Converting Old Clocks

NEWNES

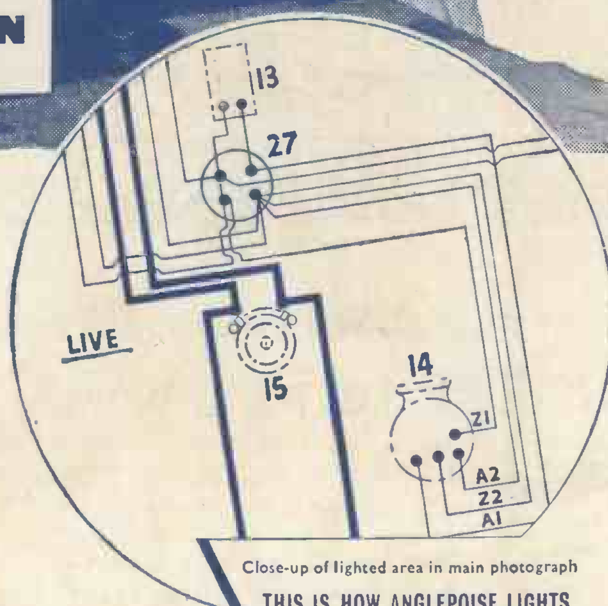
1/-

PRACTICAL MECHANICS

EDITOR: F. J. CAMM
OCTOBER 1955

Contents

Down a little! *Still nearer!* *Right on the job!*



Close-up of lighted area in main photograph

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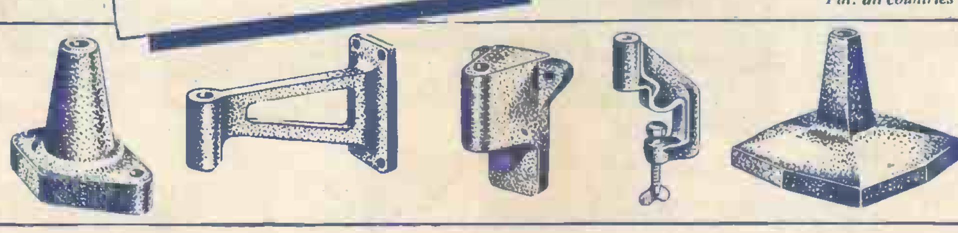

HT13

1,000,000 **Steel and Brass Precision Screws** as used on instrument work, mostly steel, sizes 2, 3, 4, 5, 6, 7, 8 B.A. various standard type heads. This is a really useful bargain. 4-gross ass. 4/9 the lot, in tin box, postage 6d. Just think—precision screws at a penny a dozen. 5 lots 21/-, post paid. 20 lots £3/10/0.

50,000 **Steel Grub Screws,** precision cut threads, not cheap rolled type. Sizes 0, 1, 3, 4, 5, 7 B.A. 3 gross ass. 3/6, in tin box, postage 6d. 6 lots £1, post paid. 20 lots £2/10/0.

200 **H.S. Morse Taper Shank End mills.** No. 1 shank ¼", 5/-; 5/16", 5/6; ⅜", 7/3 each. No. 2 shank 9/16", 10/-; ⅝", 12/-; ¾", 12/- each. Also straight shank H.S. ⅛", 4/-; ¼", 5/-; ⅜", 7/6; ½", 10/-; 1", 12/6 each.

500 **sets 13/16" dia. split dies,** ⅛", 5/32", 3/16", 7/32", ¼" Whit., 7/6 per set, taps to suit in either T., S. or P., 4/3 set; 3 sets, 12/-. Die stock, 2/9. Adjustable tap wrench, 2/3.

1,000 **H.S. long straight shank twist drills,** 3/64" to 7/64" dia., 4"-6" long, 3 ass., 5/-; approx. 7/32" and ¼" dia., 6" and 7" long, 5/- the two; 9/64" dia. 11" long, 9" flute length, 3/6 each; 2" dia., 10" long, 8" f.l., 4/6 each; 19/64" dia., 9" long, 7" f.l., 4/6 each.

500 **thin Side and Face Cutters,** 1¼" hole, 5" dia., 3/32", ⅛", ¼" thick, 25/- each. 6" dia., 7/32", 5/16" thick, 30/- each. 7" dia., 3/16", 7/32" thick, 35/- each. 8" dia., 3/32", ⅛", 5/32", 3/16" thick, 40/- each.

50 **pairs small H.S. Side and Face Cutters,** 2" dia., 5/16" thick, ⅞" bore. Teeth cut on face; one cutter right side, other cutter left side. Very useful, cheap, 15/- pair.

150 **No. 2 Morse Taper Socket Extensions,** 8" long, comprising No. 2 morse taper, ground finish at one end and No. 2 morse taper internal at other end, worth 15/- each, clear 5/- each.

500 **High Speed Side and Face Cutters,** 2¼" dia., 1" hole, ¼", ⅜", ½" thick, 10/- each; 3" dia., ¼", ½" thick, 15/- each; 3½" dia., 5/16", ⅜", ½" thick, 17/6 each; 4" dia., ½", 1" thick, 25/- each. All 1" hole.

500 **Sets Figure and Letter Punches** for steel marking, size ⅛", gift, figures, 5/-, letters 15/- per set.

1,000 **B.A. Hand Taps.** Sizes 0, 2, 4, 6 B.A. in tapers, seconds or plugs, 1/- each, 10/9 per doz., any size or sizes.

60 **Heavy Duty Ball Races,** ⅝" bore, ⅞" dia., ⅜" wide, two ball races in one, 4/- each, 7/6 pair.

50 **High Speed Shell End Mills,** 2" dia., 1½" wide, worth 62/-, clear 15/- each; ditto, 2¼" dia., 2¼" wide, 20/- each.

1,500 **H.S. Morse Taper Shank Twist Drills.** Brand New, Firth Speedicut, Balfour Capital, etc. This is an opportunity to secure a really good range of sizes at about a quarter of fractional size cost. No. 2 Morse Shank, 14 mm., 4/6.; 16 mm., 5/-; 17 mm., 5/6; 17.5 mm., 18.5 mm., 6/- each; 19 mm., 20 mm., 20.5 mm., 21.5 mm., 6/6 each; 22 mm., 7/- each. No. 3 Morse Shank, 23.5 mm., 24 mm., 24.5 mm., 8/- each; 26 mm., 26.5 mm., 9/- each; 27 mm., 27.5 mm., 10/- each; 28 mm., 29 mm., 29.5 mm., 11/- each. No. 4 Morse Shank, 40 mm., 30/- each. We strongly advise our clients to secure a stock as early as possible.

This is a H.S. Milling Cutter Bargain. All 1" bore, 3"-3½" dia., ¼"-⅝" thick, including side and face cutters, plain and angle cutters. A most useful lot for any tool room, 6 ass. for 50/-. The present maker's price of the cheapest cutter in this selection is 40/-. You must get this lot, remember you get same on approval against cash.

300 **H.S. Counterbore Drills,** 13/32" dia. pilot drill, ⅝" counterbore drill. No. 1 M.T. shank, 7/6 each.

2,000 **Small H.S. Twist Drills,** approx. 1/32"-3/32", 4/- doz.; approx., 1/16"-⅛", 7/6 per doz.; approx. 9/32"-15/32", six for 10/-.

All items brand new. £1 orders post paid. Prompt delivery. Inspection by appointment only. All items sent on approval against cheque or P.O. Refund without question if any item returned.

3,000 **Circular Split Dies,** 1" dia. cutting ¼", 5/16", ⅜", 7/16", ½" Whit., B.S.F., also brass thread, 26 thread all sizes and American N.F., 12/- per set of 5 sizes; 2 sets, 22/6; 4 sets, 42/6. Taps to suit, 9/3 per set, either taper or second or plug. 1" die-stocks, 5/- each; 3/16" to ½" tap wrenches, 12/6 each.

1,000 **H.S. Slitting Saws,** 2¼" dia., 1" hole, .011", .019", .021", .024", .027", .029", .039", .040", .056" thick. Actual value 10/- each, clear 3/9 each. Six ass., £1.

1,000 **Hand Reamers,** 5/16" and ⅜", 3/6 each.

1,000 **High Speed Inserted Blades Expanding Reamers,** 17/32" to 19/32", 14/-; 9/16" to ⅝", 16/-; 11/16" to ¾", 17/6; ¾" to 31/32", 18/6; 31/32" to 1¼", 22/6 each.

1,000 **High Speed Parting Off Tool Blades.** Eclipse brand: 11/16" x 3/32" x 5" long, 5/- each; 13/16" x 1/16" x 6" long, 5/- each; 15/16" x 3/32" x 6" long, 6/- each.

7,000 **Pratt & Whitney,** circular split dies, superior quality precision ground cutting edges, 13/16" dia., suitable for machine or hand use. Sizes: 2, 4, 5, 6 B.A., 8/6 per set.

5,000 **Ball Races,** ⅛" bore, ⅜" o.d., ⅛" thick, 4/- pair; ¼" bore, ⅝" o.d., 7/32" thick, 4/- pair; 6 mm. bore, 19 mm. o.d., 6 mm. thick, 4/- pair; 9 mm. bore, 26 mm. o.d., 8 mm. thick, 4/- pair; ⅜" bore, ⅞" o.d., 7/32" thick, 5/- pair.

4/9 **Any LOT.** Five lots, 22/6. 2 H.S. Tap or Reamer Fluting Cutters, 1¾" dia., ⅝" hole, ⅛" and 3/16" thick, worth 7/6 each; 3 assorted Centre Nail Pin and Belt Punches, total value 12/6; one H.S. Tap or Reamer Fluting Cutter, 2¼" dia., ⅜" thick, ⅞" hole; one ⅜" H.S. Hand Reamer, worth 10/-. Every item a good bargain.

500 **Sets Metal Figure Punches,** nine punches 0 to 8, the six is used reverse for nine; size 5/64", 6/6 set, worth 15/-; ditto, ⅛" size, 8/6.

2,000 **Files,** 4" to 6" flats, half-rounds, rounds, squares, warding assorted, cuts, good general lot, 10/6 doz.; three doz., 23/6.

600 **Circular Split Dies,** B.T.D. make 2½" dia., ¼", ⅜", ½", 1" Whit., ⅛" Gas; worth 11/- each. Clear 7/6 each; new 2½" die-stock to suit, worth 30/- each, clear 10/- each.

200 **Boxes A to Z Steel Letter Stamps** for marking metal 5/64" size, 17/6 set; ditto ⅛" size, 22/6 set, worth treble this price.

2,000 **Straight Shank End Mills,** size ⅛", 5/32", 3/16", 7/32", ¼", 5/16", list price 30/- set, handy bargains, 15/- set; also ⅜", 5/16", ¼" ditto, 12/6 set, all in makers' wrappings.

500 **H.S. 90% Countersinks,** body ½" dia., teeth cut to point. An essential tool for any workshop using c/s screws. Gift 5/- each.

1,000 **Bevelled Wood Chisels,** handled, ¼", 5/16", ⅜", ½", ⅝", ¾", ⅞", 1". Actual value 37/6. Gift 25/- set.

3,000 **High Speed Routing Cutters,** straight shank, two lip, as used for cutting slots in wood, sizes ⅛", ¼" dia., clear 4/- each.

1,000 **Toolmakers' Needle Files,** good assortment of shapes and cuts, worth 1/9 to 2/6 each, 12/6 doz.

200 **Ace Dial Gauges.** 2¼" face, reads to 0.001", plus and minus, very useful instrument worth 60/-, gift 45/-.

300 **High Speed Straight Shank End Mills,** ⅜" dia., 10/- each.

10,000 **High Speed End Mills Straight Shank,** 3/32" to 3/16" dia., some with teeth cutting both end but not standard sizes, clear 5 assorted, 10/-.

200 **Cast Steel Circular Saws for Wood,** 4" dia., 6/- each; 6", 10/-; 8", 13/6; 10", 18/-; 12", 24/-. Larger sizes. Prices on application.

100 **doz. 6" Three-square Saw Files,** 10/6 per dozen.

1,000 **H.S. Taper Pin Reamers,** 7/32" size, 5/- each. Also Nos. 5, 6, 7, 8, 9, 5/- each. 30/- set of 7.

500 **H.S. Angle Cutter** as used for milling teeth in slitting saws and milling cutters. Actual value £3 each. 2¼" dia., 1" hole. Clear 25/- each.

400 **H.S. Milling Cutters and Angle Cutters,** 1½"-2" dia., ⅝" hole, 4 ass., 22/6. Useful bargain.

100 **H.S. Slotting Cutters,** 5" dia., 3/16" thick, 1" hole, 12/6 each.

1,000 **Semi High Speed Centre Drills,** Slocombe brand, 5/16" body dia., 3/32" point, 1/6 each, 16/6 per doz.

20,000 **Small High Speed Milling Cutters,** various shapes and styles. We want to clear these quickly, 12 assorted 15/-.

800 **Small Rotary Files,** 3/32" shanks, various type heads, another clearance line, 4/9 per doz.

200 **Large Expanding Reamers,** 3-11/16" to 3½" capacity, 4" overall length, micrometer index, worth about £10 each. Ten super high speed blades, a gift 10/- each, cheap enough to use the blades as toolbits and make the body into expanding mandrel. Postage 2/- extra for this item even with £1 order.

500 **Carborundum Grinding Wheels,** 6½" dia., ¼" thick, 1" hole, suitable for drill or tool grinding, 3/9 each; three for 8/6, cheap enough to bush to suit your spindle, postage 2/- extra. Also 5" dia. cup wheels, ½" hole, 4/9 each.

300 **High Speed Gear Cutters,** 2¼" dia., 1" hole, d.p. 48, No. 1; d.p. 33, No. 3, 6; d.p. 28, No. 3, 5, 6, 7; d.p. 26, No. 1, 6, 7; d.p. 22, No. 5, 7; d.p. 14, No. 2; d.p. 11, No. 2; £1 each, six for £5.

2,000 **High Speed Toolbits,** 5/16" round, 3" long, 8/6 doz.

500 **High Speed Straight Shank Twist Drills.** Long Series, ⅞", 27/32", 1-1/16" dia., honestly worth 50/-, clear 12/- the three. Postage 2/- extra.

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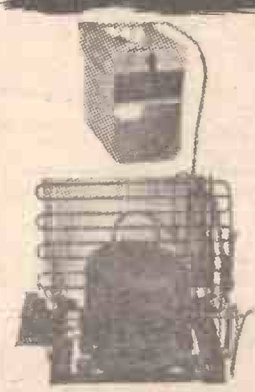

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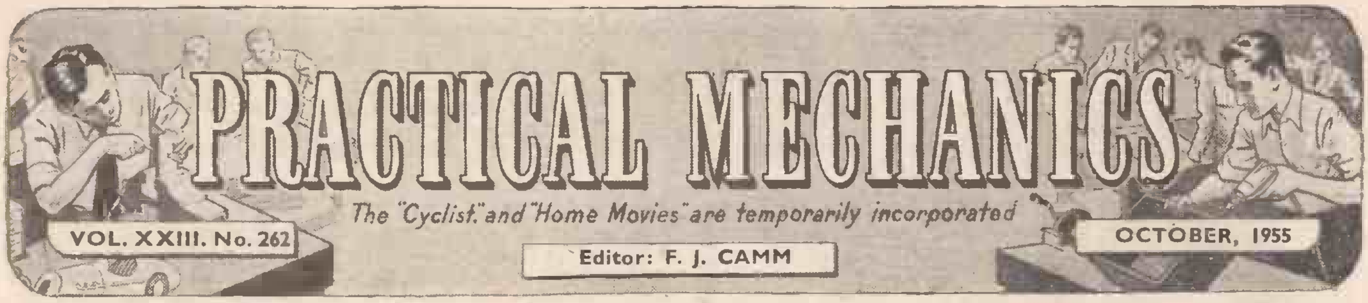

FAIR COMMENT

By

The Editor

Space Flight and "g"

THE medical profession is giving very special attention to the physiological problems which will arise when we first attempt space travel. These problems are just as complex as the mechanical problems to which so much attention has already been given. Everyone knows that "g" refers to gravity and most people are now aware that in space travel a point is reached where gravity ceases to take effect, until the space ship and those within it come within the gravitational field of the moon or some other planet. At that point the individual will tend to become lost in space, and equipment unless secured would float about. A man, for example, would be able to propel himself inside the cabin of the ship by the reaction of his own breath. He would lose all sense of direction. It is known that the human frame can stand at the most about 4 "g," and that for only comparatively short periods. Beyond 4 "g" the individual suffers blackouts and other forms of physical distress, although there have been exceptional cases where pilots have withstood 7 "g" for short periods—a matter of a few seconds. It is possible to calculate how long an individual would have to endure the effects of loss of gravity, but it certainly would be beyond the present limit of a few seconds. We shall not know the answer to that problem until the attempt has actually been made, although empirical precautions can, of course, be taken. Medical opinion, however, on these matters is sometimes not confirmed by practice. In the early years of the motor car, when a speed of 20 miles an hour was considered excessive, doctors said that the human frame would not be able to withstand a road speed of 60 miles an hour because heart failure would cause death. How ludicrous that forecast seems today, when pilots are flying at a speed faster than sound! Although the physical aspect must not be overlooked, the scientific problems concerned with the craft itself are less easily solved. The daily newspapers are now devoting considerable space to the subject. But it must not be concluded from this that space travel is imminent, though it will certainly take place during the course of the present century. Even presuming that the first attempt is successful and that a craft lands on the moon, there are other problems to solve. For example, it is presumed that there is no atmosphere on the moon and we have no knowledge of its vegetation or food supplies. The first space travellers must therefore go prepared to manufacture their own air and equipped with food supplies. No doubt the latter can be in concentrated form to save weight. There is also the problem of the return journey and maintaining contact with the earth.

Patent Application Delays

DURING 1954 there were more complete specifications filed at the Patent Office than ever before. The total reached the high figure of 26,629 and this has caused congestion in the Patent Office, which finds it almost impossible to recruit a sufficient number of qualified examiners to handle the number of specifications submitted. At the end of 1954 the number of unexamined specifications had risen to the enormous figure of 25,879. These are official figures, given by the Comptroller General of Patents.

In his report he says that the cost of running the department exceeds the receipts and although an increase in fees was agreed with the Treasury, at the end of the year another increase may become necessary if costs continue to exceed receipts. The trend of invention during the year included the patenting of small deaf aids carried on spectacle frames, and in telecommunications inventions have been filed concerning telephone exchanges, whilst in television the main work has been on multiplex transmission of colour. There is a trend towards production of more compact electrical computers, and increasing attention to the solution of equations relating to complex physical and engineering problems. Large numbers of patents concerning all forms of copy machining in the machine tool trade and for the application of electronic control systems indicate the approach of the automatic factory era, or automation.

The delay, however, in dealing with these patents is a matter of serious concern, for it is unwise to proceed with development if the patent has been anticipated and no manufacturer is interested in purchasing an invention from an inventor unless a patent has been granted, as that is the only evidence that he is the proprietor of the idea. As the Society of Inventors of Manchester points out, the delay in granting patent rights imposes a penalty on inventors and patentees for it may be as much as three years after the completed specification is lodged with the Patent Office before the patent rights are granted. As these rights are valid for 16 years, a delay of three years reduces the practical life of the patent to 13 years. This imposes a hardship on the small inventor, as it is generally in the early life of a patent that it has the most commercial value. The reason for the increased costs of patents is understood and in keeping with the general trends, but it is surely indefensible to shorten the practical life of a patent because of the delay in the Patent Office. It is my view that the life of a patent should be extended to cover any delay which occurs in the Patent Office without, of course, altering the date of priority; that is to say the date that the application is received by the Patent Office.

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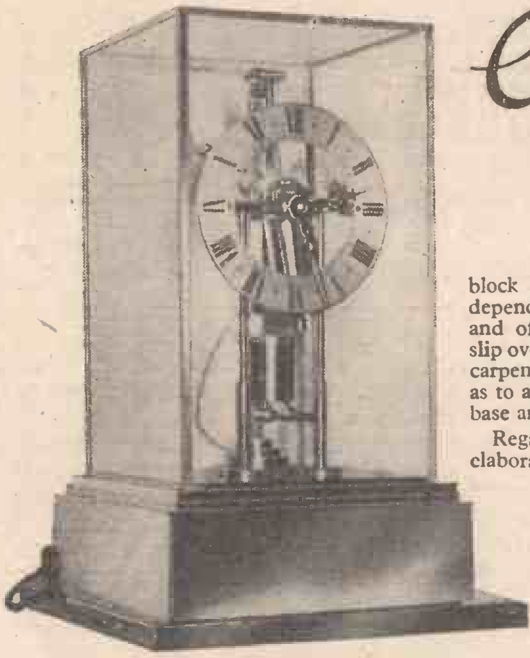


The author's earlier Bulle clock conversion.

Converting OLD CLOCKS

Useful Data for Giving a New Lease of Life to Abandoned Timepieces

By J. A. ROBERTS

MANY of the old pendulum type bracket or mantelpiece clocks found in second-hand shops and on market stalls in various stages of disrepair, and which can usually be bought for a few shillings, are worthy of a better fate, particularly those of the French type with their beautifully cut gears. The following suggestions may give them a new lease of life.

Should the clock purchased have a good case, it can be converted as it stands by removing the mainspring and the gears and pinions associated therewith up to the main minute-hand shaft, substituting for the old pendulum and escapement the new ones described here, and, if the case is sufficiently commodious, a mains battery unit fitted to enable the clock to run on the mains with a stand-by battery supply. As, however, the cases are often beyond repair, the design here is passed on to readers.

The escapement, an abandoned early patent of mine, is a simple tripping device, and has been very successfully used on pendulums of lengths varying from the full second, which some readers may like to try out, to the few inches in the one here described.

It will be found as easy if not easier to construct than the Hipp, and three of the common faults of that system, i.e., bouncing of the trailing blade off the block, faulty tracking and irregular length of pendulum swing, are eliminated; though no greater freedom from mechanical interference is claimed.

Notwithstanding the fact that the coil is switched on with every alternate swing of the pendulum, the current consumption is no more than in the Hipp, as the duration of contact is the merest flick, and these flicks add up to no more than the comparatively long "make" of the Hipp at intervals, and which accounts for the "dead end" fault.

Main Assembly

Fig. 1 shows how the main column which supports pendulum, escapement, movement and face is itself held, by a single bolt, to the brief amount of cabinet work involved. The base is a 12in. square of wood 1in. thick. The pedestal is a box-like structure, 10in. × 10in. × 3in. × ½in. thick, under which the mains unit and battery are concealed. The cover block can be either rectangular or circular, depending upon the type of cover intended, and of suitable dimensions for the cover to slip over. These three items must be accurately carpentered in well-seasoned hardwood so as to avoid the slightest trace of rock between base and pedestal.

Regarding the cover, the writer had an elaborate affair in brass angle with glass panels made to order but, though the effect is pleasing, few readers will care to go to this expense, and quite a good effect might be obtained from a wooden framed cover at a quarter of the cost. An all-glass dome might also be considered, and there is at least one firm in London who make these domes to order.

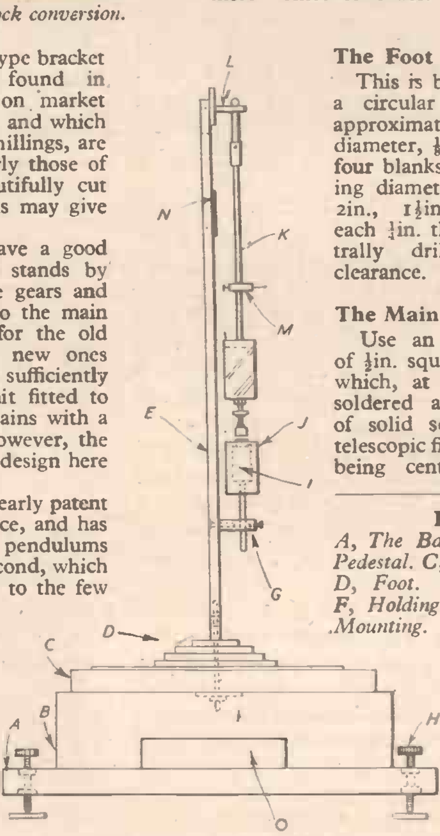


Fig. 1.—Main assembly.

The Foot

This is built up from a circular base-plate approximately 6in. in diameter, ⅛in. thick, and four blanks of diminishing diameter, say 2½in., 2in., 1½in. and 1in., each ¼in. thick and centrally drilled 2 BA clearance.

The Main Column

Use an 11in. length of ½in. square tube, into which, at each end, is soldered a 1in. length of solid square bar of telescopic fit, one of these being centrally tapped 2 BA, after both have been fitted and ground dead true in the lathe. This length of column is suitable for the 4½in. (effective length) pendulum movement used by the writer, and will have to be increased to suit greater lengths, the cabinet and foot remaining the same, up to 12in.

Though the general lay-out may remain the same for pendulums over this length, the dimensions of the components should increase pro rata.

The effective length of the new pendulum to be made, if the old one is missing, can be calculated from the gear ratio and the number of teeth on the feed wheel; a local clockmaker may assist in this.

KEY

A, The Base. B, The Pedestal. C, Cover Block. D, Foot. E, Main Column. F, Holding Screw. G, Coil Mounting. H, Poise Screws. I, Motor Coil. J, Motor Coil Cover. K, Pendulum Rod. L, Suspension. M, Crutch Pin. (For Bulle only.) N, Escapement Panel. O, Battery Trap Door.

The Coil Mounting

This consists of a rod 1in. long, ⅜in. thick, tapped 2 BA at one end (which, for accurate seating purposes, should be slightly concave) and 6 BA at the other. This arm is supported on the column by a 2 BA screw, and a ⅛in. clearance hole is drilled transversely at exactly the same distance from the column as is the centre of the grooves in the suspension supporting arms, Fig. 4 C. This hole accommodates the coil mounting pillar, a 2in. length of ⅛in. rod, threaded 4 BA for ½in., this thread passing into a hole tapped to receive it, in the bottom of the coil core.

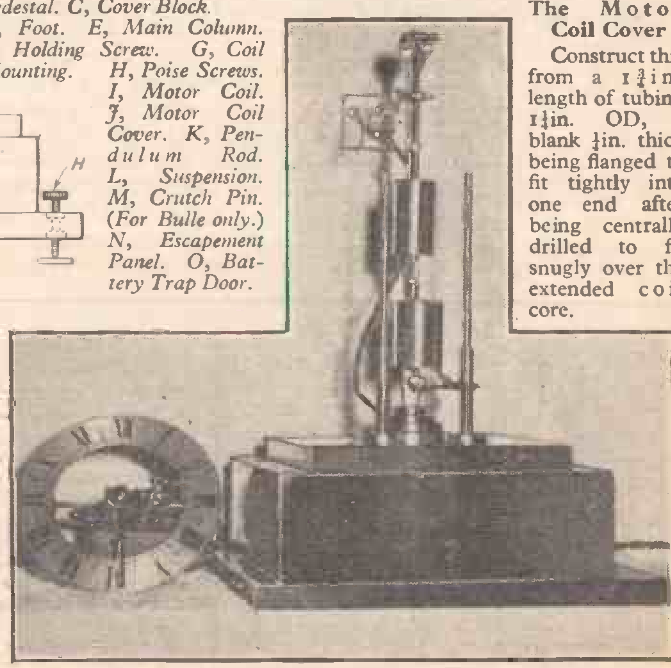
This method of mounting allows adjustment of coil to armature distance, by sliding the pillar carrying the coil up and down in the transverse hole, locking by the 6 BA screw, when the correct position has been found.

The Motor Coil

For this use an ex-W.D. relay coil of 300 ohms resistance, 1½in. long and ¾in. thick, approximately. It should not be difficult to wind a coil of this size to give a good pull from 4½ volts. Alternatively, one of the coils from an electric bell or buzzer could be used. If a coil is wound for the purpose, ⅜in. of the core should be left exposed, if not, and the core of the coil to be used is flush with the bobbin, as most of them are, it will be necessary to elongate it. Cut from a piece of soft iron rod, or preferably another core of the same thickness, a ⅜in. length. This and the coil core should then be tapped 6 BA, and the two, after being faced up, screwed together by a headless 6 BA screw.

The Motor Coil Cover

Construct this from a 1¾in. length of tubing 1¼in. OD, a blank ¼in. thick being flanged to fit tightly into one end after being centrally drilled to fit snugly over the extended coil core.



A dismantled view showing pendulum assembly and escapement.

The Poise Screws

Three 4 BA screws are ground to a point at one end, and fitted with knurled or terminal heads at the other; 4 BA clearance holes are drilled into the base, two in front and one behind, or vice versa, counterbored, and 4 BA nuts pressed into the wood, thus forming a good threaded seating for the screws. The points of these rest in small indentations centre popped in 1in. diameter blanks ⅛in. thick; these in turn rest on the table or bracket on which the clock stands.

The Holding Screw

This is a 3in. length of 2 BA studding, centrally drilled throughout its length ⅛in.,

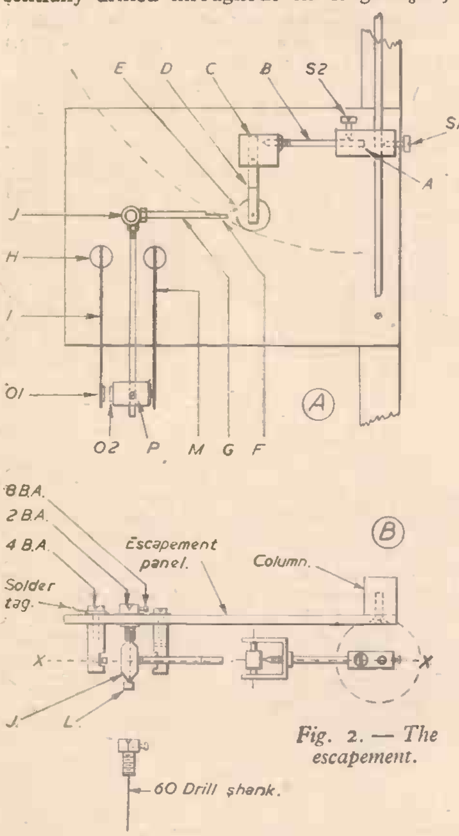


Fig. 2. — The escapement.

which, in addition to bolting together the column, foot, cover block and pedestal, also accommodates the leads from the motor coil and escapement by means of the ⅛in. longitudinal hole.

The Escapement

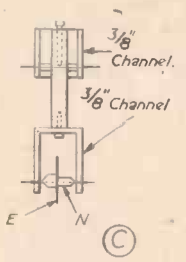
This consists of two main units, the switch assembly and the trip assembly. Fig. 2 shows both mounted in their relative operating positions, the former on the escapement panel, a piece of insulating material 2½in. by 1½in., the latter on the pendulum rod.

The Switch Assembly

A bell crank lever, G, forms one pole of the switch, and is made up from a 1in. and a 1½in. length of ⅛in. rod, to form respectively the horizontal and the vertical arms. One end of each of these is threaded 6 BA for about ⅛in., these ends being screwed into tapped holes, situated at 90 deg. intervals in the side of a ⅜in. length of 3/16in. rod, chamfered as shown. This boss J is drilled through centrally with a No. 60 drill, the shank of which forms the pivot upon which the boss turns, and which is seated in a hole drilled by the same drill in the 2 BA cheese-headed screw, being locked there by a 6 or 8 BA screw let into the head. A small boss, L, must be soldered or hammered to the outer end of this pin to prevent G working off its pivot during operation.

The contact spring, I, is a piece of clock-spring of medium flexibility, shod at its lower end with a platinum contact, O1, and secured at its upper, to the post H. This is a ⅜in. length of 3/16in. rod, filed flat at one end to accommodate said spring, tapped 4 BA at the other and secured to the panel by a 4 BA cheese-headed screw. This screw, fitted with a soldering tag, in addition to the usual washer, becomes the other pole of the switch.

The backstop spring M is devoid of contact, and similarly mounted. Its supporting post has a ⅛in. hole drilled through its side to accommodate a tommy bar, by means of which, after its screw has been loosened slightly, it can be turned to adjust the contact gap. The screw is tightened when the adjustment has been completed. Contact O1 is soldered to contact spring I, contact O2 is a platinum headed 6 BA screw let into the contact piece P, a ⅜in. length of 3/16in. rod drilled transversely ⅛in. clearance to admit the vertical member of G, and locked in position by a 6 BA screw, the head of which can be seen. The rear end of P rests against spring M.



The Trip Assembly

Make the trip head, C, from a piece of ⅜in. channel ⅜in. long, in the back of which is tapped a 6 BA hole slightly above centre as shown. Into this is passed one threaded end of the ⅞in. length of 3/32in. rod B, about which more will be said later. The other end fits into the trip carrying arm, A, a ⅞in. length of 3/16in. rod, and is locked by the adjusting screw S2.

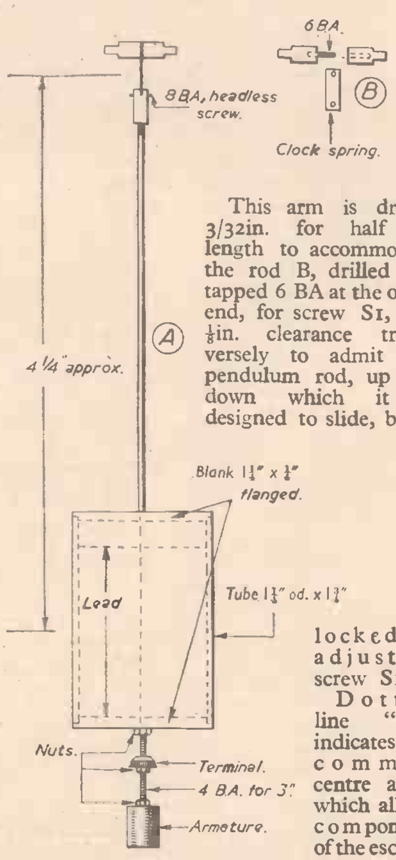


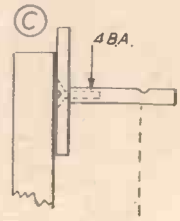
Fig. 3.—Pendulum assembly.

This arm is drilled 3/32in. for half its length to accommodate the rod B, drilled and tapped 6 BA at the other end, for screw S1, and ⅛in. clearance transversely to admit the pendulum rod, up and down which it is designed to slide, being locked by adjusting screw S1.

Dotted line "X" indicates the common centre along which all the components of the escapement must be arranged.

