automatic electric brakes. At first I would have nothing but air-brakes, but these were abandoned after a full trial. The brakes are kept on by a powerful spring held in a cylinder (the discarded air-cylinder, in fact), and pushes out a plunger to which is attached a brake lever. This cylinder is attached to the main frame; on the opposite frame is fixed a powerful solenoid, which is in series with the motor, consequently when the current is turned on the brakes come off, and conversely. I can strongly recommend this system, as being easy to construct and very efficient.

The model is practically a first attempt, and was made under pressure in seven months.

The brakes are also operated on by a hand-wheel in the cab. This is necessary in order to be able to move the model when the power is off.

The superstructure is built of No. 18 galvanised steel, and is soldered throughout without use of L brass.

The windows are effective and very simple to make. They are made from the largest size sail-makers' eyelets. These are mounted on a wood mandrel held in a chuck, and about ¼ in. cut up, leaving just enough to protrude through hole cut in cab side and be riveted over. The end windows and centres are 1⅜ ins. from cab side, and 5¼ ins. from footplate.

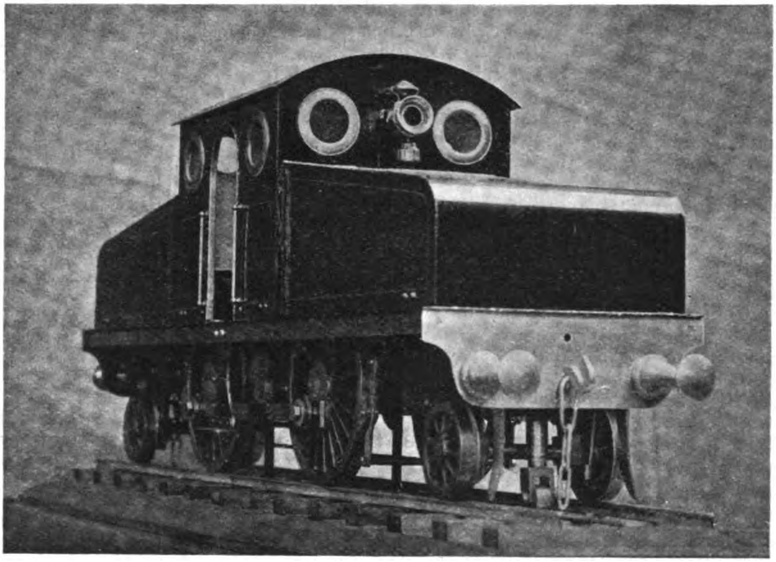

FIG. 7.—ANOTHER VIEW OF MR. FURLONG'S MODEL ELECTRIC LOCOMOTIVE.

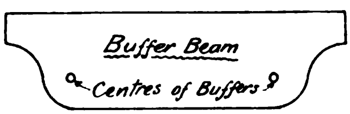

FIG. 12.—BUFFER BEAM PLATE (*Scale: One-fourth full size.*)

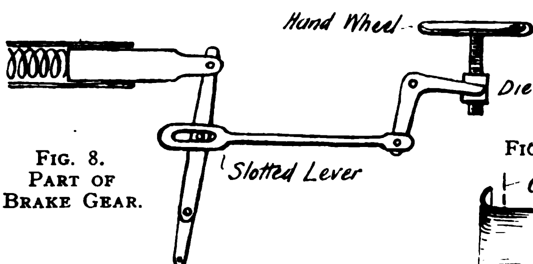

FIG. 8. PART OF BRAKE GEAR.

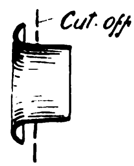

FIG. 9.

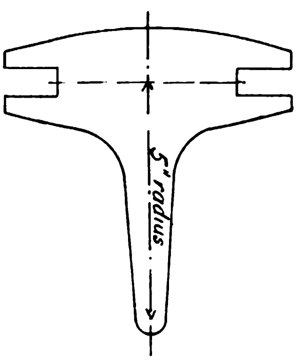

FIG. 13.—STEEL PLATE FOR BISSEL PONY TRUCK.

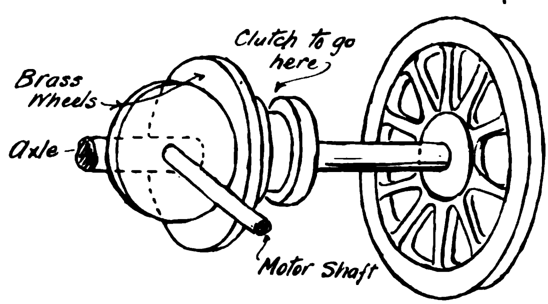

FIG. 10.—METHOD OF DRIVING FROM MOTOR AT RIGHT ANGLES TO AXLE.

It was originally intended to drive the mode by a slow speed motor placed between and affixed to the frames, the shaft protruding on each side carrying a follower crank, to which is attached a connecting-rod fitted to the driving wheel. The wheels are coupled with outside rods. However, it will be seen that this arrangement may look well in a stationary model, but would be very inefficient in a moving one.

When I have a suitable railway laid down, I intend to drive it by friction gearing. I fancy the following method is one that will make an efficient drive. On one of the driving axles will be placed a brass wheel, 3 ins. diameter, shod with rubber; this is to slide along the shaft by means of a key, this movement being obtained by means of a clutch.

The motor is arranged with its shaft parallel to the frames. At the end of shaft is a small brass disc, moving on a key and actuated by a clutch.

By such contrivances as these a variety of speeds and powers could be obtained, with the fullest efficiency of the motor, because the motor would be travelling at its regular speed, practically, at whatever speed the locomotive was travelling.

The use of a clutch on the motor shaft is to enable the driving wheel to move freely along the axle when required to alter the speed. It will be seen that a variety of speeds can be obtained, according to the diameters of the two discs.

Following is a list of dimensions of this model, which is shown in side elevation in Fig. 11 to a scale of 3 ins. to a foot.

MODEL ELECTRIC LOCOMOTIVE.

Frames (mild steel)—Length, 25½ ins.; thickness, 3-32nds in.; depth, 2¼ ins.
Buffer beams, Fig. 12 (mild steel)—Length, 7 ins.; thickness, ⅛ in.; depth, 2 ins.
Wheels (cast iron)—Diameter of driving, 5 ins.; diameter of truck, 2 3-16ths ins.
Distance of centre of truck wheels from buffer beams, 1¾ ins.; distance of centre of truck wheels to centre of driving wheels, 7 ins.; distance of driving wheel centres, 8 ins.
Height of footplate from rails, 4¼ ins.; height of top of cab from rails, 11⅜ ins.
Length of cab, 8 ins.; width of cab, 6⅝ ins.; width of motor covers, 8¾ ins.
Buffers (gun-metal)—Length, 1⅛ ins.; diameter, 1 in.; diameter of head, 1 in.
Windows (brass)—Exterior diameter, 1¾ ins.; interior diameter, 1½ ins.
Diameter of driving axles (mild steel), 9-16ths in.; diameter of trust axles (mild steel), ⅜ in.

Fig. 13 shows the shape of a piece of 3-32nds-in. mild steel plate, which, when bent up, forms the Bissel pony truck. It is to a scale of 3 ins. to a foot.

(*To be continued.*)

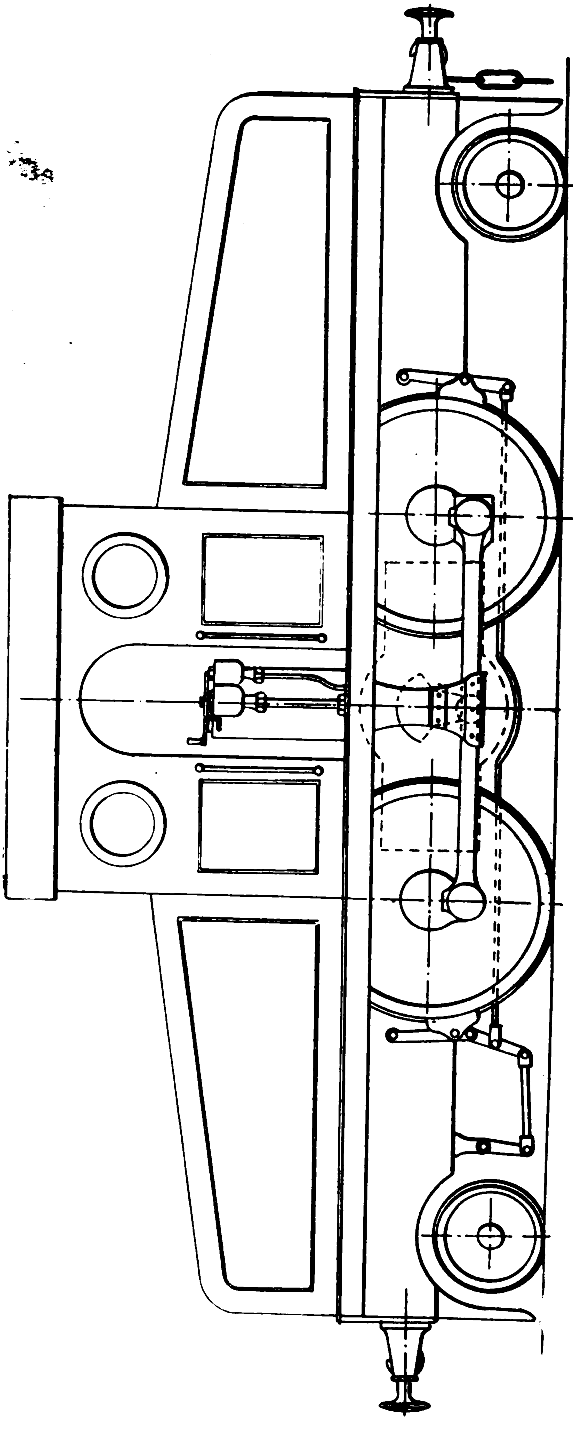

FIG. 11.—SIDE ELEVATION OF MODEL ELECTRIC LOCOMOTIVE. (*Scale: One-fourth full size.*)

IT is reported that Major Edgar Russel, of the American Army Signal Corps, has taken good photographs of Washington from a distance of 7,500 ft. by means of a telephoto camera designed for the use of war balloons.

DEMOLISHING A BRIDGE BY WATER PRESSURE.—An interesting mode of utilising the force of the tide was employed in taking down the three-span masonry bridge which spans the Zollkanal at Hamburg. Two powerful iron pontoons were moored and wedged beneath two of the spans at low tide, and as the tide rose the force was sufficient to lift the arches from their bearings and to cause the stonework to collapse.

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Cutting B.A. Screw Threads.

A CORRESPONDENT to the *A.S.E. Journal*, Mr. F. S. Button, in a recent issue, and in view of the widespread adoption of the British Association table of threads, gives to his readers the benefit of a method he has just perfected for obtaining the wheels for cutting same. He says:

In seeking information from any of the text-books now in use readers will find it impossible to obtain a simple method applicable to all lathes with differing leading screw pitches. This, it will now be seen, has been overcome by my plan, while another great advantage is that no more than two trains of wheels are necessary, whereas in most other systems three trains of wheels have frequently to be requisitioned.

It will also be seen that the system obtained by my method enables the turner to keep—during the cutting of all threads—three wheels constant. One wheel only has to be changed for each new screw to be cut. I am working a Brown and Sharpe tool lathe, and recently had orders to cut B.A. taps in sizes 0 to 12. The lathe is supplied with a metric leading screw of 4 mm. lead.

I spent some little time—regretfully stolen from more congenial studies—in attempting to obtain a satisfactory table of wheels for the metric leading screw, but with only partial success.

I then turned my attention to the English leading screw, and with the assistance of Greenwood's Handbook I evolved the following method:—

The English leading screw = 12 to the inch.

There are, as is well known, 25·4 mm. to the inch; remember also that the 0 B.A. screw has 25·4 threads per inch.

This gives $\frac{12}{25.4} = \frac{120}{254} \div 2 = \frac{60}{127}$, the necessary wheels.

Now attempt to get at a table of wheels which will enable you to cut the whole of the taps with the simplest table possible.

Let us first of all have in front of us the B.A. table:—

No. of Screw.	Pitch in mm.	Threads per inch.	Dia. Top.	Dia. Bottom.
0	1·	25·4	·236	·189
1	·9	28·2	·209	·166
2	·81	31·4	·185	·147
3	·73	34·8	·161	·127
4	·66	38·5	·142	·110
5	·59	43·	·126	·0984
6	·53	47·9	·110	·085
7	·48	52·9	·098	·076
8	·43	59·1	·087	·066
9	·39	65·1	·075	·0565
10	·35	72·6	·067	·0505
11	·31	81·9	·059	·04435
12	·28	90·7	·0512	·0378

This done we shall require in addition to our basis wheel of 127, wheels the teeth of which equal the mm. pitches given in above table. We shall then be able to get a table of wheels on the simplest and most accurate basis I have yet seen obtained.

We have already found that $\frac{60}{127}$ are the necessary wheels for cutting 0 B.A. screws.

Now remodel your table thus:—

$\frac{60}{100} \times \frac{100}{127}$, and you will find your ratio unaltered.

This I did, but I had not a 60 wheel; I, therefore, obtained the ratio of $\frac{60}{100} \div 20 = \frac{3}{5}$.

I then multiplied $\frac{3}{5} \times 21 = \frac{63}{105}$; which wheels I had; but when tried they would not gear, owing to lack of space on lathe quadrant.

I then found that $\frac{45}{75} \div 15$ gave the same ratio, viz., $\frac{3}{5}$, and these being obtainable the same were used. Now make sure you are right. $\frac{45}{75} \times \frac{100}{127}$ by cancelling equals $\frac{60}{127}$, the wheels necessary. Prove your wheels thus: $127 \div 60 = 2{\cdot}1166666$.

These figures, multiplied by 12, the pitch of leading screw = 25·3999992, or 25·4, as accurately as it is possible for it to be obtained.

Our table is now quite a simple matter, thus—

No. of Screw.	Wheels necessary.	Pitch obtained.
0	$\frac{45}{75} \times \frac{100}{127}$	25·3999992
1	$\frac{45}{75} \times \frac{90}{127}$	28·2192
2	$\frac{45}{75} \times \frac{81}{127}$	31·3572
3	$\frac{45}{75} \times \frac{73}{127}$	34·794
4	$\frac{45}{75} \times \frac{66}{127}$	38·484
5	$\frac{45}{75} \times \frac{59}{127}$	43·05084
6	$\frac{45}{75} \times \frac{53}{127}$	47·916
7	$\frac{45}{75} \times \frac{48}{127}$	52·91664
8	$\frac{45}{75} \times \frac{43}{127}$	59·06976
9	$\frac{45}{75} \times \frac{39}{127}$.	65·1256
10	$\frac{45}{75} \times \frac{35}{127}$	72·57132
11	$\frac{45}{75} \times \frac{31}{127}$	82·0644
12	$\frac{45}{75} \times \frac{28}{127}$	90·71324

Note that my claim for the alteration of one wheel only for each screw is here proved by this table, a great advantage being thus obtained, which all turners will appreciate.

We will now apply our method to other lathes. For leading screw of

10ths. per in. use wheel in 1st train whose ratio is $\frac{50}{100}$
8 ,, ,, ,, ,, $\frac{40}{100}$
6 ,, ,, ,, ,, $\frac{30}{100}$
5 ,, ,, ,, ,, $\frac{25}{100}$
4 ,, ,, ,, ,, $\frac{20}{100}$

For leading screws of 3 and 2 thd. per inch the ratio would be $\frac{15}{100}$ and $\frac{10}{100}$ respectively, but these small driving wheels are, I fear, not practicable.

The turner can now form his own table of wheels for all sizes by the simple alteration of first train of wheels, as here shown.

Make your table correspond exactly with the complete one I have given, with the exception of first train of wheels, in column headed "Wheels Necessary." Then complete table by filling in the wheels whose ratio corresponds to your lathe leading screw as shown above.

Now prove your wheels thus:—

If your lathe has a leading screw of 5 to the inch, and you have to cut 12 B.A., you will need the following wheels: $\frac{25}{100} \times \frac{28}{127}$, by cancelling, these figures $= \frac{7}{127}$. $127 \div 7 = 18{\cdot}1428$, which result being multiplied by 5 gives 90·7140 threads per inch.

If your lathe has a leading screw of 8 to the inch, and you want to cut 4 B.A., your wheels must be $\frac{40}{100} \times \frac{66}{127}$; this equals by cancelling $\frac{132}{635}$: $635 \div 132 = 4{\cdot}8106$. Now multiply by 8 and you get 38·4848 threads per inch.

If lathe has a leading screw of 4 to the inch and you have to cut 1 B.A. you will require the following wheels: $\frac{20}{100} \times \frac{90}{127}$. Cancel these and you get $\frac{18}{127}$: $127 \div 18 = 7{\cdot}05555$.

Now multiply these figures by 4 and you will find 28·222220 threads per inch will be cut.

Finally, remember that your screwing tool must be ground to 47½ degs., with top and bottom of thread radiused off to two-elevenths of the pitch.

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For very important work it will be necessary to have small radius tools for rounding the top of the thread, but for the majority of shop work a hard-wood chaser and emery powder may be quite successfully used.

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.]*

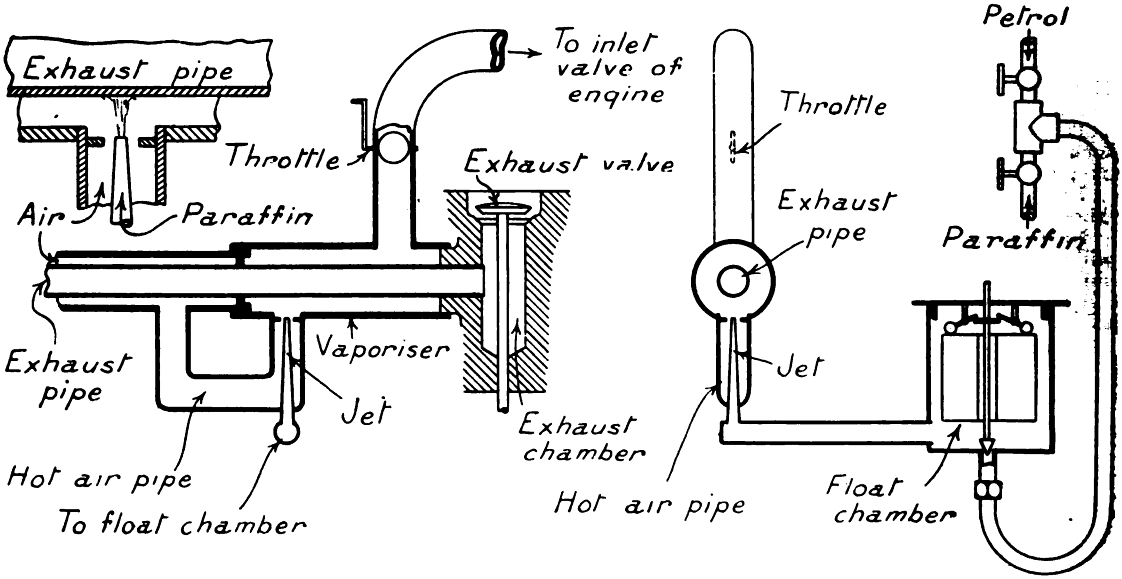
Oil Engine Troubles.

To the Editor of *The Model Engineer*.

Dear Sir,—I notice that many Model Engineer readers appear to experience a lot of trouble with their oil engines. About two years ago I described an arrangement of vaporiser and electric ignition. Mr. Frank Holmes' vaporiser is very similar to the one I described then, but he makes no provision for running on paraffin. I have now improved the arrangement then described, and the result is extremely satisfactory. It is fitted to a ½ h.-p. engine, 2½-in. by 5-in. cylinder, running at 480 revs. This engine is in regular use; it lights the house (about fifteen lights) and runs a 3½-in. lathe, circular saw, emery wheel, forge blower, etc. The consumption of paraffin is very low; 1 quart runs the engine at full power for about five hours, and we find that we use less oil for the electric light than when using oil lamps, although there are more lights and the engine does other work.

I enclose a rough sketch showing the arrangement. The vaporiser is, as before, a jacket around the exhaust pipe, but a jet is fitted so that the paraffin is sprayed against the heated pipe. A second jacket on the exhaust pipe supplies hot air to the jet. The size of the jet is found by experiment, also the size of the opening into the vaporiser. In my engine the jet is about the size of a blowlamp nipple, and the opening about 5-16ths. This creates a sharp suction on the jet, which sprays the paraffin well. The throttle in inlet pipe may be controlled by hand, or, preferably, by a centrifugal governor; it is very sensitive, far better than the "dot and carry one" business on a "hit-and-miss" governor. Petrol is used for about five minutes at starting.—Yours faithfully,

R. B. Verney.



Showing Arrangement of Improved Vaporiser for Oil Engine.

A Model Motor-car.

To the Editor of *The Model Engineer*.

Dear Sir,—I am sending you a photograph of a model motor-car made by myself. The car is 22½ ins. long over all, 11½ ins. high (when the hood is up), and 9½ ins. wide; total weight is just over 7 lbs. It is driven by an electric motor placed in the bonnet of the car, attached to some old clock wheels by a leather band to get the necessary gearing. The clock wheels are connected to the rear axle by a leather band, the rear wheels working independently of each other, to allow for turning the car round. I have arranged a three-speed gear by inserting different lengths of resistance wire in the circuit. The first speed is only used for starting the motor before the clutch is put in, the second and third for running the car only. I have also fitted a reversing arrangement, worked by a foot pedal placed by the steering wheel, which reverses the current in the motor; this required another catch to be fitted on the clutch wheel to clip in while going backwards. The motor

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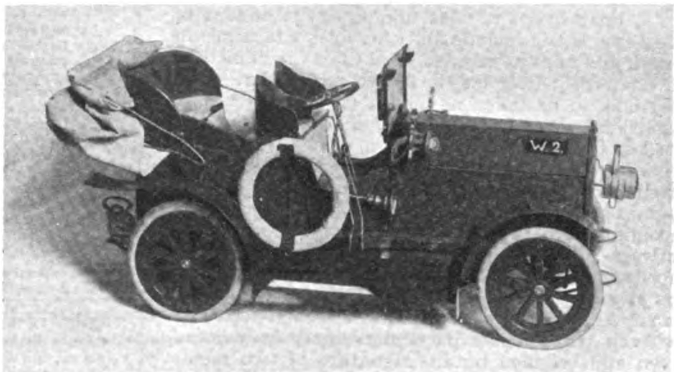
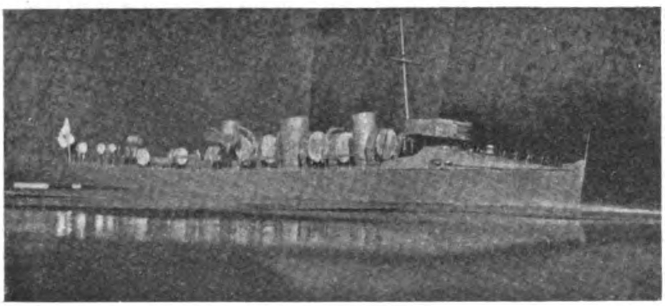
is started by turning the handle in front of car, which acts as a switch. The lamps are arranged—two in front by the wind-screen, a big bull's-eye one in the extreme front, and one at rear of car to shine on the number-plate. They are all 4-volt pocket lamp bulbs, and give a very good light. The two 4-volt accumulators for lighting the lamps and driving the motor are carried under the back seats. As will be seen from the photograph, I have made the car a four-seated one, the left-side front seat sliding out to obtain entrance to back seats. The body of car is made entirely of wood and tin. The wheels are made of wood cut out with a fretsaw, and are fitted with solid rubber tyres. The mudguards are made of tin, and the lamps of wood, afterwards gilded. The car is painted red and green. The glass wind-screen has a movable top, which can be set at any angle. The hood is made of French canvas. The box on the step is used for carrying spare parts, such as wire, leather straps, lamp bulbs, etc. Both the back wheels are fitted with brakes. The car now runs well, and will take a fairly steep gradient.—Yours truly,

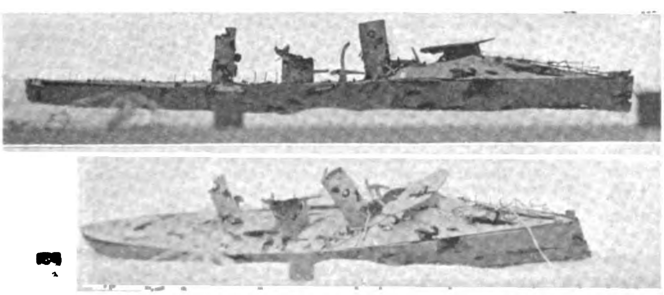
E. P. Wilkins.



Mr. E. P. Wilkins' Model Motor-car.



A Cardboard Model T.B.D.



Showing the Effect of Firing from a ·230 Saloon Pistol.

Realistic Effect of Miniature Naval Target Practice.

To the Editor of *The Model Engineer*.

Dear Sir,—I enclose three photographs of a rough cardboard half-model T.B.D. I made some time ago; scale, approximately ¼ in. to the foot, representing the 27-knot type. When finished with, she was fired at with a ·230 saloon pistol, and her appearance seemed so realistic that I photographed her, as shown herewith. Her manufacture was very rough, but I venture to think the resulting photographs convey a correct idea of the old class destroyer; and may be thought worthy of space in your Journal.—Yours truly,

J. F. Grant Dalton.

H.M.S. *Britannia*, Portsmouth.

The Society of Model Engineers.

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

London.

Future Meeting.—Monday, December 17th: Special Track and Model Night. Prizes will be awarded by popular vote to the three most interesting models or articles exhibited.—Full particulars and forms of application for membership may be obtained from the Secretary, Herbert G Riddle, 37, Minard Road, Hither Green, S.E.

Junior Institution of Engineers.—Saturday, December 14th, 3 p.m. A visit will be made to the Franco-British Exhibition Buildings, etc; the Exhibition Extension Works of the Central London Railway; and Central London Railway Power House at Shepherd's Bush.

Messrs. Harper and Brothers are issuing within the next few days "The Electricity Book for Boys" The principles of the subject are dealt with quite simply, and instructions are given for easy and inexpensive home experiments. They are well within the boy's capacity, and form interesting exercises for his ingenuity.

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The "M.E." Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows :—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given in all Class A boats which have an average speed of not less than four miles per hour, and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

A PILE-DRIVER at New Orleans is 108 ft. high, and is supposed to be the highest ever built.

Queries and Replies.

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

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

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

[18,400] **Model Locomotive Efficiency.** G. T. P. (Bruton) writes: I have made a scale model locomotive, ½-in. scale. I have a little difficulty in maintaining steam pressure to 40 lbs. per sq. in., this being the pressure at which I want same to work. The boiler is of the water-tube type, 9 ins. by 2 ins., with four ½-in. water-tubes. Cylinders (by Bassett-Lowke & Co.), 7-16ths in. by 1-in. stroke, slip eccentrics. I have fitted two tray burners with asbestos yarn wicks and methylated spirit fuel. With this I can maintain 30 lbs. per sq. in., but with the train I want it to draw it is necessary to get the higher pressure. How can I manage this; would a 6-in. burner be more efficient? I have a good draught. The outer shell is 2½ ins. diameter, and flames draw up well; when locomotive is running, I can at times see them reach as far as the smokebox door. I also notice when locomotive is standing that I can light the fumes which are emitted from funnel. This seems to point to imperfect combustion.

In reply to your query, the engine should maintain at least 50 or 60 lbs. per sq. in., but possibly you have not packed the cylinders sufficiently tight. On piston packing much of the success of a model locomotive depends. In a small engine it should be difficult to move the wheels round when the engine is first packed. There will, of course, be imperfect combustion when the engine is standing with steam off and there is no blower. This will not affect the efficiency of the boiler under load. With regard to the draught induced by the blast, the latter may be too fierce, and, when the engine is running, may be bringing too much cold air into the firebox. We do not like tray burners—where they can be avoided. A large number of small wicks is much better. But see that the engine is working efficiently before you blame the boiler.

[18,460] **Selenium.** F. R. (Glasgow) writes: Would you be kind enough to inform me on the following—Having purchased a piece of selenium from a firm in Glasgow, on passing a current of 3 volts through it in daylight, there is no deflection of the needle of a galvanometer. I enclose a sample of the selenium I used. Please say if it really is selenium. How could I prepare a piece of selenium to pass about 24 volts, and how many volts will I require to use when exposing it to a small ray of light? Is selenium only made in sticks, or can it be obtained in thin sheets?

The sample which you send is selenium. We suppose that by saying you passed a current of 3 volts through it, you mean that you applied a pressure of 3 volts. If your galvanometer needle did not read, you were passing no current at all, and your selenium was in a non-conducting state. Before it can conduct or be sensitive to light it must be annealed, and should be made up in the form of special "cells" as they are called. The annealing process requires some skill in manipulation, and consists, we believe, in keeping the selenium at a fairly high temperature for some time, then allowing it to cool slowly. Your question about a piece of selenium to pass 24 volts is impossible to answer, and we would recommend you to read the chapters on current, voltage, resistance, and Ohm's law in any elementary text-book before you proceed further. We believe that selenium is always supplied in sticks. It is easily melted and moulded to any desired shape.

[18,404] **Locomotive Drawing.** A. C. (Warkworth) writes: Could you please inform me where I could obtain the working drawings of the Midland four-coupled express locomotive, latest type, North-Eastern Railway "Atlantic," and also the Midland Great Western Railway, Ireland, express locomotive "Celtic," No. 129?

For drawings of the Midland engine, see recent issues of the *Engineer* and *Engineering*. For Midland compound 4—4—0 type and N.E.R. No. 649 4—4—2 type express engines, see "The World's Locomotives," by C. S. Lake, price 10s. 6d. net. 11s. post

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free. For M.G.W.R. (Ireland) express engine "Celtic," see July 25th (1902) issue of the *Engineer*.

[18,414] **Sketch of Tender.** J McI. (Kilmarnock) writes: Kindly give a sketch of tender for G.N.R. ¾-in. scale, No. 251. This is not included in "The Model Locomotive."

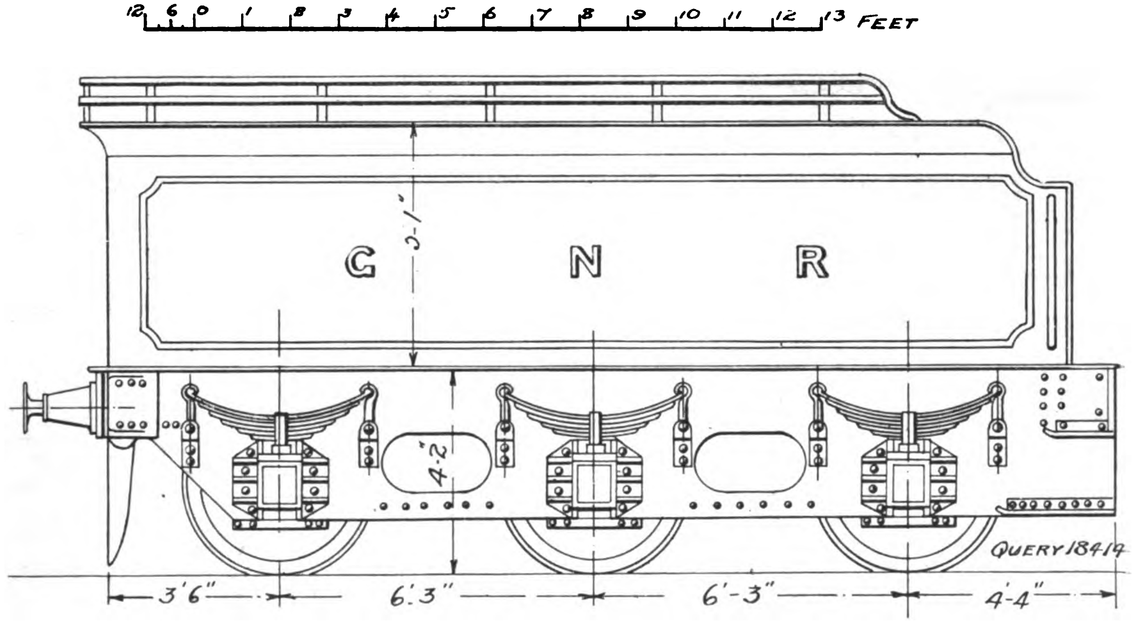
We include herewith a sketch of a G.N.R. tender, reproduced to ¼-in. scale. With regard to the width of footplates, no dimensions have been published; but the engines (251 Class) have footplates 8 ft. wide, and the width over the cab sides (which is about the same as the width over the tender tanks) is 7 ft. 2 ins. Buffer centres and heights will be the same as those on the engine.

