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EDITOR: F. J. CAMM

MAY 1954

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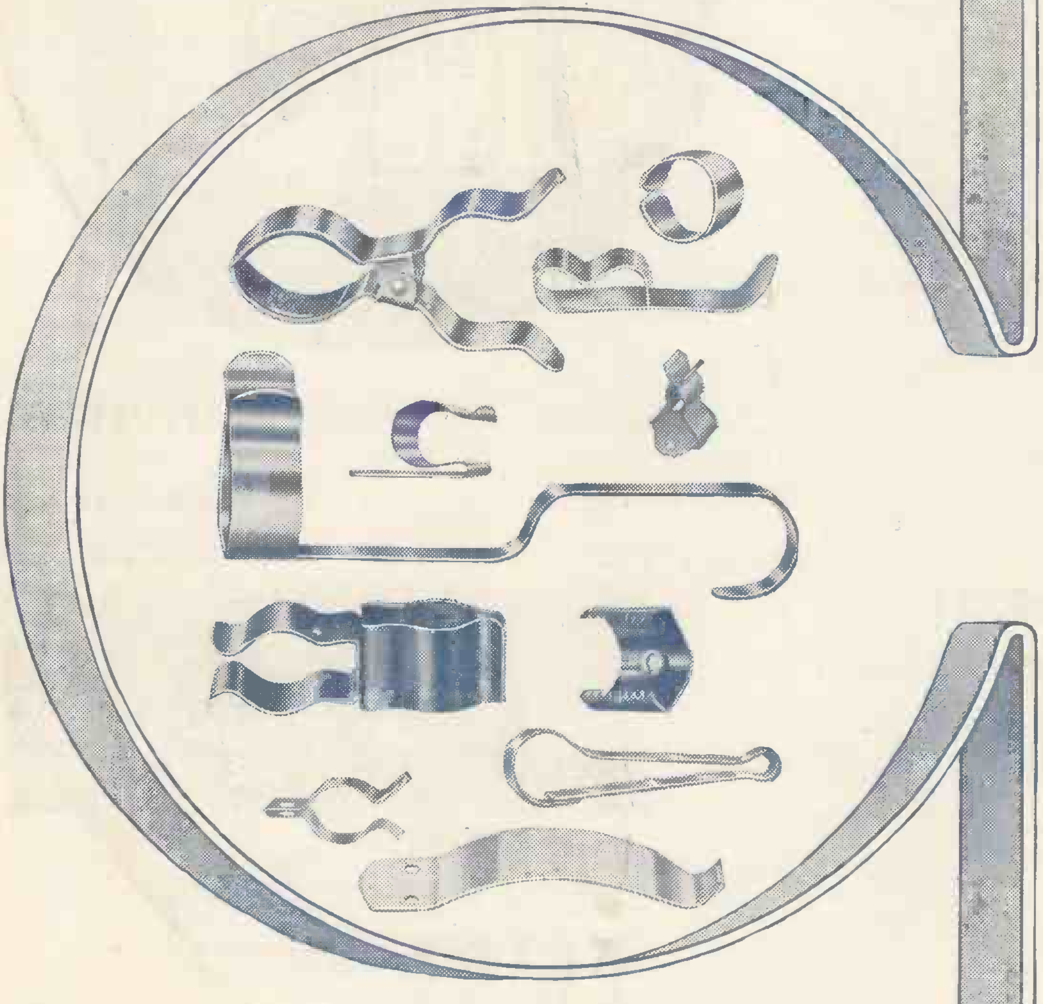

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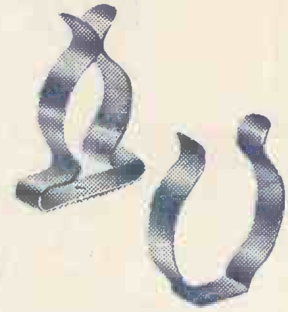

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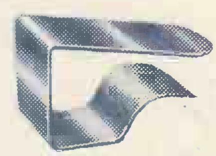

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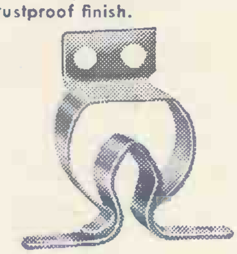

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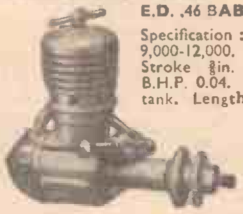

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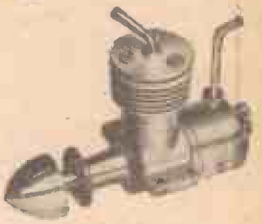

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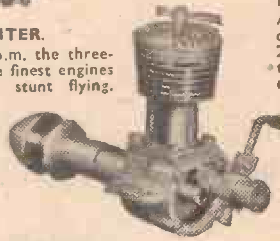

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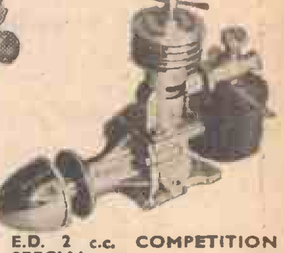

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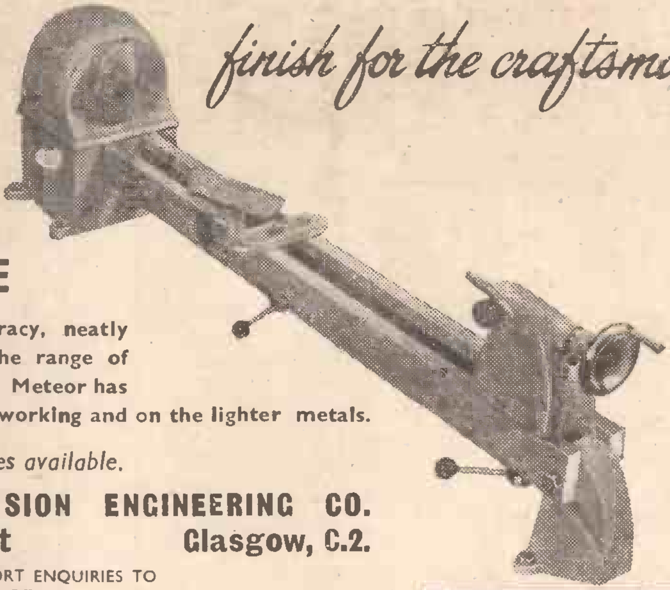

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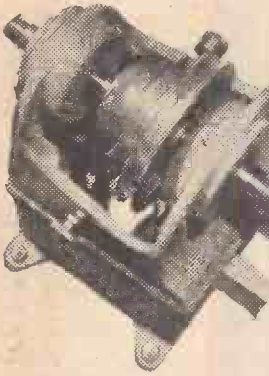

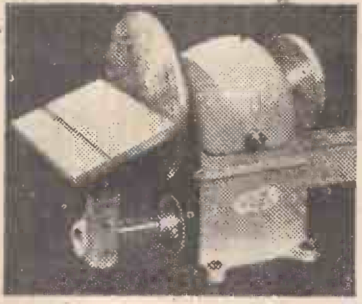

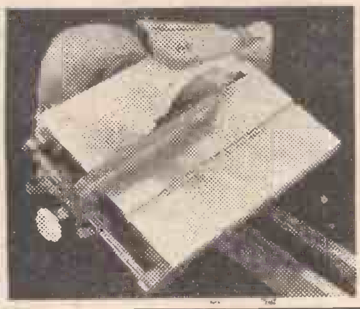

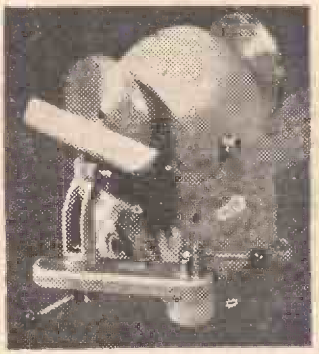

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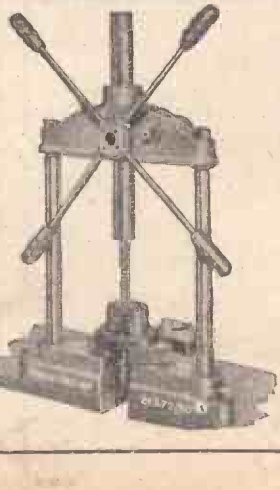

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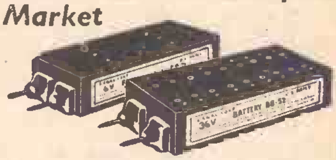

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PRACTICAL MECHANICS

EDITOR F. J. CAMM

The "Cyclist," and "Home Movies" are temporarily incorporated.

FAIR COMMENT By The Editor

Fibreglass Car Bodies

IT is likely that within the next few years car bodies will be made of fibreglass instead of steel. An American company pioneered this system in 1952, but the materials are now available over here and most large car manufacturing firms are experimenting with it. Quite apart from the steel shortage, steel is not an ideal material for car bodies. It is expensive to work and to join and certainly costly to shape and repair. The modern tendency to produce one-piece bodies with integral wings makes the cost of repairing them at least 200 per cent. higher than with bodies fitted with separate wings. With integral bodies the damaged wing must be removed with a flame cutter and the new wing welded on, necessitating the removal of the upholstery and the respraying of a much larger area than would be necessary were it possible to remove the wings. I am dealing here with a case where a compound fracture of the wing has occurred, and it is impossible or uneconomic to beat it out. In the ultimate insurance companies will be bound to increase their insurance premiums. The first laminated body weighed 185 lb. at a cost of £220. It is, of course, impervious to rust and corrosion and neither heat nor pressure is required to mould it. It does not suffer from body drum as does steel and if the material is fractured in an accident it is easily repaired. A crack 1ft. in length was repaired at a cost of 4s. Two such bodies were shown at the British Plastics Exhibition last year. They were made from a plaster of paris form over which were laid layers of fibreglass with resin in between. The material was then moulded by hand into the shape desired. A new resin for laminating the strips of fibreglass makes the material harder than steel.

A new method of laminating sheet steel and aluminium with plastic sheets has also been evolved in America. It is claimed that the result has the structural strength of steel with the corrosion resistance and bright colours of vinyl plastic.

It has for long been realised that steel car bodies are unsatisfactory not only because of the weight and the cost of making and repairing, but because no one has yet discovered a satisfactory means of rust-proofing them.

Push-button Telephone

THE automatic telephone is an awkward instrument to operate, and the process of dialling a number is unnecessarily lengthy. The Bell Telephone Laboratories are, therefore, developing a push-button dial system. It is much speedier and subscribers in a test area where it had been tried accept it in preference to the older method. Experiments on the same lines have been going on in Sweden.

Synthetic Mica

MICA is very widely used in electronics and particularly for television camera tubes and valves. Natural mica, however, is in very short supply so a plastic company has produced a synthetic mica which it is claimed gives sharper TV pictures. It is used for making large synthetic crystals, much larger than natural crystals. Large-scale production of this new synthetic material will shortly begin in the U.S.

Purchase Tax and the Home Worker

THERE are many thousands of people in this country who augment their income by making toys, jewellery, turned wooden objects and similar articles at home. Many of them make their hobby in this way a profitable sideline, but how many realise that they may be breaking the law? A large variety of objects to-day are subject to purchase tax, and whilst it is true that in a few cases the maker does not have to register especially if his output is a small one, there are many cases where registration is compulsory. Amateur-made jewellery is a case in point. Until recently this did not attract purchase tax, but under a recent order it now does. The Government has decided that as from April 1st last a 50 per cent. tax must be paid on jewellery components. This applies to brooch mountings stamped to take stones, pendant stampings, ornamental chain, ear clips and screws, ring shanks, snaps and clasps for necklets, and bracelets and other artificial jewellery components. Certain toys are also subject to tax. Everyone involved in making goods for sale should write to the Board of Trade to ascertain whether they are acting within the law.

In other directions the small maker may find himself in trouble. He may copy in all innocence some object already on the market which is the subject of a registered trade mark or a patent. It is no defence to say that you were unaware of this. The onus is upon every manufacturer to find out before making and selling goods whether proprietary rights exist. This can only be done by making a search at the Patent Office. Anyone is, of course, entitled to make one copy of a patented article, but for experimental purposes only—not for resale.

"The Practical Motorist and Motor Cyclist"—Second Issue

THE second issue of our new companion journal, *The Practical Motorist and Motor Cyclist*, on sale on May 11th, contains details of another interesting competition with £500 in cash prizes. The first prize is £250. It is obvious from the enormous demand for the first issue that our new journal supplies a need. Its motto—Service! Service to its readers and the cars they own, irrespective of make or year of manufacture.

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A Simple FLASHGUN

Making a Non-electric Powder Flash Synchroniser

By W. E. LINCOLN BROWN

THERE must be many amateur photographers who have cameras which are not internally synchronised for flash, but who would like to use this convenient form of artificial light. Shutters of the "compur" type can quite easily be synchronised to work at exposures of 1/25 sec., but faster flash speeds cannot be achieved without some form of delay mechanism providing a pause of about 20 m.secs between electrical contact with the bulb and the shutter opening. This is to ensure that the shutter catches the light, which takes about 20 milli-seconds to develop.

Using Flash Powder

Since I cannot afford the cost of flash bulbs I have made a synchroniser which uses flash powder. Although it has some disadvantages flash powder is incomparably cheaper than any other form of flash and has a convenient lack of bulk. It also provides a softer and more even light than flash bulbs, avoiding that "soot and whitewash" effect so often associated with flash pictures.

The Powder

Flash powder is sold in containers holding two packets, one containing a white and the other a grey powder. The grey powder is the igniter, and the white provides most of the light. Both should be well mixed together before use. All lumps should be removed before mixing, as these fly about on ignition.

The diagrams show graphically the basic form of the synchro gun.

Dimensions

Specific dimensions are not given because the mainspring and gears of an old alarm clock were used, and these naturally vary somewhat in size. Size is not critical provided the cam has a radius (at the widest point) of about 19 mm., and the mainspring is strong enough for the job.

Photograph showing the author's completed apparatus.

The following are a few general dimensions of my own flashgun, which may give the constructor some idea of sizes:

Length of body 20 cm.; greatest width of body 41.5 mm.; width of narrow side 20.5 mm.; length of cable release 30 cm.; body and flash pan made from sheet brass, body 1.5 mm. thick, and flash pan 1 mm.

Principle of the Gun

Winding up the mainspring rotates the cam to the point shown in Fig. 3. During winding the second gear falls out of mesh with the flint wheel gear. When wound tension is held by a rod engaging in the teeth of the ratchet wheel (Fig. 4). Depression of the release rod disengaging in the teeth of the ratchet wheel round, revolves the other gears, producing sparks from the flint which ignites the flash powder in the pan. At the same time the release cam, in turning, presses down on the end of the cable release, so releasing the camera shutter (Fig. 1). The flint wheel is geared up and moving much faster than the main gear, so that a good spark is produced well in advance of the shutter opening. This sequence of operation will be clear from a study of Fig. 2.

Powder is a little slower coming to peak than flash bulbs, so that the required spark must be produced about 25 milliseconds in advance of the shutter being fully opened.

With this device speeds of 1/300th second may be used.

Only the actual mechanism need be made of metal and it can be attached to a hardwood stock. A general view of the apparatus is shown in Fig. 5.

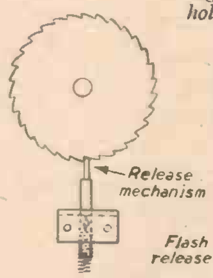


Fig. 4.—(Left) Device for holding tension prior to firing.

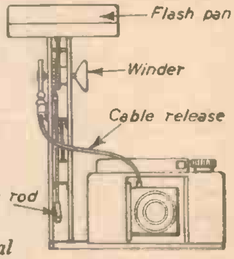


Fig. 5.—(Right) General view of the apparatus.

Cable Release

It is necessary to use a stout cable release for this job, preferably one of the metal-bound type. Adjustment to synchronisation is made by altering the position of the release cam when in the fully wound position. (The tension of the mainspring must be so adjusted during assembly that, when wound, the cam takes up the position shown in Fig. 3.)

If synchronisation for bulbs only is required a variation of the same device will serve. The two smaller gears would not be needed. A contact should be made with the cam during rotation so that the circuit is closed just before the shutter opens. Naturally this contact must be insulated and provide no circuit for the current.

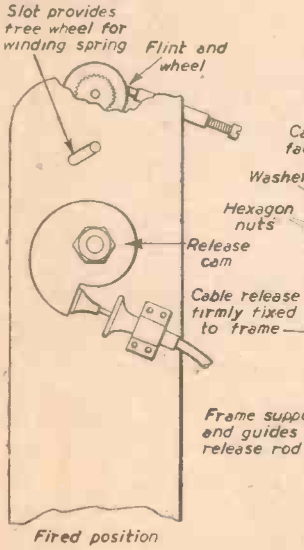


Fig. 1. — Showing the release cam in the fired position.

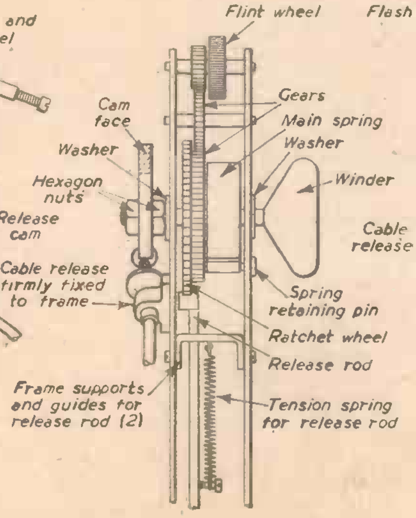


Fig. 2.—Details of the operating mechanism.

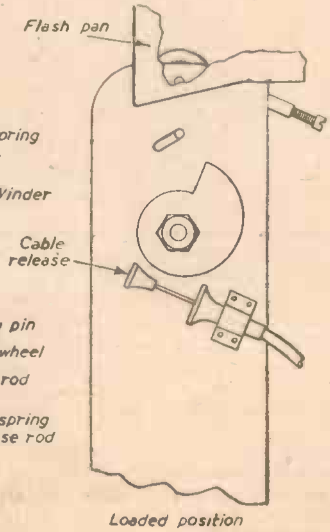


Fig. 3.—The mechanism in the loaded position, before firing.

A Film-Strip Projector

Constructional Details of an Inexpensive but Efficient Appliance for Home Use

By G. T. BUCKLEY

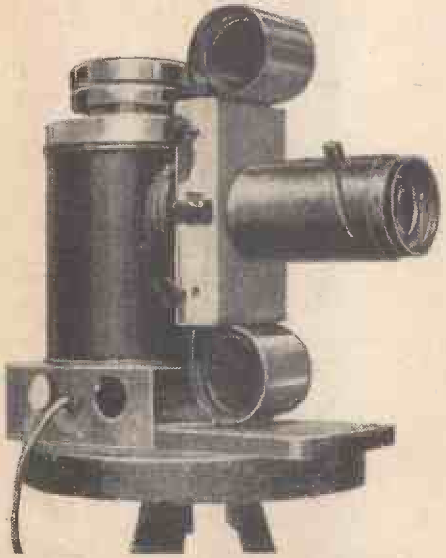
THE film-strip projector described and illustrated in the present article is made chiefly from odds and ends, including a dried milk tin, for the body, and two circular 1oz. tobacco tins for other parts.

Projector Body

Take the milk tin, which should be $4\frac{1}{4}$in. dia. and $5\frac{1}{2}$in. long, mark the centre of the base and then mark 2in. down the seam at the back, and 2in. down from the top mark a point directly opposite that on the seam; with this point as centre scribe a circle 3in. in dia. and cut out this circle with tin snips. (Fig. 1.)

Drill a hole in the centre of the bottom of the tobacco tin and using a diameter of $2\frac{3}{4}$in. cut out a circle by means of a circular tank cutter, and then cut off a strip 3/16in. deep from the top edge of the tin. Push this tin into the 3in. dia. hole cut in the body, leaving enough projecting so that the lid of the tobacco tin will fit on properly; solder the joint. The circular groove in the tin should be pointing away from the body of the projector as this groove is made use of for clipping in the spring for retaining the swivel mounting, and for adjusting the gate assembly to the horizontal or vertical positions.

In the hole made at the mark on the back seam of the body drill a 6 B.A. clearance hole and solder on a 6 B.A. nut which is to be used for the reflector adjustment.



Three-quarter front view of the completed projector.

Baffle Lid

In the top of the milk tin lid cut a 2in. dia. hole, then take a strip of tin $6\frac{1}{2}$in. by $1\frac{3}{8}$in., bend into a circle and solder this into the hole so that $\frac{1}{2}$in. projects below the top of the lid, as indicated in Fig. 1.

Cut four strips of tin $1\frac{1}{4}$in. by $\frac{3}{8}$in., mark $\frac{1}{2}$in. from one end and bend at this mark at right angles. Solder these as shown at a,

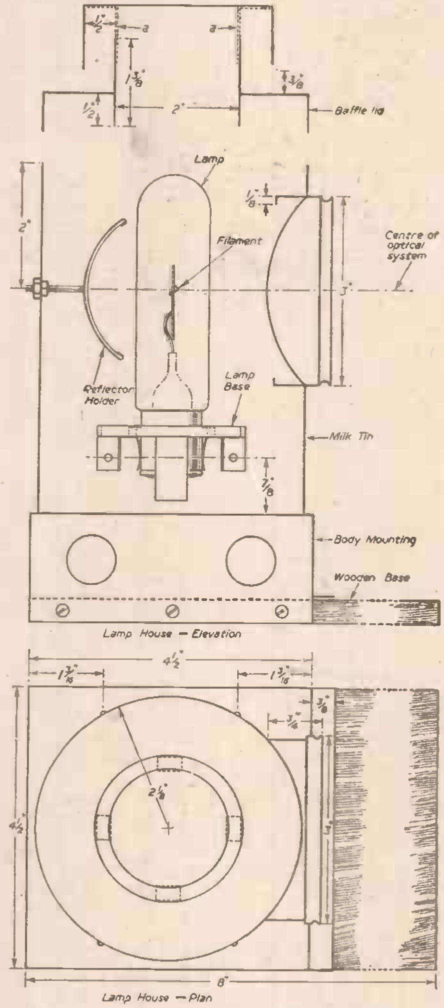


Fig. 1.—Part sectional elevation and plan of projector body and base.

Fig. 1, to the base of another tobacco tin. Place this on top of the baffle lid and adjust so that the brackets are inside the tin circle and overlap by $\frac{3}{8}$in.; solder the four brackets in place.

Body Mounting

Take a square of sheet tin 8in. by 8in. and mark out as shown in Fig. 2. Cut out a circle of 3in. dia. by means of a tank cutter, then cut out the $\frac{3}{4}$in. dia. circles. Drill the remaining holes to the sizes indicated. Cut out the four corner pieces, then bend downwards at all dotted lines, except that on extreme outer edge, which is bent so that it will screw down on the baseboard. Solder the corner joints from the inside.

Reflector Mounting

Take two strips of tin $\frac{3}{8}$in. by $2\frac{3}{4}$in. and drill holes at the centre of each strip. Attach these to a 6 B.A. countersunk head screw,

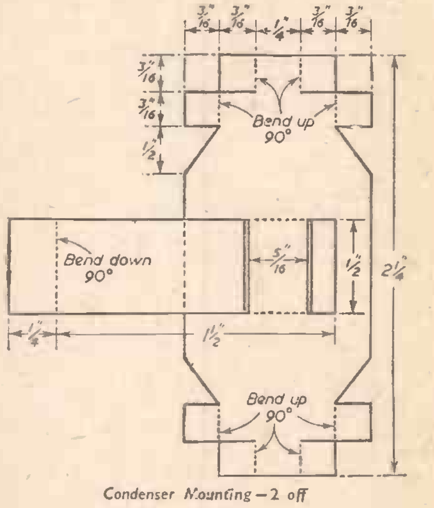


Fig. 3.—Condenser mounting before bending to shape.

by means of solder, so that they form a cross. The reflector is made by painting the back of a 2in. watch glass with aluminium paint. Place the reflector in the centre of the tin cross

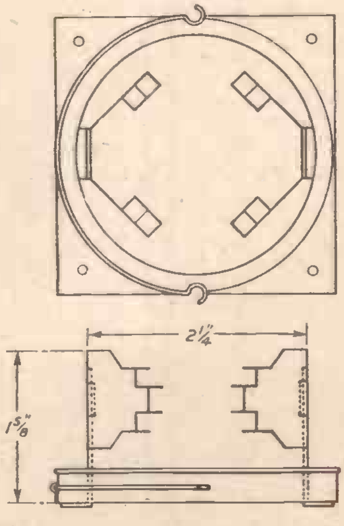


Fig. 4.—Face plate swivel mounting.

and bend the edges of the tin over to hold the reflector in place. Screw this from the inside through the 6 B.A. nut fixed at the back of the body. (See Fig. 1.)

Condenser Mounting

Mark out and cut two pieces of tin as shown in Fig. 3. Use a cold chisel to cut the $\frac{1}{2}$in. slots, then cut two pieces of packing case strip 2in. long and push these through the $\frac{1}{2}$in. slots until the ends are $\frac{1}{4}$in. from the edge of the mounting. Repeat for the second mounting, and tap on vice to secure strip. Bend the tags at the dotted lines, then bend the metal strip at a distance of $1\frac{1}{2}$in. from the end and solder these on to the face plate swivel mounting as shown in Fig. 4.

Face Plate Swivel Mounting

On a piece of tin of suitable size mark a square 3in. by 3in.; mark the centre of this and, using a tank cutter, remove from it a circular piece $2\frac{1}{2}$in. dia. Again cut a hole $2\frac{1}{2}$in. dia. in a 3in. dia. tobacco tin lid and arrange this lid so that the hole coincides with hole cut in tin square; solder the two parts together. Drill holes as shown at each corner of the square (Fig. 4). Cut a piece of 16 s.w.g. wire spring $5\frac{5}{8}$in. long and bend small loops at each end. This can be done by heating the wire red hot and bending it whilst still hot with round-nose pliers. Drill and elongate the holes for recessing the ends of returning spring. Bend the spring to shape around the outside of a circular tin lid, making sure there is a good pressure towards the centre of lid, and around the centre of the spring bend a strip of tin $\frac{3}{8}$in. wide, solder in position, and cut off any surplus.

Back Plate

Using a piece of seven-ply, 5in. by 3in., with the outside grain running the length of the wood, mark out as shown in Fig. 5. With a sharp knife, and removing one ply at a time, cut the centre section $1\frac{3}{8}$in. wide, and two-ply deep, then cut the roller apertures with a fret saw. Turn

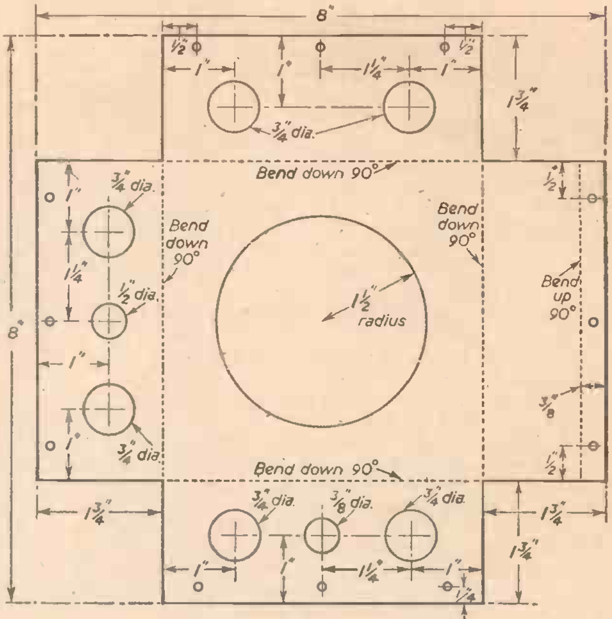
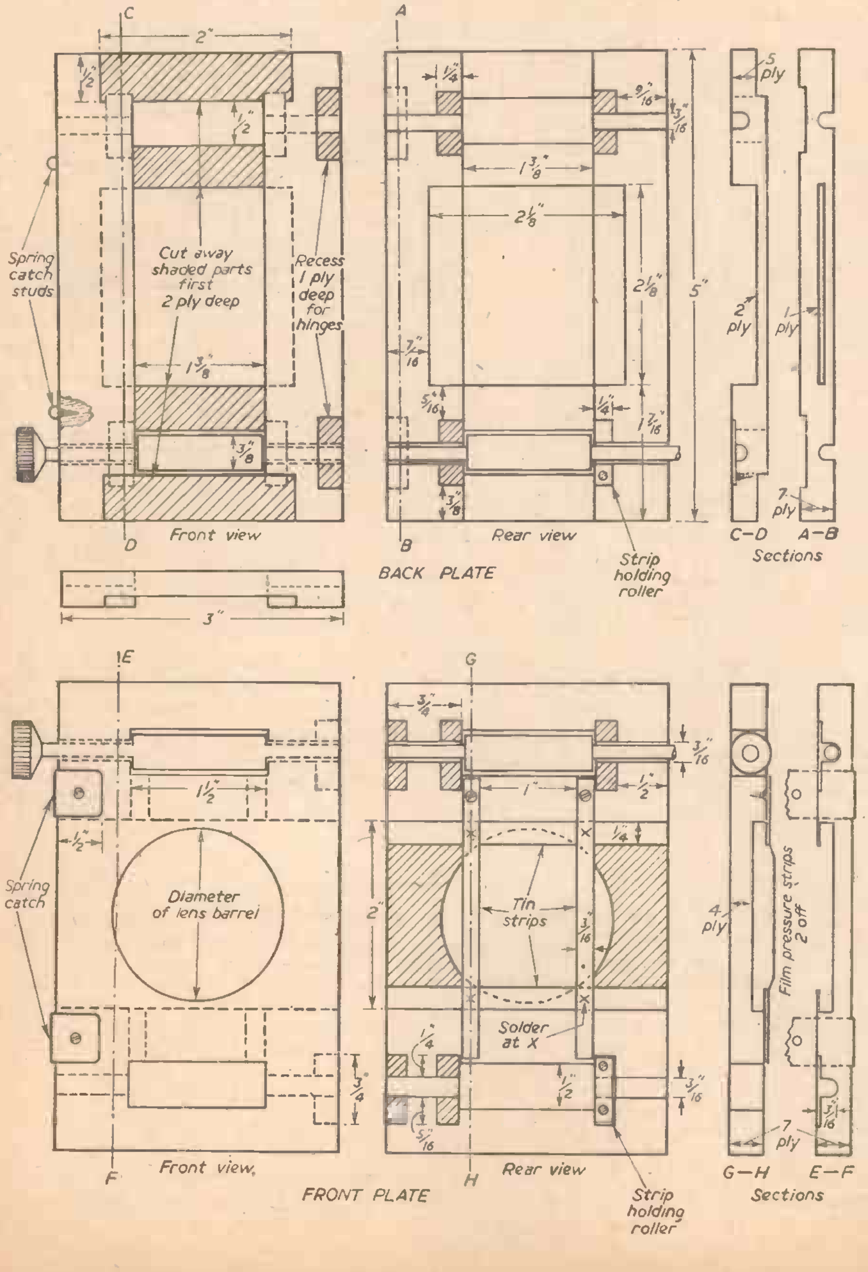
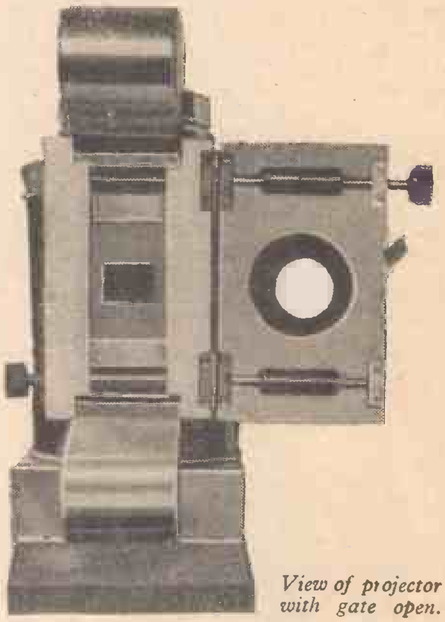


Fig. 2.—Shape of blank for forming body mounting.

wood over and cut the centre square with sides $2\frac{1}{8}$in. Make this five-ply deep, and use a chisel. This leaves an aperture $1\frac{3}{8}$in. by $2\frac{1}{8}$in. with a shoulder two-ply thick on each long side.