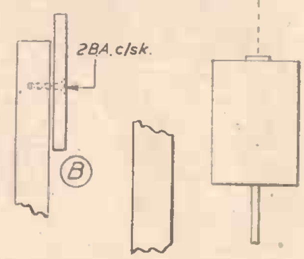
Pivoted across the arms of the trip head on a No. 60 drill shank, is the striker bar, D, a ⅛in. length of 3/16in. square bar, drilled transversely across its width with said No. 60 drill prior to the latter being cut to form the pivot, which is held in position by the set screw shown. Suitable separators can be cut from ⅛in. bar, drilled previously with same 60 drill, and rubbed down on emery board to the exact thickness required to provide freedom of movement of this member with minimum play.

A 3/16in length of the ⅜in. channel provides the bearing arms of the striker wheel, E. These arms are screwed to the lower end of the arm D by a 6 BA screw as shown in Fig. 2, C. The striker wheel, E, is a case-hard steel washer soldered to a bush, N, formed from a ⅜in. minus length of rod. One half of this is turned down to form a shoulder, against which this washer, which should be about ⅜in. diameter, is located; the amount of turning down is determined by the size of the hole in the washer.



Sequence of Operation

From the position of rest, as shown, the pendulum is given a gentle push to the left, the end, F, of the horizontal arm G (upon which a ⅛in. flat has been filed and case hardened), being in the path of the striker wheel, E, is struck. This causes the striker bar, D, to cant inwards, regaining its vertical by gravity as the pendulum proceeds on its way to the left still under the influence of the



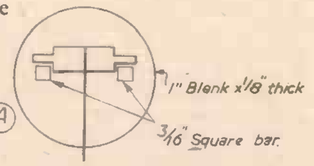


Fig. 4.—Suspension assembly.

initial push. This swing completed, the return swing commences and, at the same spot as before, F is again struck by E. This time, D, by reason of the changed direction of the applied force, is inclined to cant outwards, and would do so, but for the fact that one end of the rod B, pointed and protruding through the back of the trip head, rests against the upper end of D, thus preventing the latter from moving to the right or canting outwards.

Something must give, and what happens is that the weight of the pendulum bob transmitted via pendulum rod, and combined trip assembly, strikes the Flat F in a downward direction, thus depressing the horizontal arm of G. The vertical arm of G thus moves over to the left and closes the contacts O, switching on the motor coil.

This is timed to take place at the same time as in the Hipp (i.e., when the armature is in the same position), this being achieved by accurate adjustment of S1 and S2.

It follows that as the pendulum requires no more pull from the coil than is required to restore, in one swing, the energy it has lost during and since the previous one, the duration of contact at the points O, need be no more than the briefest flick, and these contacts should be no more than 1/32in. apart.

The greater the gap, the farther G will have to intrude into the arc described by E in order to produce the necessary amount of depression required to close it, and the greater will be the interference to the pendulum's free swing, a fault from which, as stated earlier, this system can claim no freedom.

Pendulum and Suspension

This assembly follows exactly, but on a smaller scale, the practice described in the February and March issues. In this case, the pendulum rod is 6in. long, ⅛in. thick, threaded 4 BA for about 2½in. at one end, and ¼in. at the other. A ½in. length of 3/16in. rod is slit by the slitting saw for ¼in. of its length at one end and tapped 4 BA at the other, a hole being drilled and tapped transversely across the slit.

The crossbar is made from a 1in. length of 3/16in. rod cut in half, the adjacent ends being slightly concave, and tapped 6 BA. A headless screw joins these two ends together after passing through one of two holes made in the ends of a ¾in. length of clockspring ¼in. wide.

The other end of this clockspring is let into the slit before mentioned in the ⅛in. piece of rod, the other end of which is screwed on to the short thread of the pendulum rod.

Before this is assembled, two shoulders are turned on the crossbar, as shown in Fig. 3B, in such a way that, when assembled and with spring held, these shoulders fit exactly between the supporting arms of the suspension, as in Fig. 4A. The slightest play here will cause the crossbar to "shuttle" from side to side between the supporting arms, owing to the shortness of the arc of swing.

The best way to prevent this is to cut these shoulders so that a very slight "shuttle" is produced and take this up by a pair of washers which can be rubbed down until the exact fit is obtained.

The suspension assembly is built up from a blank 1in. in diameter and ⅛in. thick. The centre is marked, a diagonal line drawn, and the centre of each half drilled 4 BA clearance. Two arms of 3/16in. square rod are drilled and tapped 4 BA at one end of each, these ends being ground dead square and held against the face of the suspension blank, the rear of which is countersunk at the two holes mentioned (Fig. 4C).

The suspension blank, with its two supporting arms is bolted to the main column by a 2 BA countersunk screw passing through a 2 BA clearance central hole, which is also countersunk, see Fig. 4B.

The Pendulum Bob

This is made up from a can of the same dimensions as the coil cover but naturally with a blank at each end, both blanks being drilled ⅛in. clearance. The armature is a ⅜in. length of similar material to the coil core, otherwise soft iron rod, and tapped for half of its length 4 BA, for screwing to the other end of the pendulum rod.

A 4 BA terminal head forms the grading nut, this and the armature, both being locked in position on the pendulum rod by suitable nuts. A lead cartridge is cast to fit snugly into the can and drilled out 4 BA clearance.

Mounting the Bulle

Movement and face are supported by a ½in. × ⅛in. flat strip, bent to the shape shown and bolted crosswise to the back of the main column, which should be recessed to accommodate it. The general arrangement is shown in Fig. 5. The actual dimensions of the movements which might be used by readers not being known, this is intended merely as a guide, the actual dimensions and positions being approximate. The extremities of the strip are bent at right angles to form faces, against which the face itself is bolted, while two lugs of ¾in. rod, screwed into the side arms of the strip, carry two bent ⅛in. rods, each of which is threaded 4 BA at one end. These pass through the two holes invariably found in the main framework upon which the Bulle is built, and are secured by locking nuts and washers.

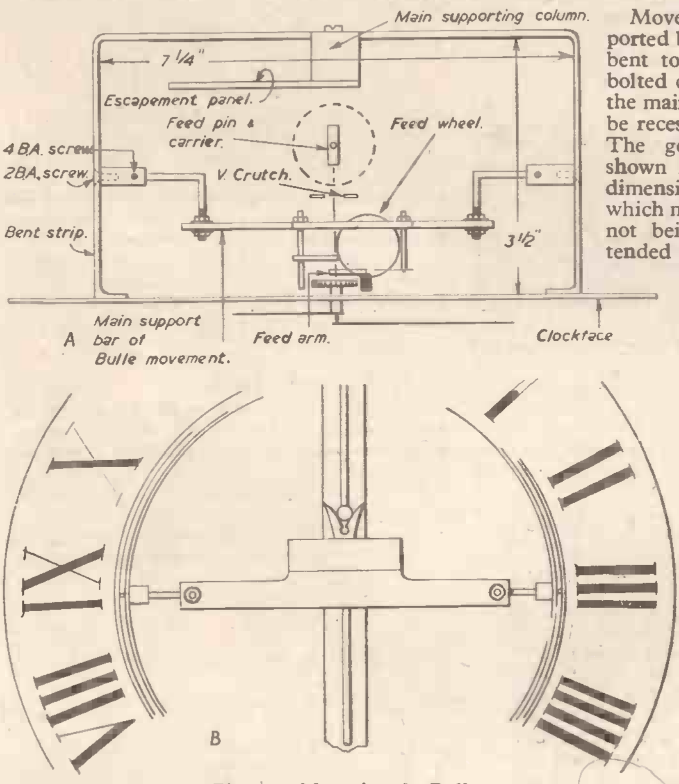


Fig. 5.—Mounting the Bulle.

Calculation of the pendulum length is not difficult in the case of the ordinary escape wheel-pallet type of clock, but it is more difficult in the case of Bulle movements, which seem to have been made for a variety of pendulum lengths, and as a contrate and wormwheel arrangement is involved great care must be exercised, if the pendulum is missing, in calculating its original length.

Positioning the Feed Pin

From a brief examination of a Bulle clock working it will be seen that the feed arm is rocked backwards and forwards, the former stroke selecting a tooth, the latter feeding same, the feed (contrate) wheel being held in position in some cases by the orthodox detent click; in others no detent is used, but a double feed arm mounted rocker-wise feeds one tooth with each oscillation.

This rocking motion is imparted to the feed arm (or arms) by a shaft upon which they are mounted, and which oscillates through 70-80 degrees. (At the end of this shaft is the crutch arm, a "V"-shaped plate which in the normal running has electrical properties.) This degree of oscillation must be preserved in order to produce the correct degree of throw or feed; it follows, therefore, that the correct position up and down the pendulum rod of the feed pin must be found, the higher up the shorter the throw and *vice versa*. The movement with its crutch arm and on its carrying strip must be mounted to match. The location on the main column of the cruciform bar, therefore, will be a tricky job as the exact amount of feed must be imparted to the count wheel, and the size of the teeth of this gives little margin either way. Correlative with the position of the feed pin on the pendulum rod we have, of course, its arc of swing, and here the coil mounting arrangements give ample scope for adjusting this swing and at the same time some error in the mounting of the movement.

Fig. 5B shows an elevated view of the mounting and the association between "V" crutch and feed pin which can, as a refinement, and to lighten the friction load on the pendulum, be fitted with a roller sleeve. Although raising the pin in the "V" will shorten the feed and *vice versa*, this must not be used as a method of adjustment, the pin remaining always half-way down the "V."

Alternative Method of Mounting Movement

The photograph shows an earlier method of

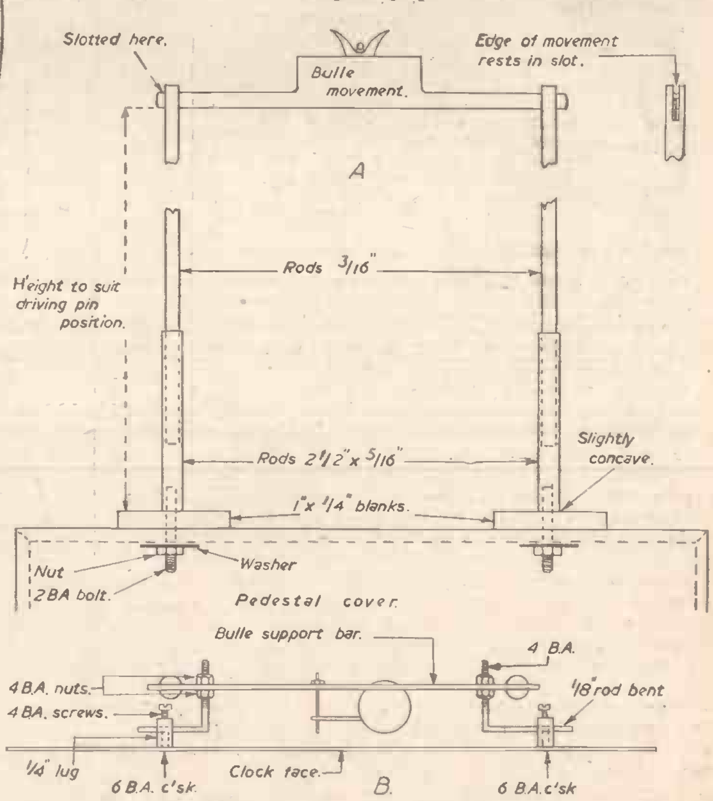


Fig. 6.—Column method of supporting movement.

supporting the Bulle movement and face on a pair of columns as shown in Fig. 6, the 6in. × ⅛in. baseplate in this case not being used. This was abandoned in favour of the bent strip method (Fig. 5A), but the choice of the two methods lies with the reader.

Fig. 6A shows that two 2½in. × 5/16in. rods are tapped 2 BA at one end and drilled out 3/16in. clearance for about 1½in. at the other. 2 BA bolts[1] secure these posts and their bases (1in. × ¼in. blanks) to the top of the pedestal cover by means of nuts and heavy washers.

The Bulle movement lies, a fairly tight fit, in slots cut in the upper ends of 3/16in. rods, the lower ends of which fit telescopically into the posts. The length of the complete column will depend upon the length of the pendulum rod and the position on same of the driving pin. In the photographed model (4½in. effective length) it is 7½in.

Fig. 6B shows how the face is secured to the movement by means of a pair of ⅛in. rods bent to right angles, one arm of which passes into lugs ¼in. thick, ½in. long, screwed at 3 and 9 to the face. The threaded end of the other passes through the movement supporting bar and is locked by nuts as shown.

The escapement in the photograph is also slightly different from that shown in Fig. 2, mainly inasmuch as the bell crank lever of the switch assembly is made from a ⅛in. square section bar bent to right angles, pivoted and having for its back stop a screw let into a post similar to H. This method, though simpler to construct, is not recommended owing to excessive play developing on the small pivotal area of the ⅛in. bar.

(To be continued)

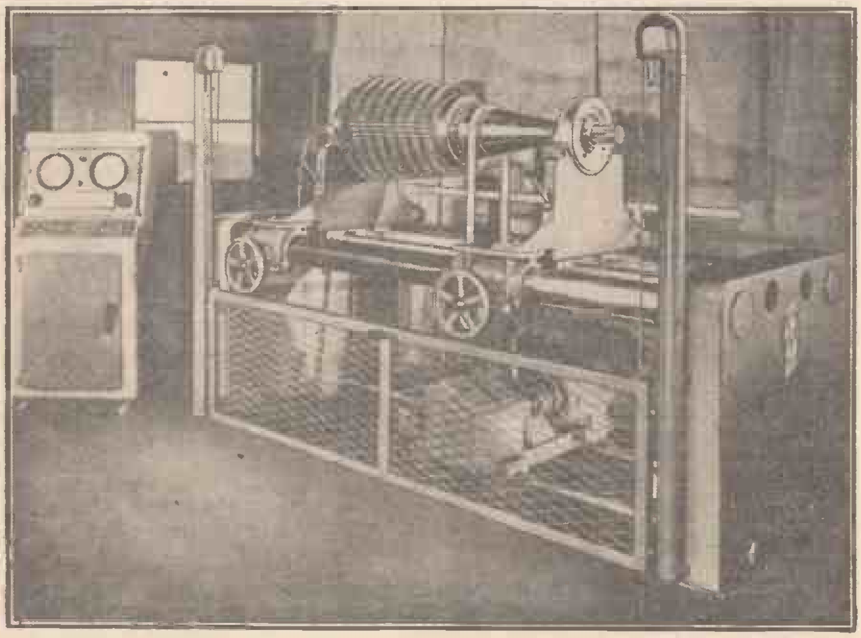
Science Notes

Railway Lines Set in Rubber

A NEW steel synthetic rubber tieplate has been produced in America by the American Railroad Pad Co. Its production was made possible by the release by the Government of a secret formula for mounting jet engines in aircraft. The rubber tieplate consists of a synthetic rubber base, a steel core and a synthetic rubber rail cup on top, all bonded together under pressure of 35 tons per sq. in.

Revolving Building

IN process of construction at Grand Junction, Colorado, is a six storey office building of glass and aluminium sandwich panels. The most unusual feature of this building is that it is mounted on a pivot below the front entrance and can revolve a total of 90 deg.; most of the weight floats on a 33,000 gallon reservoir. In summer it will present its heat-reflecting aluminium roof to the sun's rays and in winter it will turn to admit as much sunshine as possible.



Shown for the first time at the S.A.B.C. Exhibition at Farnborough (September 5th-11th, 1955), this newest and largest of the range of E.M.I. Dynamic Balancing Machines is capable of balancing rotating parts weighing from 75-1,500lb., with lengths and diameters up to 60in. and 36in. respectively. Sensitivity is sufficient for detecting and measuring unbalance forces displacing the centre of gravity by as little as 0.00002in. (0.5 micron).

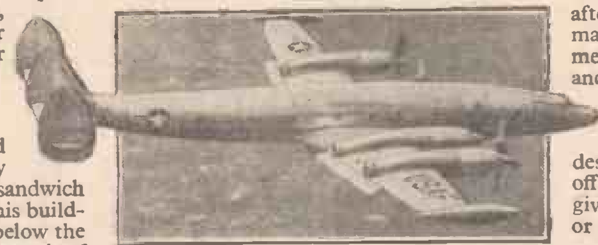
Tamper-proof Bottle Cap

A SPECIAL aluminium foil bottle cap is being manufactured by a Copenhagen firm. This cap is proof against pilfering, tampering and adulteration; it fits over the neck of the bottle and changes colour if any attempt to remove it is made.

New U.S. Transport Plane

A FLYING view of the new 440 m.p.h. turbo-prop Super-Constellation military transport aeroplane now being tested by the United States Air Force and Navy is shown below.

These new transports, powered by four



Pratt and Whitney T-56 turbo-prop engines developing 22,800 h.p. together, are the fastest propeller-driven airliners in the world.

They can fly from London to Moscow and back in seven hours or to Cairo in six. And over these ranges they can carry loads of 32,000lb.

With their 8,770 gallon fuel capacity, including 1,200 gallons in wing-tip tanks, these new planes can fly non-stop for a maximum of 4,000 miles.

The propellers needed to absorb the turbo-prop power are 2ft. wide and 15ft. in diameter.

The "Robotphone"

IN the Electronic Features Section of the Radio Show was the Pye "Robotphone," which is a telephone answering machine designed to answer a telephone automatically in the absence of the subscriber as well as permitting the caller to record a message.

If the subscriber is out when his telephone rings, it will continue to ring for ten seconds, after which the answering machine will automatically connect to the line. A pre-recorded message then gives the subscriber's identity and whereabouts and invites the caller to record a message which the subscriber can play back when he returns.

The "Robotphone" has been specially designed for use in business premises during off duty hours so that urgent messages can be given and orders taken at any time of the day or night.

An Underwater Watch

ROYAL NAVAL divers have been issued officially with a new type of wristwatch developed by Hans Wilsdorf, Chairman of The Rolex Watch Co., Ltd.

The watch is self-wound by a rotor mechanism as the diver walks or swims. The dial is a jet black instrument type illuminated for extra clear reading underwater and at night.

New Type of Glass

GLASS transmitting a greater range of infra-red rays has been developed from oxides of antimony. Ordinarily, glasses are based on silicon, but such glasses do not transmit the longer infra-red rays. The antimony oxide glass, which includes oxides of aluminium and the alkali metals as stabilising agents, will transmit rays of about one-third more of the infra-red spectrum than will ordinary glass. Light rays longer than those absorbed by water vapour are also transmitted by the new glass.

Improved Correction Fluid

A NEW correction fluid is now available for use in preparing copy for offset and other reproduction processes. The opaque white substance, which dries in a matter of seconds, is simply painted over errors in the copy. Corrections may then be typed, written or drawn on the new white, flexible surface which will neither flake nor crack. Corrections made with the fluid are not detectable in photographs.

The new correction fluid which has been given the trade name "Snopake," was developed at Battelle Institute, Columbus (Ohio), under the sponsorship of the Battelle Development Corporation, a subsidiary of the institute. The product is being made and marketed by Fototype, Incorporated, Chicago, Illinois.

A Sliding Horizontal Titler

An Accessory for the Home-ciné Enthusiast

By F. SPROTT

IT seems strange that so few amateurs complete their films by the inclusion of titles, which can mean so much by way of introduction and explanation to their viewers. A little thought will convince one that a film presented without titles is but half finished.

Keeping in mind the thought of titles when photographing, one ought to be able to find subjects such as road signs, maps, panoramas, etc., which should be shot, and later these can be introduced appropriately when editing, helping in their way to give atmosphere to the film.

There are also a variety of title cards and letters on the market designed for titling; these, in conjunction with drawings, etc., can be arranged appropriately to provide interesting titles according to the subject.

The drawings shown will enable you to make an inexpensive sliding titler.

The Feet

These are made from beech or other close-grained hardwood. Prepare the pieces to the sizes shown in Fig. 1 from 1in. thick material. Screw together the two halves and then bore the two holes a tight fit for the slide bars, which are made from ⅝in. diameter tubing. There is no need to bore these holes right through. The two halves can be made to take a tight grip on the bars by taking a slight shaving off the contact faces. Take care to keep the distance between the tubes the same on each foot. When completed the feet can be shaped to the outline shown, nicely cleaned up and glasspapered; removing the sharp edges will improve the appearance.

The ⅝in. diameter tubing can be dural, brass or steel, 2ft. 6in. to 3ft. long, and would look well and provide ease of sliding if chromium plated.

Title Frame

The title frame as shown in Fig. 2 is made to take an 8in. by 6in. card, but this can be varied to suit any commercial size cards available. The frame itself is of hardwood, ½in. by ⅜in. in section, with an ⅛in. groove in the centre to take the cards (see Fig. 1). The corners are dovetailed, glued and reinforced with ½in. by 1/16in. brass angles made for the purpose, and screwed in position as shown. The frame is mounted on a 5/16in. diameter brass column 2¾in. long, which is riveted and soldered to a ½in. wide brass plate, screwed to the underside of the frame. The column is housed in a 5/16in. diameter hole drilled in the foot. To the side of the foot is screwed a threaded brass plate to take a 3/16in. thumbscrew, which screws against the column, holding it at the required height.

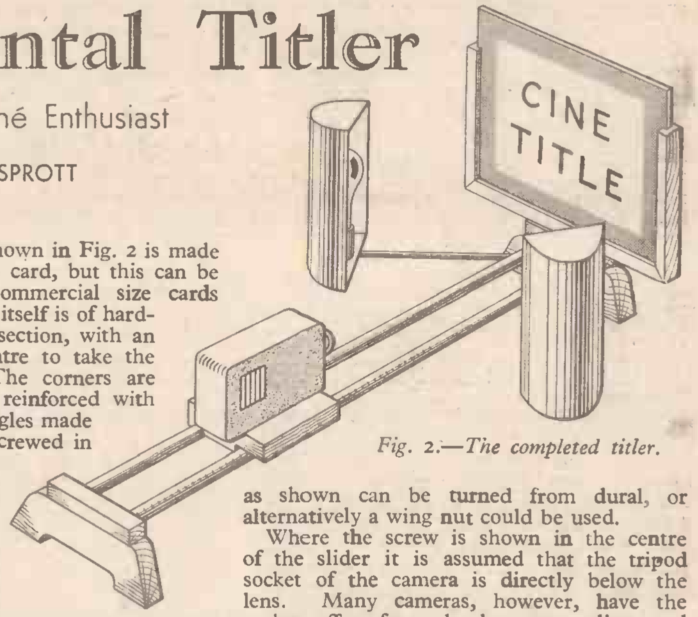


Fig. 2.—The completed titler.

Camera Support

The slider is made from hardwood 5in. long by 4in. wide and 1¼in. thick, shaped as shown in the section (Fig. 1). The centre screw is a 2½in. length of ¼in. diameter brass rod, threaded ¼in. diameter Whitworth, ⅜in. long at one end, the other end threaded similarly 1in. long. The top end has a brass plate 1¼in. by ¾in. by ⅛in. tapped in the centre for the rod, with two countersunk holes for woodscrews. This plate is screwed on the rod and soldered; the rod fits a ¼in. hole drilled in the centre of the block, with the plate sunk flush with the top and screwed in position.

As most English camera tripod bushes are threaded ¼in. Whitworth, the detail as shown will suit, but for the Continental thread ⅜in. diameter Whitworth will be required, and the central screw will have to be turned from ⅜in. diameter rod to suit, or alternatively an adaptor can be used.

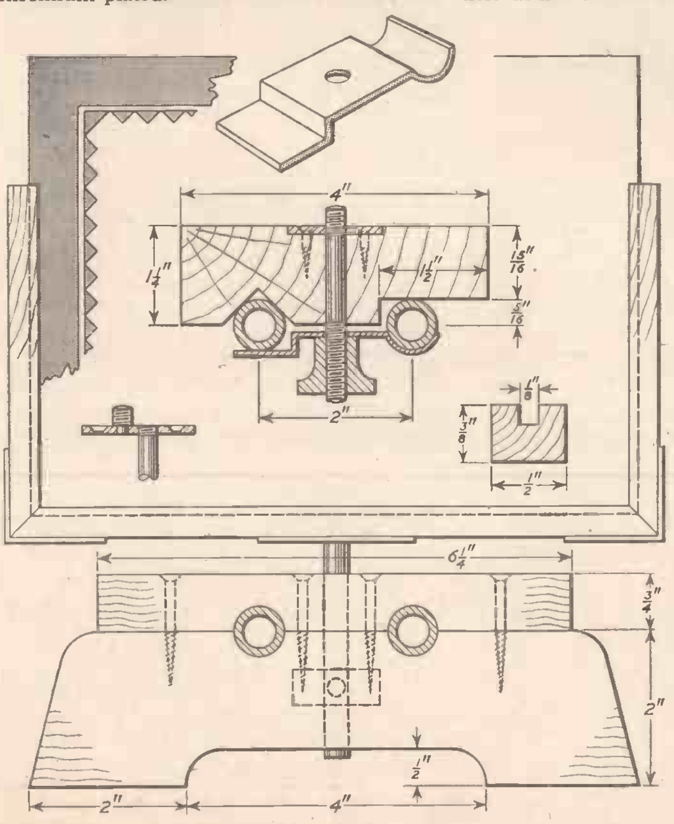


Fig. 1.—Working details and dimensions.

The Keep Plate

This is bent to the outline in Fig. 1 from 1in. by 3/32in. steel plate. Bend the curved end first over a ⅝in. diameter bar—it would be advisable to heat the end for this purpose; next set the plate in position on the slide bars and mark for the right-angle bend, allowing a little clearance as shown; the depth of this bend is 3/16in. Finally mark the position of the hole from that already drilled in the block, and drill a ¼in. clearance hole. A nut as shown can be turned from dural, or alternatively a wing nut could be used.

Where the screw is shown in the centre of the slider it is assumed that the tripod socket of the camera is directly below the lens. Many cameras, however, have the socket offset from the lens centre-line, and for this purpose the screw plate will have to be altered as shown in the small detail; this shows the tripod screw offset the required amount and riveted and soldered to the plate.

Lamp Holders and Reflectors

The reflectors are made from tinned steel plate, cut and soldered together to the dimensions shown in Fig. 3, a 1¼in. hole is cut in the bottom of each to take the lampholder.

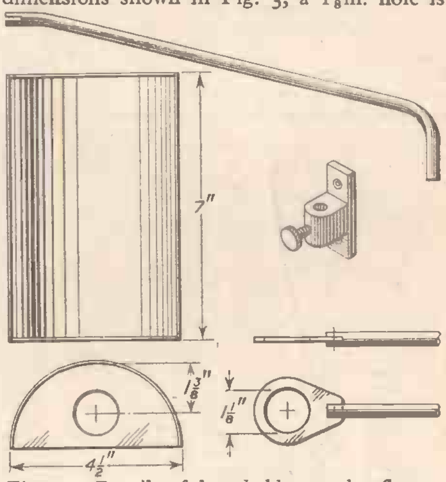


Fig. 3.—Details of lampholders and reflectors.

The supporting rods 5/16in. diameter are 12in. long, bent as shown in Fig. 3. The amount of incline should be such that the centre of the lamp comes in the centre of the title card. One end of the rod is slotted and a 1/16in. lamp plate, shaped as shown and drilled for the lamp holder, is riveted and soldered into the slot in the end of the rod. The other end is bent down to fit into a hole in the small bracket shown. These brackets are screwed to the side of the foot, allowing the lights to be swung into position and fixed with a small thumbscrew.

For measuring the position of the camera in relation to the title card small nicks can be made as shown in Fig. 2, measuring from a rule, along one of the tubes. A pointer is fixed to the slider; the nicks can then be blacked in after plating. Alternatively a collapsible steel tape-measure could be used.

On completion the tubes and light supports would look well chromium plated and the remainder painted with a grey enamel.

Finally, wire the lamp-holders with a suitable length of flex and a mains plug.

A Simple 6" Reflecting Telescope

By A. G. ROBERTSON, B.Sc., F.R.A.S.

Notes on the Construction of Telescope and Equatorial Mounting

Fig. 1.—The completed telescope.

THIS 6in. reflecting telescope was designed primarily for ease of construction, using a minimum number of tools and inexpensive materials. The main parts may be divided into three sections—a wooden mounting, the telescope tube, the optical parts.

MATERIALS REQUIRED FOR TELESCOPE AND MOUNTING

TELESCOPE

(a) *Optical*

1 6in. aluminised mirror.
1 elliptical diagonal flat mirror.
1 or more eyepieces.
(Available from Advertisers in PRACTICAL MECHANICS.)

(b) *Tube*

1 6in. diam. heavy cardboard (or light metal) tube.
1 6¼in. diam. thick wooden disc for foot of mirror cell.
1 21in. × 5in. rectangular piece of tinplate to form side of mirror cell.
1 21in. × 5in. rectangular piece of tinplate to strengthen tube at pivot.
1 3in. × 3in. × 1½in. block of wood to form eyepiece holder.
1 small triangular block of wood for diagonal holder.
1 ft. of galvanised wire to support diagonal holder.
1 6in. × 1in. × ¼in. strip of lead for counter-balance.
(All available from local merchants.)

MOUNTING

2 base bars, each 2ft. 6in. × 4in. × 2in. (A).
1 slant base, 2ft. × 1ft. 6in. × 1in. (B).
1 circular top, 1ft. 6in. diam. × 1in. thick (C).
2 sides for yoke, each 1ft. 6in. × 9in. × 1in. (D).
2 side supports for yoke, each 9in. × 5in. × 1in. (E).
1 cross strut in base 1ft. 10in. × 2in. × 1in. (F).
1 slant support 10in. × 2in. × 1in. (G).
1 friction disc, diameter 12in.
3 sets of bolts, wing nuts, spring washers (2½in. × ¼in.).
(All available from local merchants.)
References A-G on Fig. 2.

The Mounting

This is made of hardwood to form a substantial base, and is so designed that in latitude 56 deg. North the telescope can follow a star by rotation about only one axis, i.e., it is an equatorial mounting. The yoke of the mounting is so placed that comfortable observations can normally be made from a sitting position in a chair.

The various parts of the mounting are shown clearly in Figs. 1 and 2 and the sizes of material required in the list given. One or two points, however, call for comment. The 18in. circular disc of wood supporting the yoke is separated from the mounting plate underneath it by a friction plate, and the central nut and bolt so adjusted that the telescope plus yoke can easily be rotated, but sufficiently tight for the telescope to stay put in any desired position for observations to be made.

The Barrel

The tube is a 6in. diameter cardboard tube of the type used for mounting linoleum rolls on; it was brushed thoroughly on both sides with a solution of shellac and methylated spirit to give it strength and more than sufficient rigidity for the purpose. The inside was then given a coat of flat black paint to prevent internal reflections from the sides of the tube, and the outside finished in silver. As the mirror cell is semi-permanently attached to the tube a cardboard cap was made to fit the top to prevent dust entering when the telescope is not in use.

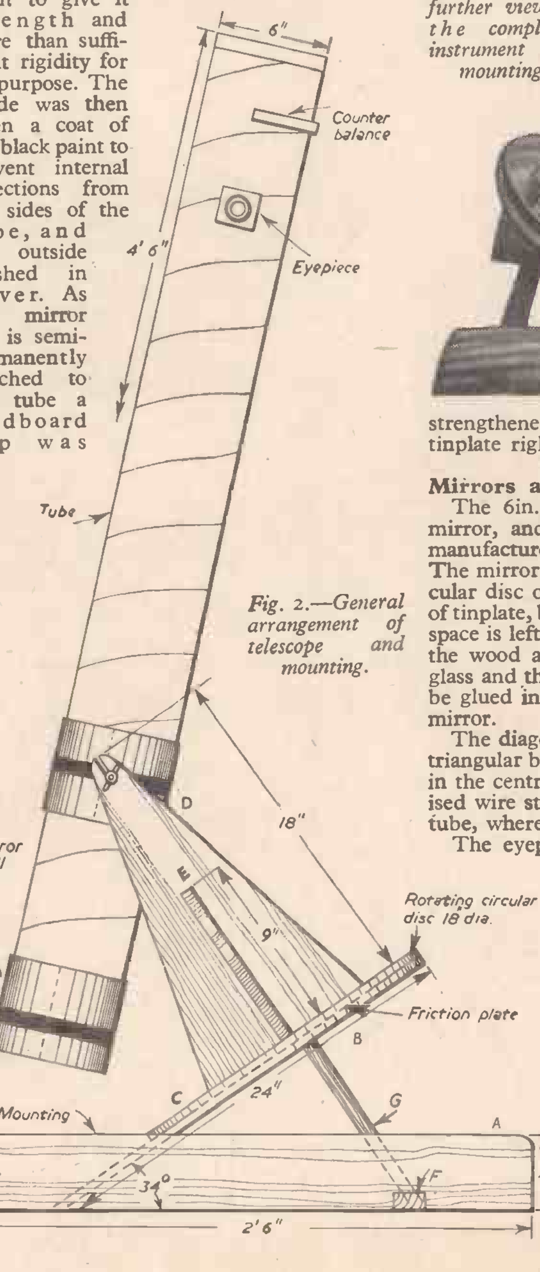


Fig. 2.—General arrangement of telescope and mounting.

The tube is attached to the yoke by means of two bolts with spring washers and wing nuts for ease of adjustment, and the tube is strengthened here by means of a band of tinplate right round it (see Fig. 2).

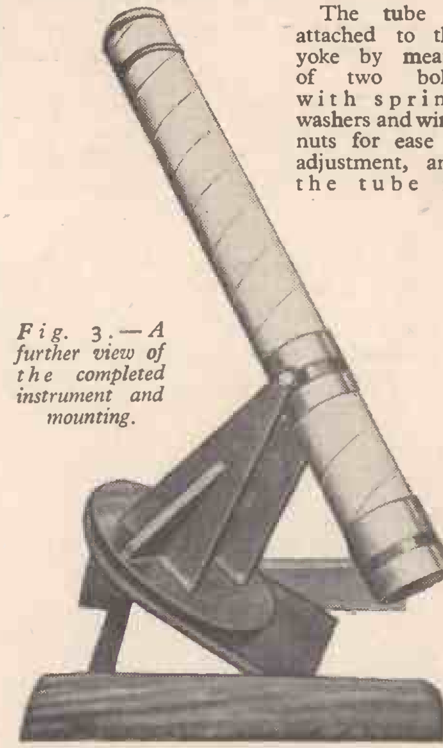


Fig. 3.—A further view of the completed instrument and mounting.

Mirrors and Eyepieces

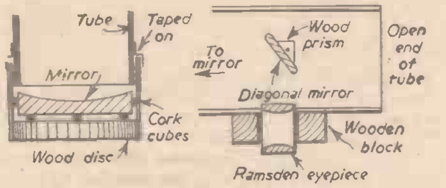
The 6in. mirror, elliptical diagonal plane mirror, and eyepieces were purchased from a manufacturer, and mounted as in Figs. 4 & 5. The mirror is set in a cell whose base is a circular disc of wood and whose sides are made of tinplate, bent round and soldered. Sufficient space is left between the back of the glass and the wood and also between the sides of the glass and the metal for small cubes of cork to be glued in order to protect and support the mirror.