[18,200] **Large Induction Coils.** B. H. (Oldham) writes: (1) In your last set of answers (September 19th, No. 18,070) you say that my coil will take about 19 lbs. of No. 36. What length of spark will this give? (2) The core is 18 ins. long, and is covered with three layers of No. 12 D.S.C., placed in two ebonite tubes. One is 24 ins. long, ¼ in. thick, 1¾ ins. internal diameter; the other is 18 ins. long, ¼ in. thick, 2 ins. internal diameter, sliding over the first, screwed at each end for clamping nuts of ebonite, to fix ¼-in. thick end-pieces. Is this insulation too much? (I ask this because you say that—"The arrangement of tubes is useful . . . but, on the other hand, you increase the distance of primary from secondary.") I do not see this point clearly; so long as you have a given thickness of ebonite to provide, it does not matter it it is laminated or not. (3) Would two tubes of ¼-in. thickness each be enough? (4) About what is a suitable condenser to use—the primary being about 450 turns of No. 12, in three layers on a 1·1 in. diameter iron core (of about No. 20 to 22 S.W.G.)? (5) About what is a suitable input in volts and amps. for a coil like this? (6) Have I enough primary turns, or should I use No. 14 and get on three layers?

(1) It is not possible to state the spark length exactly; but, if coil is thoroughly well made, you may obtain about 12 ins. spark length between the discharge points. It depends partly upon the general proportions of the coil. (2) No, the insulation thickness is not too much. The point is, that as you increase the distance between the primary and secondary windings, so you increase the leakage of magnetic lines which pass between the windings and do not cut the secondary at all, thus detracting from the useful output. But you must have ample insulation, as a breakdown of this is fatal to success. (3) No, do not risk it. (4) Be guided by the proportions given in Hare's book; there is no best size, it must be determined by trial for each coil. As a fact, it should be altered for every alteration in the spark length which you are using. Make it in several sections, and couple one or more in parallel until you find a capacity which gives best average results. (5) Depends to some extent upon which kind of break is used. For a hammer pattern, 12 volts and 6 or 8 amperes; for a mercury break, 24 volts and 3 or 4 amperes. You will have to make some trials. (6) You state that your core is wound with three layers of No. 12 D.S.C.; for battery use this is fairly suitable; we do not advise No. 14 gauge. Three layers is considered by many to be the correct number, and you will do well to adopt it. Owing to the action of the break, the flow of current to the primary fluctuates to a large extent, and cannot be stated as so many amperes, except to mean the average flow or approximate average flow.

[18,470] **Accumulators, etc.** H. B. (Cartmel Fell) writes: I have twenty-three accumulators, five plates in a cell, each plate 7½ ins. by 5½ ins. by 3-16ths in., 45 amp.-hours, which I purchased through the "Sale and Exchange Column" of THE MODEL ENGINEER. I am thinking of setting them in a place which has a board and felt roof. Would you kindly say if there is any danger of the acid freezing and cracking the glass cells? Also, I want to make the voltage up to 54; can I do this by adding an 8-volt 50-amp. accumulator in series (which I may purchase through THE MODEL ENGINEER)? The plates are covered by particles of sawdust, through packing, especially the negatives, as the paste has cracked in some of them. Would you recommend washing them? I have a glass float, marked at the upper end—1,250 in black, 1,200 in red, 1,150 in black. Please say how to use this. Also, will rain-water, kept in a bucket, be right for filling up cells through evaporation? What would be the safe charging current if the other 8 volts 50 amps. were added? and, do not the volts govern the amps.? If so, will I have to raise the volts in order to get the necessary amps.? Will I require any resistance in circuit with cells? The cells are 120 yds. from dynamo. Would it be better to have a magnetic cut-out? and, will it have to be wound for same voltage as cells take? Will sheet lead (used by builders) do for casting accumulator plates? I have made an arc lamp—the same as the one of January 1st, 1903. I have it on a separate circuit from dynamo. As soon as I switch current on, all the other lamps, or even one, go dim, and remain so, unless speed of engine is doubled? Would you kindly say the reason of this? The dynamo gives an output of 8 amps. 55 volts, engineer made. I have conductors run on poles from a water-wheel, and the insulation is bared off at several places by tree boughs. Please say whether leakage will take place—the boughs are not touching. Would coal tar be suitable for preserving the insulation? Thanking you in anticipation.

(1) There is not much likelihood of damage by frost. (2) Yes, you can add another 8-volt cell of approximately same capacity as the large set. (3) The glass float is a hydrometer, for testing the specific gravity of the acid in cells. At commencement of charge it should be about 1,180, and at completion of charge will rise to about 1,200 or 1,210. We advise you to read our handbook on "Small Accumulators" thoroughly. It is 7d. post free. The dynamo voltage should be 2·5 volts for every cell in circuit. That is, with twenty cells, it will be 30 volts, and so on. Charging rate should be approximately 5 amps. per sq. ft. of positive plate surface. Your arc lamp takes more current than can be spared, and consequently reduces the terminal voltage. Hence the incandescent lamps burn dim until speed is increased. If the boughs do not touch, there will be no leakage. Coal tar would do, if put on when the insulation is in good condition.



SIDE ELEVATION OF A G.N.R TENDER. (*Scale: ¼ in. = 1 foot*)

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[18,308] **Patterns for Machine Tools.** R. E. S. (Tunbridge Wells) writes: I notice, in small machine tools, that there are two types of slides in general use, of which Figs. 1 and 2 are sectional elevations. (1) Is there much difference in efficiency for fairly heavy work in actual practice; if so, which is the better type? I notice that Fig. 1 seems to be more general in the high-class tools. (2) With regard to the angle *a* for the slide, sometimes I find it to be 55 degs., at others 60 degs. Should I be right in making a slide of type Fig. 1, with angle of 60 degs., as I am thinking of buying a try-bar for surfacing V's, and, of course, the angles of a triangular bar are 60 degs.? (3) I wish to make a wooden pattern for Fig. 3, but cannot quite see how it will be moulded in the sand, nor where the parting line will come. I understand how to make the corebox for the ⊥'s but do not understand how to make the pattern, as I wish the ⊥-slots to be cast in, having no appliances for planing them out. I wish to make a pattern in wood for vertical slide and table (Figs. 4 and 5, but do not know how to make the pattern, as I do not quite see how it will be moulded in the sand, or where the parting line will come. Should any pieces be made "loose"?

FIG. 1.

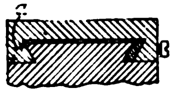
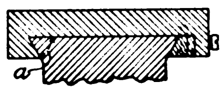


FIG. 2.



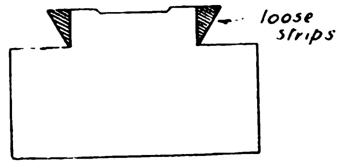


FIG. 6.

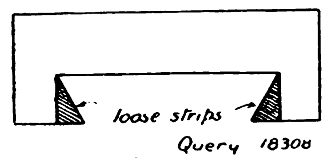


FIG. 7.

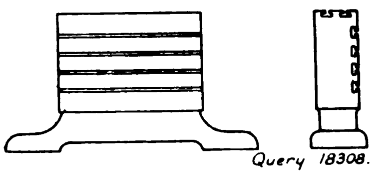


FIG. 3.

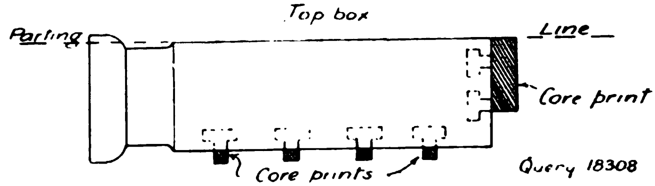


FIG. 5.

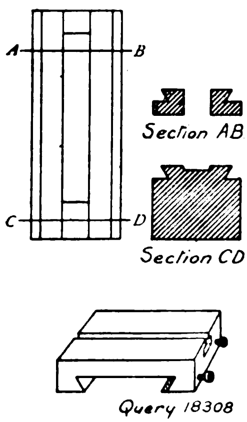


FIG. 4.

MAKING PATTERNS FOR MACHINE TOOLS.

(1) We prefer design Fig. 1, wherever possible. The arrangement shown in Fig. 2 is not so strong, and would only be used in positions where some difficulty in getting the slides over the V's exists. (2) You will be all right in making the angle of the V's 60 degs. (3) To provide sound metal the pattern for the table (Fig. 3) should be laid in the sand, as shown in Fig. 6, the main portion occupying the bottom box. The core prints for the bottom slots should project a good distance, and need not extend through to the sides. Those for the end slots should form one piece extending up to the parting line, as indicated in Fig. 6. Do not make this core print too small. With reference to the patterns, Figs. 4 and 5, you can make the shaded parts (see Fig. 7) loose, wiring them on in the usual way.

[18,412] **Small Alternating Current Machines.** D. T. (Hampstead) writes: Could you kindly let me know if any of the motors described in your two Handbooks, "Small Dynamos and Motors" and "Small Electric Motors," could be run with any result on an alternating current of 110 volts; and, if so, what power a ½ h.-p. continuous-current motor would give if run on an alternating current of the same voltage and amperage. Also, what alterations I should have to make to convert any of the motors described in your books to alternating current motors? I should like to know if there are any cheap and thoroughly practical books on the subject, telling you exactly how to set to work to make an alternating motor. Lastly, what powered motor would it require to drive a 3½-in. centre Drummond lathe, with back-gear and screw-cutting attachment, at its heaviest load? Could you kindly let me know what woods are termed hard woods for turning purposes, that is, what woods necessitate the use of hard-wood tools? If you could give me a short list I should be much obliged. Also whether mahogany is usually turned with gouge and chisel or with hard-wood tools? I can find no certain information either in your small Handbook, "The Beginner's Guide to the Lathe," or in any other book on lathe work.

Very small motors (such as Figs. 7 and 11, pages 20 and 21, or Figs. 1 and 4, pages 17 and 18, of Handbook No. 14) could be run with alternating current, but it is essential for a motor of larger size to have a laminated field-magnet as well as a laminated armature. With very low periodicities—say, not more than forty periods per second—it is possible to get good results from motors of continuous-current design up to about ½ h.-p. size, if the field-magnet is laminated, and series winding used for the coils. For ordinary supply periodicities (of fifty periods per second and upwards) the motor must be specally designed, if it is of more than about 1-20th h.-p. size. We know of no information available, except advanced expositions given in large text-books and proceedings of societies. You would have to be an expert, and also make a number of trials, to produce a successful ½ h.-p. motor. If you cared to make a trial, the best chance of success would probably be with type Fig. 13, page 20 of Handbook No. 10; it would be absolutely necessary to make the field-magnet of soft iron stampings, so that it is laminated. Machine should be wound for about 30 volts to work on a 110-volt 100-period circuit, and about 40 volts to work on a 110-volt 50-period circuit, series wound field-coil, and no metal in the bobbins. A ½ h.-p. size would give about ½ b.h.-p. or less—the lower the periodicity, the greater the power. You are sure to get sparking at the commutator, therefore have as many sections as possible. A 3½-in. centre lathe should not require more than ½ h.-p. to drive it. Mahogany should be turned with gouge and soft-wood chisel. Beech, mahogany, walnut—in fact, almost anything except deal and pine—are often called hard woods; but, practically, the only common woods which require tools of the scraping class are boxwood and lignum vitæ. Boxwood, however, can be roughed with a gouge. Very good results can be obtained for finishing the harder kinds of these woods by an ordinary carpenter's chisel held horizontal with bevel underneath.

[18,327] **Expansion of Gases.** J. W. (Manchester) writes: I am anxious to obtain some data as to the pressure exerted upon an enclosing cylinder by compressed air and also expanded air. Will you therefore oblige me with the following information: (1) What pressure per square inch does air compressed to one-eighth, one quarter, one-half, and three-quarters of its original bulk exert upon its enclosing cylinder? (2) What pressure per square inch does air exert upon its enclosing cylinder when expanded by withdrawal of the piston to eight times, four times, twice, and one and a half times its original bulk?

Boyle's law says: "That the pressure of a perfect gas varies inversely as the volume where the temperature is constant." Therefore, a given amount of gas compressed to half its volume will have its pressure increased inversely; that is, it will be at twice the original pressure. If the volume is doubled, then the pressure will be halved. In calculating under this law care must be taken

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to see that the pressures are reckoned on the absolute scale. This being so, gas at a pressure of 20 lbs. per sq. in., on the pressure gauge is not increased to 40 lbs., when it is reduced to half its original bulk. The *absolute* pressure of the gas is, of course, the

Gauge pressure + pressure of atmosphere.
20 lbs. + 14·7
34·7 lbs. absolute.

Therefore, under Boyle's law,

$$P \times V = \text{a constant quantity.}$$

and

$$P \text{ varies inversely as } V.$$

The new volume being half that of the original, a given amount of air at 20 lbs. gauge pressure (34·7 absolute) will have a new pressure of 2 × 34·7 = 79·4 lbs. absolute.

Now absolute pressure — atmospheric pressure = gauge pressure.
Therefore 79·4 — 14·7 = 64·7 lbs. per sq. in.

You may check this by the formula :—

$$P \times V = \text{constant.}$$

As $34·7 \times 1 = 34·7$ (constant).

With the new volume of $\frac{1}{2}$

$$79·4 \times \tfrac{1}{2} = 34·7 \text{ (constant).}$$

The equation can also read :

$$P = \frac{C}{V}$$

$$V = \frac{C}{P}$$

So that whether you require to find the pressure or the volume, so long as two factors out of the three are provided, the unknown one can be arrived at very readily.

[18,421] **Miniature Railway Locomotive.** H. G. (Bradford) writes : I shall be glad if you will be so good as to inform me what you consider the smallest scale for which a model locomotive must be built to be powerful enough to pull a passenger weighing about 8–8½ stones at a maximum speed of 8–10 miles per hour on the level. As I have the intention of going in for such a model, I shall be much obliged for any information you will be good enough to give me.

The smallest scale would be 1 in. to the foot ; but such an engine would be quite unsatisfactory in actual working, as the water and fuel supply would need constant attention, and the steam pressure would be continually fluctuating. We would recommend a scale of 1½ ins. to the foot, as in this scale a steel boiler might be used and the cost of materials considerably reduced. A 1½ in.-scale engine requires a copper boiler ; a steel boiler is too clumsy. We have had several requests for the publication of a design for a 1½-in. scale engine, and should like to know what type you favour. The gauge of the locomotive would be about 7¼ ins.

[18,484] **Lahmeyer Dynamo Trouble.** J. H. G. (Lichfield) writes : Can you help me in the following ? I have built a dynamo, Lahmeyer type, and cannot get same to generate. I want it for charging a small accumulator. It runs all right when driven as motor with 4-volt accumulator. The following are instructions of same : Armature, 8 sections and 8 section commutator, wound with wire, No. 27 S.W.G. Fields are also wound with same wire. Bobbins made of brass and both wound same way. Connections, one end of fields joined to brush, starting and finishing end joined together and other end to brush. Diameter of armature, 1¼ by 1½ long. There was rather too much air space, so wound fine iron wire round armature, first putting a layer of paper round. Bobbins, 3 ins. by 2½ ins. by 9-16ths in. width, wound full with enclosed wire. Will you please let me know if wire is right size, or anything else wrong ?

Many small machines run well as motors, but give more trouble as generators. This is due to any of many likely causes, and we advise you to read the chapter on "Hints on Repairs and Testing" in "Small Dynamos and Motors," 7d. post free. We do not advise paper between the armature core and the iron wire wound over it. Take this off and wind solid with soft iron wire, and try again at not less than 3,000 revs. per min.

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.*

*New Bolts and Nuts.

We have received from the Liverpool Castings and Tool Supply Co., Church Lane, Liverpool, some well-made samples of their new sizes in model bolts and nuts. These are specially adapted for cross-heads, link-motion, and similar engine details. They have also recently fitted up a machine specially for polishing the flats of their model nuts, and the samples of this work before us are very good.

Model Rails.

Messrs. A. W. Gamage, Ltd., send us particulars of standard Gauge tin rails known as "large curves," combined with the new locking device, also a sample of the new "Tessted" Rustless Steel Rail, which this firm now supply.

"Simplex" Sheet-Metal Cutter.

We illustrate herewith a very useful labour-saving appliance for cutting sheet iron, steel, brass, copper, or tin. The device was on view at the recent MODEL ENGINEER Exhibition, on the stand of T. J. Syer & Co. As clearly shown (Fig. 1), the cutters are kept apart by means of springs, and when the arrangement is placed between the jaws of a vice, as shown in Fig. 2, it can be made to cut round, square, oblong, or triangular holes, and in thin sheet metal half-

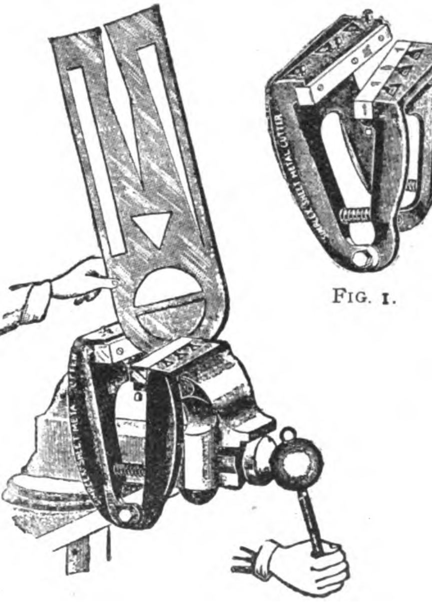

FIG. 1.

FIG 2.

THE "SIMPLEX" SHEET-METAL CUTTER.

circles can be cut. The machine is made in three sizes—for 3½-in., 4½-in., and 5½-in. vices. It is stated that the largest size will cut metal up to ⅛ in. thick. Prices and further particulars may be obtained of Messrs. T. J. Syer & Co., 45, Wilson Street, London, E.C.

New Catalogues and Lists.

George Adams, 144, High Holborn.—We have recently received a copy of Mr. Adams's new list of engineers' and model makers' tools, and after a careful inspection of its contents can confidently pronounce it to be one of the most complete and most carefully compiled tool catalogues ever issued. As the list extends to nearly 300 pages, it is obviously impossible to mention more than a few of its many contents, but special reference should be made to following lines: Blow-lamps for brazing and soldering, gauges, measuring instruments, scribing blocks, surface plates, &c.; drilling machines, lathes from the watchmakers' smallest pattern up to lathes weighing nearly a ton; milling cutters and appliances in great variety; oilstones, small reamers, at prices which are within everybody's reach; taps, dies, and screw-plates for practically all threads; tool outfits in roll wallets and boxes; pocket and other knives, and spring motors. Several pages are devoted to sizes and prices of taper and split pins, pinion wire, silver steel and mild steel in rounds, squares, and hexagons, mild steel flat bars, bolts, screws, rivets, gear wheels, &c. It should be observed that Mr. Adams lays himself out specially for the supply of these materials in small quantities, so that the amateur may buy just as much as he wants for the job in hand without overstocking his workshop. A most useful thing for readers abroad is the complete list of carriage rates to all parts of the world. The fact that Mr. Adams also conducts an engineering works enables him to select his stock from actual trial and experience in the workshop, so that he can supply others with the fullest confidence in the quality of his tools. The catalogue which will be sent post free for 6d., ought to be in the hands of every working model engineer.

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The Editor's Page.

AS we are continually receiving requests asking in which issues of THE MODEL ENGINEER certain articles or designs have appeared, we wish to point out that readers would save themselves considerable time and trouble if they would take care to possess a copy of the index which is published with the last issue of each volume. Obviously, the index entails a great amount of labour in its preparation, and we shall be gratified to know that our readers make full use of it, and thereby prove it to fulfil its object. We may say that, as we are nearing the completion of this present volume, the usual index will be included, and readers should make sure of securing the issue containing the same. We are also frequently asked—within two or three weeks following the appearance of some desired article—which issue it was published in. Our readers know that we are always willing to assist so far as possible; but we think that these enquiries would be rendered unnecessary if their orders were booked regularly for their favourite weekly.

Answers to Correspondents.

F. J. C. A. (Bedford).—Wind armature with 2½ ozs. No. 20 S.W.G. and fields with 10¼ ozs. No. 22 S.W.G., and run at 3,000 r.p.m. Running as a motor, supplied with plenty of current at 6 volts, it would give about 1-30th h.-p.

J. A. W. (Sheffield).—Your enquiry *re* crown of locomotive boiler has been dealt with. Let us know if you are still in difficulties.

B. S. L. (Hammond Island).—Many thanks for your interesting post-card. We intend to reproduce this in an early issue.

E. J. H. (Folkestone).—See the description of a model turbine-driven steamer in the issue for October 17th.

B. W. B. (Harpenden).—The smaller end.

H. J. R. (s.s. *Rossetti*).—Our letter has been returned; we are unable to trace you. We have no detail drawings in hand for a 1 kilowatt machine at present, and these would probably have to be specially prepared for you. We advise you to obtain your stampings and castings, wire, etc., from Avery, Fulmen Works, Tunbridge Wells, Kent. He would supply full instructions, etc., with the parts, ready for winding and putting together.

W. D. R. (Bridgend).—Your enquiry embraces a subject quite out of our scope. The only people we know of who could help you are the manufacturers of optical lanterns.

R. D. (Walthamstow).—In reply to your inquiry we think our handbook on "Static Electricity," 7d. post free, will meet your requirements best.

C. B. (Nottingham).—Your request is having the earliest possible attention.

N. H. (Manchester).—Any of our electrical advertisers would supply you with compressed copper oxide plates. See query reply in June 21st, 1906 issue, page 598, on Lalande cells.

H. V. C.—The details you require will be published at the earliest possible date.

S. L. (Cheshire)—See issue for June 14th, 1906. We have not published drawings of such a large one. The walls of your workshop are evidently very thin. We would suggest a covering of tarred felt; also a warming stove of some description. The plate, we should think, was made for a special job.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

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

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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. XVII. NO. 347. DECEMBER 19, 1907. PUBLISHED WEEKLY

Some Exhibits at the N.Z. International Exposition, Christchurch.

By "A LONDONER ABROAD."

(Continued from page 576.)

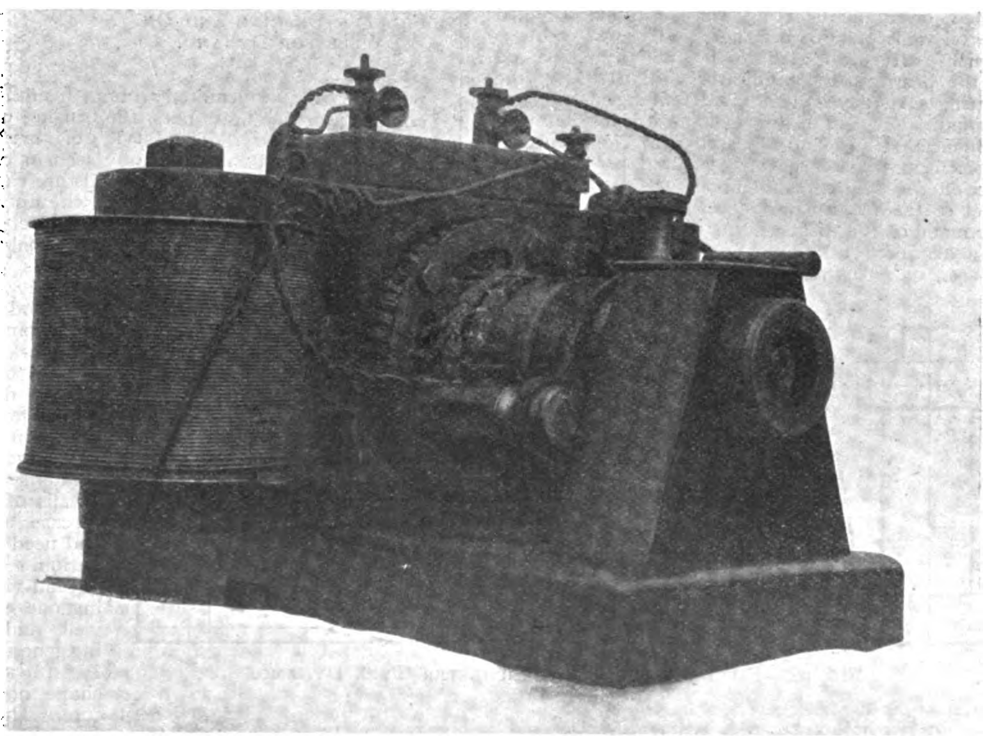

FIG. 15.—MR. TOMKIES' MANCHESTER TYPE DYNAMO.

MY modest intention of introducing to English readers some Colonial model engineering is now nearly fulfilled. I believe I have already explained that many more exhibits deserved—and obtained—my admiration than circumstances enable me to describe. Those items, however, that come in the latter category may be taken as fairly representative of a much larger number, whose owners are either *perdu*—as far as I am able to discover—or, maybe, are too modest for anything!

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Mr. Arthur G. Tomkies, of Westport (South Island), who may be seen standing beside a fine piece of his own work in Fig. 14, kindly gave me the following details relative to the machine in question—a Manchester type dynamo, more clearly illustrated by Fig. 15. It will be seen that Mr. Tomkies has a really practical bent, and many of his fellow model makers and dynamo builders will envy him that creek, with its 110 ft. head of water! Such things are perhaps as common in New Zealand as they are rare in England, and some of these days there can be not the slightest doubt that hundreds, if not thousands, of private electrical plants will be operated in Maoriland in the manner here described. Perhaps Mr. Tomkies' success will induce other New Zealanders to set about a similar useful and interesting labour. Says my informant :—

The machine described below has successfully lighted two houses with electric light for five years, and was just renovated for the purpose of exhibition. The motive power was water, which (says Mr. Tomkies) I obtained from a creek behind my house, and used under a head of 110 ft. upon a Pelton wheel, the cost of which was *nil*, after once being installed. During the whole five years the machine ran without giving any trouble, and needing no attention from the time the water was turned on until stopping same at bedtime. When originally starting the machine, I filled the oil wells of both bearings, and it was eighteen months afterwards before I put any fresh oil in the bearing at commutator end of shaft; the bearing at pulley end required refilling about once a month. This, I claim, is a most excellent performance. I also had a search-light rigged up on a platform up a large fir tree, and as my house was on the side of a hill about 150 ft. above the level of the Grey River, the light had a splendid command of the district, and under its direct rays, at a distance of 1½ miles, a sixpence could easily be seen on the ground on the darkest night!

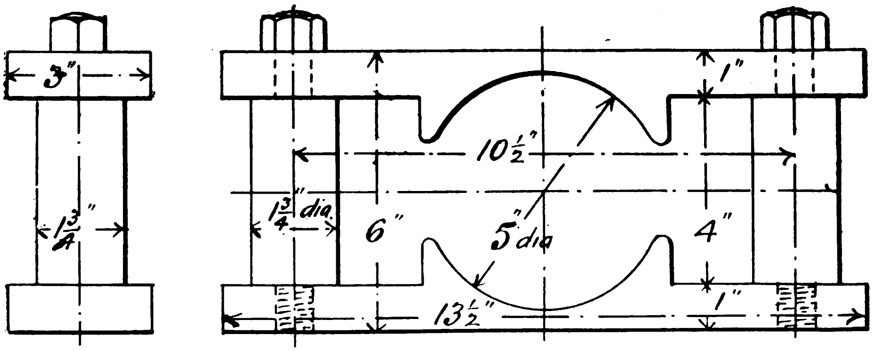

Fig. 16.—Field-magnets of Manchester Type Dynamo.

The design is original, but the machine is of the Manchester type. The magnets and pole-pieces are all of wrought iron. The bearing standards are made of 1-16th-in. mild steel plate bent around and riveted, with an oil well formed under the bearing. The bearings are turned out of gun-metal, with an oil cup at each end to catch the oil thrown off the shaft when revolving, and containing a hole to guide the oil back again into the well, to be refed on to the shaft by a brass ring, a type of bearing now commonly used on dynamos. The armature core consists of 120 stampings, with paper insulation between, and is carried upon five Muntz metal ¼-in. bolts by two spiders cut out of ⅛-in. sheet Muntz metal, which are held upon the shaft between collars and nuts. To wind the armature it is taken off the spiders, when the opening through the centre is clear of all obstacles, thus reducing the difficulty of winding. The armature has twenty coils, each containing about 26 ft. No. 18 gauge wire, and

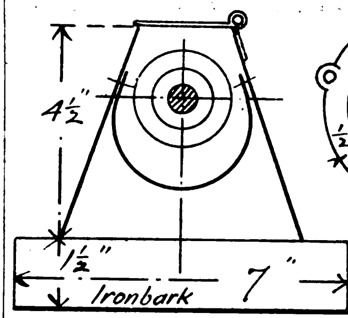

Fig 17.—Bearing and Oil Well for Dynamo.

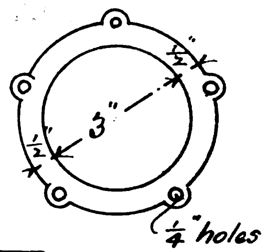

Fig. 18. Armature Core Stamping.

wound over vulcanised fibre insulation. The commutator has brass bars, the brushes used being of copper gauze. The style of brush-holders are original, and can be plainly seen in the photograph (Fig. 15). The magnet coils are each wound with about 9 lbs. of No. 18 gauge wire upon bobbins which slip over the magnets. Everything is bolted, from underneath, upon an ironbark wood bedplate 1½ ins. thick. The detail is most perperfectly thought out, and everything can be taken to pieces in from five to ten minutes.

The dimensions of the machine are shown on the drawings (Figs. 16 to 18). In the first of these, details of the iron carcase are given, and need no explanation. Fig. 17 is an end view, showing one of the oil wells and the bearing generally; while Fig. 18 explains the shape of armature core. These are all to a scale of 3 ins. to at foot.

There is one special feature regarding the method of construction that I might mention, and that is, that the armature core stampings were stamped by myself with a most simple and original stamping appliance,* which produced the complete stamping

* Mr. Tomkies has promised at some future date to describe this tool, which would doubtless prove extremely interesting to electrical readers.

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in one operation; work which is rarely, if ever, attempted by anyone except those who make a business of such.

I have never made any complete set of tests *re* output, resistances, etc., and have not the necessary instruments and power available to do so at the present time. The machine will easily run continuously twelve lamps of 16 c.-p. at 50 volts, or, say, 720 watts. This would be equivalent to about 1 h.-p. electrical output.

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.]*

MAGNETOS FOR AUTOMOBILISTS. By S. R. Bottone. London: Crosby Lockwood & Son. Price 2s., postage 3d.

Perhaps more than any other work which deals with magnetos for ignition purposes, this book fulfils its object. The author has included a brief, yet sufficiently lengthy, chapter on the apparatus in its early days, and refers to various machines and the principles upon which they work. All this, of course, has been done before, and especially have the principles of working been explained. The chief merit of the book lies in the practical data, etc., given, which will enable many an enthusiastic mechanic to turn out with his own hands a fairly sound and serviceable piece of apparatus; or, to quote the author, he has given such an "outline of the history, construction, and function of the magneto as generally used by motorists, in the hope that an amateur provided with a machine of this type may not be at a loss should slight repairs or adjustments be required when the services of an electrical expert are not obtainable, and may even, given the requisite tools, skill, and patience, be able, *in an emergency*, to make the magneto for himself." The italics are ours; and we submit that it is obvious that that wording requires a little modification or alteration. But the amateur of average mechanical capacity should certainly—given time—be able to construct a presentable machine. There are six chapters and thirty-five illustrations, making a most interesting and instructive eighty-eight pages of reading, which, we think, ranks as one of the most useful works the author has yet been responsible for, and perhaps standing second only to his "Primary Batteries"—of a few years ago—judging each on their respective merits.

FOWLER'S MECHANICAL ENGINEER'S POCKET BOOK, 1908. Manchester: Scientific Publishing Company. Price, cloth, 1s. 6d. net; post free, 1s. 9d.; leather, 2s. 6d.; post free, 2s. 9d.

This book has again been revised, and the rearrangement of subject matter in specific sections adds greatly to the convenience of reference. The tenth edition includes a new section dealing with pumps and pumping machinery; a large amount of new matter is also given in the sections relating to steam boilers and engines. Although it has been found necessary to curtail other matter and to omit machine tools and processes and building notes, which will be found in special handbooks on these subjects, the new volume contains over 100 pages in excess of previous editions, and will prove of even more value to those who have occasion to use an engineers' pocket book.