Cut the recesses for the retaining clips one-ply deep, and use a tenon saw to cut recesses for the roller spindles 3/16in. wide and 3/16in. deep. Grooves can be burnt in by placing a 4in. nail, heated to redness, in the channel. Turn plate over and cut recesses for hinges one-ply deep. The recesses for





View of projector with gate open.

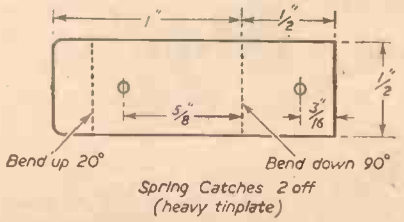


Fig. 5.—(Left) Film strip guide plates. Fig. 5a—(Above) Detail of spring catch.

the strip holder can now be cut; these are 2in. wide, two-ply deep, and $\frac{1}{2}$in. from each end. Finally cut slit for frame mask, one-ply deep and $2\frac{1}{8}$in. long, cut in the hinge side.

Front Plate

This needs very little further explanation. The roller apertures are cut with a fret saw, and roller spindle channels are cut on the back. Cut four small recesses one-ply deep for the retaining clips and finally the hinge recesses. Cut the slot for slides three-ply deep and 2in. wide by cutting with a tenon saw and taking out one-ply at the same time. Take out recesses for film pressure strips one-ply deep. Both front and back plates

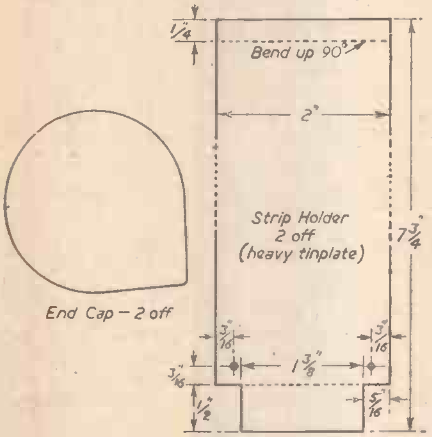


Fig. 6.—Details of strip holder and end cap.

can be cleaned up with sandpaper and before final assembly they should be tested for alignment.

Spring Catches

Cut two pieces of $\frac{1}{2}$in. wide steel packing strip $1\frac{1}{2}$in. long and bend where indicated. (Fig. 5a.) Drill holes the size of screws, the hole securing catch to front of front plate being countersunk. Bend round side of front plate. Close the gate and, making sure inside faces of both plates are in close contact, drill through other hole in spring catch a short distance into edge of back plate. Make sure that the steel screws used for spring catch studs are a good fit in the hole in spring catch. Screw these screws into holes drilled in the side of back plate. Cut off heads of screws leaving 1/16in. projecting from the edge. Smooth off end of studs. When gate is closed these should fall into holes in spring catches. In using the steel packing strip, temper it by making red hot and drop into water.

Roller Spindles

These are made from 4in. nails, two being cut to $3\frac{3}{8}$in. and the other two to $2\frac{5}{8}$in. In order to fix knobs, the ends of the two $3\frac{3}{8}$in. lengths are tinned and the knobs (from tooth paste tubes) are attached by running in solder and then a little flux. The nails should be straightened and cleaned, and finally polished with emery paper. The rollers are cut from rubber pressure tube about $\frac{3}{8}$in. dia., and they are $1\frac{3}{8}$in. long. The retaining clips are made from $\frac{1}{2}$in. packing strip $\frac{1}{4}$in. by $\frac{3}{4}$in.; four of them are drilled $\frac{1}{8}$in. from each end and the other four from one end only. The holes are 3/32in. dia. and countersunk.

Strip Holder

Mark out two pieces of tin $7\frac{3}{4}$in. by 2in. as shown in Fig. 6, cut out corner pieces and drill and countersink the holes in each piece. Bend ends as indicated and then bend the whole into a loop with end pieces pointing outwards. Place the stepped end into the roller aperture of back plate and screw into position with $\frac{1}{4}$in. countersunk screws; do the same with the other piece. If there is a projection bend it outwards on the back of back plate, and tap flat with a hammer. Close the gate and shape loops, and place flat on a piece of sheet tin, then cut out tin so as to enclose one side of loop, then solder end cap into position.

Lens Barrel

Cut a sheet of cardboard so that its length is equal to the focal length of the lens, and its width equal to the circumference of the lens. Form this into a cylinder around the lens and stick the edges together. Repeat this operation, making a tin cylinder to cover the cardboard, but allow an overlap of $\frac{1}{4}$in. on the circumference so that the seam can be soldered. This should form a tube in which the lens slides freely. Now cut a hole in the front face plate so that the tube fits tightly.

In order to make the washer which forms the flange for the lens tube cut a hole in a sheet of tin so that it fits over the tube, then increase radius by $3\frac{1}{8}$in. and cut again, to form a flat tin washer. Drill four holes, symmetrically around the washer, in order to secure to the face plate. Solder the washer $\frac{3}{8}$in. from end of lens tube, press the tube into the face plate, and secure with screws.

Lamp Base

Using a sheet of asbestos 3/16in. thick, mark out and cut and file to shape, as shown in Fig. 7, and drill the holes as indicated. Then set the tank cutter to the radius of the outer centre circle, and cut the sheet of asbestos half way through. Reduce setting of tank cutter, take out centre, cut the step clean and then cut with hack saw blade up to small marks in the step.

Film Pressure Strips

From a sheet of heavy gauge tinplate cut the shape of the contact plate (Fig. 8) and drill the centre for the pin of the cutter. Set the cutter to the radius of outer circle and cut along the arc indicated; reduce radius of cutter and cut out the inner circle; cut the arc where marked, then bend a small piece under, as indicated, to act as a stop for positioning filament of pre-focus type projector lamp. Bend the strip at innermost marks, thus forming stops for bringing filament of lamp in correct plane, then bend down 3/16in. from the end of each arc. Place the contact plate crosswise on top of the asbestos base and make sure that the 3/16in. portion of the arc which is turned down projects through small slots in the step; bend up the ends of the contact strip and tap the remainder under the asbestos base. Mark out and cut the base contact strip (Fig. 9), bend to shape and fix in position with 4 B.A. screws. Make four brass brackets, bend as indicated in Fig. 9 and drill and tap for six B.A.; secure these brackets to each corner of the asbestos base with 6 B.A. screws (Fig. 8a).

Place lamp in position and make sure all electrical contacts are in order. The contact strip at the bottom should exert an upward pressure to hold lamp in pre-focus position.

Film Pressure Strips

These are simply strips of thin gauge tinplate to hold the film against the glass plate.

Two strips of tin are cut 3in. long by $\frac{1}{4}$in. wide, and two are cut 3/16in. wide and 3 3/16in. long, the latter being shaped as shown in section G, H of the front plate (Fig. 5). Two holes are drilled, one in each 3/16in. from one end and countersunk. Fit these two strips in recesses, cut in the back of front plate and secure with small countersunk head wood screws. Lay the other two strips ($\frac{1}{4}$in. inside) crossways, leaving about 1/16in. space at edge of bottom strip. Solder at positions marked X. These latter strips hold glass slides in position.

To obtain a bright lasting finish on tinplate, polish with any metal polish, and without touching the polished parts paint with a thin film of clear cellulose acetate. The body of the projector needs to be painted with a heat-resisting paint.

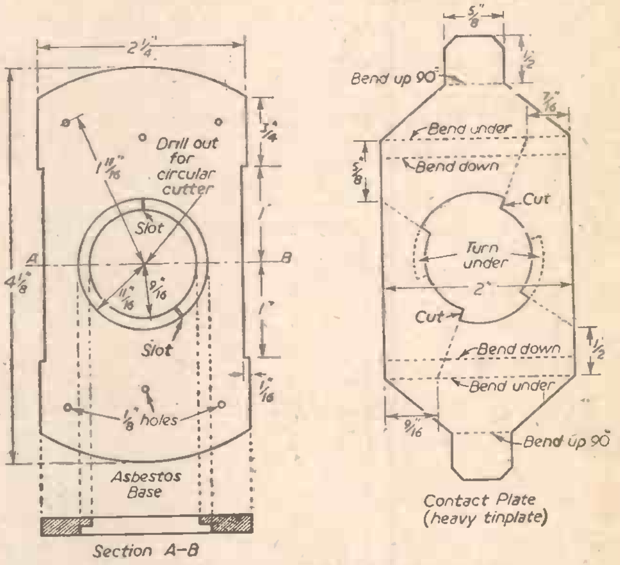


Fig. 7.—Asbestos base. Fig. 8.—Contact plate.

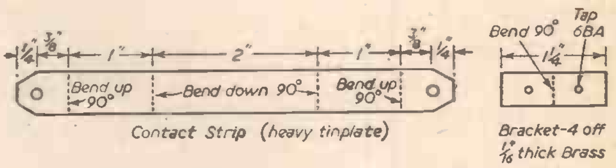


Fig. 9.—Tinplate contact strip and fixing bracket.

Assembly of Projector

Cut four pieces of thin glass $2\frac{1}{8}$in. x $2\frac{1}{8}$in., place one in the $2\frac{1}{8}$in. square space in the back plate, slide mask (Fig. 9a) in place, then place another square of glass on top. Next place in position on the back of the face plate swivel mounting, with the piece of $\frac{1}{2}$in. strip projecting on the side opposite the hinge; drill and screw in position.

Rollers

Put the rollers in position in the rear face plate, the one with the knob being at the bottom; the top one is just a plain roller

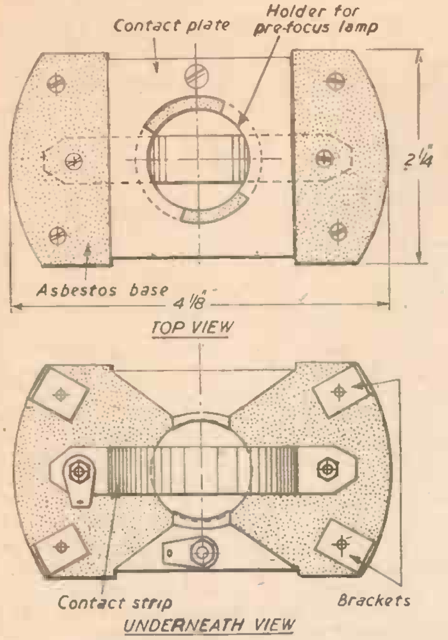


Fig. 8a.—Two views of the assembled asbestos base and contact plate.

spindle. Place the blank end of roller-retaining strip under the edge of tin and after drilling holes, screw loosely into position; upon the pressure of these strips depends the adjustment of the rollers—one strip is shown in position in Fig. 5. Put front-plate rollers in position—one with knob being at the top in this case, and screw the roller-retaining strips tightly into the recesses.

Grease all bearing surfaces to ensure that rollers run quite freely.

Positioning Swivel Mounting

Take the spring out of recess and place the swivel mounting on lamp-house; arrange gate so that it is in correct vertical position and mark groove at centre of each recess. Turn through 90 deg. and, with gate in horizontal position, make two similar marks in groove. Take gate off and drill 1/16in. where marked in groove; make small indentation for positioning spring to clip into. Check the vertical and horizontal positions of gate.

MATERIALS REQUIRED	COST
1 dried milk tin for body	—
2 1oz. round tobacco tins	—
1½ sq. ft. tinplate	—
1 piece 7-ply ⅜in. thick 6in. × 5in. ...	1s. 0d.
1 piece of wood 4½in. × 8in. × ⅜in. for baseboard	—
4 4in. nails for rollers	—
8in. pressure tubing (⅜in. dia. approx.)	—
2 toothpaste tube tops (screw-on type)	—
1 toggle switch 250 v. 3 A.	1s. 6d.
16in. of ½in. steel strip from packing cases	—
1 piece of asbestos sheet 1/16in. thick, 5in. × 3in.	—
2 pieces of thin glass 2⅛in. × 2⅛in. for frame holder	—
6in. of 16 s.w.g. spring wire (old cycle saddle spring)	—
1 100-watt 230 v. pre-focus type projector lamp	11s. 9d.
2 condenser lenses (moulded) 5in. focal length 2in. dia.	5s. 0d.
1 piece of Chance's heat resistant-glass 2in. dia. (No. 0N20)	10s. 6d.
1 old projector lens 4in.-5½in. focus, 1in. to 2in. dia. approx.	30s. 0d.
1 watch glass 2in. dia., for reflector ...	2s. 0d.
17 ¾in. No. 4 round-head wood screws	—
24 ¾in. No. 2 countersunk screws (wood)	—
8 6B.A. ⅜in. screws	—
2 4B.A. ⅜in. round-head screws with nuts	—
1 6B.A. 1¾in. long screw with two nuts	—
The total cost of above materials, including those not priced would be approximately	£3 10s. 0d.

Lamp House

Stand the body on its mounting, making sure that swivel-mounting aperture is in correct position so that it faces forward with the body central, and solder together. Put lamp base in body with larger cut-away arc pointing forward, fix in position with 6 B.A. screws. The switch is put on the back of body mounting, contacts downwards. Insert a piece of rubber tubing about ½in. long, push this through the lead hole and press lead through rubber tubing. The lead is soldered to the underside of contact plate from the switch; one of the mains leads is soldered to switch, and the other to the contact strip. The lamp can now be tested.

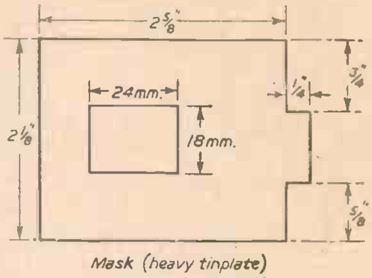


Fig. 9a.—Details of mask.

Using a wooden base board 8in. x 4½in. x ⅜in., screw the projector in place and paint it. Polish the lid of body mounting and apply a coating of cellulose acetate varnish.

Mount the condenser lenses and between them place a piece of Chance's heat-resistant glass. Put the gate assembly on the lamp-house and adjust the reflector so that the whole frame is illuminated evenly when projected on to a screen. Lock the reflector in this position with a nut. Adjust the screws on the rear of the back-plate so that the pressure exerted allows the film to run evenly between the rollers without slipping.

Always leave the gate clip open when not in use. For moving the film forward turn the bottom knob clockwise. For taking film back, turn top knob clockwise.

A Spirit Duplicator

Simple and Cheap Home Duplicating

By W. R. MASEFIELD

FEW of us possess a duplicator, but occasions do arise quite often when one would be handy. Formulæ for the old hectograph or jelly duplicator are legion, but it does not seem to be generally known that spirit duplicating offers several advantages over both this and the wax stencil methods, and that the process can be carried out very easily at home on the domestic wringer. Apart from a little methylated spirit and a few sheets of duplicator carbon (both items costing only a few pence), there is nothing else to buy.

Spirit duplicating is really a modern derivative of the hectograph process, but without the messy jelly. The original is made in reverse on the back of a sheet of glazed paper, reversal being achieved in a very simple manner as explained later, and the original is then pressed into contact with a blank sheet of paper made very slightly damp with spirit, so making a transfer copy the right way round. Manufacturers of spirit duplicators claim 70 copies from one original with ease, and this number is possible even with the primitive method outlined below.

The original can be stored for future use, and it is not messy like a used wax stencil. Up to seven colours may be used on one original.

Making the Original

The original is made by laying a sheet of *hard* glazed paper over a sheet of hectograph or "Banda" carbon paper which is put face upwards (ordinary carbons are *not* suitable). For handwriting and diagrams a hard-pointed pencil may be used, or a steel stylus, or a ball pen. A firm surface under both paper and carbon helps to get a fine clean line. For typing, the two sheets are fed into the machine together with a backing paper to protect the roller from being soiled by the carbon. Remember to put the carbon in face up instead of face down. A fair, but even, pressure on the keys must be exerted. It will be realised that, as the carbon is face up, an impression is taken on the back of the original, and it is automatically in reverse. Colours are obtained by changing the carbon colour as required; registration is, of course, also automatic.

Producing Copies

Taking copies needs a little care and attention to details, but if the following directions are carried out fully, there should be no difficulty in obtaining satisfactory results.

Lay the original carbon side down, on a larger sheet of stiff paper and stick down the edge away from you by means of a small piece of gummed paper or tape. Feed the large sheet into the wringer (screwed up for a fair pressure) until the attached edge of the original is nearly up to the rollers. Now prepare a blank sheet for the first copy. Use a hard but not thick paper and smoothly cover it with methylated spirit on a pad of cotton wool.

It is important that there are no pools of wet spirit on the paper, or the original will be ruined—the less spirit there is, the better, and the paper should be only just damp. Judgment in this comes soon with experience. Lift the original and place the spirit-damped copy paper under it, then feed the sandwich through the wringer at a fair speed. Remove the copy quickly from below the original (do not slide out, or smudging may result) and put in a warm place *at once*. This is to prevent the dye from spreading before the paper is dry. I put mine under the electric grill, switched to "low," as it is conveniently near the wringer.

Further copies are taken in the same way. After a little experience, it is possible to take 30 to 40 copies in less than 20 minutes.

If results seem unsatisfactory at first, a few trials with different papers should be made. Papers having a surface grain are not suitable, nor are the semi-absorbent duplicating papers. I have found thin second copy typing paper gives good results, or the cheaper, slightly glazed paper used for making galley proofs. For the original, a thick, smooth writing paper gives best all-round results. A further variable quantity in the process is wringer pressure; a little trial and error will soon determine the correct amount.

An Ellipsograph

An Instrument for Forming an Ellipse, the Major and Minor Axes of which are Given

By S. GOVINDAPPA

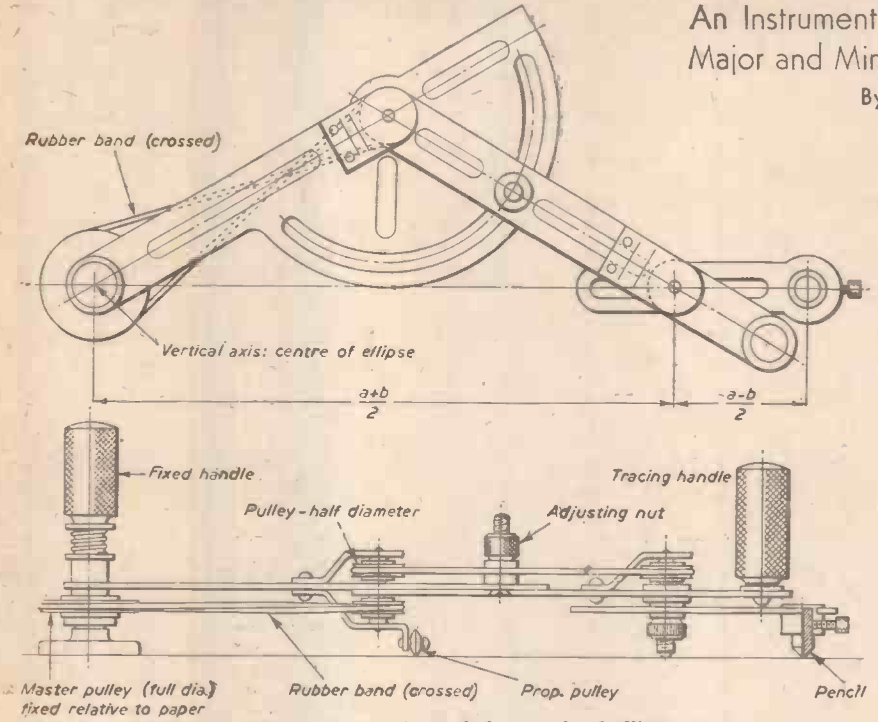


Fig. 1.—Plan and side views of the completed ellipsometer.

THE instruments consists of a vertical axle to which a pulley called the "master pulley" is rigidly fixed. On the same axle a P-shaped frame rotates. Connected to this is a flat bar (eye-bar) capable of angular movement as shown. At the other end of this bar is the tracing handle. A slotted bar called "tracing bar" is arranged to rotate about a point on this flat bar. At one end of the tracing bar is the pencil point, see Fig. 1.

Arrangement of Pulleys

The master pulley and the first pulley are cross connected. The other pulleys, i.e., second and third, are connected by an open thread. The diameters of first, second and third pulleys are half the effective diameter of master pulley.

The distance between the axis of the master pulley and the last pulley (the third), can be altered by rotating the flat bar (eye-bar) through the desired angle and fixed by means of the nut and bolt, connecting the P-frame and flat bar. The distance between the last pulley (third) and the pencil point can be adjusted and fixed in position by the nut provided (Fig. 1).

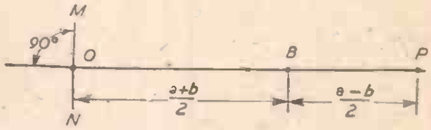
Information for constructing the device may be taken from the detailed drawings, Figs. 2, 3, 4 and 5.

Drawing the Ellipse

Let the axes of the ellipse be "a" and "b".

Draw a straight line, and mark out points O, B, P such that:

$$OB = \frac{a+b}{2} \text{ and } BP = \frac{a-b}{2}$$



The instrument is so placed that the axis of the master pulley passes through O. This can be very easily achieved as follows: Draw line MN, passing through O exactly at right angles. There are four vertical marks

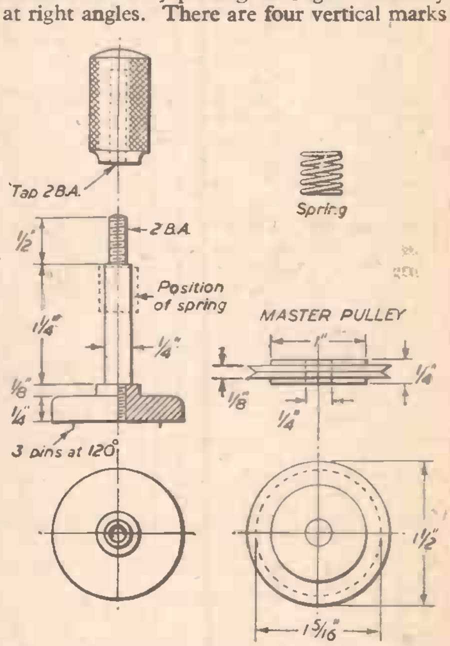


Fig. 3.—Details of the fixed handle and master pulley.

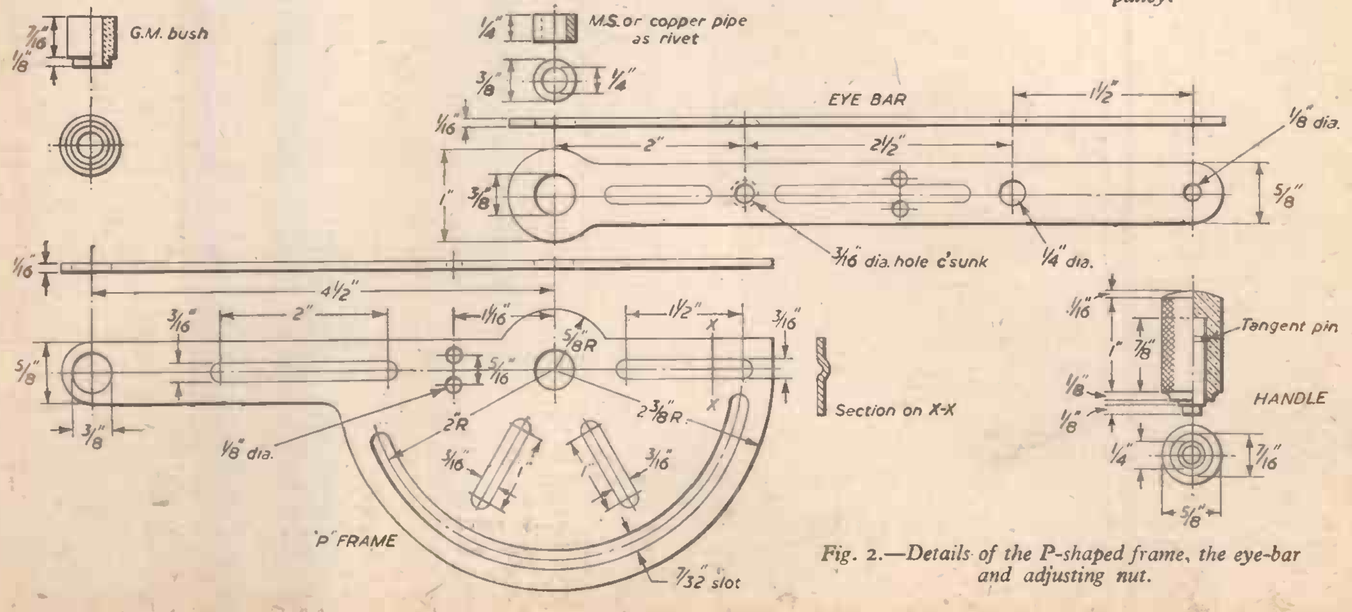
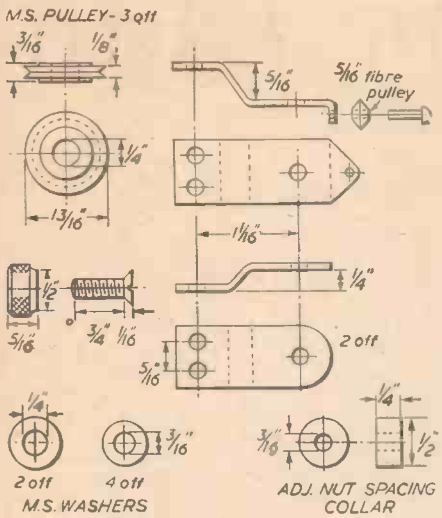


Fig. 2.—Details of the P-shaped frame, the eye-bar and adjusting nut.



on the circumference of the base displaced at 90 deg. These marks are adjusted to above OP and MN.

Loosen the nut connecting the P-frame and flat bar and turn the flat bar such that the steel ball prop comes above the point B. Tighten the nut.

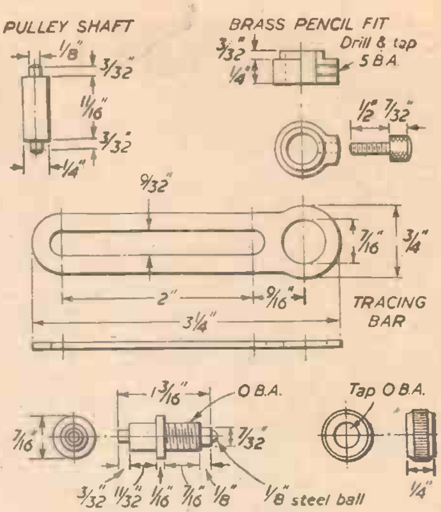
Loosen the nut on the tracing bar, and adjust the pencil point to coincide with P. Tighten the nut.

Holding the handle on the master pulley, the tracing handle is moved round, and the ellipse traced. (The base is prevented from slipping by providing it with sharp projecting pins.)

The instrument has been proved mathematically, but to safeguard against any possibility of pulley slip, these could be replaced by oothed wheels and a light chain.

Fig. 4 (left).—Details of the half size pulleys, the fibre pulley and the pulley brackets.

Fig. 5 (right).—Details of the tracing bar and the brass pencil fit.



An Aquarium Heater and Thermostat

Inexpensive and Easily-constructed Appliances for the Amateur Aquarist

By D. F. BURGESS

THE tank heaters and thermostat described below have been in constant use for nearly a year and once the thermostat was set to the correct temperature, it has required no attention whatsoever.

My tank is a 12-gallon one and anticipating power cuts in the cold weather I decided to provide sufficient wattage to supply a good reserve of power and, using a wire of fairly low resistance, two heaters were made and connected in series with each other and the thermostat. This, incidentally, spreads the heat more evenly over large tanks as the heaters can be placed at opposite ends. If thinner wire were used one heater would probably suffice, but the danger of the element overheating must be watched. Heaters of wattage in excess of that recommended for a particular tank size do not waste electricity with a good thermostat, as the current is switched off when the required temperature is reached.

The Heaters

Two of these are made as follows: Wind about 45ft. of 30 s.w.g. "nickel-chrome" resistance wire (resistance about 4 ohms/ft.) round a No. 12 knitting needle, making each turn as close to its neighbour as possible. Enough should be wound to make a "coiled coil" over the whole length of an asbestos former. Make this by cutting a strip of

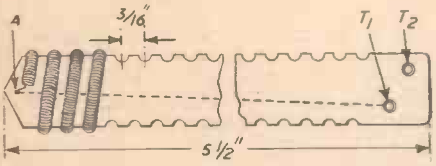


Fig. 1.—Winding the coil on the asbestos former.

hardened asbestos (the type used for roofing) which should be about 3/16in. thick and ⅜in. wide, and using a small rat-tail file make grooves all along both sides as shown in Fig. 1. (Note the grooves are "staggered" from one side to the other.)