The diagonal mirror is mounted on a small triangular block of wood, which in turn is held in the centre of the tube by means of galvanised wire struts running to the outside of the tube, where they are adjustable (see Fig. 5).

The eyepiece is set in a square block of wood, which is rounded and glued to the tube. A hole is bored in the wood so that the eyepiece forms a close fit in it in order to provide friction focusing.

The optical parts are fixed in the following order:

First, the 6in. mirror, so that the image of a pair of crossed strings at the open end (top) of the tube coincides with the strings themselves when observed from the open end. Next, the diagonal mirror is positioned so that on looking in through the hole in the eyepiece block an image of one's own



Figs. 4 and 5.—How the mirror is mounted and the eyepiece and diagonal mirror arrangement.

eye is obtained centrally. Finally, the eyepiece is fitted, the only adjustment necessary being that of focusing.

The eyepieces at present in use are a ¾in. orthoscopic and a ½in. Ramsden, giving magnifications of 64 and 96 respectively. The high-power one is sufficient to show such details as shadows in the sides of mountain ranges on the moon's surface, to give but one example. The optical train is shown in Fig. 6.

The telescope is set up for use with the yoke arms pointing north.

It is hoped to add soon right ascension and declination scales on the mounting, and a small finder telescope near the top of the tube, when the small lead balance strip could, of course, be removed.

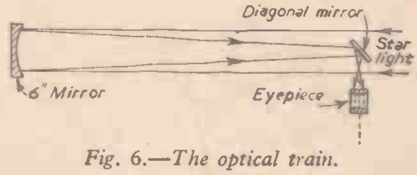


Fig. 6.—The optical train.

The total cost of telescope and mounting was well under £20, and the performance of the instrument is comparable with professionally made ones used by the writer and costing several times as much to buy. A further view of the completed instrument is shown in Fig. 3.

A Speed Control

FOR MODEL ELECTRIC RAILWAYS

A Unit with Forward and Reverse Movement

By ST. CLAIR

THE materials required are few and inexpensive, even if they have to be bought, which is unlikely, as they abound in most amateur workshops. The advantage is that you can have an infinite number of controls in your layout, at a minimum cost, and very little trouble.

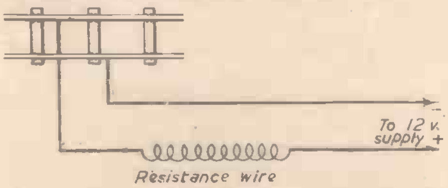


Fig. 1.—Testing length of resistance wire required.

The Resistance

This consists of a length of wire unwound from an old electric fire element. You first require to determine the total resistance necessary to lower the speed of the train, and this may be done very simply, without recourse to Ohm's law. It is assumed that a 12-volt D.C. supply is being used, and it is only necessary to put the full length of resistance wire in the circuit, as shown in Fig. 1, place the train on the track, and observe the result. In all probability the train will remain stationary at this stage, in which case it will be necessary to slightly shorten the resistance wire and try again. By a succession of such tests a suitable resistance for a starting speed will be arrived at. Next, divide the length of wire into six equal parts, and wind them into little coils as in Fig. 3, using a piece of ⅜in. dowel rod as a former. The number of turns is immaterial. Another six similar coils are also necessary for the reverse section. These six are omitted from Fig. 3, so that the saw cuts can be clearly indicated.

The Contacts and Mounting Board or Platform

The contacts are cut from 26 s.w.g. brass, after being marked out as in Fig. 2. Also shown is the mounting platform cut from hardboard. Next, affix the brass to the hardboard in the position shown in Fig. 3, using Bostik "C" adhesive, and place under firm pressure in a vice. When set, use a fret-saw, and cutting through both brass and hardboard, make saw cuts as shown in Fig. 3, so that the little brass sections have no electrical continuity. Finally, solder the ends of the coils to the outer edge of the sections, in such a manner that current flowing from one section to the next can only do so, by passing through one of the little coils. The supply current is fed to the resistances through wires soldered to the lower ends of the resistance contacts, and connected to a pair of terminals on the outside casing. All solder should be kept to the outer half of the contacts to prevent fouling of the collecting brushes on the control arm.

The Control Arm and Collecting Brush Assembly

The construction of this item can best be understood by reference to Fig. 4. Essentially, it consists of a spindle with two arms on each of which is mounted a springy brass brush which slides along the segments of the resistance contacts, collecting the current therefrom. One brush must be insulated from the arm, and current from it conducted through a wire looped around the spindle, and thence to an output terminal. Current from the other brush is conveyed through the spindle itself, at the lower end of which it is collected by another brush, which in turn is connected to the other output terminal.

A study of Fig. 5 will show how the control will operate. Imagine, first of all, that the control arm has been rotated in a clockwise direction, so that one brush is making contact with the first segment on the right-hand side of the resistance platform. It will, therefore, be receiving a negative charge

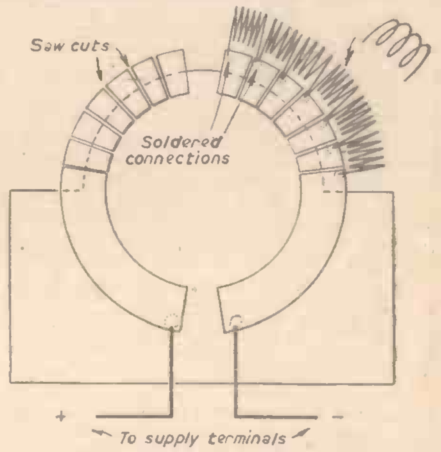


Fig. 3.—The resistance platform and one of the resistance coils ready for soldering.

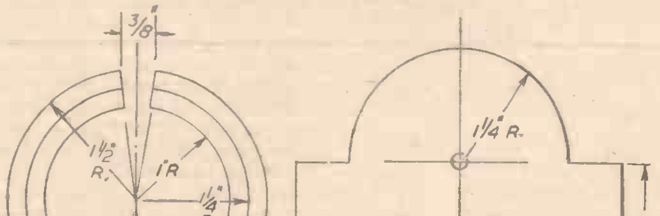


Fig. 2.—Dimensions of contacts and platforms.

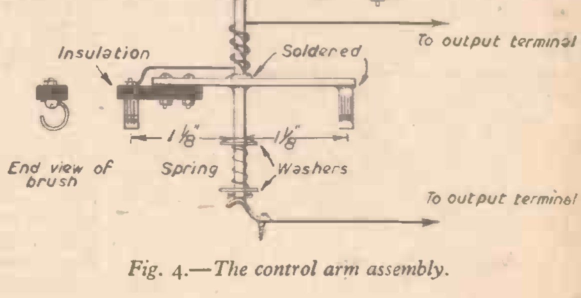


Fig. 4.—The control arm assembly.

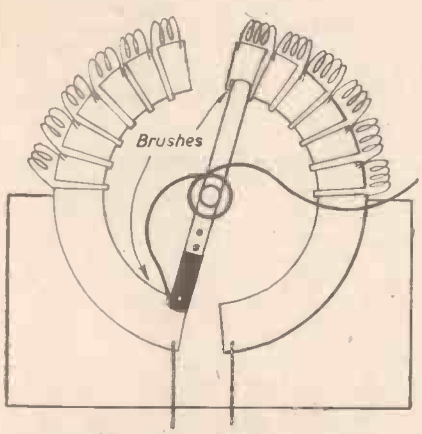


Fig. 5.—The control in position.

through the whole of that resistance, which, of course, is receiving negative current from the supply. At the same time, the brush on the other arm is receiving positive current from that part of the opposite contact which is not subjected to resistance. The train, will, therefore, move forward, let us say (depending on which way it is facing on the track) at starting speed. If the control arm be further rotated in the same direction, the brush will have moved on to the next little segment, and will, therefore, have cut out the first little coil, thereby reducing the resistance and allowing the train to continue forward at an increased speed.

Each time the brush reaches another segment the resistance will be reduced, until the brush reaches the uncut portion of the contact, when full speed will be reached.

When the control arm is rotated in an anticlockwise direction, the original brush will begin to make contact with the segments on the left-hand side of the resistance, and inversely, the other brush will now be on the right-hand side. Therefore, since polarity has been reversed, the train will also reverse.

The outer casing can be made from ⅜in. plywood or hardwood. Make the sides so that the internal dimensions are 4in. by 4in. by 2in. deep. Screw the resistance platform on to the ledges, then screw the lid in place temporarily. Then turning the case upside down on the drilling table, and using the spindle hole in the platform as a guide, drill through the lid, so that the two holes are in correct alignment. Oherwise difficulty might be encountered in getting the brushes to make contact all the way around the traverse of the platform. Next, remove the lid, insert the spindle assembly and solder on the control arm, so that it is in line with one of the arms carrying a brush. After the terminals have been suitably connected, the lid can be fixed in position. To ensure that the brushes are held down against the platform, insert a spring between two washers and put the split-pin in the hole which should already have been drilled. Fit the bottom, and arrange a brush on it to collect the current from the bottom of the spindle, and fix in place.

A few coats of shellac or bright enamel will enhance the appearance of the unit, while neat lettering of "STOP" "SLOW" and "FULL" will add authenticity.

Science and Observation

By Prof. A. M. LOW

Scientific Amusement

HAVE you noticed that in all good games and amusements science now takes a vital part? Golf balls are examined for ballistic properties, high-speed cine-cameras record various strokes and wrist positions, and the most technical methods imaginable are used to manufacture billiard tables or to record the winner of a dog race.

The new revolving winning post which only causes a slight blur to the eye but shows an exact position under the eye of a camera, is an example, but if it ever slows down during use I feel that some onlookers may think of the story of the man who stepped upon one of the new spring ballroom floors after dinner and was heard to mutter, "Does it, or am I?"

The latest joke vendor on the music-hall stage will soon be using what I might call a *personal* talker. He will affix a small loud-speaker at the focal point of a parabolic sound mirror and then, pointing it to the desired group in the audience, will tell the story.

An almost exactly similar method is used to find where echoes occur in buildings used for musical entertainment. Noises are directed at different spots and the direction of the axis of the mirror noted so that part of the ceiling or a section of some particular wall may be treated by means of sound-absorbing plaster.

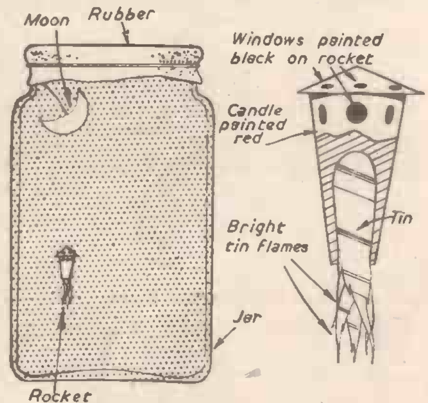
Atomic Motors

Has it occurred to you that there is now in existence an "atomic" motor? Have you not seen in the window of a chemist's shop a Crooke's radiometer? It is merely four little vanes, one side of each being blackened and the other bright. The sunlight falls upon them and, as there is a little air in the bulb, heat is usefully reflected from the bright side and absorbed by the black and round goes the motor. Obviously, black absorbs heat or gives it out whereas bright objects merely reflect like reflectors in an electric fire without themselves getting too terribly hot.

Just as a few million photo-electric cells might theoretically work an electric railway so a few more million radiometers might drive a car. It is almost an atomic motor in one sense but has very little resemblance to the machine of the future.

The Modern Version

If ever you have to amuse the younger members of the family and want to lead them towards the beauty of model making with a useful purpose, try a modernised "water imp." It is very simple. Cut about 1½in. of candle into the shape of the traditional



The spaceship "water imp."

space ship and hollow it out as in the sketch. Stick a flame-like piece of thin tin underneath and put it into a jar full of water, weighting the candle with pins inside until it only just floats. Fill the jar to the top and stretch over it a piece of rubber sheet from an old inner tube. As you press, the air in the jar is compressed, the displacement is reduced and down goes the ship; it rises again when your finger is taken from the rubber seal. A quarter moon in the top of the jar helps this toy to please everyone.

Use Water

Until comparatively recent times, everyone did not hesitate to drink water from streams. Now we have discovered queer things through microscopes and we know that a drop of water in a pond looks like a jungle with horrible creatures dashing about all day. The electron microscope magnifies to a vastly greater extent and it can even show an unfilterable virus in shadow form. It may help us to find the cause of some of the ordinary colds. Germs are quite clever things; they may even have sex differences.

Moustaches, as we all know, used to filter things from streams, but we have progressed a a little and use pack filters to remove the smallest particle. Electrical methods can destroy germ life which is bad for us. I hope that the good germs stay behind, as is alleged in the various treatments of milk.

Nowadays water is quite a complicated affair. Mountain streams need softening to avoid waste of soap and to make it usable for washing; the burbling river probably contains dirt from animals so that boiling or filtering is essential, while even aeration might be considered before the water reaches our table.

The latest method of water softening is by the use of certain strange minerals called zoolites which are found in natural form or can be made synthetically. Zoolites have the very useful property of being able to take out the lime and magnesium from water that is passed over them and replace those chemicals by harmless sodium compounds. By such a method thousands of pounds a year can be saved in industrial plants, for the cost of the water softening process is small in comparison.

The Mechanical Stenographer

I have noticed a reference to a machine which actually types what is spoken to it, and, as this would seem to outpace the beautiful dictaphone which I have used with thankfulness for 30 years, I want to cast doubts upon the practicability of this stenographic marvel.

In the first place no two people speak alike, and while it is not difficult to arrange two diaphragms of which one responds to the word "yes" and the other to "no" so that a robot will do what it is told in answer to a few simple queries, I do not credit that the system is, as yet, capable of much extension.

How could anyone adjust any mechanical apparatus so accurately? Let alone keep it adjusted in order that it might type the same word when spoken to by a Scotsman, an Irishman, an American or myself with a bad cold. The "typophone," as I have nicknamed it, will not be possible, or so I think, until phonetic speech and perfect mechanisation replaces our vocal arrangements.

I have always thought that speech was a nuisance and the necessarily complex apparatus of rubber tubes, glycerine, lubricants, balloons and pressure-control valves which were so cleverly used by Sir Richard Paget when he manufactured such simple words as "Mamma" or "Papa" most adequately supports my theory. The day when most of our bodily parts can be mechanised will not be for many, many years. I believe it will come, but I hope we shall *think* more clearly at the same time.

RADIO CONTROLLED MODELS

By Members of the I.R.C.M.S.

3.—A Two-valve Transmitter for Radio Control

BEFORE starting construction, something should be said about the G.P.O. licence which has been necessary since June 1st, 1954. Before any transmissions are made a licence must be obtained from the following address:

Radio & Accommodation Department,
Headquarters Building,
G.P.O., St. Martins-le-Grand,
London, E.C.1.

The cost is £1 for a period of five years, and there are no tests to be passed or other complications. The licensee is permitted to work in the bands of 26.96-27.28 mc/s and 464-465 mc/s with powers of 1.5 and 0.5 watts (effective radiated power) respectively. It is the former band which interests most modellers, as it is usually considered easier to handle equipment working on the lower frequency.

Transmitter Details

The transmitter design we have chosen to describe is an " Old Faithful " to radio-control fans—a push-pull Hartley circuit familiarly called a " cross coupled." It is, if correctly wired, almost impossible for it not to work satisfactorily. There is in addition only one tuning control, which can be easily adjusted to set the transmitter in the model control waveband, and it is therefore ideal for the beginner and regular user alike.

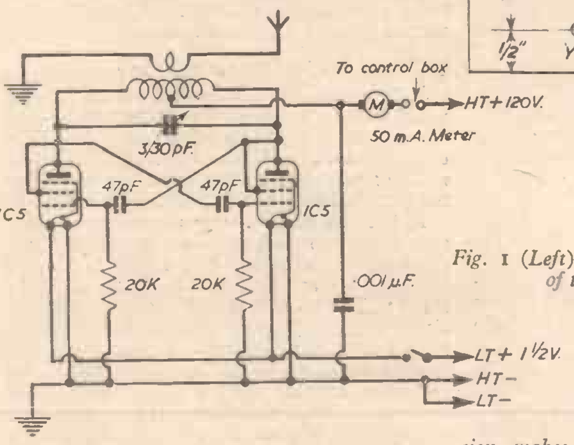


Fig. 1 (Left).—Theoretical circuit of transmitter.

Readers familiar with theoretical diagrams will see from Fig. 1 that the circuit is very simple and consists of a pair of battery pentode valves (connected up as triodes), anodes (cross connected) to grids, with a centre-tapped anode coil which, along with its associated trimming condenser, determines the frequency. The valves used in the original circuit were 1C5's, but a pair of any similar type of battery pentodes can be used providing that any necessary changes are made in wiring the valve base connections. Suitable alternatives are 3Q5, 3D6, DL33, etc. and Fig. 4 shows a transmitter employing 3D6's. A more compact arrangement could be made by using B7G based valves or else a single type 3A5 miniature double triode, but the beginner is advised to stick to the 1C5 and wire up exactly as described.

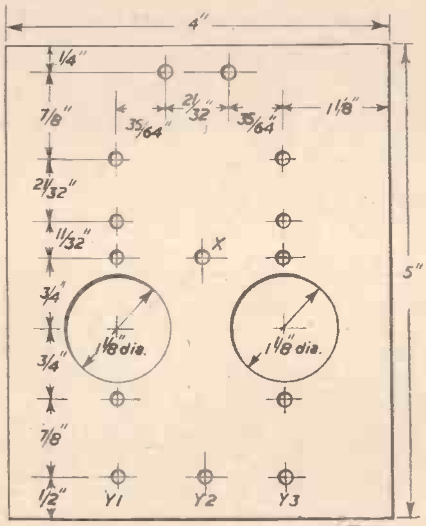


Fig. 2 (Above).—Drilling template for transmitter. All holes ⅛in. dia. except valve holes.

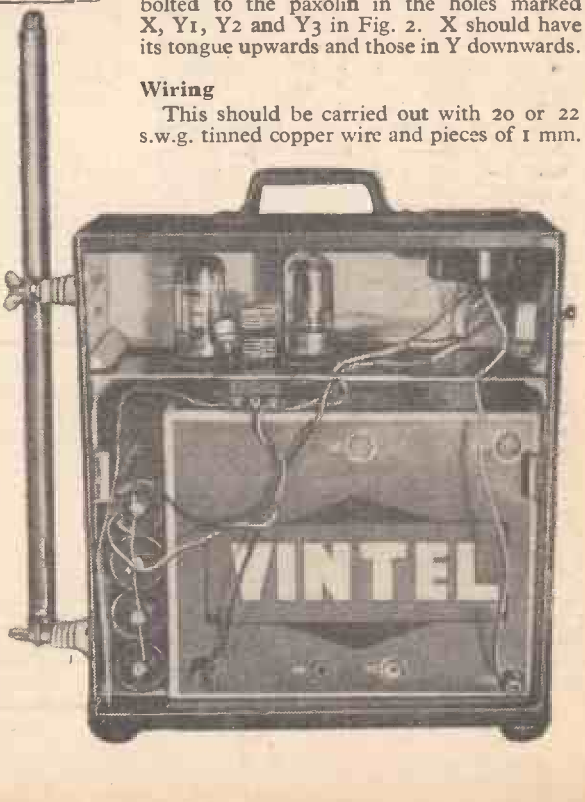


Fig. 4 (Right).—A two-valve transmitter similar to the one described in this article but this version makes use of 3D6 type valves. The position of the meter and on/off switch is easily seen. Readers will also note the method of mounting the aerial on two large stand-off insulators.

Construction

The transmitter is built on a piece of paxolin sheeting 5in. × 4in. × 1/16in. thick, and this should be drilled as shown in Fig. 2. Using 6 B.A. nuts and bolts, two International Octal valveholders (Amphenol type) should then be mounted in the two large holes, with the keyways for the valve spigots in the position shown in Fig. 3. Three Eddystone midget stand-off insulators are then mounted

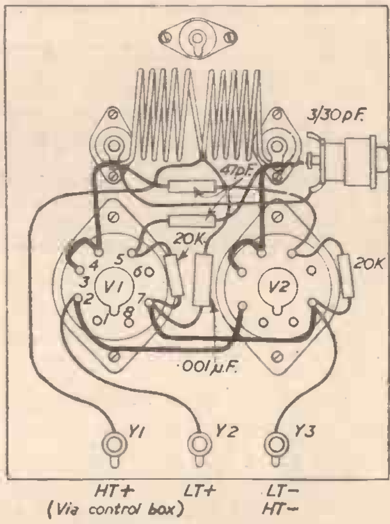


Fig. 3.—Wiring diagram for the two-valve transmitter.

as shown and a solder tag fastened under the centre nut of each. Four solder tags are then bolted to the paxolin in the holes marked X, Y1, Y2 and Y3 in Fig. 2. X should have its tongue upwards and those in Y downwards.

Wiring

This should be carried out with 20 or 22 s.w.g. tinned copper wire and pieces of 1 mm.

Systoflex tubing slipped over the bare wire for insulation. Remember that for electrical work it is important to use a hot, well-tinned soldering iron and that corrosive fluxes like spirits of salt must be avoided. Use either stick solder and Fluxite or else a cored solder like Ersin Multicore. Now proceed as follows, referring to Fig. 3:

1. Join pin 3 to pin 4 on V1 valveholder and then connect pin 4 to the solder tag on the top of the left-hand insulator.
2. Repeat for V2 valveholder, but join pin 4 this time to the right-hand insulator.
3. Join pin 2 on V1 holder to pin 2 on V2 holder.
4. Join pin 7 on V1 holder to pin 7 on V2 holder.
5. Join pin 2 on V1 holder to the solder tag Y2.
6. Join pin 7 on V2 holder to the solder tag Y3.
7. Connect pin 5 to pin 7 on V1 holder with a 20,000 ohm ½ watt resistor.
8. Repeat on V2 holder.
9. Solder to pin 5 on V1 holder one end of a 47 pfd. ceramic condenser.
10. Solder the other end of condenser to R.H. insulator.
11. Repeat 9 and 10, but this time join the 47 pfd. condenser from pin 5 on V2 holder to the L.H. insulator.
12. Now solder a piece of 22 s.w.g. tinned copper wire to the solder tag at X (Fig. 2) and connect to pin 7 on V1 holder.
13. Solder a piece of plastic-insulated flexible wire about 3in. long also to solder tag X and form it into a single-turn loop, then solder its other end to the top of the centre insulator. This will form the aerial coupling loop when completed.

N.B.—For the sake of clarity, details of 12 and 13 have been omitted from Fig. 3.

14. Now wind the anode coil from 16 s.w.g. tinned copper wire. It consists of 10 turns of wire wound on a ⅞in. diameter former (i.e., coil is approximately 1in. outside diameter) spaced out to 1¾in. long. The original coil was made from a 30in. length of wire. The ends are bent out at right angles and cut off, leaving ¼in. stubs for soldering to the tags on the L.H. and R.H. insulators. The coil must be centre tapped at the fifth turn and one end of a 0.001 mfd. condenser, also a piece of 22 s.w.g. wire soldered to the tap. This wire is to be connected to tag Y1. Slightly space out the centre turns opposite the centre tap so as to leave space for the aerial coupling loop.
15. Now mount the coil by soldering its ends to the L.H. and R.H. insulators.
16. Join the other end of the 0.001 mfd. condenser to pin 7 on V1 and the wire from the centre tap to Y1.
17. Finally, solder the centre pillar of a Philips' Beehive type trimmer 3-30 pfd. capacity to the tag on the R.H. insulator and join a wire from the L.H. insulator tag to the side tag on the trimmer.

LIST OF PARTS

- 2 1C5 type valves (or alternatives—see text).
- 2 International Octal Amphenol type valve sockets.
- 3 Small type stand-off insulators (⅝in. high).
- 2 Large type stand-off insulators (approx. 1¼in. to 1½in. high).
- 2 20 K. ½ watt resistors (or alternatively 22 K.).
- 2 47 pfd. ceramic condensers.
- 1 0.001 mfd. ceramic or mica condensers.
- 1 Philips' "Beehive" type trimmer 3-30 pfd.
- 1 50 mA meter.
- 1 On/Off switch S.P.S.T.
- 1 Plug and socket (2 pin) for control box or preferably a closed circuit jack and plug.
- 1 Telescopic aerial or aerial sections. Nuts, bolts, solder, Systoflex, 22 and 16 s.w.g. copper wire, flex, etc.

Total cost should not exceed 45/- (allowing 12/6 for meter ex advert. columns of *Practical Wireless* and *Practical Television*), but not including valves, which should not cost more than about 8/6 each.

This completes the wiring of the transmitter panel which is shown in Fig. 5.

Testing

At this stage tests should be carried out to ensure that the circuit will oscillate. Battery leads should now be connected to the tags Y1, Y2 and Y3. It is necessary to connect two leads to Y3 as this is the common negative for both H.T. and L.T. batteries. The L.T. voltage is 1½ and can be obtained from three or four U2 unit cells connected in parallel, or else one of the box type batteries fitted with a socket which are made especially for portable radios. A gas lighter cell will also give excellent results if space is available. Remember when connecting up the L.T. supply that the zinc case of the cell is negative. The H.T. voltage can be obtained from a variety of sources, but for this type of transmitter a standard 120-volt H.T. battery will give excellent results for about a year with normal use in model control.

Join up the negative leads to both H.T. and L.T. batteries and connect in series with the HT+ lead a 0-50 mA meter. The positive terminal of the meter should be connected to the H.T. battery. The two 1C5 valves can then be inserted and the L.T. positive connection made, but do not connect the aerial. The meter should rise to about 20 mA if all is well. To tune the transmitter into the band and to confirm that it is operating correctly an absorption wavemeter is a necessity. A design for this will be given next month, but if access is available to one already the trimming condenser should now be adjusted, preferably with an insulated tool, until a reading is obtained on the wavemeter, which should be placed close to the transmitter coil.

The aerial coupling loop should now be pulled nearly out of the coil and the aerial connected temporarily to the centre stand-off insulator.

The Aerial

The correct length for the usual quarter-wave vertical rod aerial employed for model control in the 27 mc/s band is 8ft. 6in. (This length actually includes the wire leading to the coupling loop.) The ex-Government surplus market has for some time now yielded several useful telescopic masts which can be used for this purpose and the very cheap 12in. long copper-plated steel aerial sections which can be plugged together also make a good aerial. It will be found now that the radiation is much stronger and will increase as the aerial coupling coil is pushed into the turns of the transmitter coil. At the same time the H.T. current shown on the meter will rise and this should not be permitted to exceed the 30 mA mark, otherwise damage may occur to the valves.

Now move the wavemeter away from the transmitter until only a very weak reading is obtained and retune the transmitter into the centre of the model control waveband.

The Case

If all tests are carried out successfully the transmitter is ready to be boxed and the design of this is obviously a matter of personal taste. The photograph in Fig. 6 shows a typical method of installing a transmitter based on this circuit, the main considerations being those of removing valves and batteries and of positioning the trimming condenser so that it can be adjusted later. The question of transportation should be considered, however, and experience has dictated a small

Fig. 5 (Left).—The two-valve transmitter described in this article. Note the position of the aerial coupling loop which is not shown on the general layout drawing.

Fig. 6 (Right).—A transmitter in its case together with its associated control box. Note the plug and jack connection on the transmitter.

attaché case shape rather than a cubic design. It is very useful to have the H.T. current milliammeter permanently connected in the circuit and the meter mounted in the case where it can be watched while operating. Any strange readings will immediately indicate trouble. Provision should be made, by means of a simple plug and socket or preferably a closed circuit jack, for the transmitter to be keyed (i.e., switched off and on) by the control box. This entails a further series connection in the H.T. positive lead. The lead from Y1 will now go to the negative of the meter, the positive of the meter will go to one side of the control box socket or jack and the other side of the socket will go to the H.T. battery.

It is often recommended that H.F. chokes are connected one in each lead to the control box socket to reduce radiation from the leads to the control box, and if this trouble is experienced later they can easily be inserted. Chokes should be of 35 turns of 32 s.w.g. enamelled copper wire wound on pieces of ¼in. diameter polystyrene rodding. A switch should be inserted in the L.T. positive lead for switching off the unit. The aerial can be mounted on the side of the case by means of metal clips attached to a pair of the larger type of stand-off insulators. A connection should be made from the coupling loop (middle stand-off insulator) to the bottom clip holding the aerial by the shortest length of wire possible.

A connection should also be made from L.T. negative to a flat metal plate screwed to the base of the transmitter which acts as an earth.

The unit should be retested in its case and

Mr. L. Thompson's radio-controlled Vosper Air-Sea Rescue launch. This vessel is electrically propelled by six type 5J1961 Nife batteries driving twin screws. The motor is a converted midget Hoover motor-generator unit (the H.T. secondary winding has been stripped). The receiver is a single valve super-regenerative unit and control is by the mark/space system. Engine speed is controlled by a six-position sequence switch and a bell rings at each speed change.

the complete tuning up sequence gone through again to ensure that everything is in order and that the transmitter is still on frequency. Note that until the control box has been made it will be necessary to short a piece of wire across the control box socket (unless a closed circuit jack is used) before the unit will work.

Now, having got the transmitter working correctly, it can be tried on the receiver, when the full drop in anode current should easily be obtained at all ranges likely to be of use for controlling a model boat. As explained in an earlier article, the range is actually limited to about 100 yards, due to the fact that the operator simply cannot see which way a model is going much farther away than this. Much greater range than this can be obtained when using the transmitter to control aircraft.

If the reader has any qualms about exceeding his licensed transmitter power the following test can be applied. As the licence now stipulates the maximum effective radiated power and not the input to the final valve as before it is not possible to compute output from the current meter already installed. It is actually necessary to measure the aerial current flowing and this can be accomplished only with a thermocouple high frequency type of meter. Fortunately these are available very cheaply on the surplus market and a 0-0.5 amp meter usually costs about 5/-. A better meter would be rated at 0-0.35 (350 mA), but these are more difficult to find. The lead from the aerial coupling loop should be detached at the point where it connects to the base of the aerial and the H.F. ammeter connected. The other side of the ammeter then goes to the aerial using the shortest possible length of wire. (N.B.—There is *no* polarity to a meter of this kind.) With the aerial fully extended and the transmitter case standing flat on damp concrete or soil (to ensure good earthing) a reading should be obtained of between 0.12 and 0.15 amps with this transmitter. For a quarter wave vertical aerial the maximum aerial current permitted at 27 mc/s is 0.2 amps (200 mA) and it will be seen that power is quite adequate yet comfortably within the limit.

Next month we shall describe a Wavemeter and Control Box which will complete the equipment necessary to steer the model by radio.

****

An Inexpensive Photo-flood

By P. A. REEVE

Fig. 1.—The completed photo-flood.

FOR the enthusiastic amateur photographer wishing to turn his attentions to indoor work, this photo-flood, costing less than 15s., will solve one of the major equipment problems. Added to the cheapness of the article compared to a commercial one is the limited amount of storage space it requires due to the folding legs of the tripod. The completed unit is shown in Fig. 1.

Materials

The basic materials required are: an aluminium pudding basin obtainable from most hardware shops for 1s. 6d.; a length of armoured tube; a length of brass or copper tube to make the main stem; three lengths of rod for the tripod legs; plus a lampholder and odd pieces of brass and copper, such as can be found in most toolboxes and sheds.

The Reflector

As previously mentioned the reflector is made from an aluminium pudding basin. No difficulty should be experienced in locating the centre of the base to provide for the lampholder as these basins are usually spun in manufacture and hence the centre is readily detected.

The Adaptors

The size of these depends entirely upon the materials to hand; their main function being to secure the armoured tube to the lampholder and the main stem.

Tripod and Tripod Adaptor

Once again the size depends upon the brass or copper available; see Fig. 2. One important factor should not be overlooked when fitting the tripod adaptor to the main stem. Unless a thin sheet of brass (or similar material) is placed on the inside of the adaptor to cover the hole for the locking screw the main stem will soon become badly marked.

Finish

A wooden bung (Fig. 2) should be fitted at the lower end of the main stem to serve as an outlet guide for the main cable.

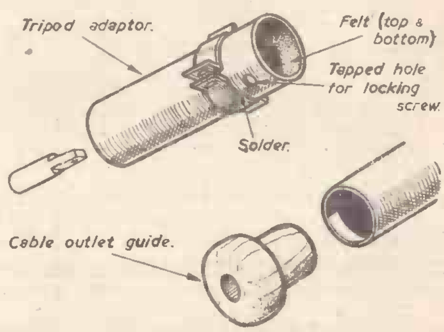
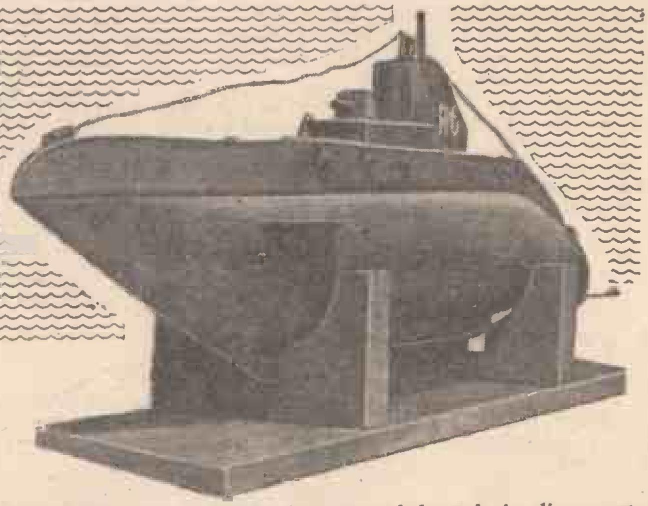


Fig. 2.—Details of the tripod adaptor and cable outlet guide.

It is advisable to paint all brass and copper parts to prevent oxidisation.

Dependent upon the availability of the various metals the constructor should be able to make a photo-flood of this type for much less than the figure quoted.

A 2ft Model SUBMARINE



Details for Making a Surface-propelled Submarine in Tinplate

By D. M. HUGHES

THE hull of the submarine is in three parts—nose, centre section and stern. Start with the centre section. This is

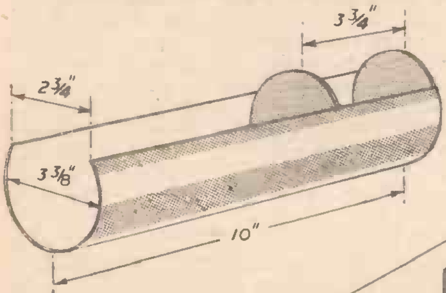


Fig. 1.—Construction of centre section.

cylindrical and is rolled from a sheet of tinplate 7⅞in. x 10in. long to a cylinder 3⅜in. diameter with the edges 2¾in. apart, see Fig. 1. Cut three discs of tinplate and solder one at one end of the cylinder and another 3¾in. from this, forming the battery compartment 3¾in. long.