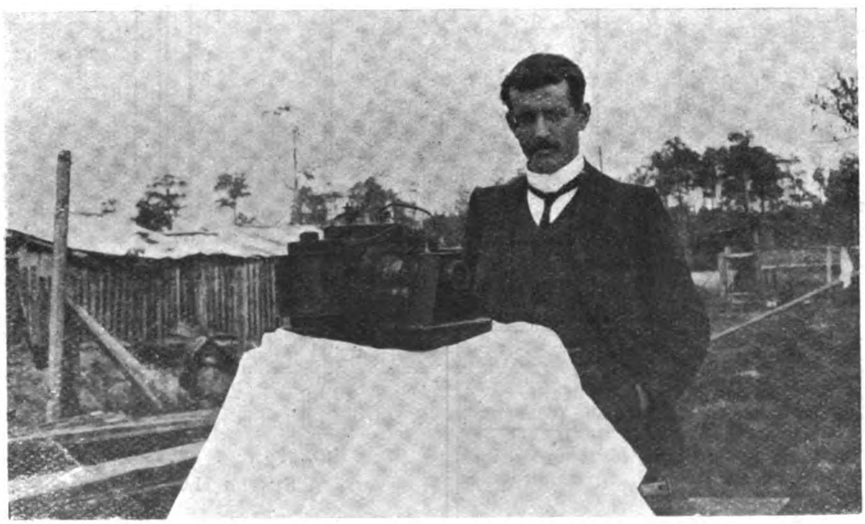

FIG. 15.—MR. ARTHUR S. TOMKIES WITH HIS MANCHESTER TYPE DYNAMO.

BRADFORD.—Model engineers and others interested in the formation of a Society of Model Engineers in this district are invited to communicate with Mr. AMOS BARBER, 15, Hartington Terrace, Lidget Green, Bradford.

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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.]

Toolbox Locating Pads.

By "SREGOR."

The accompanying sketch shows an improvement for securing an ordinary metal turning, planing, or shaping tool in the toolbox. Figs. 1 and 2 show a common pattern toolbox, with the above improvement added. The two pieces A and B are inserted into the box and project above the

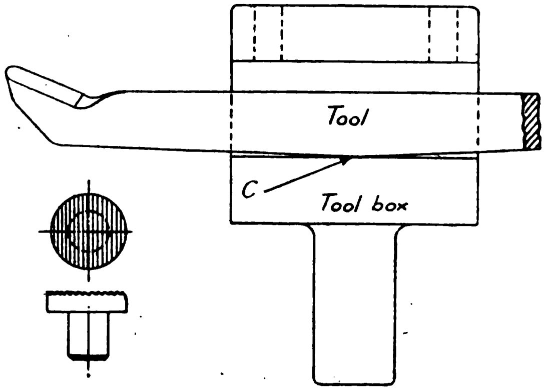

FIG. 4.
SUPPORT A AND B.

FIG. 3.

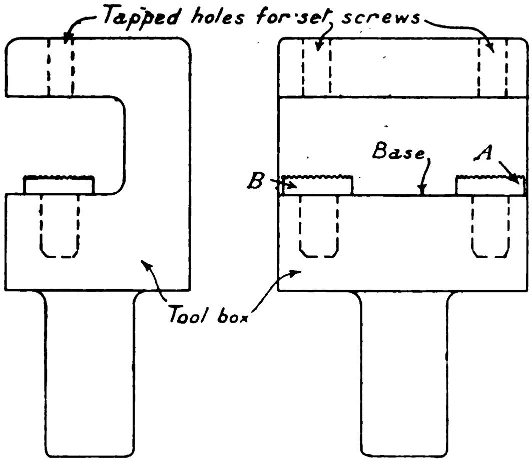

FIG. 1. FIG. 2.

A METHOD OF SECURING TOOL IN TOOLBOX.

base (or face which usually supports the tool), which ensures that the whole of the support comes on these two faces, and, being located at the two ends of the box, ensures the tool being very rigid, and entirely dispenses with the possibility of the tool being located, as shown in Fig. 3. As will be readily seen, in the event of the tool being slightly rounded where indicated by C, the only contact of the tool with the face of toolbox is at this point. Fig. 4 shows the outline of the supports, which are readily turned to fit holes in toolbox, after which they are cut diagonally across the face with a file or other convenient method to relieve the surface and afford a better grip to the tool, after which they are hardened.

A Simple Hanging Bell Push.

By W. H. G.

The following is a description of a bell push or switch which can be made in ten minutes. Two pieces of brass wire, 5 ins. long and 1-16th in. thick, are bent as in Fig. 1. Next a piece of wood a little thicker than a pencil and 2 ins. long is grooved down each side, as Fig. 2. The wires are now bound tightly in the grooves with strong twine (Fig. 3); the binding should be covered with

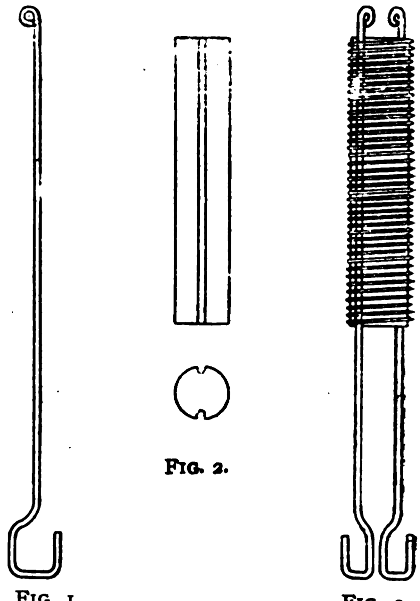

FIG. 1. FIG. 2. FIG. 3.

A SIMPLE HANGING BELL PUSH.

glue or shellac to prevent wires turning. The switch is now complete. It is worked like a clip, the connections being made to the eyes on the top. To make it look better, a slieve can be passed over the whole affair, and tied above and below the wood with ribbon. Besides being easy to make, it looks well, and it can be seen at a glance whether the switch is in fault in case of a breakdown.

A Rapid Centreing Table for Drilling Machine.

By W. B.

Some time after making a slide-rest for a 7-in. centre lathe from the rough castings, I found that to do my drilling correctly I must have a Universal sliding table, but the recollection of that slide-rest simply frightened me. I had some work in which there were a number of holes to be drilled at various distances, and I dare not trust to the haphazard

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way of getting nearly right and hoping for the best, and the outcome of my thought was the birth of the following.

As will be found, any work within the compass of the table may be correctly drilled, and every

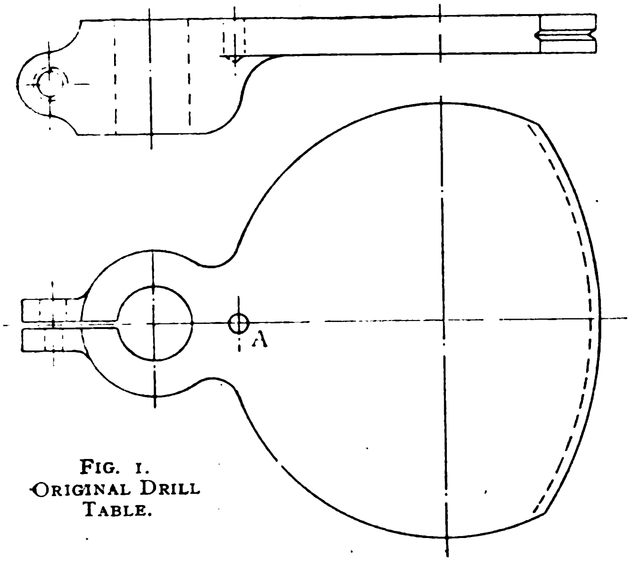

Fig. 1. Original Drill Table.

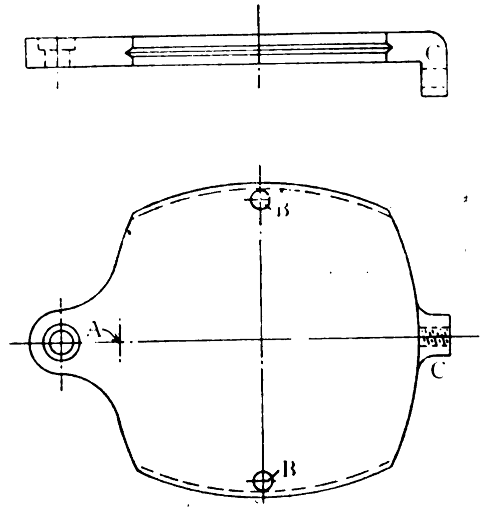

Fig. 2.—Movable Plate.

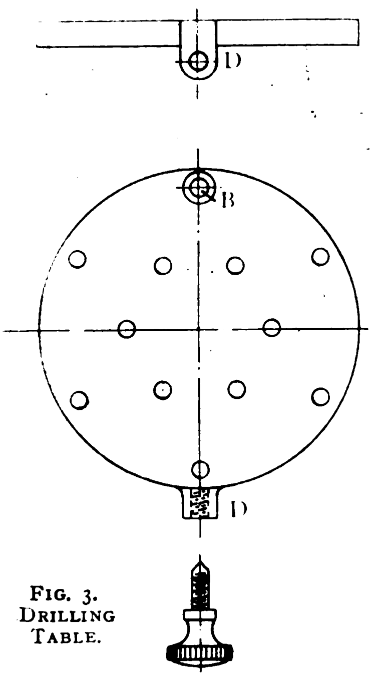

Fig. 3. Drilling Table.

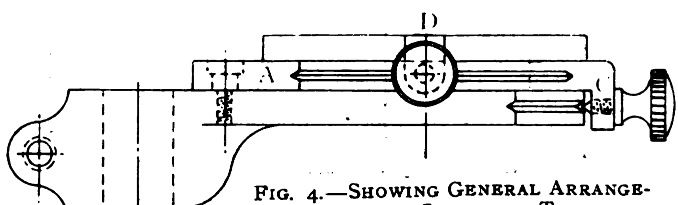

Fig. 4.—Showing General Arrangement of Rapid Centreing Table for Drilling Machine.

drilling parallel with once fixing. Anyone who is at all used to working on iron can make it, even plain castings if filed smooth make a good job. But I fixed my first castings on my (5-in. lathe) faceplate, took a second cut off each face, filed up the edges, filed out the angular grooves on the periphery where shown, fitted the few screws and the clamping screws, and I had a Universal sliding table, ten times quicker than two cross slides, ten times cheaper, and only half the height.

Fig. 1.—I presume this is the original table of your drill. A portion of the round is cut away and the groove filed out. If you object to cutting away your table, have a triangular frame (not shown) and fix to the present table with three screws. The screwed hole A will receive the shouldered screw shown at A, Fig. 4, and becomes the pivot for the revolution of Fig. 2.

Fig. 2.—This plate as shown revolving on Fig. 1 has its front curve struck from A as a centre, and with a lug cast on, with a projection as shown on Fig. 4 at C, Through this projection a knurled setscrew is fitted which securely fixes this plate to Fig. 1. At B, B, Fig. 2, are two screwed holes similar to A on Fig. 1, and from the centres of B, B, the opposite curves with their grooves are formed. A shouldered screw is fitted at A (see Fig. 4) as the pivot of this plate.

Fig. 3.—The top plate, or table, has at B a similar shouldered pivot screw similar to A Fig. 4, and a lug and projection cast on at D similar to C, Figs. 2 and 4, and with a similar setscrew. The perforations are all tapped to receive hold-down screws for clamp plates and angle-plates or for fixing work directly. As seen, this plate can be centred on either side of Fig. 2 for convenience.

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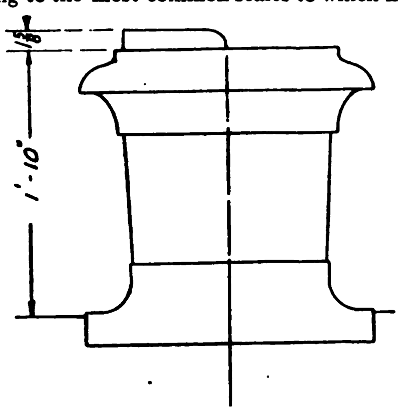
Fig. 4 shows the assembling of the whole, and it is a very compact whole.

In use the work is first fixed, the setscrews are held with each hand, and if the drill can be depressed with the foot, any point can be centred in four seconds, the setscrews tightened, and the drilling commenced.

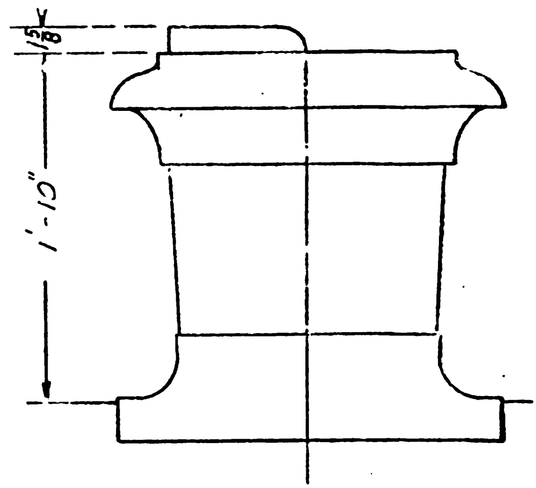
The L.N.W.R. Standard Chimney.

By H. G.

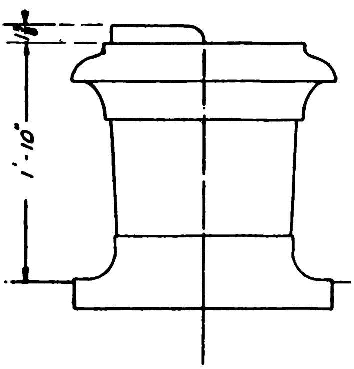
HAVING experienced some difficulty in accurately rendering the L.N.W.R. Company's locomotive chimney in making sketches of their engines, and having also noticed that attempts to model this important feature correctly often fail miserably, I submit reproductions from an official drawing to the most common scales to which models



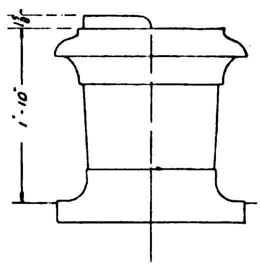
¾ in. scale, 3½ in. gauge.



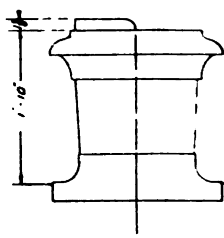
1 in. scale, 4¾ in. gauge.



11-16ths in. scale, 3½ in. gauge.



½ in. scale, 2½ in. gauge.



7-16ths in. scale, 2 in. gauge.

L.N.W.R. Standard Chimney, as used on "Experiment" and Tank Engines.
(*Scale of drawings: Full size.*)

are made. From these drawings metal templates may be made and the proper curves reproduced in the lathe. In making model chimneys, great care should be taken to see that the diameters are also correct; a very slight error either way will make a wonderful difference in the effect produced, marring the appearance of the whole engine,

The Latest in Engineering.

Vessel for Raising Submarines.—There has been recently launched at Kiel, a vessel specially constructed for the purpose of raising submarine vessels. It is 220 ft. long, and has two hulls; it is fitted with cranes capable of lifting 500 tons, and the salvaged submarine is placed on a deck between the two hulls. The salvage steamer, which is to have a speed of 12 knots, and is expected to be ready in the spring, is fitted with all requisite appliances for repairing a damaged boat.—*Engineering.*

First Swedish-built T.B.D.—The torpedo-boat destroyer *Vale*, built at the Kockum shipyard, in Malmö, for the Swedish Government, is the first torpedo-boat destroyer built in Sweden. The dimensions are as follows: Length, 66·1 metres; breadth, 6·324 metres; draught of water, with 80 tons of fuel and fully armed, 1·842 metres; displacement, 416 tons. The two engines will indicate a minimum of 7,200 h.-p., which should produce an average speed of 30 knots. The boat

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is built of Swedish steel, and certain portions are galvanised. The armament consists of two torpedo tubes, two 75-millimetre and four 57-millimetre rapid-firing guns. The *Vale* is expected to be ready before the end of the present year.

A New Zealand Bridge.—Grafton Bridge, near Auckland, New Zealand, which is to be built of ferro-concrete, will have what is claimed to be the greatest single span for a bridge of this kind in the world. The bridge, which is to be thrown across Cemetery Gulley, will cost £40,000, and will take 1,400 tons of cement. The span of the main arch will be 320 ft. The total length of the bridge will be 910 ft., and the height from the top of the roadway to the deepest part of the Gulley 147 ft. A balustrading 5 ft. high will be provided for the full length of the structure. As the carriage-way between the kerbs is 24 ft. wide, there will be ample room for three lines of traffic, and, in addition, there are two side-walks, 6 ft. wide, for pedestrians.

The Future of the Brennan Mono Railway.

SOME six months ago the engineering world was astonished by a remarkable demonstration before the Royal Society of a new method of mono-rail transport invented by Mr. Louis Brennan, C.B., the inventor of the celebrated torpedo bearing his name. This new system was illustrated and described in our issue for May 23rd last, concurrently with descriptions in technical journals all over the world, and everybody has since been asking—Is it the wild dream of a sanguine inventor, or is it a really practical and advantageous means of transport? However convincing the photographs and statements which appeared in the Press may have been, even trained engineers have been known to express doubts as to whether there was really any future for this new system, though these doubts have of necessity been qualified by a knowledge of Mr. Brennan's previous scientific achievements. For our own part we can say that any hesitation has been completely dispelled as the result of a recent private inspection of Mr. Brennan's model at work in the grounds adjoining his residence at Gillingham.

On the occasion of our visit we saw the same model previously illustrated in our paper go through track performances such as no other rail motor in the world could do, and its steadiness in running, the ease with which it takes curves of exceptionally small radius, and its traversing of a wire cable suspended in the air were absolutely convincing. The experimental track on which the model runs consists of a number of lengths of gas pipe jointed together with flush joints and laid on short transverse wooden sleepers resting on the surface of the garden lawn. This gas pipe is used in lieu of rails of ordinary section because the latter are unobtainable on such a small scale. On this track it runs as sweetly and as steadily as any two-track locomotive on the ordinary pair of rails; but it does more than this. A long length of wire cable laid in a serpentine form on the grass, without any sleepers, pegs, or other fastening, forms a most unusual track, but over this the model wends its way as easily and as smoothly as can be, accommodating itself to all the twists and curves in the readiest possible fashion without the least apparent tendency to overturn or come off the track. Similarly, it travels without any trouble along a gas pipe track which has been bent and re-bent into zigzag shape, such as might have happened as the result of a miniature earthquake. Possibly the most impressive of all the demonstrations is to see the model pull up dead on a length of cable some 6 ft. or more from the ground, and remain in perfect balance by reason of its gyrostatic controlling apparatus. Not only does it retain its balance in spite of the strongest winds, but a heavy blow on its side with one's fist does not affect it in the least. The load it is carrying need not even be symmetrically disposed, and a considerable lateral displacement of the weight being carried does not disturb the even tenour of its way. So admirably, in fact, does the model fulfil all the claims of its distinguished inventor, that one does not ask—"Will the Brennan system succeed?" but —"What is the next stage of its development?" For, develop it must.

In the course of a conversation on the future of his system, Mr. Brennan informed us that he was now building for the Indian Government a car which will measure about 50 ft. long by 10 ft. in width, and will carry a useful load of about 20 tons. This will probably be steam driven so far as the propelling power is concerned, but a small electric generating plant will be carried which will supply current for operating the gyroscope. The wheels will all be power-driven, to give great hill-climbing power, and will be placed closer together than in the present model. The centre of gravity of the car will be somewhat higher, a change in design which is rather advantageous than otherwise. The gyroscopes will run in an exhausted chamber, to obviate air friction, and they will be so perfectly mounted in their bearings that should any break-down occur in the driving gear, they will retain sufficient speed to balance the car for a period of five hours, thus enabling the car to proceed on its journey until a convenient stopping-place is reached. The full speed of the gyroscopes on this car will be 3,000 r.p.m., and an entirely new system of lubrication is being fitted to the bearings. In the various sidings which will be provided there will be low walls or other side-supports, so that when the gyroscopes are at rest the car is supported in its normal position. For military purposes separate tracks for up and down traffic will probably be employed; but for the ordinary long-distance running, a single track, with loops for passing, will answer all requirements. Mr. Brennan regards the car now being built for India as merely an intermediate stage in the development of his invention, and he promises that later on he will build enormous cars 150 ft. in length by 35 ft. in width, in which passengers will have all the comforts of a hotel on long railway journeys, and, indeed, drawings of such vehicles were actually produced for our inspection. Under his system, trains will not be limited to a single

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car, but may consist of a number of cars coupled up similarly to our present-day trains. The leading car will be the locomotive and will provide the tractive force, together with the electric current for spinning the gyroscopes with which each vehicle will be provided.

It is Mr. Brennan's laudable ambition to construct the first trans-Continental railway in Australia, and the Australian Government have already asked for information on the subject. The immense saving in first cost and upkeep of permanent way, the great adaptability in negotiating the natural difficulties of the country, and the high speeds which can be maintained with safety, make the system peculiarly suitable for an undertaking of this magnitude, and we hope that the necessary enterprise on the part of the authorities may be forthcoming. The successful completion of such an undertaking would be an achievement which would be as gratifying to Mr. Brennan as it would be serviceable to the public, for it would be the realisation of one of his boyhood's dreams. The idea of the gyroscopic mono-railway, although its details have only been perfected during recent years, was running through Mr. Brennan's mind long before his torpedo was invented, and it is naturally a special source of pleasure to him to have within his grasp the solution of a problem to which his attention has been given for so many years.

Engineering Works and Accessories for Model Railways.

By E. W. Twining.

(*Continued from page* 552.)

In connection with the Eastern end of Twerton tunnel last described, and illustrated herewith in Figs 9 and 9*a*, there is a massive retaining wall 1,120 ft. long, the greatest height of which at the tunnel end is nearly 60 ft., and somewhere near the middle of this there occurs a short tunnel or covered way having a length of approximately 120 ft. The opening has a width of 30 ft. and a height of 25 ft.; both ends are practically similar and of the same size and proportions. The style is Gothic, with flanking turrets, castellated the same as its longer neighbour, from which it is only separated by a short distance.

A drawing of the east front of this short tunnel is here given in Fig. 10, and is shown in section in Fig. 10*a*.

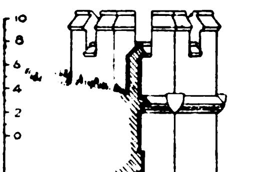

Fig. 10*a*.

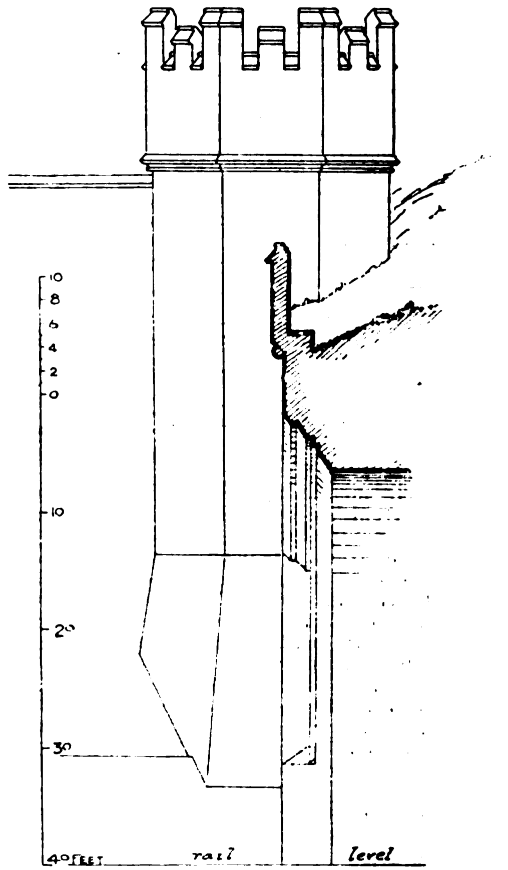

Fig. 9*a*.

The dimensions obtainable from this end will be applicable to the western end, the only point of difference being in the proportions and form of the wing wall, which at the western end is shorter and is carried up to the level of the battlements of the tower. The long retaining wall previously referred to is clearly shown in both Figs. 9 and 10, on the left-hand sides.

The outlines in Fig. 11 show the four pointed openings of the Gothic tunnels I have described. They are given to enable the centres of the various radii to be more readily obtained and accurately transferred by scale to the full size drawings of the models.

I may here say that the masonry fronts of these three tunnels last described, viz., Saltford and the two at Twerton, are, with the exception of Clayton

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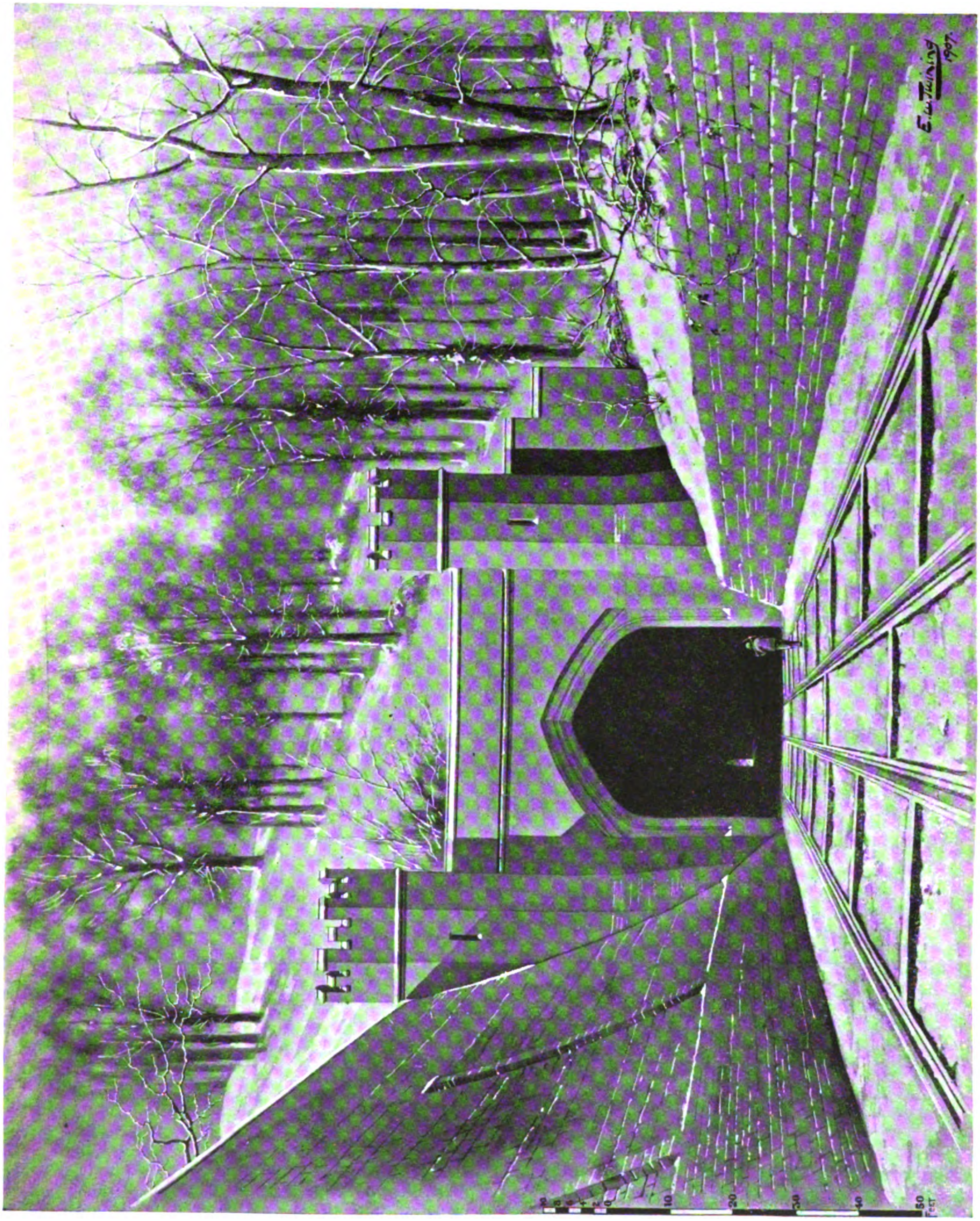
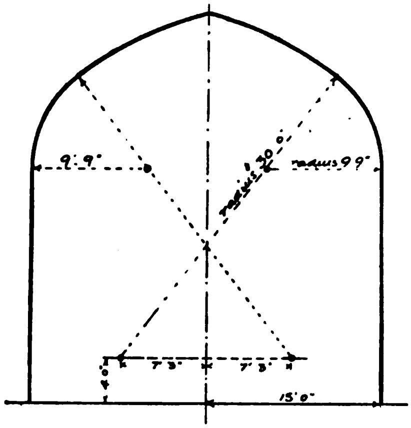
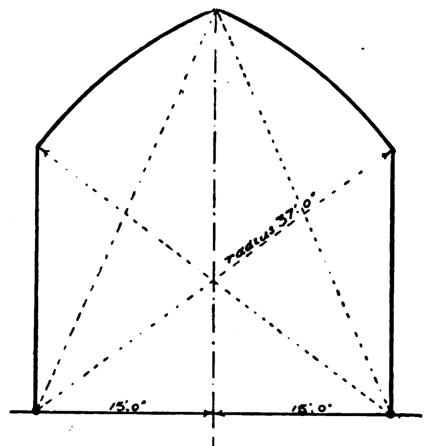


Fig. 9.—The Eastern Face of the Twerton Tunnel, G.W.R.

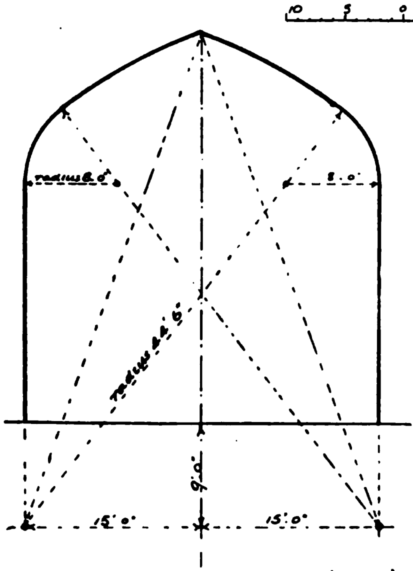
on the L.B. & S.C.R. (of which a drawing appeared in THE MODEL ENGINEER, page 249, September 14th, 1905) the only ones I know of in which the Gothic character has been carried so far as the introduction of the pointed arch; there may be others, but I do not know of any. There are a good many tunnels in different parts of the country which have embattled turrets and possess something of the Gothic character; but they are corrupt, simply because they lack the predominating feature of the Gothic, viz., the pointed arch.



SALTFORD TUNNEL BOTH ENDS (FIG 7)

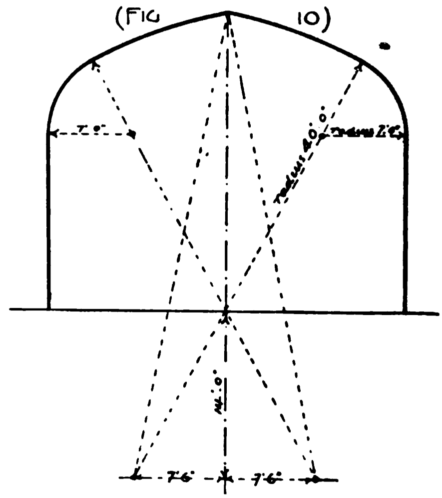


TWERTON TUNNEL WESTERN END (FIG 8)



TWERTON · TUNNEL · EASTERN END (FIG 9)

TWERTON · SHORT · TUNNEL BOTH ENDS (FIG 10)



The Redhill tunnel near Trent on the Midland, Sutton on the North-Western, and Woodhead on the Great Central, are examples of this. The first has a round-headed opening, and the two latter are elliptical, and yet all three have octagonal flanking towers with battlements. Of course, it would not be considered good engineering to line a tunnel right through with an arch in the pointed form, as it is not the form best calculated to resist the pressure of the superincumbent materials; but, if Gothic fronts are designed, the form of the elliptical lining should be made to change gradually to a Gothic pointed outline, and this is what was done in the longer tunnels at Saltford and Twerton, although the other at Twerton, being but a short gallery, is pointed throughout.