The end of the coil is then pushed through the small hole at A and fastened to terminal T_1. This straight section is insulated from the coils by a stout strip of mica laid over it as the coils are wound on. Finish off by fastening the other end to terminal T_2. The whole should slide easily into a ⅜in. by 6in. hard glass test-tube.

The leads are of the plastic insulation type, being suitable for constant immersion in water. The section should be regular, circular or oval, without any deep grooves as some types contain. Take a rubber bung to fit the test-tube and make an under-sized hole with a red-hot wire. Force the plastic lead through this hole and solder the ends to T_1 and T_2.

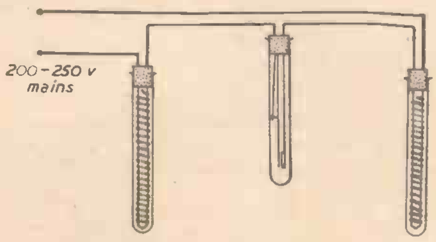


Fig. 3.—How the connections are made.

The bung should remain in place, but as an extra precaution against accidental withdrawal whilst in use, it should be bound in place by stout thread.

The Thermostat

Constructional details should be apparent from the diagram, Fig. 2. The contact points will wear better if they are tungsten-tipped. Old magneto contact-breaker points make excellent parts for this.

My magnet was ready-made with a hole for riveting, the rivet being countersunk so that the magnet lies flush with the tinplate when the contacts are closed. This is an important point, as otherwise the magnetic snap-action is ineffective. Small magnets suitable for this purpose may be purchased, and an alternative means of fixing should not be too difficult if there be no hole drilled.

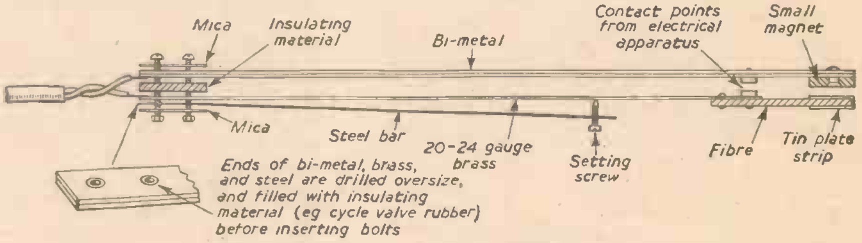


Fig. 2.—Constructional details of the thermostat.

But don't try drilling your own, as the steel is extremely hard, and the heat of friction caused destroys the magnetic properties. The snap-action is, of course, necessary to minimise the sparking which occurs between the contacts.

A ⅜in. by 6in. test-tube is used as before, and the rubber bung arrangement is also similar to that used for the heaters.

Connections

Both heaters and thermostat are connected in series as shown in Fig. 3. The heaters are placed flat at either end of the tank; the thermostat is usually placed mid-way, at the back of the tank. Adjustment can be made better in a small tank or saucepan, as the action is then quicker.

The Structure of the Earth

Some of the Theories and Ideas About the Formation of Our Planet

By "PHYSICIST"

ALTHOUGH man originated on the earth and has been for ever earth-bound, we know more about the constitution of stars that are many millions of miles away than we do about the very earth beneath our feet. That this is so is hardly unexpected when we consider that the deepest hole that man has yet made in the earth is approximately four miles, which is merely a thousandth part of its radius. Because we are only able to scratch the surface of the earth, most of our knowledge about its interior must, therefore, be obtained indirectly.

But, in this era of ever-expanding industry, the increasing use to which the materials of the earth are being put, inevitably leading to their exhaustion, is impelling man to learn more about the inside of the earth in the hope that new reserves might be found therein. Especially is this true of fuel supplies, and investigations are being actively pursued to determine how heat from inside the earth can be utilised.

Size and Density of the Earth

The size of the earth can be determined fairly simply and it is also easy to show that it is approximately a sphere of 4,000 miles radius (see Fig. 1). By studying the forces of attraction between the earth and two weights of known mass, it is possible to determine the weight of the earth (Fig. 2) and once the weight and size are known its average density can be calculated. This has been done many times and the value obtained, viz. 5.5 times that of water, is

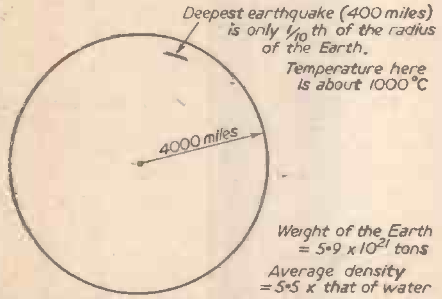


Fig. 1.—Size and shape of the earth. The deepest hole made by man is 4 miles deep, which is 1/1,000th the radius of the earth and is merely a scratch in the earth's surface.

about twice the density of the rocks which make up the earth's surface. Consequently, it has been argued that the matter inside the earth is much more dense than that on its surface. To some extent this increase in density is only to be expected, partly because of the very high pressures that exist in the interior of the earth and also because the heavier materials would tend to sink towards the centre, if this has been at any time possible.

It is now almost 200 years since the size and weight of the earth were first calculated, but it is only recently that information about the composition of the inside of the earth has been deduced. Admittedly, attempts have been made from time to time to guess the composition and structure of the earth. Amongst these, Edmund Halley's description in 1692 of the inside of the earth, based almost exclusively on a knowledge of terrestrial magnetism, was particularly outstanding, anticipating in a remarkable way some of the more recent deductions about the earth; but, because this was largely inspired guessing, some of his statements, especially those relating to the inhabitants which Halley suggested might live inside the earth, are far from reality.

Two masses, one the mountain and the other the bob of the plumb line. Forces X and Y, due to the mountain and the Earth respectively, act on the bob and pull the line AB out of the vertical.

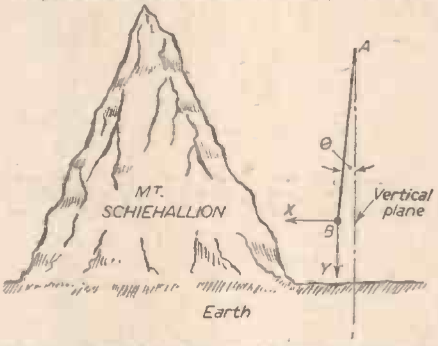


Fig. 2.—One of the first experiments to determine the weight of the earth, made by Maskelyne near Mount Schiehallion in Scotland. The extent to which the plumb line AB was pulled out of the vertical by the attractive force X of the matter in the mountain was measured. The weight of the mountain was deduced as accurately as possible by survey and the weight of the earth was thus obtained. More accurate methods have since been evolved.

Seismology

In recent years the study of earthquakes and tremors or, to be more scientifically accurate, the science of seismology, has afforded a much clearer insight of the composition of the earth's interior, for, although the destructiveness of earthquakes is confined to a small region of the earth's surface, the vibrations which accompany them travel in all directions through the earth and can be detected on instruments called seismographs. From observations made with these instruments at several points on the earth's surface it is possible to map the paths of the vibrations and also to deduce the speed with which they have travelled at all points along their paths (see Fig. 3).

The speed at which vibrations are transmitted in a material is related to its density. Therefore, once the speed with which the vibrations travel at all points of their path is known, the density distribution of the material along the path can be deduced. Thus, if the times of arrival of the vibrations from an earthquake be noted at several points on the earth's surface, the velocity of these vibrations along their respective paths through the earth can be calculated, if the relative positions of the observatories and the centre of the earthquake are known.

Mechanical vibrations can be of two kinds: (a) *longitudinal*, in which the particles of matter vibrate along the line of propagation of the vibration, and (b) *transverse*, in which the particles of matter vibrate in directions perpendicular to the line of propagation. Solids are able to transmit both types of vibrations but, in liquids, only longitudinal vibrations are transmitted.

The groups of vibrations from earthquakes which travel through the earth and are detected by seismographs, are of a very complex nature. It is found that according to the direction in which they have travelled through the earth they may be a combination of both longitudinal and transverse vibrations or longitudinal vibrations alone, and that the longitudinal vibrations have travelled along paths deepest in the earth. These observations are consistent with the hypothesis that the earth has a central region which is liquid and has a high density. It has been commonly accepted that this liquid core is a molton metal and most investigators are agreed that it is probably iron. In addition to molten iron having the right density, there is some indirect evidence to support this deduction. Iron is quite a common material in the Universe. Meteorites are mainly iron and are believed to be the fragments of matter from the same parent star as the earth and the other planets.

The radius of this core of liquid matter, whose density is roughly twice that of the surrounding material, is approximately 2,000 miles and there are some indications that its boundary is quite sharp. Surrounding this core and extending to the surface, is a shell of solid rock-like material whose density decreases towards the surface (Fig. 4a).

Seismic studies show that the actual origin of earthquakes is usually very near to the earth's surface and is never deeper than 300 to 400 miles. That this is so has

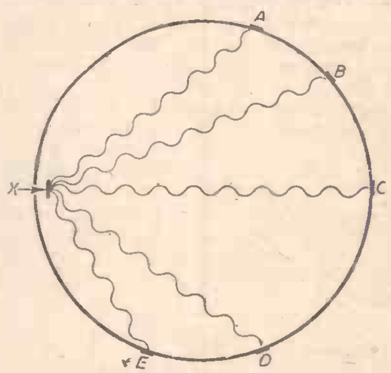


Fig. 3.—Vibrations from earthquake at X travel through the earth as shown and can be detected on seismographs at A, B, C, D and E. From a knowledge of the location of the earthquake, with respect to the receiving stations and the time taken for the vibrations to travel along their respective paths through the earth, it is possible to deduce the density of the material through which they have travelled.

been taken to indicate that below this depth the material is not truly solid, but behaves as a stiff paste or dough. Hence, it is argued that the transition from the liquid core to the solid shell is not nearly so sharp as other seismograph evidence might indicate.

Some investigators have pointed out that the high pressures which exist inside the earth might compress rock-like material and greatly increase its density. At the same time the pressure may profoundly alter the physical characteristics of this material, giving it the properties of a metal. It is therefore suggested by these investigators that the chemical composition of the earth is everywhere the same.

Unfortunately, our knowledge of the

transformations of matter that occur at high pressures is not sufficient for us to decide whether the above hypothesis is correct, but Bridgeman, at Harvard, who for many years has pioneered high pressure investigations, has succeeded in changing the soft, spongy element, phosphorus, into a black metallic form at extremely high pressures.

It is generally agreed that the earth was originally molten and it has recently been shown that if this were so, there must inevitably be a solid core within the molten centre of the earth, but there is no direct experimental evidence to confirm this (see Fig. 4b).

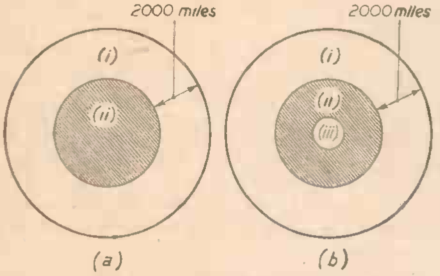


Fig. 4.—The structure of the earth.
(a) Based solely on evidence from seismographical studies. (i) Solid shell of rock-like material, approx. 2,000 miles thick and from 2.5 to 5 times as dense as water. (ii) Core of molten material probably iron, from 5 to 12 times as dense as water.
(b) Modified structure, taking into account evidence suggested from possible origin of the earth. (i) Solid shell of rock-like material. (ii) Shell of molten material, probably iron. (iii) Core of solid material, probably metallic, about 12 times as dense as water.
NOTE.—Although some seismographic data suggests that the division between the liquid core and the solid shell is quite sharp, other evidence indicates that the transition is gradual and that there is quite a large region of plastic matter.

Temperatures Within the Earth

That the temperature of the earth increases from its surface inwards has been known for a long time. At a depth of 12,000ft. the temperature is higher than the boiling point of water; and that the temperature continues to increase at greater depths is borne out in volcanic eruptions, where the temperature of the lava sometimes exceeds 1,000°C.

Attempts are being made in France to utilise terrestrial heat. It is proposed to sink a shaft 10in. in diameter to a depth of 13,000ft. which would bring a mixture of water and steam to the surface at a temperature above 100°C. and at a rate of 140lb. per second. There are hopes that sufficient heat could be obtained from a system of shafts to supply a power station.

Another means of extracting useful heat from the earth is possibly the heat pump which functions on the same principle as the refrigerator and extracts heat from a low temperature source and gives it out to a higher temperature region.

We have no real knowledge of the temperatures that exist at depths greater than a few hundred miles. Some values have been deduced from theories of the origin of the earth but, apart from knowing that it must be sufficiently high to keep the core molten and yet not so high as to melt the surrounding rock, it cannot be fixed with any degree of certainty. Typical estimates vary from 1,000 to 10,000°C.

The Earth's Magnetism

Magnetic effects are observed at all points on the earth's surface, but they vary in intensity over the surface. Even at one point they do not remain constant, varying continually with time. Most of the variations that occur can be ascribed to the influence of the sun and the moon, in the main being due to ionising radiations from the sun which produce electrical disturbances in the earth's upper atmosphere. There is, however, one variation, viz., the variation in the direction of the magnetic field, which must be due to some change occurring within the earth. The effect is cyclic with a periodicity of approximately 700 years.

In 1600 Gilbert suggested that the earth was a magnet, and in 1692 Halley elaborated the concept by postulating that the earth contained an inner solid core of magnetic material with liquid between it and the crust. Halley suggested that the north and south magnetic poles of the earth were situated on the crust and a further two poles were located on the solid inner core. Because of the liquid layer, the rotational motion of the outer solid crust was not fully imparted to the core and as a result this cyclic variation in the direction of the magnetic field was produced (Fig. 5).

There are, however, serious objections to this, or any other hypothesis which requires the material in the interior of the earth to exhibit strong magnetic properties, for it is a well established experimental fact that these strong (ferro-) magnetic properties are destroyed in all known metals and compounds at temperatures well below those which exist inside the earth.

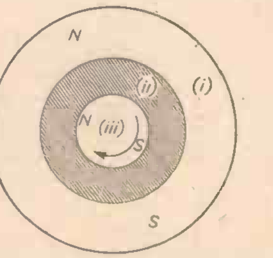
To meet this objection it has been suggested that the earth's magnetic field might be due to a system of electric currents which flow in the interior of the earth, but unless these were continually maintained they would gradually decay, due to the electrical resistance of the core. Unfortunately, we have little knowledge of the resistance of metals at very high temperatures and pressures so that we have no means of deducing the rate at which these currents might be expected to decay. There is some indication from records of terrestrial magnetism, which have been kept now for over 100 years, that there is a very small decrease in the strength of the earth's magnetic field, but this is really too small to be taken as proof that the currents, if they actually exist, are decaying.

To meet this problem of constant current flow, the idea has been advanced that they are maintained by electromotive forces which are induced by the convective movement of the material in the molten core as the earth slowly cools down (see Fig. 6).

Recently, the hypothesis has been advanced that magnetism is a fundamental property of rotating matter, being related to the mass and speed of rotation of the body. So that a body of certain dimensions should have a magnetic field strength on its surface which is proportional to its speed of rotation and its mass and which decreases continuously from the surface to the centre of rotation of the body. Measurements made in mine shafts and caves showed that the earth's magnetic field decreased with depth, whereas, if the magnetic core or current flow hypothesis were true it should increase as towards the centre of the earth. The evidence thus obtained was, therefore, interpreted in favour of the fundamental property hypothesis, but later studies on magnetism have shown that for most stars the strength of the magnetic field is continuously changing, whereas, the direction and velocity of rotation remain the same. This variation in magnetic field is accurately deduced from changes in the line spectrum of the light emitted by atoms in the star.

The size of the earth and the conditions that exist in its interior make it a valuable and virtually inexhaustible source of power. It is inevitable that as the surface supplies of basic materials are used up, more and more attention will be given to the utilisation of this great source of power, although as the features reviewed in this article show, this will not be an easy task.

At present, we have no means of penetrating the solid rock-like crust to an extent sufficient to draw fully upon the energy reserves in the inside of the earth, but there is every hope that this might be accomplished in the future. Could we but penetrate to the liquid core, there exists the possibility of using directly the electrical energy which many people hold to be the cause of the earth's magnetism. Truly we have buried treasure beneath our feet!



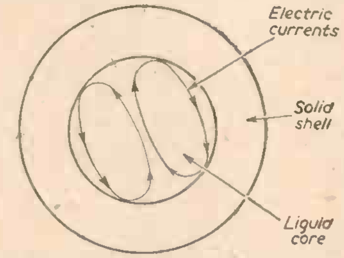
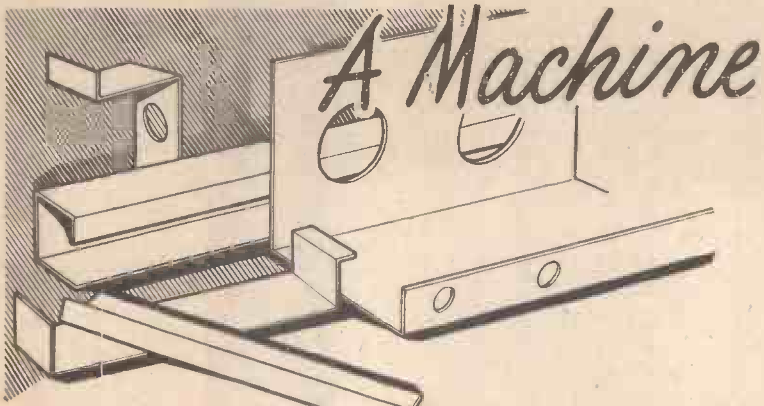


Fig. 5.—Structure of the earth suggested by Edmund Halley in 1692 to account for changes in the earth's magnetic field. (i) Outer solid shell having fixed N and S magnetic poles. (ii) Liquid region. (iii) Inner solid core again having fixed magnetic poles, but rotating with respect to outer shell.
Fig. 6 (Right).—Diagrammatic representation of electric currents in the molten core of the earth. These are possibly maintained by convection currents in the molten metal.



A Machine for Folding Sheet Metal

Constructional Details of a Simple Hand-operated Machine

By R. A. BARTHOLOMEW *(Concluded from April issue.)*

NOW prepare the clamp angle guides which are attached to the end angles. Two pieces of 1in. by ⅛in. strip are cut 4in. long and drilled 3/16in. diameter to dimensions shown in Fig. 7c. These are then screwed to the back of the angle with 2 BA by ⅜in. long round head screws, forming the back guide at each end. The front guides are cut from ½in. by ½in. by ⅛in. angle 4in. long. Drill three holes in each (for position of these see Fig. 7c) and cut off a piece of the drilled web from the corner at an angle of 45 deg. This is to clear the bearing blocks of the beam when it is swung upwards. These angle guides are screwed to the web of the end angle where the pin is mounted. The undrilled web of the guide should face the back guide.

A cleat for fixing the top angle is screwed to each end angle with two ¼in. Whitworth by ½in. long hexagon head setscrews. Made from 1in. by 1in. by ¼in. angle 2¼in. long, these cleats are drilled for each end, as in Fig. 7b. With the hinge pin and packer, clamp angle guides and top angle cleat assembled the end angles can now be painted and left to dry if desired. The pin should, of course, be left unpainted.

The Clamp Angle

This angle serves two functions, to hold the sheet metal firmly in the machine and to provide an edge round which the fold is made. Cut a piece of 2in. by 2in. by ¼in. angle to a length slightly under 19½in. and square the ends.

To form the blade mark a line on the inside of one web 5/16in. from the edge and then file this to form a chamfer along the entire length of the angle (Fig. 5c). Take 1/32in. off the sharp edge of this chamfer and again file to almost a sharp edge. Do not make this edge *too* sharp or undue wear of the blade will occur.

Drill the holes indicated in the sketch (Fig. 5a plan view). Those marked "A" are not used in the assembly of the machine but are to enable attachments to be bolted on when required. The two ¼in. Whitworth tapped holes at each end are for securing the lifting cleats to the angle. Two 1in. by ¾in. blocks are screwed to each end, overlapping the angle by ½in. These are the bearing blocks and should run freely in the guides fixed to the end angles. The blocks are tapped to take 5/16in. Whitworth setscrews, 1in. long (Fig. 5a, front view).

Lifting Cleat Assembly and Clamp Screws

The two cleats each consists of a plate 2¼in. long and two packers ½in. long cut from 1in. by ¼in. mild steel strip. Drill the plates and packers as shown in Fig. 5b.

There are two methods of making the clamp screws. (i) Using ½in. Whitworth threaded rod (termed "studding"), or (ii) using ½in. diameter plain bright mild steel rod. For both methods (i) and (ii) two lengths of approximately 8in. are required, and a hole is drilled and tapped in one end of each to take a ¼in. Whitworth by ½in. long countersunk screw. A ¼in. diameter hole is drilled through the rod at the opposite end, ⅜in. from the end. This latter hole is to take a "tommy bar" made from ¼in. diameter rod 4in. long. When method (ii) is used a ½in. Whitworth thread must then be cut for a distance of 5in., measured from the tapped-hole end.

Two washers are required, 1in. diameter and ⅛in. thick, with a ¼in. diameter hole drilled in the centre and countersunk to take a ¼in. Whitworth countersunk-head screw.

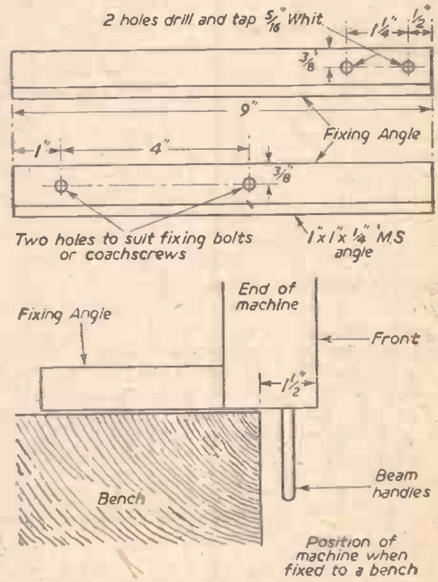


Fig. 8.—Fixing angles.

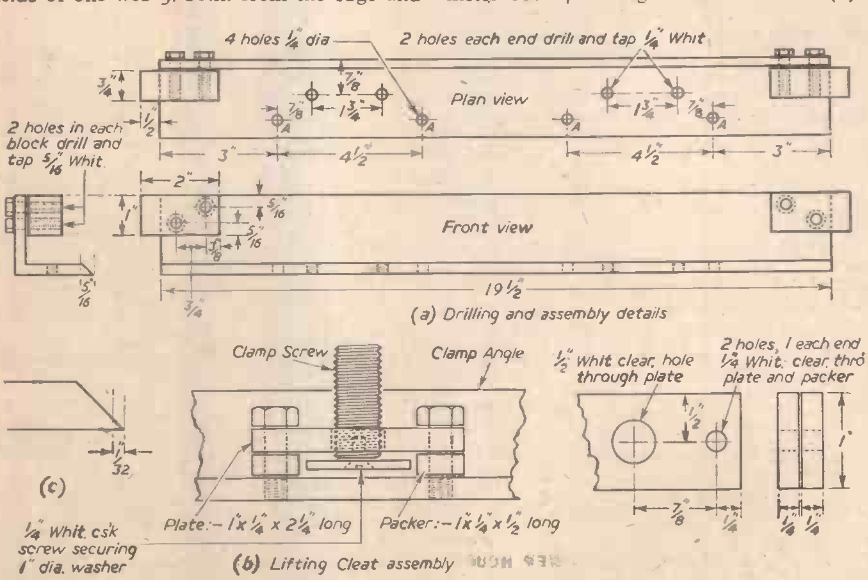


Fig. 5.—Clamp angle details.

The Beam Angle

Made from a piece of 2in. by 2in. by ¼in. angle, 19½in. long, this is drilled to take the two bearing angles and the front packing strip (Fig. 6a). Two ½in. Whitworth-tapped holes enable the beam handles to be secured. These are ½in. diameter rod 8in. long, threaded at one end (Fig. 7d). They are screwed into the holes tapped in the beam angle and locked with a nut on the inside.

To ensure that the beam is level with the bed angle and fits easily between the bearings, it is advisable to assemble the bed, end and bearing angles (as shown in Fig. 4a) before drilling and tapping the bearing-angle fixing holes marked X (Fig. 6a).

The Bearing Angles

Two pieces of 1in. by 1in. by ¼in. angle, 3½in. long, are cut and filed to the shape and dimensions shown (Fig. 6b). The packing pieces of 1in. by ¼in. strip 2½in. long should be drilled and countersunk and then fitted to the bearing angles before the ½in. hole is drilled. If possible this hole should be first drilled to 31/64in. diameter and then reamed out to the full diameter.

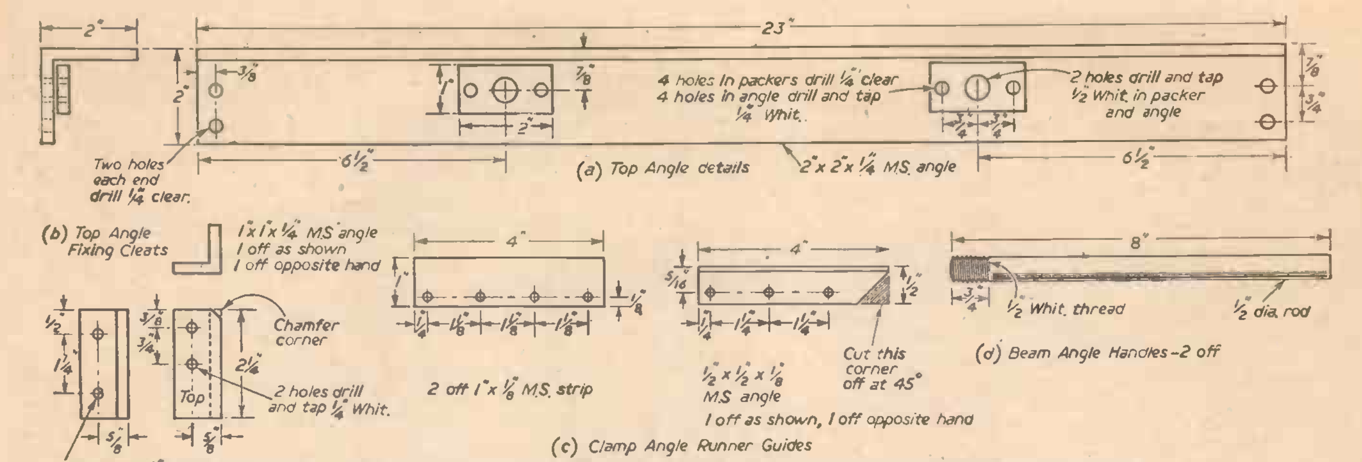


Fig. 7.—Top angle details and fixing cleats, runner guide details and handle details.

The Top Angle

This is simply a length of 2in. by 2in. by ¼in. angle, 23in. long, drilled to fit on to the two end angles and tapped to take the clamp screws. Packing pieces are screwed to the

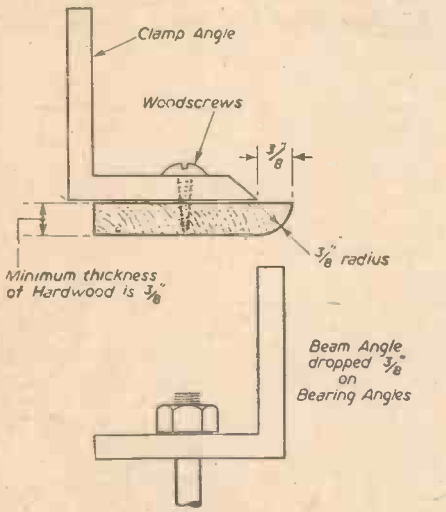


Fig. 9.—Suggested attachment for making ⅜in. radius folds.

angle to give extra thickness for these threads. (Fig. 7a.)

Fixing Angles

To enable the completed machine to be firmly fixed to a bench, two pieces of 1in. by 1in. by ¼in. angle, 9in. long, are cut and drilled as shown in Fig. 8.

Assembling the Machine

Before assembling the various parts should be painted, with the exception of the top web of the bed angle, the top edges of the beam angle and front packing strip, and running surfaces of the guides and clamp angle blocks and bearings. These should be kept lightly oiled.

Commence assembly by screwing the completed bearing angles to the beam angle with ¼in. diameter by ½in. long Whitworth setscrews. Slide the bearing pins of the end angles into the reamed holes in the bearing angles. (The other web of the end angles should face away from the beam.) Now turn the whole thing over so that the beam angle lies downwards and place the bed angle in position. The edge of the top web of this should just touch the inside and lie level with the top edge of the beam angle. Using 5/16in. diameter by ½in. long Whitworth setscrews, bolt the bed to the end angles with eight screws in the back, one in each end, screwing into the cleats already fixed on to the underside of the bed angle.

If care has been taken in drilling the various parts no trouble should be experienced in fitting them together. However, should the bed angle butt against the beam too tightly, thin packing strips can be placed between the web of the bed angle and the end angles before tightening the screws.

The clamp angle, with the bearing blocks screwed on to the inside at each end, can now be slipped between the guides on the end angles. A little lubricating oil should be applied to the guides and the blocks before assembly.

To assemble the top angle, clamp screws and lifting cleat plates, screw the clamp screws into the top angle, slide a cleat plate on to the screws and secure the 1in. washers to the end with ¼in. Whitworth countersunk-head screws. These screws must be locked by riveting over or centre punching the head, or they will unscrew themselves in use.

Place the assembled top angle in position on the two end angles and bolt the lifting cleat plates on to the clamp angle, placing two packers under each plate, using ¼in. Whitworth setscrews ¾in. long. The top angle is then secured to the cleats already fixed to the top of the end angles with ¼in. diameter Whitworth setscrews ½in. long. Finally, bolt the fixing angles on to the inside of the end angles with 5/16in. diameter Whitworth setscrews ½in. long. Before using the machine check to see that the ends of the screws do not protrude on either the

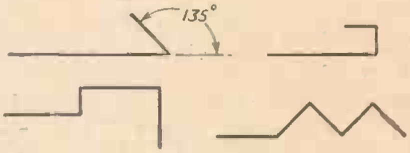


Fig. 10.—A few examples of sections which the machine will fold without attachments. Many other variations and combinations of these are possible.

underside of the clamp angle or the top of the bed angle. File flush if they do or they will mark the sheet metal and prevent correct tightening of the clamp angle.