Next, form the stern section, which is a cone 3⅜in. diameter and 6½in. long. Cut the tinplate to the pattern shown in Fig. 2, roll to shape and solder the seam. Drill a ¼in. diameter hole 5in. from the point of the cone on the opposite side to the seam. Drill a ¼in. hole in the third tinplate disc 1-1/16in. from the centre. Push a piece of ¼in. diameter copper or brass tube 5½in. long through the hole in the cone and through the disc, set the tube parallel to the cone axis with the disc at right angles to it, and solder the disc and tube in place. Immerse the assembly in water to ensure watertightness and cut off the tube so that ⅛in. protrudes from the disc and 2⅜in. from the cone. This forms the propeller shaft tube.

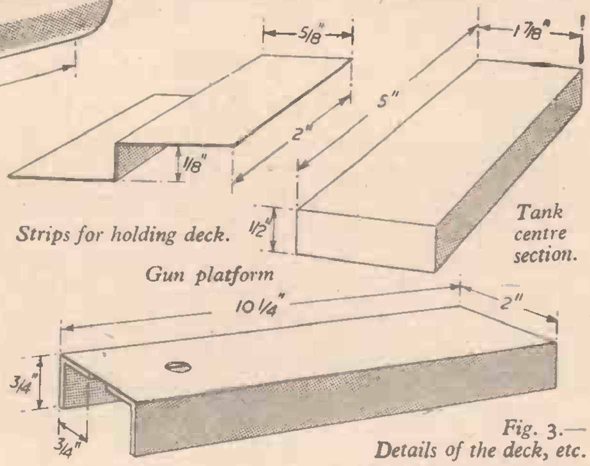


Fig. 3.—Details of the deck, etc.

Solder the cone assembly to the cylindrical centre section so that the tube is at the bottom and the opening in the cylinder is at the top. The larger compartment, thus formed, to the rear, is for the motor and gearbox. Test again for watertightness.

The nose section is formed from a single piece of tinplate. This, whilst appearing to be a little difficult to make up, is justified in giving strength at the bow, and in giving the characteristic lines at this point.

Cut out the tinplate to the pattern shown in Fig. 2 and bend on the centre line over a steel rule held in the vice and suitably protected. We now have the piece doubled back on itself. Bend the portions marked "A" on the pattern along the lines at right angles. Open out the piece until these portions overlap by about 1/16in. and solder the seam. Form the end of the piece into a circle 3⅜in. diameter and solder to the cylindrical centre section. This completes the main hull assembly. Test again for watertightness.

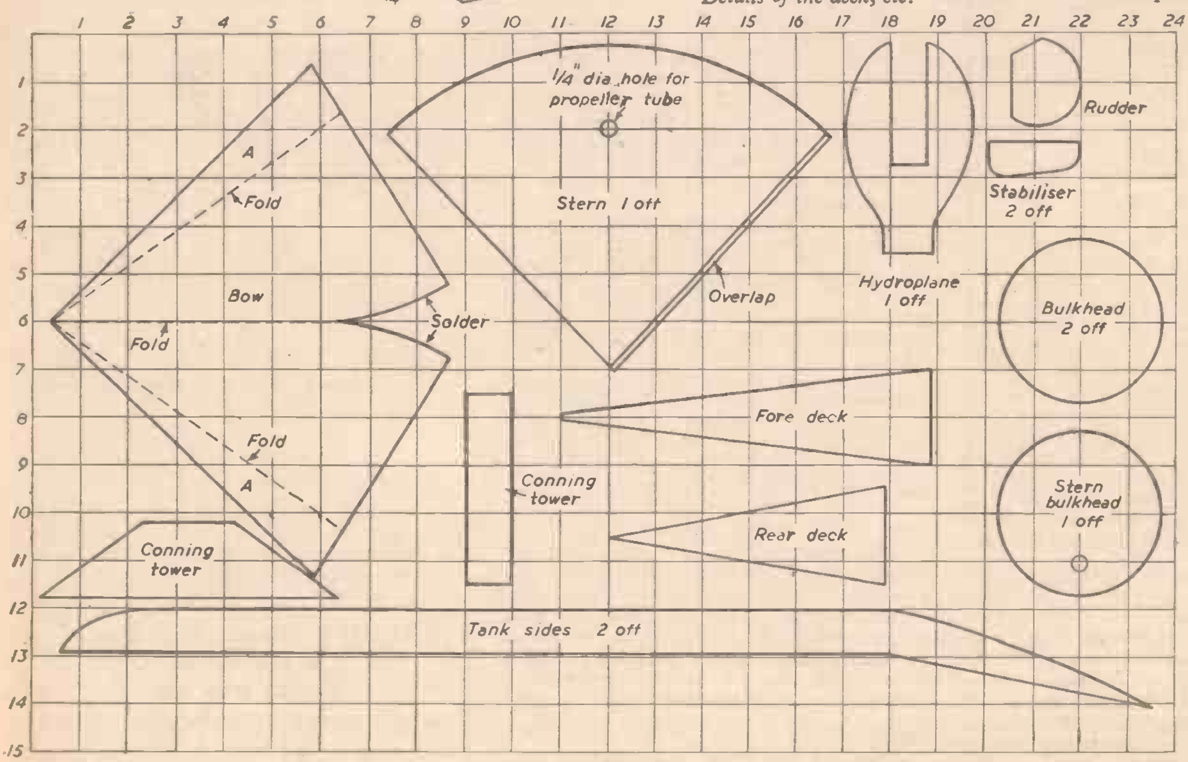


Fig. 2.—Pattern for cutting parts from tinplate.

The Tank

Cut to the pattern shown in Fig. 2, solder on the decks, and solder to the hull, ensuring that the sides are upright, and that the opening in the tank section coincides with that in the hull. To facilitate joining with the centre section, place the two pieces edge to edge and solder a ¼in. strip along the joint inside.

Deck and Superstructure

The forward and after deck sections having been fitted to the tank section, we proceed with the centre section. This is removable for access to motor and batteries and is formed from a piece of tinplate $10\frac{1}{4}$in. x 2in. A piece of 20 s.w.g. angle brass $\frac{3}{8}$in. x $\frac{3}{8}$in. is soldered along each edge as shown in Fig. 3. A piece of brass 2in. x 2in. is bent as shown and soldered at the rear end, underneath the decking and protruding also as shown in Fig. 3.

The gun platform is bent up to the dimensions shown in Fig. 3 and soldered into place.

The conning tower is cut out to dimensions in Fig. 2, and bent up and soldered on to the platform. The gun is formed from a piece of 3/16in. O/D tube or rod, soldered into a tinplate housing which is then soldered to the platform in front of the conning tower. A piece of brass 2in. x 2in. is soldered underneath the decking at the front of the centre section for the removable section to rest on.

Assemble the centre deck section by raising the front, pushing the brass strip underneath the rear decking and lowering the front on to the front strip. Along each side of the centre tank section drill six $\frac{1}{8}$in. holes through the brass channel, as shown in the general arrangement drawing, Fig. 4 and in Fig. 5.

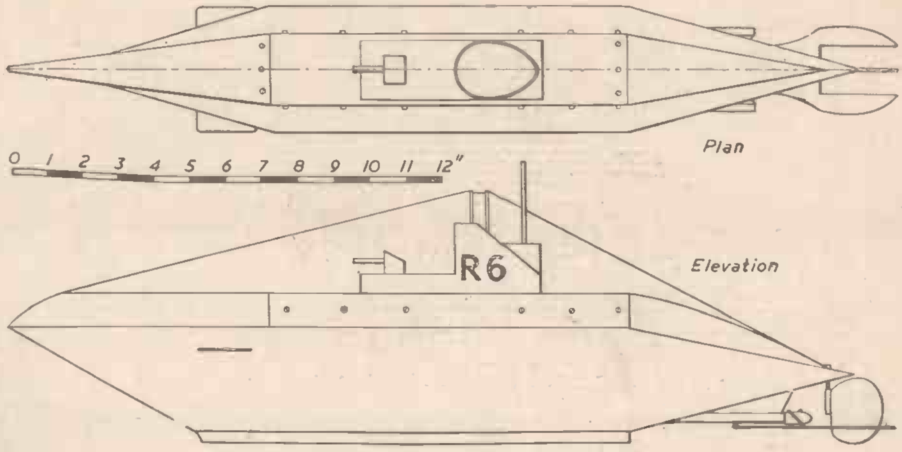


Fig. 4.—The general arrangement.

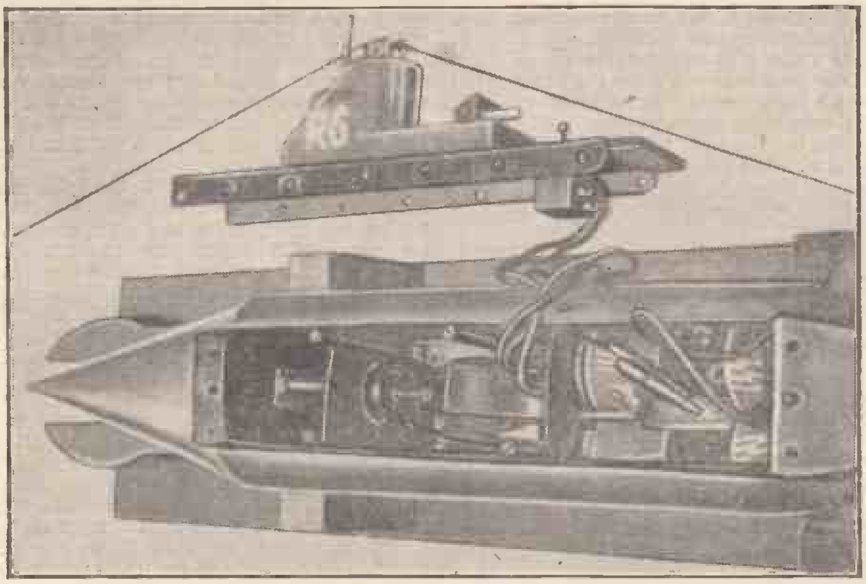


Fig. 5.—The submarine with top removed.

Next, take 6 pieces of brass or steel rod $\frac{1}{8}$in. diameter and $2\frac{3}{4}$in. long, thread each end 5 B.A. for a distance of $\frac{3}{8}$in. Push a rod through each pair of holes, put on a rubber washer, brass washer and nut in that order on each side and tighten up.

Drill three holes each end through the top decking into the brass strips and tap 4 B.A. Open out the holes in the decking to clear 4 B.A. screws. Insert the screws and secure.

Drill a $\frac{1}{2}$in. hole in the top deck, forward of the platform and insert a Bulgin S.258 switch with a rubber washer between the switch and the underside of the deck. Tighten the locking ring.

The keel is a length of brass tube about 10in. long and $\frac{1}{2}$in. diameter which is filled with lead. On final assembly of the boat, complete with motor, etc., fix this to the bottom so that the boat floats level. Adjust the balance by cutting away the tube as necessary. Fix in position by means of a tinplate shield to keep the lines of the hull.

Propulsion Unit

The motor used is a "Trix" electric motor, price about 10/-. This was chosen because it is easily fixed by means of holes in its base and it was used with great success in some previous models of the author's make. It is powered by 2 twin-cell cycle batteries and provides ample power for scale speeds with a $1\frac{1}{4}$in. to $1\frac{3}{4}$in. propeller, without heating up.

Gearbox

The propeller being set horizontally near the bottom of the boat, some form of gearing is necessary to drive it from a motor whose line is near the centre line of the boat. The gears used were $1\frac{1}{8}$in. diameter. This diameter is not essential as the position of the motor axis can be varied later, and any pair of gears may be used provided they match and are approximately the diameter given. The layout can be seen in Figs. 5 and 6.

Cut two brass plates $2\frac{1}{4}$in. x $1\frac{1}{2}$in. Drill a $\frac{1}{8}$in. hole through the two plates on the centre line and $\frac{3}{8}$in. from the bottom. Push a $\frac{1}{8}$in. rod through and slip on one gear wheel. Mesh the other with this and mark through its centre on to the brass plate, again on the centre line. Drill $\frac{1}{8}$in. Separate the two plates and cut two pieces of suitable tube for use as distance pieces $1\frac{1}{8}$in. long. Solder these in place, ensuring that the holes in the plates are in line. Fit the gears to the shaft. On the other end of the top shaft place a collar and a coupling made as Fig. 7 on the other (bottom) shaft. The motor and gearbox are fitted to the baseplate by means of brass angle.

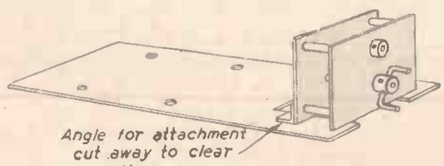


Fig. 6.—Gearbox mounting.

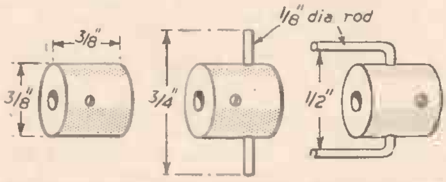


Fig. 7.—Collar and couplings, all made from $\frac{3}{4}$in. diameter x $\frac{3}{8}$in. long rod; $\frac{1}{8}$in. hole and 6 B.A. setscrew.

The Baseplate

This is of brass $4\frac{5}{16}$in. x 2in. and is cut as in Fig. 8. Make two angle pieces $3\frac{1}{4}$in. long, one angle $\frac{3}{8}$in. wide and the other to suit the motor height. Bolt the motor to the angle and then drill and tap the baseplate to take 4 B.A. holding down screws. These are made from 3/16in. rod $2\frac{1}{2}$in. long. Thread one end 4 B.A. for a distance of $\frac{1}{4}$in. and put a screwdriver slot in the other. These elongated screws greatly facilitate removal of the motor and gearbox in the confined space inside the hull and may be seen in Fig. 5. The gearbox is similarly mounted on the baseplate by means of brass angle as shown in Fig. 6. Cut away to clear the bottom gear.

Propeller and Shaft

Turn the propeller boss as shown in Fig. 9 and drill $\frac{1}{8}$in. for $\frac{1}{4}$in. along the centre. Take a piece of $\frac{1}{8}$in. silver steel $5\frac{1}{4}$in. long and drill through the boss at right angles for 1/16in. pin. Now cut three slots at 120 degrees round the boss at 45 degrees to the centre line, using a new hacksaw blade. Cut the propeller blades as shown from 20 s.w.g. brass and drive

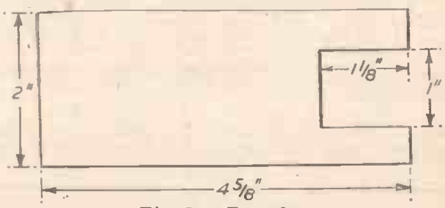


Fig. 8.—Baseplate.

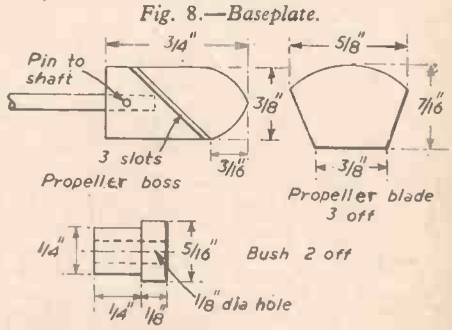


Fig. 9.—Propeller blade and boss, and the bush.

Fig. 10.—A threequarter rear view of the completed model.

into the slots. Braze or solder into place. Now twist the tips of the blades so that they are at right angles to the boss and polish and round all edges.

Turn two bushes as shown in Fig. 9 and push one into the inner end of the propeller tube. Make a coupling for the propeller shaft and, after packing the tube with grease, insert the outer bush and shaft and fix the coupling.

Cut out the hydroplanes and rudder to the shape shown in Fig. 2. Solder the hydroplanes to the bottom of the propeller tube and fix the rudder by means of a 5 B.A. nut and screw through the stern as shown in Figs. 4 and 10. Cut out and solder on the front stabilisers. See Figs. 4 and 10 for the position of these also.

Fix the motor and gearbox to the baseplate and sweat the latter into position in the hull.

Mounting the Batteries

Two twin-cell cycle batteries are used, mounted one on top of the other in the battery compartment. Cut a circle of rubber 3⅜in. diameter with a piece cut out 1½in. x 1in. Stick in position on the front bulkhead with the cut out at the bottom. Insert the bottom battery with its top contact on the bulkhead which should be clean. On top of this battery place a piece of plywood with a metal contact and lead, so that the contact on the board touches the battery side contact. Place the second battery on top and clip the lead from the wood strip to the front contact of the battery. The switch leads terminate, one to the centre bulkhead, either soldered or by means of a nut and screw, and the other in a crocodile clip which is clipped to the remaining battery contact. The motor is wired in as shown in Fig. 5.

Remove the motor, gearbox and batteries and coat the inside of the hull, except the front bulkhead, with two coats of paint. Assemble the whole boat and coat the outside with three coats of battleship grey; the number and letter can be painted in white.

Use lead ballast to bring the waterline just below the holding nuts at the side. The speed and appearance of the model on the water are to scale and Fig. 12 shows how the completed model should appear.

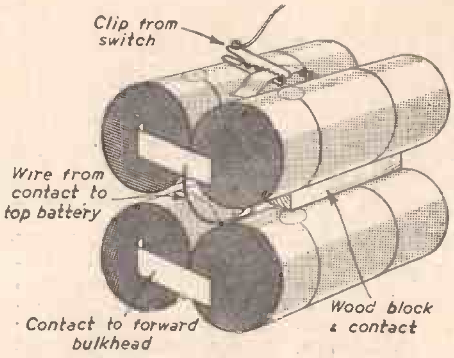


Fig. 11.—The twin-cell cycle batteries and their connections.

Fig. 12.—A side view of the completed model.

Fitting a Water-heater Indicator

A Practical Addition to the Domestic Hot-water System

By S. SIMPSON

FOR domestic hot water supply the writer uses an electrically-operated water heater which normally provides about three gallons at a temperature of 180 deg. When auxiliary elements are switched on the quantity made available becomes sufficient for baths, wash-days, etc.

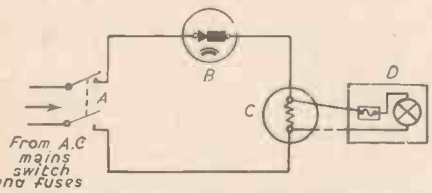


Fig. 1.—A general circuit. A—Mains supply switch on heater. B—Thermostat. C—Heater element. D—Remote indicator.

It has, however, proved rather a nuisance not to know when the bulk elements have brought the water up to "cut-off" temperature. To obviate the risk of drawing off the partly-heated supply and finding it run cold before ample water has been run off, a visual indicator has been fitted to the system and remains alight until the full temperature is reached.

The device is simply a neon indicator connected across the heater elements, and the principle is adaptable to almost any type of immersion heater. Fig. 1 shows a general circuit for such an indicator and Fig. 2 the arrangement as carried out by the writer.

Materials Required

(a) One 230-250 v. 0.5 w. neon indicator lamp, B.C. fitting.

(b) One batten-type lamp-holder.

(c) One "Belling" or "Slydlok" single fuseholder, to carry 1-amp fuse.

(d) One two-switch-unit wood block, to carry items (b) and (c).

(e) Sufficient lighting cable (not "flex") to connect the water heater to the remote indicator. The P.V.C. or "plastic" type of insulation is suitable where there is no likelihood of damage to the cable.

(f) One yard of asbestos cord.

(g) Screws, cable clips, Rawlplugs.

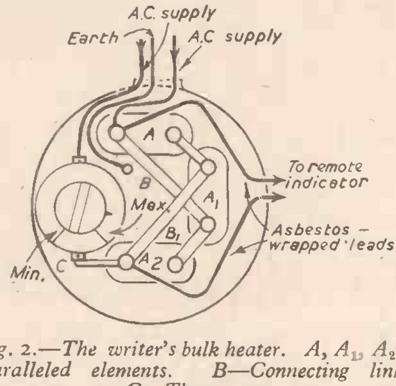


Fig. 2.—The writer's bulk heater. A, A_1, A_2—Paralleled elements. B—Connecting links. C—Thermostat.

Installation

Little need be said regarding the actual fitting, except that the leads secured under the terminals of the element should be wrapped with asbestos cord to an extent well clear of any part of the heater which runs hot in operation. The fuseholder is wired in series with the lampholder; the indicator circuit is thereby protected by a much lighter fuse than that which safeguards the complete water heater.

A Warning

The cable should be run in accordance with I.E.E. regulations, and it is the customary requirement of the local electricity undertaking that they should be notified of any addition or alteration to an existing installation.

One final word of caution; in any electrical work which involves switching off at the mains—keep the fuses in your pocket until the job is ready for connection to the supply.

RUNNING MODELS *from* D.C. MAINS

Some Notes to Interest the Model Enthusiast

By F. G. RAYER

WITH A.C. mains a transformer may be used to reduce the voltage and isolate a model from the main supply, but with D.C. mains this is not possible. There are, however, various means of employing D.C. mains, and these can be safe and satisfactory, if correctly arranged. It is particularly convenient and economical to obtain power in this way when a model is operated for long periods. But even in other circumstances it can be of advantage to dispense with batteries, which have quite a short working life if the current drawn is at all heavy.

The required low voltage for a model motor, etc., can be obtained by voltage

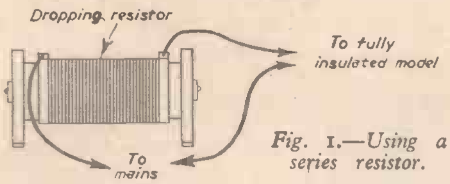


Fig. 1.—*Using a series resistor.*

dropping, or by using a rotary converter. Each method has its advantages. In addition, it is sometimes very convenient to use an accumulator (possibly to replace dry batteries) in view of the extreme ease with which this can be re-charged from D.C. mains.

Voltage Dropping

With this method, a resistance reduces the mains voltage to a figure suitable for the model, the resistance being wired in series with one lead as illustrated in Fig. 1. This is satisfactory for illuminated models, small motors, etc., but has the disadvantage that the model is directly connected to the mains.

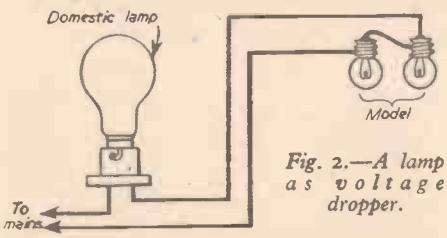


Fig. 2.—*A lamp as voltage dropper.*

In no circumstance must this be overlooked, and the system should not be used with trains or any layout having exposed connections. It is, however, satisfactory for illuminated models, display models driven by motors, and any other equipment where no leads, etc., will be touched. When it is used the whole model should be treated as if it were mains equipment.

The danger of shocks arises from two causes. First, the voltage drop depends on the current flowing. As a result, the full mains voltage will appear immediately any interruption to the circuit arises in the model. Secondly, one or both leads may be at high voltage in relation to earth, resulting in a shock if either be touched. This may be guarded against to some extent by taking the "earthed" main to the model, and wiring the resistance in the other main lead. But even then connections cannot be regarded as safe. The earthed main is not necessarily the negative.

Fig. 2 shows how a lamp may be used in the same way, exactly as the resistor in Fig. 1. As with Fig. 1, the circuit should be reserved for models where there is no possibility whatever that connections, etc., will be touched. With either circuit the model lamps or motor will be current-operated, and the resistance or lamp may be chosen with this in mind. For example, the bulbs used in a model might all be .3 amp. types, in series. An operating current of .3 amp. would then be required, and the resistance or lamp is chosen with this in view.

The current passed by a resistance, in amps., will be determined by the following :—

$$\frac{\text{Voltage}}{\text{Resistance in ohms}}$$

The required resistance value, for a given current, may be found by the calculation :—

$$\frac{\text{Voltage to be dropped}}{\text{Current in amps.}}$$

For example, assume a 6 volt .5 amp. motor is to be run from 240-volt mains. Here, 234 volts must be dropped. A resistance of 468 ohms is thus required. In practice, such a value would do well for 220 to 250 volts. With illuminated models, the bulbs are best wired in series, to keep the operating current down. The resistance must be rated to carry the current required. It should receive adequate ventilation.

With lamps, the current flowing may be ascertained from the wattage, which equals voltage × current in amps. For 200-volt mains, the current passed by lamps would be as follows :—

50 watt = $\frac{1}{4}$ amp. 100 watt = $\frac{1}{2}$ amp.
150 watt = $\frac{3}{4}$ amp. 200 watt = 1 amp.

The currents will be slightly less with mains voltages above 200 volts. Frequently the best lamp may be found by trial, the wattage being increased until the model operates satisfactorily.

Rotary Transformer

A rotary transformer has two or more windings on a single armature, and can step up or down D.C. supplies. As the voltage is not critically related to the current drawn, as with a series resistance dropper, and complete isolation from the mains can be obtained, it is almost essential to use such a transformer with some models. With trains, or models where connections may be touched, such a method must be used.

Ex-service rotary transformers may be obtained readily, and were intended to provide a high-voltage output from a low-voltage input. Most such transformers provided a D.C. output; these can have the high-voltage side run from D.C. mains, when a low voltage will be obtained from the other winding. This is shown in Fig. 3, which illustrates the fact that there is no direct connection between input and output circuits.

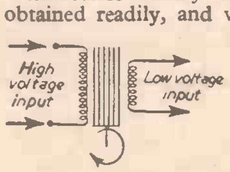


Fig. 3.—*The rotary transformer.*

An actual transformer of this type is shown in Fig. 4. The mains connections should be covered and insulated, but the output leads may be handled exactly as with a battery supply. If any danger of short-circuits exists (as with model trains) a fuse should be included in one lead to the model.

A transformer with a winding rated at about 250 to 275 volts is most suitable for the usual mains, but some have windings rated at 300 volts, 350 volts or more. With these, the full rated voltage of the other winding will not be obtained, but they will, nevertheless, be satisfactory in most cases. If the output voltage is too high for the model, it may be reduced by wiring a resistor in one lead, at the low-voltage side. This resistor will be of quite low value, such as may be used for speed-control with a battery-driven motor.

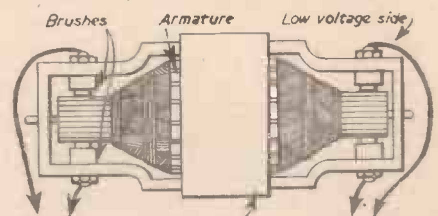


Fig. 4.—*A typical rotary transformer.*

An alternative is to wire a resistance in the transformer input circuit, thus reducing the speed at which the armature runs. A domestic lamp may be used for this purpose, as the input current is small.

Some transformers have more than two windings. In addition to using the windings singly, two windings may be connected in series, to obtain a higher input circuit voltage, or a higher output voltage. When this is done the positive brush of one winding should

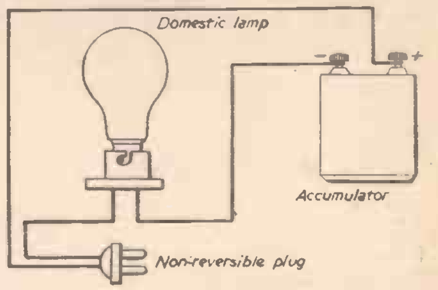


Fig. 5.—*Accumulator charging from D.C. mains.*

be wired to the negative brush of the other. If the reverse is so the transformer cannot operate properly.

To reduce noise the transformer may be totally enclosed in a stout box, lined with sound-absorbent material, with a tightly-fitting lid. A rubber or other soundproof mounting should be used for the transformer.

Accumulator Charging

D.C. mains offer so ready a means of charging an accumulator that this method of powering a model is well worth considering. Even when the model is of fixed type an accumulator has the advantage of complete safety and simplicity. It may, therefore, be favoured when no kind of mains-driven equipment is desired, or may take the place of dry batteries.

A circuit, with lamp, is shown in Fig. 5. The lamp will light with almost unchanged brilliance, and may thus serve some useful purpose. As there is no need whatever that charging be in one continuous period, the accumulator may be charged a few hours every evening, or as convenient.

If desired, the lamp may be chosen to pass a known current, as mentioned. For example, a 100-watt lamp would pass ½ amp. on 200 volt mains, and slightly less with mains of higher voltages. Leads from lamp and mains to accumulator should be of proper flex, and the accumulator so located that it will not be handled. Leads should not be connected or removed, or the accumulator touched in any way, until the mains supply plug has been completely withdrawn from its socket. It is feasible to enclose the accumulator in a box or cupboard, and provide a plug and socket of the usual mains type, so that a table or reading lamp can be brought into use in the charging circuit immediately when required.

Charging may take place at any figure up to that indicated on the accumulator as the maximum charging rate. Dry accumulators can be dealt with by noting the charging time, in accordance with the maker's instructions. Free-acid cells can be tested with a hydrometer.

It is also feasible to use a rotary transformer for charging, the rate being adjusted by means of a resistance. This is more economical when a high charging rate is required. The accumulator will depend on the model, but usually it will be 4, 6 or 12 volts.

Constructing a PHOTOMETER

A Unit Incorporating a Photo-electric Cell and a Micro-ammeter

By D. CRAWLEY

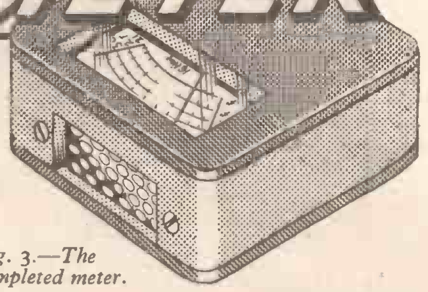


Fig. 3.—The completed meter.

AFTER several unsuccessful attempts to produce a correctly exposed 9.5 mm. ciné film. I decided to make a photo-electric exposure meter.

The standard circuit is shown in Fig. 1. The working principle of the photo-electric cell is that current developed by the photo cell varies with light intensity, the strength being

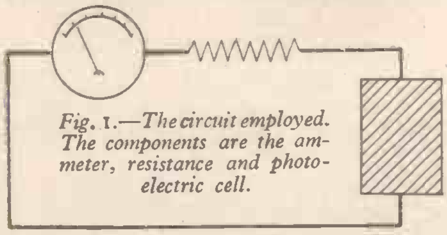


Fig. 1.—The circuit employed. The components are the ammeter, resistance and photo-electric cell.

recorded by a sensitive micro amp movement. It follows, that a scale of light intensity can be calibrated for aperture settings. A further consideration is the angle of light allowed to fall on the cell, and to restrict this angle to the correct value a matrix is placed directly in front of the cell.

Materials

The materials required are: Perspex ⅛in. thick, perspex cement, a photo cell 40 mm. by 22 mm., the visual indicator, a 6.8 kΩ ½ W. resistor, 1/32in. thick brass sheet 2in. by 2in., 20 G. aluminium 3in. by 3in., two 4BA screws 1in. long, two 4BA screws 2in. long.

Perspex is available from L. Glazer and Son, Ltd., 275, Neasden Lane, London, N.W.10. The photo cell may be obtained from G. R. Products, Ltd., 22, Runnymead Avenue, Bristol, 4, price 7s. 6d. The visual indicator is supplied for 12s. 6d. by Clydesdale Supply Co., Ltd., 2, Bridge Street, Glasgow, C.5. As two movements are included in each visual indicator, it is cheaper if two people make the photometer at the same time.

Construction

Commence with the case, cutting and filing the perspex to the dimensions given in Fig. 2. On completion, join, sides and base with perspex cement. It is advisable to drill the fixing holes for meter movement after purchase, using the magnet clamping plate as a template.

The lid is cut and filed, together with glass window retaining pieces, which are cemented in position. Due to severe electrostatic effects, the original perspex window was replaced by glass. From a further piece of perspex, the photo cell frame, matrix and retaining strip are shaped and drilled, as shown in Fig. 4.

Apply a coat of black cellulose to the case interior, with the exception of the photo cell aperture which obviously requires to be transparent. A coat of cellulose is also applied to the frame and retaining strip. A fine brush should be used for the matrix holes, carefully removing any surplus which may have accumulated on the surfaces during this process. From 1/32in. brass sheet, the front and rear contact plates are cut and a length of insulated wire soldered to each tag. For the scale, 20 G. aluminium is used, on to which a piece of card is firmly cemented by means of rubber solution.

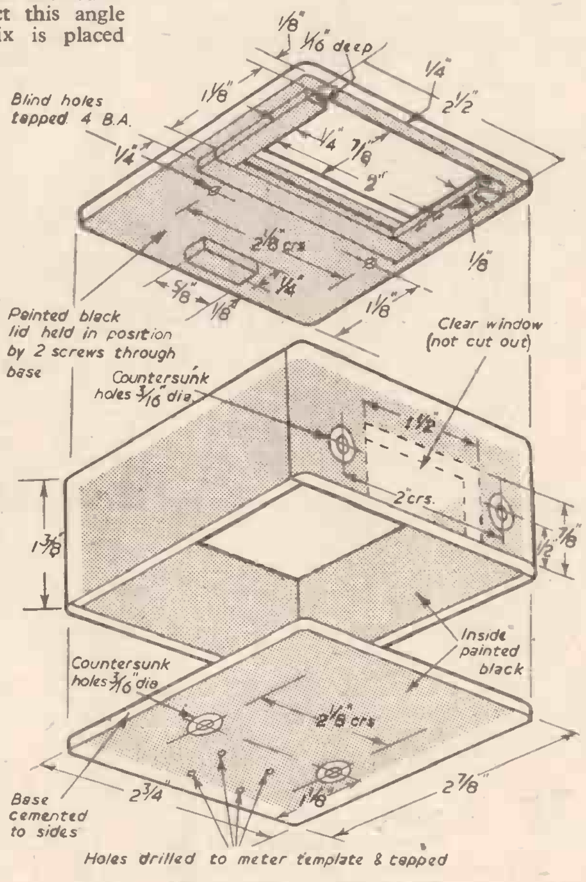


Fig. 2.—Details of the photometer case.

Assembly

The matrix is first placed in position, followed by the photo cell frame, front contact plate, photo cell, rear contact plate, and strap, all of which are held in position by two 4BA countersunk screws. The meter movement is removed from its original case and

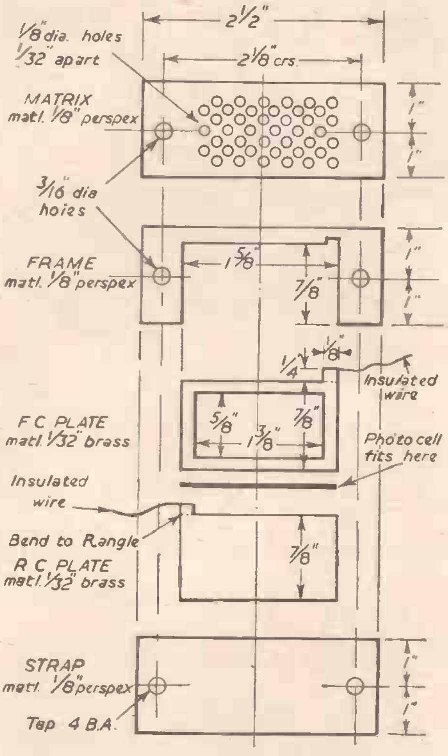


Fig. 4.—The photo-cell assembly.

placed in position. Clamping to the base is achieved by four screws, two of which pass through the scale plate. By soldering a wire from the front contact plate to meter and from the rear contact plate via a 6.8 kΩ resistor to meter, the circuit is completed.