(*To be continued.*)

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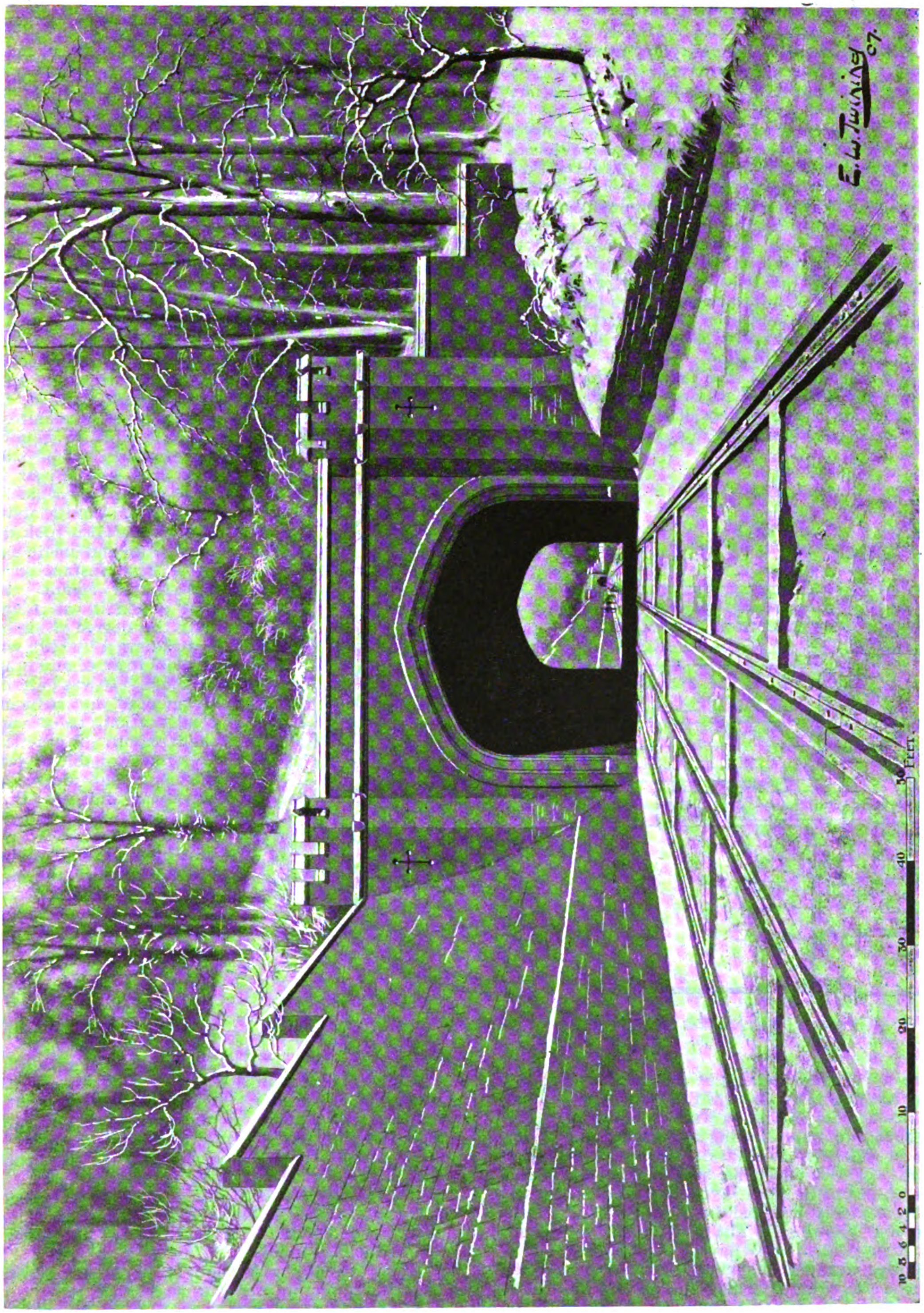

FIG. 10.—THE EASTERN END OF THE SHORT TUNNEL AT TWERTON, G.W.R.

How It Works.

XIII.—The Schmidt System of Superheating for Locomotives.

By Chas. S. Lake, A.M.I.Mech.E., Member Society of Arts.

The ever-increasing demand for locomotives of greater power has led to the adoption of devices having for their object the extraction, from a given weight of steam, of a larger amount of work value. Until recent years compounding was the only generally recognised and practical medium towards that end, and, as readers will not need to be reminded, the point as to whether it is actually accomplished by this means after every circumstance has been taken into consideration has formed for many years the subject of the most strenuously contested debates wherever locomotive design and construction are in question. However that may be, we have before us the fact that locomotive engineers the world over are now seriously turning their attention to the subject of superheated steam for use in locomotives; and in Germany especially, and to a considerable extent in Canada also, the matter has now been advanced to a stage far beyond that reached in any other railway country. The most successful superheating apparatus, and by far the most widely used is that devised by Mr. Wilhelm Schmidt, of Wilhelmshöhe, near Cassel, Germany, and this, in one or other of its two separate forms, has been widely adopted both in the land of its origin and elsewhere. The great body of Model Engineer readers who have a special interest in locomotive matters, and many others besides, may find it useful to have at hand a description of the superheaters; and the writer, with the object of providing this want, obtained from Mr. Schmidt the necessary particulars and data for writing up the subject. A portion of the information communicated by the inventor is reproduced in the following article almost verbatim because of its exceeding clearness and lucidity, and the drawings are taken from originals kindly provided by Mr. Schmidt.

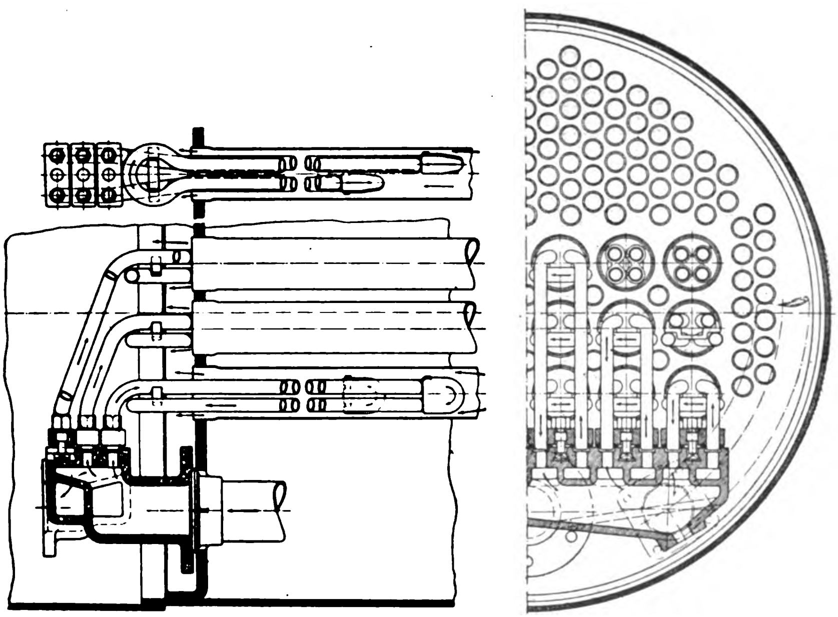

Fig. 1 —General Arrangement of Schmidt's Smoke-tube Superheater.

Before going into the details of the apparatus, which it is our present purpose to describe, it may be of interest to briefly review the history of steam superheat. From the early days of steam engineering, designers have directed their attention to the reduction of the losses arising from initial condensation in the cylinders of all types of engines using what, for the purpose of distinguishing it from superheated steam, we may call "saturated" steam. James Watt recognised the real nature of cylinder condensation and tried to eliminate the trouble by the use of steam jackets, a method which has remained in use up to the present time. It has long been known that the losses in question could have been much more effectually reduced, and, under certain circumstances, entirely avoided, by the use of superheated steam. Since the year 1830 engineers had made various attempts to employ superheating, but the subject does not appear to have been scientifically investigated until about 1857, when Hirn took the matter up, and made use, in a few instances, of superheated steam. At that period it was found that the degree of superheat adopted by Hirn was too low to be of any practical use. It was only instrumental in reducing condensation to a very slight extent. A practical apparatus capable of producing a high degree of superheat did not then exist, and, what was even a greater drawback, the best lubricant of that day could not resist the high temperatures inseparable from the use of superheated steam. Consequently superheating had to be abandoned, and the process of abandonment was hastened by the introduction of compounding, which took place about that time. Compounding, which was accompanied by the employment of relatively high pressure, offered another method of reducing the amount of initial condensation in the cylinders, but when, owing to the development of the principle from double to multiple expansion, the limit of efficiency with saturated steam was reached, engineers began once more to turn their attention to superheating. Foremost perhaps among those who devoted themselves to the subject was Mr. Wilhelm Schmidt.

About twenty years ago Mr. Schmidt was engaged in perfecting a type of engine using a mixture of hot air and steam by the use of which he expected to obtain a marked improvement over the ordinary

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steam engine. The tests convinced him that it was feasible to use temperatures of up to 600° F., and he also came to the conclusion that highly superheated steam was the one agent which would obviate all the losses due to condensation. The exceptionally low figures for coal and water consumption obtained by him with his early engines proved that the use of highly superheated steam was practicable, and, in fact, to-day hardly any large stationary engine plant is put down where superheated steam is not employed. The successful results obtained in connection with stationary engine practice led the inventor to attempt the application of superheat to locomotives. The Prussian State Railways were the first to put to a practical test the Schmidt system of superheating on locomotives. The first two engines thus equipped were introduced on the State Railway system in the beginning of the year 1898, or, practically speaking, ten years ago, while the total number of locomotives so fitted or being fitted amounted, up to July, 1907, to 2,252. A number of difficulties were naturally encountered in the construction of the two pioneer locomotives to which reference has been made, but they were soon overcome by designing special forms of pistons, piston-valves and stuffing-boxes suited to withstand the high temperature of the steam and to ensure greater efficiency and durability. In 1899 the two original locomotives were followed by two express locomotives using superheated steam, and in 1900 by two tank engines fitted with the same form of apparatus. In spite of the unfavourable conditions obtaining, these six trial engines proved conclusively that it was possible to generate and successfully employ highly superheated steam in such engines, although the practicability of this had previously been doubted even by leading engineers.

Coming now to a specified description of the Schmidt superheating apparatus, this, as already mentioned, exists in two forms, viz., the smoke-*box* and smoke-*tube* forms. The present article deals with the latter, and the smokebox superheater will be made the subject of a second article. Each type has advantages over the other in the matter of adaptability to meet particular circumstances in the design of the locomotives. In the smokebox type of superheater, the general arrangement of which is illustrated in Fig. 1, the upper part of the boiler is fitted with from two to four rows of large smoke tubes, which are expanded into the firebox and smokebox tube plates in a special manner. These tubes are from 4 ins. to 5¼ ins. inside diameter, except near the firebox and where the diameter is slightly reduced. Inserted in each tube is a superheater "element," or section, consisting of two sets of pipes bent in the form of a U and connected, at the smokebox end, to a header, thus forming a continuous double-looped tube. The steam has to traverse each element to and fro. In

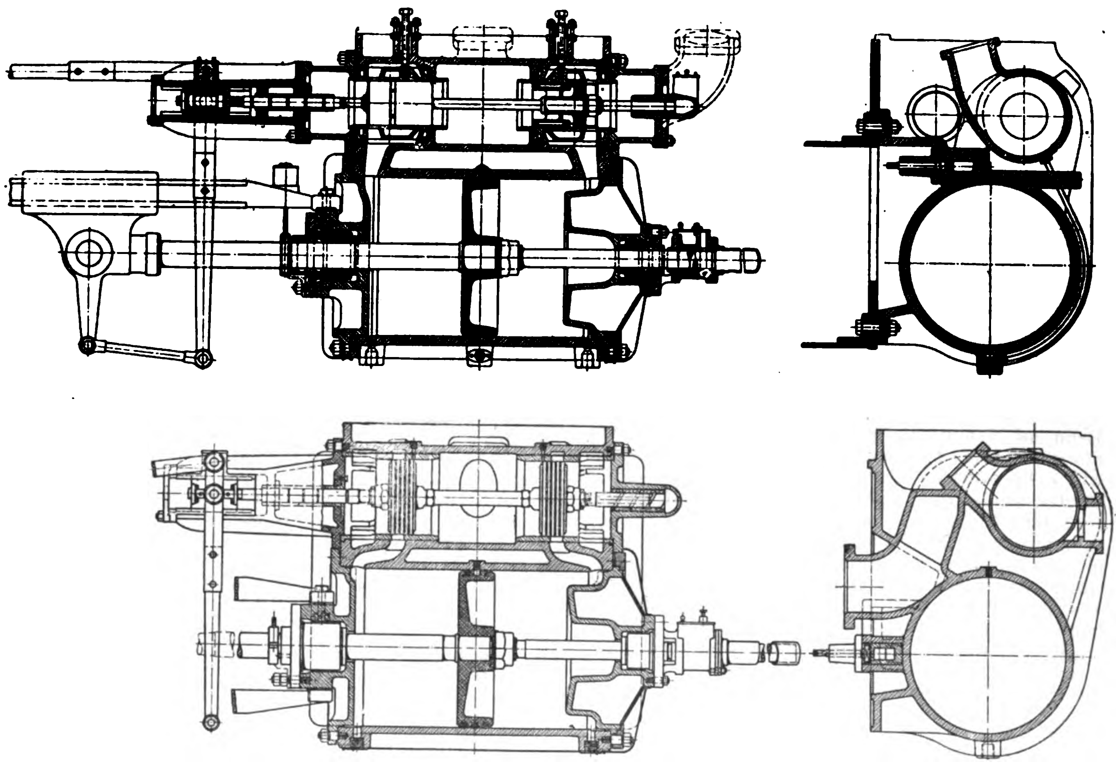

Fig. 2.—Details of Cylinders, Piston Valves, etc.: Schmidt's Superheated Steam Locomotive.

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the original arrangement of the apparatus, now superseded, each element consisted of two separate single loops, but the double looping of the superheater pipes, now adopted, has the advantage of increasing the velocity of the steam through the tubes, with the result that the temperature of the latter is lowered, and their life correspondingly lengthened. The open ends of each element extend into the smokebox, where they are bent slightly upwards and expanded into a common flange, which is secured to the face of the steam collector by a single central bolt.

(*To be continued.*)

Electrical Transmission of Photographs.

We are indebted to the Editor of the *British Journal of Photography* for permission to reproduce the following article, which appeared in the above journal of November 22nd, 1907:—

The fascinating problem of transmitting pictures by wire has occupied the minds of many photographic scientists (*cf.* R. Liesegang *Die Fernsehen*), and recently general attention has been drawn to it by the remarkable results obtained by Prof. Korn, of Munich. As was intimated some months ago in our columns, a French scientist, M. Edouard Belin, of Nancy, has been also engaged with this question, and the interview and demonstration which he afforded at the Société Francaise de la Photographie, Paris, inspire confidence that a very considerable advance has been made. It is known to many that M. Belin has made himself expert in sensitometric problems, and it is these studies which have led him, he claims, to the solution of some of the most important problems in technical photography. Transmission of a given photograph by wire, a self-registering opacity-meter, a registering sensitometer, and last, not least, the transmission by wire of the image of any given person, object, or proof! The last problem, not to be confounded with the first, is the one M. Belin has been longest devoted to, but, having put it aside for the others, its solution is not complete. None the less, he is confident of success, and that fairly soon. The first question, which has attained a certain solution from Herr Korn, M. Belin claims to have completely solved, but in a quite different manner, and also fulfilling certain conditions of which Korn's method is incapable. These are:—

(1) That the image received should be of precisely the same dimensions as that transmitted: Korn's images are reduced in size.

(2) That they should be reproduced, or reduced, or enlarged, if desired, but the detail should remain on the same scale as if the original size were preserved.

(3) That, whatever the original, a positive or negative image can be formed at will at the receiver. The value of this for photo-mechanical processes is obvious. The nature of the original is simply telephoned to the receiving station, when adjustment is made accordingly.

(4) Further, the image received shall be of the same intensity as the original, or, if desired, can be intensified or reduced. And this is obtained by no subsequent chemical treatment, but during transmission by a simple physical adjustment.

It now remains to describe the apparatus which performs these marvels. The complete model installation, containing transmitter, receiver, motor, and a resistance-line of 4,000 ohms, equivalent to several hundred kilometres, is mounted on a stand about a metre square, and M. Belin kindly explained the functioning of the apparatus. The two photographs give a very good idea of its disposition.

Telestereography.

To commence with, the method is entirely different from that of the German *savant*, which, as is well known, utilises the varying electrical resistance of selenium when exposed to light. Belin calls his procedure "Telestereography," or transmission of a relief to a distance, and one essential lies in the use of a carbon print as the original transmitted, such a print being, of course, a relief in which the contours are proportional to the intensities of the image.

This print is wound on the cylinder of the transmitter T. In perfect synchronism with this revolves the cylinder of the receiver R, the synchronism being effected by the use of an alternating current in the same manner as adopted by Prof. Korn.

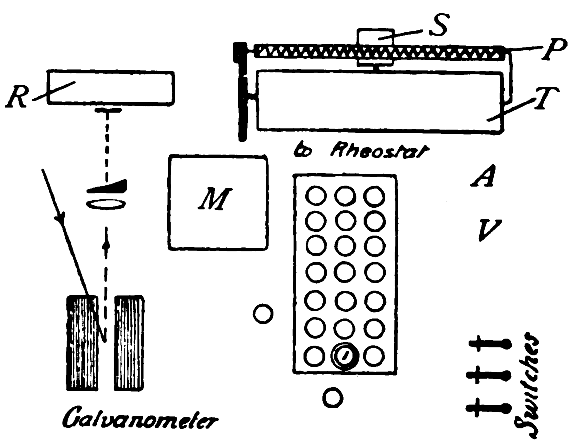

Fig. 1.

A, Ammeter; V, Voltmeter; O, Resistance Coils; o, Main resistance; S, Style or point; R, Receiving cylinder; T, Transmitter.

As the cylinder of T revolves, a small point or style in contact with it moves along the axis P, which is geared on to the cylinder or drum. The conditions chosen are such that the print advances lineally 1 mm. for six turns of the cylinder, from which results that detail down to $\frac{1}{6}$ mm. is faithfully reproduced. The movements of the point or style are transmitted by an arm to a small sliding contact or roulette, working on a minute rheostat. This rheostat consists of twenty very small plates of copper separated by layers of mica and each branching off to a resistance coil.* There

* M. Belin explained that he had chosen a range of 1–20 as representing the possible range of contrast in photo-mechanical processes.

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are thus twenty variations of the intensity of the current possible. At the commencement, before alteration introduced by the cylinder, there is simply a large resistance *o* of 4,000 ohms, the movement of the transmitting cylinder and the style then call into play the variations, always according to the contours of the carbon image, and hence in proportion to the values of light and shade. One may compare the arrangement to a delicate finger, running over the relief and transforming the variations of intensity into variations of electrical current. It will be seen that such difficulties as Korn's method has to meet, in the "chemical sluggishness of selenium," are entirely avoided in that of M. Belin, which depends on purely physical action. Nor is it a small advantage that the carbon print is of great permanence and durability. So much for the transmitting mechanism.

The Receiving Apparatus.

The variations in the current of the circuit, proportional, as they are, to the intensities of the image, are registered by the extremely delicate galvanometer of Blondel, known as the oscillograph. The great advantage of this instrument is its immediate response to variations of current, it being capable of following changes occurring as fast as 50,000 per second. On the mirror of the galvanometer falls a beam from a Nernst lamp, the oscillations of the reflected ray are then proportional to the intensities of the current. *Bien*! Let us follow the reflected ray.

The diagram (Fig. 2) explains the disposition which enables the registration as a photograph to be effected of these electric fluctuations. An aplanatic lens *l* throws an image of the reflected ray from the mirror *f* on to a small hole *f*2, this hole being $\frac{1}{6}$ mm. in diameter; *f*1 and *f*2 are conjugate foci of the lens. Behind this minute hole revolves the second synchronised receiving cylinder R, on which is a photo-sensitive surface. The hole is so near the film as practically to be in contact with it, so that any diffusion of light is avoided. In other words, an image of the hole is continuously printed on the film, and this means that detail is preserved to $\frac{1}{6}$ mm. Under these conditions, there would still be no variation of the light intensity. The way this is effected—that is, the method by which the deviations of the galvanometer are converted into light intensities—is ingenious. Behind the lens (see Fig. 2) is a scale of tones, *i.e.*, of densities (in the sense of Hurter and Driffield), increasing from bare glass to a certain value; in fact, an optical wedge. Various ways of producing this optical wedge may be employed: at present M. Belin uses a photographic plate specially exposed. The scale of densities increases in proportion to the mirror deviations, *i.e.*, to the intensities of the current, and the more (or less) the reflected ray deviates, the more (or less) it is absorbed, so that the hole is illuminated by light varying in intensity with the intensities of the original image. The density-scale is mounted on a revolving axis, so that according to the direction of increase of density, relative to the mirror deviations, a positive or negative image can be obtained at will on the receiving film, fulfilling the third condition mentioned at the start.

Intensifying or Reducing.

Again, if instead of a scale of tones corresponding to those of the original, one of harder or softer gradation be substituted, the image may be obtained reduced or strengthened in intensity, and by purely physical means.

It must be confessed that both the ingenuity and the comparative simplicity of the apparatus make it very promising. The results obtainable at present are very fair, and M. Belin hopes by certain slight modifications, such as a refinement of the rheostat and the cursive point, to greatly improve the rendering. He claims that in transmission of detail his apparatus is greatly superior to that of Prof. Korn, and its capacities in other directions also appear to transcend those of the selenium telectrograph. In a few weeks, with the promised aid of the State telegraph lines, he hopes to give a public demonstration of its

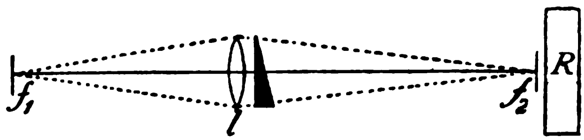

Fig 2

capabilities over long distances, an event which will be awaited with much interest. M. Belin states that he can also transmit writing in relief by his instrument, and that the question of speed is one chiefly conditioned by the fineness and perfection of mechanical and electrical details. At present the transmission of 9 by 12 cms. image occupies about thirty minutes.

As to the more romantic problem of simultaneously photographing and transmitting the image of any object, scene, or person, M. Belin would only state that the idea involved was entirely different from that sketched above. His last words were: "*Nous verrons*!"

The "M.E." Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows :—

SILVER MEDAL to the fastest boat in Class A beating previous records.

BRONZE MEDAL in Class A to all other boats beating previous records.

SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.

BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.

SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.

BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given to all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; to Class B vessels with an average speed of not less than four miles per hour; and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

How to Make an Inter-Communication Telephone.

By FRED RUDOLPH.

(*Concluded from page 572.*)

SELECTOR SWITCH.

THIS is shown in Fig. 16. The switch lever A is made from sheet brass, cut and shaped as shown on drawing. A brass or ebonite knob is fixed on the arm to facilitate the handling of switch. At the other end a suitable hole is drilled to admit a shouldered clamping and connection screw B and washers C and D. The whole switch can be either lacquered or nickel-plated, care being taken in the former case to keep the contact parts E free from lacquer.

From the drawings and description in the foregoing articles, the writer thinks that, with moderate care and a little trouble, a really efficient telephone system can be made by any reader of THE MODEL ENGINEER, and if the explanations and drawings of a hitherto little explained subject have been of any service to any reader, the trouble of preparing same will have been amply repaid. Any point not perfectly clear will be gladly made clear if any reader finds himself in any little difficulty.

NATIVES OF HAMMOND ISLAND SAILING THEIR MODEL YACHTS.

Native Model Yachtsmen.

THE very interesting photograph we reproduce on this page has been sent to us by Mr. B. S. Lovett, of Hammond Island, showing a number of natives sailing their model cutters. He says, referring to the boats, they have an outrigger, and sail well. It may be mentioned that this island is one of the Prince of Wales' group, of which all the natives are clever on the water.

THE *Engineer* records that the P. & O. steamer *Caledonian* has broken the record from London to Calcutta, reaching the Hooghley in under twenty-five days from London.

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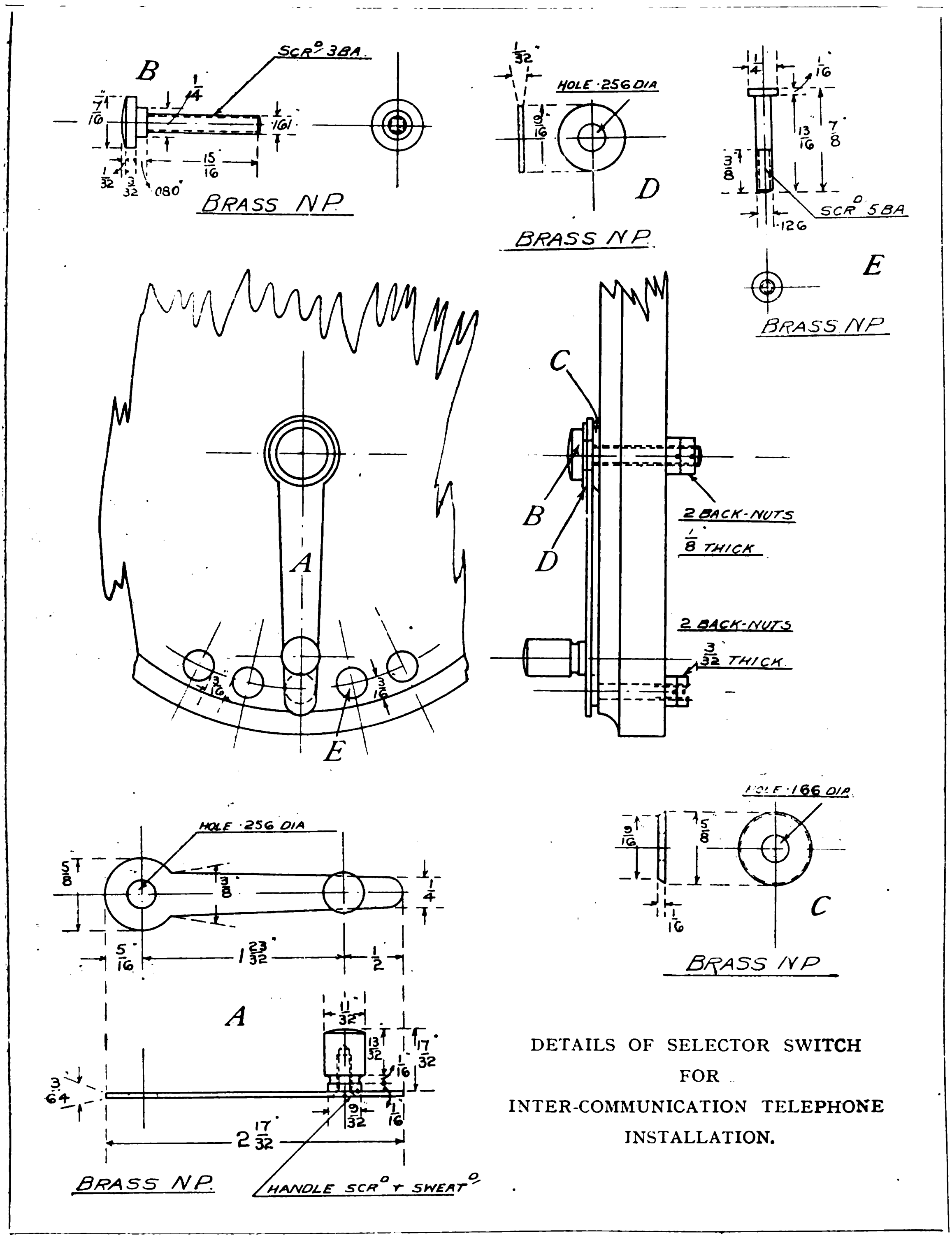

DETAILS OF SELECTOR SWITCH FOR INTER-COMMUNICATION TELEPHONE INSTALLATION.

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.*]

Two-way Ammeter Switch.

To the Editor of *The Model Engineer*.

Dear Sir,—Below is shown the connections of a two-way ammeter switch by means of which one ammeter is dispensed with when the current is required to be read in two separate circuits. The switch itself is of any construction suitable to carry the current. The switch brush must be made to bridge the gap between the contacts A and B. The connections being made as shown, and the switch arm being placed in the position shown full on B, the current comes from the dynamo through A, to the ammeter, part goes to lights and part to B through switch to C and then to motors, the ammeter registering current given from dynamo. If switch is moved to dotted position on A, the current

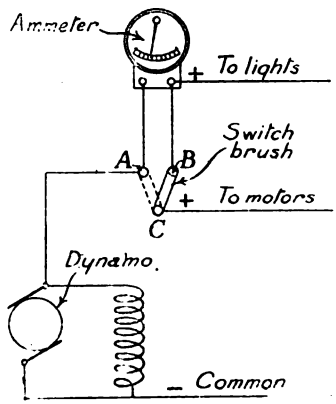

Diagram of Connections of a Two-way Ammeter Switch.

comes from dynamo to A, part to ammeter, and part to C and to motors; the remainder goes through ammeter to lights. This registers current going to lights. By substraction you get current going to motors. By this means you get total current from dynamo, current consumed by lights, and current consumed by motors—all on one ammeter.—Yours truly, R. C. T.

On Making a Small Tesla Coil.

To the Editor of *The Model Engineer.*

Dear Sir,—Some years ago I made a small Tesla coil, similar to the one described by F. E. Bornhardt, in May 10th issue, 1906, the secondary being wound with No. 28 s.c.c. wire, but did not get good results until I wound the secondary with No. 36 s.c.c. The change worked wonders. I enclose you one or two photographs taken of it. I used a ½-in. spark coil I made from instructions in your handbook on coils. I have discarded the spring contact breaker altogether, and use a mercury break, which I made partly from instructions given in the same book. It is made from an electric bell. I only use one glass bottle, which is sunk into the base and held firmly by three long screws, which pass through a brass plate which is fixed in the wooden part of the cork. One of these screws acts as a connection to one of the terminals, and a flexible wire is soldered to the insulated end of the dipper holder and carried neatly along past the insulations into the bell cover through the base to the other terminal. I use a much stronger spring on the armature, thus :—

I have soldered two terminals on the cork plate, one on each side of the dipper rod, with screws sideways. Copper wires pass through : one dips into the mercury, and is easy to renew when eaten away by the mercury ; the other wire is screwed into

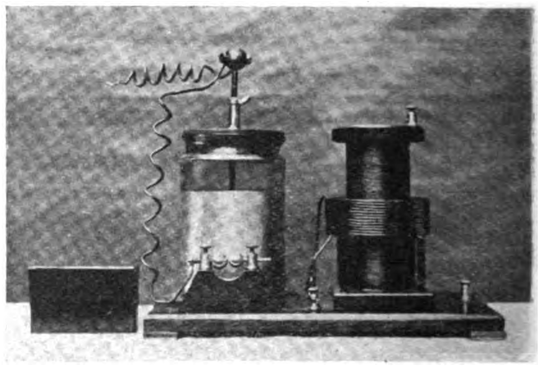

Fig. 1.—Tesla Coil.

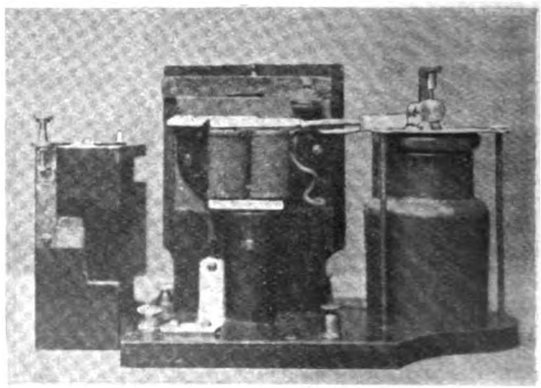

Fig. 2.—Mercury Break.

a cast-iron ring to regulate the height of the mercury. The break is further improved by the screw and sliding plate fixed on the end of the cover. A piece of flat rubber is riveted to the end of the plate, which fits under the arm of the dipper. It will be plainly seen that by turning the screw the plate holding the rubber can be moved up or down, and will not only regulate the dipper, but also act as a

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silencer to the break, which I think will be appreciated by all users of these good but noisy pieces of apparatus. I also send you a photograph of the break, which works well, and has a neat appearance. You will notice that the bottle is covered with opaque material; also the spark gap on the Tesla is covered by a cardboard box to protect the plates from light when taking spark photographs.

I have other models made and in making, that I may send photographs of at some future time. Most of them are taken from THE MODEL ENGINEER. I have two drawers full of back numbers, but it will be a long time before they are in the market for sale.