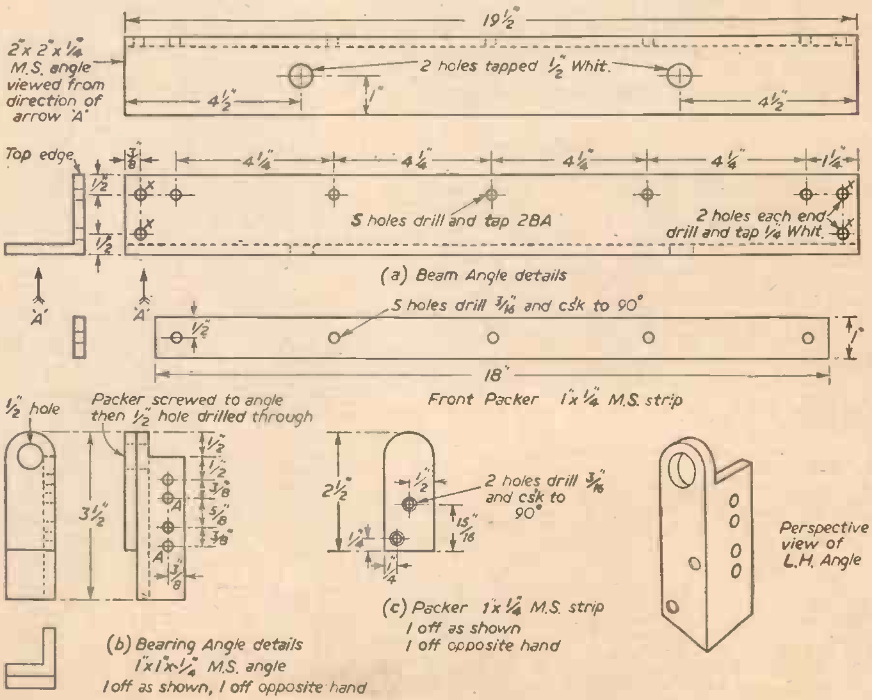


Fig. 6.—Beam angle details.

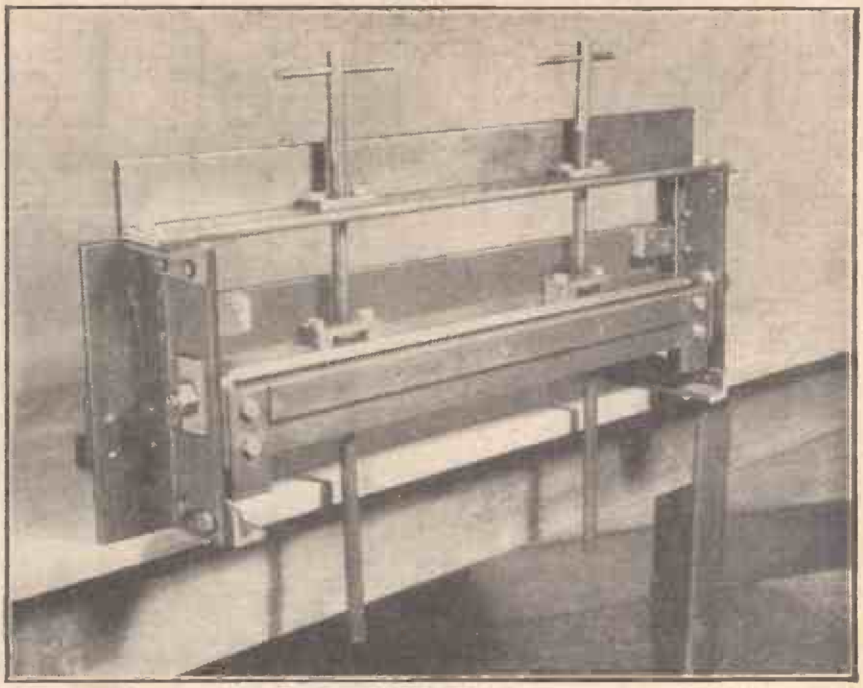
Using the Machine

The sheet metal is placed between the bed and clamp angles and the screws tightened securely. The beam is then lifted by the handles to whatever angle it is desired to fold the metal. Various sections can be folded and a little experimenting will soon show its versatility. The front packer can be removed to enable smaller Z-shaped sections to be folded. Flanges not exceeding 1in. in length can be formed on three sides of a piece of metal without making special attachments by folding one edge and then placing it under the clamp angle block at right angles to the blade and folding the next fold, following the same procedure for the third.

To fold an edge to form a safe edge fold not more than ½in. to the fullest extent of the beam. Thin gauges can then be flattened under the clamp angle, but heavier gauges should be flattened with a mallet.

Attachments

It will soon be obvious to the user that various " tools " can be made to extend the range of work the machine will do. For instance, to enable radius folds to be made an attachment can be made from a piece of hardwood shaped as in Fig. 9, and mounted to clamp angle blade through holes marked A (Fig. 5a). The front edge should protrude ⅛in. past the front of the blade and the beam angle dropped, using set of holes (A, Fig. 6b) drilled for this purpose in the bearing angles.



A photograph of the author's completed machine.

Once built the machine will require little maintenance and really ambitious sheet metal articles can be made which hitherto it would have been unwise to attempt.

Moon Bridge Discovery

ON the fringe of the Mare Crisium, on the moon, is a newly found " bridge " which has now been added to maps of the lunar landscape, thanks to Dr. Percy Wilkins, 57-year-old director of the British Astronomical Association's lunar section. For it was he who discovered this " most extraordinary feature known on the moon to-day " with the aid of his 15in. back-garden telescope at his home at Bexleyheath, Kent. He had previously spotted a curved shadow thrown across the moon's surface by the sun. It lengthened as he watched. Dr. Wilkins, who began his lunar studies 45 years ago, knew that the strange shadow—first seen by an American astronomer, who died without registering an official claim—must be caused by the sun's shining above and beneath something shaped like a bridge. He trained his 15in. reflector telescope on the fringe of the Mare Crisium, a low-lying, desolate plain of 66,000 square miles. Here he found his bridge. It is so regular in outline that it looks like an engineering construction made of concrete. It is roughly two miles in breadth and 20 miles long.

A section of Dr. Wilkins' moon map showing position of the newly discovered bridge.

Dr. Percy Wilkins and his telescope.

Bridge Formation Theory

Astronomers believe that during cataclysmic changes ages past a solid barrier was formed at the spot, and a meteorite from outer space may have crashed through leaving the arch—or perhaps the centre part of the barrier may have eroded. Dr. Wilkins is now busy making amendments—beginning with the newly sighted bridge—to his huge map of the moon, started 16 years ago, which now fills the living-room of his Bexleyheath home.

New Diesel Locomotive

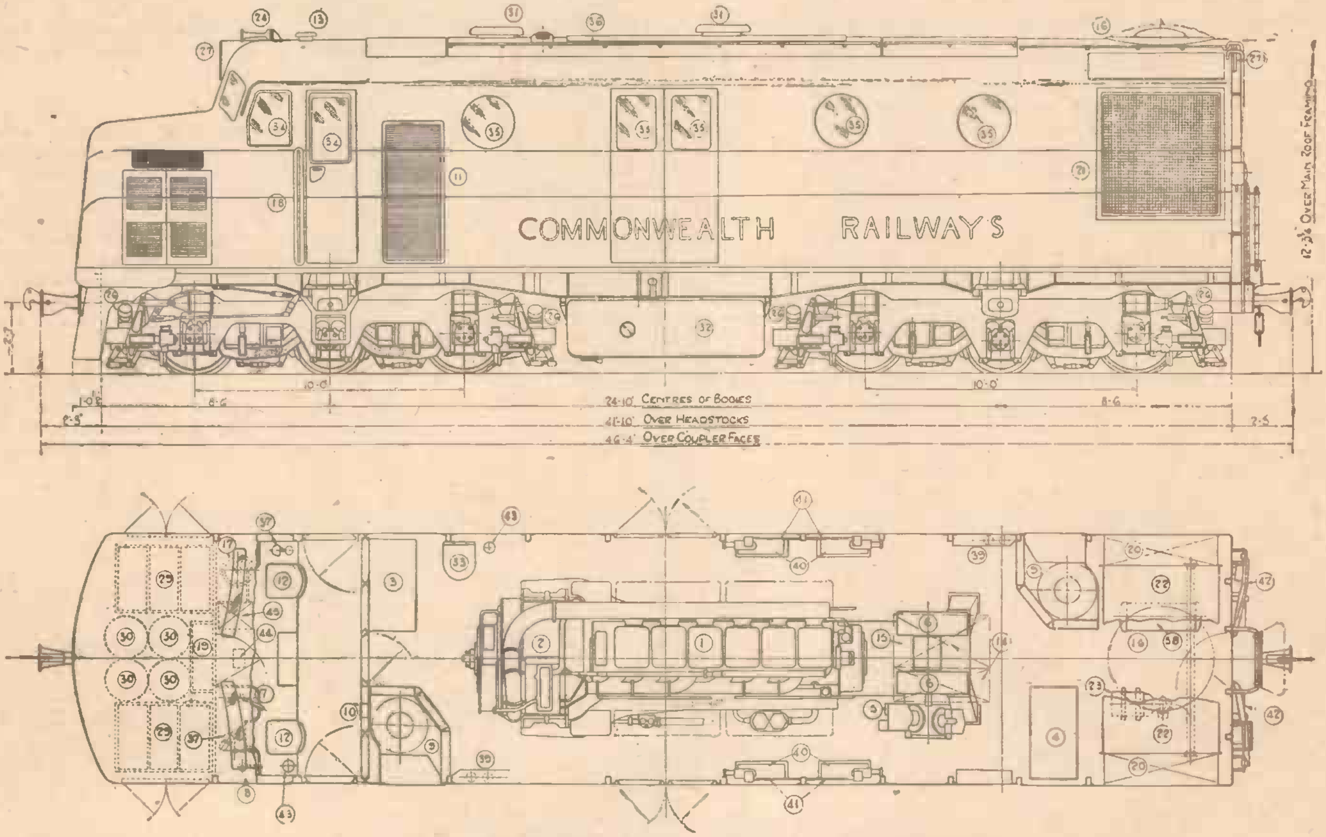
Made in Britain for Central Australia

THIS 1,000 h.p. 62-ton Sulzer-engined diesel locomotive for the Central Australia line of the Commonwealth railways was designed to haul 1,000 tons, without the axle load exceeding 10 tons; has a pressurised interior to keep the effects of sandstorms out of the machinery and the cab; is fitted with "black" lighting for night driving; contains a water-flushed w.c. for the engine crew; and has an automatic device to shut off power and apply the brakes if the speed exceeds 50 m.p.h. It was built by the Birmingham Railway Carriage & Wagon Co., Ltd.

Specification

Wheel Arrangement	AIA-AIA
Maximum weight in working order	62½ Tons
Weight with half fuel	61¼ Tons
Adhesion weight	41 Tons

The new diesel locomotive.



Detailed side elevation and plan view. The key is given immediately below.

KEY

1. ENGINE
2. GENERATOR
3. MAIN CONTROL CUBICLE
4. AUXILIARY CONTROL CUBICLE
5. AIR COMPRESSOR
6. TRACTION MOTOR BLOWER
7. CONTROLLER STAND
8. DRIVER'S BRAKE PEDESTAL
9. AIR FILTER CABINET
10. AIR FILTER TO CAB
11. AIR INTAKE LOUVRE
12. SEAT
13. ADJUSTABLE CAB VENTS
14. AUXILIARY WATER TANK
15. AUXILIARY FUEL TANK
16. RADIATOR FAN & MOTOR
17. HANDBRAKE
18. COMMODE HANDLE
19. CLOTHES LOCKER
20. RADIATOR
21. RADIATOR LOUVRE
22. WATER TANK
23. WATER PUMP & MOTOR
24. HORN
25. ENGINE EXHAUST
26. SAND BOX FILLER
27. HEADLIGHT
28. SIDE MARKER LIGHT
29. BATTERIES
30. AIR RESERVOIRS
31. ENGINE ROOM VENTS
32. FUEL TANK 700 GAL.
33. TOILET
34. DROP LIGHT
35. FIXED LIGHT
36. CATWALK
37. DEADMAN'S FOOT VALVES
38. CONTROL AIR RESERVOIR
39. E.P. MAGNET VALVES
40. LIFTING JACKS
41. TOOL SHADOW BOARDS
42. RE-RAILING RAMPS
43. FIRE EXTINGUISHERS
44. HOT PLATE
45. DRINKING WATER COOLER

Axle load (half fuel)	10¼ Tons	Carrying wheel diameter	30in.
Gear ratio	14/65	Length over headstocks	41ft. 10in.
Maximum tractive effort	26,800 lb.	Overall width	9ft. 4in.
Driving wheel diameter	36in.	Overall height	12ft. 9in.

Tractive Effort, one-hour rating 20,000 lb. at 11 m.p.h.

Tractive effort, continuous rating 15,500 lb. at 15 m.p.h.

Engine ... Sulzer 6LDA28 type, 955 b.h.p. on site at 750 r.p.m.

Making Transformers

The Design and Construction of Small Static Transformers

(Continued from the April issue)

MENTION should be made in passing of special cores, again more useful in radio work, which are composed, not of sheets or stampings, but of nickel-iron alloy in powder form. This metallic powder is mixed with a suitable binding material, after being carefully graded for size and granular formation, and then is pressed into the desired shape and heat treated. The avoidance of magnetic joints and the adaptability of this construction to difficult shapes of core is, of course, a valuable feature, but it is not a process that lends itself to amateur facilities.

Overlapping Stampings

Magnetic joints in a transformer core must be arranged so as to reduce air-gaps to a negligible amount. This is done by assembling the stampings in such a way that the joints of one layer are overlapped by the unbroken surface of the next layer. Fig. 14 illustrates this method. Here the succeeding odd and even layers are seen assembled with their joints alternately right and left, so as to avoid any serious interference with the passage of the magnetic lines. Another point to be noted in core building is that all bolting up studs passing through the stampings for clamping up purposes must be lightly insulated themselves to prevent contacting with the edges of the stampings, otherwise they will short-circuit them and defeat the object of lamination.

Obviously, the least expensive type of core is the one that can be built up from plain strips without the need for special tools. These can be built up after the manner of Fig. 6 (April issue) and a range of standard cores of standard dimensions arrived at that will cover the requirements of most experimenters. Each core will consist of two long and two short sides, all stampings being of the same width, sufficient being used to pile up to a depth equal to their width. The result is a core whose limbs have a square cross section when clamped up, which has the advantage that coils of circular section, wound in the lathe, can be employed, leaving small air spaces at the sides for ventilation (Fig. 15). The table of sizes (Table I) will be found very useful for those who have limited experience in working out their own designs, the output capacity of each sized core being also stated for all ordinary commercial frequencies, between 25 and 100 cycles.

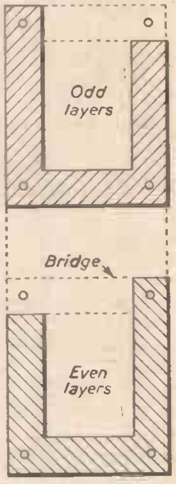


Fig. 14.—Showing method of overlapping stampings.

Output Obtainable

It will be noticed that the output obtainable from any core size in Table I, given below, is determined by the frequency of the circuit to which it is connected, that is the speed of the magnetic flux reversals. In this, a resemblance to the behaviour and output capacity obtainable from generators and motors will be traced; their outputs also largely depend upon speed, although in their case it is in the form of rotation of the armature instead of oscillation of the flux. Another thing to note is that although the weights and sizes of core specified are found to give satisfactory performances from extended use and trial over a number of years, it does not follow that they are the only possible dimensions from which these performances are obtainable. Larger and heavier iron cores with smaller copper coils could quite well be used to attain the same outputs, and vice versa. But in general there is a relationship to be found between the proportions of iron and copper which give best all-round results, and which entail the least expense in construction. When working at a definite flux density in the iron core of a transformer, the number of turns required in either the primary or secondary coil will depend on the cross sectional area of the iron, and on the frequency of the circuit. If a stalloy core has a sectional area of one square inch, for instance, and is working at a frequency of fifty cycles with an economical flux density, eight turns per volt would be required in either primary or secondary coils. If the core had a sectional area of two square inches, there would be twice as many flux lines as before threading the coils and, therefore, only four turns per volt would be necessary. If the frequency were doubled to one hundred cycles, only one half the turns required for fifty cycles are wanted; if reduced to twenty-five cycles, twice as many turns would be needed. These facts are included in Table II; the factor "Turns per Volt" will be found given for each of the core sizes appearing in Table I for all commercial frequencies between 25 and 100 cycles per second, and can be applied direct to all calculations of voltages for either primary or secondary windings.

Core No.	Inches A	Inches B	Inches C	Inches D	Section sq. in.	Weight lb.	Watts Output Continuous Rating 25 cycles	Watts Output Continuous Rating 50 cycles	Watts Output Continuous Rating 100 cycles	Core Depth in inches
1	4	2¼	1	7/32	1	3½	35	70	140	1
2	4¼	2⅝	1¼	9/32	1½	6	60	120	240	1¼
3	4½	3	1½	9/32	2¼	9¼	90	180	360	1½
4	5¾	3⅜	1¾	11/32	3	15½	150	300	600	1¾
5	6	3¾	2	13/32	4	22	220	440	880	2

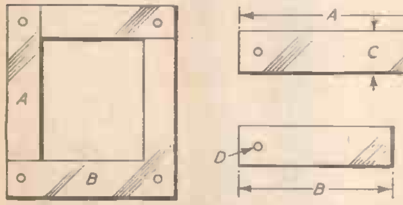


Table I. Particulars of transformer cores. (Left) Diagram showing forms of stampings.

Transformer Coil Calculations

Fifty cycles per second is almost universal for public services of A.C. supply nowadays, but the other frequencies mentioned were in constant use formerly, and are still sometimes met with. These two tables—I and II—enable the core dimensions and the turns per coil to be quickly arrived at in order to suit all specified output. For example, if it is desired to select a suitable size of core for a transformer to develop 50 volts 6 amperes on the secondary output, when supplied with an input of 230 volts 50 cycles, and so ascertain how many turns of wire there must be in each of the coils, turn first to Table I. Find the loading in watts by multiplying together the secondary volts and amperes; this is 50 x 6 = 300 watts. At fifty cycles frequency, Table I shows that core No. 4 is suitable for this rating. Next refer to Table II and this at once gives the turns per volt as 2.6. The primary coil turns

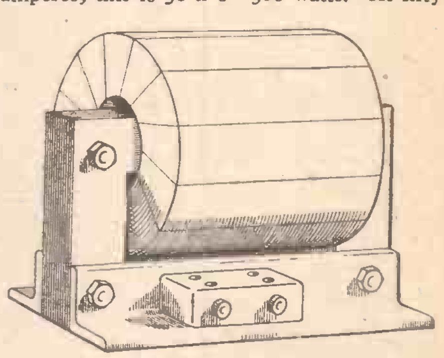


Fig. 15.—Stampings and coil assembled, showing air passage at the sides.

Core No.	Turns per Volt for various frequencies: 25 cycles	33 cycles	40 cycles	50 cycles	60 cycles	83 cycles	100 cycles
1	16	12	10	8	6.7	4.8	4
2	10.2	7.7	6.4	5.1	4.2	3.1	2.6
3	7	5.3	4.4	3.5	2.9	2.1	1.8
4	5.2	3.9	3.3	2.6	2.2	1.6	1.3
5	4	3	2.5	2	1.7	1.2	1

Table II. Transformer coil specifications.

S.W.G.	Dia. inches	Safe current in Amps.	Ohms per lb.	Yards per lb.	Turns per linear inch		
					Enamel covering	Single cotton	Double cotton
14	.080	7.54	.082	16.7	—	11.3	10.6
15	.072	6.10	.140	21.2	—	12.6	11.9
16	.064	4.82	.202	24.8	—	14.0	13.1
17	.056	3.69	.420	35.1	17.1	15.8	14.7
18	.048	2.71	.639	45.0	19.8	18.5	17.2
19	.040	1.88	1.32	68.8	23.7	21.7	20.0
20	.036	1.52	2.01	80.0	26.1	23.8	21.7
21	.032	1.20	3.23	107.4	29.4	26.3	23.8
22	.028	0.92	5.52	129.4	33.3	29.4	26.3
23	.024	0.67	10.22	191.0	38.8	33.3	29.4
24	.022	0.57	14.48	215.3	42.1	35.4	31.2
25	.020	0.47	21.19	275.2	46.0	38.5	33.3
26	.018	0.381	32.21	340.0	50.6	41.7	35.7
27	.0164	0.316	46.55	410.0	55.9	44.6	37.9
28	.0148	0.258	70.12	503.0	61.4	48.1	40.2

Table III. Winding tables for small transformers.

must, therefore, contain 230 x 2.6=598 turns, while the secondary will require 50 x 2.6=130 turns.

Gauges of Coil Windings

The next step is to decide upon suitable gauges of wire for the two coils, and Table II must be consulted, after first ascertaining the approximate value of current in each coil. The secondary current is, of course, already known by the specification as 6 amperes, and to find the primary current the loading in watts is divided by the primary volts, e.g., 300 watts÷230=1.3 amperes approximately. As a matter of fact, the input current will be slightly greater than this to allow for the inevitable copper and iron losses and a 10 per cent. increase will safely cover the requirements in this range of small sizes, so that the figure of 1.3

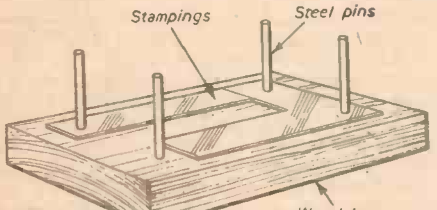


Fig. 16.—Simple jig for assembling stampings.

becomes 1.3 plus 0.13, i.e., 1.43 amperes for the primary current. Reference to Table III now indicates suitable gauges of wire for each of these current values, namely No. 20 for the primary and No. 15 for the secondary.

The complete specification can now be stated as follows:—

Rating:—Input, 230 volts 50 cycles single phase. Output, 50 volts 6 amperes, continuous rating.

Iron Core:—No. 4, Table I. Stalloy strips.

Secondary Coil:—130 turns of No. 15 s.w.g. d.c.c. copper.

Primary Coil:—598 turns of No. 20 s.w.g. d.c.c. copper.

If great accuracy is required in the voltage ratios a few additional turns should be allowed for on the secondary coil to compensate for drop of volts due to internal resistance when full load current is passing.

Workshop Hints

In conclusion a few workshop hints may be useful as regards handling the various stages in general assembly. The first step consists in building up three sides of the iron core, leaving the fourth side open for the time being, so that the coils can be mounted in position before putting in the bridge piece. The long studs used for bolting up the corners are fixed in an upright position at appropriate centre distances in a wood base and the stampings threaded on them in layers, the joints coming alternately right and left as in Fig. 16. When the stampings have been piled up to the required depth allowing for compression the nuts on the studs are tightened up and the partly built U-shaped core set aside while the cores are prepared.

Except for the very smallest coils, it is best to use cotton-covered wire as enamel coverings are so easily damaged by inexpert handling, and the slightest defect in the covering may lead to internal short-circuits and a general burn-out. One circular "former" does for winding both the secondary and primary coils. This is a fairly easy job in the lathe, the former being shaped as in Fig. 17, the body and one flange being in one piece, the opposite flange being loose and the whole held together by a long bolt through the centre. Note the shallow grooves running along the body corresponding with sawcuts made radially in each flange. This enables fine string to be threaded through the coil and tied securely in four places before removing the coil from its former, and prevents it from collapsing and losing its shape. Remember to wind the secondary on first, following this by the primary, placing at least two layers of 10mm. leatheroid sheet between them as insulation. Keep the turns even and closely wound; any turns that slip down at the ends in contact with the lower layers will have a tendency to break down owing to the increasing difference of potential which exists between layers as the coils build up.

Counting Turns of Wire

The most important detail is to keep an accurate account of the turns, and the best way to avoid mistakes is to use a "Veeder" counter attached to the lathe head which will indicate the exact number of revolutions made. When both coils have been wound tie them securely with fine twine, remove the loose flange and slide them carefully off the former body. A little french chalk applied to the latter before starting facilitates this. The coils must be thoroughly dried in an oven to expel any moisture and while still hot immersed bodily in a tin of suitable insulating varnish. Shellac is not advised, often being acid, and special insulating varnishes, such as "Ohmaline," are preferable. After all air bubbles have ceased to rise lift the coil out and let it drain well, then return it to the oven and bake out for several hours at about 180 or 200 deg. F. It is important that this is done before the coil is put to work as "wet" varnish is a frequent cause of breakdown. Remember when drying out that the varnish gives off a highly inflammable vapour and do not place naked lights near it.

The final treatment consists of wrapping the coil radially with cotton tape, half-lapped and brushing the surface over with one or two coats of air-drying oil-proof varnish. "Dry" coils (that is, unvarnished) will never stand up long without trouble, but the above doping process is well repaid in making a permanent job.

Finishing and Mounting

The finished coil after tapping is then ready to assemble over one of the long limbs of the iron core which should be first wrapped with two complete turns of 10mm. leatheroid. Finally, the bridge piece can be put in and the stampings clamped up by the

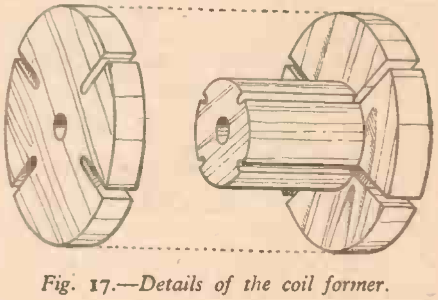


Fig. 17.—Details of the coil former.

studs and nuts, tapping them into line, if necessary, with a light wood mallet until flush on all sides and well squared up. Do not forget to insulate the corner studs by wrapping one turn of leatheroid round them as they are pushed through the holes.

For mounting the finished transformer angle-iron strips can be attached to the bottom of the core to form a foot as shown in Fig. 15. The two-way standard moulded terminal blocks make a satisfactory means of attaching the coil ends and at the same time providing means for connection to the outer circuit.

A NEW ROCK WOOL FACTORY

THE Rt. Hon. The Earl of Home, Minister of State for Scotland, recently performed the opening ceremony of the new rock wool factory at Stirling which provides a new industry for Britain in the production of a long fibre rock wool. All the raw materials are available in large quantities in Scotland and have never hitherto been used for this type of production. The main components of the mix to produce the rock wool are dolomite rock from Duror, on the south side of Loch Linnhe, in Argyll, and siliceous clay from Stirlingshire.

"Rocksil," as the new product is called by reason of its fine silken appearance, is an inexpensive form of heat, cold and sound insulation material made up into a great variety of forms suitable for the insulation of buildings, ships, road, rail and air vehicles, cold storages and industries in general where heat must be conserved to achieve maximum efficiency. Its manufacture is the second Scottish enterprise of the Cape Asbestos Co., Ltd., of London and South Africa. Last year this company jointly with the Johns-Manville Corporation of America installed large plant in a factory at Germiston, Glasgow, to produce "Marinite," an incombustible boarding for ships' joiner work.

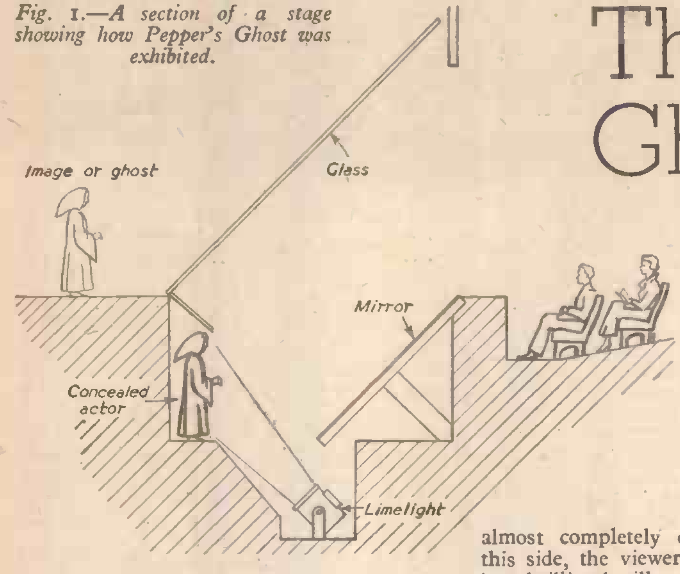


Fig. 1.—A section of a stage showing how Pepper's Ghost was exhibited.

The Pepper's Ghost Illusion

An Explanation of How This Illusion Works and Details for Constructing a Device to Demonstrate It

By F. W. J.

THE old Pepper's Ghost Illusion was exhibited in three continents in the last century and is so called after J. H. Pepper, a chemist and mechanical inventor. Although it was actually invented in its earliest form by one Henry Dircks, of Liverpool, Pepper very much improved it, and travelled with it in this country, in the U.S.A. and in Australia. It is a device which allows living people and "ghosts" to appear on the stage at the same time, and to act together. The "ghost" is the image of an unseen actor, produced by reflection at an unsilvered sheet of glass, which itself is invisible to the audience. The sheet is placed as such an angle that the image is correctly located. Sudden illumination of the unseen figure results in a dramatic materialisation of the "ghost," while a gradual or abrupt diminution of the light brings about its equally spectacular disappearance. Moreover, movement of the actor over a carefully measured "beat" results in the "ghost" walking through furniture, etc. (see Fig. 1).

An Elementary Form

A very elementary form of the illusion is not so well known as it might be. Place a sheet of window glass and two candles as shown in Fig. 2. The glass must be vertical and the candles as nearly the same size as possible. Light candle A and move it backwards and forwards until the image of the flame is located exactly on the wick of candle B. The illusion that candle B is in fact alight is now a very perfect one.

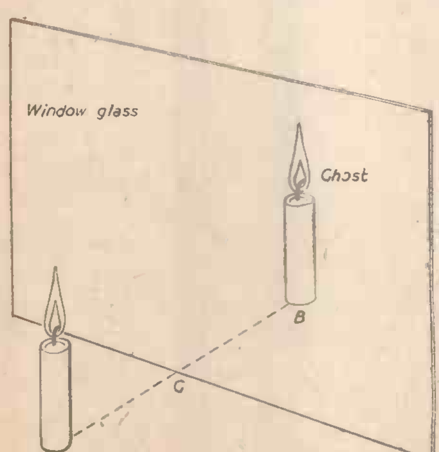


Fig. 2.—Candle flame illusion.