Calibration was achieved using a loaned commercial model as a standard. A fixed shutter speed of 16 frames per second was decided upon and four scales of S values were drawn, the calibrations being aperture settings. This may be seen in Fig. 3.

A 3½" x 2½"

Fig. 1.—The completed camera, with frame viewfinder.

IN making preparations for constructing this camera I had in mind my limited abilities as a craftsman, plus a desire for an "all round" camera. The ability to interchange lenses is a desirable feature, and also a rising front for architectural subjects and a rangefinder. The construction had to be fairly simple, in fact "utility," but still retain the essentials. In hand were a set of single metal Zeiss type dark slides, a folding focusing hood from an old camera, and a 13.5 cm. f4.5 lens in Compur shutter.

Construction

The body is a simple open box of 3/16in. teak, 5in. by 5in. by 2¼in. rebated and hot glued. Inset in the body, 3/32in. from the back edge, is a piece of ¼in. ply with an aperture of 3½in. by 3½in. the four corners of which form a circle of 4 5/16in. diameter. This is hot glued and pinned into position. The platform consists of ply, 5in. by 4¾in. by ¼in., channelled to receive the rack and pinion. It is attached to the body by good quality brass hinges (piano lid hinges of heavy gauge are ideal, although I used two ordinary type). These are let into the top of the platform and the underside of the body. The assembled body and platform is shown in Fig. 2.

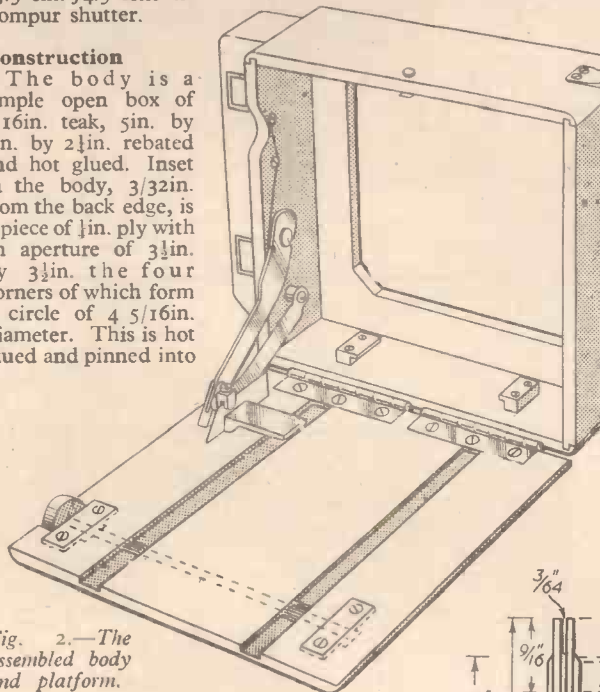


Fig. 2.—The assembled body and platform.

The lugs, taking the supporting struts, are segments of a circle of dural as in Fig. 3, drilled and tapped 6 B.A. and bolted to the platform with large area washers underneath the heads of the bolts. The struts are formed from 3/64in. mild steel and were the subject of much experiment with cardboard models until a profile was obtained which allowed them to slide into the body without fouling the back or projecting from the edge of the body when the platform was closed. These are the old-fashioned style of strut and have nothing to recommend them except simplicity, but I found that they do the job as well as the more complicated types. The studs were turned from mild steel and accurately positioned into the sides of the body and held fast by nuts. The slots in the struts are cut at right angles to the "pull" and allow the platform to project at 90 degrees from the body. Pressure is exerted on the struts by a wire spring attached to the inside of the body. In view of the simple nature of this strutting device I added a lock to one side as shown in Fig. 4. This makes certain that the struts cannot be accidentally pushed out of position when handling the camera.

The Focusing Slides and Rail

These consist of: A. The female—½in. by 3/16in. dural with channel to accept the male slide (see Fig. 5). The channels were cut with a small metal circular saw with a jig so that the cuts were accurate and parallel. B. The male slide, made of 3/64in. mild steel, is scribed to pattern and drilled and filed to shape with its two edges parallel. It is then fitted to the female slides with a push fit.

At this stage the brass rack and rails, on which the lens cradle sits, are fitted and screwed into position. The 6 B.A. screws are countersunk into the teeth of the rack C, pass through the male slide B and into the underside of the rail D. These components must be parallel to one another, with the brasswork and rail just clear of the female slides A. The heads of the screws are finally filed to the profile of the teeth in the rack. The completed layout of the platform will be clear from Fig. 6.

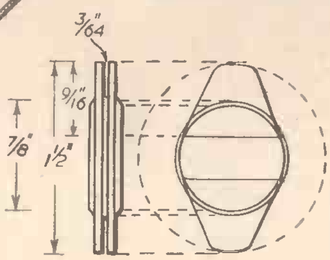


Fig. 3.—Lugs cut from circle.

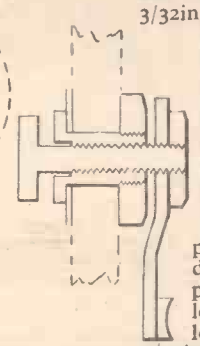


Fig. 4 (Right).—Section through left-hand strut lock.

Lens Cradle and Lens Board

The lens cradle, of ⅜in. by 3/32in. dural, is bent to shape round a wooden block, two sides of which converge a little to allow for the material to spring back into parallel after bending. The posts of the cradle are slotted, with a 3/16in. milling tool in the lathe, to accept the studs on the lens board. The posts are then filed from ⅜in. width at the bottom to ½in. about half-way up. The 3/16in. slots are cut centrally in the ½in. width. All these details may be seen in Fig. 7.

The lens board of ⅜in. mahogany is a mitred and keyed block with a 2in. circle cut from the centre. It was mitred so that the screws holding the dural edges bit into side grain on all four sides.

With the 3/32in. dural edges in place the block should be a close fit between the posts. The two side studs should be keyed into the dural edge, leaving 3/32in. of plain shank protruding before the start of the thread. When assembled the lens board should be held firmly by the two thumb nuts, and after loosening them should be free to move up and down and swing back and forth without any play. The dural edge plates of the lens block are left protruding 3/32in. from the face of the block to form a recess into which the lens panel fits.

The bottom edge can now be fitted, with the addition of two steel springs to keep the lens panel in position. The top edge is of the same dimensions as the others, but has the lens panel lock added to it. This lock consists of two pieces ½in. by ½in. by 3/32in. dural and an "L" shaped

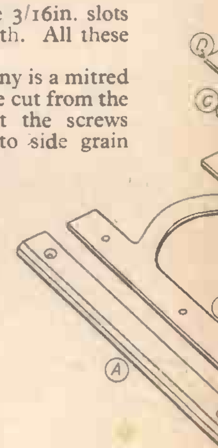


Fig. 5.—T

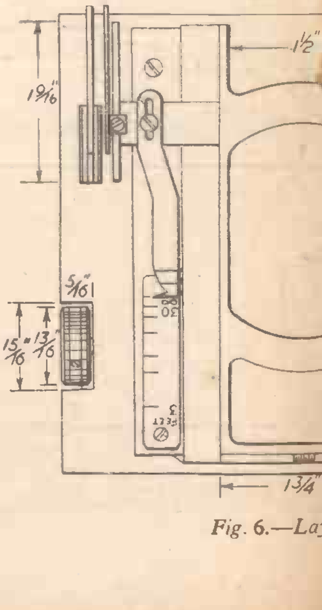


Fig. 6.—La

PRESS-TYPE CAMERA

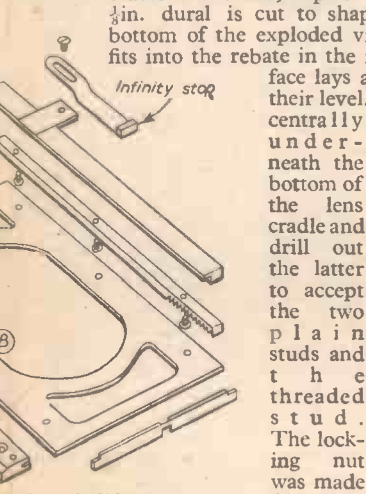
Constructional Details for Making a Useful Plate Camera

By R. F. MERLINI

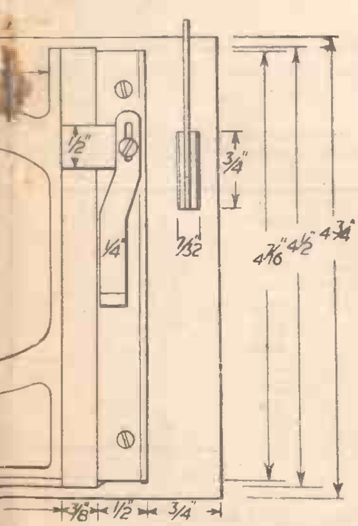
piece to lip over on to the lens panel. The "L" piece has two 1/16in. studs on which to hinge and the two small pieces are drilled to accept them. A flat spring is then bent to a "U" shape and slid into position from the back edge. The whole is screwed to the lens board by two 1in. screws inserted underneath the "L"-shaped clip. Before doing this it might be necessary to file a little of the lens board away to allow for the thickness of the spring.

The Locking Device

Having assembled the focusing slides, lens cradle and board, a piece of 2in. by ⅜in. by ⅛in. dural is cut to shape as shown at the bottom of the exploded view (Fig. 7). This fits into the rebate in the rails D and the top face lays about 1/64in. below their level. Position this piece centrally underneath the bottom of the lens cradle and drill out the latter to accept the two plain studs and the threaded stud. The locking nut was made from a brass nut given a little shape in the lathe, and the arm is simply cut into it and soldered in position. When assembled the lens cradle should be firmly locked on to the rails with the arm on the locking nut pointing forward. A quarter-turn or less should be sufficient to release the cradle and allow it to slide along the rails.



...rack and slides.



...yout of platform.

The pinion which actuates the focusing slide is next prepared by cutting away all the teeth except the two short pieces which engage with the rack. Two bearings are made to accept the pinion and are cut into the platform in positions which will not foul the screws holding the female slides on to the platform. A suitably turned knob is then fitted and locked with a grub screw.

The female slides can now be screwed on to the platform and must be held firmly and parallel. The edges of the male slide must now be thicknessed until they are capable of being moved easily, but with no play in their counterpart. When this is achieved the cradle can be fitted and checked to see that it stands at 90 deg. to the platform and parallel with the back of the body.

The Rotating Back

A piece of 3/16in. ply forms the basis of the back panel, into which a 3½in. by 2½in. aperture is cut. On to this are glued and screwed two pieces of hardwood rebated to form a channel of suitable depth and width for the particular type of dark slide to be used. With the dark slide in position, a piece of hardwood, rebated the same dimensions as the sides, is inserted at the bottom, thus blocking one end of the channel and forming a stop (see Figs. 8 and 9).

The frame for the ground grass screen is made next. A depth-gauge measurement from the face of the dark slide to the face of a plate is taken and the ground glass screen is rebated into the frame a little more than this depth. When the final register of plate and ground glass is made the frame is papered down on a sanding disc until screen and plate lay in the same plane. This should not be done until the pressure springs and velvet light trap are in position.

The light trap is glued into a shallow trough of suitable depth, cut into the ply, and coinciding with the light trap on the dark slide. The object to achieve here is to mesh the two pieces of velvet without pushing the dark slide away from the face of the channel. Pressure springs of conventional type are next fitted and adjusted so that the screen is held firmly in the focusing position and when the dark slide is inserted it does so without undue effort. The final register of screen and plate can now be made and must be done carefully by taking depth-gauge checks over the whole of the screen/plate area.

The Rotating Device

This is made from 3/32in. dural sheet.

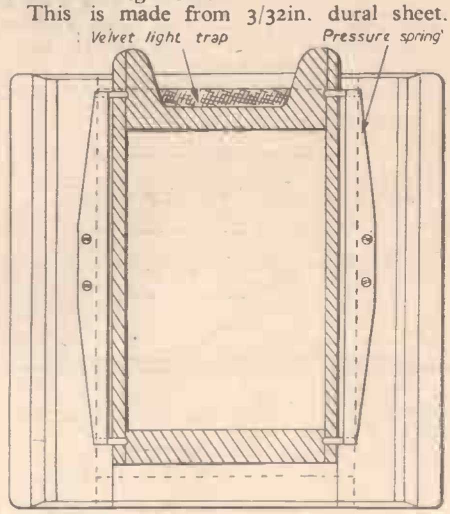


Fig. 8.—View of back panel and ground glass screen.

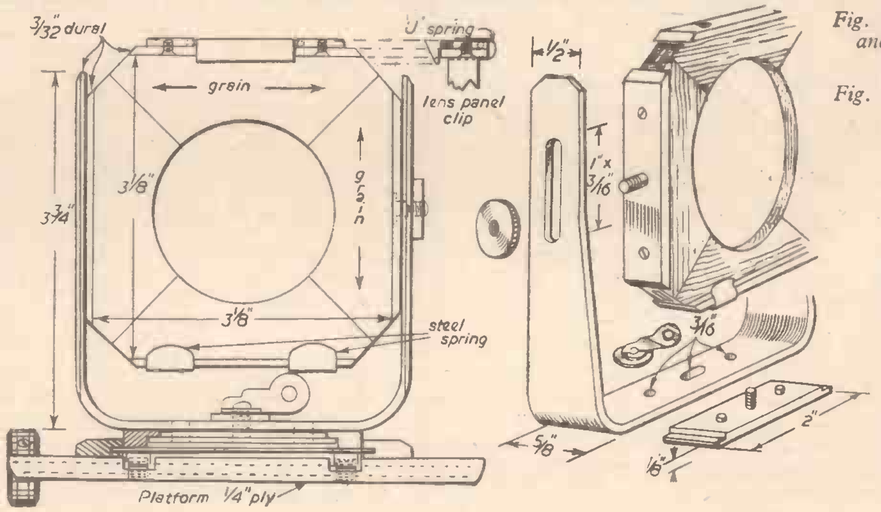


Fig. 7 (left).—Cradle, lens board and lock.

A piece 5in. by 5in. is cut and a 4½in. circle scribed in the middle. Screwholes are drilled and countersunk in suitable positions to enable it to be fixed to the back of the body. A block of wood 5½in. diameter by ½in. is screwed to the faceplate of the lathe and faced off dead-flat. (My lathe takes only 2⅞in. swing, hence the wheel shape of this portion—otherwise this part can be left 5in. by 5in.) The dural is screwed firmly to the block of wood and the 4½in. circle cut away. Next, the channel, 1/32in. by 1/16in. deep, is cut on the inside edge. See A (Fig. 10). A good clean cut is a "must" here, with no burrs left.

This block with the dural still attached is taken off the faceplate and another block substituted. This is turned to 4½in. diameter and faced off flat. A piece of 3/32in. dural of slightly more than 4⅝in. diameter is scribed with a rectangle 3½in. by 2½in. and cut cleanly away. Screwholes are marked and drilled, making certain that they do not foul the screws holding the channel pieces on the back panel. This is then screwed on to the block on the faceplate and turned to leave the body of the metal a shade under 4½in. and the tongue projecting 1/16in. by 3/32in. thick. These details are shown in Fig. 11.

The next step is to cut away four portions of the tongue and four portions of one wall of the channel in A (Fig. 10) so that the two slot together and rotate. The periods at which the portions are cut away must not be regular, otherwise the back will tend to come away at each quarter-turn, and it would be wise to experiment with cardboard first models.

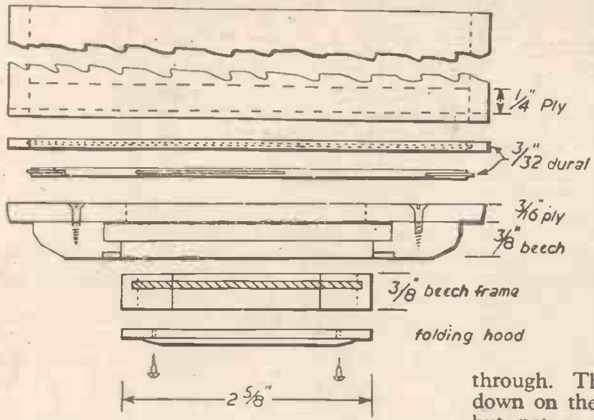


Fig. 9.—Exploded top view of back.

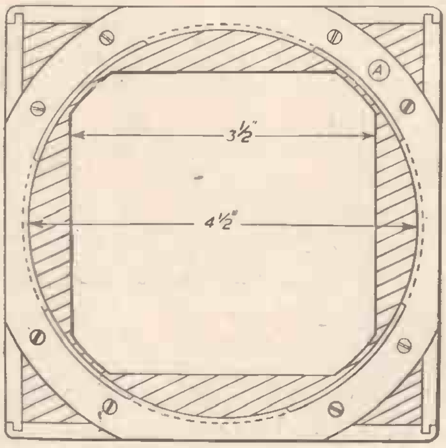


Fig. 10.—Back of body.

Part A can then be screwed to the back of the body and B to the face of the back panel. A piece of thick paper fixed under B will leave sufficient clearance. This device does not form a true rotating back, but the ability to switch from upright to horizontal format without having to change grip on the camera justifies this arrangement, in my opinion.

The Bellows

It is quite an achievement to handmake camera bellows and the easiest way is to have them made to order by one of the advertisers in the photographic Press.

The Range-finder

This is a simplified version of the more conventional type as used on professional Press cameras and the position of the parts is shown in Fig. 12. One mirror is fixed at the upper end of the body side, using a piece of angle brass as a frame with springs soldered on to act as retainers for the mirror. The mirror as used in handbags is, I found, suitable providing that flat portions are chosen for use. A piece is cut to fit the frame formed in the angle brass and all the reflecting surface is scraped off with the exception of a small area in the centre. The shape and size of this area must be the subject of experiment. This fixed mirror must lay at 45 deg. across the line of sight and will not be fixed to the body until the movable parts are finished and assembled.

The movable mirror (fully silvered) is mounted on a brass peg with a cone apex and a cone bearing surface which sits in a flanged bush screwed to the side of the body. The brass peg and flanged bush can be turned in the lathe so that the shank of the brass peg is a push fit in the bush and protrudes about 1/16in. from it. The bottom of the shank is tapped 6 B.A., and after this the movement of the peg in the bush should be made firm and consistent. The dimensions of these parts are not important so long as they are kept as small as possible consistent with their usage.

When filing the cut-away portion of the peg which accepts the housing and mirror allowance must be made for the thickness of the housing to allow the reflecting surface of the mirror to assume a line across the pivotal centre of the peg. Pressure is applied to the top cone of the peg by means of a piece of hard flat brass spring in which a hole is made, allowing a small portion of the cone to pass through. The position of the bush is as low down on the body as possible (see Fig. 13), but not so low as to allow the fingers to obstruct it when focusing. This gives a base of about 2¾in., which is considerably longer than most of this type and therefore should be capable of greater accuracy.

The lug carrying the range-finder cam is next made from ½in. by ¼in. by 1in. brass shaped as in Fig. 12, and cut into and soldered to the rail of the focusing slide as in Fig. 12. A lug on the opposite side is fixed in the same way, but is of flat brass ½in. by 13/16in.

The cam is made from 3/64in. mild steel and the top edge of it must be dead straight, the inclined front end allowing the arm to meet the platform gently when closing the camera. It is as well to make two or three of these cams as the position of the holes taking the retaining screws must be decided by experiment. The rear hole is drilled a close fit for the size of screw used and the front hole drilled oversize or elongated to allow for adjustment. The arm, of 3/64in. mild steel, is made and temporarily fitted to the mirror peg. With the focusing slide on the infinity position, i.e., back as far as possible, mark on the arm the position of the saddle, which should be sitting about 1/16in. from the top of, and inclined to match up with, the " incline " of the cam. The saddle is quite a simple arrangement and is soldered to the arm.

Range-finder Adjustments

The bellows are next temporarily pinned to the back of the body and rear of the lens board, a suitable lens panel made and the lens and shutter fitted. The fixed mirror is attached to the body and now a period of experiment and adjustment commences.

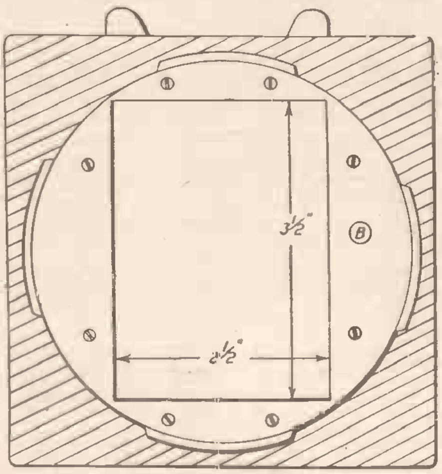


Fig. 11.—Front of back panel.

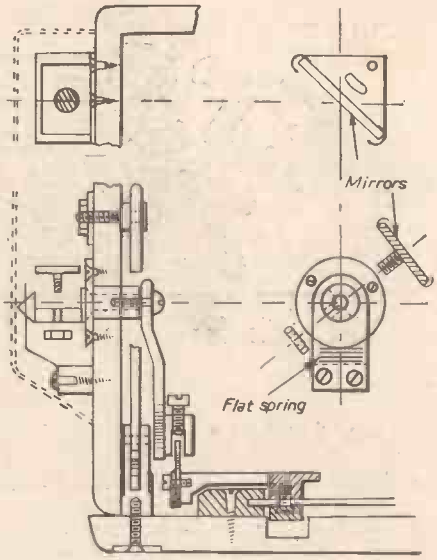


Fig. 12.—Disposition of range-finder parts—front view.

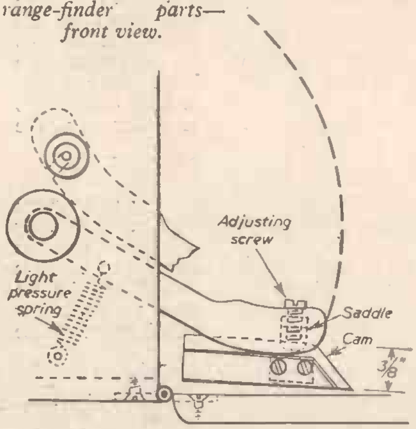


Fig. 13.—Range-finder actuating arm and cam.

Briefly, the object is to dispose the various parts of the range-finder and lens system so that (a) the lens is focused on infinity and positioned by the infinity stops, and (b) the mirrors brought into strict parallel and showing a coincidence of image along the focusing range. (At the infinity end of the cam some deviation from " straight " may be necessary. The cam is, of course, only lined up for the lens which will have the most use, any other lens will have to be focused by screen or scale.)

When these adjustments have been made check that all parts are firm and rigid and fix the bellows permanently. Various means of doing this will suggest themselves. Actual checks can now be carried out, using the conventional test charts or other suitable means. After a thorough check of the components—watch for slight movement in the wooden parts—the range-finder cover can be made. This is a simple trough with appropriately sized viewing windows. The rear wall of the trough consists of 5/16in. wood through which two screws pass and secure the whole to the body. A clip for securing the platform in the closed position will be necessary and need be only of simple straightforward construction. Tripod bush and strap complete the mechanics of the camera with the exception of the viewfinder. There is so much divergence of opinion over viewfinders; mine is of the open frame type, as may be seen in the photograph, Fig. 1, but there is plenty of room on top of the body to accept one of another type.

(Concluded at foot of page 46.)

THE PLANETARIUM its History, Design & Use

By FRANK W. COUSINS, A.M.I.E.E., A.C.I.P.A., F.R.A.S.

(*Concluded from page 543 of the September issue.*)

(E) The Planet Cage and Projectors (see Fig. 13)

IN each planet compartment there are three parts of an orrery mechanism. The Sun is the fixed central point, one set of gears moves a point representing the Earth, and a second set of gears moves another point corresponding to the planet.

The inferior planets Mercury and Venus are moved by a mechanism similar to that shown in Fig. 14, while the superior planets Mars, Jupiter and Saturn are moved by a mechanism similar to that shown in Fig. 15.

As previously mentioned in the discussion of the orrery, the gear ratio problem is a complex matter. For example, the period of the Earth's revolution about the Sun (one year approx.) is 4.15209106 times Mercury's period (0.24 years approx.). By the aid of continued fractions[6] a suitable gear train was found to be

$$\frac{3^3 \times 11 \times 43}{2 \times 7 \times 13^2}$$

The error of this train was so little that after 5,000 planetarium years the position of Mercury would be only one degree (two Moons' diameters) out of its true place on the planetarium sky.

The system of planet gears and motors enables the operator to bring the Earth to a standstill and race into the past or future to see the planets take up their positions against the star fields. In this way the audience may see in a few minutes the complex direct and retrograde motion of the planets and the positions they held in ancient days or will hold in nights as yet unborn.

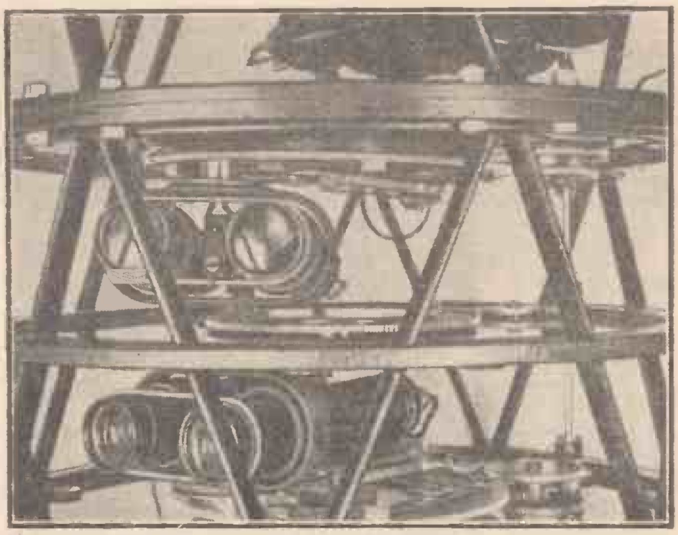


Fig. 13.—Projector case for Mars and Jupiter. Each projector is doubled to overcome dimming as the light impinges on the cage struts. The paired projectors are aligned to produce a single image.

For the convenience of the reader a table of data for the naked eye planets is included. Fig. 16.

(F) The Moon Projector

The mechanism of the Moon projector is shown in Fig. 17. The central pin is inclined at 5° to allow for the Moon's orbit which is tilted at 5° to the ecliptic. Small periodic changes in the inclination of the lunar orbit have been ignored.

Changes in the direction of the line of the nodes (i.e., the intersection of the lunar orbit with the ecliptic) which makes a retrograde revolution in a little over 18.6 years (6793.391 days) is achieved by applying an extra motion to the central pin.

The phases of the Moon, from cresentic, dichotomised, gibbous to full, are imitated by mounting in line with the diaphragm which provides the lunar image a revolving stop of special form.

(H) Projection of the Celestial Sphere and Meridian

This is analogous to the laying out of latitude and longitude lines on the terrestrial sphere. It is of great importance to the full understanding of the planetarium and its educational projects that the grid system of the celestial sphere be understood.

The common motion of the stars may be imagined by considering them to be attached to the surface of a sphere, which is made to move uniformly about the diameter NP. SP. The extremities of this diameter are called the *Celestial poles*. The great circle E_1, E_2, E_3, E_4 is the *Celestial equator*. The Meridian is the great circle NP. Z SP. N passing through the Zenith and nadir and the Celestial poles. It cuts both the horizon and equator at right angles.

The Sun, while participating in the diurnal rotation of the heavens, possesses, in addition, an independent motion relative to the stars (already mentioned in Fig. 11). This motion relative to the stars is an apparent motion

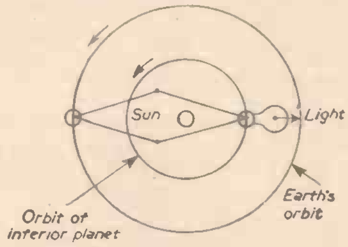


Fig. 14.—Mechanism for moving Mercury and Venus.

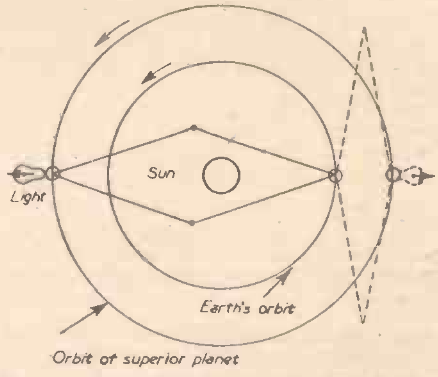


Fig. 15.—Mechanism for moving Mars, Jupiter and Saturn.

6 "Gear Trains." Dr. Merritt Pitmans, 1947.

Name	Inclination to Ecliptic	Mean distance from Sun (millions of miles)	Sidereal Period (years)	Diameter (miles)	Period of Axial Rotation
Sun	—	—	—	864,000	25-30 days
Moon	5°	238,900 miles from Earth	—	2,160	—
Mercury ...	7°	36	0.24	3,100	88 d.
Venus	3° 23′	67.2	0.61	7,700	225 d. ?
Earth	—	92.9	1.00004	7,927	23 h. 56 m.
Mars	1° 50′	141.5	1.88	4,200	24 h. 37 m.
Jupiter... ...	1° 18′	483.3	11.86	88,700	9 h. 50 m.
Saturn... ...	2° 29′	886.1	29.46	75,100	10 h. 14 m.

Fig. 16. — Data. Sun, Moon, Planets.

caused by the motion of the Earth round the Sun. It will be found that the Sun moves from West to East and that the path on the celestial sphere is inclined to the equator at an angle of 23° 27′. The path is also a great circle and it is called the *Ecliptic*. The Ecliptic is, in fact, the great circle which is the trace, on the celestial sphere, of the Sun's annual path relative to the stars. The intersection of the ecliptic and equator are called the Equinoctial Points. The position of a point (e.g., a star) on the celestial sphere may be defined by means of two co-ordinates. Two systems are of special interest to us.

(1) Right ascension and declination (the equatorial system),
(2) Celestial latitude and longitude (the ecliptic system).

All these important features are shown in Fig. 18.

The Complex Gyrational Motions of the Projector

To understand the motions which the projector can make, it is best to consider a simplified drawing (Fig. 19) of the mounting and the disposition of the axes.

The perpendicular to the ecliptic YY_1 and the polar axis XX_1 intersect at an angle of 23° 27′. The shaft 10 is journalled in a housing 11 which is rotatable about the axis XX_1 while the shaft 10 is rotatable about axis YY_1. The housing 11 is not directly rotatable on a stand rigidly fitted, but on a circular body 12, which by means of trunnions 13, 13_1 is supported on carrying members 14, 14_1. Thus the circular body 12 is rotatable about axis HH_1 in such a way that axis HH_1 is perpendicular at all times to the polar axis XX_1. Rotation of the shaft 10 relative to the housing 11 serves for adjusting in the plane of the ecliptic the position of the equinoctial line corresponding to a definite epoch.

The carrying members, 14, 14_1 are so arranged that the intersection point E lies in the centre of the hemispherical projection room, and the axis HH_1 is arranged to be horizontal.

By rotation of the circular body 12 about axis HH_1 it is possible to impart to the axis of rotation XX_1 any desired position relative

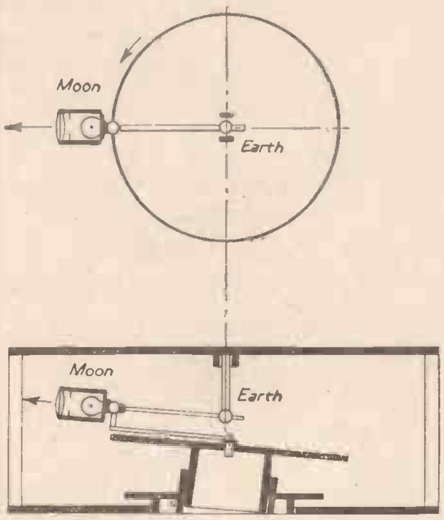


Fig. 17.—The Moon cage.

to the horizontal plane determined by the axis HH_1; consequently, adjustment for any latitude is obtainable.

To project great circles for the ecliptic and celestial equator special projectors are carried by the housing 11. It follows that the projected ecliptic and equator do *not* depend on rotations of the shaft 10. It is thus possible to rotate shaft 10 with its stars on the dome and keep the ecliptic and equator

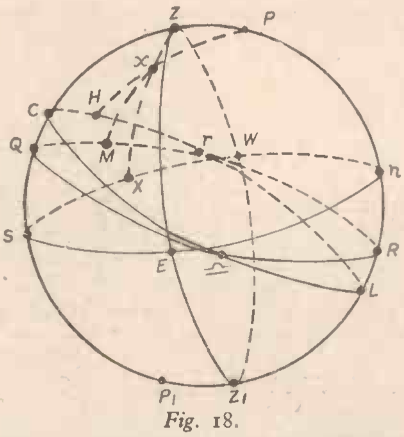


Fig. 18.

GREAT CIRCLES

Horizon, nESW.
Equator, EQWR.
Meridian, ZSZ1n.
Prime Vertical, ZEZ1W.

Ecliptic, rC♎L.
r, First Point Aries.
♎, First Point Libra.

THEIR POLES

Zenith, Z; Nadir, Z1.
North Pole, P; South Pole, P1.
East Point, E; West Point, W.
North Point, n; South Point, S.

CO-ORDINATES

Declination, Mx.
Right Ascension, rM.
Celestial Latitude, Hx.
Celestial Longitude, rH.