I might mention that my small Tesla coil will light up the various metal filings beautifully, which I have mounted between glass plates and will

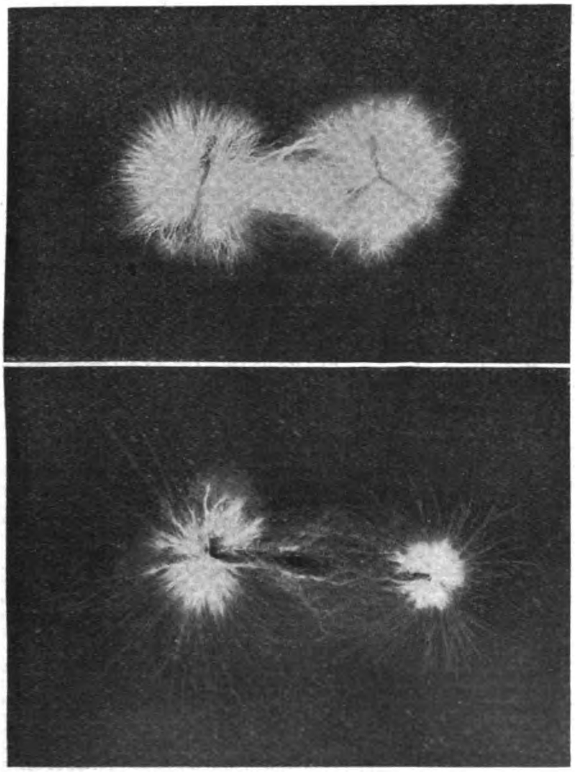

FIG. 3.—SPARK PHOTOGRAPHS.

light up broken filament, 4- and 6-volts sizes, without touching the terminals.—Yours truly,

Bolton. J. FLETCHER.

EIFFEL TOWER TIME.—According to the *Electrical World*, the Eiffel Tower has been utilised for public time service; a set of electrical numerals, changing every minute, has been installed high up on the tower, and tells the time at night not only to all Paris, but far beyond the city limits. Unfortunately, such an indicator cannot be made visible at an equal distance in the daytime.

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 Friday, November 29th, at the Cripplegate Institute, Golden Lane, E.C., Mr. A. M. H. Solomon taking the chair, and upwards of eighty members and visitors being present.

The Secretary having read the minutes of the last ordinary meeting, and a new member having been elected, the Chairman gave notice of the Committee's intention to expend a portion (not exceeding £5) of the Society's Capital Fund in the purchase of several important new works to be placed in the Society's Library. The proposal was put to the meeting, and it was unanimously resolved that this expenditure be made. The Chairman also announced that a presentation had been made to the Library of Messrs. Lukin's and Marshall's books on Turning, and of several volumes of *Cassier's Engineering Magazine.*

A discussion took place as to the advisability of postponing the Annual Conversazione, due to be held in January next, to a later date in the year, the possibility being mentioned of holding a combined Conversazione and Model Making Competition in May next. A motion having been duly proposed and seconded that the Conversazione be postponed was put to the meeting and carried unanimously.

The Chairman then called upon Mr. L. M. G. Ferreira to give his further series of "Model Making Wrinkles." The lecturer had brought to the meeting a vertical launch engine and boiler which embodied many of the improvements mentioned in his former paper—notably, the small water gauge and injector. The model was shown under steam, the action of the injector being observed with great interest. The one fitted to this boiler was the subject of the illustration which appeared in a recent number of this Journal and injected 6 ozs. of water in a very few seconds against a steam pressure of 20 lbs. Its behaviour was consistently most satisfactory during the time the boiler was under steam. Mr. Ferreira then proceeded to describe and illustrate a number of handy and ingenious wrinkles in various branches of model making, particularly dealing with the making of small lathe tools and holders, a number of these being handed round for the members' inspection. At the close a very hearty vote of thanks was proposed by Mr. John Wills and carried with acclamation. A fuller report of this lecture will be given in an early issue of this Journal.

FUTURE MEETINGS.—The next meeting will be held on Friday, January 3rd, 1908, at the Cripplegate Institute, when a series of demonstrations in turning, wire drawing, silver soldering, filing, marking out, etc., will be given by various members.

A series of visits is being arranged to various places of engineering interest in and around London, the dates of the visits and particulars will shortly be announced in this column, and members are requested to note this.—Full particulars of the Society and forms of application may be obtained from the Secretary, HERBERT G. RIDDLE, 37, Minard Road, Hither Green, S.E.

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Queries and Replies.

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

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

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

[18,105] **Steam Port and Valve Proportions.** F. McI. (New York) writes: Will you kindly let me know what number of revolutions per minute (about) a horizontal engine of 1 3-16ths-in. bore and 2-in. stroke, with ports (steam, 3-32nds in. by ⅞ in.; exhaust, 9-32nds in. by ⅞ in.; port bars, ⅛ in.) would give at 60 lbs. boiler pressure? Valve measurements—outside, 1 in. by 1 in.; inside, 17-32nds in. by ⅞ in. (see Fig. 1). What advance should be given to eccentric, and what indicated horse-power will it develop?

We recommend that you make the steam ports ⅛ in. wide, instead of 3-32nds. in., without increasing the length of the valve. This will lessen the amount of lap, but we submit that you would be advised to do this in any case. With the altered proportions, provide an eccentric which has 7-32nds throw (7-16ths in. travel), and give it ⅛-in. advance. The lead will then be 1-64th in., and the point of cut-off 68 per cent. of the stroke. The engine will develop about ⅛ i.h.-p. at 50 lbs. pressure and 500 r.p.m. Five hundred revolutions per minute is the highest speed at which we would advise you to work the engine. Provide a boiler with about 250 to 350 sq. ins. of heating surface for this power.

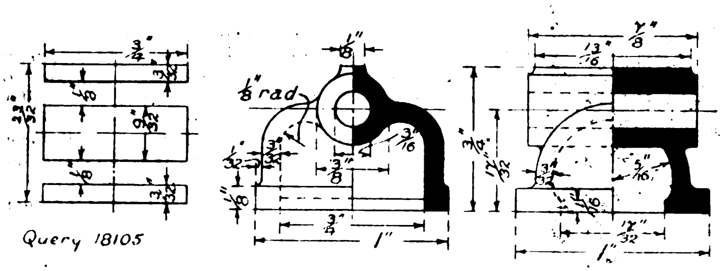

FIG. 1.

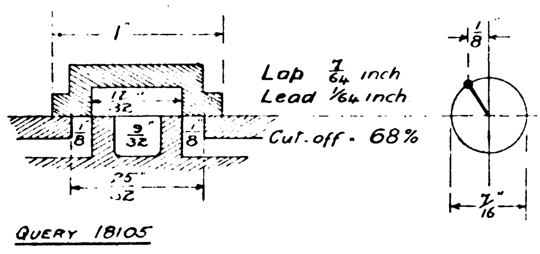

FIG 2.

STEAM PORT AND VALVE PROPORTIONS.

[18,377] **Return-Tube Model Marine Boiler.** W. J. W. (South Wales) writes: (1) After reading your valuable handbook on "Model Boiler Making," I have decided to make a boiler, same design as given in Fig. 15, A, Page 45, this size being suitable for a cylinder ¾-in. bore by ¾-in. stroke. Would this boiler want reducing to make it suitable for a slide-valve cylinder ⅝-in. bore by ⅝-in. stroke; if so, will you kindly give me dimensions? (2) Would the flue tubes and water tubes require to be silver soldered in to work at the given pressure, *i.e.*, 50 lbs. per sq. in.? (3) If so, where can I obtain silver solder, and how is it worked? Would I require a blowlamp to work it with, or could a methylated spirit lamp be used? Could you recommend me any of your handbooks on the subject? (4) Is it essential that a blowlamp be used for steaming, or could a spirit lamp be made to fit in the furnace tube and fired in this way, as shown in diagram? (5) Would the exhaust be required to be nozzled and led up the uptake with any method of firing adopted? (6) What is meant by the "blower stay" shown in the end view of boiler? (7) How can the fittings be arranged on this type of boiler, since the smokebox nearly covers one end and the combustion chamber covers the other end? I should like to fit a glass water gauge check valve and blow-out cock to the end of this boiler, if you will favour me with advice and show me any alteration that might be necessary.

(1) You will find that the boiler will satisfactorily work a single-cylinder engine ⅝-in. bore by ⅝-in. stroke. (2) The water tubes must be silver soldered into the furnace tube, otherwise you will only court disaster. The flue tubes may be expanded in at one end and screwed with a fine thread at the other or expanded in at both ends. (3) You will require a gas blowpipe or a blowlamp for silver soldering. See the excellent article in our issue of April, 1903. (4) A benzoline lamp will be required for the purpose of firing the boiler. A spirit lamp is out of the question. (5) You will find the use of the exhaust for the purpose of inducing the draught quite satisfactory, it not absolutely necessary to success. Nozzle the exhaust according to the rule in "The Model Locomotive." (6) A blower stay is a hollow stay through which the steam for the blower jet passes from the backplate to the smokebox. The blower pipe may proceed from the top of the boiler, and after being coiled in the combustion chamber, proceed through the boiler to the smokebox. (7) Arrange the fittings on the side. A blow-off cock may be fitted under the smokebox. This had better be of the screw-down pattern.

[18,387] **Model Locomotive Queries.** W. R. T. (Anerley) writes: Some time ago I wrote to you when making a boat, and, as a result, it turned out a jolly good model. I am now, with the help of "The Model Locomotive," building a small locomotive, ¾-in. scale. It is a mongrel, being taken from Mr. Greenly's design for N.E.R. 4—4—0, but with 1⅝-in. trailers, substituted for the 3⅛-in. coupled wheels, making it 4—2—2, and an Atlantic type boiler. (1) Will the boiler (outer casing 2⅜-in. light brass), 10 ins. by 2 ins. by 1-16th-in. copper, with ⅜-in. tubes, all tubes solid drawn as well as boiler, and well brazed together, supply enough steam for two ¾-in. by 1-in. cylinders with 3⅛-in. driving wheels? The engine seems to be getting rather weighty. (2) Which is best of three, four, or five water tubes? (3) What pressure (maximum) will boiler safely stand?

(1) Never mind the weight. Make all parts as well as you can, seeing that everything is perfectly free without being slack, and you will have no difficulty. The boiler and the valves must be perfectly steamtight, and the pistons and glands well packed. (2) You will find four tubes best. (3) If brazed throughout, about 150 lbs. safely. The bursting pressure would be somewhere about 750 lbs. per sq. in. The brazing (silver soldering) should be well done, and unless you have had some experience you had better send it out to be done, or, commencing with the smaller pieces of the work, gradually gain proficiency, until you feel confident of making a success of the boiler.

[18,380] **Engine for Dynamo Driving.** B. L. K. writes: What size dynamo (in amps. and volts) should a horizontal steam engine (cylinder, 1⅛-in. bore by 2½-in. stroke), working at 60 lbs. per sq. in., drive? What is the nominal horse-power of this engine?

The indicated horse-power of the engine (nominal horse-power is a term quite out-of-date now, and conveys nothing at all), at 500 r.p.m., is A × L = ½ i.h.-p. A equals area of piston and L length of stroke in ft. You therefore ought to get ½ of ½ of 746 watts = 180 watts. We would advise putting in a 150-watt dynamo if the boiler you have will really maintain 60 lbs. per sq. in. when the engine is working under load. The boiler requires about 100 sq. ins. of heating surface.

[18,462] **Model Locomotive Boiler Tubes.** W. P. (Ynyshir) writes: I have partly made a locomotive boiler—barrel, 13 ins. long (outside); firebox, 6 ins. long, 5½ ins. deep from boiler centre, and 3¼ ins. wide. I wish to use one flue-tube crossed with water-tubes. How many tubes shall I use? I intend riveting both ends of flue-tube to tubeplates with copper angle-rings.

You will be unwise to adopt this idea. It was favoured in the

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early days of model locomotive building, but experience has proved that a large number of small flue tubes gives best results. Use ⅜-in. tubes, screwing them in with a taper thread at the firebox end and expanding them in at the front tube plate (in the smokebox).

[18,417] **Charging Cells.** A. W. (Lewisham) writes: I should be extremely obliged to you if you would answer this query for me. I want to make a charging board for charging accumulators. Can you give me an idea as to the wiring of same (as per sketch), so as—by pressing the press-button—the voltmeter will indicate the voltage of the cell being charged.

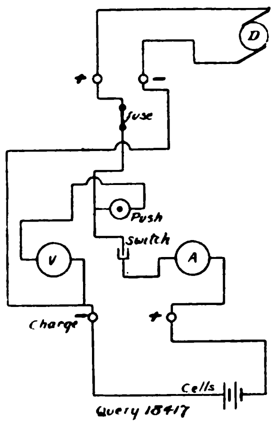


DIAGRAM OF CONNECTIONS FOR CHARGING CELLS.

The above diagrams give the connections for a small charging set, with the voltmeter connected across the mains and in circuit with a push-switch. To test voltage of cells, the voltmeter should be connected across their terminals.

[18,385] **Model Locomotive to Carry the Driver.** J. B. (Tottenham) writes: I should feel very grateful if you could answer the following questions, with a sketch if possible. For a six-coupled goods locomotive and tender or a good tank locomotive, and able to haul just over 9 stone, to be fired with Primus burner, what class would you recommend? Do you think the Caledonian would do well, or what other class would be best? What is the smallest scale for pulling the above weight on a level track? What would the gauge be, and sizes of cylinders, boiler, and wheels? Would you advise the water-tube boiler or the ordinary locomotive type; if to be the latter, what size and number of tubes? I should like to be able to get drawings to work from. I was much interested in the six-coupled locomotive which was running at the Exhibition and able to pull a man along at a fair speed. I want to build one as simple as possible with plenty of power. Would slip eccentrics do well or the reversing be better?

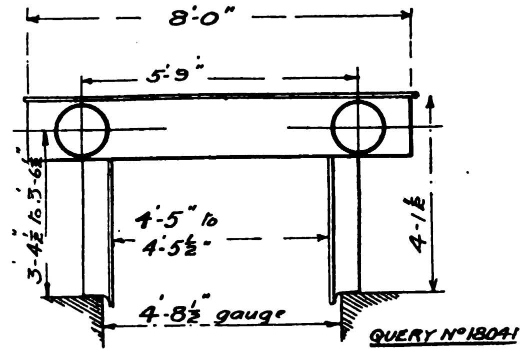
The smallest scale advisable is 1 in., but, of course, 1½-in. scale is much to be preferred, as there will be less attention required. Coal fire may be used, and the experience of actual locomotive practice more nearly obtained. The cylinders, frames, and motion plates may be of iron or steel, and the first cost of materials for the engine will not be very much greater than for a smaller engine involving the use of brass and copper. A steel boiler may be used. Link motion or Joy's valve gear may be fitted without involving any of the difficulties of construction present in an engine of small size. Much more fun can be obtained from a larger engine, which will have a good load. A 1½-in. scale engine should be capable of hauling two passengers easily. A small engine of pretentious character will be found more troublesome to build, more costly, and less satisfactory in working than a large scale locomotive like that on page 36 (Fig. 29) of "The Model Locomotive."

[18,390] **Boiler for Dynamo Driving.** P. W. F. (Torquay) writes: Will you kindly tell me if the following boiler, 12 ins. by 24 ins., with 12 steel 1½-in. tubes across firebox, central flue, forced draught, is big enough to drive a horizontal engine, 2-in. by 4-in. cylinder, 4-in. stroke, driving a dynamo 25 volts 8 amps., or 200 watts? The steam pressure is 60 to 70 lbs. per sq. in. Boiler will work to 100 lbs. pressure, and tested to 200 lbs.

A 12-in. by 24-in. boiler will not drive a 2-in. by 4-in. engine satisfactorily. We do not care for cross tubes in the firebox unless you arrange some means whereby the firebox may be readily taken out, as in a steam fire engine boiler. We recommend a 16-in. by 30-in. boiler with plain flue tubes (say 16 tubes, 1½ ins. diameter). For dynamo driving the boiler power must not be reduced to the absolute minimum. Something should be allowed for adverse conditions of working.

[18,041] **Standard Railway Buffer Heights.** F. V. L. (London) writes: What is the width between centre to centre of buffers on all standard engines on English lines, 4-ft. 8½-in. gauge? Are the buffers on the Metropolitan sloping end electric engines same as engines on other lines? I am making a ½-in. scale model of one of this type, and have a blue print and everything, but it does not show dimensions asked for, as above.

The standard distance between buffers is 5 ft. 9 ins., though on some railways drawings of locomotives and carriages show the dimensions as 5 ft. 8 ins. The height from level of rails varies slightly. Sometimes it is figured on official drawings at 3 ft. 4½ ins.; but on the L.N.W.R., all new vehicles are built with the centres no less than 3 ft. 6½ ins. above rails. We suppose this is to allow for wear of tyres and the general settling down of the vehicles in their springs when fully loaded. We append a list of dimensions



STANDARD RAILWAY BUFFER HEIGHTS.

adopted by leading model manufacturers as standards for various gauges. The Metropolitan electric locomotives conform to the standard dimensions, as they are intended to haul the standard goods wagons and coaching stock.

Scale.	Gauge.	Buffer Centres.	Height from Rail.
No. 0	1¼ ins.	1 in.	1 9-16ths. in.
No. 1	1¾ ins.	1⅜ ins.	2¼ ins.
7-16ths in.	2 ins.	1½ ins.	2⅜ ins.
½ in.	2½ ins.	1¾ ins.	2⅞ ins.
11-16ths in.	3¼ ins.	2⅜ ins.	3 15-16ths ins.
¾ in.	3½ ins.	2⅝ ins.	4 5-16ths in.
1 in.	4¾ ins.	3½ ins.	5¼ ins.
1¼ ins.	6¼ ins.	4⅜ ins.	7¼ ins.
1½ ins.	7¼ ins.	5¼ ins.	8⅝ ins.

[18,331] **Power required for Running Dynamo.** H. B. (Ainsdale) writes: I have a spark coil which I made, and it gives a very strong shock, capable of killing a large rat, but the bushy spark which it gives at the secondary terminals hardly exceeds 1-32nd in., when joined up with about four 1-qt. Leclanché cells. It has also a large condenser connected one end to the break pillar, and the other to the hammer. Can you tell me the cause of so small a spark, and how to rectify? I also have a 1 kw. shunt-wound dynamo giving 100 volts for twenty 16 c.-p. lamps, is there a more economical way of lighting, say, 8 to 12 of the lamps, as seldom more than this number will be required at one time, without the intervention of accumulators, as it will, in my case, be too costly a matter to have a 2 b.-h.p. oil engine driving the dynamo for only half the quantity of lamps the dynamo is capable of lighting. If not, please give me the number of accumulators I shall need, along with the volts, and amp.-hours of each for twelve of the above lamps. Also the best way to charge them, and for any other details regarding the above matter I shall be obliged. Would it be better and cheaper to have two 50-volt 10-amp. dynamos driven separately with two 1 b.h.-p. engines? If so, how should I join up the dynamos?

A dynamo takes power from the engine which drives it according to the number of lamps connected at that moment. If you switch off lamps, less driving power is taken; if you switch on lamps, more driving power is taken. The power required by the driving belt friction in the dynamo and field-magnet winding remains practically the same. If you have a smaller dynamo it will not be of so high efficiency, so there will not be much gain. If you use accumulators there will be a loss to provide for, because you have to put in more energy into the accumulator than you will get out again. To light 100-volt lamps you will require 53 accumulator cells in series, about 30 amp.-hour size, to charge at the same time as you are lighting the lamps (see our handbook No. 1 on "Small Accumulators"). There is no advantage to be gained by using two dynamos. *Re* spark coil, Leclanché cells are not suitable; try bichromate pattern cells or accumulators.

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[18,410] **Engine for Small River Launch.** W. B. D. C. (Exeter) writes: I should be much obliged if you will kindly help me out of a little difficulty. I am thinking of fixing a compound engine to a boat (fairly heavy) 17 ft. 6 ins. long. What ratio cylinders and what length stroke would you recommend, working at 150 lbs. per sq. in. boiler pressure? Would you advise double slide-bars? Do you think turbines could be fitted to work with any success?

We can recommend you, from experience, a compound engine with cylinders 2¼ ins. and 4 ins. by 3-in. stroke, and if you wish to save expense in pattern making, we may mention that you can obtain castings of an engine of this size from Stuart Turner, Ltd., Shiplake, Henley-on-Thames. There is no advantage in double slide-bars where the boat will run for the most part in the one direction. With regard to the working pressure, you need not work the engine at 150 lbs., if a condenser and air-pump are used; 120 lbs. per sq. in. would do. The condenser may be simply made by running the exhaust pipe outside the skin. If a turbine was well designed and made in a first-class manner, you would get good results; but, as a "Parsons" turbine is out of the question, you might have some trouble in satisfactorily gearing down the turbine to the propeller shaft.

[18,289] **Multipolar Dynamo.** A. W. B. (Stanningley) writes: I have purchased a set of castings for Mr. Avery's multipolar dynamo—20 volts 4 amps. at 1,200 r.p.m., and would like to ask you the following queries—(1) I would like to order the wire for magnet and armature, but as the weight is not given, I have no idea what quantity I shall require, as my drawing only shows me the number of turns, not mentioning the weight. Should be obliged if you would tell me how much No. 24 and how much No. 22 to get—a little over rather than under the quantity. (2) Could I make another of the same dimensions, etc., to run as a motor, direct-coupled, to drive the above, as I have nearly another set of castings and enough stampings to build another. Should I require a different winding; if so, kindly give me windings? (3) I do not quite understand the diagram of brush connections. Could you give a different diagram explaining it more fully, showing the beginning and finishing ends of each bobbin on the magnet? My drawings are from The Model Engineer of December 15th, 1902.

(1) Field-magnet will require about ¼ lb. of wire on each pole. Armature will take about 1½ ozs. for each pole. (2) Yes, but as the machines are of equal size, the motor could not drive the generator to its full output of 20 volts 4 amps. unless for a very short time, as the motor would have to take so much energy that its coils would over-heat. It could, however, drive the generator to less than full output, as determined by experience when running the

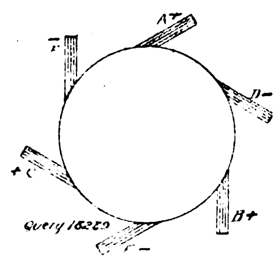


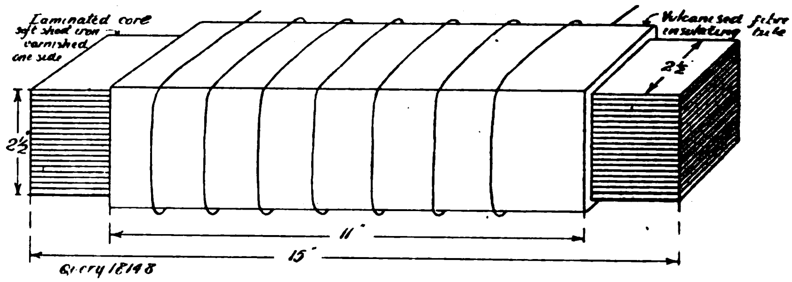
Diagram showing Brush Connections of Multipolar Dynamo.

machines. You do not say what voltage the motor is to be wound for; this will determine the windings. As a pair of these machines coupled would make a pretty model, we think you may well fit up the second machine as proposed. You can use the same winding for the motor armature, and supply it with current at a voltage high enough to obtain the desired speed; possibly about 30 volts will be necessary. We should advise No. 24 gauge wire for the motor field in this case. (3) The brush connections are quite simple. The brushes are set at equal spaces upon the commutator. There are three positive brushes and three negative brushes; the respective polarity will appear when you drive the machine, but the positive brushes will alternate with the negative brushes, as sketch above. All positive brushes must be joined together, and all negative brushes joined together. Thus, you will join brushes A, B, and C together and to one pole of the machine, that is, to one end of the field-magnet winding. Brushes D, E, and F must be joined together and to the other end of the field-magnet winding. You need not trouble as to which are positive and which are negative brushes, but merely connect alternate brushes together, as explained. When you start the dynamo they will determine their own polarity. If machine does not excite, try shifting the rocker forward or back by the space of one magnet pole to the next.

[18,418] **Valves and Valve Gearing.** E. G. P. (Acton) writes: Would you please send me a diagram and an explanation of Stephenson's link motion reversing gear, to suit double-action slide-valve cylinders?

Your query would involve a reply too lengthy for insertion in the ordinary way. We can recommend you our handbook, the "Slide Valve" (price 6d. net, 7d. post free) as a preliminary study, and for further information on the design and construction of model valve gears the chapters (VIII and IX), "Valves and Valve Gearing" and "Motion Details," contained in Greenly's book, "The Model Locomotive: Its Design and Construction," price 6s. net, 6s. 4d. post free. Special reference may be made to model for working out slide-valve and link-motion problems, illustrated by Figs. 158 169, and 170. The chapter on "Cylinders and Valves" should also prove useful.

[18,148] **Choking Coil.** "Bioscope" writes: It is required to make a choking coil for bioscope working for 35 to 40 amps., voltage 110, single-phase, fifty periods. Will you kindly state



Choking Coil.

size, shape, and weight of core and size and weight of wire needed for winding.

A choking coil must be largely determined by a method of trial and error. We advise you to try one as sketch herewith. To keep iron core plates together, wind linen tape tightly on as a binding. Core is to slide easily in the insulating tube. Tube to be wound with about seventy turns of No. 8 gauge D.C.C. copper wire in two layers. If the choke is not enough, wind on some more wire; if it is too great, withdraw iron core more or less from tube. About 6 lbs. of wire will do for the first trial.

[18,413] **Annealing Brass and Copper.** J. R. S. (Pelton) writes: I am going to make a ½-in. scale locomotive, but I find that when I want to bend the brass or copper it shows signs of breaking where I try to bend it. Do you think I should put it through the fire and then put it into cold water to take the temper out of it; also, what should I do to make joints steamtight? I find that ordinary solder does not stick to copper as it does to brass. What should I use?

Before brass or copper can be subjected to any considerable amount of bending or working it must be annealed, *i.e.*, softened. This may best be done by heating to a full red heat, and when it has cooled a little, plunging it in water. The plunging in water is not necessary to the annealing, and it has a tendency to remove the dirt and scale. Where the material is very dirty, or has been silver-soldered, plunging in a dilute solution of sulphuric acid (say 1 to 20) will remove all the burnt borax, etc., and leave the work looking clean and workmanlike. The plunging of steel in water, of course, hardens it. Brass and copper—indeed, most metals, become hardened when hammered. You must use a flux in soft soldering. Resin, chloride of zinc (spirits of salt killed with zinc), or one of the many soldering pastes on the market may be used. In soldering copper, heat the work, if possible; but, where an iron only can be used, see that it is properly hot. Copper is such a good conductor of heat that it transfers the heat to other parts of the work away from the joint very readily.

[18,409] **Model Locomotive Boiler.** A. C. (Ware) writes: I am building a ½-in. scale model locomotive, so will you please answer the following—(1) Will a firebox 4 ins. long and 2 ins. wide be large enough? (2) Is 1-16th-in. copper tube too thick for boiler? (3) Can I use a thin sheet of asbestos inside boiler shell?

In reply to your enquiries—(1) Yes, you may use a firebox 4 ins. long by 2 ins. with expectations of success. (2) One-sixteenth-in. thick copper tube (seamless) will do very well. However, you may use 18 S.W.G. with safety. (3) If the outer shell is large enough (it should be at least 2½ ins. diameter), you may lag it inside

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with a sheet of asbestos. As regards paint preserving, this will not avail very much; asbestos cannot be considered a very efficient non-conductor.

[18,393] **Polarised Relays** A. C. (Simonstown, S. Africa) writes: I should be very pleased if you would enlighten me upon the following—I have a "Siemens" polarised relay, almost identically similar to that described by Mr. Howgrave-Graham in his new book on "Wireless Telegraphy." Everything seems in perfect order. Yet I find it difficult to get same to work properly, even with two cells connected to it. I may add that I want to use same with a coherer. On connecting relay with a cell and inserting a Morse key, the armature moves, but very irregularly, and that only with contacts adjusted very finely. I should be glad if you could advise me what to do to enable relay to work crisply for rapid signalling. Also, could you tell me what is resistance of coils? I believe resistance is very high.

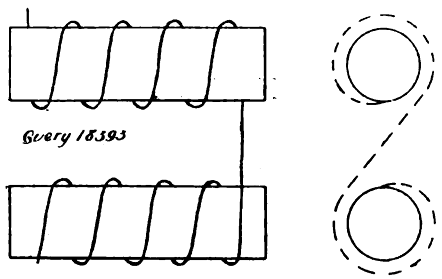
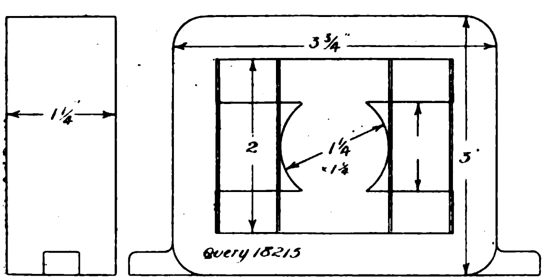


DIAGRAM OF CONNECTION FOR POLARISED RELAY.

There is something very wrong with your relay, as it ought to respond to one cell through many thousands of ohms resistance. It is, however, absolutely impossible to say what is wrong without an examination; neither do we see how we can tell what is the resistance of your coils without testing them. We can only suggest that you make quite sure that the two bobbins are connected so as to help each other (as sketch); that you make sure that you are sending the current through the instrument in the right direction, as a polarised relay will only work with the current one way, unless it be provided with double contacts; and that you test through with a cell and a telephone or galvanometer, to ascertain whether the coils are continuous.

[18,215] **Small Avery Type Dynamo.** G. N. F. (Edinburgh) writes: As a constant reader of your Journal, would you please answer the following questions about a small dynamo which I have designed after a perusal of the "A.B.C. of Dynamo Design," and which I contemplate building. Enclosed please find sketch of field-magnet. (1) Is general design and size of field-magnet correct? (2) Armature has about 33 yards No. 28 S.W.G. on it, and field-magnet about 6 ozs. No. 26, connected in shunt. Are windings correct? (3) Would pole-pieces in pattern need to be made in one piece and cored out, or could it not—in so small a machine—be made



FIELD-MAGNETS FOR AVERY-LAHMEYER DYNAMO.

exactly as casting required? (4) Who would cast the field-magnet, and approximate cost of same?

(1) Yes. (2) Yes, get on as much wire as you can in the spaces. (3) We think you will be able to get a casting without coring out; round off all corners. (4) You can probably find a founder in your locality; ask for a soft casting. You will find a firm of founders advertising on page 3 of THE MODEL ENGINEER for October 10th last. When you have made dynamo, try it with an 8- or 10-volt 1 c.-p. lamp, and run speed up if you do not get sufficient voltage. You will probably have to run at least 4,000 r.p.m. Make gap clearance between armature and magnet poles very small; indeed, just enough to clear.

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.*

Accumulator Pocket Lamp.

The Universal Electric Supply Co., 60, Brook St., C.-on-M., Manchester, have sent us particulars of their accumulator pocket hand lamps, which we illustrate herewith. The advantage of these accumulator hand lamps being that about six to eight hours' light can be obtained from one charge of the accumulator, the latter being easily

THE UNIVERSAL ELECTRIC SUPPLY CO.'S ACCUMULATOR POCKET LAMP.

charged at the cost of a few pence. For those who have already got pocket lamps, they are supplying the accumulators only, which fit in the ordinary cases, at a low price for either 2-volt or 4-volt. Prices may be had upon application to the above.

• Educational Models.

To familiarise the student with the many different types of dynamos and motors to be met with in modern times, a unique "Series of Educational Working Models" has been prepared by the firm of A. H. Avery, Fulmen Works, Tunbridge Wells, especially adapted to the needs of amateurs whose pocket money and workshop facilities are alike limited. This copyright series of designs includes at present six different models of modern dynamos and motors, viz., Overtype, Undertype, Simplex, Manchester, Ironclad and Multipolar, and more are in preparation. Each machine has been correctly designed and proportioned to the same scale all the fittings are interchangeable, and the details are so much simplified that any lad with mechanical tastes can easily put them together with the aid of a file and a few drills and taps, no lathe being necessary. This series is put up in complete sets of castings, parts, screws, wire and everything necessary down to the smallest detail. Full printed instructions are supplied, together with scale working drawings, and the whole packed in a strong cardboard box.

New Catalogues and Lists.

Hampson, Bros., Ltd., New Lane Works, Patricroft, near Manchester.—In the new catalogue issued by this firm, their small high-speed engines, which are specially suitable for electric lighting, workshop, or marine work, are included, also castings and parts, and back-geared bench lathes.

The Walsall Electrical Co., Ltd., Walsall.—We have before us a leaflet illustrating the "Walsall" auto cut-out for use with accumulators. The special advantages and prices of the apparatus are given.

S. Holmes & Co., Bradford, have issued a pamphlet giving particulars and specifications of their well-known "Gem" portable twist drill and tool grinder. Readers requiring such an accessory for their workshop should send for this list.

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The Editor's Page.