A Demonstration Device

A more elaborate form of this device is often used in showrooms. A substantial box or cabinet is provided with a hinged lid, and one of its sides is almost completely open; on looking into this side, the viewer sees the interior of the box brilliantly illuminated, and some object standing towards the back. As he watches, without any great change in the overall illumination, the object becomes less apparent, fainter, and finally disappears, having literally faded away. It reappears in the same manner. Alternatively it may be replaced by some other object. The transformation is recurrent and automatic (Fig. 3).

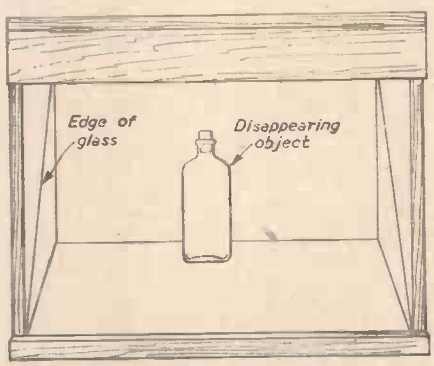


Fig. 3.—Front view of box.

Constructional Details

Such a box may be constructed as follows. Exact dimensions are the concern of the individual builder, but certain proportions must be maintained and these are indicated. The end panels must be square, for instance. Having cut the various sides, top, and base from substantial plywood, a smaller square DCFE is drawn on each end panel (Fig. 4). The diagonal EC of this square gives the line of slope of the invisible reflecting surface, a sheet of window glass. A second sheet of glass forms a horizontal platform as shown at DC. The glass is best set in grooves, but it is simpler to support it with small section square or rectangular beading. It is important that DC equals CF, and that angles DCE and CEF are 45°. The box, if it is a large one, may now be assembled and the lid fitted with hinges and a hasp. If it is small, it is better to complete the interior assembly first. In either event, areas AJHB and CHGF, walls, floor and lid must be painted glossy white. Area DCFE, sides and floor, must be painted *dull* black. The exterior should be stained and varnished or finished otherwise according to taste.

It is now necessary to arrange for the alternate illumination of areas ABCD and GHGF. This is accomplished by the rotation of a suitably shaped shade around a fixed lamp by means of a motor (Fig. 5). The speed of rotation must be slow, and there are several suitable government surplus motors with gear trains, advertised regularly. A ½lb. cocoa tin will make a shade for a 60-watt lamp of standard shape; a little more than half the tin must be cut away. A standard tubular lamp with a single bayonet cap fitting is better. A 60-watt lamp of this style is approximately 12in. long by 1½in. in diameter. A shade is made for it by cutting and bending aluminium sheet. This shade is mounted on a spindle, which can be of 3/16in. silver steel rod, and the brackets made of brass or steel strip, while the pulley can be turned up on the lathe. The end plate must be secured to the spindle by hard soldering or riveting and the shade riveted to this.

Next the lamp and shade assembly may be screwed into position, and tested for freedom of movement. The leads to the batten lamp-holder may be taken through the back of the box and may usefully be continued as two or three yards of flex terminating in a bayonet cap adaptor plug.

Testing

The apparatus is now ready for testing. Connect up the motor to the pulley. Place two suitable objects in position. The diagram shows two standard medicine bottles, one half filled with a dark liquid. Obviously, this must be the one in position F. Switch on lamp and motor, and adjust the position of bottle D until its image as it becomes visible exactly replaces bottle F. The effect in this example is that the visible bottle becomes alternately half filled and empty.

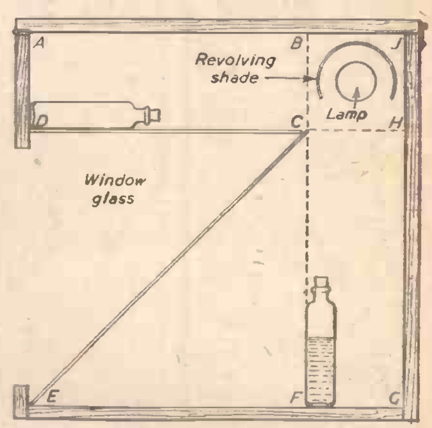


Fig. 4.—Section of box.

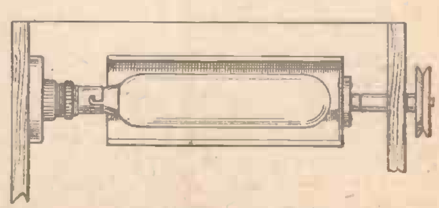


Fig. 5.—Arrangement of lamp and shade.

Small Wind Power Plants

Simple Methods of Building Small Wind-power Plants from Surplus Dynamos and Other Scrap Material with the Minimum of Tools

This series of articles was first published in "Practical Mechanics" in 1944, and are now being reprinted in response to readers' requests.

WINDCHARGERS are divided into two main classes—geared and directly driven. Geared units are so difficult to build without unusual facilities and depend to such an extent on the odds and ends of machinery available that no attempt will be made to describe their construction. On the other hand, a directly-driven dynamo must begin to charge below 500 r.p.m. to make use of light winds, so the choice of dynamo is fairly limited.

Choosing a Dynamo

Dynamos off old cars generally have a low charging speed, but are usually built for 6-volt working. A modern 12-volt dynamo does not cut-in before 900 r.p.m., but may be slow enough when used on a 6-volt windcharger. There are several advantages in using a 12-volt dynamo on a 6-volt circuit. Such a unit will be charging at currents up to 4 amps. in winds that would not cause the same dynamo to cut-in on a 12-volt circuit, and as summer months bring weeks of these light, steady winds the advantage is obvious. The heating effect in the field-coils is only one-quarter as great as it would be at 12 volts so there is practically no danger of the dynamo burning out. Also, since the magnets get, at most, half of their correct magnetic flux, the current will reach a maximum value of about 15 to 20 amps. and even twice the propeller speed will not cause much increase. This protects both armature and battery cells. Lastly, it is much cheaper to build a 6-volt outfit.

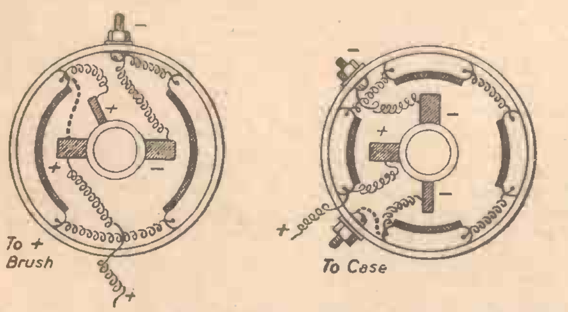


Fig. 1.—Diagrams explaining the removal of third brush from car generators. Dotted lines show new connections.

Cutting-in Speed

In choosing a dynamo there are certain points to watch that give a rough idea of its value for windcharging. Generally a slow dynamo has a large diameter case rather than a long one. The armature is wound with wire of about 18 s.w.g. for slow charging, whilst the faster ones have a 16 s.w.g. winding. There seems to be little difference in cutting-in speed between 2-pole or 4-pole construction. To test a dynamo wind a yard or two of string around the axle and give it a strong, steady pull. A sudden jerk should be felt as the dynamo gathers speed and after that it should only be possible to rotate it comparatively slowly with the string. After trying several different dynamos it is easy to judge which ones are slow. A fast dynamo will continue to gather speed until the string is nearly off before beginning to generate.

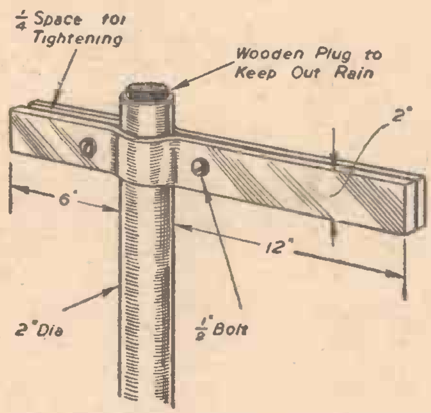
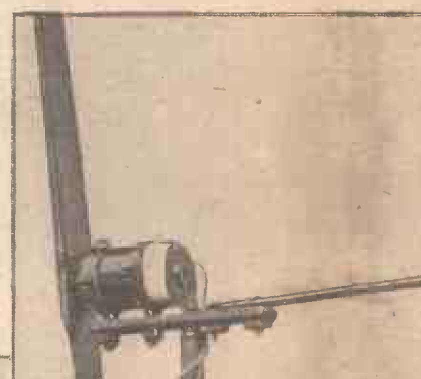


Fig. 2.—Method of making a simple turntable.

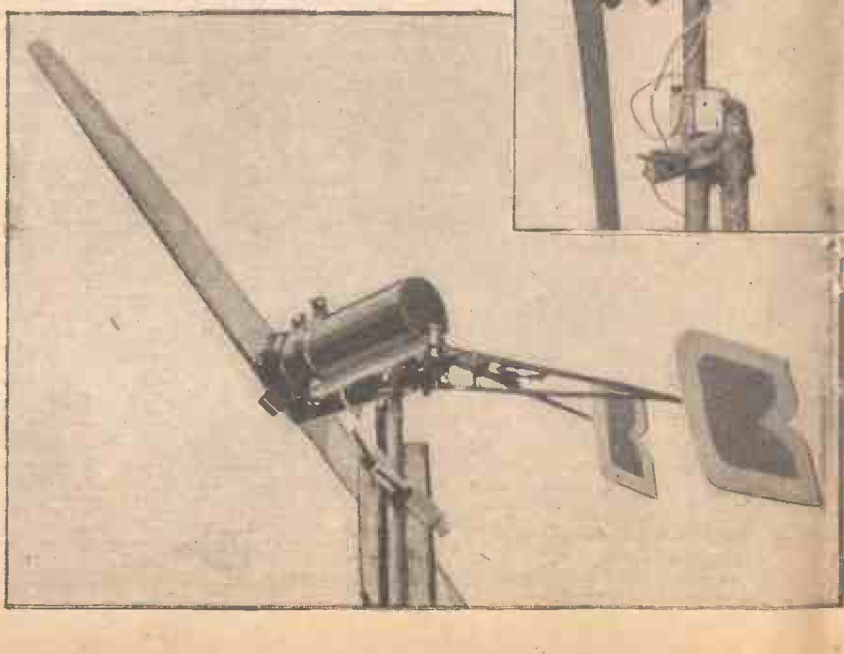
For comparison purposes remember that the maximum speed possible when turning a dynamo by hand is about 300 r.p.m. Commercial windcharger dynamos will charge at this speed, but no ordinary car dynamo would register more than one volt at 300 r.p.m. The dynamo should light a 12-volt 24-watt bulb easily when turned by string in this manner. See that it has good ball-bearings at each end and that the backward pressure of the wind on the propeller will not displace bearings. The commutator should show no sign of a groove where the brushes press. The axle must project far enough from the case and have sufficient screw-thread to allow for secure fixing of the propeller.

Overhauling the Dynamo

Dismantle the dynamo and remove any oil or carbon dust. If the mica insulation in the commutator grooves is level with the copper surface cut it down with a pointed tool. For windcharger work the third, or "regulation" brush, is removed to lower the cutting-in speed and to reduce wear. This brush is connected directly to one end of the field-coils, and is movable and usually smaller than the other two. Trace the field-



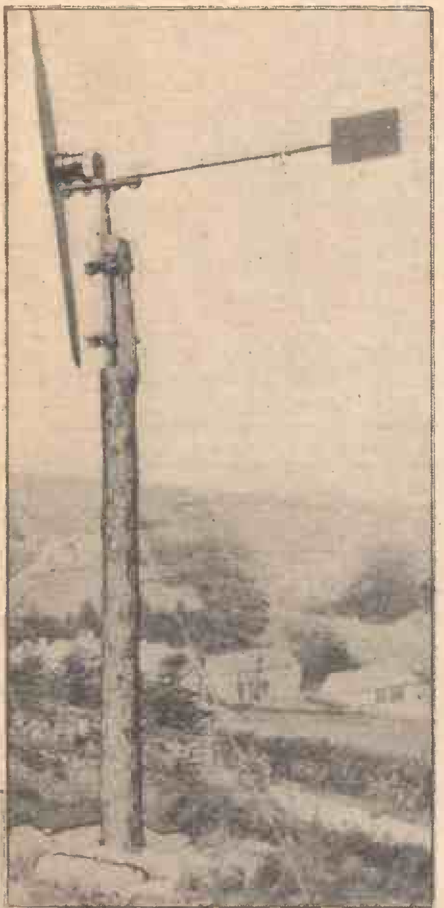
Right.—A view of the 6-volt windcharger described in the text, built with a Lucas C 45 A type 12.5 dynamo, cutting in about 450 r.p.m.

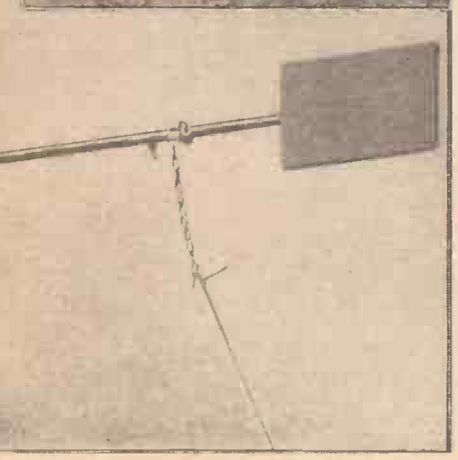


Right.—General view of the large model to be described in the next article. Full details for building and winding the dynamo will be given.

Right.—The windcharger suitably mounted several hundred yards from the house.

coil connection in series through the two or four coils and find where the end remote from the regulation brush is connected. In a two-pole machine it is usually earthed to the case, but with four-pole construction it will be joined to the main positive brush. Leave it where it is. Remove the other end





of the coils from the regulation brush and connect it so that the coils are across the two main brushes. The third brushholder can then be removed altogether. Fig. 1 makes this procedure clear, the dotted line showing the new connection in each case. Test the dynamo again with string.

It is useful to know that the direction of rotation of the dynamo is reversed by interchanging the ends of the field-coils, since it may be necessary to do this when changing from chain gearing to cog-wheel gearing. A dynamo which has been idle for long often fails to work because the trace of magnetism necessary to start the field current is absent from the pole-pieces. To remedy this connect it with correct polarity to a car battery and allow it to spin as a motor for several minutes. Finally, give the complete dynamo two or three coats of good enamel after making sure that all screw-holes or other openings are closed to moisture.

Turntable

The turntable is the part of the outfit most likely to cause trouble. Complicated fittings, for example ball-bearings, should be avoided and no timber should ever be used in the construction. The final details depend entirely on the material available and general constructional hints are all that can be given in an article like this. A convenient form of turntable consists of two lengths of iron pipe about 3ft. long and $1\frac{1}{2}$ to 2in. in diameter. They need not be a very accurate fit since a little rocking will cause no damage. The outside pipe is blocked by a wooden plug at the bottom to form an oil reservoir and can be fixed easily to a wooden pole, as shown in the illustration on the opposite page. The inside pipe is blocked similarly at the top to prevent the entry of rain (see Fig. 2).

To secure the dynamo to the inside pipe a cross-arm is needed. This can be made by putting semi-circular depressions in two 20in. lengths of flat iron bar. Pieces of farm-cart wheel-bands are suitable and any blacksmith will bend them to the required shape. The bars are clamped around the pipe as shown in Fig. 2, using two $\frac{1}{2}$in. bolts. They should be flat against each other on the long side, but have a clearance of $\frac{1}{4}$in. on the short side to allow for tightening. The long side should be long enough for the particular dynamo used. The dynamo is fixed to the turntable by a pair of bands shown in Fig. 3. These are made from any light strips of iron about 1in. wide and $\frac{1}{8}$in. thick. The turntable for the small windcharger shown was made with a solid iron bar instead of the inside pipe. It is attached to the flat cross-bar carrying the dynamo by means of a large nut and split-pin. It was part of an iron bedstead and had about $1\frac{1}{2}$in. of one end threaded. The tube carrying the tail-fin can be attached by small bolts to the short end of the cross-arm. It should consist either of light, circular tubing, or right-angle iron, to prevent vibrations being set up in it. Four feet is a suitable length for a small turntable.

The Tail Fin

The tail fin is made of any strong, light material, and is about 1ft. square. A bigger fin will put unnecessary strain on to the dynamo axle when changing direction due to the gyroscopic effect of the propeller. When mounted, the turntable is filled with heavy lubricating oil. Every constructor will find methods of his own for building a simple turntable, but the points given can form the basis for individual design. No mention has been made of slip-rings to carry the current from the turntable. During a year's continuous running with the windcharger illustrated, it was found that only once was it necessary to unwind the direct connections going to the dynamo. Heavy rubber-covered leads were used, sufficiently long to loop easily around the turntable pipe should the wind change direction by a complete revolution.

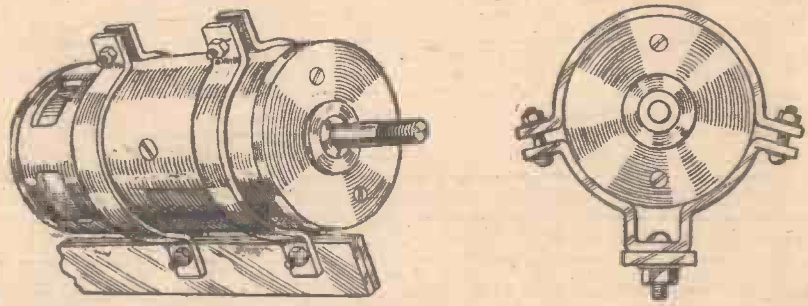


Fig. 3.—Showing methods of attaching dynamo to turntable described, and to a flat bar, as in the model illustrated.

Propeller Design

The propeller is quite easy to make, and provided the fundamental principles are adhered to, wide variations of slope and dimensions are possible. Details are given of two typical types, a very fast one for the small windcharger described, and a more powerful one, not so fast, for rewound or geared dynamos. After one or two attempts, the constructor will get the knack of propeller making, and will be able to introduce alterations. The first essential is a sound board of uniform thickness, with the grain running along the length. Douglas fir is

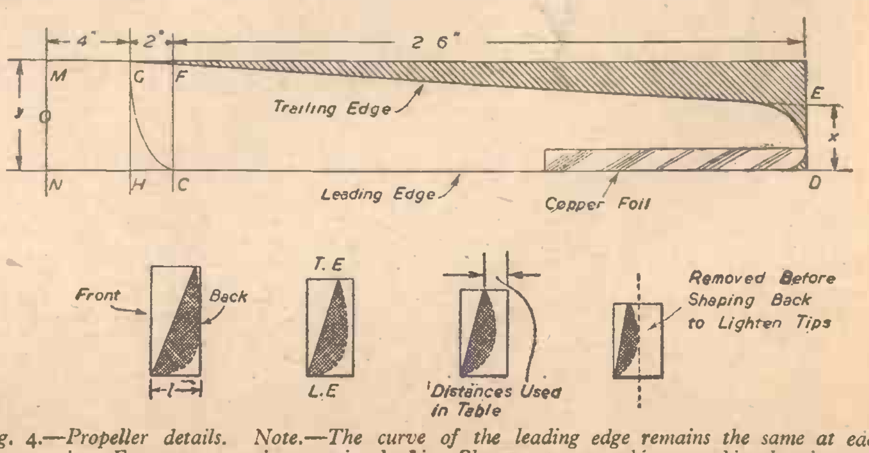


Fig. 4.—Propeller details. Note.—The curve of the leading edge remains the same at each se tion. F st type. $x=3$in., $y=4$in., $l=\frac{3}{8}$in. Slower type. $x=3\frac{1}{2}$in., $y=4\frac{1}{2}$in., $l=1$in.

the best timber, but well-seasoned ash is a good substitute.

For very high speed running 5ft. 6in. is a good length, but a 6ft. propeller is a better all-round source of power, and can easily be cut back a few inches if necessary. Both propellers described rotate clockwise. For the fast one, a board 6ft. by 4in. by ¾in. is needed, but the slower type needs a board 6ft. by 4½in. by 1in. Find the centre and drill a ¼in. hole for testing the balance by hanging the propeller on a nail in the side of the bench. The propeller should return to the horizontal from any other position, and it is essential that this test be done, and it only remains to shape the back for the lowest possible air-friction. The dotted lines on the cross-section diagrams show the final shape of the back surface, which is planed into a smooth curve with a blunt "leading" edge and decreasing rapidly away to a point along the trailing edge, the maximum thickness of timber being one-third of the width of the blade from the leading edge at all points. In order to reduce the weight of the outside portions of the propeller, and to maintain the correct proportion between thickness and width, some timber has to be removed from the back before shaping to the streamline section described. Lay the propeller with back uppermost and put two or three blocks of timber underneath the front face to act as supports, since the driving slopes will not lie flat on the bench. Plane the board, keeping a flat surface, until it changes from its original thickness at the end of each blade.

VERY FAST TYPE BOARD DIMENSIONS: 6ft.×4in.×¾in. x=3in.

Distance from centre of board	2	3	4	4½	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Distance from back surface on T.E.	.75	.75	.75	.25	.10	.06	.06	.06	.10	.20	.24	.26	.28	.30	.31	.32	.34	.36
Distance from centre of board	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Distance from back surface on T.E.	.39	.40	.41	.41	.41	.42	.42	.44	.50	.55	.57	.58	.59	.60	.60	.61	.62	.62

SLOWER TYPE BOARD DIMENSIONS: 6ft.×4½in.×1in. x=3½in.

Distance from centre of board	2	3	4	4½	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Distance from back surface on T.E.	1	1	1	.60	.50	.20	.10	.10	.12	.13	.16	.2	.2	.2	.22	.23	.25	.27
Distance from centre of board	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Distance from back surface on T.E.	.35	.40	.42	.43	.45	.49	.50	.52	.54	.60	.65	.70	.71	.73	.76	.76	.76	.76

and any deviation corrected after each separate operation in making the propeller. It is not sufficient to balance the finished propeller by removing some timber at random from the heavier side. Mark the board as shown in Fig. 4, and saw off the shaded portions, cleaning the saw cuts with the plane. Along either trailing edge, mark off from the table the distances shown, measured from the back surface of the board, and join them with a pencil line. To form the driving slope, the front of the propeller must now be planed down so that a flat, smooth surface connects the original edge CD of the board to the pencil line all the way along each blade. The space GFC can best be "scooped" out with a spoke-shave, but a small plane will also do. The flatness of the new surface is tested with the edge of a ruler, and should be fairly true all the way along. The cross-section of the board at various points is shown in Fig. 4. This completes the driving slopes of the propeller,

Protecting Propeller Tips

The streamline curve illustrated by dotted lines can now be worked on to the back of the blades. Cut the tips of the blades to the shape indicated, and the propeller is ready to be sandpapered. This should be continued, from coarse paper to fine, until the whole propeller has a glass-like surface. Particular attention should be given to the tips of the blade, where the speed is greatest. If a suitable piece of light copper or lead foil is at hand, the leading edge should be protected for the last 12in. of its length. The foil must be bent to fit the shape of the blade perfectly, extending back about ¾in. on the blade, and fixed by about six small wire staples, passed through tiny holes drilled through the foil and timber, and clenched on alternate sides. This protection is almost a necessity, since the timber comes to pieces along the leading edge after several months' working. Give the propeller at least two coats of good outside varnish. If the first coat is not properly hard before the second is added centrifugal force will drive the varnish into ridges underneath the layer formed by the second coat. Attach the propeller to the dynamo by whatever system is most suitable to the particular type used. Generally, a ¼in. plate held on the dynamo axle by the nut that secures the pulley wheel, and attached to the propeller by two ¼in. bolts spaced by about 4in. is quite sufficient. Small windchargers seldom need to be shut off to avoid over-charging, but a light rope can be left hanging from the tail to tie the machine perpendicularly to the wind direction, or to unwind the dynamo connections if they should ever become wound around the turntable. It is absolutely necessary that the whole installation be wired with the heaviest possible wire, and on 6-volt circuits there is no need to have covered wires, either outside or inside, provided there is no danger of opposite polarity wires touching. This makes possible the use of 7/22 bare aerial wire.

A small unit of the kind described above is only suitable for supplying a few lights in good wind areas, but on account of its simplicity and strong construction, it is practically trouble-free in use.

(To be continued.)

British Railways Training School

THERE are several schools run by British Railways, each specialising in various branches of railway work, for the further education of their employees. Among them is the British Railways Staff Training College at Derby, which has courses for permanent-way supervisors, works supervisors, civil engineer's clerks, bridge examiners, station masters, assistant controllers and stores staff. Courses last from one to six weeks, with fifteen to thirty on a course. There are eight permanent instructors at the college, who are supplemented by lecturers drawn from a panel of practical men holding positions of responsibility, who can talk to students on the various aspects of railway working in which they have specialised. The method of instruction at the College is the well-tried one of explanation, demonstration, execution and repetition. To apply this method it is necessary to be able, on the one hand, to demonstrate, and on the other, to permit the student to carry out practical exercises concerning (a) the equipment used in the safe running of trains, (b) the organising of train services and (c) the making of a timetable and its operation under typical changing circumstances, such as traffic fluctuation, late running of trains, mishaps, etc. To meet this need the college is equipped with a complete railway system in miniature. It is an electrically-operated gauge "o" railway and is situated in the Central Hall of the College, which measures 118ft. by 46ft.

An Electrostatic Motor

A Motor That Will Run Without Current

INSTRUMENTS operating on the electrostatic principle, such as the multi-cellular voltmeter, are more or less familiar to readers interested in electricity. In this instrument, relative motion between the two sets of fixed and movable elements, interleaved but insulated from one another, is occasioned by the well-known law of mutual repulsion existing between static charges of similar electric sign. The movable elements interleaved with and suspended between the fixed elements in the voltmeter take up a rotational movement for a portion of a revolution, until the repulsion effect is balanced against the torsion of a control spring, the deflection being indicated by a pointer on a scale calibrated in volts.

The idea may be developed a little further by suitably designing some of the parts in such a way that continuous instead of partial rotation is secured, resulting in a novel form of electrostatic motor apparently able to run without current, merely by maintaining high potential charges at suitable points where they can strongly react to one another.

Mr. James Wimshurst

Many years ago the late Mr. James Wimshurst, the originator of the famous "Wimshurst High Tension Influence Machine," made a crude model embodying the functions of an electrostatic motor of such types as above, which ran at high speeds when coupled up to one of his influence machines, and this model somewhat developed is presented here in workable form.

Any motor that will run without current would appear to be something of an anomaly. The present example is not just another of those constantly-recurring perpetual motion fallacies, nor can it be expected to develop power by itself without a corresponding input of energy in some shape or form from outside sources. Electrical power is measured in "watts," that is volts x amperes, but if this motor will run from static charges of high voltage alone imparted to its sectors, as it does in practice, without any actual flow of current taking place from positive to negative, where does one look for the watts necessary to give it any power output capabilities, since watts in electrical power terminology cannot be represented by either voltage or current alone? Possibly the solution to this problem lies in the fact that there is a minute transference of current taking place all the time to maintain the static charge in the sectors of the rotating element during their rotation, otherwise all laws as to conservation of energy would fall through.

The Motor

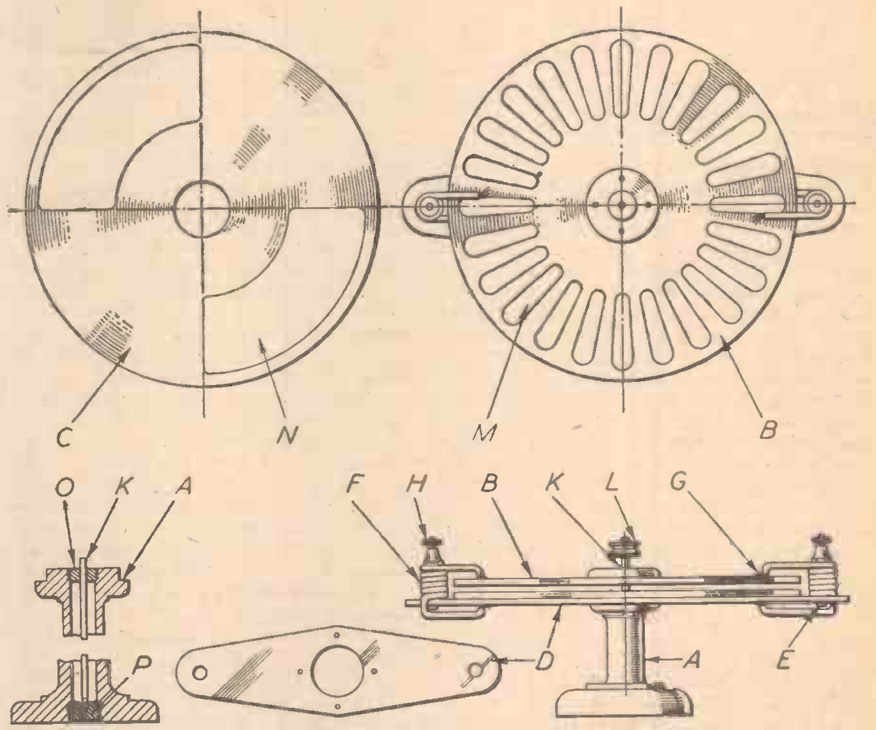
Leaving this rather nice point for the scientists to argue out, and turning to the practical construction, the accompanying illustration shows the motor to consist of two circular plates of insulating material, B and C, the lower one C fixed to a stand A, carrying on its under surface two large quadrants of metal foil N, while the upper plate has a larger number of smaller sectors M on its top face. The upper plate is carefully mounted to run as truly as possible on a silver steel spindle K, supported by a cup and cone bearing P at the lower end and guided by a metal bush O at the upper end. The details are shown enlarged in the bottom left corner of the illustration. On the underside of the lower fixed plate is a brush holder D of insulating material carrying two metal studs E which are finished off with terminal heads at H for connection to the outer circuit or high tension current supply. On each of the studs E will be seen a brush carrier F. This consists of a length of stout brass or copper wire close-coiled and of such diameter as to spring over the studs gripping them tightly. Each end of the wire is drilled up a short distance to take a few strands of fine copper wire (No. 38 or 40g.) or a short length of metal tinsel. These brushes G trail lightly on the sectors under them, both top and bottom.

The Plates

For the two plates B and C, also the brush holder D, either glass, ebonite or one of the various synthetic products now available for high tension insulation may be used. The chief essential is that the material should be quite flat and possess a high specific inductive capacity. One of the best materials is called "Tufnol" and is light and easy to work. For the sectors M and N, stout tinfoil is preferable. It can be secured to the plates by very thick shellac varnish or a strong tube adhesive. Hardwood makes a suitable material for column A, which requires to be accurately bored, threaded and fitted with metal bushes at O and P.