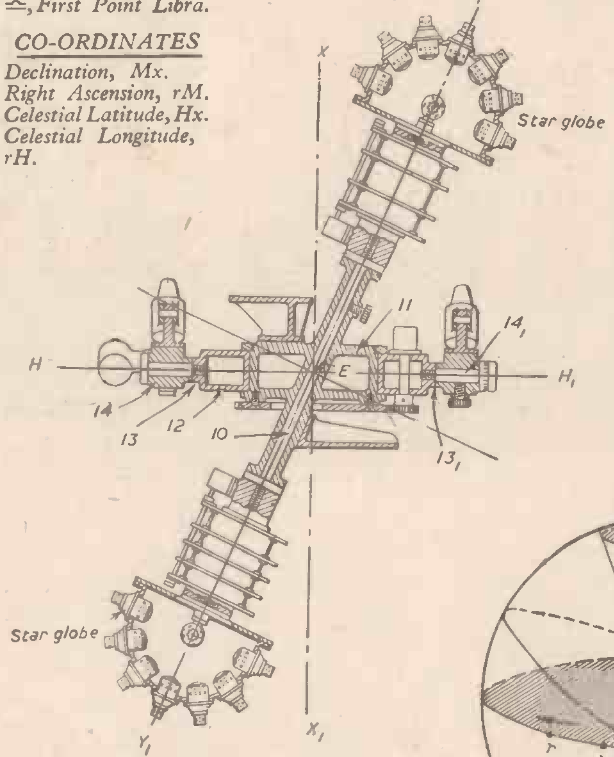


Fig. 19.—A simplified drawing of the projector mounting and disposition of the axes.

stationary. The relative motion produced between them the points of intersection of the ecliptic and equator (i.e., the famous first point of Aries and first point of Libra) and the "fixed" stars, provides a demonstration of the so-called precession of the equinoxes. This phenomenon is more fully appreciated from Fig. 20. It will be seen that the north pole of the heavens moves amongst the stars in a circle of 23½ deg., making one complete circle in 25,800 years. The north celestial pole is now passing very close to the star Polaris and this star has the distinction of being the North Star. In approximately 12,000 years its pride of place will be taken by the fine bright star Vega.

The projector of the planetarium is able to give a demonstration of precession in about one and a quarter minutes. The whole cycle of the "wobble" of the Earth's axis which in nature takes 25,800 years, is demonstrated in this fleeting fraction of time, a truly stupendous reduction when one considers that there are 525,960 minutes in a year.

It has been stated for the famous Fels Planetarium of the Franklin Institute, that in turning the projector through one day in 10½ minutes, the motor shaft makes 16,800 turns, such is the amazing gear reduction in the instrument. If one precessional cycle of equinoxes were performed by a succession of daily motions of 10½ minutes, the motor shaft would make 158,000,000,000 turns. It is most unlikely that such a demonstration would be given as it would take more than 188 actual years.

Distribution of Planetaria

From the prototype on the Zeiss works, in Jena, which first operated in 1924, these instruments have been made for many cities in Germany, Vienna, Rome, Moscow, Chicago, Stockholm, Milan, Osaka, Paris, Tokyo, The Hague, Brussels, New York, Los Angeles, Philadelphia and Sao Paulo, in Brazil.

The instrument now being built (1955), for London, is the greatest venture in the teaching of astronomy ever to take place in Great Britain. All persons who have read of the men of renown in astronomy produced by this island will rejoice that the public are soon to appreciate more fully the magnitude of the achievements of their forbears in elucidating the celestial mysteries.

Reports from Planetaria throughout the Earth are encouraging. The oldest planetaria are still filled to capacity and the demonstrations are carefully arranged to provide a valuable course in astronomical science. Special evenings are devoted to less erudite matters and spectacular demonstrations are arranged for a pleasurable session. Even those who are not enlightened in the arts of celestial mechanics may gain aesthetically and

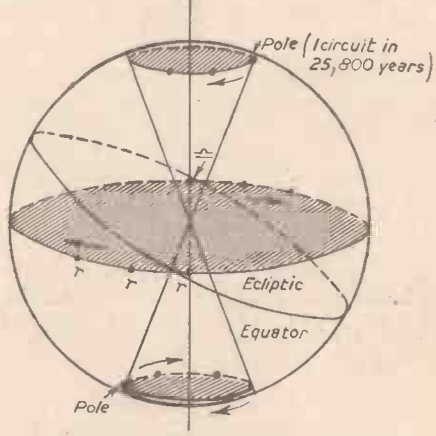
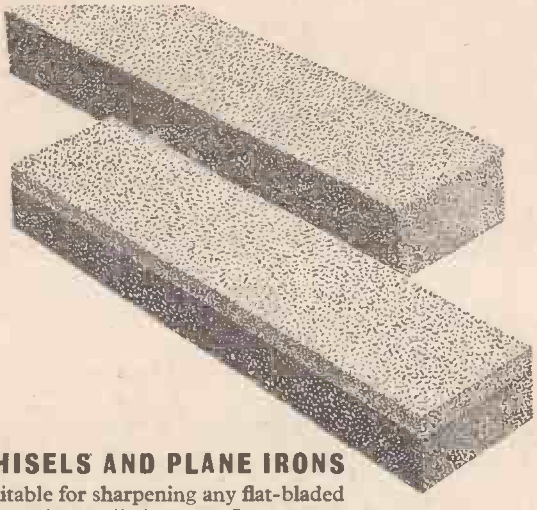


Fig. 20.—Precession of the equinoxes.

echo Shelley's beautiful words :—

Worlds on Worlds are rolling ever
From Creation to decay,
Like the bubbles on a river,
Sparkling, bursting, borne away.
What is Heaven ? A globe of dew,
Filling in the morning new
Some eyed flower whose young
Leaves waken
On an unimagined world :
Constellated Suns unshaken,
Orbits measureless, are furled
In that frail and fading sphere
With ten million gathered there,
To tremble, gleam and disappear.



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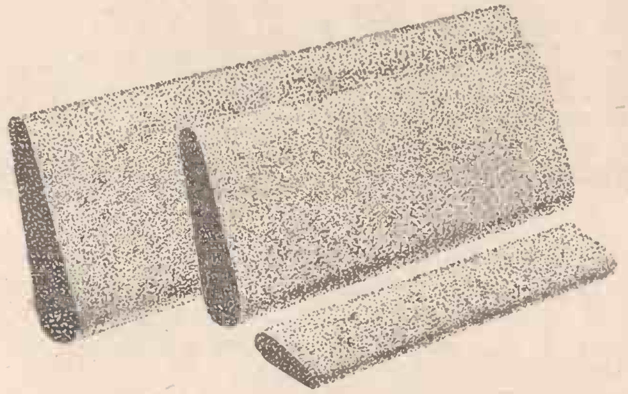

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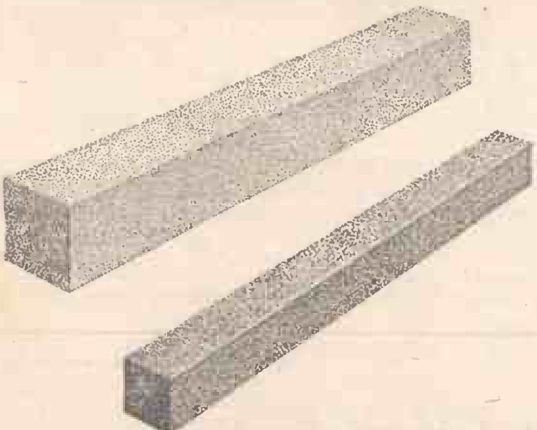

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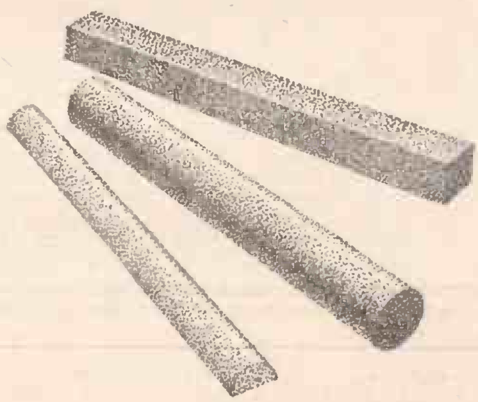

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OCTOBER/55 IC.68A

Building a Home Workshop

6.—Making an Angle Plate and Gauge Block

By TUBAL CAINE

(Continued from September issue)

An angle plate, made a perfect angle and with both ends square with these faces, is a most useful asset, and it serves equally well on the marking out table and, if necessary, when used for setting a casting on either the lathe, milling machine or shaper.

The construction and machining of such a device is well within the scope of the average model engineer's workshop and as only one is generally needed a pattern is unnecessary. A fabricated steel member made to the dimensions in Fig. 1 is useful for those who find an interest in small-scale steam locomotive construction, and though the length of this angle plate is given as 4½in., obviously this dimension is easily modified—the plates being merely lengthened or cut shorter as needed.

For this accessory obtain some pieces of steel plate which are in fairly good condition and not covered in thick rust, as this will spoil the appearance of those faces not machined, cut them as illustrated in the "exploded" view. On some of these details you will note there is a series of small angles about ⅛in. x 45 deg. These are provided to ensure that there is a generous fillet of weld and are essential for a strong joint. As this idea follows full-size practice, make sure they are included before attaching them to the mating parts.

At this stage do not trouble to mill the elongated slots in the webs—these are easily machined during the initial rough machining stage, but you can, of course, carry out this work if you wish prior to welding. The tapped holes in the angle faces must enter square with the machined surfaces, so these should be drilled after the final milling or shaping process over the faces has been accomplished.

A small point which the user will appreciate later on is the removal of all the sharp edges round the angle plate and apertures. It is suggested that you tackle this problem as you go along—in this case see the edges have been filed off the sides of those supporting angles to make the accessory pleasant to handle.

Dowelling the Parts

The word dowelling is perhaps a little misleading in describing the function of the pins shown in Fig. 2, because dowels in the engineering industry are usually items for holding parts together accurately. These pins also hold the pieces in place, but close accuracy is unnecessary; they are used to simplify the welder's task and to make sure he does not join them together incorrectly. Remember if the plates are set about 1/16in. out of square it will mean that some extra machining is required before the faces will clean up properly, and this can give the angle plate a rather thin appearance.

Verbal instructions to a welder or a brief drawing are all very well, but these do not prevent him making a mistake, and if you include the dowels or pins in each piece it automatically positions them and errors are impossible.

The dowel holes used for locating various details in the manufacture of jigs and fixtures are always carefully reamed to make sure a permanent positioning is secured, but for the work we are attempting drilled holes, if carefully made, will suffice. A drill is chosen which allows you just to push the pin into the plate, say, for half the length, one or two hammer blows driving it the remaining distance. It is unnecessary to use long pins or have them very large in diameter; about ⅛in. by ½in. long is ample.

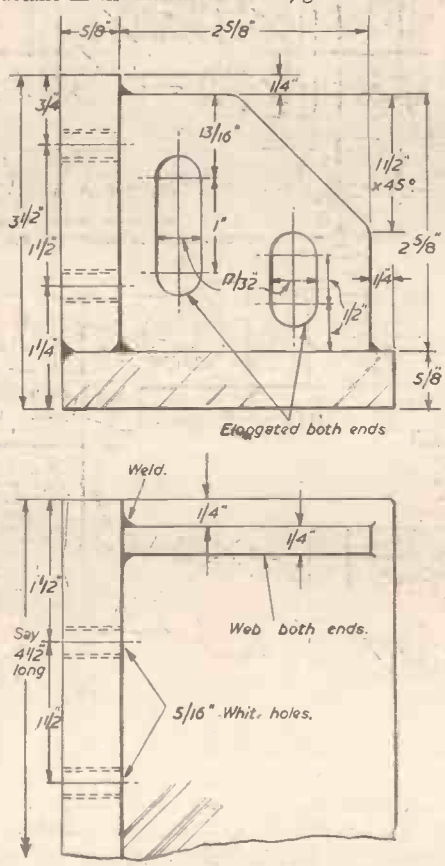


Fig. 1.—Two views of the angle plate.

A brief check to see all the pieces are square is the final operation before taking along the assembly to the local garage for the welding process, and the result is a fabricated angle which should present very few problems during the machining stages.

Machining the Angle Plate

The first step on receiving the accessory back from the welders is to file or chip off any excess welding material and generally to make sure there are no rough surfaces which can affect the location and clamping during the final machining operations.

Clamp the part down as shown in Fig. 3, and with the edge standing just over the boring table take a cut across the face with the large inserted cutter described in the last instalment of this series. The dimensions of this angle plate are arranged for one cut only across; there is no need, in this case, to reset the part if you have made the cutter body to the sizes given, with the tools spaced on a 6in. P.C.D. This cut is rather a heavy one, so make sure the clamps are well tightened—a slip while this cutter is traversing over the face will prove disastrous for both angle plate and cutter.

When this face is machined to your satisfaction slack off the clamps and rearrange it with the next surface toward the cutter—again have the face a slight distance out from the boring table edge. Fig. 3 illustrates this point.

The cut is repeated—though these notes refer to one cut being applied. It may be found convenient to take two or even three in order to secure a smooth, flat surface. A perfectly smooth face is virtually impossible while milling, the tool marks always remain, so endeavour to keep it as smooth as possible and do not worry too much over the circular marks that remain.

These two operations give the plate a true right angle, and the next stage is to square the ends also at right angles to those already made. For this process a really accurate try square is required and the angle plate is arranged as shown in Fig. 4. There is, of course, a plan view of the setting, and note should be made of the remarks included relating to the use of cigarette papers and slip or feeler gauges

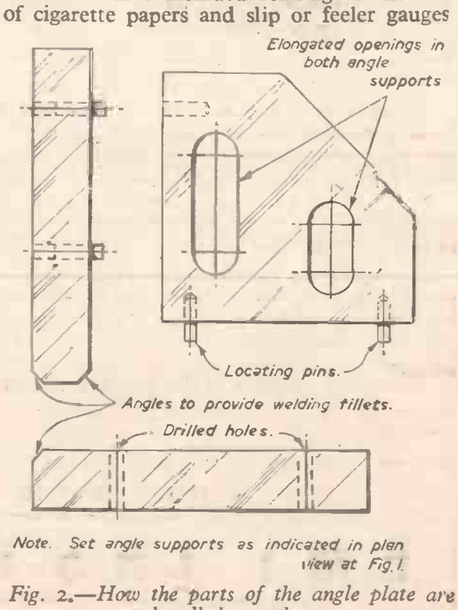


Fig. 2.—How the parts of the angle plate are dowelled together.

which will tell you whether the plate is at right angles to the lathe axis. Care while setting at this point will ensure an accurately made unit, and one which will not require further adjustment in an effort to make it square.

When all is satisfactory clamp it down carefully and then check over the setting to make sure it has not moved through the twisting action of the clamps. Incidentally, when tightening the clamp nuts advance each member with the fingers and very gently take up the pressure, giving both nuts about an eighth of a turn at a time; by applying these methods there is practically no risk of disturbing the angle plate and thus making extra work in setting.

Milling the Ends

The machining of these ends requires a slower feed than that used for the milling of the broader faces—the two short faces which the tools will strike create a rather severe intermittent cut, and if a proper clamping has not been effected the plate may move from the original setting. For both these ends the reader is advised to work slowly and carefully. A deep cut can pull the angle plate away from the proper set, so in this instance double the number of cuts is perhaps advisable in an endeavour to prevent accidents.

A useful item which can help to overcome any movement is the use of one or two pieces of steel attached by clamps to the boring table each side of the angle plate. Fig. 4 illustrates these in position after the setting with the try square has been accomplished. One on the side which resists the cutting pressure would suffice, but it takes only a few minutes to install the second piece and this is a set well worth the time spent on it.

If the plates have been cut reasonably square before the welding operation the initial cut should clean up the end faces, but watch to see that you do not start off with a comparatively shallow cut and find that halfway over the surface it has increased to about double the depth. The removal of 1/16in. per pass is ample and you should not, if the welding was properly done, need more than two cuts.

When both ends have been machined, on the bench vice file off all the machining burrs and then mark off and drill and tap the holes which you will need for future work to hold the component parts to the plate. These are spaced as indicated on the drawing, but vary the centre distance if you wish. There is no point in having them too close together as this obviously cuts down the available surface on which you can stand the workpieces.

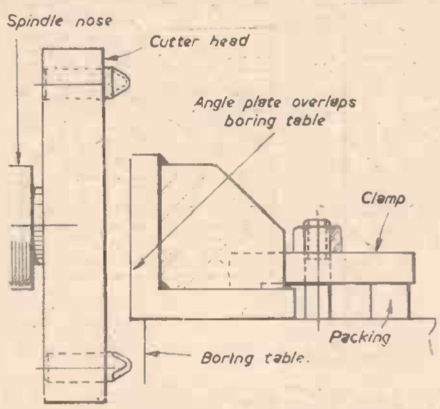


Fig. 3.—Machining the angle plate.

The Gauge Block

This item is another very useful accessory to possess, and for some work it has a certain superiority over the angle plate because there is more weight and this prevents it tipping forward if a rather heavy detail is clamped to a face. In the machine shops a gauge block is often preferred to the previous part, but it is suggested that the reader makes them both.

Regarding welding and machining, the work is more or less identical in both instances. Holes are drilled and tapped in two of the faces as Fig. 5 shows. The other faces could be given a series of similar holes, but generally a plain flat surface is useful for those small or perhaps slender parts which would fall through the holes. There are many occasions when the reader will only need to hold a component against the gauge block with the fingers to ascertain whether a certain face is square or to make a quick mark with a scriber. Clamps on those occasions are not required and a flat face free from all holes is an asset. Holes, therefore, are specified in two adjacent sides only.

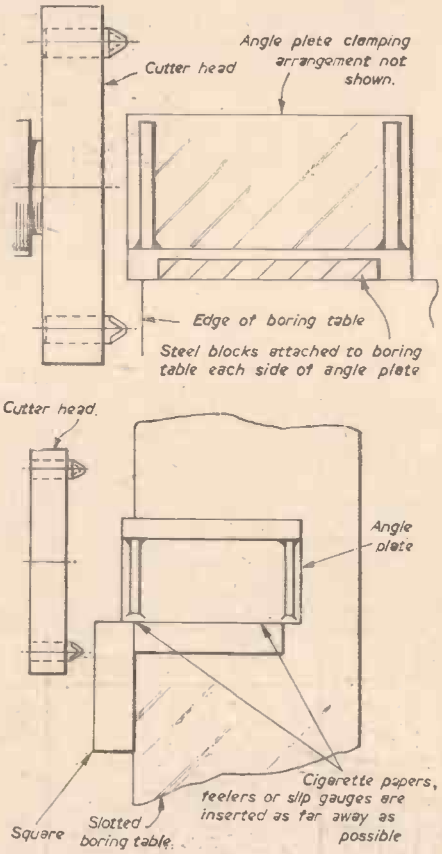


Fig. 4.—Squaring and milling the ends.

Reverting for a moment to the welding question, small chamfers are again included where shown to facilitate the entry of the weld. This block is just large enough to allow the welder to insert the torch inside to attach each part together, but it is not advisable to make it any longer or difficulty may be experienced.

Finishing the Surfaces

Some readers may have access to the machine for grinding the surfaces and it is suggested that those who can have this operation carried out should do so; the finish is far superior to the milled surface and the accuracy achieved is closer—the odd error of perhaps .0005in. is corrected to the advantage of future items for which the angle plate and gauge block are needed.

For those who have not access to a grinding machine a careful application of some very smooth emery is recommended. Taking great care not to concentrate the rubbing action in one particular spot, some of these marks are removable. I would never apply a file because despite very great care there is always the risk of taking too much off one corner and this will mean the complete face needs remachining.

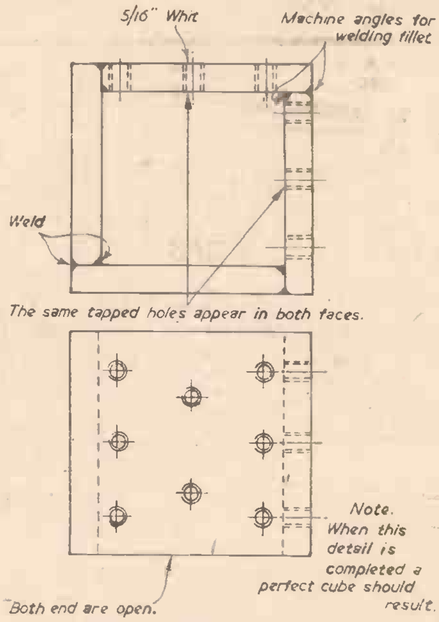


Fig. 5.—The gauge block.

Generally

Most readers must probably rest content with a burring process to rid the corners of all sharp edges and a careful rub over with the emery cloth to make the accessories pleasant to handle, but if you exercise care and are prepared to spend, say, half an hour or so on each, then the result is quite a good-looking article.

These accessories are two of the most useful if not the most important in your workshop. You cannot perform much accurate marking out without them and care during the setting and machining stages will pay good dividends on other work at a later date.

You can check the squareness with the aid of the try square—in full-size practice other methods would be employed, but if you can obtain a surface flat enough to hold a cigarette paper at all points, then you have a first-rate accessory and well worth the trouble taken to make it. Slight inaccuracies are removed by scraping, but this is a process which is tedious, so give all your attention to the machining and so avoid too much handwork.

Tap the holes a standard size—they are shown in the Figs. as 5/16in. Whit., a size used because the thread is so much stronger than the ¼ Whit. If a smaller thread is preferred tap the plate and block 0 BA as this is slightly stronger in the root diameter. Tap both accessories the same thread otherwise you will assuredly have regrets later on if time is lost searching around for a particular screw or bolt when one taken from the other accessory would fit easily if the threads had been made the same size. Either tap them both 5/16in. or both 0 BA and avoid this waste of time.

(To be continued.)

How the PERPETUAL CALENDAR works

An Explanation of the Extra Gear Trains Necessary to Indicate the Day, Month and Phases of the Moon

THIS, known from its inventor as the Brocot system and of which there are variations, is perhaps the simplest to understand.

Fig. 1 shows how part of the assembly is mounted on the rear and part, shown by the dotted lines, on the front plate of the movement.

The Working Sequence

The operation commences with wheel A, which carries the hour hand on its boss, turns

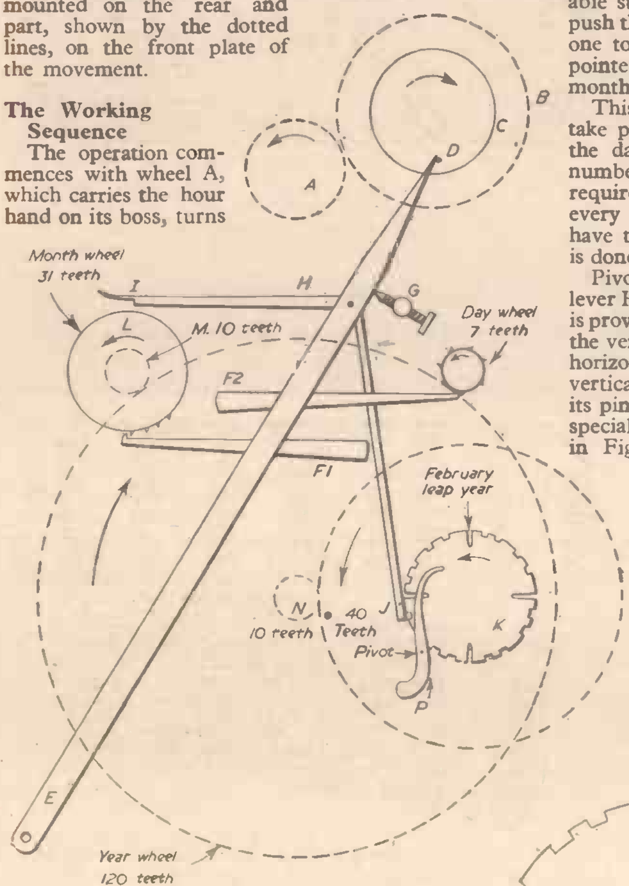


Fig. 1.—Layout on backplate of movement.

once in 12 hours, and meshes with wheel B, which, having twice the number of teeth, makes one revolution every 24 hours. The shaft upon which wheel B is mounted carries also, at the rear of the movement, the plain wheel or disc C, this being furnished with a pin D.

The long arm E is pivoted on and near the bottom of the rear plate, the other end engaging, with a precise amount of overlap, with the pin D. It carries two counter-balanced pawls F1 and F2, the former engaging with a ratchet wheel of 31 teeth, the latter with a smaller ratchet wheel of seven teeth. At the opposite end of the shaft carrying the 31-toothed wheel is mounted a pointer which scans a dial on the face of the clock, marked for the 31 days of the longest month, this being termed the month wheel, a similar arrangement being provided for the other wheel, except that its dial is inscribed with days of the week.

It will be seen that as C revolves in the direction indicated pin D exerts pressure on arm E, which moves to the left, allowing both pawls to select a tooth on their respective wheels, the degree to which the end of E overlaps pin D being such that the pawls select one tooth only. As C continues its revolution D releases E, which drops by its own weight, or the assistance of a spring, against the adjustable stop G, causing the pawls to push their respective wheels forward one tooth, and the aforementioned pointers to progress one day of the month and one day of the week.

This fall back of E is timed to take place at midnight, and if all the days of the month were 31 in number nothing more would be required, but months of 30, 28, and every four years 29 days' duration have to be arranged for, and this is done as follows.

Pivoted on arm E is a bell crank lever H, the horizontal arm of which is provided with a step or claw I, and the vertical arm with a pin J. The horizontal arm is heavier than the vertical, and so keeps the latter and its pin in contact with the edge of a specially designed wheel K, shown in Fig. 2, and which is driven from the month wheel by the gear arrangement carried on the front plate of the movement.

This gear train consists of a 10-toothed wheel M mounted on the same shaft as the month wheel and engaging with a wheel of 120 teeth, which, therefore, turns once per year.

The shaft of this wheel

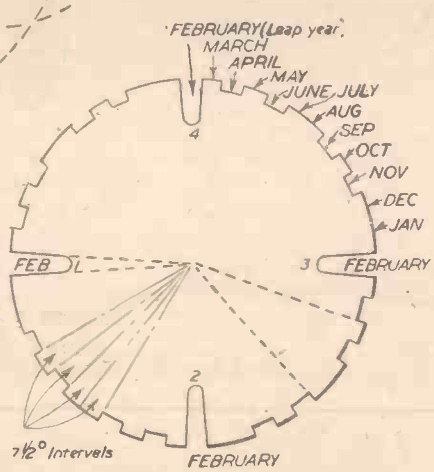


Fig. 2.—The selector wheel.

carries a pointer scanning a dialon the clock face inscribed with the months of the year. This wheel is called the year wheel, and its shaft carries also a 10-toothed wheel N which engages a 40-toothed wheel O, upon the shaft of which is mounted the selector wheel K.

Thus a 12 : 1 gear ratio exists between M and the year wheel, 4 : 1 between K and the year wheel (the former turning once every four years) and a 48 : 1 ratio between K and M. Though variations of this gear arrangement are sometimes seen, the ratio is the same.

The Selector Wheel

Fig. 2 shows how the circumference of the wheel K is divided into 48 sections each 7½ degrees wide, to each of which is allocated one of the months of the four years taken by the wheel to complete one revolution, the sequence recommencing again once the Leap Year notch has been entered and vacated by pin J.

All the months occupy divisions of the same width, the shallow indentations cut in the edge of the disc representing the 30-day months, slots 1, 2 and 3 the 28 days of normal Februarys, and slot 4, which, as described, is shallower than these three, accounting for the February of Leap Year; the ridges left after the indentations have been made allow for the 31-day months, July and August occupying adjacent ridges, as do December and January.

The walls of the indentations follow the direction of their respective radii, as shown by the dotted lines, a factor necessary to assist the pin J out of the indentations, in which respect, in the case of the deep slots, the shaped and weighted arm P pivoted on the rear plate (Fig. 1) also assists.

How Months of Different Lengths are Indicated

When pin J is lying on the circumference of K, i.e., during the course of a 31-day month, the horizontal arm H is riding in its highest position, and so when arm E moves over to the left the claw I will pass over the pin L with which the month wheel is fitted and in a corresponding position to which is fitted the pointer of same.

When, however, the clock is running in a 30-day month wheel K will have turned slightly. Pin J will have dropped into one of the shallow slots in K, and H, with its claw, will have dropped a correspondingly small degree.

It follows that if the drop-back action of E is to take place at midnight, the selecting action will commence some time, say, three hours, before this. If we divide the full

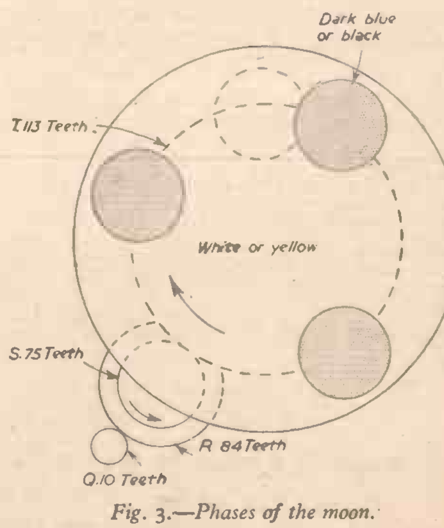


Fig. 3.—Phases of the moon.

length of the selecting stroke into three divisions, on 30-day months claw I will engage pin L at the commencement of the last of these, or at 11.0 o'clock on the night of the 30th. During the next hour, pin L, its wheel and pointer will creep forward from 30, at which point it has been since the previous night, to 31, and when the drop back comes at midnight the pointer will leap forward to the 1st, thus for about one hour at the end of the last day of a 30-day month there is a false indication.

The action at the end of February is similar and during this month wheel K will have presented one of its deepest slots to pin J, which lies therein, causing arm H and claw I to lie at the lowest of their three positions, thus engaging pin L at the commencement of the first of the three divisions of the selecting stroke.

This will, of course, take place at about 9.0 p.m. on the 28th, and as the selecting stroke continues for the next three hours the pointer will, during this time, creep forward from 28 to 31, arriving there at midnight, leaping to the 1st immediately afterwards.

February of Leap Year is accounted for by a slot deeper than those of the 30-day months, but not so deep as those of the 28-day month, and pin L is engaged at the commencement of the second third of the selecting stroke or at the end of the 29th day. Days 30 and 31 are advanced during the last two hours of the 29th, the 1st of the new month appearing, as before, immediately after midnight.

Thus it could be said that the unwanted 31 at the end of a 30-day month is eliminated between 11.0 and 12.0 p.m. on that day, the unwanted 29, 30 and 31 between 9.0 and 12.0 p.m. on February 28th non-Leap Years, and the unwanted 30 and 31 between 10.0 and 12.0 p.m. on February 29th in Leap Years, always assuming that the full selecting stroke takes approximately three hours. This slight false indication has always had to be accepted at the end of the last day of months of other than 31 days' duration.

The Phases of the Moon

These can, with an infinitesimal degree of error, be indicated by a gear and disc arrangement as shown in Fig. 3. This illustration shows the moon plate U and the gears by which it is turned mounted on the front plate of the movement, as are wheels A, B, M, N and O (not shown).

A pinion Q (of 10 teeth) on the shaft of the day wheel engages with a wheel R of 84 teeth,

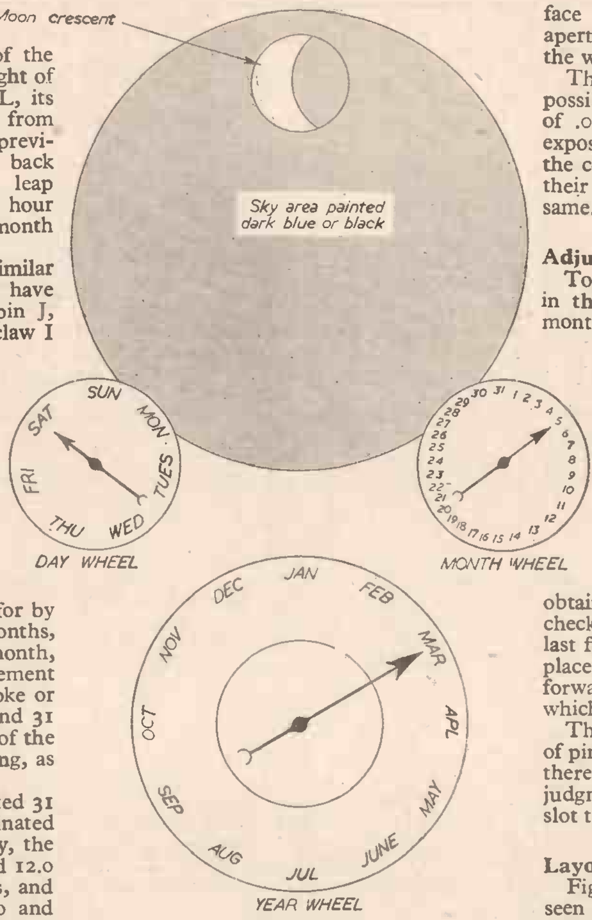


Fig. 4.—Layout of dials.

to which is fixed wheel S of 75 teeth, this engaging a final wheel of 113 teeth (T).

This carries a plate U upon which three circles are painted of a dark colour to match the "sky" area painted on the face of the clock, the remainder of the plate between the discs being of a light colour suitable to the accepted colour of the moon.

Plate U is mounted sometimes on the same axis as the hour hand, sometimes independently and higher up. The layout in this respect and also the other dials vary with the make of clock.

As this plate revolves behind the clock face the circles pass behind a similar-sized aperture in the face and create the effect of the waxing and waning of the Moon.

The gear ratio stated is as near as it is possible to get to accuracy and gives an error of .0008 of a day for each complete lunar exposure. The distance between the edges of the coloured discs at the points farthest from their centres is equal to the diameters of the same.

Adjusting the Calendar

To adjust the month hand see that pin J is in the correct position on wheel K. Each month in the four-yearly cycle has its own notch, slot or ridge, and the pin must lie not only in its correct section, but in the correct part with relation to the day of the month. If the day on which the calendar is set in motion is, say, the 28th of January, the pin will lie very near the end of the January ridge and so on throughout all the other months.

To adjust the phases of the moon remove temporarily the day wheel pointer, turn shaft of same to obtain "full moon" effect on the clock face, check from a calendar upon which day the last full moon should have appeared, and replace the hand to correspond. Then turn shaft forward with hand replaced till the day on which the setting is being done is indicated.

The most difficult adjustment is the location of pin J on the contours of wheel K, for which there is nothing to assist the operator except judgment as to where on the ridge or in the slot the pin should lie.

Layout of Dials

Fig. 4 shows a typical layout of the dials as seen from the front of the clock face. A different gear arrangement, but the same ratio, between the gear wheels connecting the month and year wheels with longer pawls F1 and F2 will account for the dials on some makes of clock being more widely spaced. By means of wider diameter wheels Q, R, S and T the moon plate could be, and sometimes is, mounted on its own spindle and higher up the clock face, not as shown turning upon the same axis as the hour and minute hands.

It should not be difficult, as an added refinement, to arrange at the lowest point of the assembly a four-unit counter of the revolving drum type to indicate the actual year, i.e., 1955, 1956, etc., a pin on the year wheel turning the units drum as it passes same, though a flick action would have to be devised.

BOOKS *Received*

Steam Road Vehicles and Railcars in Germany. Compiled by J. N. Walton. 36 pages. Price 3s. 6d. net. Published by "Light Steam Power." Kirk Michael, Isle of Man.