It is undoubtedly a good sign when readers from various parts of the Provinces write to us expressing their desire to attach themselves to a local Society of Model Engineers, or in places where such a body does not already exist, to form a Society for mutual benefit in their mechanical and electrical work. Whenever possible, we are pleased to assist readers to get into touch with fellow enthusiasts, and when secretaries of kindred institutions are known to us we notify our correspondents accordingly. It is very evident from the requests we receive that the idea is entertained that such Societies are affiliated to the London Society of Model Engineers. This, we may here point out, is not the case, every Provincial Society being entirely independent and self-governed. For the benefit of those readers who seek advice for the formation of a Society, we cannot do better than refer them to the article which appeared in The Model Engineer for September 17th, 1903, Vol. IX, "How to Form a Local Society of Model Engineers." The very useful and practical advice given therein, although by no means binding, would assist considerably in the preliminary planning out of the new venture. Copies of the above issue are still obtainable from our publishing department.

* * *

The very interesting articles which have appeared recently in these pages from "A Londoner Abroad" on the New Zealand International Exposition at Christchurch have brought to light some very fine specimens of model engineering executed by some of our Colonial readers, notably the work of Mr. Tomkies, which is illustrated in this issue, giving us further evidence of the extent to which model engineering as a hobby can prove of good useful service. One result at least of these descriptions is to lead us to ask for more. We should like to hear from many of our readers across the sea, who have doubtless turned out other fine examples of work, which have proved especially useful in the peculiar and out-of-way localities where their makers reside.

Answers to Correspondents.

S. R. B. (Wolverhampton).—We regret your contributions are not suitable.

K. M. F. H.—You will find full particulars as to the super-elevation of curves in the recent articles under heading of "Chats on Model Locomotives," by H. Greenly (see issues of October 3rd and 10th). Some useful notes on laying scale model permanent-way are contained in the handbook—"Model Railways," price 7½d. post free from this office.

E. J. H. (Folkestone).—Thanks for your letter *re* results of your advertisement, which we were pleased to hear. Your inquiry is not very clear, and we cannot trace the steamer mentioned in the issues you refer to.

T. H. O. (Manchester).—We regret we have no information on this subject, and, as far as we know, no drawings have been published. Official or Government information of this kind is seldom made public.

J. T. N (Brixton).—A useful apparatus for the study of mechanisms is described in March 14th, 1907, issue, to which please refer.

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, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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Contents.

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

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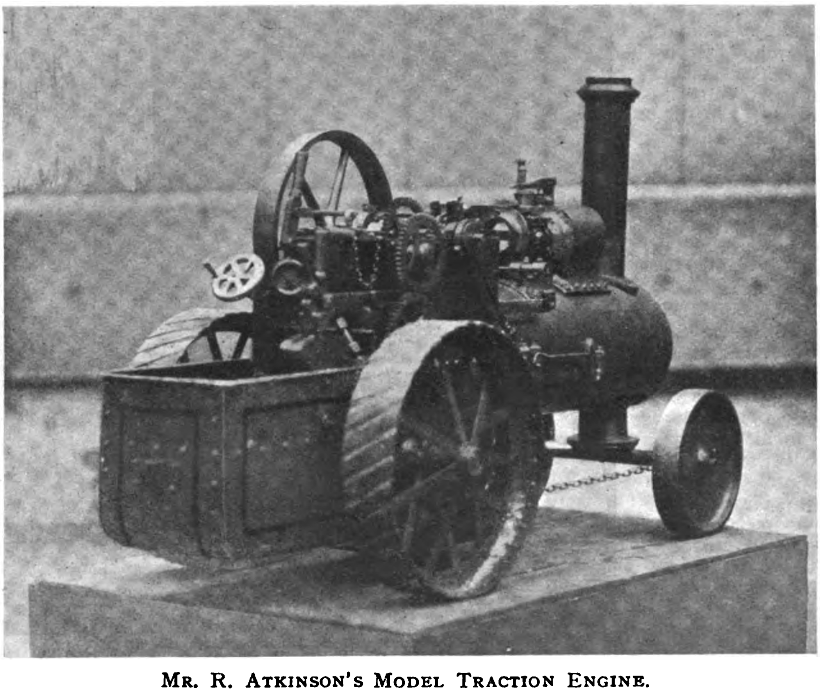
THE
Model Engineer
And Electrician.
A JOURNAL OF PRACTICAL MECHANICS AND ELECTRICITY.
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.
VOL. XVII. No. 348. DECEMBER 26, 1907. PUBLISHED WEEKLY.

A Model Traction Engine.

By R. ATKINSON.



MR. R. ATKINSON'S MODEL TRACTION ENGINE.

THE photograph reproduced herewith illustrates a model traction engine which I have made in my spare time during three years. It is my own work, with the exception of the steam gauge, and was made without the use of a lathe. It may be interesting for readers to know how, and of what, the component parts are made. The outside of boiler is an old pump barrel, inside of which is a 2-in. pipe crossed with four water-tubes. Firebox has water-space all round, with two water holes. It is a splendid steamer when the engine is running, charcoal being used as fuel. The cylinder is a piece of copper hot-water pipe, a continuation of which serves as a guide to cross-head. The flywheel, reversing gear, steering wheel, pump parts, and eccentric are my own casting, from instructions in THE MODEL ENGINEER a while back. The driving cogs were taken from an old beef roaster; the rest of the parts were sawn and filed out of gudgeons taken from old

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threshing machines. The large wheels are built up; the water tank is iron, made from an old putty keg. Total weight, 5 stone.

A Simple Piece of Metal Work.

A Photographic Drying Rack.

By John Pike.

ONE of the minor arts, easy to learn, and likely to prove profitable as the years pass, is that of soldering. I refer, of course, to such metals as tin and zinc, and work which can be done with the usual plumber's soldering iron, and at a comparatively low temperature. I claim no expertness, but merely affirm that a certain proficiency in the work is very essential to the amateur electrician, mechanic, and model-maker, and is a money saver to the photographer.

Now-a-days metal racks and troughs are common enough, and cheap: they are also easily made. I have some racks, etc., made fifteen years ago, quite as serviceable as when new, but of course there is a secret in the use of these metal appliances, and that is: always put them away *dry*. In addition, mine are not in constant use.

I might not have written a word about the subject, but for the fact that recently I had a large number of lantern slides to make, and the incident shows how useful it is to be able to make one's own tackle. When a number of slides (or plates) have to be treated the operations are very much facilitated by getting ready all the necessary appliances, racks, and so on, so that the plates, as soon as developed and washed, may be safely stacked out of harm's way, and handily stored ready for subsequent operations, *i.e.*, some require toning or varnishing or spotting, etc., and all require to be mounted and bound; and, naturally, the more spacious the rack the less room taken up on the work-table. Before commencing on the slides a day was devoted to the construction of a drying rack and stand to hold practically the whole number required, viz., 108. The rack figured holds 128, *i.e.*, four rows of sixteen on each side. I append a photograph of this, which, however, does small justice to the appliance, which is very fairly symmetrical throughout; not a work of art exactly, but a very useful contrivance nevertheless (see Fig. 1). Racks require a good supply of strips of metal, tin or zinc, *corrugated* for the purpose of separating and holding the glass plates safely, without touching. The amateur will do well to buy sheet zinc of a thickness which may be easily worked, *i.e.*, not too thick and heavy; about the gauge of a thin post-card will do for the purpose. A few yards of galvanised iron wire about 14 gauge should also be provided. I do not know whether narrow strips of zinc (corrugated) can be purchased as one buys wood, grooved for making negative boxes, but I may confess that I at one time spent many hours in laboriously bending the strips with pliers, a very slow and far from satisfactory business. The amateur need not bother himself about that matter while he has access to the family mangle or wringer, for there he will find a solution to the query.

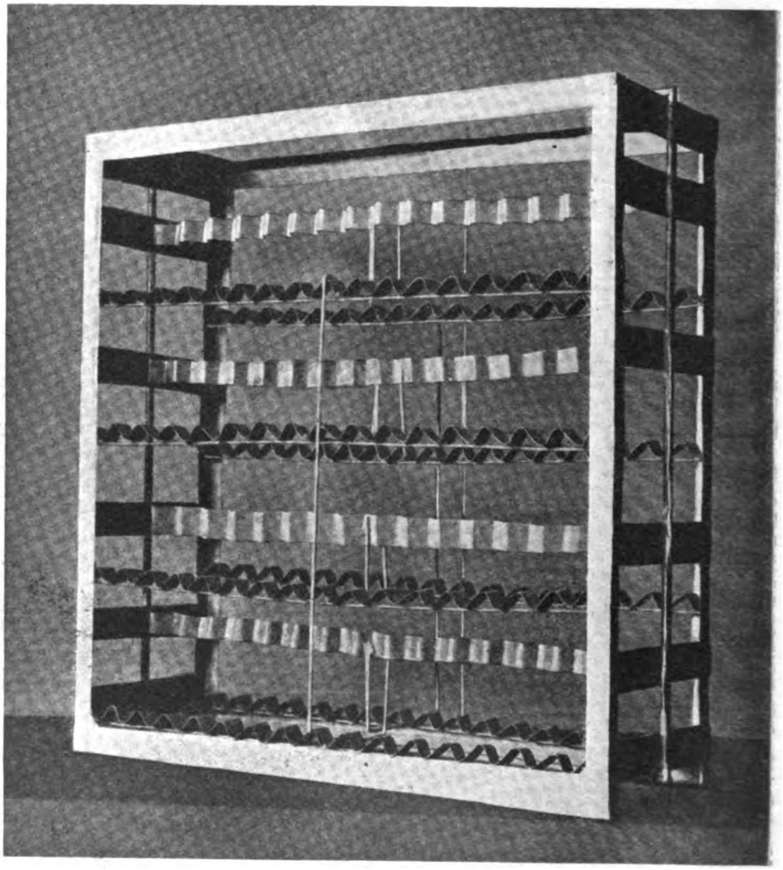

Fig. 1.—Photographic Drying Rack.

In the case figured twelve equal lengths of corrugated metal are required, to be placed as there shown. So far as length goes, the pieces may, after forming, be compressed or drawn out to some definite dimensions, but it is necessary that the number of spaces should be the same in each. We therefore start by cutting out of the sheet zinc twelve pieces 24 ins. by, say, 1 in.; the width matters only to the extent that it is desirable to leave as much room as possible for air to circulate freely round and over the drying plates, and, as a fact, we need only provide enough material to adequately support the plates in a vertical position, and so that they do

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not come in contact one with the other. Now, taking these strips to the domestic mangle, we select the set of gear or cog-wheels which appear most suitable, and these will usually be the smallest pair. It would not be a difficult nor expensive job to select a pair of geared wheels and set them up between two cast-iron brackets expressly for the purpose, and some people, of course, might have access to a smaller pair than those to be found upon a wringer; for instance, a good size would be about ¼-in. pitch, with rounded teeth. A suitable pair set up firmly and with a handle for turning would make us independent of the domestic apparatus and provide a neater piece of work, but, as will be found, any pair of a size reasonably small, with ½-in. pitch and wide enough to take the strip will answer requirements. Starting with a trial strip, we insert one end, and holding the strip straightly, send it through (turning the handle backwards), we find the result is precisely what we want, and the twelve strips are then neatly corrugated or formed in much less time than it takes to describe the process.

Having the strips shaped, we can decide upon the length. In the present case I found them reduced to 16 ins., with sixteen available spaces in each strip, but, as before mentioned, they can be reduced by pressure to 12 ins. or so, or left at about 16 ins.; in any case, they must all be kept at one uniform length. Now, out of the galvanised wire cut eight pieces of the exact length decided upon, get them quite straight and solder one piece to each of the eight strips. The ends of these eight strips should be turned up as shown in Fig. 2, and the wire soldered on as there marked. There will be at least sixteen joints to solder.

Sometimes (the wire being soldered close to one edge) the work may be strengthened by fixing on, also with solder, a piece of sheet zinc (a strip ¾ in.). In this case the strip is first bent lengthwise along one side to give it a sectional L shape, and as all sides, corners, and the frame generally is built of lengths of zinc similarly shaped, only wider, it will be convenient to state at once that these strips up to, say, 2 ft. long, can be bent without much trouble in a vice of moderate size. Firstly, we provide two stout iron or brass plates, each 2 ft. in length and 1 in. by ¼ in. sections, and perfectly straight. These are clamped between the jaws of the vice with the zinc between them and at the proper height for bending. The latter is done easily with a piece of hard wood such as the handle of a chisel. Having the zinc straight and tight in the vice no difficulty will arise, but the *ends* must, of course, be gripped and held firmly with one hand while bending with the other. The best plan is to start from the ends.

Most of the trouble met with in soldering—by the amateur—is, I should say, the result of using too small an iron, and heating this in the ordinary coal fire. The result is that the iron is always dirty, and usually too hot—when it is practically of no more use than if too cold. A gas stove should be used and an iron as nearly as possible of the professional size. The work is then pleasanter and more certain, for the reason that the iron is always clean, and retains its heat for a time sufficient to allow of a fair amount of work to be done, and the iron can be kept over the gas stove at a fairly even temperature. The soldering fluid used is the usual "killed" spirits of salts (common hydrochloric acid, saturated with zinc, in the shape of zinc clippings, and diluted with about half its bulk of water), applied to the parts (clean, of course) to be joined. The soldering iron being sufficiently heated, the copper "bit" is rubbed on a piece of cloth, dipped in the fluid, and rubbed on the solder (the usual soft variety). If the copper is at the right heat it becomes silvered with the solder, and may be applied at once to the parts to be joined, these being held in close contact meanwhile.

I strongly recommend the amateur and merely casual worker in this direction to wear gloves during the operations, cutting up the sheet zinc and the rest of it, as the skin is thereby saved many abrasions; the work also will probably be better done, as the fingers can often be used to hold parts of the frame, etc., during the application of the iron which otherwise would, on account of the heat, have to be rather hastily passed over. A pair of cheap gardening gloves serves the purpose. It is not necessary to labour the matter. The amateur has merely to note the shape of these appliances to go home and at least improvise something for his own use in a very few minutes.

On a small scale, of course, not much will be required in the way of strengthening beyond the

FIG. 2.

use of wire here and there, and the bent zinc, as for use at the corners, and the frame generally. For larger work, such as this rack for over a hundred small plates, the frame is rendered more secure by means of thicker rods or wire, old stair rods, and so on, taking care to have every joint well set and hard, and without undue strain.

When the work is complete and satisfactory as regards strength, a washing in hot water will clear away all superfluous soldering fluid, which, if left, would corrode, remain unsightly, and eventually result in fracture. Finally, after thorough drying in front of the fire a coat or two of bath enamel finishes the article.

It is stated that there are over 5,000 motor boats on the canals of Holland, mostly driven by paraffin motors.

CHEAPER GAS FOR BALLOONS.—M. Moison, the well-known French *savant* and chemist, has announced a new method of manufacturing gas for balloons by an electrical process. By the use of the current he produces hydrate of calcium, commercially known as hydrolyte. In this shape it is extremely light and portable, and one small piece no larger than a good-sized fist will, with the addition of a small quantity of water, liberate 1,000 litres of hydrogen. The average capacity of the military balloon is about 500 cubic metres, and in order to produce this, it is now necessary to carry along about 3½ tons of apparatus. Hydrolyte acts in exactly the same manner as the carbide of calcium, which is used in the generation of acetylene. The amount of gas thrown off and the rapidity of its generation is controlled largely by the amount of water. The withdrawal of the water causes the generation of the gas to stop almost instantly.—*Gas Engineers' Magazine.*

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The "M.E." Speed Boat Competition, 1907.

General Conditions.

THE entries for this Competition will be divided into three classes. Class A will include all boats over 5 ft. 6 ins. and up to 7 ft. in length, and Class B will include all boats over 3 ft. 4 ins. in length and under 5 ft. 6 ins., and Class C will include all boats of 3 ft. 4 ins. in length and under. The length is to be taken as length on the water line. Each boat must be timed over a total distance of not less than 300 yards, which may be divided into separate trips of not less than 100 yards each. At starting each trip, power must be turned on, and the engines started and kept running for at least fifteen seconds before the boat is released. The interval between each of the successive trips must be as short as possible, and must be stated in the particulars given. The exact length of the course must be measured, and the exact time to a second recorded for each trip. These particulars must be written down and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Yacht Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must furnish photographs and descriptions of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows:—

- SILVER MEDAL to the fastest boat in Class A beating previous records.
- BRONZE MEDAL in Class A to all other boats beating previous records.
- SILVER MEDAL in Class B to fastest boat, provided speed is not less than 5 miles per hour.
- BRONZE MEDAL in Class B to the second fastest boat doing not less than 5 miles per hour.
- SILVER MEDAL in Class C to the fastest boat, provided speed is not less than 3½ miles per hour.
- BRONZE MEDAL in Class C to the second fastest boat doing not less than 3½ miles per hour.

If in Class A the performance of the first boat does not surpass that attained in previous competitions, then the highest awards will be a Bronze Medal and Certificates respectively. The number of competitors interested in any one boat, either as designers or builders, will be limited to two. A signed declaration is required, giving particulars as to the building of the model, in addition to the usual certificate of performance. Certificates will be given to all Class A boats which have an average speed record of not less than five-and-a-half miles per hour; and to Class B vessels with an average speed of not less than four miles per hour; and to Class C boats with an average speed of not less than three miles per hour.

The last date of entry is December 31st, 1907.

TO READERS IN BEDFORD AND DISTRICT.—With a view to forming a local Society of Model Engineers, Mr. JOHN L. A. SILLEM, 51, Waterloo Road, Bedford, will be pleased to hear from model engineers and others resident in that district.

Notes on Wireless Telegraphy Apparatus.

By V. W. DELVES-BROUGHTON.

(*Continued from page 529.*)

AERIALS.

MY direct personal experience began and ended with a single vertical wire carried on a high pole and carefully insulated, the lower end being earthed and a spark gap provided as is usual. On one occasion I did use more or less of an aerial capacity, as my cable was too long, and I did not wish to cut it, so made it into a coil, which I sent up to the masthead.

I have recently designed a capacity for a friend, which he desired to fix on the roof of the house in which he lived, but whose landlord would not allow him to make any permanent attachment beyond driving a few holdfasts. My friend has not yet completed his installation, so I cannot say how the erection answers electrically, structurally it seems all right. I am not responsible in any way for the electrical design of this installation beyond the details of connections, etc. The areas and arrangement of the network, etc., can be altered to suit individual tastes and requirements.

The aerial described in Mr. Howgrave-Graham's book on "Wireless Telegraphy," although very suitable on his house, might not be so suitable in another situation. I therefore submit my plan, which, with a little modification, could be made to suit most houses.

The materials required are :—	£	s.	d.
Two selected pieces of quartering 15 ft. long by 2 ins. square, free from knots, or light scaffold poles would do; one ditto 10 ft. long ..	0	4	0
25 yds. of 2-in. mesh 19-gauge galvanized iron netting	0	4	9
5 lbs. stranded copper wire, 7 strands, No. 22 gauge, at 1s. 6d.	0	7	6
14 lbs. No. 8 galvanized iron wire..	0	2	4
1 doz. terminating holdfasts ..	0	0	9½
12 small galvanized iron thimbles..	0	0	6
½ lb. tinned iron wire, No. 28 gauge..	0	0	4
One deal plank 12 ft. by 9 ins. by ¾ in.	0	2	2
Six bamboos, 6 ft. 6 ins. by 1 in. diameter	0	1	3
Six deal stakes, 3 ft. by 2 ins. by 2 ins.	0	1	0
3 lbs. paraffin wax	0	1	2
5 lbs. gas tar	0	0	6
One piece of sheet ebonite, 6 ins. by 3 ins. by 5-16ths in.	0	0	8½
10 ft. high tension wire as used for motor-cars	0	10	0
One hank of spun yarn	0	0	6
Nails, cement, and sundries ..	0	1	6
	£1	19	0

I believe the actual installation was made for under £1 10s., as old packing cases were used instead of buying new plank, and other like economies were made.

The six stakes were first taken in hand, and the upper ends were boiled in wax and allowed to cool in it, about 15 ins. being treated in this manner. The other ends were then pointed and thoroughly

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heated and charred in a small wood fire and tarred whilst still hot. These stakes were then driven as indicated in the plan (see Fig. 3).

Next four pieces of wire netting were cut off, each 18 ft. 9 ins. in length, and securely whipped with binding wire in pairs to the 6 ft. 6 in. bamboos, the ends of which should be thoroughly tarred and plugged, if not cut near a joint.

The bamboo at one end should be then slipped over two of the terminal holdfasts, which have been driven into the heads of the four end stakes and laced to the holdfasts at the other end with some of the spun yarn. The third bamboo is now slipped under the net and rested on the central pair of stakes, each of which should be provided with a pair of nails driven in such a way that the bamboo will not roll off. Both "capacities" are similar, days or, in very fine weather, turn on the garden hose. Near each end of the capacities the three longitudinal stranded copper wires should be joined by a cross-wire, a solid terminal being provided to join up the high tension leads when the apparatus is required for use.

The three poles are next to be erected on the roof, and securely guyed, as shown in the drawings. the thick galvanized wire specified at the heading of this article being used for the purpose. If quartering is used for the poles they should be roughly planed up octagonal, and the cross-bars slightly checked in, pinned on with a wooden dowel, and the whole whipped together with suitable wire, which should be soldered together.

The derrick bars leaning over the side of the house are not provided with guys to take their weight, as

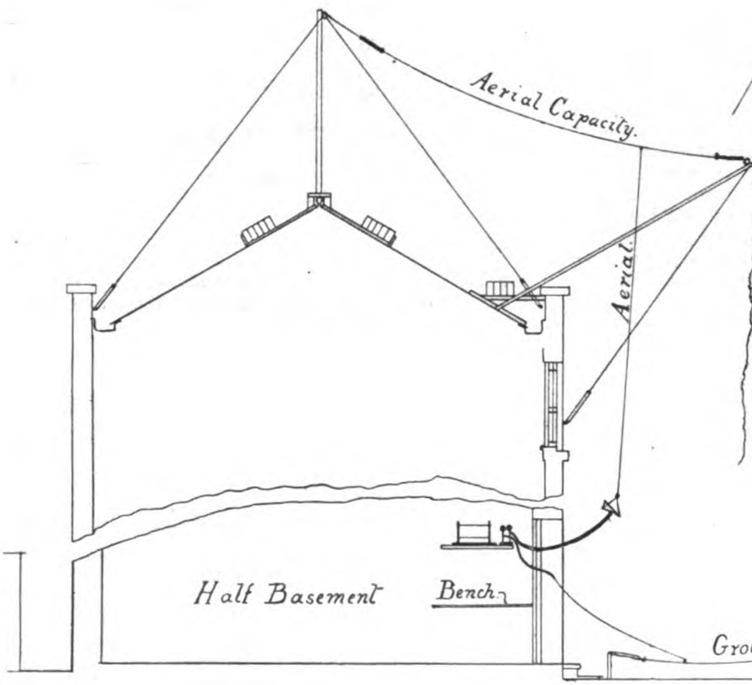

FIG. 1.

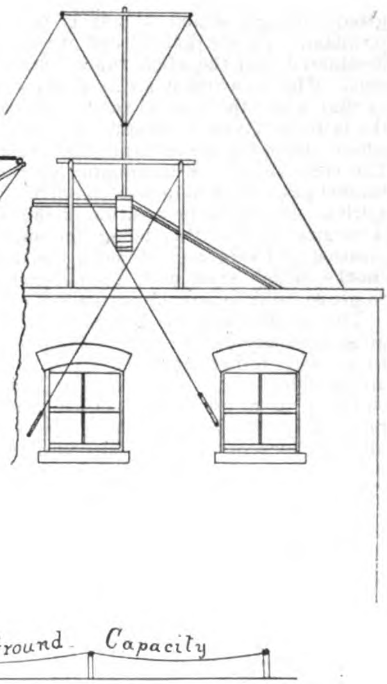

FIG. 2.

so that they can be treated in the same way, the only exception being that the upper capacity has the central bamboo whipped to the netting, while the lower one simply rests upon it. The stakes for the lower capacity form a convenient place on which to spread the netting whilst attaching the stranded copper wire, which should be threaded in and out of the meshes as shown by the heavy lines, and whipped with tinned wire every two or three feet and soldered (see Fig. 3).

The galvanized iron wire in the netting should first be tinned at the points decided upon, using dilute unkilled spirits of salts—then the copper wire should be whipped on with some thin tinned iron wire, and the whole run together with a hot iron. The corrosive action of any soldering solution used will be washed away in a very short time if the capacities are left out in the open for a few rainy this installation was intended to be more or less permanent, and the aerial capacity itself serves this purpose.

The vertical mast is stepped, as seen, on a wooden saddle resting across the ridge of the roof and weighted with bricks. The derrick bars are also stepped in wooden frames resting against the parapet on one side and the roof on the other, and weighted with bricks. The holes in the walls for the holdfasts were bored with a brace and a special bit, formed out of a piece of square steel flattened out for about 4 ins. to a width of 1 in., and then twisted whilst hot (by gripping one end in the vice and the other with a spanner) in such a manner that a sort of twist drill was formed.

The holdfasts were jagged with a chisel and grouted into the holes with neat cement, a little clay spout being formed round the holes to enable the

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cement to be poured in. When the holes were filled with cement the holdfasts were well wiped over with cement and, after removing the clay, pushed into the holes. In this manner they were very securely fastened.

The holdfasts are illustrated in Fig. 4, and the ends of the guy wires with the thimbles attached in Fig. 5. The wire should be bent round the thimbles, thoroughly whipped, and soldered. Fig 1 shows how the coil is placed and the wire led out through holes bored through the glass in the upper panes of the French window. The aerial, up to the drip cone, consists of heavily rubber insulated cable; and from there up, of the stranded copper wire specified in the estimate.

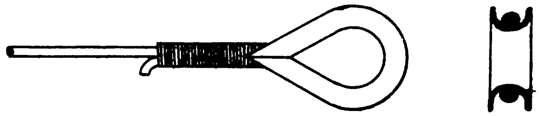
The drip cone consists of a piece of tin formed into a cone about 6 ins. high, with a lip turned up on one side as shown in the drawing. At the small end of the cone a piece of ebonite or hard wood is fitted, through which a bolt is passed to hold a terminal. To this bolt the end of the insulated cable is soldered, and the whole run in with a little marine glue. The terminal is given about 1 in. overhang, so that when the cone is suspended from the aerial the latter is given a certain cant which ensures the water dropping clear from the insulated cable. The cone should be thoroughly painted with good enamel paint or sealing-wax dissolved in methylated spirits. In Fig. 1 the position of the coil and bench is clearly shown, this being the most convenient position of fixing, and obviates the danger of stray shocks, which even with a small coil are sufficient to prove fatal to anyone with a weak heart.

This is all the more necessary as there is still a great curiosity on the part of the public in anything to do with radiotelegraphy, and if any one puts up an installation he is certain to have to show it working to a great number of people, who will probably come in groups, and want a lot of looking after to keep out of danger. Notices of danger are useless. The casual stranger likes danger, and if he sees "DANGER" stuck up somewhere will probably try to find out what the danger is—just as you are explaining the action of the spark gap to someone else. I am sorry to say ladies are much the worst offenders in this matter.

The aerial described above is for coils giving anything over a 6-in. spark, and, as pointed out in Mr. Howgrave-Graham's book, this spark should be of a very heavy type, making a crack like a toy pistol when each spark passes. For this reason coils for radiotelegraphy should be wound with very much thicker secondary than is usual. Mine is wound with 10 lbs. of No. 30 wire, and although the spark is not long, it is very fat, and even when attached to a high aerial, will work well with a 2-in. gap. As already stated I have not tried it with large capacity areas, but only with a Marconi aerial.

For most amateurs, and especially those with small banking accounts, the aerial illustrated in Fig. 7 will answer all requirements.

FIG. 5.



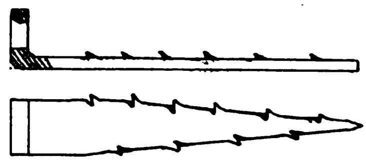


FIG. 4.

Two bamboos of any suitable size are lashed together in the centre, and then copper wire is strung round—as shown in the illustration—the wires being carefully whipped and soldered where they cross.

Two exactly similar capacity areas are constructed, and the upper one is hung from a light bamboo derrick rigged in the upper window of the house, or, if this is not high enough, from the roof of the house itself. The lower capacity area is hung directly on to the aerial wire, which is attached to the insulating device shown in Fig. 7 and already described in a previous article. The installation is clearly shown in Fig. 8, in which UC and LC are the upper and lower capacities and I and I are insulators.

It must be borne in mind that it is quite useless trying to use very large capacity areas unless a sufficiently powerful coil is available to charge them. This is fully explained in Mr. Howgrave-Graham's

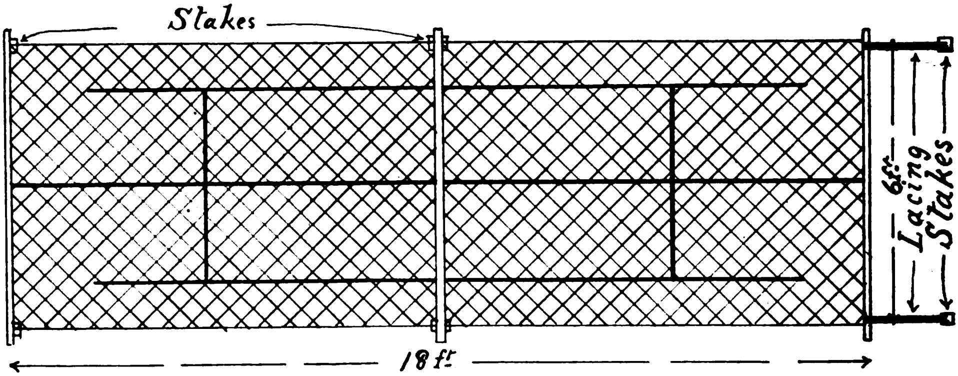


FIG. 3.

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book. In the installation from which this design is taken the capacities were each 4 ft. square, and the wire used was No. 20 soft copper used double. The aerial was three strands of No. 20 wire twisted together, and the distance apart was 26 ft. This, with a coil giving a heavy 2-in. spark, transmitted signals to a similar station about half a mile distant with great clearness. At first, at one of the stations, the capacity areas were arranged about 40 ft. apart, but it was found that better results were obtained when both were made similar. An ordinary filings

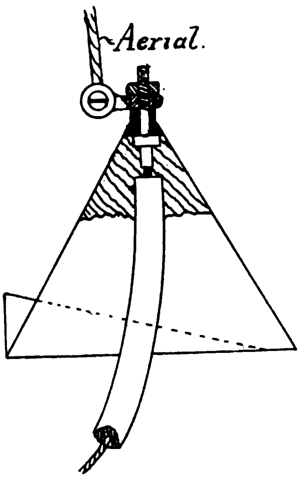

Fig. 6.

coherer was used in this experiment. The amount of wire used in these capacities was determined in a very simple manner. Two coils of wire were taken and opened out on a brass rod so that the convolutions cleared one another.

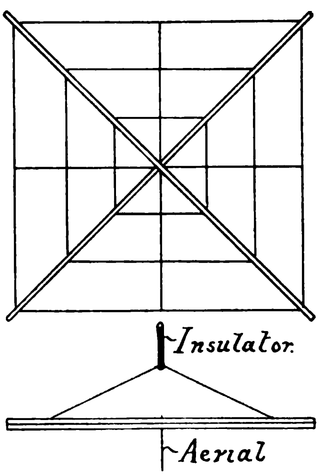

Fig. 7.

One of these coils was hung up at each end of the room, and they were joined up with the induction coil and tested, and the wire cut off till the spark became strong and sharp over a quarter inch gap. The capacities were then made out of the remaining wire, sufficient being reserved for the aerial and leads.

On completion it was found, however, that there

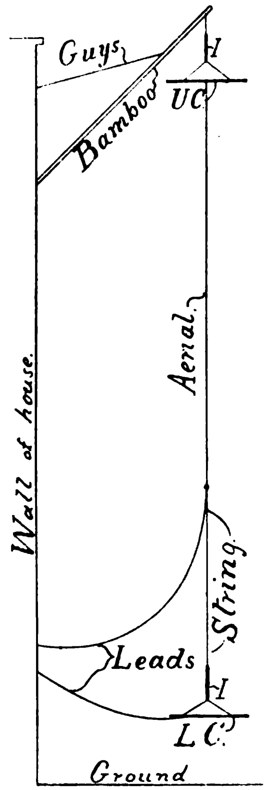

Fig. 8.

was too much wire used, and that the spark became reduced to about 3-16ths in., but this was corrected by cutting some wires out of the capacities.

Apparently the rule is to test as above and reduce the quantity by one-quarter. I do not know if this rule will hold good in all cases, but it will serve as an approximate, and the final adjustment be made by trial. The best results seem to be obtained when the coil gives sharp cracking sparks when connected with the aerial at one-eighth of the distance that it will work at when entirely disconnected. Again, this is an approximate rule, and the best distance will have to be found by trial.