Fairly High Speed

When connected to a Wimshurst machine, a Leyden Jar, or a spark coil of reasonable size, the motor will be self-starting and will run up to a fairly high speed. Any two of the top and bottom sectors M and N, being similarly charged, will, of course, be repelled and rotation takes place in their endeavour to mutually separate as far as possible. Every successive sector on the top plate behaves similarly as it follows round, so that there will be a succession of repulsion impulses for the first quarter revolution. These charged sectors then begin to approach the quadrant on the lower plate oppositely electrified, and so experiences a force of attraction, increasing the torque. Once they have touched the opposite brush, however, their charges first become neutralised and then reversed to the same polarity as that of the large sector below with which the brush is in contact. From this point a fresh set of repulsion effects starts up for another quarter revolution, to be followed by attraction as it approaches the starting point once more. Thus there would appear to be six clearly defined cycles taking place during one complete revolution of each top sector: first repulsion, then attraction, then neutralisation; followed by a second set of conditions under opposite conditions of electrification, the process being repeated indefinitely.



Constructional details of the motor—plan views of the two circular plates and underneath these, a side view of the assembled machine. In the bottom left-hand corner is shown a sectional view of the silver steel spindle and the mounting.

POLAR TELESCOPES

General Principles and Detailed Instructions for Making a Small One

By E. W. TWINING

(Concluded from the April issue)

I CAN see no reason why the mirror should not be made of hard gunmetal, which is bronze or naval brass, and plated heavily with the metal, chromium. The chromium will be deposited straight on to the bronze or gunmetal; but it would be of no use to work up the surface of the metal mirror until it is optically flat and then just get it plated. It must be machined, ground and worked up to approximate truth, then plated with a heavy deposit and the final optical flatness given to the chromium.

To begin at the beginning: a wooden pattern must be made which will be sent to a foundry, and from this one or preferably two castings will be made; let the pattern be 7/16in. thick. Ask the foundry to cast in the finest hard gunmetal. Only one mirror is wanted, but it would be as well to make two and finally select the more accurate. When the castings are received take them to a machine shop, where there is a fairly new and accurate planing machine. Have both sides of each casting planed, and let it be done so accurately that the castings are perfectly uniform in thickness; there will then be no inequality in expansion and contraction later when the mirrors are subjected to great changes of temperature. Ask that the final cuts shall be with a finishing tool and very very fine, so that the surfaces already look almost polished.

Optical Flatness

Obtain three pieces of best quality polished plate glass, preferably 3/8in. thick and about 15in. square. These are to be used as grinding surfaces for the mirrors, but they must first themselves be ground true. Mark them on their edges: 1, 2 and 3. Then using a fine abrasive such as, first, Tripoli powder and then metal polish (Brasso) grind No. 1 on No. 2, No. 2 on No. 3 and No. 3 on No. 1 in rotation a number of times until it seen that all make perfect contact all over the whole of the faces.

Now turn the glasses over and do the same with the other three sides, but in this case bring them to a more brilliant polish with the finest rouge and water. All six surfaces should now be true, and the first three sides should be marked. On these first sides the mirrors are ground—first on No. 1 glass, then on No. 2, then on No. 3 and back again in rotation, but the fineness of the abrasive will depend upon the accuracy and finish of the machining. If anything coarser than the finest flour emery is wanted, and it certainly should not be, then it would be best to do the preliminary rough grinding on another bit of plate glass before going to the three prepared glasses.

When the surfaces of the mirrors are reasonably true and bright, have the plating done. The deposit should be at least .005in. thick. When the mirrors have the chromium on them they must be merely washed thoroughly; they must not of course be buffed nor any attempt be made by the platers to polish them. This you will do yourself upon the second sides of the three glasses and with the finest rouge in water. They may, to get the utmost brilliancy, be given dry treatment; obtain a piece of either the softest chamois skin, or failing that an optician's polishing cloth nearly as large as one of the three glasses. Sprinkle this with optical rouge through a sprinkler and spread it on the glass; stretch it tightly and pass the mirror over it for a few minutes, working it in all directions and letting the weight of the mirror do the polishing. In order to avoid raised spots by expansion around the edge, the metal must not be touched by the

(Continued on page 355)

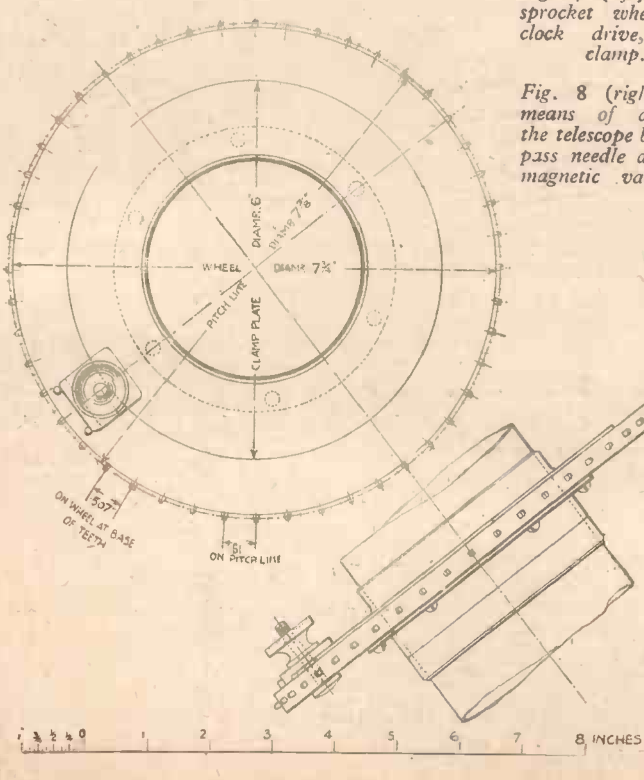


Fig. 7 (left).—The sprocket wheel for clock drive, with clamp.

Fig. 8 (right).—A means of aligning the telescope by compass needle and the magnetic variation.

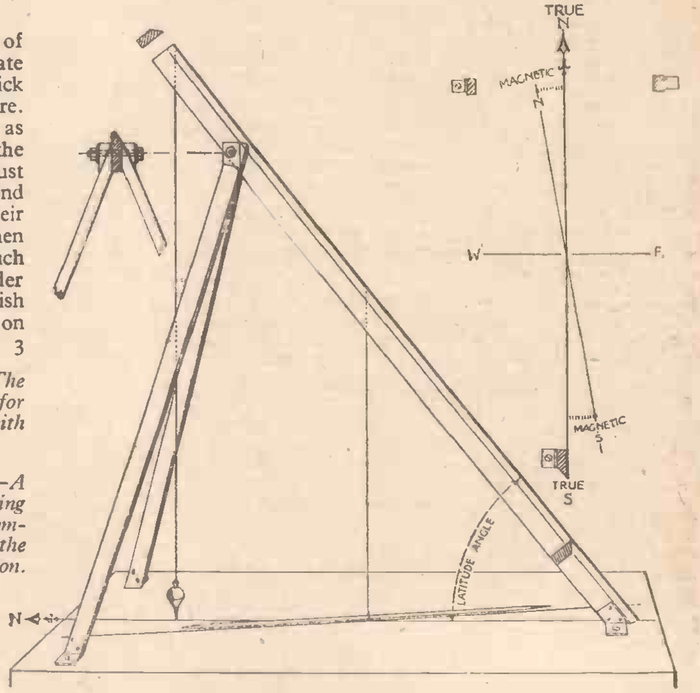
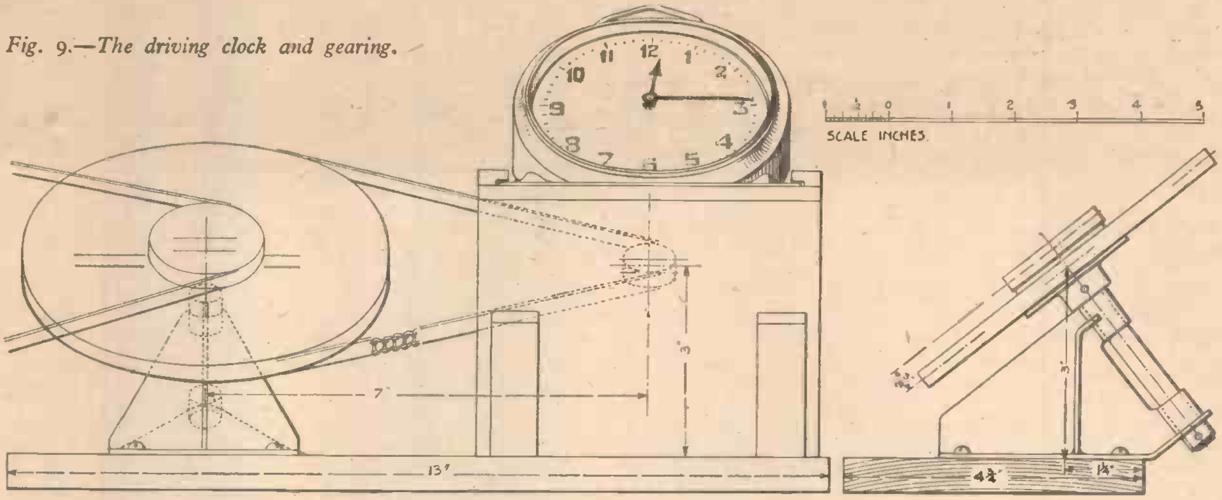


Fig. 9.—*The driving clock and gearing.*



(*Continued from page* 352)

hands of the operator; it will be quite a simple matter to make a pair of wooden forceps which will be wide enough to bridge across the width of the mirror; lightly grip it and slide it about on the cloth.

In Fig. 4, where the tray and the mirror are shown in cross section, the mirror is not resting on the bottom of the tray but upon a bed of soft material such as felt, a rectangular piece of carpet, or perhaps best of all three or four thicknesses of cloth which may be cut from an old suit or from tailors' patterns. This will ensure that the mirror does not flex under its own weight. The ends and sides of the tray must not grip the mirror and the bottom of the tray must be flat. The mirror must in effect be floating, for although it is small in length and breadth and $\frac{3}{8}$in. thick any inequality in the support would mar its optical flatness.

To complete the telescope itself the sprocket wheel shown in Fig. 7 must be fitted. This is a disc of 9mm. thick, aircraft quality plywood. The teeth can be formed by wood screws inserted accurately at correct pitch distance (.507 on the wheel), the heads cut off and the projecting parts filed to shape. The wheel must be free to revolve on a ring collar below and he held in place above by a flanged circular plate. On this plate a clamp is made to engage, the clamping piece being mounted on the wheel. This wheel takes the final driving chain from the clock, and like the declination wheels has teeth engaging with every third link of the chain.

The Setting Up to True North

I now come to the matter of setting up the telescope so that its axis points to the North Pole. If the telescope is erected in conjunction with a wooden hut, or shed, on a garage, or raised on some such support above the ground, there would be no difficulty since an opening could be cut in the roof, and with the optical portions, i.e. the object glass and eyepiece, removed sights could be taken through the tube to the pole star, allowance being made for the $1\frac{1}{2}$ deg. which this star is away from the pole. Such an opening could afterwards be left and a hinged shutter made to cover it. But in cases where the telescope is to be used outside of a room in a building and it is carried on a window sill, as in Fig. 2, then the pole is quite hidden from view by the rest of the building. So we must make use of a compass and the known magnetic deviation of the same to find the pole. An ordinary compass has too short a needle to be of much use, so we must magnetise a rod of hardened steel and use that as a compass, see Fig. 8. On the sill of the window, either at the side of the window in which the telescope is to be used or one adjoining it, a truly flat board must be screwed—a small drawing board will be ideal—and

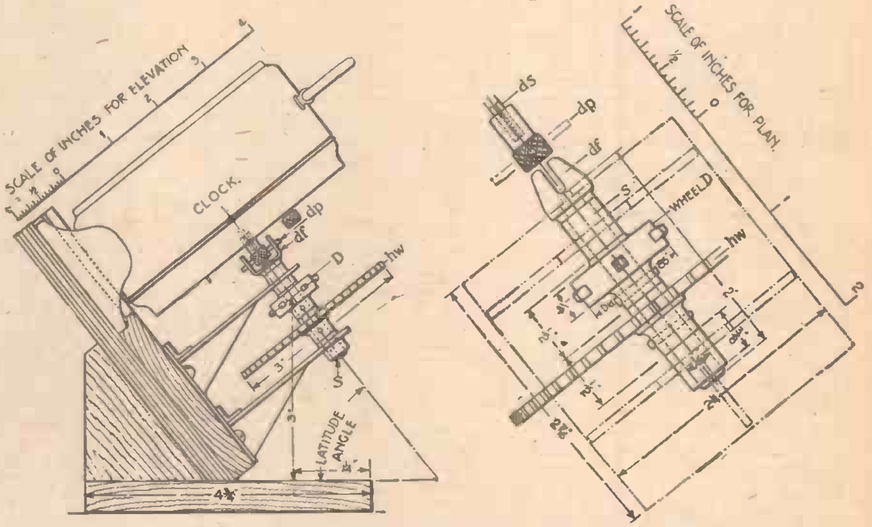


Fig. 10.—*Side view of driving clock and slow-motion hand-wheel with plan of drive.*

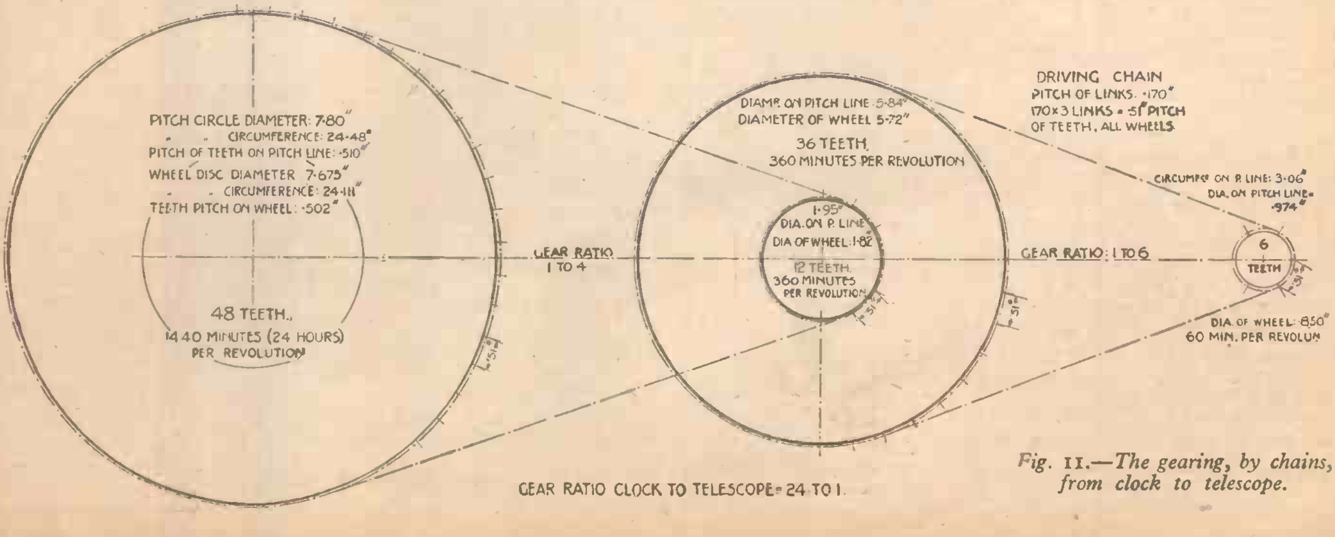


Fig. 11.—*The gearing, by chains, from clock to telescope.*

levelled up by means of a spirit level. Then make and erect on the board the tripod arrangement shown in the perspective sketch. The size does not matter, except for the fact that the bigger it is the better. The long bevelled top bar should be from 24 to 30in. long. The upper edge of this bar should make an angle with the baseboard equal to the latitude of the place. It is readily set at this angle by holding against it an adjustable set square, or failing that a piece of card on which the angle has been drawn from a protractor. Draw a long straight line in a slightly inclined direction across the board; this will be the line of the compass. Now get a piece of ⅛in. dia. round tool steel rod of any convenient length and form points at the ends. A steel knitting needle is just such a piece of steel and is readily pointed. This rod must be magnetised, which can be done by stroking it—always with one pole and in one direction only—with a powerful magnet, such as one from a motor-cycle or car magneto. The resulting magnetised needle is suspended, so that it is exactly balanced and neither end touching the board, by a fine silk thread from the tripod, as shown in Fig. 8; it will find the magnetic north. From the outer end of the main bar hang a small plumb-bob with its point nearly touching the board. Now, with the needle lying over the drawn line, swing the whole tripod around an amount which shall equal the deviation of the compass. Allow the needle to come to rest exactly over the line.

For the year 1954 the deviation of the magnetic north from the true north makes an angle at London of 9½ deg. west, and at Bristol 8½ deg. west. That is to say the variation is about 1 deg. for every 2½ deg. of longitude.

If the telescope is to be set up in or around London swing the tripod around on the board, keeping the centre of the needle on the magnetic pencil line until the plumb-bob indicates an angle of 9½ deg. Through this point and the centre of the needle suspension draw another line, and this will lie to the true north and south. It will follow also that the knife edge of the main bar of the tripod will be pointing to the true pole of the heavens.

Make sure that every setting is correct, and then through the metal lugs on the feet of the tripod insert screws to fix them to the board. From the knife edge of the long main bar sights and measurements can be taken to the telescope barrel, and if these line up at both top and bottom of both bar and barrel then the telescope should be pointing truly to the poles of the heavens.

The Driving Clock

We now come to the clock drive which is provided in order that the body in the heavens which is under observation shall be kept in the field of view continuously for just so long as may be desired. Although it is not generally considered to be a very accurate time-keeper I have chosen, as suitable for driving a 3in. telescope, an ordinary spring-driven alarum clock—the alarum is not wanted in this case and so I have not shown the alarum setting in the drawings. There are four things in favour of such a clock: it is cheap, it is readily obtainable, it is a powerful motor, and the escapement has such a high rate of speed that it will give 200 impulses to the spindle which we are going to use, every minute. This spindle is the extension at the back of the minute hand and the drive will be by a pin engaging with a fork, which pin is soldered in the knurled finger knob which is normally used for setting the hands.

Whilst I am, of course, aware that the movement of the telescope in right ascension should be continuous I feel sure that 200 impulses per minute, which is 3⅓ per second, would not impair the visual definition, and the interrupted movement would not be detected by the human eye, except perhaps when a high magnifying power is used.

The general arrangement of the whole assembly is shown in Figs. 9 and 10—the first being a front elevation with a side view of the intermediate spindle and its bearing, whilst the second is a side elevation of the clock, its mounting, and the driven gear-wheel and the slow motion hand-wheel by which the rotation is accelerated or retarded. The drawing on the right of Fig. 10 is a plan of the first gear-wheel and the hand-wheel. For the sake of clarity this is drawn twice the size of the other views. Both figures show that the clock and the spindle of the intermediate gears must be set at the same latitude angle as the telescope. The reason for this is, of course, that the final drive is to the telescope barrel and the driving chain must not be twisted.

Fig. 9 shows the clock and gears mounted on a baseboard, and this must be supported on a horizontal shelf bracketed to the wall on the right-hand side of the telescope. If it should be desired to disconnect the final drive chain from the telescope, in order to remove the instrument from its cradle when not in use, the clock board should be made to slide and so slacken the chain sufficiently to lift it over its sprockets. The clock is readily lifted off the first driven spindle and can then be used as an ordinary timepiece, though the regulator should be so set that the clock and telescope will keep sidereal time.

The Gear Wheels

All the gear-wheels except the first can be of 9mm. plywood, which must be of aircraft quality, bone dry, and after turning to correct diameters well coated with shellac varnish; they are made as already described—but the first wheel, because it is so small, had better be of brass and turned in one piece with the prolongations at each end as shown on the right of Fig. 10. I would suggest that it be bored to take the spindle and—at least the finishing cuts on the wheel where the teeth are to go—be turned on the spindle. The teeth can be either metal screws in tapped holes or plain round brass wire soldered in and filed to shape.

Fig. 11 is a diagram of all the gears, and this shows the times and revolution of each wheel, the diameters of the wheels and the numbers and pitch of the teeth; in fact it gives all the calculations which are required for the whole assembly. The diameters and circumferences of all the wheels involve some fine figures (some of them run to three places of decimals), but this is brought about by the pitch of the chain, coupled with the gear ratios required. I really know of no better chain that could be used than this one taken from a construction kit—and after all the three places of decimals given in a few cases are largely theoretical, and the sprockets and chain would work if the third figures after the decimal points were ignored.

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The above photo shows the packing department, where the finished pins are either stuck into paper sheets by automatic machines, as shown here, or are weighed into packets and boxes.

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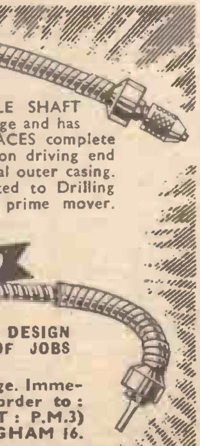

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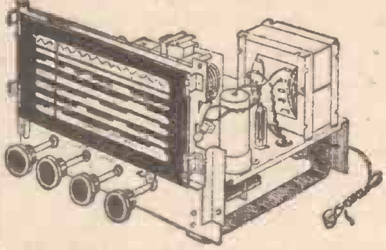

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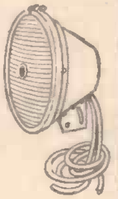

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Ex-U.S.A. ROTARY CONVERTORS, 12 volts D.C. input, outputs 500 volts 50 m/a., 275 v. 100 m/a. Complete with smoothing, **22/6** each, carriage 2/6, as new.

Ex-NAVAL ROTARY CONVERTORS, 110 v. D.C. input, 230 volts A.C. 50 Cy, 1 ph 250 watts output. Weight approx. 100 lbs., **£12/10/-,** c/forward.

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ELECTRIC LIGHT CHECK METERS, useful for subletting, garages, etc., all for 200/250 volts A.C. mains, 5 amp load, **19/-** each ; 10 amps, **22/6** ; 20 amps, **27/-** ; 25 amps, **32/6.**

METERS. Moving coil, 0 to 14 amps, 18/6 each. Ditto, Moving Iron, suitable for A.C. 0 to 30 amps, **25/-** each. Another moving coil, 100 to 250 amps, D.C., 35/- each, all 4in. scale.

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WELDER TRANSFORMER, 200/250 v. input, output 0/60/80 volts, 800 amps. Complete, on trolley, £25, c/fwd.

HEAVY DUTY BATTERY CHARGERS 200/250 volts A.C. input 36 volts, 36 amps D.C. output, £25 each, c/fwd.

400 WATT DIMMER RESISTANCES, Large Stud type, 30/- each, post 3/6 each.

Ex-RADAR TRANSFORMERS, 230 volts input, output 4 or 5 kV at 30 m/a., 6.3 v. 2 a., 2 v. 2 a., 4 v. 1 a., immersed in oil, capable of a larger output than stated, **£3/15/-** each, carriage 5/-.

LETTERS TO THE EDITOR

The Editor does not necessarily agree with the views of his correspondents.

Interplanetary Space Travel

SIR,—In his letter in the March issue of PRACTICAL MECHANICS Mr. W. J. Law makes several statements which in the interests of accuracy should be corrected.

He states: "In a vacuum no electricity can flow till the space is rendered conductive by heating the filament."

A flow of electricity may be defined as continuous movement of electrons from one point to another. In the case of conductors (usually metallic) movement is easy and high currents can flow, whereas in an insulator movement is difficult due to the atomic structure of the material, and little or no current flows.

Electrons can be made to pass through a vacuum provided that the emitting filament is correctly heated *and* there is some force of attraction acting on the emitted electrons, this being usually in the form of a collector plate or anode.

Neither the operation of heating the filament nor the provision of a positive attractive force actually renders "space" conductive. The two operations simply give a motion to the electron and this motion constitutes an electric current.

Furthermore, Mr. Law compares the passage of electrons through space with radiation of heat through the same medium. Comparisons at best are odious and in this case completely futile. The radiation of heat through a vacuum takes the form of an electro-magnetic radiation at a frequency in the order of 10^{14} c.p.s. The passage of electrons through space is not a radiation in the same sense.

In answer to the question "Can heat be freely radiated through a vacuum irrespective of the length of the vacuum's path or intensity of heat" I should like to point out that the sun manages to warm the earth adequately through approximately 93 million miles of space.—J. C. D. MARSH (Rayleigh).

SIR,—In spite of what has been said by C. Jackson (March issue, 1954) I maintain and am prepared to stand by my statement (January issue, 1954) that pressure set up by high-speed flying tends to immobilise the human body.

Being an aircraft engineer your correspondent ought to know that pressure under high speed, as is with the case in question, produces a corresponding rise in temperature since it is frictional, and to state as he does that this has no effect upon a pilot in an enclosed cabin seems to me to be very odd indeed.

Had I meant that the human body tends to become immobilised through high-speed acceleration I should have employed the word "compressibility."

Mr. Jackson's headache regarding the existence or non-existence of the flying saucer is undoubtedly one of high- (very high-) speed manœuvrability. However seeing that your correspondent fails to understand how the effects of very high-speed manœuvrability both upon the machine and the human pilot can be overcome, reference to his bucket experiment is no excuse at all for such lack in understanding.

All barriers that confront the very high-speed flying machine will be overcome when the fullest use of the two forces "centrifugal" and "centripetal" is made.

These two forces are produced by the "Flying Saucer." They are equal and opposite in direction, but, when required, a difference between the two forces can be had by altering one of them. Thus, when the flying saucer is hovering at one point, apparently motionless, the centripetal force can be considered to be equal to the centrifugal force which creates it, thus the flying saucer remains spinning at one point.

However, when the pilot (human) requires to move from one point to another he proceeds, by remote control (radio), to cause a difference between the two forces which, because they are equal, hold the machine at one point. The result of the difference made can be a one directional speed of anything from one to 60 thousand miles per hour. However, at whatever speed the flying saucer is travelling in one direction it also spins at a number of revolutions equivalent to that speed; thus it may be seen that the centrifugal force and its accompanying centripetal force are equal to any kind of manœuvre at any speed and at any time. Therefore, at all speeds of manœuvrability the pilot or pilots would experience no effects at all.

The need for aerodynamics as applied to the flying machine was created shortly after the Wright Brothers gave their demonstration to the world. Whereas the birth of the "Flying Saucer" became the death of aerodynamics; in so many other words, the flying saucer caters for the treatment of air in motion in all directions to its line of flight, whereas in motion the conventional type is "one directional" only.

My interest in space ships, etc., occupies a large amount of my spare time, but as much as I should like I cannot find interplanetary space travel, as yet, a possibility. My reasons being those concerned with the structure of the universe.—V. A. MILBURN (Sittingbourne).

Perpetual Motion

SIR,—I should like to comment on the letter of C. P. Thompson on perpetual motion in your February issue.

If the word perpetual is to continue to have its universally accepted meaning, then the motions to which he refers are so obviously not perpetual motions that it is difficult to understand why he continues to insist on so describing them.

I suggest that the minimum requirements for a motion to be classified as perpetual are that it should maintain its speed unaltered without relying on any outside energy source. Such a motion would in theory never cease.

I would add that physicists do not, as he appears to suppose, state that self generating perpetual motion is theoretically impossible. They simply state that such a motion would be an exception to the principle of the conservation of energy and, as no exception to this principle has ever been found, any attempt to find such an exception would almost certainly be unrewarding.—A. A. TYLER (Colchester).

Papering Over Glossy Paint

SIR,—Regarding the query of Wm. H. Secker (Deal), February, 1954, I should like to say that it is seldom satisfactory to paper over glossy, or any painted surface, because the paste will eventually attack the paint and cause it to "craze," the surface becoming like crocodile leather. This causes the paper to follow, resulting in splitting, particularly at the joints, taking six to twelve months to occur. On the other hand, any attempt to remove the paint by solvents will result in the solvent entering the pores of the plaster, to give trouble later on. The only method I have found by past experience to give reasonable success is as follows.

First coat the painted surface with hot jelly-size, to each half-gallon of which is added a good handful of plaster, such as Adamantine. The mixture must be kept hot and frequently stirred whilst applying.

When dry, the surface should feel rough, but if thought to be too rough, it may be lightly glass-papered. This operation insulates the paint from the paste and gives a "key" and absorption to the pasted paper.

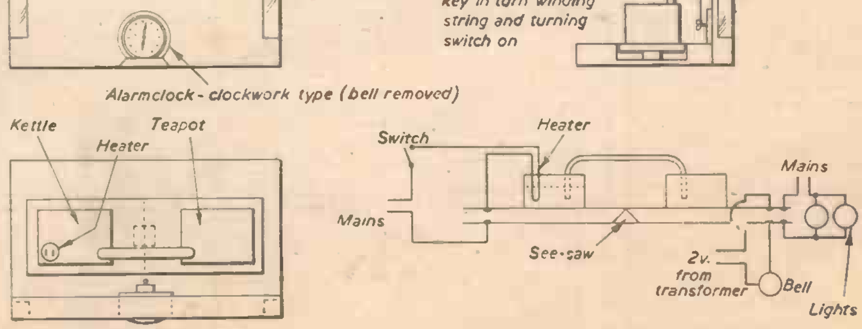
The next step is to paper the walls with a thin lining paper hung horizontally and running the full length of the walls. Joints should be butted.

When this is dry it will present an ideal surface for any kind of wallpaper, the joints of which will, of course, cross those of the lining paper.—W. H. POSTLETHWAITE (Malmesbury).

Tea-making Alarm Device

SIR,—S/Ldr. K. Herring (R.A.F., Northwood) should find the information he asked for in "Information Sought," January issue by referring to the drawings below.

The heater is the type used for a tropical fish aquarium and cost approximately 9s. 6d. The teapot and kettle may be two square tins



D. B. Raine's tea-making device.

of the same weight and the kettle must have a tight-fitting lid to ensure that steam pressure forces water from kettle to teapot.—D. B. RAINE (Morden).

SIR,—In reply to S/Ldr. K. Herring's letter in the "Information Sought" column of January's issue of PRACTICAL MECHANICS, the following are details of an automatic tea-maker which I constructed last year.

The electrical circuit is shown in Fig. 1. The alarm clock switch and lamp switch are originally at the off position, i.e., all contacts open. The mains, battery and boiler switches are on (closed).