THIS booklet, of interest mainly to the steam power enthusiast, traces the development of steam road vehicles and railcars in Germany from the 1930's to 1947. The long list of illustrations includes many photographs.

Half Safe. By Ben Carlin. 279 pages. Price 16s. net. Published by Andre Deutsch. Ltd.

THIS book is somewhat outside the normal scope of "Books Received," but its inclusion may be justified because it tells one of the most fantastic stories in the history of the automobile. *Half Safe* is, besides being the title of the book, the name of the vehicle (or vessel) in which Ben Carlin and his wife crossed the Atlantic on the first lap of their journey round the world—it is, in fact, an amphibious jeep. It is impossible to give, in the space of a short review, a satisfactory picture of the adventures, difficulties and triumphs involved in such an undertaking, but *Half Safe* will go down in history as being the first car to cross the Atlantic under its own power.

Welding and Cutting. By J. A. Oates, A.M.I.P.E., M.Inst.Met. 93 pages. Price 5s. net. Published by Percival Marshall & Co., Ltd.

THIS is a useful and practical handbook, describing the welding and cutting of metals by the oxy-acetylene and metallic arc processes.

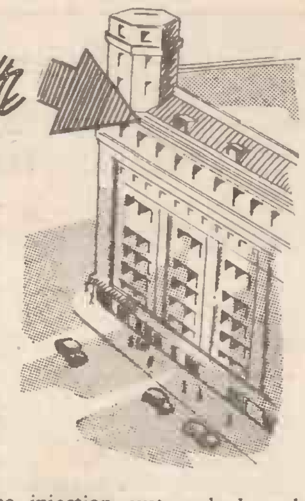
Motor Repair Manual. By the Staff of "The Motor." 179 pages. Price 6s. net. Published by Temple Press, Ltd.

WRITTEN for the increasing number of private car owners who are to-day undertaking their own repair and maintenance work, this eleventh edition of the manual contains much practical information and advice Chapters are included on Workshop Equipment; The Lathe and Its Uses; Making Tools and Appliances; Workshop Practice; Engine Overhauls and Soldering Brazing and Casehardening. There are sections dealing with the clutch, gearbox, brakes, axles, springs, bodywork, etc., and final chapters on electrical and miscellaneous repairs. There are two appendices, a particularly useful one being devoted to tracing engine troubles.

Graphical Design of Optical Systems. By L. E. W. van Albada. 153 pages. 21s. net. Published by Sir Isaac Pitman & Sons, Ltd.

IN this English version of the original Dutch edition, the author sets out some of his own comparatively simple methods of constructing optical systems graphically, avoiding complicated calculation and lengthy and complex computation. Even for the more involved optical systems discussed in the book, nothing more than a fundamental knowledge of geometry and trigonometry is required. A certain basic knowledge of elementary optics is assumed, but the book is primarily for the amateur and the student. Illustration is by line drawing.

Letters to the Editor



The Editor Does not Necessarily Agree with the Views of his Correspondents

Space Travel

SIR,—It is good to see and hear that more people are beginning to believe in the possibility of life on other planets. I believe that a considerably greater amount of evidence will be forthcoming when the new radio telescope comes into operation this year; also the new electronic camera now in use by two French astronomers may bring in new information.

One reason that people have not reported sightings of flying saucers to P.M. in the past is probably because your magazine showed itself to be among the unbelievers. I have had one sighting that I believe could not have been accounted for by anything off this earth. But like many others throughout the world, I felt that it was right to report sightings to F. S. Bureaux and other like societies and the air forces throughout the world, where they would be investigated by people who were prepared to examine all the available evidence. Only the Australian Air Force Intelligence, however, seems to be working with the Australian Flying Saucer Bureau. Other Flying Saucer Bureaux and like societies do not seem to have the same intelligent co-operation.

Recently I was among others who heard a tape recording from George Adamski, and it was my impression that while he is very sincere and intelligent, he has not the necessary knowledge to fool experts of the air forces, and other experts with whom he has come in contact. Many people forget that George Adamski's photographs have never been proved false, and the experts have had over two and a half years to study them. One other thing that people have overlooked is this: about 14 months after Adamski took his photographs, a 13-year-old-boy at Coniston, England, took a photograph of a saucer of identical proportions. The military authorities of this country and America have had nearly one and a half years to compare those photographs, but have also not produced any new statements concerning them. The editor of the Australian Flying Saucer Society has publicly stated that he can prove that Adamski's visitor did in fact come from outer space.

Finally, Adamski has said that American planes were in the vicinity when he met the Venusian; why has the Air Force never denied this?—RONALD W. G. ANSTEE (Bristol, 2).

[*We suggest that it is impossible to prove that the visitor came from outer space.*—ED.]

SIR,—On the subject of "Flying Saucers" Adamski, Allingham and Desmond Leslie, either know more about the "Flying Saucer" and its occupants, or else they are being led up the garden path.

I agree with all three that "Flying Saucers" have landed and that conversation has taken place with at least two of the above named gentleman and the occupant or occupants of these machines. However, by no stretch of the imagination could anyone convince me that these machines came from another planet. They are being fooled by a masterly piece of acting.

The last remarkable "Capering" of a "Flying Saucer" was on the night of March 24th, 1955, when it flashed across the skies of Britain, acting the "Meteor." Meteors do not change course, as this one obviously did, and besides, it becomes a modern wonder that a meteor should last for at least 10 whole minutes in "level" flight.

Making calculations at the time, I find that this particular machine should be about 55ft. in diameter, with a wing rotation of approximately 3,200 r.p.m., giving a speed of something near 6,000 miles per hour.

I believe, however, that these so-called mysterious machines and their occupants come from this earth!—V. A. MILLER, (Sittingbourne).

A Sawdust Burner

SIR,—*Re* Mr. Laing's letter concerning a sawdust burner, July P.M., in a copy of the *Scout*, dated October 2nd, 1920, I read the following in an article by Sir Robert Baden-Powell, K.C.B.

"Obtain an iron drum from a painter or oil man about 18in. high and 7in. across. It should be open at one end. Cut a hole in the bottom and insert a length of broomstick (see sketch). Pack dry sawdust very tightly into the tin around the broomstick. Carefully draw out the broomstick, taking care to leave a clear passage up through the middle of the sawdust which has been rammed tight and hard.

"Stand the tin on three bricks and set light to it through the hole in the bottom with paper or oily waste. When ignited it should burn for seven hours."—A. LLOYD (Warrington).

Mr. A. Lloyd's Sawdust burner.

"Beware of the Night"

SIR,—Regarding the article in the July issue, under the title "Science and Observation," Prof. Low dismisses as a rumour the apparent development of extra power from a car at night time. He suggests that this apparent power is due to a reduction of visual distance. I should like to suggest that this factor of visual distance is only a secondary factor, the major issue is really an increase in power.

Before enlarging on this particular aspect of the discussion, consider the next paragraph dealing with moisture being dripped into the inlet manifold. Prof. Low states that it should really be injected as liquid against the cylinder walls if it is to do any good. I think that the whole discussion revolves around this statement and either Prof. Low is wrong or I have misunderstood the text of the article.

During the war quite a number of aircraft engines were fitted with a water injection system, and in this system water was injected into the eye or centre of the supercharger, the object of this idea was much the same as the moisture drip of which Prof. Low speaks, that is to cool down the charge of gas to the engine cylinders. By doing so the density of the mixture or gas is increased and consequently a greater amount of mixture enters the cylinder. The ultimate result is an increase in power which on one particular engine (Wright Cyclone) was amazing, an increase of around 200 h.p. being effected. The injection system had to be used in emergency only. Reverting to the car engine again, during the night the atmosphere is generally cooler and damper, which effect can be considered as a parallel to the water injection system, i.e., water being used to cool the mixture, this being so, an increase of power under these conditions must take place. Towards the end of the text the following statement is made. "After a general overhaul we are often told not to exceed, say, 35 m.p.h. and although it is not a good thing to achieve high cylinder temperature by a wide open throttle the main reason is not one of explosion pushing the piston too hard but of the terrific forces, amounting to many tons, exercised in the engine by the reversal of reciprocating parts."

First, an explosion does not take place in the cylinder, the mixture or gas drawn into the cylinder burns at a fairly uniform speed although this burning process is rapid; the burning rate, or to give its correct name, flame rate varies with different fuels. Should an explosion occur in the cylinder, detonation results and pinking and knocking of the engine can be heard. This detonating or explosive effect is due to a number of faults, the main ones being badly tuned engine, incorrect ignition setting or faulty carburation. Secondly, the remarks regarding high cylinder temperatures due to wide throttle setting completely baffle me; it seems to me that Prof. Low has something mixed up somewhere.

I think what is intended is this. After general overhaul the new components are reasonably tight and have not bedded down, consequently a high friction is caused particularly on the cylinder walls if a speed of 35 m.p.h. is exceeded, the friction increases, and in consequence an excessively high temperature due to this friction arises. This high temperature causes the lubricating properties of the oil to break down and rapid wear takes place; in extreme conditions engine seizure takes place.—W. J. HUGHES (Gosport, Hants).

A Compensated Pendulum

SIR,—In reply to Mr. T. Craig's letter, July issue, commenting on my article on a compensated pendulum, he is quite correct inasmuch as the ½in. O.D. tube and rating nut should be of Invar, not brass.

The compensating brass "pad" Mr. Craig mentions would have to be washer-like in form, so I called it a washer, and I did say that it would have to be of suitable thickness, to be arrived at by trial and error, to match the expansion and contraction of the suspension spring. Though I agree that the use of a brass tube and rating nut would detract from the compensating characteristics of the pendulum, I do not agree that this would render it less compensated than if the bob were supported simply on its rating nut, as the main compensating feature, i.e., the equal expansion above and below the centre of gravity of the bob, together with the Invar rod, would still be preserved.

On these fine points of pendulum performance, i.e., compensation, interference, etc., the leading horologists of the day seem to differ. Though I agree that we must obtain all the compensating advantages we can, and that an Invar tube and rating nut would be preferable to one of brass, it is curious that in F. J. Britten's Watch and Clockmakers Handbook, we see two observations in his chapter on the Invar pendulum: 1. "When close results are required, it is necessary to support the bob on a compensating tube usually of brass, resting on the rating nut." No suggestion of resting the bob on its centre of gravity is made. 2. "A bob 8in. high, and made of a mixture of tin, lead and antimony would, if supported on the bottom, itself approximately compensate for the elongation of an Invar rod with an expansion co-efficient of .000003C without requiring compensation." So it would appear that little compensation would be lost even if a brass tube were used.

What I consider to be the true answer to the thorny problem of pendulum expansion and contraction is two pendulums, each compensated as nearly as possible, of similar materials but different effective lengths, working in a "beat frequency," following mechanically the same principle as used electrically in radio, both expanding and contracting together to the extent of their lack of perfect compensation but the difference remaining the same. This can be done by a special escapement I patented and abandoned some years ago.—J. A. ROBERTS (W.2).

No New Force

SIR,—With reference to the pivoted paper cylinder described by Professor A. M. Low in your April issue, which rotated when the hands were cupped around it, as there seems to be some difference of opinion regarding the cause of the rotation and suggestions have even been made that it is necessary to introduce an unknown force emanating from the human body to explain it, your readers may be interested in the following simple experiments I have made with this apparatus.

The cylinder was made exactly as described by Professor Low and it was confirmed that it did indeed rotate when the hands were cupped around it.

A cylindrical screen was then made to enclose the apparatus consisting of a wire framework 6in. long by 4in. diameter covered with cellophane sheet, the ends being left open.

The hands were then placed around the screen in close contact with the cellophane and it was lowered over the apparatus. It was found that rotation of the cylinder took place so long as the top and bottom of the screen were both open, but if either of them was closed by lowering the screen down on to the table or covering the top with a card, rotation immediately ceased and was only resumed when *both* ends of the screen were open.

It was also found that the above results could be duplicated exactly by substituting for the hands a coil of resistance wire heated by passing an appropriate current through it.

I think that the above demonstrates beyond doubt that the rotation is due to convection currents in the air between the hands and the cylinder and is caused by heat from the hands. The introduction of any new force appears to me to be quite unnecessary to explain the rotation.—"INTERESTED" (Colchester).

Wolf Cub Drill as a Mixer

SIR,—In reply to the query from Handiman (Glasgow) in "Information Sought," August issue, as to whether it is possible to employ a ¼in. Wolf Cub electric drill for use in beating egg and cake mixtures, I would like to offer a method by which I accomplished this object. It was not with a Wolf Cub, but with an ordinary ⅛ h.p. motor; but there should be no difficulty about using the Wolf Cub with a slight alteration. I first tried direct drive with two vanes but the speed was such that the vanes were spread out horizontally. Obviously a reduction gearing was necessary, but for reasons of economy I wanted to use the vanes of a cheap hand mixer. To do so I had to preserve the distance A—B in Fig. 1, which is 1⅛in., and this did not allow for two large enough wheels. Finally, the following method was adopted and has proved satisfactory, giving a reduction of 12 to 1. Other reductions could be arranged by using suitable tap and bolt.

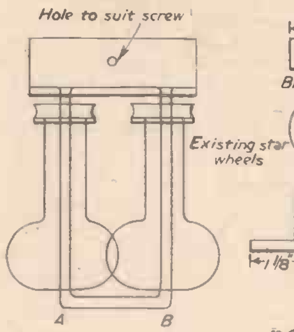


Fig. 1.—Fitting hand mixer vanes.

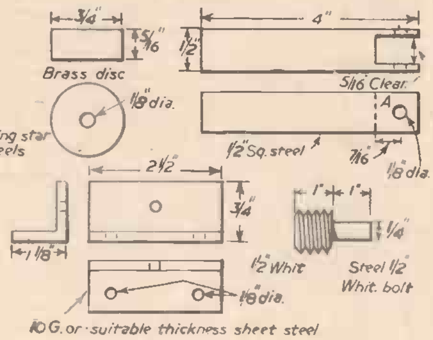


Fig. 2.—Details of the parts required.

Turn up two brass discs as in Fig. 2.

Take a piece of ½in. square steel about 4in. long and drill ⅛in. hole at A, Fig. 2. Then cut slot with a hacksaw, as shown.

Employing this as a holder, use either a piece of ⅛in. silver steel or a ⅛in. bolt and nut to hold the disc in the slot so that disc will revolve. Place holder in tool post. Take a ½in. Whitworth tap and put it in the chuck. Run lathe slowly and feed the brass disc up to the tap. The brass disc will revolve and the tap, as a hob, will cut the brass disc into a worm wheel. Cut both discs.

Take a ½in. Whitworth bolt. In my case I cut a piece of the threaded part about 1in. long and drilled it to drive fit the spindle of my motor, but in the case of the Wolf Cub I would suggest cutting a piece 2in. long, leaving 1in. of thread and turning a spigot ¼in. diameter for use in drill (Fig. 2).

Take a piece of 10 g. sheet steel and bend at a right angle, Fig. 2, or use a suitable piece of angle iron, and drill as shown to suit vane spindles. The single hole is to screw angle to wooden backing piece.

The two discs are drilled and riveted to existing star wheels on top of vanes. Insert the threaded piece of ½in. bolt between the brass discs. Assemble the vane spindles in holes in angle and tap over ends.

The Wolf Cub drill could be mounted to steady it or it could be held for length of time for mixing.—F. A. NEWMAN (Perthshire).

Using Metal Dishes for Photography

SIR,—I have just been reading your reply in the May issue to a correspondent who asks about paint for photographic dishes. I notice that you condemn the use of metal for dishes and then aver that there is "quite definitely" no suitable paint for the purpose.

I have used home-made tinplate dishes in all sizes from postcard to 20in. x 16in. for over twelve years, and consider them superior to enamelled steel or porcelain.

I make them in good quality tinplate and paint them with two coats of "Japlac" synthetic paint. Every few years I glasspaper them down and repaint, and they are as good as new. Hypo dishes should be repainted about every two years as this stuff affects the paint more than does developer.—W. H. LORD (Nelson).

Society of Inventors

SIR,—With reference to Mr. Wace's letter and one by Mr. Tew-Cragg on the subject of a Society of Inventors, kindly permit me to say that the reason why inventors in many cases have received so small a return for their work is lack of organisation.

I beg to differ from Mr. Tew-Cragg, that a limited company could not be run effectively, as I think it would be a matter of obtaining sufficient capital and it would have to have effective advertising.

A Society of Inventors would answer the problem for the time being, until a company could be formed, by those desiring to do so, and of course making the Society of Inventors a permanent organisation.

I, for one, would be only too pleased to subscribe to a Society of Inventors when formed, provided the subscription was reasonable.—E. S. HUMPHREY (Romford).

The Age of the Automaton

SIR,—Surely you err gravely when you say that "machines capable of *thought* now control other machines"?

The misnamed "Electronic Brains" are only clever and elaborate devices which respond in predetermined ways to prearranged stimulus, but they are quite incapable of *thought*.—IAN H. MCLAREN (Wimbledon).

A 3½" x 2¼" PRESS TYPE CAMERA

(*Concluded from page 32*)

The Finish

Before finishing and covering the camera all the wooden parts should have been filled with wood filler to keep out moisture. The interiors are painted with matt black "Blackboard" paint, all the steel parts polished and lacquered (as good as chrome), the movable slide "blued" and lacquered and the brass parts "Blackbronzed." The leather covering was glued to the body and finished with "wing dope" which gave it a slightly hard surface and restored the shine after handling it.

No doubt some readers will be able to improve on some details of the camera, but proof of the merit of any modifications carried out will appear finally in the negative. I find that the camera handles easily and is of such construction that should any improvements be deemed necessary they can quite easily be carried out.

READERS' SALES AND WANTS

The pre-paid charge for small advertisements is 6d. per word, with box number 1/6 extra (minimum order 6/-). Advertisements, together with remittance, should be sent to the Advertisement Director, PRACTICAL MECHANICS, Tower House, Southampton Street, London, W.C.2, for insertion in the next available issue.

FOR SALE

BRAND NEW Brooks ¾ h.p. Motors (ball-bearing), 230 v. A.C., 50 c., 2,800 r.p.m. Ideal for driving woodworking machines, grinders, etc. Latest type fully guaranteed split phase, £9/14/-; Capacitor, £10/16/-; carriage paid mainland. Approval against cash. P. Blood & Co., Arch Street, Rugeley, Staffs.

CHROMIUM PLATING.—Complete Outfits, 10/- and 25/-; Electro-plating Outfits, 13/6 each. Details and sample 4d. stamps. A. Dutch, 51, Monkhams Lane, Woodford Green, Essex.

COMPRESSORS for sale, 2½ CFM, 180lbs. sq. in., on metal base, with driving wheel and receiver, price £3; ¼ h.p. Heavy Duty Motors, price £3; carriage forward. Wheelhouse, 1, The Grove, Isleworth. (Phone: Hounslow 7558.)

NUTS, BOLTS, SCREWS, Rivets, Washers, and hundreds of other items for model engineers and handymen; s.a.e. for list. Whiston (Dept. PMS), New Mills, Stockport.

HOUSE SERVICE METERS, credit and prepayment; available from stock. Universal Electrical, 221, City Road, London, E.C.1.

LATEX FOAM UPHOLSTERY. 2ft. 6in. Damask Mattress, £8/11/-, carr. 2/-; 14½in. x 13in. x 1½in. Seat Unit, 8/6, carr. 1/-; 21in. x 18in. x 4in., 32/6, carr. 2/-; all shapes and sizes; s.a.e. list. B & M (Latex) Sales, 35, Station Road, Addlestone, Surrey. (Telephone: Weybridge 3311.)

"PERSPEX" for all purposes, clear or coloured dials, discs, engraving. Denny, 15, Netherwood Road, W.14. (SHE 1426, 5152.)

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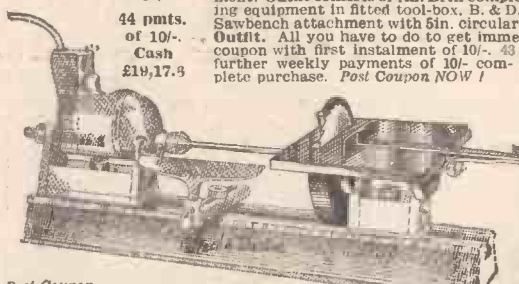

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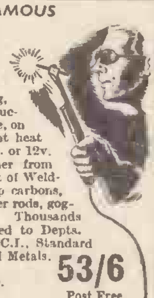

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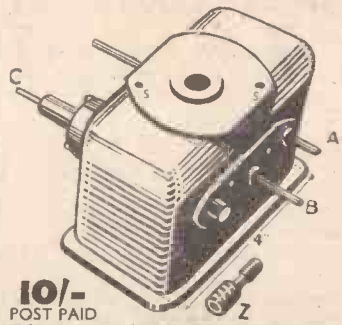

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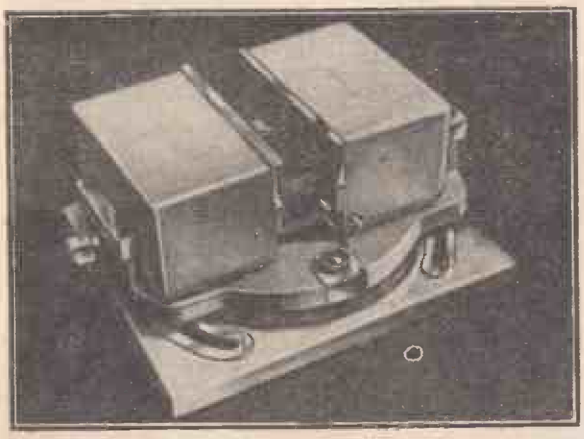


(Left).—The Dormer down grip machine vice.

(Right).—Boring a lampstand by means of the Black & Decker lathe boring attachment.

and a lever action which keeps the jaws parallel with each other and with the base at all times, in addition to exerting a downward pull as the work is gripped. The vice is mounted on a large swivel base and can be rotated through 360 deg., a scale being provided. It is available in three sizes, the width of jaws being 8in., 6in. and 4in., with opening capacities of 8in., 4in. and 2½in. respectively. Prices, with swivel base, are £38, £28 10s. and £19, and proportionately less without the base. Specially designed reversible jaw plates for gripping smooth or irregular workpieces are provided and add to the versatility of the vice. Further details are available from the designers and manufacturers, The Sheffield Twist Drill and Steel Co., Ltd., Sheffield.

Wolf Cub Tools

THESE well-known tools were on show at two recent exhibitions and practical demonstrations of the complete range were given. At the Model Engineer Exhibition a high-speed precision bench planer and bench sander were on display for the first time. At the International Handicrafts Exhibition was shown the new flexible shaft set and it is claimed that intricate grinding, drilling, sanding, engraving, polishing, cutting, etching, carving and decorative work in Perspex, plaster, wood, ivory and plastic are only some of the useful operations which can be carried out.

Wolf Cub Electric Tools, Ltd., have introduced a new easy-payment plan which is being operated by Wolf stockists and dealers throughout the country and a similar scheme is available to purchasers of Wolf industrial tools.

The Wolf bench planer in action.

The Polly-Max Developing Tank

MADE, like the already popular Polly-Min, entirely of chemical-resistant polystyrene, the Polly-Max has several important new features.

The "Polly-Max" developing tank.

In the transparent spiral flanges are two groove stops. These, when pulled out, leave the grooves clear and enable a size 116 film, a full-length 36 exposure 35mm. or 5-6ft. of 16mm. to be inserted. But by pushing the groove stops in after inserting a 20 exposure 35mm., a 127 or a 120 film, a second film of these three sizes can be loaded, the stops preventing the films from overlapping. Later an intermediate flange with grooves on both sides will be available, enabling the user to develop *four* 20 exposure 35mm. or two 36 exposure 35mm. films at once in only 21oz. of solution. (All volumes are marked on the base of the tank.)

"Second-exposure" of colour films without removal from the spiral; automatic "two-way" agitation; "Roto-Feed" easy loading; a quick positive lock to the lid; clean filling and emptying (a full tank with lid on can be emptied in 20 seconds); a stirring rod in which a thermometer can be inserted; a practice loading film and very full instructions are other points worth noticing.

The retail price of the Polly-Max is 32s. 6d. Distribution to the trade is jointly by Johnsons of Hendon, Ltd., and Neville Brown and Co., Ltd.

Black and Decker Handy Utility Tools

BLACK AND DECKER had on view at the International Handicrafts Exhibition a complete range of handy utility tools. Among the power units on view were the sander-polisher drill and the ¼in. utility drill; new accessories included a saw table attachment, a saw table stand, a lathe boring attachment and a metal sanding and sharpening plate.

The saw table attachment has been introduced for use in conjunction with the portable saw attachment which it converts into a robust saw table. It is designed to be permanently attached to a workbench and when in position lies flush with the bench top.

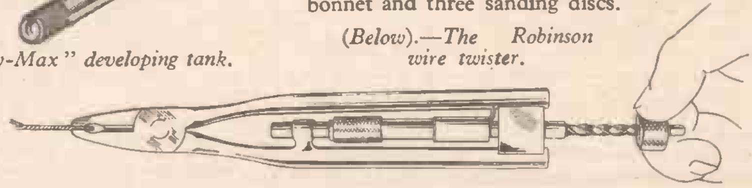
The saw table stand has been introduced so that owners of the ¼in. utility horizontal stand can use the B. and D. lathe saw table without the necessity of purchasing a lathe.

The purpose of the lathe boring attachment is to enable the home handyman to drill central holes through lampstands and pedestals in order to pass through electric lighting flex (see photograph).

The fourth new item is the metal sanding and sharpening plate, which incorporates four slots cast in the face of the plate. If a sanding disc is attached to the plate and is pierced at the slots, it is possible to see the cutting edge of a chisel or other tool through the slots when the plate is rotated at high speed. It is therefore a simple matter to sharpen a chisel to the correct cutting angle by placing it against the revolving disc, the cutting edge of the tool being visible from above during the actual operation.

The Black and Decker sander-polisher drill pack has been reduced in price from £9 10s. to £8 10s. The contents of the pack remain the same as before and consist of the basic unit, a ¼in. chuck, a rubber pad, a lambswool bonnet and three sanding discs.

(Below).—The Robinson wire twister.



The Robinson Wire Twister

THIS is an American tool, now manufactured in Great Britain by the sole concessionaires: Douglas Kane Associates, 55, Pall Mall, London, S.W.1.

The Robinson Wire Twister does any twisting operation in a fraction of the time normally required. The jaws grip the two ends of the wire. They are locked tight by simply sliding down the centre sleeve, whilst squeezing the handles slightly. By pulling on the central spindle the tool is then caused to spin, thereby twisting the wire evenly to any desired degree of twist. The jaws are then opened again by slight pressure on the handles and the ends of the wire cut off with the side-cutters incorporated in the plier head.

The whole operation takes two to three seconds and three sizes are available according to the work for which the tool is required.

The tools are priced from £4 18. 6d. for the 9in. length to £5 7s. 6d. for the 12in.

Your Queries Answered

RULES
A stamped, addressed envelope, a sixpenny, crossed postal order, and the query coupon from the current issue, which appears on the inside of back cover, must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Damp-proof Covering for Mirror Back

COULD you suggest a coating or covering for the back of a bathroom mirror? At present it is coated with a dull red substance, presumably to protect the silvering, but I am worried in case the bathroom steam will affect it in time.—C. Gaskell (Lancs).

TAKE a small tin of any wax polish. Hold it in front of a fire until it becomes very soft. Then, with a soft, flat brush, rub a layer of the polish over the back of the mirror, so as to form a substantial coating (not forgetting the mirror edges). Finally, cut to size a sheet of waxed paper and press this down on to the waxed back of the mirror. When placing the mirror in its frame, put in the frame an additional sheet of waxed paper, loose-fitting this time, and not pressed down on to the mirror back. Finish the job by securing a stiff card or plywood back to the mirror. Varnish this (both sides) with a shellac varnish, and then give the exterior side of this backing a rubbing over with wax polish. The mirror will be quite permanently damp and steam-resistant.

It should be remembered that the mirror should not actually touch the wall; small projecting brass screws should be inserted into the back of the mirror frame (one at each lower corner) so that when the mirror is suspended by cords or chains it cannot make contact with the wall. By this means a permanent air space is effected between the mirror and the wall, so that steam and dampness is not able to accumulate at the rear.

Making Transparent Lacquer

CAN you give me a formula for making a spray polish suitable for wood finishing.—O. Hicks (Glam).

A GOOD spray polish or transparent lacquer for wood finishing can be made quite simply by dissolving 15 parts (by weight) of polyvinyl acetate resin in 85 parts (by measure) of warm methylated spirit. The resulting solution may be diluted with more methylated spirit if it is too thick. This gives an excellent spraying and quick-drying liquid. Polyvinyl acetate resin can be obtained from most of our advertisers of plastic material or directly from Shawnigan, Ltd., Marlow House, Lloyd's Avenue, London, E.C.3. In regard to this latter firm, "Gelva Resin No. 7" is the most suitable material to use.

Transformer Modification

I HAVE a small transformer which gives 12 volts A.C. from the mains and with a rectifier it gives about six volts D.C.?

Would you please inform me how I should rewind it so that the output will be 12 volts D.C.?

Fortunately the output and input are on separate coils side by side, so it would be easy to rewind if I knew the gauge and amount of wire to use.—S. R. Charters (Ruislip).

IN order to obtain 12 volts from the rectifier you should rewind the secondary coil of the transformer with 160 per cent. of the present number of turns, using wire which has 63 per cent. (approximately) of the present cross-sectional area (i.e., approximately 80 per cent. of the present diameter).

As you may appreciate, the full load current (amps) at the higher voltage obtainable after the transformer has been converted will be about 63 per cent. of the present full-load current output.

Film Reversal Process

PLEASE give me details of the reversal process for 35 mm. film in order to obtain positive transparencies.—A. E. Chadderton (Nr. Doncaster).

ANY of the medium speed film material of Ilford or Kodak manufacture is capable of undergoing the reversal process quite satisfactorily.

Briefly, the process is as follows:

Develop the film in: Metol 3 grams; sodium sulphite crystals, 100 grams; hydroquinone, 6 grams; potassium bromide, 2.75 grams; ammonia (.880), 11 c.c.; water to 1,000 c.c.

Rinse the negative. Do not fix it, but bleach it in: Potassium permanganate, 2 grams; sulphuric acid conc., 10 c.c.; water, 1,000 c.c.

After the film has been for one minute in this bath white light may be turned up, and after this all further operations may be done in white light.

After bleaching in the above bath the brown stain is cleared in: Potassium metabisulphite, 25 grams; water, 1,000 c.c.

The negative is then washed for five minutes in running water. It is then exposed for four minutes at a distance of 3 to 4ft. from a 100-watt lamp. Finally, it is developed in an ordinary M.Q. developer, rinsed, fixed for two minutes, washed and dried.

Readers are asked to note that we have discontinued our electrical query service. Replies that appear in these pages from time to time are old ones and are published as being of general interest. Will readers requiring information on other subjects please be as brief as possible with their enquiries.

Spray Outfit for Limewash

I WISH to limewash two very large cellars. Using a brush is out of the question. Could you advise me how to rig up some kind of spray apparatus for this purpose?—H. Kay (Sheffield).

IF you are of the opinion that it would not be possible to do your limewashing by brush methods, the two cellars which you have to treat must be very big indeed, for it is usually estimated that a single man can whitewash the side of a house in an hour or two. We should, therefore, advise you to reconsider your decision before committing yourself to the more difficult spraying method.

Because limewash is usually heavier and thicker than paint, ordinary household paint-spraying equipment will not usually give satisfaction when dealing with limewashes, which are always coarse-particled and which, therefore, require the use of a heavy air-pressure (around 40 lb./sq. in.), and a wide nozzle aperture.

The type of equipment necessary for you would be a heavy spraying gun fitted with a wide nozzle suitable for large-particled paints, limewashes and distempers. This would require a minimum of 40 lb. pressure to drive it. You could obtain this pressure by obtaining an old aero-compressor unit (from a Government surplus stores), driven by petrol engine or electric motor. It would feed air to a special air container of copper fitted with a pressure gauge and a safety valve, designed to blow off at 60 lb. pressure. From this reservoir, air would be taken direct to the gun.

The complete equipment might cost you several pounds, even if you assembled it yourself from Government surplus material. It is, therefore, for the sake of economy that we suggest you use the old brush method of

(Continued on page 52)

limewashing, which is cheap, certain and reasonably speedy.

Cutting Glass Jars

I HAVE been given a number of 100oz. Winchester bottles, which, if cut off at the shoulder, would make excellent small aquaria and specimen jars. I have tried a file mark all round and the "burning string" method, but this was not successful. Can you suggest an alternative ?—L. Burke (Swindon).

THE "burning string" method of cutting the top off a Winchester which you describe can be quite successful, but it requires a good deal of practice. A more positive method is to make a complete diamond scratch (with a diamond cutter) right round the wall of the Winchester and then to apply the tip of a red hot iron just above the scratch. If applied rapidly at several points the upper part of the bottle will break off.

Mechanism for Windmill Sails

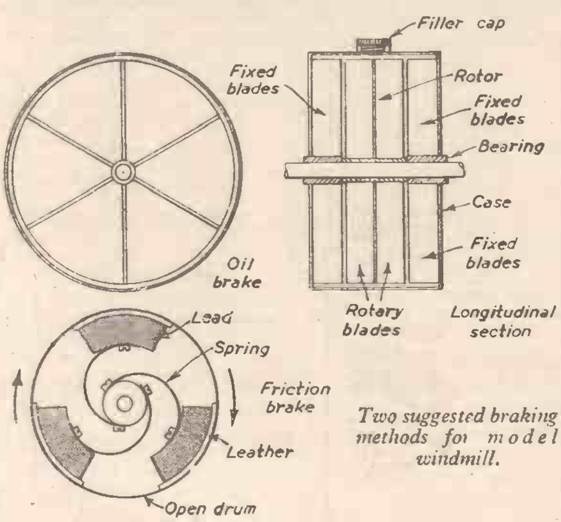
I WISH to construct a working model of a windmill in such a way that when fixed up outside, the wind, whether blowing high or low, will turn the sails in a slow and stately manner and not whirl them like an airscrew. Also, the fantail must keep the sails into the wind, as in the real thing. The assembly of sails would be 2ft. in diameter.

What is the best way to restrain the sails without friction ?

For the fantail to turn the cap of the mill I would need a pinion, a contrate wheel, two bevel gears, a worm and a circular rack for the worm to travel round, all of a pretty small size. Where could I obtain such gears ?—M. M. Dawes (Kent).

A PADDLE wheel working in heavy oil (back axle oil) would be the best form of brake. The oil should be in a circular case of as large diameter as possible and have paddles, say, six, arranged radially on each side and soldered to the case. Between these fixed blades is a rotary disc having on each side of it six revolving paddles. This disc is carried on a shaft which is connected to the shaft of the sails either by belt or by chain (see sketch).