(*To be continued.*)

The Use of Dies.—As an instance showing the vast growth of the use of dies for forming pieces formerly made by hand (says the *American Machinist*) Mr. G. H. Steward, in a paper before the Master Blacksmiths' Association, pointed out that at the Altoona shops of the Pennsylvania Railroad they have complete sets of dies and formers for making all parts of steel passenger, baggage, mail, and dining cars, from the deck moulding at the top to the trucks, excluding the welding of the rods and similar parts. In all there are 1,054 dies in use at these shops.

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Engineering Works and Accessories for Model Railways.

By Ernest W. Twining.

(*Continued from page* 594.)

THE next tunnel I propose to describe—the western front of which I have illustrated—is the famous one cut through Box Hill on the Great Western line below Chippenham, and near the village of Box, from which it derives its name.

It was, at the time the work was in progress, considered a great undertaking, and a little while before that, when the Bill for the whole line was before Parliament, it was described by the opponents to the scheme as a "difficult and most dangerous undertaking."

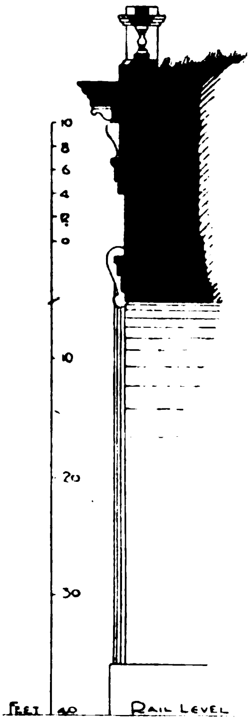

Fig. 12*a*.

Box tunnel is remarkable in that it was cut on an incline and was bored through four distinct geological strata—for that matter the whole of the Great Western main line between Bristol and London is most interesting from a geological point of view. Entering the tunnel at the western end, we have the blue marl or lias marl, next above this lies the inferior oolite. Then we have a bed of fullers' earth, and, lastly, the great oolite formation. This latter is celebrated in the building trade, and is known as Bath stone.

These strata are in general very much inclined, rising from east to west, which, together with the fact that the tunnel is on a gradient running in the opposite direction, accounts for so many formations being cut through in the comparatively short distance of 1¾ miles, which is approximately the length of the tunnel.

The tunnel is ventilated by nine shafts, six of which are 25 ft. in diameter, the remainder being 12 ft. 6 ins., the deepest being 300 ft.

The clear height of the arch above the rails at the entrances is (or originally was) 35 ft., and the width 30 ft.; the interior section is semi-elliptical, and here the height is only 25 ft. It is only lined through a part of its length. The surface of the ground at the western entrance is 64 ft. above the rail level, and at the eastern entrance 69 ft.

The architectural style of the upper or eastern end is plain, or almost so. The arch is semicircular, springing from upright sides. The quoins and voussoirs project, and have open channelled joints; they are sculptured in what is known as vermiculated rustic, a design common enough on the pediments of many buildings in the Roman Classic style in London and elsewhere. On each side of the entrance is a projecting pier, the stones of which are treated in like manner. The whole is capped by a plain blocking course. The style is Roman; but is so severely plain, being without columns, cornice, or anything of classic beauty, and consequently so little worthy of being copied for model purposes, that I have not given an illustration. Its appearance has not been improved by a modern addition in the shape of a deep brick lining bringing the roof down to conform to narrow gauge dimensions, leaving the outline of the original arch still plainly visible. Should any reader particularly wish to model both ends of Box tunnel, I may say that there is a picture post-card published showing the eastern end, from which, with the aid of the dimensions of the opening which I have given, he should be able to make a model with tolerable accuracy.

The western front of this tunnel—quite the opposite of the eastern (in a double sense)—is very handsome, being much more ornate, and of this I give a drawing in Fig. 12, from which it will be seen that the style is classic and extremely beautiful, the cornice being very fine.

This is the last of the Great Western tunnels I propose to give examples of, although I shall revert again to the G.W.R. when dealing with overbridge viaducts, and stations.

In reviewing the drawings it has struck me as being rather remarkable that they represent the western fronts with three exceptions, and in two of these, viz., Saltford and the short tunnel at Twerton, the western ends might just as well have been shown, since both ends in each case are alike, or practically so. It seems singular that all down the line the masonry of the western entrances should be more elaborate or more beautiful, or that a more decided style of architecture should have been adopted than that employed for the eastern fronts. It may be accounted for by the fact that in most cases the tunnels at their eastern ends terminate in deep cuttings or are otherwise in places further removed from public ways and dwellings, and consequently are less seen than the western ends; but, again, it is a curious coincidence that this should be so.

(*To be continued.*)

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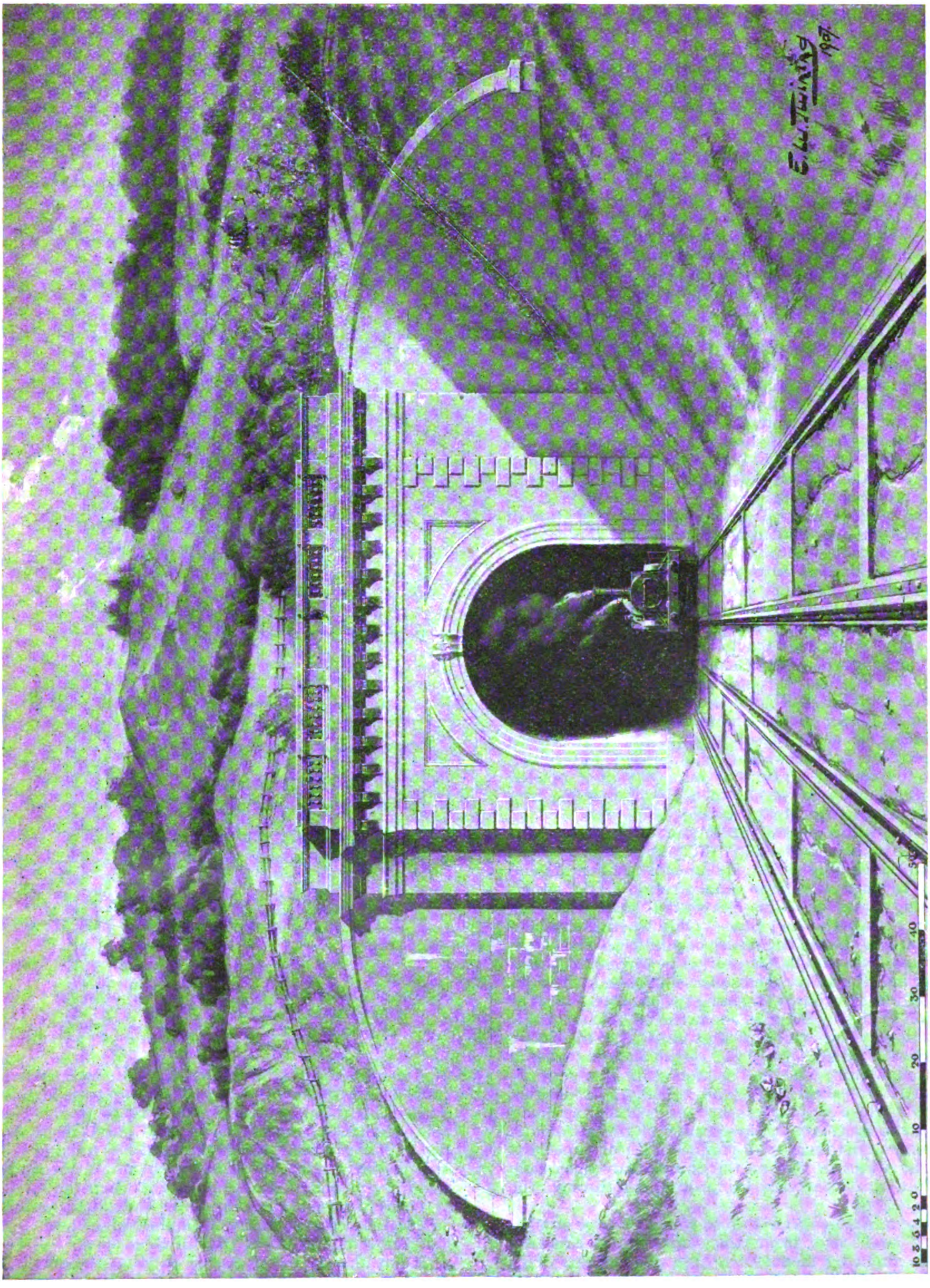


FIG. 12.—BOX TUNNEL: AN EARLY BROAD GAUGE TRAIN EMERGING FROM THE WESTERN END.

How It Works.

XIII.—The Schmidt System of Superheating for Locomotives.

(*Continued from page* 598.)

By CHAS. S. LAKE, A.M.I.Mech.E., Member Society of Arts.

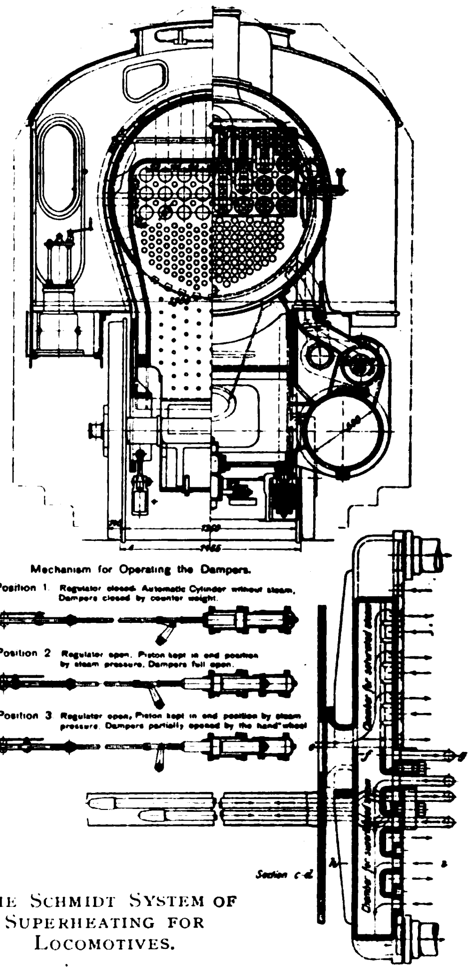
TWO slightly different methods are employed in arranging the pipe ends in the smokebox. The ends may be either bent upwards only, as shown in Fig. 1, in which case the flanges are horizontal and fastened by vertical bolts, the heads of which move in slots in the bottom of the collector casting; or the ends of the pipes may be bent upwards and backwards, as shown in the general arrangement drawing of the new 4—6—0 type locomotive of the Prussian State Railways, illustrated in Fig. 3. In the latter case the pipes are connected to vertical flanges secured by horizontal studs to the steam collector. Both methods have been extensively used, the latter having been selected by the Prussian State Railways, while the former appears to find favour on the majority of other railways on account of its greater simplicity.

The general principle involved in the operation of the Schmidt superheating apparatus of the smoke-tube type is as follows:—The gases of combustion divide themselves into two portions, one passing through the ordinary boiler tubes and the other through the larger tubes. The heat contained in these gases is partly given up to the water surrounding those tubes and partly to the steam contained in the superheating elements enclosed therein. The flow of heat through the large tubes is controlled by dampers hinged or pivoted below the steam collector in the smokebox. As long as the regulator is shut, these dampers are kept closed either by a counterweight or a spring; but immediately steam is turned on, they are opened simultaneously by means of a piston working in a small automatic steam cylinder.

Thus, while getting up steam or whenever the regulator is closed, and the superheating pipes are not cooled by steam, no gases of combustion can pass through the large smoke-tubes. The superheating pipes are thus prevented from becoming unduly heated at any time. Only when the regulator valve is opened can steam be admitted, and this is effected by a simple connection between the valve-chest and the above-mentioned small steam cylinder used for the purpose of opening the dampers. As the piston of this cylinder, when at the end of its stroke, acts as a valve which is kept closed by the steam pressure, leakages past the piston cannot cause a loss of steam, and the piston can therefore be adjusted to work freely and reliably. If desired, the superheater dampers can be worked by hand from the footplate independently of the automatic cylinders, so that any required degree of superheat can be attained. When the dampers are open they permit of a clear view being obtained through the superheater.

Soot and ashes are removed from the large smoke-tubes and also from the superheater elements inside them by means of a hose and nozzle. This operation is preferably carried out from the firebox, but it can also be done from the smokebox. As the clearing of the large tubes and the others contained within them can be effected much more rapidly by steam or compressed air than by brushes, the ordinary boiler tubes may with advantage be cleaned in the same manner. Each individual tube can be removed and examined without disconnecting the whole arrangement by merely loosening the single nut securing it in position. At the same time the smoke-tubes are rendered thoroughly accessible.

The most suitable temperature of superheat is in



THE SCHMIDT SYSTEM OF SUPERHEATING FOR LOCOMOTIVES.

the neighbourhood of 650° F., but locomotives have been worked with temperatures up to as high as 720° F. without trouble being experienced. The temperature is measured in the valve-chest by a reliable pyrometer, the dial of which is fixed in the cab of the engine. When the steam is throttled down by means of the regulator, or when the latter is entirely closed, the pyrometer indicates the fall in the temperature of steam in the valve-chest, but not the temperature of that in the boiler.

It has already been pointed out that the employment of highly superheated steam involves the use of special pistons, piston valves, and stuffing-boxes, and great care has been given by the originator of

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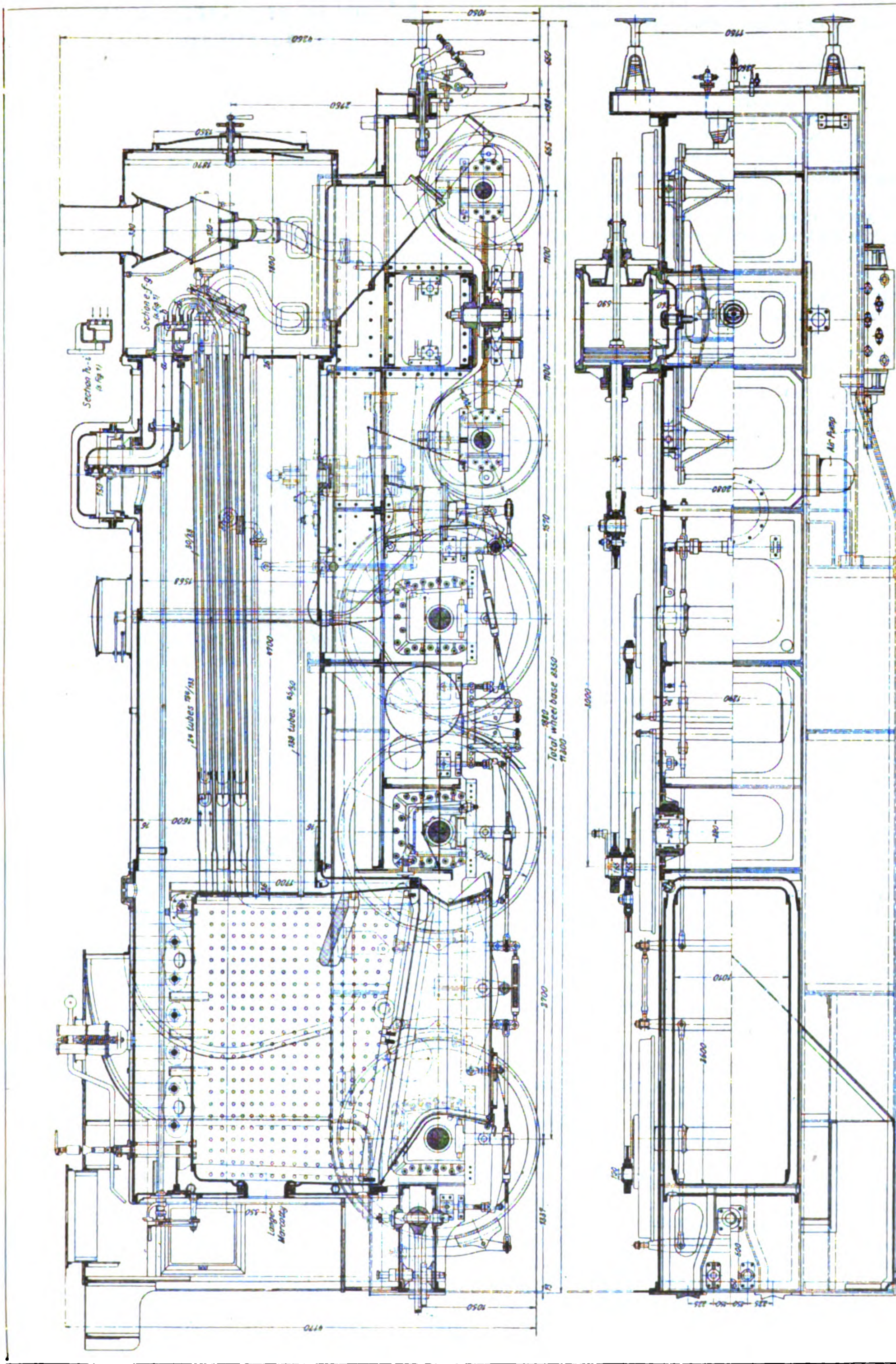

Fig. 3.—Heavy 4—6—0 Type Express Locomotive, fitted with Schmidt's Smoke-tube Superheater: Prussian State Railways.

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the system under consideration to the designing of these details to meet the conditions introduced. Fig. 2 illustrates a cylinder, with piston-valve and other details, as fitted to superheated locomotives on the Prussian State and other railways. The cylindrical walls of the valve-chest are separated from the cylinder casting proper in order that the injurious strains due to the inflowing superheated steam and the unnecessary transmission of heat with consequent heat losses may be prevented, as would be the case if the piston valve casing and cylinder were made in one. Relief valves are fitted to the cylinders and shifting valves to the valve-chest or steam pipe. Forced lubrication with mineral oil having a high flash point is essential for the purpose of ensuring efficient lubrication. In order to ensure tightness of the pistons combined with a minimum amount of friction, pistons of the so-called Swedish pattern are employed. These are provided with three small rings having specially arranged circumferential grooves and holes so that the steam entering behind the rings merely presses them lightly and evenly against the cylinder walls. Neither the piston rings nor the stuffing-boxes ought to carry the weight of the body of the piston, and for this reason tail rods are employed so that the weight of the piston is taken at the front end by a specially provided guide and at the back by the crosshead. Provision is made for cooling the stuffing-boxes by air to avoid risk of their becoming overheated.

With a view to ascertaining the relative merits of a compound and a superheated locomotive of approximately equal power, the Prussian State Railways Administration carried out some comparative trials between a Von Borries four-cylinder compound of the "Atlantic type and a four-coupled bogie simple express locomotive fitted with Schmidt system superheating apparatus. The trials took place on the line between Grunewald and Güterglück. Both engines had an adhesion of about 32 tons, but the heating surface of the compound, which had "Serve" tubes, was 2,476 sq. ft., as against 1,087 sq. ft., and 330 sq. ft. for the superheater, in all 1,417 sq. ft. for the Schmidt engine. In spite of its lower heating surface the latter locomotive showed a very material superiority in efficiency. The trials consisted of working three trains made up respectively of nine, eleven and thirteen carriages.

The economy of the superheated locomotive, based on 1,000 ton-miles of train weight, was :—

(*a*) With nine carriages : 25 per cent. in coal and 41 per cent. in water.

(*b*) With eleven carriages : 27·8 per cent. in coal and 40·5 per cent. in water.

(*c*) With thirteen carriages : 33·3 per cent. in coal and 36·7 per cent. in water.

As before mentioned, the Schmidt smokebox superheater will be made the subject of an article to follow.

THERE are at present fifty Mallet articulated compound locomotives in service in the United States, distributed over four roads. The Great Northern Railway has twenty-five in road service, the rest being in pushing service, as follows: Northern Pacific Railway, 16; Great Northern Railway, 5; Baltimore and Ohio Railroad, 1; and Erie Railroad, 1.

Elementary Ornamental Turning.

By T. GOLDSWORTHY-CRUMP.

(*Continued from page* 566.)

AS an illustration of procedure in producing work with the drill spindle on the surface, the manner of ornamentation shown in Fig. 6 will be described in detail. The screw of slide-rest has ten teeth per inch, and the feeds and advances are given in this ratio. The drills used were No. 1 × 1-20th in. for "star" portion, No. 1 by 1-10th in. for outside fluting, No. 16 × 3-20ths in. for beads, and a cranked drill No. 27 with a radius of 1-5th in. for central figure. A piece of hard wood 5½ ins. in diameter was chucked plankways and faced up and the edges turned and chamfered. The ring inside "star" was scribed 1⅞ ins. diameter.

The drill spindle was now fixed up parallel to the lathe bed and exactly to centre height, and the slide-rest adjusted at right angles. No. 1 × 1-20th in. drill was inserted and overhead connected up. The "star" can now be proceeded with, and for this purpose the index finger is adjusted to the 144 circle on the division plate.

It will be seen there are 72 flutes in the "star," therefore we use every other division in the 144 circle. Commencing at zero on this circle, the slide-rest and drill are adjusted exactly on the scribed line of inside of star, and the drill advanced into cut and given a penetration of 1-30th in. This penetration should be fixed by means of a stop so that slide cannot be advanced further, and thus ensure each flute being the same depth. The cross-slide is now traversed towards the operator by nine turns of screw, and back again to the scribed line, thus producing the longest flute required. The division plate is now revolved so that one hole is missed and the index finger engaged with the third hole. The cross-slide is again traversed outwards, only the screw is turned eight times, and returned to the scribed line. The division plate is again revolved as before, and the cross-slide run out six turns. The same again with the cross-slide run out four turns, and this forms the shortest flute in the "star." The work is continued exactly as before, but the traverse of the cross-slide increases, being six turns, eight turns, and again nine turns, thus completing one-twelfth part of the star, and the same sequence of operations is followed to complete the figure. The drill need not be stopped throughout this figure.

The next portion to receive attention are the twelve single dots just inside the outer ring. The cross-slide is run out to bring the drill in the required position, and the divisions are obtained from every twelfth division on the 144 circle; the penetration being the same as for the flutes.

The drill should now be changed for No. 1 × 1-10th in., which is employed for cutting the outside ring of flutes. The index pointer is set at hole 1—not zero—and the drill brought into the required position and advanced into cut, giving a penetration of 1-10th in. The depth of cut is secured by a stop as before. The cross traverse slide is now to be advanced half turn and reversed towards the operator one turn, and returned half turn to the first position. The drill having been withdrawn, the division plate is revolved to hole 3, and the drill

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advanced into cut and withdrawn. The division plate is then revolved to hole 9 and drill brought into cut. The index finger is carefully withdrawn, the mandrel being firmly held and slowly revolved so that drill cuts circular flute as far as the preceding hole. The division plate is then revolved to 11 hole, and the drill manipulated as for hole 1. The remainder of the figure is produced by repeating the movements.

The row of beads inside the star are simple, No. 16 × 3-20ths-in. drill being used, and the divisions are every six on the 144 circle.

We now come to the central figure, and for this we require drill No. 27 × 1-5th in. *radius*, and a penetration of 1-40th in. The 96 circle is employed. Setting the division plate at zero and the edge of drill nearly in the centre of work when furthest from the operator, it is brought into cut and withdrawn. The division plate is revolved one hole, and cross-slide traversed towards the operator ½ turn, and drill brought into cut and withdrawn. This is repeated six times outwards and six backwards, the division plate being revolved one hole each movement for the twelve circles. The division plate is then revolved twelve holes and the same movements gone through. These are repeated twice more and the central figure is completed.

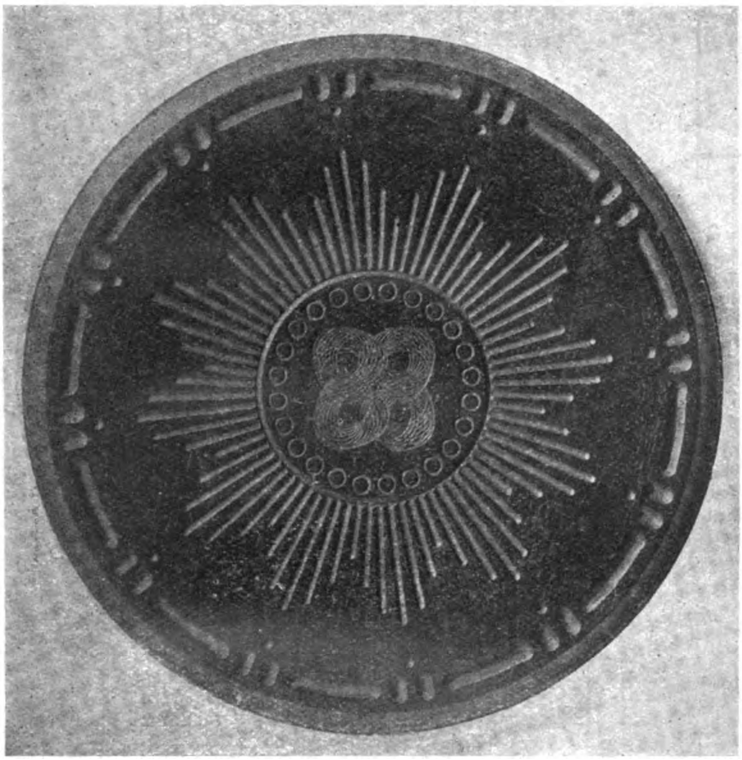

Fig. 6.—Circular Panel.

In nearly all drill work the spindle can be kept running, the various adjustments being made without stopping; care, of course, being taken to see that the drill is sufficiently clear of the work when out of cut.

(*To be continued.*)

Chats on Model Locomotives.

By Henry Greenly.

Electric Locomotives.

(*Continued from page* 417.)

BEFORE going on with the description of other types of electro-motors for model locomotive work, I must reply to several inquiries which have been forwarded to me with regard to the circular pattern of motor illustrated in the three previous articles. Some readers have asked for further particulars anent the making of the motor, and I may say that the drawing of the motor on page 375 of the issue of October 17th was not intended to convey more than a general idea of the construction and the over-all dimensions. I do not consider that this particular motor is one which comes within the scope of the average amateur mechanic. Powerful permanent magnets are not things that everyone can make, and the magnets employed in the interesting and, for the purpose of locomotive driving, useful type of electro-motor I have just dealt with cannot be termed particularly simple forgings. Special steel is also necessary, and I have heard that there are some trade secrets held by certain Continental manufacturers who supply magnets of astonishing power and permanence for use in magneto ignition machines. This being the case, I recommend all those readers who intend to go in for electrically controlled locomotives, and who may take a fancy to this motor, to make it an item in first cost and buy one outright. I discovered and obtained this motor by courtesy of Mr. Thompson, of T. W. Thompson & Co., Greenwich, S.E., and I believe his firm will obtain these motors for readers who require them. The price is 30s.

But this electro-motor, although it approaches in its main attributes the motor of my design which I will describe later on, and which has been taken up by a well-known firm of model engineers with great success, being universal in its application, is not the only one that can be used. Where the amateur does not mind being tied down to certain types of engines, and can get hold of a few telephone or ignition magneto magnets, he will be provided with the basis of an excellent reversible motor for a tank locomotive or for the tender of an express engine.

A complete design is included herewith, the type of engine being the new 0—4—4 tank locomotives of the S.E. & C.R. This particular engine was chosen in deference to the desire of a reader, but there are other locomotives with higher tanks and wider cab which would suit the motor better. The

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scale of the model is $\frac{3}{8}$ in. to the foot, and, as will be seen, the motor lays flat in the side tanks. The armature shaft is vertical with the commutator end of the shaft on top, and if the cab is made so that it can be readily removed (the style of cab being separate from the tank lends itself to this), the operator will have little difficulty in getting at the brushes when any repair or adjustment of the important features is required.

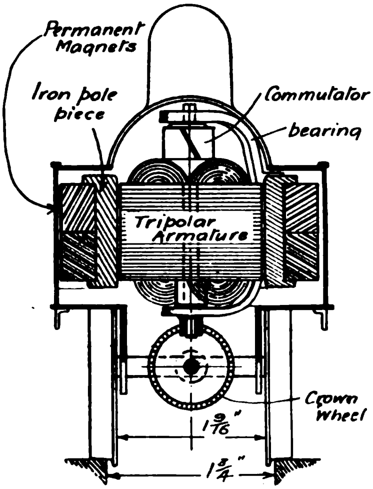

Fig. 16.—Section of S.E. & C.R. 4—4—0 Type Tank Locomotive, showing Motor in Position.

The drive is made through a countershaft. On this shaft, which, by the way, is arranged to run longitudinally in a separate bearing frame attached to the main frames in a suitable manner, is fitted a bevel pinion, which gears into a bevel wheel in the driving axle, and at the other end a crown wheel (see Fig. 10, page 401 *ante*), which is driven by a clock pinion having eight or ten teeth on the armature shaft. This pinion is best made solid with the armature shaft, the stampings (where such are used) being clamped on a brass tube with screwed ends and nuts, or being riveted together by three 1-16th-in. iron rivets (one through each pole piece), so that the pinion wire shaft may be knocked out and the bottom bearing taken out. Otherwise some difficulty would be occasioned in winding the armature. Another method is to make the armature shaft in brass and let a piece of pinion wire in at the driving end, but this course is open to some objections.

Where driving wheels are larger than shown on the drawing (I have figured the driving wheels $1\frac{7}{8}$ ins. diameter, which is somewhat smaller than they should be), the side tanks will have to be made higher, and possibly the height of the boiler centre increased.

But, to return to the construction of the motor: magneto magnets are made with parallel sides, and although the drawings show permanent magnets of the average size and shape, the exact dimensions of the motor must suit the magnets it is possible to obtain. Since preparing these drawings I have had lent me a telephone magneto, and I

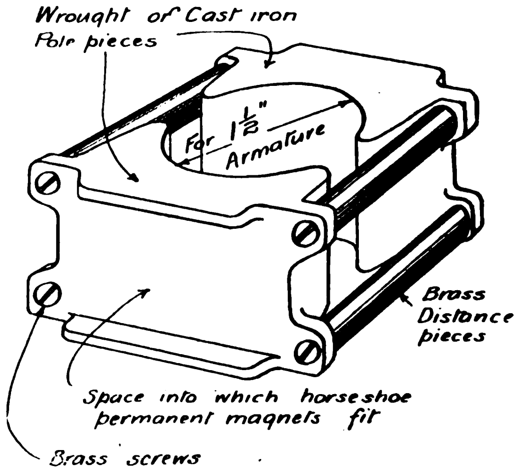

Fig. 17.—Perspective Sketch of Pole Pieces for Permanent Magnet Motor, showing Distance Bolts.

find that the magnets are 4 13-16ths ins. to $4\frac{7}{8}$ ins. long, 2 7-16ths ins. to $2\frac{1}{2}$ ins. wide, the section of metal being $\frac{3}{4}$ in. by $\frac{3}{8}$ in. square. The magnets would therefore allow a $1\frac{1}{2}$-in. armature to be used.

Having obtained the magnets, it must be borne in mind that nothing can be done with them in the matter of fastening pole pieces on which would involve drilling or tapping the magnets. They will be found to be dead hard, and any "annealing" (softening) would destroy their magnetism. The pole pieces must, therefore, be self-contained, as shown in the perspective sketch, Fig. 17, the permanent magnet or magnets fitting over the pole pieces in suitably prepared grooves.

In the working drawing, Fig. 15, I have presumed the possession of two magnets, $\frac{1}{2}$ in. by $\frac{3}{8}$ in. section, and would point out that two small magnets

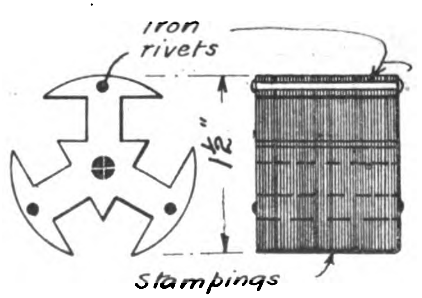

Fig. 18.—Armature Stampings riveted together.

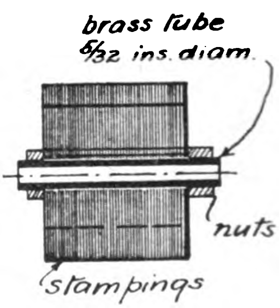

Fig. 19.—Armature Stampings mounted on a Brass Tube.