When the pre-set alarm goes off, the alarm switch makes contact and the battery and heater relay are in circuit. This completes the mains supply and electric ring circuit and, at the same time, short-circuits the primary of the bell transformer. The alarm switch also completes the bell and secondary of the transformer circuit, and also the battery and lamp relay circuit. This completes the lamp circuit which is in turn short-circuited by the heater relay.

When the alarm goes off the only thing that happens is that the electric ring heats up. (The alarm hammer is removed from the clock so that one is not woken up by it.)

On the electric ring stands a boiler of greater capacity than the tea-pot. The water boils in it and syphons out, at the same time opening the boiler switch. This breaks the heater relay and battery circuit, which in turn un-short-circuits the lamp and bell transformer primary circuits. The electric ring dies down because the current drops. The lamp lights up, the bell rings, and the tea is made!

Upon getting up, the operator opens the battery switch and closes the lamp switch.

To prepare the tea-maker for operation

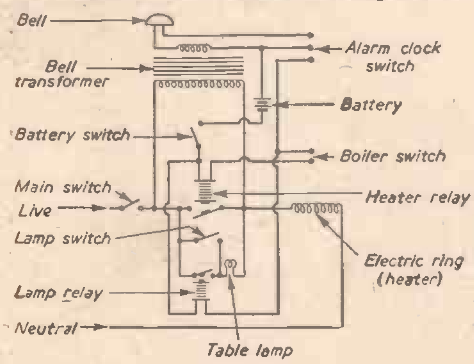


Fig. 1.—Circuit of W. R. A. Kirke's automatic tea-maker.

the boiler is filled, the alarm wound up, the lamp switch switched off, and the battery switched on.

The components used are as follow:—

Bell. The ordinary electric 3-8 volt type is suitable for A.C. working.

Bell-Transformer. 230 v. input 4-8-12 v. output.

Lamp Switch. 230 v. 1 amp.

Main Switch. 230 v. 4 amp.

Battery Switch. 2 v.

Battery. 3 v. cycle-lamp.

Table Lamp. Ordinary type, 40-60 watt.

Relays. To act off 3 v. high resistance. Gap wide enough to prevent arcing. Snap action.

Electric Ring. 1,000 watts, 230 v., spiral element.

Boiler. A tin with an air-tight lid will serve. A hole is drilled in the lid big enough to hold a copper tube which is bent as in the diagram and soldered in position. For the boiler switch I used an old piston and cylinder from a reciprocating steam engine, soldered to the lid with a hole to let the steam in from the boiler. The piston is controlled by a strip of thin clock spring, one end of which is

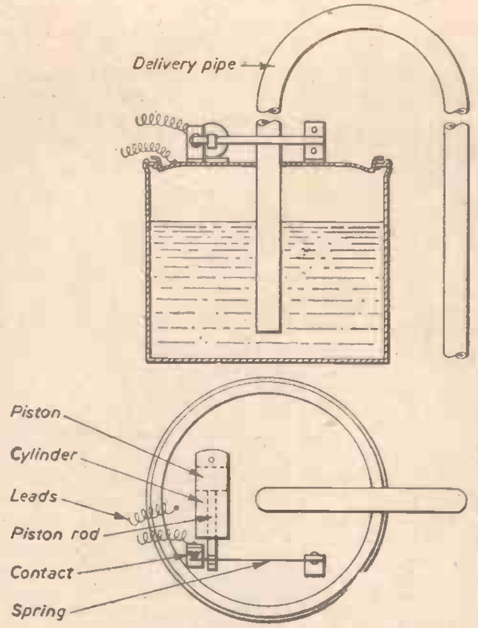


Fig. 2.—The boiler and switch mechanism.

fastened to the lid by a bracket, the other end contacting a point which is fixed, insulated, to a bracket also fixed to the lid. The spring must be adjusted so that when pressure builds up inside the boiler the piston moves out and breaks contact, making contact again slowly as the pressure drops. This arrangement may be seen in Fig. 2.

The alternative is to fix a switch under the tea-pot so that when it gets heavier the switch breaks. The latter is simpler, but less efficient.

The Alarm Clock. This should be the type in which at the pre-set time a strip of metal springs up and thus releases the hammer. The clock should be taken to pieces and the alarm train removed. The springy strip will still jump up at the pre-set time.

Two insulated stiff copper wire leads are bound to the frame in such a way that when the springy strip jumps up it makes contact with both leads. The third lead is attached to the frame of the clock.

I recommend that the clock and lamp be on long leads and not built in. This will ensure safety. The lid of the boiler should be also on leads at least 18in. long to facilitate filling the boiler.

The actual layout of the machine depends entirely upon the size and shape of the components available.—W. R. A. KIRKE (Somerset).

Boiler for Model Steam Engine

SIR,—I note the details you give to Mr. S. Hadden, of Nottingham, for a gas-fired boiler for his 1½in. bore 2¼in. stroke mill engine.

I feel sure a smaller and simpler boiler than the one suggested, i.e., 26in. by 13½in., would be suitable. Also, if he is going to fire it with a gas ring a water space fire box is not necessary as there is little side heat with a gas ring. In my opinion tubes of 1¼in. diameter are much too large and would allow the heat from the gas ring to escape too quickly. As many ½in. tubes as could be got in the space would be better.

As Mr. Hadden does not require his engine to develop any great power a much smaller boiler working at 25 to 30lb. say a plain vertical boiler 9in. by 14in. without a water space fire box, and ½in. or ⅜in. tubes between top and bottom plates and sufficient space at bottom for gas ring. The boiler could stand on three legs about an inch high and screwed to baseboard.

I see that Mr. Hadden mentions a horizontal boiler which I think would be easier to construct than the vertical boiler, i.e., a Babcock type boiler made from 4in. copper tube 15in. long with cast end supplied by Messrs. Stuart Turner, sheet iron casing, and four or five water tubes, fired by a suitable gas burner.

I have a mill engine myself of the same bore and stroke as Mr. Hadden's, with a loco type boiler 4in. diameter barrel, coal fired and arranged as an undertype engine. I get ample steam at 30lb.

I should be pleased to help Mr. Hadden in any way if he would care to get in touch with me.—W. C. LONEY (Axminster).

Flying Saucers

SIR,—I have read with great interest your articles on "Flying Saucers," and have searched your "Letters to the Editor" pages to read the views of other people. R. J. Norman, of Belfast, is quite correct when he states that the photograph at the foot of page 165 in the January issue was taken by Carl Hart, Junior, on August 30th, 1951. It was one flight of many which passed over Texas on that night. The photograph at the top of the page, which you say was taken on August 30th, 1951, was actually photographed against the moon by George Adamski, on May 29, 1950—the date which you give for the photograph at the bottom of page 165.

I am sure that this was a mistake, and reference to Plates 2 and 3 in the book under discussion, "Flying Saucers Have Landed" will soon prove my point.

E. S. H., of Romford, is only one out of the many astronomers who have seen those points of light on the moon. To those who are still sceptical, I say—have you ever tried to photograph any certain part of the moon, while that part is moving? This would account for the lack of actual photographs.

In your "Fair Comment" in the November, 1953, issue, you wonder why Mr. Adamski asked his companions to leave him just before he had contact with the man from the Flying Saucer. I think that the reason for this is made quite clear in the book. Old records show that "Flying Saucers" have landed, and taken off again with Earth inhabitants inside them. Surely this is reason enough for George Adamski asking to be left alone, for if all six were taken off, nobody would know that a "Flying Saucer" had landed. But if Mr. Adamski had been taken up alone, then his five friends could have told the world what had happened.

Returning to your March issue, W. Kohl, of London, R. J. Norman, of Belfast, and William Rodwell, of Suffolk, all seem to think that the photographs of the "Flying Saucers" are fakes. Perhaps they would like to know that all Mr. Adamski's photographs are processed by a reputable chemist, who says that if they are fakes, then Mr. Adamski is the world's best faker.

I would also like to say that Mr. Adamski has devoted his life to "Flying Saucers," so it is not surprising that he should see what the ordinary man would not see; and that Flying Saucers, or Vimanas, to use the name given to them by the ancients, have been seen and photographed by many other people. —J. W. SELWOOD (Newport, Mon).

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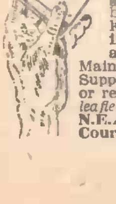

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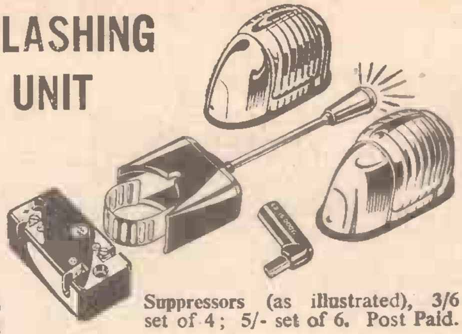

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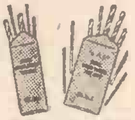

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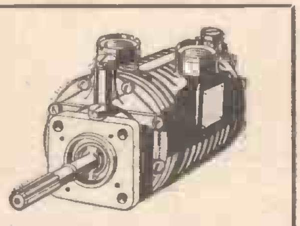

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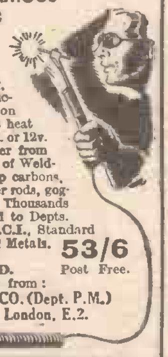

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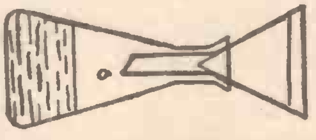

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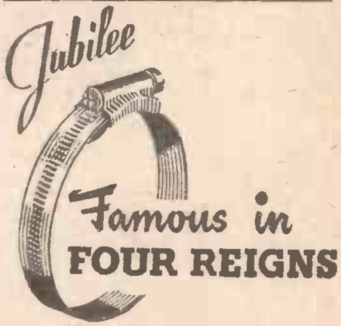

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Trade Notes

New "Utility" Craftsman Lathe

MESSRS. BLACK AND DECKER have just released details of their new lathe which is intended for use with either their "Utility" ¼in. drill or 5in. sander/polisher. The lathe is capable of accurate wood turning up to 2¾in. diameter, and 12in. in length. It will do face turning up to 5in. diameter, and many other useful jobs, such as sanding with a table attachment, grinding, buffing and wire brushing. In addition, the Craftsman lathe will do the work of a horizontal drill stand enabling the ¼in. Utility drill, or the 5in. Utility sander/polisher, to be used for stationary sanding, buffing and grinding. The price of the lathe is £5 5s. od., and further particulars can be obtained from Black and Decker, Ltd., Harmondsworth, Middlesex.

The Black and Decker "Craftsman" lathe.

Compton Products at the B.I.F.

DAWSON, MCDONALD AND DAWSON, LTD., Compton Works, Ashbourne, Derbyshire, will be occupying the same site as last year.

The Compton DPF spraying machine will be shown. The compressor is of the diaphragm type which ensures an air supply uncontaminated by oil, quiet running and simplicity. The gun normally supplied is a pressure feed internal break-up type, and has a container of approximately one quart capacity. A range of four easily interchangeable jet caps is provided, which enables a very large variety of work to be tackled. Compton diaphragm air compressors and vacuum pumps are also suitable for many industrial uses and have been supplied for a wide range of purposes.

The Compton "S" air compressor, which aroused considerable interest last year, will again be on show. This machine provides air for spraying, high pressure lubrication, tyre inflation, etc.

For the laundry and dry cleaning trades, the Compton "Airless" and A2 water spray guns are well known. They will be available for inspection and test.

An absolutely new product, the pressure-fed paint roller, was fully dealt with in last month's "Trade Notes."

Johnson Enlarger Time Switch

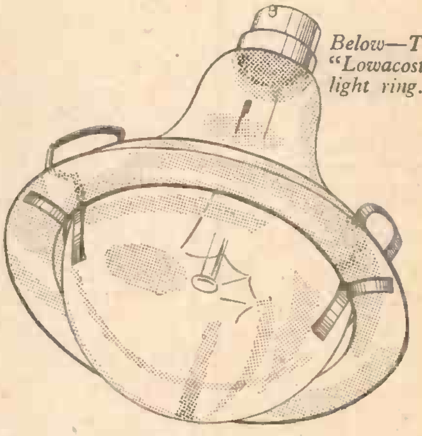
THIS handy photographic accessory is manufactured by the famous clock-making firm of Smiths, and world rights in it are held by Johnsons of Hendon, Ltd. The timer uses a clockwork mechanism and is very simple to operate. It is wired into the enlarger circuit by removing base and connecting up to terminals inside, the wiring passing through a special hole in the case. When the desired exposure is known the pointer is set by rotating the centre dial knob. There is an independent switch on the timer which allows the enlarger light to be switched on for focusing without disturbing the setting on the dial. This switch is finally left in the "off" position and then, when the printing paper is set, the centre top button is depressed. This switches on the enlarger light, moves the side switch to "on" automatically and starts the clock mechanism. The switch breaks the circuit and the clock stops at zero on the termination of the selected time setting.

The time switch is designed to work on A.C. current only, maximum load 3 amps. The switch is attractively cased in black plastic material and the dial is plain and easily read. The small rubber feet on the underside ensure that it stays in one place on the bench, and this is also aided by the instrument's design, particularly the flat base. The price, retail, is 45s.

"Lowacost" Light Rings

THIS device takes the form of a circle of crystal glass which is fitted to the normal lamp bulb by means of spring clips. It may be fitted at any angle, making it possible to lead the light radiation in any direction. The fitment also acts as a cooling ring. The theory is that this high grade crystal glass ring made in the form of a moulded prism makes it possible to catch the dispersed light rays of a lamp and force them into the required direction, and the makers claim that a 40 watt lamp fitted with one of these rings gives a C. P. brightness equal to a 100 watt lamp. The sole distributors are the Mercantile Marketing Co. Ltd., 22, Grosvenor Crescent Mews, London, S.W.1, and they will answer any questions as to local stockists. The retail price is 5s. 6d. each.

The Johnson enlarger time switch.



Below—The "Lowacost" light ring.

Club Reports

International Radio-controlled Models Society

THE International Radio-controlled Models Society will hold its annual international contests for radio-controlled models in Birmingham on July 10th and 11th, 1954.

The contests for radio-controlled model boats will be held on Saturday, July 10th, and contests for radio-controlled model aircraft on Sunday, July 11th. The aircraft sections of these contests, comprising a contest for power-driven aircraft and a contest for gliders, are held in accordance with the F.A.I. Regulations for International Contests.

Further details and entrance forms will be available soon, and will be forwarded on to anyone who may write for them.—H. CROUCHER, 27, St. Johns Road, Sparkhill, Birmingham, 11, England.

The Coventry Model Engineering Society

THE meetings of this society are held at the Centre Ballroom, Holyhead Road, Coventry, commencing at 7.30 p.m., and refreshments are available.

For the summer season the permanent railway track of 3½in. and 5in. gauge at the Memorial Park, Coventry, will be in use most week-ends. New members who wish to help run this railway will be especially welcome. We operate with the club loco. and are kept continually busy on fine days. The track is continuous and is 560ft. long. This year 2½in. gauge rail is to be laid.—Hon. Sec., L. J. N. SOUTHAM, 52, Sussex Road, Coventry.

Harrow and Wembley Society of Model Engineers

RECENT activities of this society include the following meetings:—On Thursday evening, April 22nd, a marine section meeting was held at the society's boating water, which is a section of the Grand Union Canal, where it passes under the Western Avenue (Uxbridge) about a quarter of a mile on the London side of the Oxford roundabout. A dinghy, built by the marine section, was available for use on the water. On April 28th, at 7.30, a lecture was given by Mr. Flemons on the "Preservation of the Tal-y-Llyn Railway," with photographic illustrations. Visitors are cordially invited to our meetings at Heathfield School, College Road, Harrow (opposite Harrow-on-the-Hill Station).—Hon. Sec., K. D. CARTER, "Hedgely," 4, South Approach, Moor Park, Northwood, Middlesex.

QUERIES and ENQUIRIES

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.

Making Composite Boards

I AM keenly interested in starting a business manufacturing commodities from sawdust and paper pulp. The articles I have in mind are (1) sheets made up of sawdust, glue and formalin for use such as plywood; (2) sheets made up of sawdust, paper pulp, Portland cement and whitening to form ceiling boards; and (3) sheets made up of sawdust, asbestos powder, Portland cement and whitening to form roofing material.

Do you consider the materials I propose to use suitable for the uses the finished article will be put to?

Would I need much heavy plant, i.e., power presses, etc.?

What would you consider the possibilities of such a business?—N. E. Brooks (Bristol, 4).

WE do not advise you to undertake the various manufactures which you mention, because such activities would only be commercially profitable if carried out on a very large scale. This would involve the consumption of rather high capital resources.

However, for your information we make the following comments: sheets which are made of bound sawdust and other fillers have usually to be formed in large presses. The binding agent in this case can be glue solutions or, alternatively, various solutions of synthetic plastic resins, particulars of which you would be able to obtain from Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey. Sheets compounded of sawdust and other fillers, together with paper residues, are far more satisfactory than those of sawdust entirely. These paper products, too, use similar binding materials to the above and are produced on similar lines, i.e., by means of light pressure.

The materials which you propose to use for your various manufactures are quite sound, but they will render a fair amount of experiment and trial necessary before you can devise the right working formula. We note that you propose to use mixtures of glue and formalin. This is not particularly good, for, in such an instance, the formalin will insolubilise the glue before the latter has had time to exert its binding powers. The correct procedure in all such cases is to bind first with the glue and then, when the product has set, to spray with formalin or to pass it through a bath of the latter.

Apart from mixing plant and heavy presses, moulds, etc., you would not need any really extensive plant for your manufactures. Yet these products are so changeable in popularities and uses that, unless you have ready markets for them, together with ample capital and manufacturing resources, we hardly feel inclined to advise you to enter into any such businesses on a mass scale. Such a recommendation, of course, should by no means debar you from "trying out" any manufacturing business of this nature on a small scale.

Lime Kiln Details

I LIVE in a hilly part of this country and own about 50 acres of "camp" in which there is a considerable amount of lime, which I wish to put to commercial use. Could you give me details on how to construct a lime kiln? The fuel will be logs of wood? How many hours has the lime to be burnt before being properly cooked?

In which form could I get the best returns for the lime: lump quicklime, ground quicklime, hydrated or slaked lime?

Could you tell me the proper manner of achieving this test? Would it be advisable to have this lime analysed to see the amount of calcium oxide it contains?—H. Catchwell (Argentina).

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.

NATURAL "lime" consists of calcium carbonate which, when heated, is converted into calcium oxide (this being true lime) with the evolution of carbon dioxide gas. One part of pure calcium carbonate, or limestone, after adequate calcination at red heat (about 700 deg. C.), produces 0.56 parts of calcium oxide (true lime) and 0.44 parts of carbon dioxide gas. Naturally, if the original limestone is in any way impure (as is usually the case) these figures will not be applicable.

Lime kilns are of varying designs. The average design for your purpose would be a stone- or refractory-lined, or even a brick-set kiln, containing iron trays or shelves, on which the limestone is placed. These shelves, or compartments, would be raised above iron firegrates on which the logs of wood would be placed and ignited. The time of burning of the limestone varies with the temperature obtained, the quality of the limestone and, of course, the nature of the fuel. All of these factors taking into consideration the actual size of the kiln. The lime should be heated to a temperature of 700 deg. C. for a period of anything between eight and sixteen hours depending on the purity of the product which is being calcined. If there is much clay present in the limestone, it will tend to prevent the reaction occurring and the lime produced will be said to be "dead burnt." Likewise, as is often the case, if there is much sand present in the limestone, a similar state of affairs will be set up. For this reason, it is really essential that you should get a representative sample of the limestone in question analysed in order that you may know accurately the precise proportion of calcium carbonate which it contains. This particular analysis may roughly be carried out by stirring an accurately weighed quantity of the limestone (say, a few grams of it) into a quantity of dilute hydrochloric acid (1 in 5) After the effervescence has died down, the sediment and insoluble matter (sand, clay, etc.) is filtered off, carefully washed on the filter paper, dried and weighed. The loss in weight when calculated as a percentage of the original amount of limestone taken, represents the percentage of calcium carbonate in the sample of limestone.

Likewise, it would be as well to have the limestone analysed for its iron content, since limes which are heavily contaminated with iron are detrimental for a number of technical purposes.

Before proceeding with your project it would be well for you to obtain a really good technical book on lime burning. Few of these have been published, but one such work which is known to us is entitled "Lime and Magnesia: The Chemistry, Manufacture and Uses of the Oxides, Hydroxides and Carbonates of Calcium and Magnesium," by N. V. S. Knibbs. This book was originally published in 1924 at the price of 30s. We believe that it is still in print and, if so, it will be obtainable from any good export bookseller in this country such as Messrs. Wm. Bryce, 54, Lothian Street, Edinburgh, Scotland, or from Messrs. H. K. Lewis & Co. Ltd., 136, Gower Street, London, W.C.1. A book such as this would not only be useful for preliminary study, but also as a volume for ready reference on various points as and when required.

Lump quicklime consists mainly of the product obtained by calcining limestone or natural lime. It consists of calcium oxide, CaO. Ground quicklime is simply this product which has been reduced to a fine powder and suitably graded by means of sieves or meshes. Hydrated lime is simply quicklime which has been slaked with water in shallow trays. It is a white powder which is sparingly soluble in water but, unlike the majority of solids, it is more soluble in cold water than it is in hot water. Chemically, it is composed not of calcium oxide, CaO, but of calcium hydroxide, $Ca(OH)_2$, that is to say, it is a compound of calcium oxide and water.

Quicklime has a powerful affinity or absorption-capacity for water. For this reason it is often employed as a potent dehydrating agent.

In conclusion, we feel that a close study of the many technical points concerning the

production and properties of the various limes is absolutely essential on your part. We cannot possibly deal with the many phases of the question, since these are all bound up very closely with the purity and character of the original limestone from which the lime and other allied products are to be produced. You will, we think, find all such information in a volume such as the one which we have mentioned.

Domestic Descaling Solution

CAN you please give me the information necessary for making a solution for removing scale from domestic utensils?—W. H. Davis (Hunts).

THE correct choice of a descaling solution for domestic utensils depends to a large extent on the metal of the utensils. In our opinion, dilute hydrochloric acid (1 in 6) is an excellent descaling agent, the dilute acid merely being poured into the vessels and then poured out again after a few seconds. During this time, the acid dissolves the scale but has not time to attack the metal. It would be quite safe to use the dilute acid with utensils of copper, steel or iron. Solutions of 1 part of caustic soda in 1 part of water are also useful, particularly when used warm, but all such alkaline solutions attack aluminium and zinc actively and should, therefore, be used with caution with such metals. Similar solutions of sodium metasilicate can also be used.

You will be able, we think, to obtain descaling salts direct from Sofnol Ltd., Greenwich, London, S.E. The materials above mentioned can be obtained from any firm of laboratory suppliers, such as Messrs. Griffen & Tatlock, Ltd., Kemble Street, Kingsway, London. Hydrochloric acid is quite cheap, but its rail transit is costly. Only the impure or technical acid need be used. Acetic acid at a similar dilution can be used instead. It is milder in action and less likely to attack metal.

Apart from dilute acetic or hydrochloric acids, you can use almost any alkaline solution for descaling purposes, such solutions including those of caustic soda, washing soda (sodium carbonate), sodium metasilicate and trisodium phosphate. You will be able to obtain the latter salts from Laporte Ltd., Luton, Beds.

Tar Oil Winter Wash

COULD you give me information for making tar oil winter wash for the spraying of fruit trees in winter?—H. W. Reed (Bucks).

THE tar oil washes to which you refer were first introduced from Germany in 1921. They were so successful that they have now developed into many types, depending on the precise tar oil which they contain.

On an average, all these washes contain 10 parts (by vol.) of any light tar oil (obtained from any tar distillers or gasworks) dissolved in 80 parts of paraffin or white spirit. This tar oil wash is sometimes sprayed neat on to the winter barks of the trees, or, sometimes, the oil, made as above, is stirred into soapy water, about a 50-50 mixture being used. In this case, it is essential for the mixture to be kept well stirred up, otherwise it will quickly separate into two layers, one of oil, the other of water.

Domestic Hot Water Installation

PLEASE tell me how an expansion pipe is fitted to a hot water system where the supply is off the mains. Is it necessary to install a tank and have gravity supply?—Daniel Keehan (Co. Limerick).

IN reply to your several questions, we think that the best thing we can do is to give you the enclosed layout of the usual domestic type of hot water installation. We think you will find all the information you require in this sketch. Note particularly that the hot water cylinder must be on a higher level than the fire boiler. Also, that the cold water supply cistern must be on a higher level than the hot water cylinder in order to effect a gravity flow of cold water to the latter. The expansion pipe which you mention is merely the curved pipe which bends over the cold water cistern. Its purpose is to accommodate any undue expansion of hot

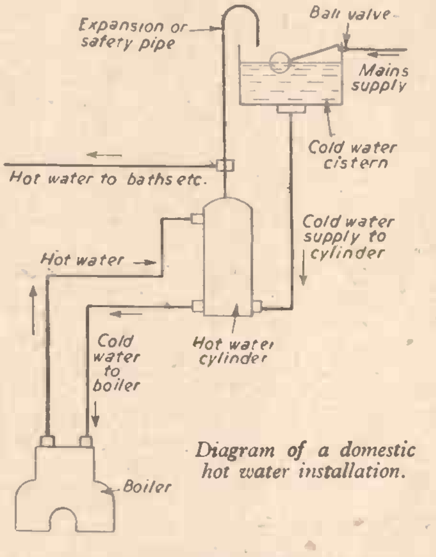


Diagram of a domestic hot water installation.

water in the cylinder and to allow the surplus water to be emptied into the cistern.

It is not absolutely essential to install a gravity water supply when the water is taken from the mains. Usually, however, this is done, as it should be in your case.

Damaged Film Perforations

I WISH to make a printer for making duplicate films of positive 8mm ciné films. As the claw striking edges of the perforations of the films I wish to duplicate have been damaged, and because of the matter of reversal involved, I assume that the film will have to be run through in the reverse direction to that normally projected, and that the printer will have to be an optical one. Can you please assist me?—Major F. van Niekerk (South Africa).

YOUR suggestion for a direct optical printing of the film in the reverse direction to the normal one is a sound scheme always provided that you can make certain of strict equality of exposure of the sequence of frames. In fact, from what you say, using your damaged film as it is at present, there is no other certain method.

The alternative is to reconstitute the damaged perforations of the positive film by careful repair work on the film. This is a tedious task, but it will render you able to make a duplicate print of the film in the normal manner. In a nutshell, what you have to do is to cut out from a piece of clear celluloid an entire perforation which is then cemented down over the damaged perforation. Or, perhaps, you may be able to find a clear strip of such perforations which could be cemented down over the damaged strip, using any clean film cement for the purpose. The slight streaks and markings shown by the presence of the dried cement will not show in the printed copy provided that the printing light falls flat on the film and is not focused obliquely thereon from one side.

Spraying Equipment and Explosions

I HAVE a two-cylinder piston type compressor feeding air into a small tank to which I have fitted a 0-100 lb. per sq. in. pressure gauge, and with a pressure release (spring loaded) adjustable valve at lowest point of the air receiver.

A friend has warned me that a small spot of grease can cause an explosion by entering oxygen flame cutting cylinders, so there is risk in connection with compressed air plant, due to the pressure and concentrated oxygen content in the apparatus.

The pressure I propose to use would be between 35-50 lb. per sq. in.

I have filled the sump of the compressor with sewing machine oil (to a suitable level). I have been advised the oil will not "froth." Is this oil suitable and what are the chances of an explosion?—G. Staples (Edgware).

WE do not consider that there is the least danger of an explosion occurring in your spraying equipment. Your pressures are far too low, and you seem to have provided quite adequately for automatic pressure release. It is true that small amounts of grease or oil can cause severe explosion or detonation in contact with compressed oxygen in the pure state, but you must remember that you are not proposing to work with pure oxygen at any pressure, whilst, as regards oil, the latter is an inherent constituent of all good paint, and you will not, therefore, be able to get away from it. Remember, too, that compressed air is commercially filled into cylinders at pressures far exceeding that of 100 lb. per sq. in., which is to be your maximum.

In general, there is absolutely no risk of explosion or detonation in your paint-spraying equipment. If you want to reduce the amount of frothing of any oil which you may be using, this is easily done by adding to the oil a few drops of octyl alcohol, a clear liquid which may nowadays be obtained from most chemical suppliers, as, for example, Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2. We think that the oil which you propose to use is rather thin for the work in view. A slightly thicker oil would be more suitable and would give rise to less wear of the parts, but in no case would explosion risk arise from the use of a low flash-point oil or from catalytic detonation of oil vapour in an atmosphere of compressed oxygen.

Oil for Pottery Underglaze Decoration

I WISH to make my own oil for mixing dry colours for pottery painting—the articles are to be fired after being painted. I should be grateful if you could tell me the nature of the oil used. I have been experimenting with raw linseed oil and oil of cloves, but this mixture is not satisfactory.—B. Lidderdale (Nelson).

THE usual oil for pottery underglaze decoration is a mixture of equal parts of high-grade raw linseed oil and genuine turpentine, as little of the oil mixture as possible being used for the grinding of the colours. The separate oils can be obtained from any dealer in artists' materials, or you may be able to obtain a specially-compounded oil for your purpose from Messrs. Wengers, Ltd., Etruria, Stoke-on-Trent, Staffs, or from Dryad, Ltd., St. Nicholas Street, Leicester.

If you use a linseed oil containing oil of cloves you will not get good results, for oil of cloves is not a drying oil. It will not dry properly under heat influence and will always tend to leave a sticky film.

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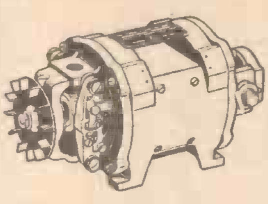

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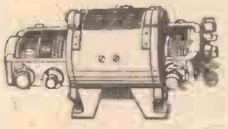

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Editor: F. J. CAMM
VOL. XXII MAY, 1954 No. 384

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COMMENTS OF THE MONTH By F. J. C.

U.C.I. Restore N.C.U. Recognition

THE recent U.C.I. Congress decided to restore sole recognition of the N.C.U., which a year ago it had lost to the B.L.R.C., because of the petulant tactics of N.C.U. delegates in walking out of the meeting. Whilst this new decision limits the authority of the B.L.R.C., its year of grace when it became the sole authority on mass start has enabled it to gain in stature and to enhance its prestige. For to-day the B.L.R.C. retains control of Britain's professional road men and under the joint agreement also the bigger proportion of amateur road racing.