Another kind of brake would be of the centrifugal type which consists of, say, three weights carried at the ends of springs whose inner ends are attached to the main sail shaft. These weights would be shod with leather which would rub on the inside of a cylinder and the greater the speed of the shaft the greater will be the restraining effect of the friction set up.



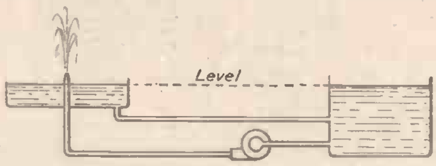
Two suggested braking methods for model windmill.

Bassett-Lowke, Ltd., stock small gear wheels, mitre wheels, pinions, etc., or you might try "Bonds o' Euston Road." The first is in Northampton, though they have a shop at 112, High Holborn, London, whilst Bonds are at Euston Road, London, N. I should be inclined to make the friction brake first of all. Let the drum be fairly large and at low speeds arrange that the weights do not, or only just, touch the drum.

A Small Garden Fountain

I WISH to construct a small fountain in my garden and have completed the pedestal and jet. I have tested it out by syphoning water from my water butt, and now wish to make a small centrifugal pump to be driven from a small motor which I have (2,600 revs. per minute). Could you tell me how such a pump works ; whether or not it has to be primed ; and how the water circuit should be arranged so that the overflow from the basin runs into a sump and pumped up through the fountain again ? —K. G. S. Lovett (Surrey).

THE centrifugal pump consists of an airtight and watertight circular case having an inlet for water near the centre and an outlet on the periphery. In this case and mounted upon a shaft, which is driven by a motor, is an impeller. This is merely a disc having radiating vanes which are cast upon it. If this type of pump is mounted above the water supply it will have to be primed. As this may be difficult or inconvenient to do, it is recommended that the pump and the motor be always below the tank or basin and the tank on a level with the water in the pool containing the jet of the fountain, as shown in the sketch.



Suggested arrangement for garden fountain.

Then to start the fountain playing all you will have to do will be to switch on the motor and the pump will commence circulating the water. The height to which the water is thrown from the jet will depend upon the power of the motor and the efficiency of the pump.

Curing Corrosion of Battery Terminals

I OWN a battery radio receiver, and would like, if possible, to find a cure for corrosion on the accumulator terminals. Even with new batteries, in a week or two the terminals have a very heavy coating and in a month even the wires corrode through. I have tried the usual Vaseline, etc., but to no avail. Can you help me ?—Wm. Hamilton (W. Lothian).

PERSISTENT corrosion of battery terminals points to some slight electrical leakage between the terminals. If you could clean the terminals up and then remount them, paying particular attention to their effective insulation, we do not think you would experience further trouble in this direction.

If the corrosion persists, coat the terminals and their bases with a polyvinyl acetate varnish, made by dissolving 25 parts of polyvinyl acetate (obtained from any of our advertisers of plastics) in 75 parts of warm methylated spirit. This will give a clear, syrupy solution of high electrical resistance.

Cementing a Broken Clarinet

I HAVE an ebonite clarinet which has broken across and I have tried several types of adhesive, all of which were unsuccessful.

Please can you suggest a commercial adhesive, or any formula which I could prepare myself capable of repairing the instrument.—Ray Scobie (Troon).

THE entire success of the cementing up of your broken clarinet depends entirely upon the type of fracture. If the instrument has been broken cleanly across, the fracture will be most difficult to mend, in which case some type of binding will be necessary.

For the actual cement we suggest any type of cellulose cement, a cement made by dissolving scrap Perspex in trichlorethylene or the proprietary cement based on polyvinyl chloride and known as "Portex Universal Cement," which is prepared by Portland Plastics, Ltd., Wear Bay Road, Folkestone, Kent.

Information Sought

Readers are invited to supply the required information to answer the following queries :

Building a Rotary Hoe

I WISH to build a rotary hoe, using a Villiers Mark VIc, two-stroke (147 c.c.) engine complete with two-speed gear box. Would you answer the following ?

I have seen one type of rotary hoe where the carrying wheels are *not* driven by the engine. The revolving hoe blades were at the front of the machine and *seemed* to assist the operator in moving it forward. Is this a satisfactory principle, as all other types (mostly with the blades at the rear) have the wheels engine driven ? Do the rotating blades tend to push or pull the machine forward, or do they tend to act as a brake when digging ? If there is but little advantage in driving the wheels I could save a lot of work and calculation in gearing down, quite apart from the fact that the engine will have less to do if driving the blades only.

I shall be using chain drives.

I have some old pit saws made of steel about 1/8in. thick. Will this material be suitable for making the revolving hoe blades ?—A. O. Whitfield (Lincs).

Grinding a Telescope Mirror

I AM contemplating building a machine to grind a telescope mirror and should be very happy if you could enlighten me in the design of such a machine as I believe they are not complicated in construction.—T. L. Mansell (Worcs).

Frogman Suit

I AM making a dry immersion suit similar to the frogman's "Sladen" suit, to use with the Practical Mechanic's Aqua-lung.

It is made of stockingette with wrist and ankle seals of rubber. Can you tell me a suitable method of rubberising the suit ? I have tried rubber solution without success.

I also require a suitable design of neck seal which, whilst being tight enough to be waterproof, will not strangle me ! It has to stretch far enough to allow my head to go through.—K. G. Paull (Bedford).

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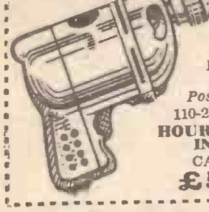

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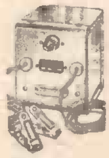

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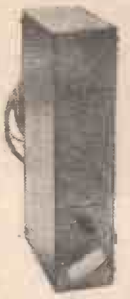

Any T.V. receiver which will receive Alexandra Palace will also receive the commercial programmes by the simple addition of our converter. No mods. to the T.V.—simply plug in the aerial leads and connect to the mains. Converter is in neat stove enamelled case with provision for fixing to the side or back of the T.V. Price £7.10.0 or £2.10.0 deposit and six payments of £1. **BUILD YOUR OWN CONVERTER.** If you build the converter yourself you can save up to £2.0.0. We will supply all the components including stove enamelled case, valves and even transfer for decoration and indentification for £5.5.0. Data is included free with the parts or available separately price 1/6.

KIT FOR WIRELESS WORLD CONVERTER also available. Price 42/6 plus 2/6 postage. Data available separately 1/6.

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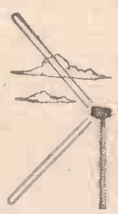

Known as the Folded 'V' this is probably the most efficient aerial for its size that it is possible to obtain. It is directional, signal strengthening, and noise reducing. Complete kit including alloy elements, neat plastic centre piece, Polythene insulators, and fixing bracket. Mounts anywhere, in loft, on window frame, drain-pipe, etc. Price 8/6 plus 1/6 post. Constructional data free with parts or separately price 1/-.

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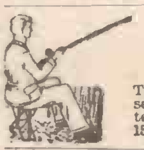

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Parts suitable for making a multimeter to measure A.C. volts as well as D.C. volts, milli-amps and ohms. Price for kit containing all the essential items including moving-coil meter, metal rectifier, resistors, range selector, calibrated scale, etc., etc., is 19/6, plus 1/- post and packing. The D.C. only version is 15/-, plus 9d. post and packing.

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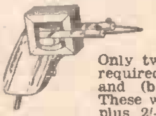

A 7-second solder gun of the type costing £3-£4 was described in last month's issue. Only two essential parts are required—(a) the transformer and (b) the push switch. These we can supply at 13/6, plus 2/- post. The rest of the parts you will have in your own "junk" box. Copy of the copy article concerned given free with the kit.

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uses a 3-valve circuit with high-efficiency coils—covers long and medium wave bands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £3/19/6 plus 2/- post. Constructional data free with the parts, or available separately 1/6.

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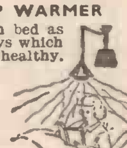

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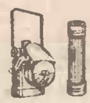

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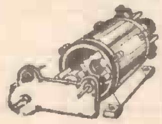

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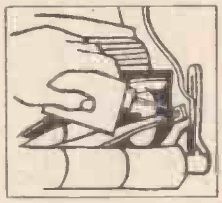

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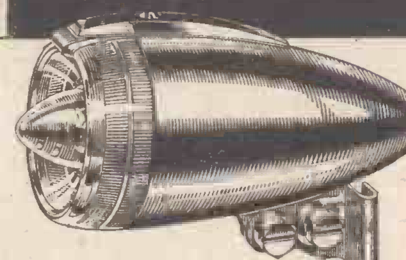

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Ex-R.A.F. 2-valve (2-volt) Microphone Amplifiers as used in plane intercom., in self-contained metal case; can be used to make up a deaf-aid outfit, intercommunication system, or with crystal set; complete with valves and fitting instructions, 20/-, post 2/-. Useful wooden box with partitions to hold amplifier, 2/- extra. Ditto, less valves, 10/-.

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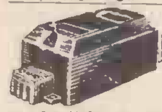
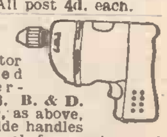


Bell Transformers. These guaranteed transformers work from any A.C. Mains, giving 3, 5, or 8 volts output at 1 amp., operate bulb, buzzer or bell. Will supply light in bedroom or larder, etc. PRICE 9/-, post 8d. **Similar Transformer** but with output of 4, 8 or 12 volts, 12/6, post 10d. **Transformer** with similar output, but with fused secondary and earth terminal, 18/-, post 1/-. **BELLS** for use with either the above or batteries, 6/6, post 6d. **"Big Ben" Chimes.** Housed in Cream Plastic Case. Easily connected to give Two-Note Chime from Front Door, and Single Note from Rear. Operated from 6-9 volt Batteries or Transformer (shown above), 21/2, post 1/-.

Crystal Sets. Our latest Model is a real radio receiver, which is fitted with a permanent crystal detector. Why not have a set in your own room? 12/6, post 8d. Spare Permanent Detectors, 2/- each. When ordered separately, 2/6. With clips and screws, 2/10, post 3d. Headphones, brand new, S. G. Brown, G.E.C., etc., 23/-, and super-sensitive, 30/- a pair, post 1/-.

Headphones in Good Order, 6/-. Better quality, 7/6 and 10/-. Balanced armature type (very sensitive), 13/6. All post 1/-. **New Single Earpieces,** 3/6. Balanced armature type, 4/6 (two of these will make an intercom. set). Ex R.A.F. earpiece, 2/6, all post 4d. **Headphones** with moving coil mike, 15/-. Similar phones with throat mikes, 12/6, post 1/-. **Headphone Cords,** 1/3 a pair, post 3d. **Replacement Bands,** 1/3, post 4d. **Wire Bands** 6d. **(All Headphones listed are suitable for use with our Crystal Sets.)**

Hand Microphones, with switch in handle and lead, 5/6. **Tannoy,** 7/-. Similar instrument, moving coil, 8/6. All post 1/-. **Mask** type with switch, 3/6, post 4d. **Mike Buttons** (carbon), 2/-. **Moving Coil,** 4/6; **Transformers,** 5/-. All post 4d. each.



Black & Decker ¼in. Drill (as illustrated). Universal A.C. or D.C. motor fully suppressed against interference, £5.19.6, post 2/6. **B. & D. 5in. Sander Polisher,** as above, but the addition of side handles makes it an ideal tool for waxing and polishing cars, furniture and floors, sanding to remove paint or rust, etc., £8.7.6, post 2/6, or complete with sander and polishing kit, which includes ¼in. chuck for drilling, lambswool bonnet and pads, polishing and sanding discs, £9.17.6, post 2/6. **B. & D. Lathe** for use with either of the above, £5.5.0, post 2/6. **B. & D. Bench Stand,** for use with either drill or sander, £3.7.6, post 2/6.

Morse Keys.—Standard size keys wired to work Buzzer or Lamp, 3/-, post 6d. Slightly smaller keys, 2/6, post 4d. **BUZZERS,** 3/9, or heavy duty, 4/6, post 5d.

Terminals, brass 2BA, mounted on strip, 6d. pair. .0005 Airspaced **Variable Condensers,** 2/6, post 4d. .00003 twin gang with trimmers, 2/6, post 4d. 24 volt, 15 mm., **M.E.S. Bulbs** for model railways, etc., 1/- each, 10/- doz., post 4d. **Wander Plugs,** Brass, 1/6 doz., post 4d. **Fuses.**—1 amp., 1¼in., packet of 10, 2/6, post 3d. Also 150 mA. and 250 mA., same price. Ex-G.P.O. Telephone **Twin Bells,** with box, 5/-, post 1/-. **Single Telephone Bell,** 3/6, post 6d.

Bargain Parcels, of really useful equipment, containing Switches, Meters, Condensers, Resistances, Phones, etc., 10/-, or double assortment, 17/6; treble 25/-. All carriage 2/3. This country only.

Meters, 20 amp. 2½in. m/i, 12/6. 15 v., 2½in. m/c., 9/6; 150 v., 2in., m/c., 10/-; 3.5 amp. 2in., T.C., 6/-; 4 amp., 2½in. T.C., in case with switch, 9/6; 100 mA 2in., m/c., 7/6; Meter Units containing 2-500 microamp. movements, 7/-, post 1/-.

Money refunded if not completely satisfied.

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THE
Cyclist
Editor : F. J. CAMM

VOL. XXIV OCTOBER, 1955 No. 401

All letters should be addressed to the Editor, "THE CYCLIST," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2

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WHAT I THINK By F. J. C.

Causes of Accidents

As we go to press, the latest chapter in the story of road accidents has come to hand from the Ministry of Transport, and they relate to June and July. They make an interesting study for the report shows that casualties for July totalled 27,180—over 3,700 more than in the same month last year. Deaths numbered 456, an increase of 30 and serious injuries 6,219, an increase of 713. Slight injuries increased by 2,990 to 20,505.

The final total for June was 24,297. This was 2,970 more than in June last year, and included 455 deaths, an increase of 86, and 5,336 serious injuries, an increase of 193.

These figures show that casualties are continuing to grow with the volume of traffic. In July the number of motor vehicles registered for the first time reached the record total for any month of nearly 90,000 and the latest total for all motor vehicles, new and old, is 5,930,000 or 538,000 more than a year ago.

In the first six months of this year there were 115,053 casualties to road users compared with 102,220 in the first half of 1954. The chief increases were: motor cyclists and passengers, total casualties 24,807, an increase of 3,851 or 18½ per cent. ; occupants of other motor vehicles, 38,848, total casualties an increase of 6,476, or 20 per cent. ; and child cyclists, 5,341 total casualties, an increase of 716, or 15½ per cent.

Fatalities to children, on foot or on wheel, increased in the first half of the year by about a fifth. This is a major change in the pattern ; casualty figures for children have for many years shown a downward trend.

Accident causes reported by the police in the first six months show little change, but the proportion of accidents caused by drivers or pedal cyclists turning right or crossing at a road junction without taking proper care has increased. One quarter of the accidents attributed to drivers were caused by one or other of these faults. For pedal cyclists the proportion was also one quarter.

Crossing the road or stepping off the footpath without due care was the main fault of pedestrians, contributing to nearly 20,000 casualties. Comparatively few serious accidents to pedestrians happened on zebra crossings. For example, in June, accidents on crossings accounted for 43 out of a total of 1,320 pedestrians killed or seriously injured ; of these five were fatal.

These statistics indicate very clearly that all of the methods introduced in the name of road safety have failed. Pedestrian crossings, one-way streets, the driving test, the Highway Code, thousands of prosecutions, speed limits, poster campaigns, road safety weeks, flashing signs, courtesy cops, radio lectures, lectures to scholars on road safety, traffic lights, overbridges, subways and railed-off pavements, it would seem that almost everything has been tried except to instil into people that self-preservation is the first law of Nature, and that people cannot be made good road users by Act of Parliament. We are certain that if traffic could be kept free flowing and not obstructed every few yards by traffic lights and other obstructive devices, accidents would be reduced. Speed has little to do with accidents, for most occur where traffic is slowest. The answer, of course, is more and better roads, but the State steadily refuses to supply them. It has had the money in abundance, but does not consider that the saving of human life should take priority over other forms of state expenditure.

The loss of thousands of lives each year is a loss which no country can afford, nor can it afford the greater number of accidents not involving loss of life. It is creating a severe problem for hospitals, interferes with production and revenue. If a road plan were devised today to accommodate the ever-growing volume of traffic, it would not be completed in ten years. So it is obvious that we must grow accustomed to reading these deplorable records.

A Condominium

An analysis of the affairs of the cycling bodies shows that all of them cannot survive. It has been suggested many times that at least two of them should amalgamate and the difficulty has always been as to which body should absorb the other, with corresponding loss of identity. Personalities have entered into the matter. There have been those who for vainglorious reasons wish to retain the power they have wielded for so long—those who have come to regard themselves as the proprietors of the sport, and like to be regarded as "cycling legislators." But times have changed. Finance alone will force an issue within the next few years, and if the matter is not grappled with now, one or more of the bodies will go out of existence anyway. We have never liked the title of the National Cyclists' Union which smacks too much of politics. We can see no reason for the existence of the National Clarion Cycling Club with its comparatively small membership posing as a national body, nor can we see the need for a separate body to control cycling in Scotland. We see no reason why four bodies should control track and road sport. One body alone should be sufficient. A condominium of those four bodies, suitably departmentalised, would provide a more efficient and economical control, since the funds now distributed amongst four bodies would be administered by only one. This would enable a fully qualified and efficient secretary and staff to be employed full time.

As far as the touring side is concerned, the need for a national body has passed. It has outlived its period of usefulness and has now largely become a political body. By no stretch of the imagination can it claim to speak on behalf of 10,000,000 cyclists. The time is ripe, therefore, to re-examine the question of amalgamation. One body can speak with a stronger voice than several. In the past the various bodies have expressed opposing points of view.

The Late Rear Admiral E. O. Hefford

It is with regret that we record the passing of engineer Rear Admiral E. O. Hefford, who was a vice-president of the C.T.C. and past chairman of the Council. He became president in 1948 and for the most signal service to the club he was awarded the Sir Alfred Bird Memorial Prize in 1941. He had been a member of the C.T.C. for nearly 60 years, had represented the club in international affairs, and was a member of the North Road Cycling Club.

We had many interviews with Rear Admiral Hefford and when he first began to take an interest in the mangagement of the club, he told us of his plans and of his unhappiness with the internecine conflict which was going on at that time.

How to FORM and RUN a CLUB

The Author of this Short Series has had Lengthy Experience of Club Life, and has Held Many Offices

(Continued from page 68 in the September issue)

THE president is purely ornamental! When present, he automatically takes the chair at meetings. When he is not present the chair should be taken by the senior vice-president or the captain.

A vice-presidency is an honour generally bestowed upon a man who has done good work for the club, or on some prominent local personage who has been, or it is hoped will be, useful to the club. V.Ps. pay no fixed subscription, but donations from them are welcome.

The hon. general secretary is the pivot round whom the club revolves. He conducts all club correspondence and keeps " minutes " of all meetings. He must get out a report on the past year's working, incorporating reports from the various departmental secretaries, and present same to the Annual General Meeting. The Hon. Sec. sends out notices convening all committee and general meetings. To make a success of his job he must be ready to take on any duty which comes along and for which a volunteer cannot be found.

The Hon. Treasurer collects subscriptions and donations and gives receipts; he produces a rough balance sheet showing the financial position of the club at each committee meeting, and a complete and duly audited balance sheet at the A.G.M. All accounts due for payment are settled by the treasurer, to whom the other departmental " managers " refer their items.

The road racing secretary accepts entries—with fees—for all competitive road events; arranges for a timekeeper, marshals, officials at the turn, etc. He arranges the course to be used, with the approval of the R.T.T.C., of course, and, like the social secretary, must periodically hand to the treasurer any money which comes to him in the course of his duties.

The social secretary organises dances, concerts, whist drives and other events of a social nature. It is usual to allow the social secretary a " float " of a couple of pounds or so to meet his current expenses; he will account for this to the treasurer and pay to him any profits from social fixtures.

The Captain's Responsibility

The captain takes full charge on all club runs and when members are gathered in the club room. He draws up a list of runs, and brings same before the committee for approval. He orders lunch and tea at the various catering houses which the club visits; pays bills for meals, and collects each person's share from those who participate. The captain generally sets the pace for club runs, as in these days when nearly every club has a racing section, runs are apt to degenerate into fast training spins. In such cases the captain should depute the sub-captain to remain with stragglers, and generally see that all sections enjoy themselves. If the captain is a racing man the sub-captain should most certainly *not* be one.

At the start of an early-season club timetrial

It is of vital importance that the captain and sub-captain should welcome new members and make them feel at home, and I personally regard this as a very important part of the captain's duties. Once upon a time we had a rule " no members may pass the captain on a run," but this has passed into oblivion with the ancient regulations regarding club uniforms, riding in solemn procession two by two, and obeying the captain's orders as conveyed to the members by the bugler.

Most clubs have a publicity secretary whose duty it is to send reports of the club's activities to the local papers. If he hopes to get these accepted he should make them short and snappy; each paper should receive a different report (circular reports go straight to W.P.B.), and the information should be sufficiently interesting to merit insertion as an item of news. Such reports as " sixteen members rode to . . . on Sunday and enjoyed a good tea at Mrs. . . . " are useless to news editors.

Procedure at Committee and General Meetings

First and foremost, make every effort to start business reasonably near the hour stated on the notice calling the meeting! The chairman *must* keep order, and see that speakers are not interrupted. No member should be allowed to speak more than once on a proposal, except the proposer, who has a right to reply to the arguments before the motion is voted upon. Once he has replied, discussion must cease and the motion be put to the vote.

The chairman may accept an amendment to a proposition: this must be proposed and seconded, and after discussion is put to the meeting and voted upon. While it is an amendment, it may not, in its turn, be subject to amendment, but if it is carried, it must then be again put to the vote as a substantive proposition, and in this form it is subject to amendment, as is any other proposition.

Some clubs insist that alterations to rules must be carried by a two-thirds majority of those present and voting; but in most cases a bare majority suffices to make the alteration legal and binding.

It is a safe rule to decree that vice-presidents may attend and speak at all meetings, but may not vote unless they pay an active member's subscription. Many of my readers will disagree with me on this point, but I have found it a valuable safeguard against the possibility of a few vice-presidents, who are not active modern riders, outvoting an elected committee composed of active members.

The Chairman

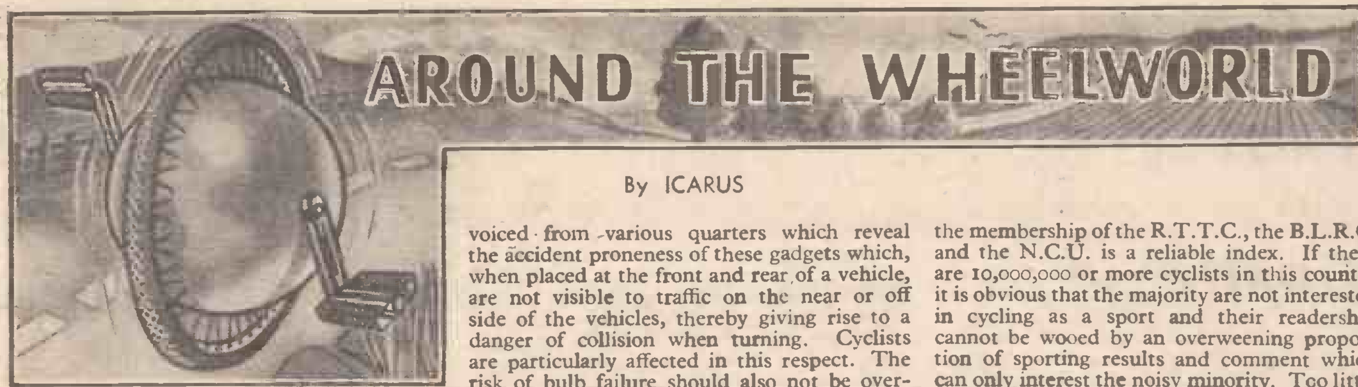
It is to be presumed that the chairman will not have qualified for his exalted position without having served an apprenticeship; his experience will enable him to guide a meeting without actually dictating its policy. He must be firm on matters of procedure and not afraid of ruling a speaker " out of order " if he is infringing the rules of debate. For instance, he should point out the great difference between " instructing " an official or a sub-committee to adopt a certain definite course, and " requesting " the same action. I have always found it best (when one is dealing with efficient officials) to leave as much as possible to the discretion of the individual. A little unhampered responsibility puts him on his mettle, and urges him to do his best.

But there is a serious technical difference between requesting and instructing. I recall an instance in which a General Meeting gave definite instructions to a committee to hold the club dinner at a certain restaurant. The selected venue was burnt down and the committee had to call a Special General Meeting to get their instructions altered. This is an extreme case, but it serves to illustrate my meaning.

Some clubs have a rule which compels a member to attend a certain number of club runs before he is eligible to take a prize which he has won in a race.

I have included this stipulation in the set of model rules which will appear in next month's article, but I disagree with it. The reason for its adoption is to prevent " pot-hunters " joining a club, taking prizes for racing, and displaying no interest in the club's other activities. I would prefer that they were not elected to membership.

(To be continued)



AROUND THE WHEELWORLD

By ICARUS

The Bath Road 100

THE Bath Road 100 provided some surprises this year in that there were 77 finishers with times under 4 hours 45 minutes. Indeed, 71 of them were inside 4 hours 40 minutes. We must not forget, however, that Frank Southall beat 4.40 many years ago, in 1927 to be exact, and that at the time it was thought that this time would not be beaten for many years. The Bath Road 100 has published a full list of the times and I gave them last month. There must, of course, be one time for this course which will put the course record on the shelf for all time. Many of Harry Green's records, like those of Southall, stood impregnable and unassailed for many years, but gradually they fell. What would Green's and Southall's times have been had the roads been in the condition they are to-day and organisation as perfect as it is to-day? Machines have got lighter and faster. If Southall to-day could retrieve his form of 1927 he would be putting up some most spectacular times.

St. Clement.
the little church dating from the 13th cent in this quiet Cornish village.

Winking Lights

FOR once I find myself in agreement with the National Cyclists' Union; they want winking lights on cars abolished and I also would like to see this American idea abolished on English cars. In America, to sell motor cars the manufacturers have to resort each year to the introduction of some almost useless gadgets or some piece of ornamental ironmongery. Trafficators, winking lights and all other devices for signalling the intention of the driver do not absolve him from his responsibility to give proper hand signals. This is another way of saying that mechanical devices for signalling are not infallible. Trafficators are particularly temperamental. They are fixed in a position where rain and grit can enter, as they are recessed into a pocket in the door pillar. A driver might operate the switch and be oblivious of the fact that the trafficator has not emerged from its recess. The hand signal is still the best method. In any case, there seems to be no standard practice about the fitting of these electrical gadgets. The text of the N.C.U. letter to the Ministry of Transport is: "We respectfully draw your attention to the increasing danger to all road-users arising from the use of winking lights as trafficators, which are allowed to be fitted in various positions on motor vehicles. You will be aware of many individual points already voiced from various quarters which reveal the accident proneness of these gadgets which, when placed at the front and rear of a vehicle, are not visible to traffic on the near or off side of the vehicles, thereby giving rise to a danger of collision when turning. Cyclists are particularly affected in this respect. The risk of bulb failure should also not be overlooked. We would urge that powers be sought immediately for the complete abolition of all winking lights on vehicles."

Regarding bulb failure, however, the N.C.U. must have overlooked the fact that the driver would be immediately aware of this since the winking mechanism is quite audible from the driving seat. Cyclists, however, do not often give hand signals and often turn to the right without warning.

The Tricycle

I FOLLOWED behind a sedate old gentleman poised on the perch of an antiquated tricycle along the Bath Road the other day. The machine was evidently geared to suit his age for he was pedalling fast at eight miles an hour. I have never been able to understand the fascination which the tricycle has for some youngsters; although I can understand why some of the older men still love to live in the past and remain loyal to their first love. Mechanically the tricycle has everything against it. It is a difficult machine to ride, it is uncomfortable because it has three tracks instead of one, it is heavier and harder to propel and, of course, more costly to buy. It was produced in the first instance for snob appeal. Whilst the *hoi polloi* used bicycles it was *de rigueur* for those who could afford it to advertise their superior social position by riding on one of these mechanical monstrosities. Of course, when you are getting on in years it must be comforting to know that you are on a vehicle from which you cannot easily fall. Within 20 years, in my view, tricycle manufacture will cease.

Too Much Sport?

A PERUSAL of cycling periodicals might lead a newcomer to the belief that the only aspect of cycling which counted was sport. Yet those interested in sport in this country cannot total more than 50,000 if the membership of the R.T.T.C., the B.L.R.C. and the N.C.U. is a reliable index. If there are 10,000,000 or more cyclists in this country it is obvious that the majority are not interested in cycling as a sport and their readership cannot be wooed by an overweening proportion of sporting results and comment which can only interest the noisy minority. Too little attention is given to the other aspects of cycling and too little to attracting new cyclists into the fold. My colleague, Frank Urry, has done more than any other cycling journalist to draw attention to the pastime of cycling as distinct from the sport. For over 50 years his pen has drawn pictures of the delights of pedalling and he has given precious little attention to sport. It is unfortunate also that daily newspapers which run a cycling feature concentrate too much on sporting results.

Hinged-head Handlamp

THE Ever Ready Co. (Great Britain), Ltd., have recently introduced their No. 5196 hinged-head handlamp. This is of contemporary design in brilliant red enamel with chromium fittings.

The head, 4¾in. in diameter with chromium plated lens ring, is hinged to the body. This is designed in two halves joined by a hinge and locked in position by means of a spring clip. The handle is chromium plated and a hole is provided to enable the lamp to be hung on a nail if desired.

The switch, built into the handle, has a positive slide action marked off/on. The lamp is of robust construction in steel and provides for a 360 degree light projection. This is achieved because the hinged head can move through an arc of 140 degrees; the lamp can be used on its base, its end, or on either side;

The Ever Ready hinged-head handlamp.

the nail hole in the handle allows the lamp to be hung.

The price is £1 14s. 10d. plus 3s. 6d. for Ever Ready battery No. 996, making a total cost of £1 18s. 4d.

Wayside Thoughts

By F. J. URRY, M.B.E.

The Happy Miles

DURING the summer some friends of mine persuaded me to visit Northumbria in their company to explore the area for a week. We travelled by car, but for once I enjoyed the few days idleness this brought. We made our headquarters in Bamburgh, a sleepy unspoiled village by the sea, and did our exploring in day trips.

It was good to be alive and in the company of appreciative people, people who until then had no conception Northumbria was so beautiful, for they had always linked it with industry and coal, and perhaps the Roman Wall. One lovely morning of flashing sun and purple cloud shadows we drifted to Otterburn, where the girls of the party invaded the tweed mill to the extent of delaying lunch, until I felt only this northern air was left to chew. Eventually we did get away, and high up Redesdale found the perfect picnic spot, and so contentment overtook me. We passed over Carter Bar and low down on the Scots side turned right to wander those lovely lanes creeping along the foothills, perfect of surface except when we crossed the cattle grids, with the hills running to the Border ridge on our flank and ahead to the left the sleeping, flatter lands rich with produce to be. The only divergence from our quiet drift was, at request, to cross the Tweed at Coldstream. The river was running low and it was strange to us, who had come from the damp fields of the Midlands, to find this district needed rain. And so we more or less followed the river to Berwick to see the swans and the ancient, oft-disputed burgh, the fine bridge, and to swallow a needed and welcome cup of tea. Then home, twenty miles in a trifle over half an hour, and for the first time that day we saw some touring cyclists and a little car traffic. The value of a powered vehicle is having seen the places of desire at leisure and, with time to spare, you can run back on your tracks without the need to seek accommodation. Ah ! but I'd rather go on ; it is the going back I do not like, for force of habit during six decades of cycling dies hard, and my hope is still to awaken the morrow morning to a new scene and another experience.

Aldbourne, Wiltshire.

A lovely village of old stone cottages and inns. (Newbury Swindon road)

Old Memories

WHEN you tell folk you have been holidaying a short space in Northumbria they frequently raise their eyebrows and wonder why. But I tell you this land north-west of Newcastle is a lovely one and largely a lonely one if you eschew the main roads. I love the little narrow ways winding over the moors and among the Border hills, and the great visions they frame in blue distance and mystery. We drifted all one day for less than a hundred miles, and brushed up history by a visit to Flodden Field and its simple monument " to the brave of both nations," saw the denuded herd of wild cattle on Chillingham Chase that suffered reduction in the winter of '47 and is now slowly building up again, and in the afternoon crept up the defile to Langleeford under the Cheviot, a valley as lovely and remote as any I know. Years ago I came here by bicycle, and essayed to climb the mountain, but hunger sent me back to the iron rations in my bag after an hour's hard heather walking. But I saw a glorious butting match between two hefty rams and stayed to watch the battering contest in a mood of sheer belligerency, and lower down the slope had the satisfaction—to me—of putting up a small covey of black game whose sudden flight startled me. Except for my companion, not a soul did we see on our three hours of worship in Langleeford, and the experience of those long-gone days was almost repeated on this occasion ; but now we had a primus and the resulting cup of tea was as nectar drunk to the Gods of the Borderland. That was a good day, warm, unhurried, spent amid the green-grey hills under a painted sky, and nearly always within the sound of running water.

Is it Declining ?

ALL the while I was on the road I was on the look-out for my friends the touring cyclists. Maybe it was a little early in the year to see them scattered thickly on the ground, but I must confess to a sense of disappointment, almost of dismay, to see so few, and even those few always on the highway. Is this gentle art of cycle-touring losing its appeal to the young generation ? I hope not, yet from the cursory prowling of so delectable a section of the land it would almost seem the call of that type of holiday adventure is less virile than it once was. Here is a beautiful area, yet there were fewer touring cyclists than I had ever seen at the end of June in any previous year. The conviction that the game is declining has been with me for years, but never have I felt it more strongly than on this occasion. Maybe because I am no longer physically capable of undertaking the long journey awheel, the old desire to so occupy my holiday time has given me a keener sense of expectation that other people have realised how good this game is, and, in looking for its hopeful spread, I find but a sprinkling of the spirit that still moves me to a mental appreciation which I am unable to implement as of old. And even the too few I saw were hurrying along the crowded highways, and none of them was seen over the moors or on the secondaries where beauty reigns and quietude and the peace that the big ways have lost for ever. It made me a little sad that the glorious hours of my own touring adventures are only partly inherited by the younger people, and I thought of how much they were missing. It would seem we need a cycle-touring crusade to teach the young generation how to enjoy a holiday of exploratory adventure away from the madding crowd, the humming machinery and the raucous circus of humanity, and by so doing regain a measure of personal values.

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