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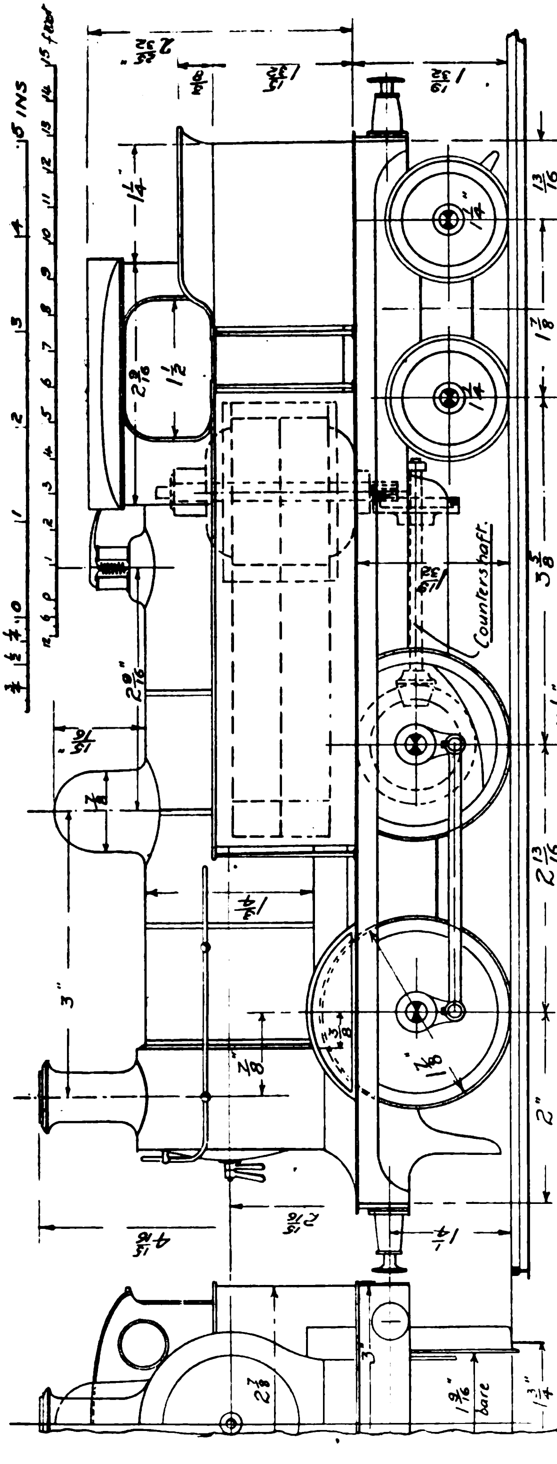

FIG. 13.—⅛-IN. SCALE MODEL S.E. & C.R. TANK LOCOMOTIVE, 4—4—0 TYPE, FITTED WITH PERMANENT MAGNET MOTOR.

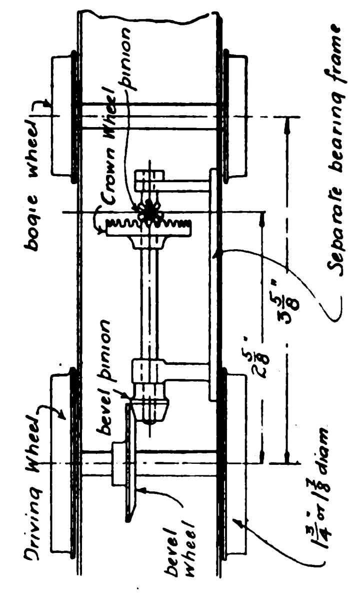

FIG. 14.—ARRANGEMENT OF GEARING MOTOR TO DRIVING WHEELS.

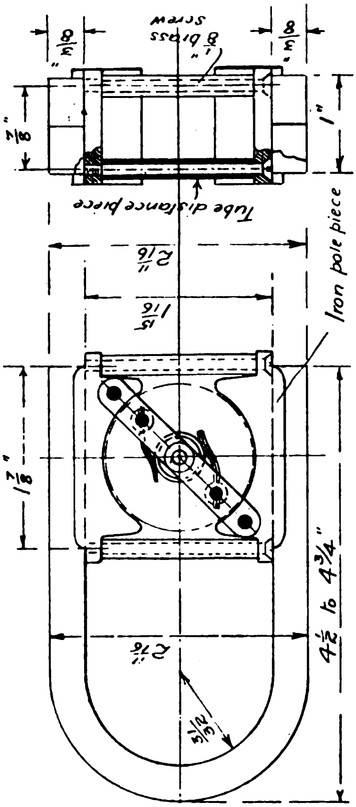

FIG. 15.—PLAN AND END VIEW OF PERMANENT MAGNET MOTOR.

ELECTRICALLY DRIVEN MODEL LOCOMOTIVES.

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will give better results than one large one. The pole-pieces should be of iron (wrought iron for preference, although good soft cast iron will give excellent results). The connection bolts must be of brass—the use of iron or steel would divert the passages of the "lines of force" from their proper course through the armature—and may be $\frac{1}{8}$ in. or 5-32nds in diameter with distance pieces made of *brass* tube. The magnets should fit over the pole-pieces tightly, so that the magnetism is provided with a good path, the presence of an air gap of course reducing the efficiency of the fields. In making the pole pieces I suggest that the iron be roughly filed to shape (if not cast), and the distance pieces fitted in. One side may then be filed flat, and placing the pole pieces on a faceplate, the tunnel may be bored in the ordinary way. The bearing plates are shown crossing the pole-pieces diagonally. These may be of brass, and should be shaped so that they will just clear the boiler of the locomotive. Should any difficulty arise on the matter of arranging this bearing, owing to peculiarities in the superstructures of the locomotive, a plate may be affixed to the outside distance pieces of the motor, or a special

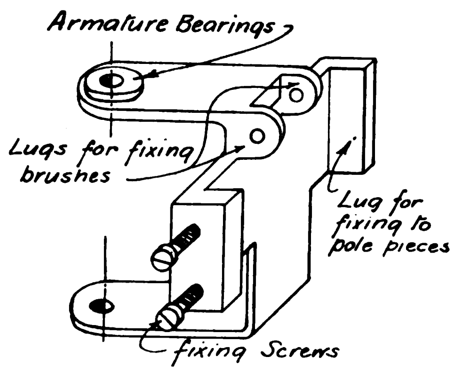

FIG. 20.—ALTERNATIVE ARMATURE SHAFT BEARING BRACKET FOR PERMANENT MAGNET MOTOR.

brass casting may be substituted for the tubular distance pieces and bolts at the back of the motor. A sketch of a bracket applicable to the case is shown in the perspective sketch, Fig. 20.

As with the other permanent magnet motor, reversing may be accomplished from any point on the line without necessitating a polarised relay switch, and the field-magnets being permanent, the armatures should be wound with fine wire, say, No. 26 or 28 S.W.G. for 4-volt working. The field strength of the motor being more or less limited, the speed ratio should be fairly high, say somewhere about 1 to 15. This can be obtained by using 8-tooth pinion wire on a 30-tooth crown wheel, and a 4 to 1 bevel drive.

The driving wheels should be made of brass, as well as those portions of the superstructures which would be likely to deflect the magnetic lines of force emanating from the permanent magnets. Parts included in this category comprise the frame, footplates, cab, and side tanks. No such trouble arises in connection with the circular permanent magnet motors described in the preceding articles so long as the boiler barrel is made of brass or copper.

(*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 Suggestion for Sunday Popular Lectures.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—I wish to make the following suggestion. Would it not be possible for you to get up a series of popular lectures and demonstrations in London on Sundays. There must be a great many of your readers who are not employed on any mechanical work, and yet are greatly interested in scientific subjects. Some of them after a hard day's work are probably too tired, or being employed at night, are unable to attend any classes or lectures on a week-night. In my case, I am a musician, and engaged every evening in a theatre, or I should certainly join the Society of Model Engineers at once. There are thousands of people who attend the Sunday League concerts every Sunday, and I am sure there must be a good percentage of these who would much rather attend a popular scientific demonstration. As an example, the demonstrations you were giving at THE MODEL ENGINEER Exhibition at the Horticultural Hall. Here, again, the principal electrical demonstrations were given in the evenings, when I, for one, was unable to see them. I would suggest that a hall be engaged in London for Sunday evenings. The lectures to be open to both sexes, and a charge from 6d. upwards be made for admission. I think, if the lectures were made known, no difficulty would be experienced in filling the hall.—Yours truly, J. GAME.

Kensington, W.

A ½-inch Scale Model Locomotive.

TO THE EDITOR OF *The Model Engineer.*

DEAR SIR,—Enclosed herewith I send photographs of a model locomotive I have recently constructed with the help of my friend Mr. T. Bailey. It is a ½-in. scale model of a ten-wheeled four-coupled tank engine, and is intended to represent an engine of the largest dimensions that the English loading gauge will allow. The over-all length is 20 ins., the greatest width 4¾ ins., and the height to top of funnel 6½ ins. The cylinders are 9-16ths-in. bore by 1-in. stroke, and the driving wheels are 3 ins. diameter. It is fitted with a complete and correct Joy's motion, reversed by a lever in the cab, and works very well. The boiler is of the water-tube type, but is without a "down-comer," the tubes being, instead, turned upward at the back. The inner barrel is 2 ins. diameter, and the outer casing 3 ins. diameter, a lagging with air space covering all. There are three water-tubes 3-16ths-in. diameter, and there is an ample supply of steam at 50 lbs. or more. It is fitted with a blower, which is a convenience in raising steam, but the blast of the exhaust gives sufficient draught in working. The smokebox door is complete, and not a dummy.

It is fitted with a steam pump drawing from tanks, but the mechanism of the steam-end is too small to be reliable, and I intend to replace it with a hand pump. The pump itself is quite efficient, though the suction valve is only 1-16th-in. diameter.

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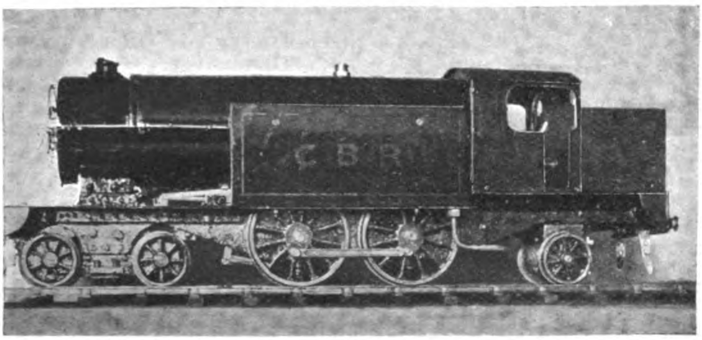
The firing is by methylated spirit, with a sight-drip arrangement, and the tank contains 7 ozs. (fluid), sufficient for 15 minutes, keeping full pressure with the regulator full on. The burner is formed of three ½-in. tubes, each with a longitudinal slit packed with asbestos and slightly inclined downward from the tank. The cylinders have hollow piston-valves, ½-in. diameter, but these are not so satisfactory as I think flat valves would be, as, if closely fitting they seize when hot, and when free they leak rather badly.

All wheels are fitted with springs, the bogie with compensating bars, and the gauge of rails is 2½ ins. The front bogie and rear truck are of a proper working design, and have side check springs. The buffers are of steel and have springs. The water



MR. A. B. CORBY'S ½-IN. SCALE MODEL LOCOMOTIVE.

anks and cab sides have a slight "batter" or "tumble home" towards the top, as in the new wide rolling-stock employed on many railways, reducing the width at the top to 4½ ins.

The only castings employed are the cylinders and wheels, all else being of sheet and bar material, mostly brass. The construction of the engine has taken a good part of the leisure time of three years, having been commenced in November, 1903. The total working time has amounted to about 700 hours, a careful record having been kept. The boiler shown in the photograph is the second one fitted, this being responsible for about 75 to 100 additional hours. The first boiler was of the fire-tube type, having an oval horizontal flue 4 ins. long and ten fire tubes 6 ins. long. This was rather difficult to fire as a very fierce draught was necessary to keep the spirit burner working, and although the rate of evaporation was good, so much steam was required for the blower, whether the engine was working or not, that the pressure could not be kept higher than 25 lbs. If the draught stopped for an instant the fire went out. Moreover, the boiler held only a little water and constant stops for pumping were necessary. The consumption of spirit was about treble that with the present boiler, which is very easy to work.

Our track consists of a straight, or nearly straight; run of 150 ft. on a nearly continuous gradient of 1 in 50. The engine would attain a much higher speed up this than is safe, and has more than once run off. The highest speed attained is 5 miles per hour. The rails are 3-16ths-in. square iron, drilled through every 4 ins. and pinned down to sleepers. The expansion in hot weather is a source of trouble, and at times parts of the line will rise 3 ins. above the ground from this cause.

On the brake the engine has exerted a pull of ¾ lb. at 600 r.p.m. for 10 minutes.—Yours truly,

Stockport. A. B. CORBY.

The Society of Model Engineers.

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

London.

FUTURE MEETINGS.—The next meeting will be held on Friday, January 3rd, 1908, when a series of workshop demonstrations will be given by various members, the subjects including metal turning, wire drawing, silver soldering, setting out and marking off, lathe tool making and twist-drill grinding. The following meeting will be held on Tuesday, January 28th.

VISIT.—On Saturday, January 11th, at 3 p.m., a visit will be made to the Machine Tool Testing Rooms in Palmer Street, Westminster, of Messrs. Schuchard and Schutte, where a number of the latest types of machine tools will be shown in operation. Members wishing to participate should inform the Secretary at once, as the party is limited. —HERBERT G. RIDDLE, Secretary, 37, Minard Road, Hither Green, S.E.

Queries and Replies.

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

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

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

[18,467A] **Model Locomotive: Draught of Boiler.** W. H. (Donegal) writes: In the outer casing of a boiler of one of my locomotives (Smithies' type) a small aperture was left just where the boiler joins the smokebox support. Would this necessarily spoil working of engine? If so, what remedy would you suggest?

In reply to your inquiry, we may say that although the hole will certainly impair the draught, we do not think that it will cause the boiler to be any less efficient. This you may judge by running the engine blocked up and watching the action of the "beat" on the

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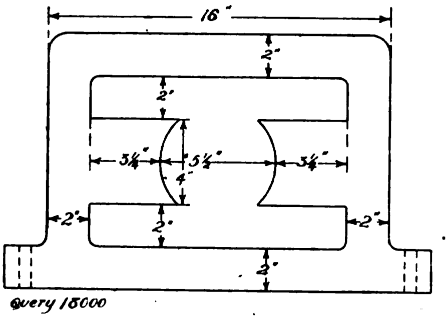
flames of the lamp. If there is but little effect, then increase it by stopping up the hole. A piece of plate with asbestos between will suffice. Although a draught is required, there must not be any tendency for the blast to "knock the fire about" too much, and to bring in too much cold air. So long as the flames are *not* blue, but are a bright orange colour, you have nothing to fear.

[18,000] **Windings for 1,000-watt Ironclad Dynamo.** A. M. (Tyne Dock, South Shields) writes: I am making an ironclad dynamo, with an armature of 5¼ ins. diameter. I wish it to develop 100 volts 10 amps. Would you be kind enough to give me sizes of wires for armatures and magnets. I am making it a shunt-wound machine. The width of casting is 5¼ ins.



FIELD-MAGNET FOR 1,000-WATT DYNAMO.

Wind armature with No. 18 gauge D.C.C. copper wire and field-magnet with No. 22 gauge s.c.c. copper wire. Get on as much wire as you conveniently can in the winding spaces; probably about 30 lbs. in all will go on the magnet.

[17,951] **Resistance for Charging Cells; Capacity of Accumulator.** C. T. (Norwich) writes: Will you kindly give me a diagram of a resistance board, and please state amount and gauge of German silver wire required to produce 2, 3, and 4 amps respectively from a 220-volt main? The resistance board is for charging accumulators. I have a quantity of this wire (sample enclosed), but am not certain whether it is German silver or copper; could you tell me which it is? If it is German silver, could I use it for the resistance? Could you tell me how to calculate the capacity of an accumulator?

Sample wire you sent was No. 36 S.W.G. copper. The required resistance will be

$$R = \frac{E}{C} = \frac{220 \text{ volts}}{2 \text{ amps}} = 110 \text{ ohms.}$$

In the second and third case the resistance is found in the same way. For continuous working you will need to use No. 22 S.W.G. German

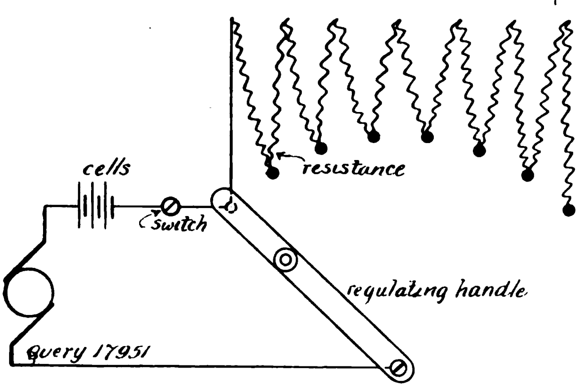


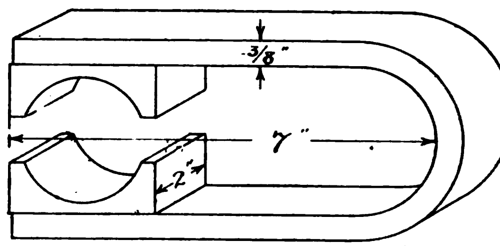
DIAGRAM OF RESISTANCE FOR CHARGING CELLS.

silver wire. About 60 yards will give over 110 ohms, and by dividing this up into several lengths you can get the various resistance you require. The capacity of an accumulator depends on the size of the plates. Reckon 15 amp.-hours per sq. ft. of + plate surface (both sides). See replies on this subject in back numbers of this journal.

[18,334] **High Voltage Generator for Installation Testing; Choking Coil.** "NOVICE" writes: I should like to make a generator, to be used for testing electric light installations. I should like it to give not less than 500 volts, and be as small in size as possible. Will you kindly say (1) what gauge and quantity of wire would be required for winding; also what size magnet frame and size and type of armature would be best? (2) Please state best way to make a choking coil to work in conjunction with an arc burner taking 40 to 50 amps.? The voltage is 110, 50 periods.

(1) We can only advise you in a general way, as such an instrument would be the outcome of trial and error of proportions and design. Make the magnet of simple horseshoe shape, say, to sketch (Fig. 1) herewith, and fit pole-pieces of wrought iron. It should be a hardened steel permanent magnet. Armature, drum pattern, cogged, say 3 ins. outside diameter, with 24 slots, wound with 24 coils, 2 in each slot. Try No. 40 gauge S.S.C. copper wire, and fill up slots, which should be cut as deep as the strength of teeth will allow. Insulation between coils and core must be very good indeed. Commutator to have 24 sections, which must be well insulated from the spindle. Wind armature as Fig. 48, page 36, of our handbook No. 10. Clearance between armature and pole pieces to be as small as possible. Weight of wire, perhaps about 6 ozs. (2) A choking coil must be largely determined by a method of trial and error. We advise you to make one with a sliding core. By pulling out

FIG. 1.—FIELD-MAGNET FOR HIGH VOLTAGE GENERATOR.



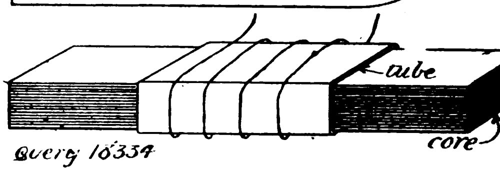


FIG. 2.—CHOKING COIL.

the core the choke is decreased and a certain amount of adjustment can be thus effected. Try the following arrangement. Core made of sheet iron of good soft quality; length, 15 ins.; width, 2¼ ins. by 2¼ ins. depth. Cut strips of the iron, varnish one side of each, and build them up to form a laminated core, so that a layer of varnish is between each strip and the next one. To keep them together wind linen tape over them tightly. Make a rectangular tube of vulcanised fibre or other insulating material, just large enough to slide easily over the core. Wind it with about 70 turns of No. 8 gauge D.C.C. copper wire in two layers; the length of this tube should be about 11 ins. If the choke is not enough, wind on more turns of same gauge wire, about 6 lbs. would do for first trial. Place coil where the heat can readily get away.

[18,424] **Screw Cutting in the Lathe.** F. K. P. (Portsmouth) writes: In the examination of candidates for electricians in H.M. Navy each man is required to cut in a lathe either a 3-start ¼-in. pitch, or a 6-start 1¼-in. pitch screw, with a fixed 40-tooth wheel on lathe mandrel. I shall be pleased if you will explain how to divide up the wheels (with sketch) so as to obtain the 3 or 6 threads. I can cut any multiple thread in the lathe when the mandrel wheel is divisible by the number of threads to be cut in the screw, but I cannot work out how to do it by using a wheel (as 40) on the mandrel that is not divisible by the number of threads required. Leading screw, four threads per inch.

You do not interfere with the wheels when they are indivisible. If the slide-rest is provided with a top slide parallel to the bed, shift the tool along by an amount which is equal to the pitch divided by the number of threads when you have finished cutting one thread, and shift it again by a similar amount for each thread. Thus, when cutting the 3-thread ¼-in. pitch screw, cut the first thread, then move the tool along by $\frac{1}{12}$ in., and cut the second thread, then move it along by $\frac{1}{12}$ in. again and cut the third thread. If you now move it along $\frac{1}{12}$ in. further the tool will cut into thread No. 1 again, because you have moved it by an amount which is equal to the pitch, ¼ in. by 3 ins. = $\frac{1}{12}$ in. When cutting the 1¼-in. pitch you will move the tool by an amount equal to 1¼ ins. divided by 6 = 5-24ths in. for each thread. If the rest has no top slide, like

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some American lathes, then you must divide the circumference of the work into spaces to equal the number of threads and shift it round in the carrier to start each thread at the correct place. For other information see "Practical Lessons in Metal Turning," by Percival Marshall.

[18,467] **Valve and Steam Port Proportions.** "READER" (Denmark Hill) writes: I should be much obliged if you would give me some information regarding the size of ports and amount of lap and lead which would be best for the following engine. Engine is single-cylinder, of about ¼ h.-p., to work from a flash boiler at a pressure of about 100 lbs. per sq. in.; speed, 400 r.p.m.; cylinder, 1·75-in. diameter by 1·5-in. stroke.

We would recommend a cut-off of about 60 or 70 per cent., with a free exhaust. The parts may be of the following sizes: steam ports, 1 in. by ⅛ in.; port bar, ⅛-in. wide; exhaust port, 1 in. by ¼ in. The lap of the valve should be 3-32nds in., and the lead 1-32nd in. As the steam will be hot, the exhaust may have inside clearance, say, about 1-64th in., that is the length of the cavity may be 1-32nd in. longer than the normal dimension, viz., P B + E P + P B − ⅛ + ¼ + ⅛ − ⅛ in. The cavity will be 17-32nds in., and the total length of the valve 15-16ths in.

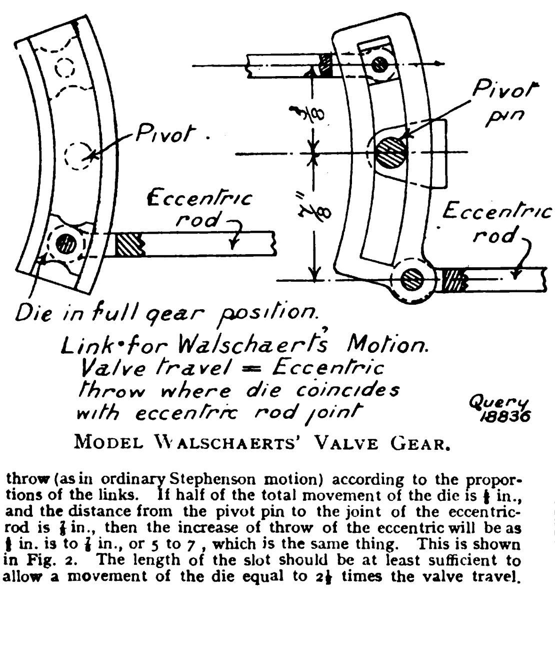
[18,440] **Model Locomotive with Oscillating Cylinders.** B. W. F. (Cricklewood) writes: I am building a ⅜-in. scale 2—4—2 tank locomotive; drivers, 3-in. diameter; boiler, 8½ ins. by 2½ ins., externally fired, plain cylindrical Would two (or one) oscillating cylinders (single-action, with reversing block, page 154, "Model Locomotive"), 1½ ins. by ½ in., do for this locomotive? Frames, 15 ins. About what should it pull, and what should be its working pressure?

We recommend you to use two single-acting oscillating cylinders, 7-16ths-in. bore by 1⅛-in. stroke. The load it will haul will depend on how well you make the model. No doubt the load would almost equal that of any other engine with the same size boiler having double-action slide-valve cylinders. The actual measure of power is the boiler, and you will find that oscillating cylinders, owing to the positive valve action and simple construction, are very efficient in small sizes where friction is a large factor in the working of a model. We note you are staying the boiler. The pressure need not be more than 25 or 30 lbs.

[18,836] **Model Walschaerts' Gear.** T. L. (Runcorn) writes: I am going to make a horizontal engine with Walschaerts' gear, but I shall have to implore your kind assistance. The cylinder is 2-in. bore and 3-in. stroke, travel of valve ⅝ in., ports 3-16ths in. wide by ⅞ in., exhaust ⅜ in. by ⅞ in. What centres should I require on the return crank to produce a ⅝-in. travel of the valve? What length of quadrant? Does the valve require any lap?

Everything depends upon the type of link used. Normally (Fig. 1) the throw of the eccentric will be the same as total travel of the valve, but where the type of link with the eccentric-rod joint below the point of full travel of the die, the eccentric will require a greater

FIG. 1. FIG. 2.



MODEL WALSCHAERTS' VALVE GEAR.

throw (as in ordinary Stephenson motion) according to the proportions of the links. If half of the total movement of the die is ⅝ in., and the distance from the pivot pin to the joint of the eccentric-rod is ⅞ in., then the increase of throw of the eccentric will be as ⅝ in. is to ⅞ in., or 5 to 7, which is the same thing. This is shown in Fig. 2. The length of the slot should be at least sufficient to allow a movement of the die equal to 2½ times the valve travel.

There is no need to fit the vibrating links and connecting links to the cross head if you do not provide laps. The length of the vibrating link and the distance between the two pins at the top, with the length of the stroke, govern the lap and lead. For further particulars see "The Model Locomotive" by H. Greenly, price 6s. net, 6s. 5d. post free.

[18,181] **Accumulators.** P. W. (Sheffield) writes: Would you oblige by answering the following? I have a 16-volt 25-amp. accumulator, which I want to charge from a dynamo output 100 volts 4 amps. Shall I be right in connecting two 40-volt. 16 c.-p. lamps in series with accumulator. Will two 16 c.-p. lamps pass 1½ amps. (see sketch)? Would you give me a sketch showing number and size of lamps, and how to connect same so as to get as many amps. as possible in accumulator? I have your book on accumulators, but am not quite clear how lamps are connected.

Connect lamps as sketch. They can be two 40-volt. lamps in series, or one 80-volt. lamp instead. When you put lamps in series, however, they must be of the same candle-power, but those in parallel may be of different candle-power. By connecting lamps in parallel you increase the flow of current. A 40-volt 16 c.-p. lamp of ordinary efficiency would pass about 1½ amps. Arranged as

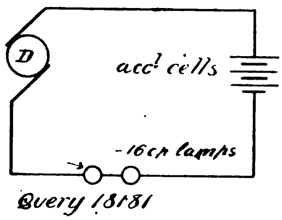


FIG. 1.

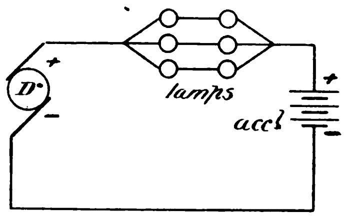


FIG. 2.

ACCUMULATOR CHARGING DIAGRAMS.

above each two lamps in series would pass 1½ amps., so the total flow of current would be 4½ amps. If possible start your dynamo at low speed when first charging, and increase it by degrees as charging proceeds. The voltage of cells will be low at commencement of charge.

New Catalogues and Lists.

Scott Homer, Cradley, Staffs.—The enlarged catalogue we have received illustrates numerous specialities supplied by the above firm. Amongst them may be mentioned model high-speed launch engines, horizontal engines, direct-coupled dynamos, gas engines, small dynamos and motors, all of which may be obtained finished and in working order, or sets of castings and materials for construction are supplied. The list also gives prices of brass model engine and boiler fittings, armature stampings, terminals, wires, geared and ungeared lathes, tools, faceplates, angle plates, planing machines, etc., and will be sent to readers of this Journal in the United Kingdom post free for three penny stamps; to foreign and Colonial readers post free.

Crisp Bros., 132, Cambridge Road, Mile End, London, N.E.—We have received an illustrated list of various makes of disc and cylinder talking machines and records. Those who wish to construct a machine for themselves can be supplied with necessary parts and accessories, some of which are included in the list, which will be forwarded post free to readers of THE MODEL ENGINEER upon application.

A. G. Thornton, Ltd., King St. W., Manchester.—A copy of this firm's catalogue for 1908 has been sent to us, and we notice that a number of items are included which have not previously appeared in former editions. A large assortment of English-made sets, half sets, and single drawing instruments are illustrated. Attention is called to the new aluminium instruments which Messrs. Thornton have brought near to perfection. Further items of interest are their improved Napier and other combination compasses, which can be folded up neatly for the pocket, foreign-made instruments for students and beginners, drawing-boards, scales, squares, protractors, and, in fact, every accessory for the drawing office. An apparatus to facilitate draughtsmen's work is illustrated, known as the "Eclipse" drawing set, consisting of an ordinary board and tee square, with the addition of an improved isograph. Adjustable drawing-tables, office drawers, surveying instruments, and slide rules are dealt with; full-size diagrams of various makes of the latter are included. The catalogue forms a very handy and complete book of reference for drawing office requirements. For the convenience of customers abroad a list of foreign and colonial parcel post rates is attached. The price of the catalogue is 1s.

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The Editor's Page.

WITH our next issue, which commences a new volume, we shall follow our usual custom of presenting a plate of coloured working drawings. The subject on this occasion will be a very novel one, viz., a model steam motor fire engine, and we think it will prove a very interesting and attractive model to make. It has the additional merit of being quite up-to-date, and as we have hitherto given but little information on the subject of model fire engines, we trust our choice of subject will be a popular one.

* * *

We have received a number of letters approving our proposal to give drawings of a large scale model locomotive, and also of a model traction engine, and we are in a position to assure those who have written that we shall proceed with both of these subjects. As was only to be expected, the ideas of our readers as to exact type and scale of both models are somewhat varied, and it will require a little consideration to decide as to what is most likely to be generally acceptable. The matter shall have our careful attention, however, and we will announce in an early issue exactly what we propose doing.

* * *

We have in preparation a further book by Mr. Chas. S. Lake dealing with "Locomotives of 1907." This will be a companion volume to the much-appreciated "Locomotives of 1906," and will keep the locomotive enthusiast right up-to-date in the various developments in locomotive practice. It will be published early in January, and will be issued at the usual price of 1s. net, post free 1s. 2d.

* * *

With this issue we give the index to the volume just completed, and a glance through its contents will show how thoroughly the interests of the model engineering fraternity have been catered for during the past half-year. **Bound copies of Volume XVII will shortly be ready, price 6s. 6d., post free 6s. 10d.,** while those who prefer to have their own loose copies bound may obtain cloth binding cases from our Publishing Department, price 1s. net, post free 1s. 3d.

Answers to Correspondents.

A. K. (Newton).—If you cannot get a sufficient heat this way, you must do the job in a temporary furnace. This could easily be made by lining an old tin, copper or iron box with asbestos card-board. Please comply with our rules in future.

D. C. (Oldham).—Thanks for your letter. We will keep your request before us and deal with the matter as soon as possible.

J. L. A. S. (Bedford).—See our remarks in the Editor's Page in issue for December 19th.

E. J. H. (Folkestone).—We thank you for your further reply to query.

M. R. (London, S.E.)—An outline drawing of a 4—4—2 type Great Western tank locomotive appeared in our issue for August 17th, 1905. A photograph of the same engine was reproduced in the issue for May 24th, 1906.

C. P. (Mile End).—Coils differ considerably, and various makers get different results from the same materials. The best test is an actual trial. The data given in handbook is based on practical experience, but it is no doubt possible to get good results by somewhat different windings. If you read recent query replies on this subject you will get some useful information on coils in general and of various sizes. Your wires are No. 21 and 38 S.W.G. respectively.

A. G. (Bolton).—See p. 77, Fig. 29, 6th edition of "Telephones and Microphones," 7d. post free.

Notices.

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

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

Advertisement rates may be had on application to the Advertisement Manager.

How to Address Letters.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to The Editor, "The Model Engineer," 26—29, Poppin's Court, Fleet Street, London, E.C.

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

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

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

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