This *volte-face* of the U.C.I. is typical of cycling politics in this country. Indeed, it was to be expected that the N.C.U. would not take its defeat lying down. That it has lost prestige notwithstanding the new accord is beyond all doubt, for in this country it must play second fiddle to the B.L.R.C., although so far as international events are concerned it is secondary to the N.C.U. The latter has stated through its president that it will grant licences to every League member who wishes to ride abroad, and this was the trump card used in the lobbying campaign which, again in strict accord with cycling politics, preceded the meeting. Both parties canvassed for support. The League indeed was pressing for a further year so that an entirely independent body could be formed. It is a pity that this was not granted.

In many respects both sides are back where they were, and so far from healing the breach, the recent decision is likely to widen it, for unless wiser counsel prevails each side will seek to strengthen its position, the N.C.U. to be the chief controller of professional road sport in this country and the B.L.R.C. to regain its lost position as the pre-eminent body. We are not surprised that the Italians, who last year supported the League, this year opposed them. The British nation has had experience of that turncoat policy.

It is now for the League to remodel its policy and to present a more united front than it has done hitherto.

The B.L.R.C. has asked the N.C.U. and R.T.T.C. to agree to an emergency meeting of the Joint Committee, in order that Clause 6c of the Tripartite Agreement can be implemented without further delay. This may have taken place by the time this issue is published. This clause relates to the formation of an overall body to accept U.C.I. recognition. This overall body should have been brought into being by December 31st, 1953, but at the request of the N.C.U. and the R.T.T.C., the B.L.R.C. agreed not to press for its formation immediately.

In view of the fact that the N.C.U. is now trying to use to its own advantage the U.C.I. affiliation accorded to it by the Joint Agreement under Clause 6a, the B.L.R.C. feels that it can no longer delay pressing for the implementation of Clause 6c.

Until such time as this overall body comes into being, the B.L.R.C. has the right, under Clause 8 of the Agreement, to issue its own International Racing Licence, and to accept invitations for events abroad.

Nonsense from the U.S.A.

THE Bicycle Institute of America, through its safety committee, recently stated that British bicycles are the cause of a growing accident rate in the United States. We are not as yet in possession of the evidence from which they have drawn this nonsensical conclusion which has caused some flutterings in the dovecotes of British bicycle manufacturers. The director of the B.C.M.U. had no comment to make on the report except to say that he could not credit that a responsible American association can have made such a wild, inaccurate allegation. He went on to say: "This safety committee is quoted as criticising the brakes of British bicycles because, they say, these need constant adjustment which the young people of America are unwilling to make. Well, then, British bicycles have been in production for more than 50 years. They are accepted today by almost every market in the world, and their fittings, including of course the brakes which are the result of years of development, are generally accepted as second to none. No criticism of them has come from any other quarter of the globe.

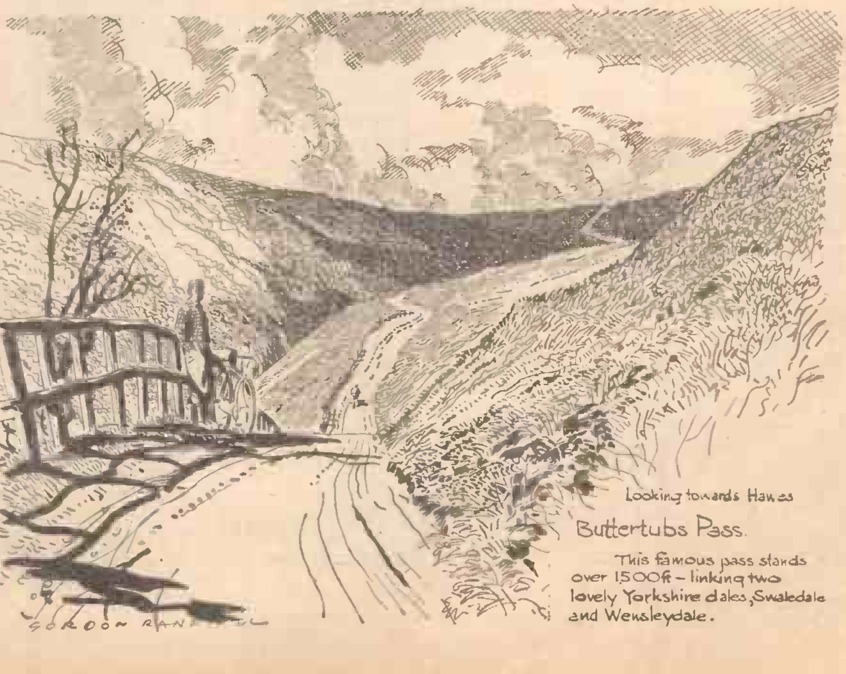
"Our British bicycles do very heavy duty in many parts of the world, notably in British West Africa, India and Malaya, where they have to stand up to extremely rough treatment. When I was recently in India, for example, I noticed that it was the rule rather than the exception for a bicycle to carry two fully-grown adults. If the so-called 'delicate' mechanism of our bicycles can triumphantly survive the treatment it gets from the natives of Africa and elsewhere, it can surely stand up to the youth of the United States.

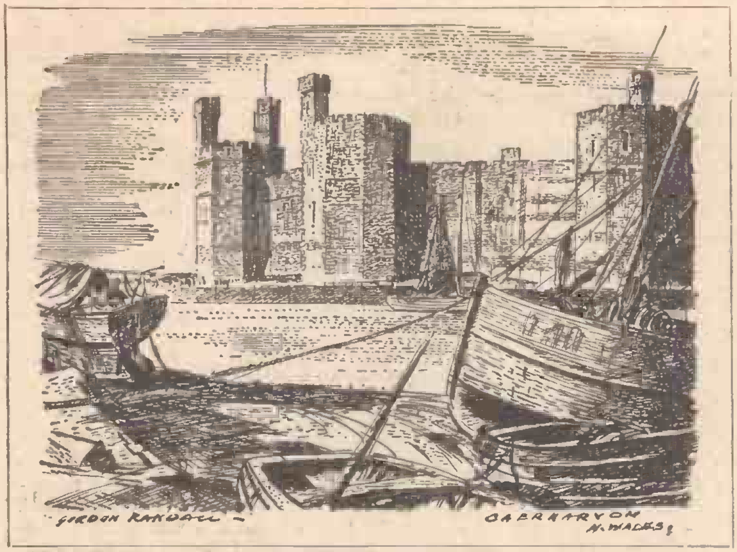
"The fact is that bicycle manufacturers in the United States hardly seem to believe their own safety committee, for they themselves are now producing in increasing quantities bicycles of 'European type' which follow almost exactly the standard British design, and indeed often incorporate British components. Moreover, the most popular standard U.S. bicycle model is fitted with only one brake whereas every British bicycle has two."

The Cycle Show—A Suggestion

THE Queen has graciously consented to be Patron of this year's Cycle and Motor-Cycle Show at Earl's Court, November 13th to 20th.

It would be an excellent idea if the Bicycle Manufacturers' Union offered prizes for models of bicycles, both modern and vintage, and set aside a special Show stand for their exhibition at the show. The Auto-cycle Union has already announced details of its competitions for motorists and motor-cyclists, but it seems to us that the bicycle as the progenitor of the motor-cycle should not be overlooked. It is not too late to arrange details for such a competition. We think, however, that a rule should be included specifying the scale so that the exhibit will give an impression of relative sizes. The A.C.U. omitted this important detail and competitors are merely limited to a length of 10in.





The great castle of Caernarvon dating from the 13th century.

Wayside Thoughts

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

Buck Up

WHATEVER manufacturers may be thinking of the future of the bicycle, it seems true that many dealers are pondering the question with a tinge of dismay. Why is this? I think so many of our retail friends, having done quite well out of the industry and its customers, have slipped into the easy way of travel and allowed themselves to be divorced from the spirit of cycling. Their enthusiasm has tamed and they have forgotten the thrills of the pastime and grown old in action as well as spirit.

At seventy-five I am not inclined to be critical of age, but I think I can understand how it happens and why, and I, for one, am sorry; sorry because cycling is a game all of us who have the pleasure of activity can play to the end of the story. I know, of course, the trade of the bicycle is dependent on its cheapness and its utility, a fact which its severest critics cannot deny, but beyond and above that is the game of riding for the sheer pleasure of silent travel and complete freedom of movement in time and distance. The spirit of cycling as I feel it must be part of the make-up of the individual, but that it will grow with the passage of the years and become all important in the desire to retain activity in cycling is not to be doubted.

I am a cyclist because I love the pastime; I am sometimes a motorist because it is convenient, a utilitarian motorist, as it were, and a pleasure cyclist. There is no doubt about the latter, and much about the former from my point of view.

The Old Adam

I SOMETIMES wonder how far jealousy and its satisfaction has made power travel so popular—for pleasure. Certainly the motor trade has banked on that very human failing and got away with it. The Smiths buy a new car, and the Joneses, not to be outdone, follow suit. That is happening in thousands of cases, and, unfortunately, the bicycle is afterwards forgotten.

I do not blame the folk concerned if they can afford it and find any sense of satisfaction in the change; but why give up cycling? Anyhow, a man ought not, in his own interests, let himself run to seed because he has a motor vehicle, and if he does then you can take it from me he will sooner or later be sorry. To lose old habits of health value and quiet pleasure for the sake of new ones, without the former, and when the first thrill of possession has passed, reduced in the latter category, is not wise, nor is it necessary. Some people seem to think so, however, and fall out of the cycling habit without proper consideration. They forget the good days of their youth, they lose sight of the fact that at a slower tempo they can recapture so much joy from those early days of adventure—as I do—and run through the years with the quiet, pleasant freedom of contemplation and contentment, even if it be but for a few hours at the week-end. It is one of the genuine compensations of life that fall to a man when his more active hours are over, and it is very precious.

How foolish we are to give up so charming a means of capturing a quiet hour for what so frequently starts as an unconscious form of jealousy, because someone you know has four wheels instead of two. Motor by all means, but I say to you from the platform of a full life, never give up cycling, that geared walking of ease and grace that keeps you a man, and an active one.

The Ever-ready

I AM rather keen on this aspect of cycling well into the sere and yellow years because I am now living them, and as a result of my quiet wheeling am finding them gracious. Many folks are apt to deride the pastime as only suitable for the young and nimble, who in the course of time will grow out of the habit and, if they are lucky, indulge other means of travel. Actually if they are lucky—and wise—they will remain cyclists, even if motoring comes their way by pressure of family desire or the modern urgency of life.

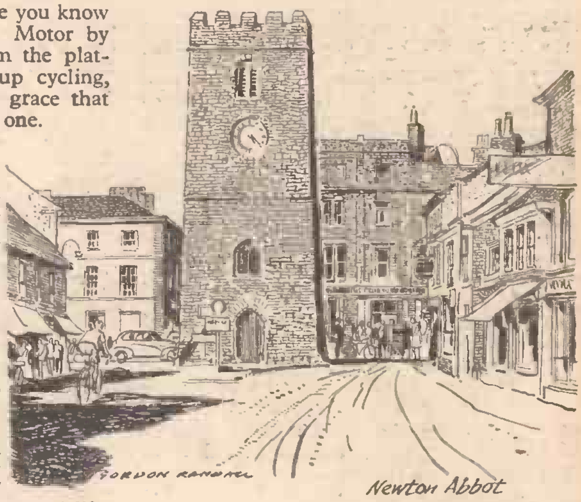
It is just that bustle of modern times to which cycling quietly at any odd hour can be, and indeed is, a foil; returning to life, time to stand and stare and to wander within the limits of your activity without the handicaps of the clock. Whether I go ten miles or fifty, matters not at all, providing I enjoy the journey, for it is the pleasure that counts, the freedom, and the unhurried sensation of the lovely little lanes forever holding out their welcome, especially in the season of spring.

It is true I ride to work and home again most days because I like the exercise, and I know it does me good and keeps me as nimble as I am entitled to expect. But I am not a slave to the daily cycling journey; why should I be, when a car passes my door every morning, and I can then make my decision to ride or to be taken? Most often it is the former, even in the winter-time, and nearly always in the mid-year seasons, unless a deluge descends. Once I would have scorned the car aid and called the stormy journey an adventure; and in my younger days there was no car, only the pony and trap, and the bicycle was in a commanding position. So you see I do not despise car aid, but I like cycling better for the simple reasons given.

After Exercise—Tranquillity

I HAVE an impression that this age of rush and tear, miles without memories, and journeys without the warm intensity of joy—will pass. It will pass slowly, perhaps, but inexorably, because at the end of the story the average human wants peace, the kind of peace and quietude that is not sucked up by the hurry of travel, the present desire to "go somewhere." Wireless, TV, the cinema, the dance-hall, the club, the battle of football, all have helped in their degree to make mortals restless, and yet a man must do something with the larger leisure that has come his way in these post-war years. Yet many of the things that tempt us now are almost an extension of our working hours; we have to get there and home again, and we grow easily critical if the entertainment does not fit our then frame of mind. The broad result of all this leisure time without a break into the more simple periods of existence leaves us unsatisfied and often unconsciously devoid of memory of them; and memory, happy reflection, makes the joy of a tranquil life.

This is where cycling becomes a gentle corrective, a foil to the blare and blaze of

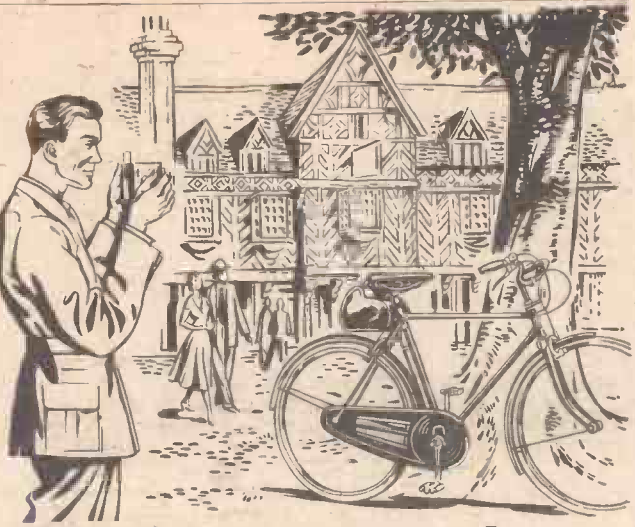


Newton Abbot

A busy Devon town lying six miles inland from Teignmouth. Its river the Leman flows down from Hay Tor on Dartmoor. . . . .

daily habits, a pleasure to the easy expert that, although simple, means so much.

You cannot, however, ride a bicycle all the time and all the time be happy. The hunters after the year mileage records have found that out; and many young men and women have been so intent on piling up the furlongs that finally they have burned themselves out. He who rides too far or too fast grows weary in the day. Cycling to me, and at my age, is the easy fulfilment of a desire to do an unexciting and unexacting thing that will change my outlook by giving me the grace, the beauty and the outline of a lovely countryside and all it connotes.



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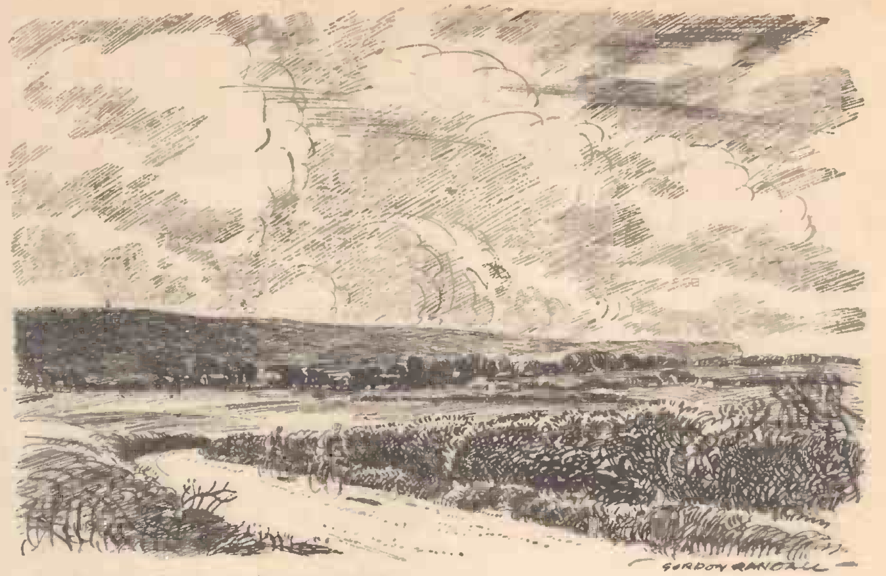
IC18

Around the Wheelworld

By ICARUS



The Open Road. Chale. Isle of Wight.
Looking back to the little village, with the bold sweep of Chale down behind - the ruins of an ancient Pharos, a guide to mariners in early days still stands on its top.

New Handbooks

THE new and enlarged BLRC Handbook for 1954 is now available at 1s. 6d. from W. Thompson, 25, Chesterfield Road, Sheffield, 8. Its 96 pages comprise the rules, standing orders, definition of categories and details of all league events for the coming seasons. It is illustrated with photographs of national and section champions; 25 events are listed as being open to professional and independent riders. The shortest race is the Dover-London event which took place on March 21st (65 miles). The longest single stage race (210 miles) is the London-Bath and back on August 8th. The NCU touring wallet is available at 2s. 6d. to members only. The wallet contains the NCU touring handbook for 1954 and the book of recommended appointments.

Two Up

AT the recent UCI congress, it was decided to revert to 2-up matches for the semi-finals and final of the World Sprint Championships. Britain and Holland supported this proposal with fierce opposition from France. The voting, however, was close—39 to 37 in favour. It is possible, therefore, that next year the decision will be reversed.

Battery-operated Horn

CLEAR HOOTERS LTD. are manufacturing, and Wico-Pacy Sales Corporation are distributing, a new dry battery-operated horn specially designed for use on bicycles, auto-cycles and light-weight motorcycles which have no electrical supply of their own. Styled the Cadet Model 545, it costs 16s. 6d. As will be seen from the illustration it has been designed on modern lines with a silver finish and chromium-plated front. It is operated by a push

The "Cadet" Cycle Horn.

button which can be conveniently located at the rider's fingertips. The standard 1.5 volt dry battery is housed in the watertight body and is capable of giving up to 30,000 clear hoots.

The mounting of the horn and switch is a matter of moments, the body being fluted to provide a squat and secure fitting.

The appeal of the "Cadet" to cyclists and lightweight motor-cyclists will be obvious, but in addition, other applications will suggest themselves, such as works trucks, tractors, invalid carriages, small boats, etc.

The horn, complete with switch cable and clip, will retail at 16s. 6d., and as stated above, the sole concessionaires for the United Kingdom are Wico-Pacy Sales Corporation Ltd., Bletchley.

Club Prizes

SURELY the Bath Road Club Ltd. could put up better prizes than 3 guineas for the fastest time, 2 guineas for the second and 1 guinea for the third in their recent jubilee unpaced scratch 50? It is not alone in the small value of its prizes. Indeed, clubs generally have not increased prize values since pre-war years and bearing in mind the diminished and diminishing purchasing power of the pound it is time that prize values were revised. Otherwise a lot of budding riders will join the mass start brigade where publicity and higher value prizes are more readily available because of trade support.

Bearing on this subject are the remarks of the UCI president in an interview with a member of the staff of a contemporary. He was asked to comment on the suggestion that amateurs should accept cash prizes and the reply that they should if they needed it. Foreign riders are entitled to do so and their wins are advertised. He made it clear that he was entirely in favour of cash prizes and so am I. This squeamish attitude towards amateurs and professionals, the distinction being that you are a professional if you take money, is absurd, indeed, an anachronism. A professional is a man who devotes his whole time to cycling in order to earn his living. An amateur is a man who indulges in cycling for sport and not for a main source of income. In his case it matters not whether his reward for winning is a silly pot which is neither useful nor ornamental and indeed is very much out of date, some article which is engraveable or a medal—equally out of date. People do not wear watch chains these days on which to string a row of medals. I say therefore give a man cash and let him buy something he really wants.

A mild racket has been worked for years in this respect. A prize-winner has only to know a friendly jeweller who will supply the engraveable object to decorate the top table at the Annual Dinner. After the "presentation" the object is handed back to the jeweller who gives the winner the value less, say, 20 per cent.

The general view in the Cycle Trade that publicity is an unclean thing and the cyclists demean themselves by taking money is absurd. It started in the early days of the sport when professionals rode as amateurs and the sport was unclean and full of roguery and common swindles. That could not happen to-day and the rules which ban publicity and the taking of cash prizes should now be abolished. They will be one day perhaps when the present proprietors of the sport have ceased to be associated with it. There are signs that the present generation of sportsmen will eventually oust those who insist that the sport should be run to-day in accord with their dictates. However, as was to be expected when the UCI president's view was put to an official of the NCU he stated that if any move were made at the UCI congress to permit amateurs to receive cash payment it would be opposed. The French are already proposing that amateurs should be allowed to carry advertising matter when racing.

C.B. Tandems for Russia

NOW that Russia has ordered a number of C. B. tandems, will she claim to have invented the tandem? The tandems are racers and suggest that the Russians may be interested in entering these for international events—and almost certainly for the Olympic Games. Russia has never excelled at cycling sport, but possibly a more civilising influence is now at work in that country.

CYCLORAMA

By H. W. ELEY

Note From the Hunting Country

THE latest addition to my collection of letters from readers comes from Melton Mowbray, the centre of the fox-hunting country, the very heart of the Quorn, Belvoir and Cottesmore country, where, on wintry days, men and women thrill to the joy and excitement of the chase, and sleek Reynard slips stealthily over the ridge and skirts the bare common. As my good correspondent says, here is historic ground indeed, and no county in all England is more closely enshrined with hunting and all its traditions than Leicestershire. My correspondent does not confine his comments to hunting, however, for he tells me that Melton, where he was born, is a very ancient market town, and that it possesses a great cruciform church, with a noble fifteenth-century tower; and he underlines his statement that there are no pork pies in all the world to equal those from Melton Mowbray! I always like to hear from riders in the shires, and even if I may not share my friend's native enthusiasm for the chase, I can certainly answer his letter and sing the praises of Melton Mowbray pork pies!

May Day of the Long Ago

I AM afraid that in few towns and villages to-day are we likely to find the gay, spontaneous revels associated with the first of May. "Merrie May" was the month ushered in with dancing on the village green. Colourful maypoles were brought round to houses by cheerful boys and girls, ready to sing a tuneful song to greet the "month of flowers" and well content with a few coppers for their trouble. Every carter bedecked his horse with ribbons and flowers, and in some of our towns, notably Knutsford in Cheshire, there were great revels and rejoicings. I believe that the May Day festival does survive in Knutsford, the town forever associated with "Cranford"—that gentle-moving story of Mrs. Gaskell's. Now, in the main, May Day comes and goes without a song or a dance, and I cannot but feel that it is a pity that these ancient English customs have lapsed; they would bring a touch of romance to our ordered, stereotyped lives!

Glory of Dandelions

RIDING down a lane the other day, I was struck by the brilliance of the dandelions which grow so lavishly on the green verges. A common flower, despised maybe, but on these good May mornings, when the blooms are kissed by the sun, they make a brave picture, and give the authentic touch to spring. Over the hedges, pink and white daisies star the fields, and I think what a grand thing it was to cycle out on a May morning. No sultry heat to mar the pleasure of riding; but sunshine all the way; a blue sky, and a chorus from a choir of birds. No better way to spend such a morning than in the saddle, wheeling along the Queen's highway and, when feeling like a rest, calling at some wayside tavern for a mug of ale. I shall long remember these rides because of the gold of those dandelions.

The Old Man Buys a Bicycle

WE call him "Old Sam" in the village, and I do not think that anyone is aware of his real age, but old he certainly is, and for years he has cycled the long miles to Three Elms Farm, where he has worked since a boy. A few weeks ago his old bike, which had served him for an incredible number of years, really indicated that it had "had its day" and that a new machine was necessary. Now buying a new cycle may seem a simple transaction to the sophisticated rider, but to "Old Sam" it was a very momentous matter indeed. He wrote for catalogues; he went over to our neighbouring market town and inspected the machines in every dealer's shop. He called on the Vicar for his views and advice, and finally, one fine Saturday, he appeared in the village with his brand new and gleaming bike. Never was a small boy prouder of his possession! To-day the machine stands in the "best room" of Jasmine Cottage, is rubbed over every night, is oiled and cleaned, and Old Sam is the proudest man in all the village.

Thor's Cave nr Wetton. Staffs. The great cave stands 250ft above the bed of the Manifold river. The arch is 30 ft high and 23ft wide . . . .

Cannock Chase—and King Canute

WHEREVER we tour in this England of ours we come across the historic, and the unusual, and a few weeks ago, when business took me to the Cannock Chase part of Staffordshire, I spent an interesting hour with an old man who had been born and bred in the town of Cannock itself, and who was by way of being an authority on the famous Chase—an ancient district indeed, for it is chronicled by Erdswick in 1593 as "the Forest of Cannock." Cannock Chase is supposed to have taken its name from two Saxon words—"Cann," meaning strong or powerful, and "aic," meaning oak. But what really intrigued me was the information that it was King Canute who first acquired the Chase as a royal hunting-ground, and it is because of this, doubtless, that Erdswick the old chronicler made reference to the area as Canutus Wood. And further, my well-versed companion told me that in ancient times there were constant disputes between the kings, and the bishops of Lichfield, in connection with game and venison! It is a little difficult to-day, when Cannock is so much given over to the lordship of King Coal, to picture the great days when kings found their sport on the Chase, and all the vast region was a royal preserve. Some of the area is glorious still, and "Cannock Coals" have not spoiled entirely the beauty of this wooded region in Staffordshire, that county maligned by those who do not known of its beauties and only think of it as containing the Black Country in the south and the equally grimy Potteries in the north.

Similarly maligned is the county of Lancashire; many visitors see only the coal mines, the black smoking mill chimneys, the grey slag heaps and the depredations of open cast mining. They do not realise that part of the beautiful Lake District comes within the boundaries of Lancashire. It is not always wise to condemn a county merely on hearsay.

Magic in the Dusk

IT is on May nights, just when the purpling dusk is falling, that one may be fortunate enough to hear the lucid and thrilling notes of the nightingale. I know the old apple tree from which he sings at nine o'clock in the evening, so I take my stand nearby and await his first notes, with the knowledge that I am going to enjoy the sweetest of all our native bird songs. The night air is scented with the faint odour of apple blossom and of the wallflowers which bloom so bravely in the big bed under my window. An owl hoots mournfully from the old spinney, and then I hear my nightingale. I count myself lucky that I can enjoy this nightly concert, for I am pretty far north, and usually our sweetest songster prefers the woodland glades of Surrey, Kent, and Hampshire to this rather bleak Derbyshire land.

Careful Riding

IF ever I had the idea that cycling would be free of all dangers in the countryside, and that I should be able to relax my caution because of the absence of traffic on the country roads and lanes, that idea has long since been dispelled. When I take out my machine and ride to villages and hamlets, I am particularly careful to observe every rule of the road, and I keep my eyes very much open. The reason? Well, the lanes are winding and narrow, there is a truly surprising amount of heavy lorry traffic, and I have found that one has to be very much on the alert to avoid unpleasant encounters at "double bends" and other spots. Yes! cycling in the country, in these days, calls for as much care and caution as cycling in the busy town or city.

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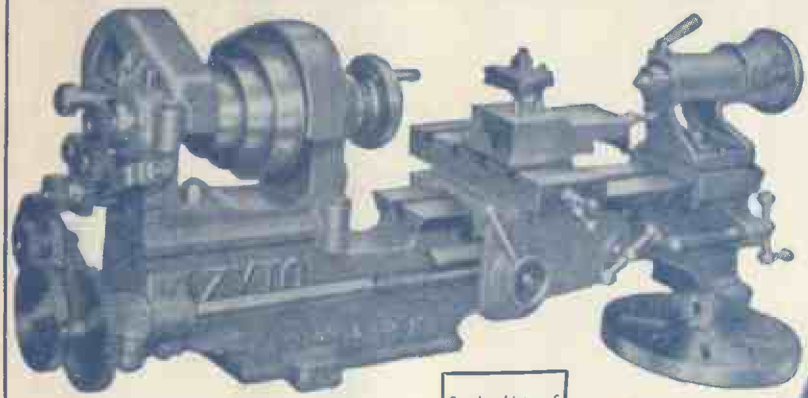

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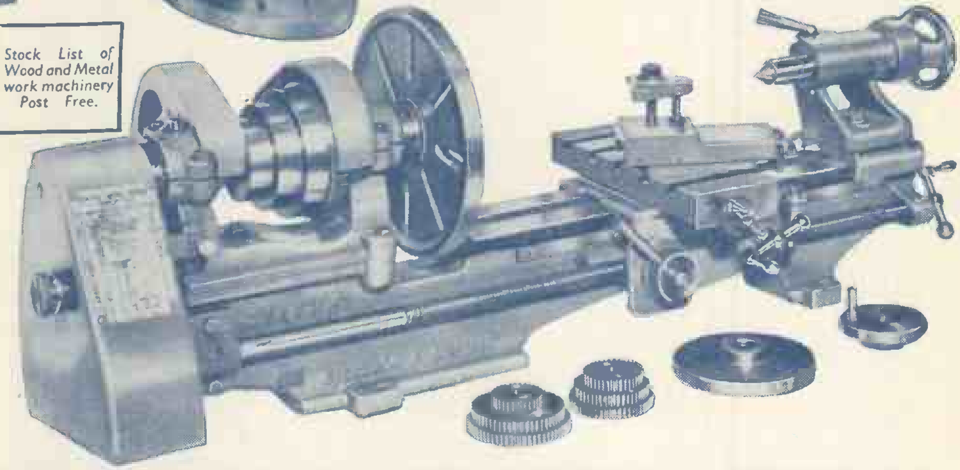

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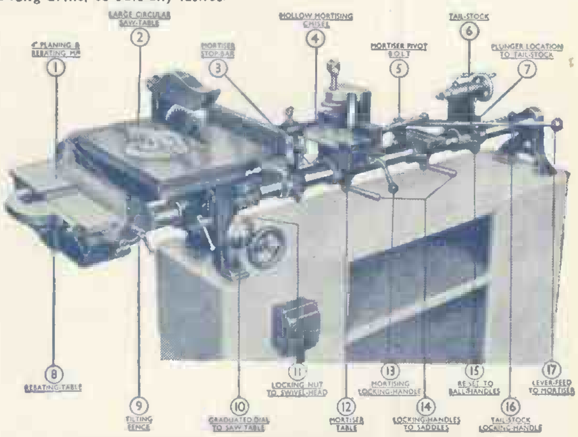

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